

CITY OF HOLLYWOOD



F-4696-21-OT

DEEP INJECTION WELLS NO. 3 AND NO. 4 PUMP STATION

CONFORMED - FOR CONSTRUCTION

VOLUME 1

Prepared by:

**Brown and Caldwell
1560 Sawgrass Corporate Parkway, Suite 240
Sunrise, FL 33323**

Brown AND Caldwell

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DEPARTMENT OF PUBLIC UTILITIES**

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**CITY OF HOLLYWOOD
DEPARTMENT OF PUBLIC UTILITIES
ENGINEERING AND CONSTRUCTION SERVICES DIVISION (ECSD)**

SECTION 00 03 00

NOTICE TO BIDDERS

PROJECT NAME: Deep Injection Wells NO. 3 and No. 4 Pump Station
BID NUMBER: 19-9119A

NOTICE IS HEREBY GIVEN that the City Commission of the City of Hollywood, Florida, is advertising for sealed bids which shall be submitted to the City Clerk's Office (City Hall, 2600 Hollywood Blvd., Hollywood, Florida 33022-9045, Suite 221), until 3:00 p.m., local time, January 18th, 2021. The bids will be opened and read publicly in the City's Procurement Services Division, 2600 Hollywood Blvd., Suite 303, P.O. Box 229045, Hollywood, Florida 33022-9045.

The work to be performed under this Contract shall consist of the construction of a new Injection Well Pump Station, a new Injection Well Electrical Service Center building, and associated site improvements to support the new facilities. The project is divided into two phases of work with an interim milestone established for Phase I.

Phase I work includes the following:

- Injection Well (IW) 3 and IW-4 and Surge Tanks piping connections including control valves and flow meters including structural pads around Injection well and above grade piping and equipment.
- Electrical and I&C components to temporary connect IW-3 and IW-4 control valves and flow meters into the existing injection well pump station systems.
- Yard piping and valve vaults to connect the existing injection well pump station to the IW-3 and IW-4.
- Temporary piping to extend the WTP concentrate force main to the effluent box for clarifier 1 to 4.
- IW 3 and 4 startup and one year conditioning period.
- Monitoring Well (MW) 2 sampling pumps and associated piping, valves, fittings and structural pad.
- Rehabilitation of IW-1 and IW-2 brushing the inside wall of the final casing and acidization of both IWs. This work shall be performed during the startup / testing of IW- 3 and IW-4

Phase II work includes the following:

- Civil site work including yard piping required for the IW-3 and IW-4 Pump Station and associated site improvements to support new facilities.
- New retention walls based on a performance specification provided as part of this package.
- New IW-3 and IW-4 Pump Station No 2 building with integrated wet well.
- Concentrate transfer system, with integrated wet well, to IW-3 and IW-4 to be housed in the same building as the IW-3 and IW-4 Pump Station.
- Electrical work including power and I&C work required for the IW-3 and IW-4 Pump Station.
- New Injection Well Electrical Service Center building with standby electrical power generation for IW-3 and IW-4 Pump Station
- New Plant Drain Pump Station including all appurtenances
- Surge Control Tanks Pad
- Fuel Storage Tanks Pad
- Strainer Equipment Pad
- Actuated valve addition at the Water Treatment Plant on the WTP Concentrate Injection Well Pumping system.
- Connection of the generators to the North Electric Service Center (NESC)
- Integration of the new facilities into the existing plant SCADA system.
- FPL power extension
- Project permitting including Air Permitting

The Bid Package and Contract documents can be downloaded at: www.bidsync.com. For information



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- Project permitting including Air Permitting

The Bid Package and Contract documents can be downloaded at: www.bidsync.com. For information

concerning procedures for responding to this Bid, contact the Procurement Services Division Otis J. Thomas, Senior Purchasing Agent via email at othomas@hollywoodfl.org or by phone at (954) 921-3224, or Steve Stewart, Assistant Director, Financial Services for Procurement (Chief Procurement Officer) via email at sstewart@hollywoodfl.org or by phone at 954-921-3628, or his designee. Such contact is to be for clarification purposes only. It is preferred that all other questions be submitted in writing via bidsync.com. Deadline for questions is **January 11th, 2021 at 5 p.m. local time.**

Each bid must be accompanied by a Bid Security in an amount no less than ten percent (10%) of the bid amount. Said security shall be in the form of a Certified Check or Cashier's Check on a solvent National or State Bank, or a bid bond executed by the Bidder and a qualified Surety, satisfactory and payable to the City of Hollywood, Florida.

A Cone of Silence is in effect with respect to this bid. The Cone of Silence prohibits certain communications between potential vendors and the City. For further information, please refer to Section 30.15(F) of the City's Code of Ordinances.

The City of Hollywood is strongly committed to ensuring the participation of local Hollywood vendors in the procurement of goods and services. For additional information about the City's Local Preference Ordinance, visit www.hollywoodfl.org.

It will be the Bidder's sole responsibility to hand-deliver or mail his/her proposal to the City Clerk's Office at City Hall on or before the closing time and date for the receipt of bids as noted above.

The City Commission reserves the right to reject any or all bids, to waive informalities and to accept or reject all or any part of any bid, as they may deem to be in the best interest of the City of Hollywood, Florida.

Dated this 30th Day of November, 2021

CITY OF HOLLYWOOD, FLORIDA

Otis J. Thomas, Senior Purchasing Agent
Procurement Services Division

SECTION 00 10 00

INSTRUCTIONS TO BIDDERS

1. PREPARATION OF BIDS:

Bids must be submitted on the separate and enclosed BIDDING PACKAGE forms, which shall be completed by typewriter or legibly handwritten in ink. The Bid price of each item on the form must be stated in words and numerals; in case of a conflict, words will take precedence. Where unit prices and extended totals are required, unit prices take precedence. Likewise, discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.

If the Bid is made by an individual, he must sign his name therein and state his address. If the Bid is made by a firm or partnership, its name and address must be stated, as well as the name and address of each member of the firm or partnership. Bids by corporations must be signed by an authorized corporate officer (accompanied by evidence of authority to sign) and the corporate seal must be affixed and attested by the Secretary or an Assistant Secretary of the corporation. The corporate address and state of incorporation shall be shown below the signature. When the state of incorporation is other than Florida, proof of registry with Florida must be attached.

2. RECEIPT AND OPENING OF BIDS:

The Bid Package consisting of the Bid, Bid Proposal Form, Bid Bond, Trench Safety Form, all requested information as specified within and list of Subcontractors and/or material suppliers shall be completed, signed and sealed as required and must be delivered or mailed to the City Clerk of Hollywood, Florida, by the time and date specified in the Notice to Bidders and shall be properly identified on the face thereof.

Bids will be publicly opened and immediately read aloud at the time and place designated in the Notice to Bidders. No Bid will be considered which is not based upon the Drawings and Specifications, or which contains any letter or written memorandum qualifying the same, or which is not properly made out and signed in writing by the Bidder.

3. PRE-BID CONFERENCE:

The pre-bid meeting for the project will occur on **December 14th, 2021** at 2:00 pm at 1621 N. 14th Avenue, Hollywood, Florida 33020.

4. CONTRACT DOCUMENTS:

The Contract Documents give the location and description of the work to be done under this Contract and estimated quantities of each item of work for which Bids are invited, the time in which the work must be completed, the amount of the Bid Guaranty, if any, and the date, time and place of the receipt and opening of the

Bids.

5. EXAMINATION OF CONTRACT DOCUMENTS AND SITE:

The Bidder is required to carefully examine the site of the work and the Contract Documents for the work contemplated. It will be assumed that the Bidder has investigated and is fully informed as to the requirements of the Contract Documents, laws, ordinances, codes and any other factors which may affect the performance of the work. Failure to be so informed will not relieve a successful Bidder of his obligation to furnish all material, equipment and labor necessary to carry out the provision of the Contract Documents and to complete the contemplated work for the consideration set forth in his Bid.

6. DIMENSIONS, QUANTITIES AND SUBSURFACE INFORMATION:

Dimensions, quantities and subsurface information supplied by the City are in no way warranted to indicate true amounts or conditions. Bidders/Contractors shall neither plead misunderstanding or deception, nor make claims against the City if the actual amounts, conditions or dimensions do not conform to those stated. Any "Outside" reports made available by the Engineer are neither guaranteed as to accuracy or completeness, nor a part of the Contract Documents.

7. ADDENDA - CHANGES WHILE BIDDING:

During the Bidding period, Bidders may be furnished addenda or bulletins for additions or alterations to the Plans or Specifications which shall be included in the work covered by the Proposal.

Any prospective Bidder in doubt as to the meaning of any part of the Drawings, Specifications or other Contract Documents may submit a written request to the Engineer for an interpretation. The Bidder submitting the request will be responsible for its prompt delivery. Any interpretation of the documents will be made by an addendum and a copy of such addendum will be mailed or delivered to each prospective Bidder who has received a set of documents. The City will not be responsible for any other explanations or interpretations of the proposed documents. Each prospective bidder must submit their questions or inquiries via www.bidsync.com.

8. BID GUARANTY:

A Bid Guaranty in the form of a Cashier's Check, Certified Check or Bid Bond executed by the Bidder and a qualified Surety in the amount of **10%** of the Bid is

required for this project in accordance with the Notice to Bidders.

9. TRENCH SAFETY FORM:

The Trench Safety Form included in the Bid Documents must be completed and signed. Noncompliance with this requirement may invalidate the bid.

10. QUALIFICATIONS AND DISQUALIFICATIONS OF BIDDERS:

The Contract will be awarded only to the responsive and responsible bidder, who in the opinion of the Engineer and Procurement Division, is fully qualified to undertake the work and is in compliance with the City's Local Preference Criteria (when applicable). The City reserves the right before awarding the Contract to require a bidder to submit such evidence of his qualifications as it may deem necessary and may consider any available evidence of his financial status, technical qualifications and other qualifications and abilities.

Bidders shall submit proof, along with their bid, that their firm has successfully completed comparable projects meeting the following criteria:

- A. The Bidder shall have successfully completed a minimum of one (1) project demonstrating experience with large pump stations projects having a total construction value of greater than \$50 million and three (3) projects demonstrating experience with large pump station projects having a total construction (for each project) of greater than \$15 million. These projects shall have been performed within the past ten (10) years from the date of the Invitation to Bid.
- B. The Bidder shall have successfully completed a minimum of one (1) project demonstrating experience with pumps that are greater than 400 HP. This project shall have been performed within the past ten (10) years from the date of the Invitation to Bid.
- C. The Bidder shall have successfully completed a minimum of one (1) project demonstrating experience with generators that are greater than 1500 kW. This project shall have been performed within the past ten (10) years from the date of the Invitation to Bid.
- D. The Bidder's proposed project manager shall have successfully completed a minimum of two (2) projects demonstrating project management experience with large pump station projects having a total construction value (for each project) of greater than \$15 million. These projects shall have been performed within the past ten (10) years from the date of the Invitation to Bid.
- E. The Bidder or the Bidder's Large Diameter Piping Subcontractor shall have successfully completed a minimum of three (3) projects demonstrating experience constructing piping projects that include 54" or larger Ductile Iron pipe with runs greater than 300 feet and which include connections to existing large diameter pipes. These projects shall have

been performed within the past ten (10) years from the date of the Invitation to Bid.

- F. The Bidder or the Bidder's Large Diameter Piping Subcontractor Superintendent shall have successfully completed a minimum of two (2) project demonstrating experience constructing piping projects that include 54" or larger Ductile Iron pipe with runs greater than 300 feet and which include connections to existing large diameter pipes. These projects shall have been performed within the past ten (10) years from the date of the Invitation to Bid.
- G. The Bidder or Bidder's Electrical Subcontractor shall have successfully completed a minimum of three (3) projects demonstrating experience with medium or high voltage power supply systems, including transformers and switchgear. These projects shall have been performed within the past ten (10) years from the date of the Invitation to Bid.
- H. The Bidder or Bidder's Electrical Subcontractor Lead Electrician shall have successfully completed a minimum of two (2) projects demonstrating experience with medium or high voltage power supply systems, including transformers and switchgear. These projects shall have been performed within the past ten (10) years from the date of the Invitation to Bid.

Any one of the following causes, among others, may be considered as sufficient justification to disqualify a bidder and reject his or her bid:

- A. Submission of more than one bid for the same work by an individual, firm, partnership or corporation under the same or different names.
- B. Evidence of collusion.
- C. Previous participation in collusive bidding on work for the City of Hollywood, Florida.
- D. Submission of an unbalanced bid in which the prices bid for some items are out of proportion to the prices bid for other items.
- E. Lack of competency. The Bidder shall provide proof that their past experience can demonstrate similar complexity and size compared to this contract. The Engineer may declare any bidder ineligible, at any time during the process or receiving bids or awarding the contract, if developments arise which, in his opinion, adversely affects the bidder's responsibility. The Bidder will be given an opportunity, by the engineer, to present additional evidence before final action is taken.
- F. Lack of responsibility as shown by past work judged by the Engineer from the standpoint of workmanship and progress.
- G. Non-compliance with the City's Local Preference (when applicable).

- H. Uncompleted work for which the Bidder is committed by Contract, which is in the judgment of the Engineer, might hinder or prevent the prompt completion of work under this Contract.
- I. Being in arrears on any existing Contracts with the City, or any taxes, licenses or other monies due the City; in litigation with the City or having defaulted on a previous contract with the City.

11. LIFE AND WITHDRAWAL OF BID:

All Bids shall remain open for 90 days after the day of the Bid opening, however, the Engineer may, at his sole discretion, release any Bid and return the Bid Guaranty prior to that date. Any Bid may be modified or withdrawn prior to the time scheduled for the opening of Bids.

12. REJECTION OF IRREGULAR BIDS:

Bids will be considered irregular and may be rejected if they show omissions, alterations of form, additions not called for, conditions, limitations, unauthorized alternate Bids or other irregularities of any kind.

13. BIDDING ERRORS:

If after the opening of bids, a Bidder claims an error and requests to be relieved of the Award, or the Engineer believes that an error may have been made then, the Bidder shall present his work sheets and supplier quotations to the Engineer for verification. This information shall be presented on the same day as the bid opening or if the opening is in the afternoon then on the following business day. When the Engineer has suspected an error and requires the documents, Bidder's failure to produce them within the time specified shall make the Bidder non-responsive and thereby eligible for disqualification. Award may then be made to the next lowest responsive, responsible Bidder, or the work may be re-advertised or it may be performed by City forces, as the Commission desires.

14. AWARD OF CONTRACT:

The City Commission reserves the right to reject any or all Bids, or any part of any Bid, to waive any informality in any Bid, or to re-advertise for all or any part of the work contemplated. If Bids are found to be acceptable by the City Commission, written notice of award will be given to the lowest responsive, responsible Bidder.

15. EXECUTION OF CONTRACT:

The Bidder to whom the Contract is awarded shall, within ten days of the date of award, execute and deliver three (3) copies of the following to the Engineer.

- A. The Contract

- B. Performance and Payment Bond
- C. Evidence of required Insurance
- D. Proof of authority to execute the Contract
- E. Proof of authority to execute the Bond on behalf of the Awardee
- F. List of Subcontractors, estimated Contract Value for each and proof that such subcontractors possess all required Federal, State, County and/or municipality licenses, including but not limited to certified of competency and occupational license.

The above documents must be furnished, executed and delivered before the Contract will be executed by the City. The Contract shall not be binding upon the City until it has been executed by the City and a copy of such fully executed Contract is delivered to the Contractor.

16. FAILURE TO EXECUTE CONTRACT, BID GUARANTY FORFEITED:

Should the Bidder to whom the Contract has been awarded refuse or fail to complete the requirements of Article 15 above within ten (10) days after Notice of Award, the additional time in days (including weekends) required to CORRECTLY complete the documents will be deducted, in equal amount, from the Contract Time, or the City may elect to revoke the Award. In the same manner as Article 13, the Bid Guaranty of any Bidder failing to execute the awarded Contract shall be retained by the City and the Contract awarded as the Commission desires.

17. GUARANTY OF FAITHFUL PERFORMANCE AND PAYMENT:

A Performance Bond and a Payment Bond each equal to 100 percent of the total Bid will be required of the Awardee. The Bond must be written through a company licensed to do business in the State of Florida and be rated at least "A", Class X, in the latest edition of "Best's Key Rating Guide", published by A.M. Best Company. As per Florida Statute Section 255.05, the Contractor shall be required to record the payment and performance bonds in the public records of Broward County.

18. INSURANCE:

Bidder must satisfy all insurance requirements as set forth in the Supplementary and General Conditions.

The insurance policy shall not contain any exceptions that would exclude coverage for risks that can be directly or reasonably related to the scope of goods or services in this bid/proposal. A violation of this requirement at any time during the term, or any extension thereof shall be grounds for the immediate termination of any contract entered in to pursuant to this bid/proposal. In order to show that this requirement has been met, along

with an insurance declaration sheet demonstrating the existence of a valid policy of insurance meeting the requirements of this bid/proposal, the successful proposer must submit a signed statement from insurance agency of record that the full policy contains no such exception.

19. QUALIFICATIONS:

At the time of submission of the bid, Bidder must possess, and be able to provide City, any and all required Federal, State, County and/or municipal licenses, including but not limited to certificates of competency and occupational licenses. Moreover, upon receipt of the Award of the Contract, Bidder must provide proof of valid licensing for all subcontractors and/or material suppliers hired by the Contractor.

When the Bidder is a Joint Venture, in order to satisfy the construction licensing requirements one member of a Joint Venture must hold a valid state certificate as well as the appropriate county and city license. The Contractor shall be held responsible for assurance that all subcontractors and/or material suppliers hired by the Contractor have the appropriate state certificate and licenses.

20. PERMITS:

The Contractor and Subcontractors must obtain Building Permits required for all work covered under this contract as well as any other permit required by any other regulatory agency. The Master Building Permit required by the City shall be obtained by the Contractor but paid for by the City. Any and all other permits required by the City, County, State of Florida, or other regulatory agency shall be obtained and paid for by the Contractor.

The Contractor or Subcontractors shall also be responsible to call for all inspections as required in Section 105 (Inspections) of the latest edition of the Florida Building Code.

- END OF SECTION -

SECTION 00 20 00



NOTICE OF IMPOSITION OF CONE OF SILENCE

On November 30th, 2021, the City of Hollywood, Florida Department of Procurement Services Division issued the following:

Bid #F-4696-21-OT: Deep Injection Wells No. 3 and No. 4 Pump Station

Project Scope: The work to be performed consists of the construction of a new pump station and a new electrical service center to support the new pump station.

Pursuant to Section 30.15(F) of the Code of Ordinances, a Cone of Silence has been imposed on the items set forth above. The Cone of Silence will continue until the City awards or approves a contract, votes to reject all bids or responses, or otherwise takes action which ends the solicitation. If the City Commission refers the item back to the City Manager and staff for further review, the Cone of Silence shall remain in effect until an award is made, a contract is approved, or the City Commission takes any other action which ends the solicitation.

cc: City Commission Office
City Manager
City Clerk (sunshine board)
Affected department(s)/office(s)

- END OF SECTION -

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SECTION 00 30 00

PROPOSAL

ORIGINAL

TO THE MAYOR AND COMMISSIONERS
CITY OF HOLLYWOOD, FLORIDA

SUBMITTED 01/31/2022

Dear Mayor and Commissioners:

The undersigned, as BIDDER, hereby declares that the only person or persons interested in the Proposal as principal or principals is or are named herein and that no other person than herein mentioned has any interest in this Proposal or in the Contract to be entered into; that this Proposal is made without connection with any other person, company or parties making a Bid or Proposal; and that it is in all respects fair and in good faith without collusion or fraud.

The BIDDER further declares that he has examined the site of the Work and informed himself fully in regard to all conditions pertaining to the place where the Work is to be done; that he has examined the Drawings and Specifications for the Work and contractual documents relative thereto, including the Notice to Bidders, Instructions to Bidders, Proposal Bid Form, Form of Bid Bond, Form of Contract and Form of Performance Bond, General, Supplementary and Technical Specifications, Addenda, Drawings, and Local Preference Program, Exhibit A, and has read all of the Provisions furnished prior to the opening of bids; and that he has satisfied himself relative to the work to be performed.

The undersigned BIDDER has not divulged to, discussed or compared his bid with other bidders and has not colluded with any other BIDDER of parties to this bid whatever.

If this Proposal is accepted, the undersigned BIDDER proposes and agrees to enter into and execute the Contract with the City of Hollywood, Florida, in the form of Contract specified; of which this Proposal, Instructions to Bidders, General Specifications, Supplementary Conditions and Drawings shall be made a part for the performance of Work described therein; to furnish the necessary bond equal to one hundred (100) percent of the total Contract base bid, the said bond being in the form of a Cash Bond or Surety Bond prepared on the applicable approved bond form furnished by the CITY; to furnish all necessary materials, equipment, machinery, tools, apparatus, transportation, supervision, labor and all means necessary to construct and complete the work specified in the Proposal and Contract and called for in the Drawings and in the manner specified; to commence Work on the effective date established in the "Notice to Proceed" from the ENGINEER; and to substantially complete all Contract Work for Phase 1 within 214 days with final completion within 244 days and all Contract Work for Phase 2 within 734 days with final completion within 818 days, and stated in the "Notice to Proceed" or pay liquidated damages for each calendar day in excess thereof, or such actual and consequential damages as may result therefrom, and to abide by the Local Preference Ordinance.

The BIDDER acknowledges receipt of the following addenda:

- No. 1 Dated 12/01/2021
- No. 2 Dated 12/06/2021
- No. 3 Dated 12/07/2021
- No. 4 Dated 12/08/2021
- No. 5 Dated 12/13/2021
- No. 6 Dated 12/28/2021
- No. 7 Dated 01/12/2022
- No. 8 Dated 01/20/2022
- No. 9 Dated 3 0 00-1 01/26/2022

And the undersigned agrees that in case of failure on his part to execute the said Contract and the Bond within ten (10) days after being presented with the prescribed Contract forms, the check or Bid Bond accompanying his bid, and the money payable thereon, shall be paid into the funds of the City of Hollywood, Florida, otherwise, the check or Bid Bond accompanying this Proposal shall be returned to the undersigned.

Attached hereto is a certified check on the

_____ Bank of _____

or approved Bid Bond for the sum of

*****ten percent of bid price***** Dollars (\$^{10% of bid price}) according to the conditions under the Instructions to Bidders and provisions therein.

NOTE: If a Bidder is a corporation, the legal name of the corporation shall be set forth below, together with signature(s) of the officer or officers authorized to sign Contracts on behalf of the corporation and corporate seal; if Bidder is a partnership, the true name of the firm shall be set forth below with the signature(s) of the partner or partners authorized to sign Contracts in behalf of the partnership; and if the Bidder is an individual, his signature shall be placed below; if a partnership, the names of the general partners.

WHEN THE BIDDER IS AN INDIVIDUAL:

(Signature of Individual)

(Printed Name of Individual)

(Address)

WHEN THE BIDDER IS A SOLE PROPRIETORSHIP OR OPERATES UNDER A TRADE NAME:

(Name of Firm)

(Address)

(Signature of Individual) (SEAL)

WHEN THE BIDDER IS A PARTNERSHIP:

(Name of Firm) A Partnership

(Address)

By: _____
(SEAL)
(Partner)

Name and Address of all Partners:

WHEN THE BIDDER IS A JOINT VENTURE:

(Correct Name of Corporation)

By: _____
(SEAL)
(Address)

(Official Title)

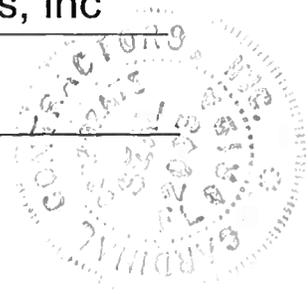
As Joint Venture
(Corporate Seal)

Organized under the laws of the State of _____, and authorized by the law to make this bid and perform all Work and furnish materials and equipment required under the Contract Documents.

WHEN THE BIDDER IS A CORPORATION:

Cardinal Contractors, Inc
(Correct Name of Corporation)

By: 
(SEAL) **Eric Macek**



Vice President

(Official Title)

13794 NW 4th Street, Suite 200, Sunrise, FL 33325

(Address of Corporation)

Organized under the laws of the State of Florida, and authorized by the law to make this bid and perform all Work and furnish materials and equipment required under the Contract Documents.

CERTIFIED COPY OF RESOLUTION OF BOARD OF DIRECTORS

Cardinal Contractors, Inc

(Name of Corporation)

RESOLVED that Eric Macek

(Person Authorized to Sign)

Vice President of Cardinal Contractors, Inc

(Title) (Name of Corporation)

be authorized to sign and submit the Bid or Proposal of this corporation for the following project:

CITY OF HOLLYWOOD

**Deep Injection Wells No. 3 and No. 4 Pump Station
Bid No.: F-4696-21-OT (Deep Injection Wells No. 3 and
No. 4 Pump Station)**

The foregoing is a true and correct copy of the Resolution adopted by

Cardinal Contractors, Inc. at a meeting of its Board of

(Name of Corporation)

Directors held on the 01 day of October, 2021.

By: [Signature]

Title: Secretary

(SEAL)

The above Resolution MUST BE COMPLETED if the Bidder is a Corporation.

- END OF SECTION -



RESOLUTION OF THE BOARD OF DIRECTORS OF
CARDINAL CONTRACTORS, INC.

DATED October 1, 2021

The undersigned, being all of the members of the Board of Directors of Cardinal Contractors, Inc., a Florida corporation duly formed and validly existing under the laws of the State of Florida (the "Company"), pursuant to the authority granted in the Bylaws of the Company, do hereby consent to the adoption of the following resolutions, and do hereby adopt such resolutions:

RESOLVED, that the resignation of Richard Holt as Vice President of Company be, and hereby is, accepted effective October 1, 2021.

BE IT FURTHER RESOLVED that the following individuals are the approved slate of officers of Cardinal Contractors, Inc. and each is authorized and has the power to bind the Company by entering in any contract or by executing any instrument in the name of and on behalf of the Company, and such authority is general and not confined to specific instances, and shall continue until modified by resolution;

Bobby Bridges	President	Eric Macek	Vice President
John M. Perisich	EVP/CLO/Secretary	David Van Dam	Vice President
Blanche Arceneaux	CFO	Mitch Bernhard	Vice President
Michael Brandao	Vice President		

Tom McCormick

Ken Dodgen

Bobby Bridges

John Perisich

SECTION 00 30 10
CITY OF HOLLYWOOD
DEPARTMENT OF PUBLIC UTILITIES
ENGINEERING AND CONSTRUCTION SERVICES DIVISION
PROPOSAL BASE BID FORM

Bid No.: F-4696-21-OT
Project Name: Deep Injection Well No. 3 and No. 4 Pump Station

BASE BID PHASE 1:
Site Work and Demolition Bid Items

<u>No.</u>	<u>Description</u>	<u>Qty</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Total</u>
1	Pipe Demolition <u>five hundred thousand</u> Dollars and <u>zero</u> Cents	1	LS	500,000.00	500,000.00
2	Site Demolition <u>seventy five thousand</u> Dollars and <u>zero</u> Cents	1	LS	75,000.00	75,000.00
3	Site Clearing <u>one hundred fifty thousand</u> Dollars and <u>zero</u> Cents	1	LS	150,000.00	150,000.00
4	Site Grading <u>one hundred fifty thousand</u> Dollars and <u>zero</u> Cents	1	LS	150,000.00	150,000.00
Site Work and Demolition Sub-Total					
	<u>eight hundred seventy-five thousand</u> Dollars and <u>zero</u> Cents				875,000.00

Temporary Yard Piping Bid Items

5	Concentrate Pipe System <u>one hundred fifty thousand</u> Dollars and <u>zer</u> Cents	1	LS	150,000.00	150,000.00
6	Drain Pipe System <u>twenty five thousand</u> Dollars and <u>zero</u> Cents	1	LS	25,000.00	25,000.00
7	Temporary Pipe Decommissioning <u>twenty five thousand</u> Dollars and <u>zero</u> Cents	1	LS	25,000.00	25,000.00

Temporary Yard Piping Sub-Total

two hundred thousand _____ Dollars and
 zero _____ Cents

200,000.00

Permanent Yard Piping Bid Items

<u>No.</u>	<u>Description</u>	<u>Qty</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Total</u>
8	Sheet Piling seven hundred seventy-three thousand nine hundred _____ Dollars and zero _____ Cents	10,900	SF	<u>71.00</u>	<u>773,900.00</u>
9	Concentrate Pipe System South of Clarifiers five hundred twenty thousand _____ Dollars and zero _____ Cents	1	LS	<u>520,000.00</u>	<u>520,000.00</u>
10	Concentrate Pipe System North Area three hundred thousand _____ Dollars and zero _____ Cents	1	LS	<u>300,000.00</u>	<u>300,000.00</u>
11	Secondary Effluent Pipe System and Fittings				
a	54in. Secondary Pipe twenty seven thousand _____ Dollars and zero _____ Cents	10	LF	<u>2700.00</u>	<u>27,000.00</u>
b	54in.x42in. Secondary Reducer forty-one thousand _____ Dollars and zero _____ Cents	1	EA	<u>41,000.00</u>	<u>41,000.00</u>
c	54in. Secondary Plug forty-nine thousand _____ Dollars and zero _____ Cents	1	EA	<u>49,000.00</u>	<u>49,000.00</u>
d	42in. Secondary Pipe five hundred forty thousand _____ Dollars and zero _____ Cents	270	LF	<u>2,000.00</u>	<u>540,000.00</u>
e	42in. Secondary 90 deg Bend thirty one thousand _____ Dollars and zero _____ Cents	1	EA	<u>31,000.00</u>	<u>31,000.00</u>
f	42in. Secondary 45 deg Bend twenty-four thousand _____ Dollars and zero _____ Cents	1	EA	<u>24,000.00</u>	<u>24,000.00</u>
g	42in. Secondary 22.5 deg Bend forty-five thousand _____ Dollars and zero _____ Cents	2	EA	<u>22,500.00</u>	<u>45,000.00</u>

<u>No.</u>	<u>Description</u>	<u>Qty</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Total</u>
h	42in.x42in. Secondary Tee forty-seven thousand _____ Dollars and _____ Cents	1	EA	47,000.00	47,000.00
i	42in.x30in. Secondary Tee seventy thousand _____ Dollars and zero _____ Cents	2	EA	35,000.00	70,000.00
j	30in. Surge Pipe ninty-seven thousand five hundred _____ Dollars and zero _____ Cents	50	LF	1,950.00	97,500.00
k	30in. Surge 90 deg Bend twenty-eight thousand _____ Dollars and zero _____ Cents	2	EA	14,000.00	28,000.00
l	30in. Surge Cap sixteen thousand _____ Dollars and zero _____ Cents	2	EA	8,000.00	16,000.00
m	16in. Secondary Pipe nineteen thousand five hundred _____ Dollars and zero _____ Cents	10	LF	1,950.00	19,500.00
12	Mixed Concentrate Pipe System and Fittings				
a	42in. Mixed Concentrate Pipe sixty-two thousand _____ Dollars and zero _____ Cents	40	LF	1,550.00	62,000.00
b	42in. Mixed Concentrate Wye eighty-nine thousand _____ Dollars and zero _____ Cents	1	EA	89,000.00	89,000.00
c	42in.x30in. Mixed Concentrate Reducer forty-one thousand _____ Dollars and zero _____ Cents	1	EA	41,000.00	41,000.00
d	42in.x24in. Mixed Concentrate Tee thirty-four thousand _____ Dollars and zero _____ Cents	1	EA	34,000.00	34,000.00
e	30in. Mixed Concentrate Pipe three hundred fifteen thousand _____ Dollars and zero _____ Cents	210	LF	1,500.00	315,000.00

<u>No.</u>	<u>Description</u>	<u>Qty</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Total</u>
f	30in. Mixed Concentrate 22.5 deg Bend twelve thousand _____ Dollars and zero _____ Cents	1	EA	12,000.00	12,000.00
g	30in. Mixed Concentrate 90 deg Bend thirty thousand _____ Dollars and zero _____ Cents	2	EA	15,000.00	30,000.00
h	24in.x12in. Concentrate Reducer six thousand _____ Dollars and zero _____ Cents	1	EA	6,000.00	6,000.00
i	16in.x12in. Concentrate Reducer three thousand _____ Dollars and zero _____ Cents	1	EA	3,000.00	3,000.00
j	16in. Concentrate Plug four thousand _____ Dollars and zero _____ Cents	1	EA	4,000.00	4,000.00
k	12in. Concentrate Pipe ten thousand five hundred _____ Dollars and zero _____ Cents	30	LF	350.00	10,500.00
l	12in. Concentrate Transition Coupling ten thousand _____ Dollars and zero _____ Cents	1	EA	10,000.00	10,000.00
13	Sanitary Sewer System				
a	Laterals two thousand _____ Dollars and zero _____ Cents	2	EA	1,000.00	2,000.00
b	8in. Sanitary Pipe (8ft. to 10ft.) eleven thousand two hundred fifty _____ Dollars and zero _____ Cents	75	LF	150.00	11,250.00
c	Coring of Existing Sanitary Sewer Manholes five thousand _____ Dollars and zero _____ Cents	1	EA	5,000.00	5,000.00
d	Sanitary Sewer Manhole (8ft. to 10ft.) eight thousand _____ Dollars and zero _____ Cents	1	EA	8,000.00	8,000.00
e	Coating of New Structures twelve thousand _____ Dollars and zero _____ Cents	1	EA	12,000.00	12,000.00

<u>No.</u>	<u>Description</u>	<u>Qty</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Total</u>
14	6in. Backwash Pipe seventeen thousand _____ Dollars and zero _____ Cents	1	LS	17,000.00	17,000.00
15	Miscellaneous Water Main Modifications three hundred thousand _____ Dollars and zero _____ Cents	1	LS	300,000.00	300,000.00

Structural, Process, Electrical, and I&C Bid Items

16	Injection Well No.3 and No. 4 Wellhead Piping, Fittings, and Valves				
a	20in. Plug Valve with Motor Operator two hundred forty thousand _____ Dollars and zero _____ Cents	2	EA	120,000.00	240,000.00
b	30in. Butterfly Valve forty-six thousand _____ Dollars and zero _____ Cents	2	EA	23,000.00	46,000.00
c	6in. Ball Valve twenty thousand _____ Dollars and zero _____ Cents	2	EA	10,000.00	20,000.00
d	6in. CARV thirty-two thousand _____ Dollars and zero _____ Cents	2	EA	16,000.00	32,000.00
e	24x20in. tee with blind flange eighty thousand _____ Dollars and zero _____ Cents	2	EA	40,000.00	80,000.00
f	30x20in. eccentric reducer forty-two thousand _____ Dollars and zero _____ Cents	2	EA	21,000.00	42,000.00
g	30in. 90 deg bend fifty-two thousand _____ Dollars and zero _____ Cents	2	EA	26,000.00	52,000.00
h	20in. 45 deg bend thirty-six thousand _____ Dollars and zero _____ Cents	4	EA	9,000.00	36,000.00

<u>No.</u>	<u>Description</u>	<u>Qty</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Total</u>
i	20in. piping one hundred twenty nine thousand _____ Dollars and zero _____ Cents	30	LF	4,300.00	129,000.00
j	30in. piping one hundred forty-four thousand _____ Dollars and zero _____ Cents	30	LF	4,800.00	144,000.00
k	Pipe Supports fourteen thousand four hundred _____ Dollars and zero _____ Cents	8	EA	1,800.00	14,400.00
l	20in. Mag Meter sixty thousand _____ Dollars and zero _____ Cents	2	EA	30,000.00	60,000.00
17	Injection Wells No. 3 and No. 4 Slabs one hundred thirty-six thousand _____ Dollars and zero _____ Cents	1	LS	136,000.00	136,000.00
18	Monitoring Well No. 2 Slab and Piping one hundred forty-nine thousand _____ Dollars and zero _____ Cents	1	LS	149,000.00	149,000.00
19	Valve Vault for Secondary 42in. Piping, Fittings, and Valves nine hundred thousand _____ Dollars and zero _____ Cents	1	LS	900,000.00	900,000.00
20	Concentrate 12in. Valve Vault, Piping, Fittings, and Valves four hundred thousand _____ Dollars and zero _____ Cents	1	LS	400,000.00	400,000.00
21	Concentrate 42in. Valve Vault, Piping, Fittings, and Valves nine hundred thousand _____ Dollars and zero _____ Cents	1	LS	900,000.00	900,000.00
22	Miscellaneous Electrical eight hundred fifty-three thousand _____ Dollars and zero _____ Cents	1	LS	853,000.00	853,000.00

<u>No.</u>	<u>Description</u>	<u>Qty</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Total</u>
23	Miscellaneous I&C <u>one hundred twenty thousand</u> Dollars and <u>zero</u> Cents	1	LS	<u>120,000.00</u>	<u>120,000.00</u>
24	All Other Miscellaneous Work <u>fifty thousand</u> Dollars and <u>zero</u> Cents	1	LS	<u>50,000.00</u>	<u>50,000.00</u>
Structural, Process, Electrical, and I&C Sub-Total Permanent Yard Piping Sub-Total					
<u>four million, four hundred three thousand four hundred</u> Dollars and <u>zero</u> Cents					<u>4,403,400.00</u>
Phase 1 (Bid items 1-24) Sub-Total Permanent Yard Piping Sub-Total					
<u>nine million seventy nine thousand fifty</u> Dollars and <u>zero</u> Cents					<u>9,079,050.00</u>

BASE BID PHASE 2:**Site Work and Demolition Bid Items**

No.	Description	Qty	Unit	Unit Price	Total
25	Pipe and Above Ground Features Demolition seventy-five thousand _____ Dollars and zero _____ Cents	1	LS	75,000.00	75,000.00
26	Site Clearing two hundred fifty thousand _____ Dollars and zero _____ Cents	1	LS	250,000.00	250,000.00
27	Site Grading one hundred twenty-five thousand _____ Dollars and zero _____ Cents	1	LS	125,000.00	125,000.00
28	All Other Miscellaneous Site Work and Demolition Items seventy-five thousand _____ Dollars and zero _____ Cents	1	LS	75,000.00	75,000.00
Site Work and Demolition Sub-Total five hundred twenty five thousand _____ Dollars and zero _____ Cents					525,000.00

Permanent Yard Piping Bid Items

29	Sheet Piling one million three hundred eighty-six thousand _____ Dollars and zero _____ Cents	66,000	SF	21.00	1,386,000.00
30	Sanitary Sewer (SAN) System				
a	8in. Sanitary Pipe (4ft. to 6ft.) three thousand eight hundred _____ Dollars and zero _____ Cents	20	LF	190.00	3,800.00
b	21in. Sanitary Pipe (4ft. to 6ft.) twenty thousand _____ Dollars and zero _____ Cents	40	LF	500.00	20,000.00
c	21in. Sanitary Pipe (8ft. to 10ft.) twenty four thousand one hundred fifty _____ Dollars and zero _____ Cents	46	LF	525.00	24,150.00
d	12in. Sanitary Pipe (4ft. to 6ft.) five thousand seven hundred sixty _____ Dollars and zero _____ Cents	16	LF	360.00	5,760.00

<u>No.</u>	<u>Description</u>	<u>Qty</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Total</u>
e	12in. Sanitary Pipe (6ft. to 8ft.) eighteen thousand _____ Dollars and zero _____ Cents	50	LF	360.00	18,000.00
f	12in. Sanitary Pipe (8ft. to 10ft.) twelve thousand _____ Dollars and zero _____ Cents	30	LF	400.00	12,000.00
g	24in. Sanitary Pipe (8ft. to 10ft.) fifty four thousand _____ Dollars and zero _____ Cents	30	LF	1,800.00	54,000.00
h	6in. Sanitary Pipe three thousand six hundred _____ Dollars and zero _____ Cents	20	LF	180.00	3,600.00
i	Sanitary Sewer Manhole (4ft. to 6ft.) forty-five thousand _____ Dollars and zero _____ Cents	3	EA	15,000.00	45,000.00
j	Sanitary Sewer Manhole (6ft. to 8ft.) sixty four thousand _____ Dollars and zero _____ Cents	4	EA	16,000.00	64,000.00
k	Re-Coating Existing Structures thirty thousand _____ Dollars and zero _____ Cents	2	EA	15,000.00	30,000.00
l	Coating of New Structures eighty four thousand _____ Dollars and zero _____ Cents	7	EA	12,000.00	84,000.00
31	Process Drain (PD) system				
a	24in. Process Drain Pipe (0ft. to 4ft.) ninety four thousand five hundred _____ Dollars and zero _____ Cents	135	LF	700.00	94,500.00
b	24in. Process Drain Pipe (4ft. to 6ft.) three hundred thirteen thousand six hundred _____ Dollars and zero _____ Cents	196	LF	1,600.00	313,600.00
c	4in. Process Drain eight thousand four hundred _____ Dollars and zero _____ Cents	30	LF	280.00	8,400.00

<u>No.</u>	<u>Description</u>	<u>Qty</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Total</u>
d	8in. Process Drain eight thousand _____ Dollars and zero _____ Cents	20	LF	400.00	8,000.00
e	Process Drain Manhole (4ft. to 6ft.) ninety-two thousand _____ Dollars and zero _____ Cents	4	EA	23,000.00	92,000.00
f	Coring of Existing Process Drain Manhole seven thousand _____ Dollars and zero _____ Cents	1	EA	7,000.00	7,000.00
32	Storm Drain (STD) System				
a	8in. Storm Drain Pipe (0ft. to 4ft.) ten thousand four hundred _____ Dollars and zero _____ Cents	80	LF	130.00	10,400.00
b	12in. Storm Drain Pipe (0ft. to 4ft.) twelve thousand _____ Dollars and zero _____ Cents	80	LF	150.00	12,000.00
c	12in. Storm Drain Pipe (4ft. to 6ft.) fourteen thousand four hundred _____ Dollars and zero _____ Cents	90	LF	160.00	14,400.00
d	12in. Storm Drain Pipe (6ft. to 8ft.) eight thousand seven hundred fifty _____ Dollars and zero _____ Cents	50	LF	175.00	8,750.00
e	12in. Storm Drain Pipe (10ft. to 12ft.) six thousand five hundred _____ Dollars and zero _____ Cents	20	LF	325.00	6,500.00
f	15in. Storm Drain Pipe (6ft. to 8ft.) fifty thousand _____ Dollars and zero _____ Cents	250	LF	200.00	50,000.00
g	24in. Storm Drain Pipe (0ft. to 4ft.) thirty-six thousand _____ Dollars and zero _____ Cents	120	LF	300.00	36,000.00

<u>No.</u>	<u>Description</u>	<u>Qty</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Total</u>
h	Storm Drain Catch Basin (0ft. to 4ft.) eighty-eight thousand _____ Dollars and zero _____ Cents	8	EA	11,000.00	88,000.00
i	Storm Drain Catch Basin (4ft. to 6ft.) sixty thousand _____ Dollars and zero _____ Cents	5	EA	12,000.00	60,000.00
j	Storm Drain Catch Basin (6ft. to 8ft.) thirteen thousand _____ Dollars and zero _____ Cents	1	EA	13,000.00	13,000.00
k	Coring of Storm Drain Manhole one thousand four hundred _____ Dollars and zero _____ Cents	1	EA	1,400.00	1,400.00
l	Yard Drains twenty thousand _____ Dollars and zero _____ Cents	2	EA	10,000.00	20,000.00
m	Mitered End nine thousand _____ Dollars and zero _____ Cents	1	EA	9,000.00	9,000.00
n	Headwall thirteen thousand _____ Dollars and zero _____ Cents	1	EA	13,000.00	13,000.00
o	12in. Culvert six thousand two hundred fifty _____ Dollars and zero _____ Cents	50	LF	125.00	6,250.00
p	18in. Storm Drain Pipe (6ft. to 8ft.) twenty-five thousand three hundred _____ Dollars and zero _____ Cents	110	LF	230.00	25,300.00
33	Chlorine Solution (CLS) System forty five thousand _____ Dollars and zero _____ Cents	1	LS	45,000.00	45,000.00

<u>No.</u>	<u>Description</u>	<u>Qty</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Total</u>
34	Concentrate (CON) System one million one hundred thousand _____ Dollars and zero _____ Cents	1	LS	1,100,000.00	1,100,000.00
35	Force Main (FM) System				
a	8in. Force Main Pipe twenty-nine thousand two hundred fifty _____ Dollars and zero _____ Cents	90	LF	325.00	29,250.00
b	8in. 45 deg Bend Force Main nine hundred fifty _____ Dollars and zero _____ Cents	1	EA	950.00	950.00
c	8in. 90 deg Bend Force Main nine hundred seventy five _____ Dollars and zero _____ Cents	1	EA	975.00	975.00
d	8in. X 4in. Reducer Force Main one thousand _____ Dollars and zero _____ Cents	1	EA	1,000.00	1,000.00
e	8in. Plug Valve Force Main four thousand five hundred _____ Dollars and zero _____ Cents	1	EA	4,500.00	4,500.00
36	Non-Potable Water (NPW) System				
a	2in. Non-Potable Water Pipe twelve thousand _____ Dollars and zero _____ Cents	300	LF	40.00	12,000.00
b	2.5in. Non-Potable Water Pipe sixteen thousand _____ Dollars and zero _____ Cents	40	LF	400.00	16,000.00
c	4in. Non-Potable Water Pipe nine thousand _____ Dollars and zero _____ Cents	60	LF	150.00	9,000.00
d	16in. Non-Potable Water Pipe five hundred forty thousand _____ Dollars and zero _____ Cents	450	LF	1,200.00	540,000.00

<u>No.</u>	<u>Description</u>	<u>Qty</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Total</u>
e	12in. X 4in. Tap & Sleeve Non-Potable Water four thousand four hundred _____ Dollars and zero _____ Cents	1	EA	4,400.00	4,400.00
f	12in. X 6in. Reducer Non-Potable Water one thousand four hundred _____ Dollars and zero _____ Cents	1	EA	1,400.00	1,400.00
g	2in. 45 deg Bend Non-Potable Water eight hundred twenty five _____ Dollars and zero _____ Cents	3	EA	275.00	825.00
h	4in. X 2in. Reducer Non-Potable Water seven hundred _____ Dollars and zero _____ Cents	1	EA	700.00	700.00
i	90in. Bend 6in. Non-Potable Water one thousand eight hundred _____ Dollars and zero _____ Cents	2	EA	900.00	1,800.00
j	16in. 45 deg Bend Non-Potable Water forty-eight thousand _____ Dollars and zero _____ Cents	15	EA	3,200.00	48,000.00
k	2in. Plug Valve Non-Potable Water one thousand four hundred _____ Dollars and zero _____ Cents	1	EA	1,400.00	1,400.00
l	16in. Gate Valve Non-Potable Water seventeen thousand _____ Dollars and zero _____ Cents	1	EA	17,000.00	17,000.00
m	16in. Air Release Valve (ARV) Non-Potable Water twenty-eight thousand _____ Dollars and zero _____ Cents	1	EA	28,000.00	28,000.00

<u>No.</u>	<u>Description</u>	<u>Qty</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Total</u>
d	12in. 6in. Tee Potable Water six thousand _____ Dollars and zero _____ Cents	4	EA	1,500.00	6,000.00
e	12in. X 6in. Reducer Potable Water one thousand two hundred _____ Dollars and zero _____ Cents	1	EA	1,200.00	1,200.00
f	6in. 90 deg Bend Potable Water one thousand five hundred _____ Dollars and zero _____ Cents	2	EA	750.00	1,500.00
g	6in. 90 deg Bend MJ Potable Water seven hundred fifty _____ Dollars and zero _____ Cents	1	EA	750.00	750.00
h	6in. Gate Valve Potable Water nine thousand two hundred _____ Dollars and zero _____ Cents	4	EA	2,300.00	9,200.00
i	12in. Gate Valve Potable Water fifteen thousand _____ Dollars and zero _____ Cents	3	EA	5,000.00	15,000.00
j	12in. Air Release Valve (ARV) Potable Water twenty eight thousand _____ Dollars and zero _____ Cents	1	EA	28,000.00	28,000.00
k	Fire Hydrant eleven thousand two hundred _____ Dollars and zero _____ Cents	4	EA	2,800.00	11,200.00
39	Scum (SCUM) System one hundred seventy five thousand _____ Dollars and zero _____ Cents	1	LS	175,000.00	175,000.00
40	Secondary Effluent (SEC) System				
a	42in. Secondary Effluent Pipe three hundred forty five thousand _____ Dollars and zero _____ Cents	150	LF	2,300.00	345,000.00

<u>No.</u>	<u>Description</u>	<u>Qty</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Total</u>
b	54in. Secondary Effluent Pipe three million three hundred thousand _____ Dollars and zero _____ Cents	1,100	LF	3,000.00	3,300,000.00
c	64in. Secondary Effluent Pipe four hundred fifty thousand _____ Dollars and zero _____ Cents	60	LF	7,500.00	450,000.00
d	42in. 45 deg Bend Secondary Effluent one hundred twenty five thousand _____ Dollars and zero _____ Cents	5	EA	25,000.00	125,000.00
e	54in. 22.5 deg Bend Secondary Effluent ninety thousand _____ Dollars and zero _____ Cents	2	EA	45,000.00	90,000.00
f	54in. 36in. Tee Secondary Effluent two hundred seventy six thousand _____ Dollars and zero _____ Cents	3	EA	92,000.00	276,000.00
g	54in. 45 deg Bend Secondary Effluent three hundred forty eight thousand _____ Dollars and zero _____ Cents	6	EA	58,000.00	348,000.00
h	54in. 54in. Tee Secondary Effluent one hundred sixty seven thousand _____ Dollars and zero _____ Cents	1	EA	167,000.00	167,000.00
i	54in. 90 deg Bend Secondary Effluent five hundred four thousand _____ Dollars and zero _____ Cents	7	EA	72,000.00	504,000.00
j	54in. Sleeve Secondary Effluent sixty thousand _____ Dollars and zero _____ Cents	1	EA	60,000.00	60,000.00
k	64in. X 54in. Reducer Secondary Effluent eighty six thousand _____ Dollars and zero _____ Cents	2	EA	43,000.00	86,000.00

<u>No.</u>	<u>Description</u>	<u>Qty</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Total</u>
41	Seal Water (SW) System				
a	2in. Seal Water Pipe seventeen thousand eight hundred fifty _____ Dollars and zero _____ Cents	350	LF	51.00	17,850.00
b	2in. 22.5 deg Bend Seal Water one hundred fifty _____ Dollars and zero _____ Cents	2	EA	75.00	150.00
c	2in. 45 deg Bend Seal Water two hundred fifty _____ Dollars and zero _____ Cents	3	EA	75.00	225.00
d	2in. 90 deg Bend Seal Water three hundred seventy five _____ Dollars and zero _____ Cents	5	EA	75.00	375.00
42	Waste Activated Sludge (WAS) System				
a	6in. Waste Activated Sludge Pipe two hundred fifty-five thousand _____ Dollars and zero _____ Cents	600	LF	425.00	255,000.00
b	6in. 11.25 deg Bend Waste Activated Sludge one thousand _____ Dollars and zero _____ Cents	1	EA	1,000.00	1,000.00
c	6in. 22.5 deg Bend Waste Activated Sludge seven thousand _____ Dollars and zero _____ Cents	4	EA	1,750.00	7,000.00
d	6in. 45 deg Bend Waste Activated Sludge fourteen thousand _____ Dollars and zero _____ Cents	8	EA	1,750.00	14,000.00
43	Sampling Line (SMP) System thirty nine thousand _____ Dollars and zero _____ Cents	1	LS	39,000.00	39,000.00
44	Water Services eighteen thousand _____ Dollars and zero _____ Cents	2	EA	9,000.00	18,000.00

<u>No.</u>	<u>Description</u>	<u>Qty</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Total</u>
45	Pipe Encasement seventy five thousand _____ Dollars and zero _____ Cents	100	LF	<u>750.00</u>	<u>75,000.00</u>
46	All Other Miscellaneous Permanent Yard Piping Items eight hundred fifteen thousand _____ Dollars and zero _____ Cents	1	LS	<u>815,000.00</u>	<u>815,000.00</u>
Permanent Yard Piping Sub-Total thirteen million two hundred thirty one thousand six hundred sixty _____ Dollars and zero _____ Cents					<u>13,231,660.00</u>

Civil, Structural, Process, Electrical, and I&C Bid Items

47	Injection Well Pump Station No. 2 Strainer Improvements two million _____ Dollars and zero _____ Cents	1	LS	<u>2,000,000.00</u>	<u>2,000,000.00</u>
48	Plant Drain Pump Station Improvements one million six hundred thousand _____ Dollars and zero _____ Cents	1	LS	<u>1,600,000.00</u>	<u>1,600,000.00</u>
49	Surge Tanks and Fuel Storage Tanks Improvements two million five hundred thousand _____ Dollars and zero _____ Cents	1	LS	<u>2,500,000.00</u>	<u>2,500,000.00</u>
50	Existing Injection Well No. 1 and No. 2 Modifications one million two hundred thousand _____ Dollars and zero _____ Cents	1	LS	<u>1,200,000.00</u>	<u>1,200,000.00</u>
51	Splitter Box Improvements at Clarifier No.2 two million four hundred thousand _____ Dollars and zero _____ Cents	1	LS	<u>2,400,000.00</u>	<u>2,400,000.00</u>
52	Injection Well Pump Station Building No.2 thirty three million _____ Dollars and zero _____ Cents	1	LS	<u>33,000,000.00</u>	<u>33,000,000.00</u>
53	Electrical Service and Generator Building thirty million _____ Dollars and zero _____ Cents	1	LS	<u>30,000,000.00</u>	<u>30,000,000.00</u>

<u>No.</u>	<u>Description</u>	<u>Qty</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Total</u>
54	Gravity Retaining Wall nine hundred thousand _____ Dollars and zero _____ Cents	1	LS	900,000.00	900,000.00
55	Sidewalks, Parking Pads, Stair Landing Pads, and Miscellaneous Concrete Pads one hundred thousand _____ Dollars and zero _____ Cents	1	LS	100,000.00	100,000.00
56	Fuel Delivery Trench Box forty eight thousand seven hundred fifty _____ Dollars and zero _____ Cents	75	LF	650.00	48,750.00
57	Concrete Curbs and Valley Gutters thirty-two thousand five hundred _____ Dollars and zero _____ Cents	1,300	LF	25.00	32,,500.00
58	Site Fill and Grading one million five hundred thousand _____ Dollars and zero _____ Cents	1	LS	1,500,000.00	1,500,000.00
59	Guard Rails twelve thousand _____ Dollars and zero _____ Cents	80	LF	150	12,000.00
60	Installation of New Perimeter Fencing sixty thousand _____ Dollars and zero _____ Cents	750	LF	80	60,000.00
61	Geotechnical Instrumentation and Monitoring three hundred sixty thousand _____ Dollars and zero _____ Cents	1	LS	360,000.00	360,000.00
62	Low Voltage Power Circuit forty five thousand _____ Dollars and zero _____ Cents	5	EA	9,000.00	45,000.00
63	Control Circuit forty thousand _____ Dollars and zero _____ Cents	5	EA	8,000.00	40,000.00
64	All Other Miscellaneous Civil, Structural, Process, Electrical, and I&C Items sixty hundred seventy five thousand _____ Dollars and zero _____ Cents	1	LS	675,000.00	675,000.00
	Civil, Structural, Process, Electrical, and I&C Sub-Total seventy six million four hundred seventy-three thousand two hundred fifty _____ Dollars and zero _____ Cents				76,473,250.00

Roads and Site Restoration Bid Items

<u>No.</u>	<u>Description</u>	<u>Qty</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Total</u>
65	Road Construction <u>two hundred forty thousand</u> Dollars and <u>zero</u> Cents	5,000	SY	<u>48.00</u>	<u>240,000.00</u>
66	Milling of Asphaltic Course to 1in. Nominal Thickness <u>fifty six thousand</u> Dollars and <u>zero</u> Cents	8,000	SY	<u>7.00</u>	<u>56,000.00</u>
67	1.5in. Thick Asphaltic Concrete Structural Course for Trench Restoration <u>ninety three thousand</u> Dollars and <u>zero</u> Cents	1,500	LF	<u>62.00</u>	<u>93,000.00</u>
68	1.5in. Thick Asphaltic Concrete Surface Course for Pavement Overlay <u>one hundred seventy two thousand</u> Dollars and <u>zero</u> Cents	8,000	SY	<u>21.50</u>	<u>172,000.00</u>
69	Install new thermoplastic or painted pavement markings, reflective pavement markers, and traffic signs <u>five thousand</u> Dollars and <u>zer</u> Cents	1	LS	<u>5,000.00</u>	<u>5,000.00</u>
70	Site Restoration <u>one hundred thirty thousand</u> Dollars and <u>zero</u> Cents	10,000	SY	<u>13.00</u>	<u>130,000.00</u>
71	All Other Miscellaneous Road and Site Restoration Items <u>ten thousand</u> Dollars and <u>zero</u> Cents	1	LS	<u>10,000.00</u>	<u>10,000.00</u>
Roads and Site Restoration Sub-Total <u>seven hundred six thousand</u> Dollars and <u>zero</u> Cents					<u>706,000.00</u>

<u>No.</u>	<u>Description</u>	<u>Qty</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Total</u>
72	South Electrical Service Center				
a	Demolition fifty thousand _____ Dollars and zero _____ Cents	1	LS	50,000.00	50,000.00
b	Civil/Site Work eight hundred ninety thousand _____ Dollars and zero _____ Cents	1	LS	890,000.00	890,000.00
c	Structural, Process, Electrical, and I&C four million _____ Dollars and zero _____ Cents	1	LS	4,000,000.00	4,000,000.00

General Bid Items

73	Mobilization / Gen. Requirements three million _____ Dollars and zero _____ Cents	1	LS	3,000,000.00	3,000,000.00
74	Demobilization / Gen. Requirements two million two hundred thousand _____ Dollars and zer _____ Cents	1	LS	2,200,000.00	2,200,000.00
75	Permit, Licenses, and Fees Allowance Five hundred thousand _____ Dollars and No _____ Cents	1	LS		\$500,000
76	Materials Testing Allowance Two hundred and fifty thousand _____ Dollars and No _____ Cents	1	LS		\$250,000
77	Third Party Special Inspections Allowance Two hundred and fifty thousand _____ Dollars and No _____ Cents	1	LS		\$250,000
General Sub-Total six million two hundred thousand _____ Dollars and zero _____ Cents					6,200,000.00
Phase 2 (Bid items 22-77) Sub-Total one hundred two million seventy five thousand nine hundred ten _____ Dollars and zero _____ Cents					102,075,910.00

<u>No.</u>	<u>Description</u>	<u>Qty</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Total</u>
78	Miscellaneous Work Allowance/Contingency Three million _____Dollars and No-----Cents	1	LS		<u>\$3,000,000</u>
79	Unforeseen Utility Locates or Break Repair two hundred fifty thousand _____Dollars and zero _____Cents	500	HR	<u>500.00</u>	<u>250,000.00</u>
80	Consideration for Indemnification Ten _____Dollars and No-----Cents	1	LS		<u>\$10.00</u>
BASE BID TOTAL FOR COMPLETE PROJECT:					<u>114,404,970.00</u>

BASE BID TOTAL IN WRITING: one hundred fourteen million four hundred four thousand nine hundred seventy dollars and zero cents

NAME OF BIDDER: Cardinal Contractors, Inc

LIST OF SUBCONTRACTORS

The Bidder shall list below the name and address of each Subcontractor who will perform work under this Contract in excess of one-half percent of the total bid price, and shall also list the portion of the work which will be done by such Subcontractor. After the opening of Proposals, changes or substitutions will be allowed with written approval of the City of Hollywood. Subcontractors must be properly licensed and hold a valid Hollywood Certificate of Competency.

	Work to be Performed	Subcontractor's Name / Address
1.	Electrical	Loveland Electric 1344 S. Killian Dr., Lake Park, FL 33403
2.	Painting	Southland Painting 2635 NW 4th Street, Fort Lauderdale, FL 33311
3.	Masonry	3C Construction 3601 NW 55th Street, Miami, FL 33142
4.	I&C	CC Controls 5730 Corporate Way, West Palm Beach, FL 33407
5.		
6.		
7.		
8.		
9.		
10.		

NOTE: Attach additional sheets if required.

- END OF SECTION

NOT APPLICABLE

SECTION 00 43 50

LOCAL PREFERENCE

(EXHIBIT "A")

Pursuant to §38.50 of the City of Hollywood *Code of Ordinances*, the City shall grant a preference to local Hollywood vendors if their initial bid is within 5% of the bid of the lowest responsive responsible bidder that is a non-local Hollywood vendor. The preference shall allow the local Hollywood vendor to submit a second and final offer, which must be at least 1% less than the bid of the lowest responsive responsive non-local Hollywood vendor to be awarded. The local Hollywood vendor shall have the burden of demonstrating that it maintains a permanent place of business with full-time employees within the City limits and has done so for a minimum of one (1) year prior to the date of issuance of a bid or proposal solicitation within Hollywood, Florida. All supporting documentation (e.g. City of Hollywood valid local business tax receipt) for local preference eligibility must be received with the bid package prior to the bid opening date and time.

BROWARD COUNTY LOCAL BUSINESS TAX RECEIPT

115 S. Andrews Ave., Rm. A-100, Ft. Lauderdale, FL 33301-1895 – 954-831-4000

VALID OCTOBER 1, 2021 THROUGH SEPTEMBER 30, 2022

DBA:
Business Name: CARDINAL CONTRACTORS, LLC

Receipt #: 180-310509
Business Type: GENERAL CONTRACTOR (CERT
GENERAL CONTRACTOR)

Owner Name: MICHAEL BRANDAO
Business Location: 13794 NW 4 ST STE 200
SUNRISE
Business Phone: 941-377-8555

Business Opened: 11/20/2020
State/County/Cert/Reg: CGC1529337
Exemption Code:

Rooms Seats Employees Machines Professionals
67

For Vending Business Only						
Number of Machines:			Vending Type:			
Tax Amount	Transfer Fee	NSF Fee	Penalty	Prior Years	Collection Cost	Total Paid
150.00	0.00	0.00	0.00	0.00	0.00	150.00

THIS RECEIPT MUST BE POSTED CONSPICUOUSLY IN YOUR PLACE OF BUSINESS

**THIS BECOMES A TAX RECEIPT
WHEN VALIDATED**

This tax is levied for the privilege of doing business within Broward County and is non-regulatory in nature. You must meet all County and/or Municipality planning and zoning requirements. This Business Tax Receipt must be transferred when the business is sold, business name has changed or you have moved the business location. This receipt does not indicate that the business is legal or that it is in compliance with State or local laws and regulations.

Mailing Address:

CARDINAL CONTRACTORS, LLC
13794 NW 4 ST STE 200
SUNRISE, FL 33325

Receipt # WWW-20-00219691
Paid 07/07/2021 150.00

2021 - 2022

BROWARD COUNTY LOCAL BUSINESS TAX RECEIPT

115 S. Andrews Ave., Rm. A-100, Ft. Lauderdale, FL 33301-1895 – 954-831-4000

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SUNRISE
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State/County/Cert/Reg: CGC1529337
Exemption Code:

Rooms Seats Employees Machines Professionals
67

For Vending Business Only						
Number of Machines:			Vending Type:			
Tax Amount	Transfer Fee	NSF Fee	Penalty	Prior Years	Collection Cost	Total Paid
150.00	0.00	0.00	0.00	0.00	0.00	150.00

Receipt # WWW-20-00219691
Paid 07/07/2021 150.00

**LOCAL BUSINESS TAX RECEIPT
RECEIPT EXPIRES: 9/30/2022**

BUSINESS NAME: CARDINAL CONTRACTORS INC

LOCATION ADDRESS: 13794 NW 4 ST

200

SUNRISE, FL 33325

ISSUE DATE: October 01, 2021

EXPIRATION DATE: September 30, 2022

TAX RECEIPT NUMBER: BTR-003593-2021

BUSINESS CLASS: 55(A) - Contractors—General contractor

TOTAL AMOUNT PAID:

\$514.04

Comments:

RECEIPT MUST BE CONSPICUOUSLY DISPLAYED TO PUBLIC VIEW AT BUSINESS LOCATION.

**NOTICE: THIS RECEIPT BECOMES NULL & VOID IF OWNERSHIP, BUSINESS NAME, OR ADDRESS IS CHANGED.
TAXPAYER MUST APPLY TO BUSINESS TAX DIVISION FOR TRANSFER.**

CITY OF SUNRISE BUSINESS TAX RECEIPT DO NOT DISCARD

**John Scott, CARDINAL CONTRACTORS INC
13794 NW 4 ST
SUITE 200
SUNRISE, FL 33325**

SECTION 00 49 50

TRENCH SAFETY FORM

This form must be completed and signed by the Bidder.

Failure to complete this form may result in the bid being declared non-responsive.

Bidder acknowledges that the Florida Trench Safety Act, Section 553.60 et. seq., which became effective October 1, 1990, shall be in effect during the period of construction of the project. The Bidder by signing and submitting the bid is, in writing, assuring that it will perform any trench excavation in accordance with applicable trench safety standards. The Bidder further identifies the following separate item of cost of compliance with the applicable trench safety standards as well as the method of compliance:

<u>Method of Compliance</u>	<u>Cost</u>
Shoring, sheeting, trenchboxes, and sloping	Total \$ <u>2,000,000.00</u>

Bidder acknowledges that this cost is included in the applicable items of the Proposal and in the Grand Total Bid Price. Failure to complete the above will result in the bid being declared non-responsive.

The Bidder is, and the Owner and Engineer are not, responsible to review or assess Bidder's safety precautions, programs or costs, or the means, methods, techniques or technique adequacy, reasonableness of cost, sequences or procedures of any safety precaution, program or cost, including but not limited to, compliance with any and all requirements of Florida Statute Section 553.60 et. seq. cited as the "Trench Safety Act". Bidder is, and the owner and Engineer are not, responsible to determine if any safety related standards apply to the project, including but not limited to, the "Trench Safety Act".


Witness Signature

Mary Washburn
Witness Printed Name

13794 NW 4th Street, Suite 200, Sunrise, FL 33325

Witness Address

01/31/2022
Date


Contractor's Signature

Eric Macek
Printed Name

Vice President
Title

01/31/2022
Date

- END OF SECTION -

Ron DeSantis, Governor



Halsey Beshears, Secretary



STATE OF FLORIDA
DEPARTMENT OF BUSINESS AND PROFESSIONAL REGULATION

CONSTRUCTION INDUSTRY LICENSING BOARD

THE GENERAL CONTRACTOR HEREIN IS CERTIFIED UNDER THE
PROVISIONS OF CHAPTER 489, FLORIDA STATUTES



MACEK, ERIC

CARDINAL CONTRACTORS, INC.
13790 NW 4TH STREET SUITE 109
SUNRISE FL 33325

LICENSE NUMBER: CGC1528398

EXPIRATION DATE: AUGUST 31, 2022

Always verify licenses online at MyFloridaLicense.com



Do not alter this document in any form.

This is your license. It is unlawful for anyone other than the licensee to use this document.



Ron DeSantis, Governor

Halsey Beshears, Secretary



STATE OF FLORIDA
DEPARTMENT OF BUSINESS AND PROFESSIONAL REGULATION

CONSTRUCTION INDUSTRY LICENSING BOARD

THE GENERAL CONTRACTOR HEREIN IS CERTIFIED UNDER THE
PROVISIONS OF CHAPTER 489, FLORIDA STATUTES

BRANDAO, MICHAEL LUIS

CARDINAL CONTRACTORS, INC.
13794 NW 4TH STREET SUITE 200
SUNRISE FL 33325

LICENSE NUMBER: CGC1529337

EXPIRATION DATE: AUGUST 31, 2022

Always verify licenses online at MyFloridaLicense.com



Do not alter this document in any form.

This is your license. It is unlawful for anyone other than the licensee to use this document.

Supplier Response Form

ACKNOWLEDGMENT AND SIGNATURE PAGE

This form must be completed and submitted by the date and the time of bid opening.

Legal Company Name (include d/b/a if applicable): Cardinal Co Federal Tax Identification Number: 80-0388780

If Corporation - Date Incorporated/Organized: Cardinal Contractors, Inc. - 2003

State Incorporated/Organized: Florida

Company Operating Address: 13794 NW 4th St, Suite 200

City Sunrise State FL Zip Code 33325

Remittance Address (if different from ordering address): 18484 East Petroleum Drive

City Baton Rouge State LA Zip Code 70809

Company Contact Person: Mike Brandao Email Address: mbrandao@prim.com

Phone Number (include area code): 561-809-1285 Fax Number (include area code): 954-337-0431

Company's Internet Web Address: <https://www.primoriscorp.com/>

IT IS HEREBY CERTIFIED AND AFFIRMED THAT THE BIDDER/PROPOSER CERTIFIES ACCEPTANCE OF THE TERMS, CONDITIONS, SPECIFICATIONS, ATTACHMENTS AND ANY ADDENDA. THE BIDDER/PROPOSER SHALL ACCEPT ANY AWARDS MADE AS A RESULT OF THIS SOLICITATION. BIDDER/PROPOSER FURTHER AGREES THAT PRICES QUOTED WILL REMAIN FIXED FOR THE PERIOD OF TIME STATED IN THE SOLICITATION.

Bidder/Proposer's Authorized Representative's Signature: Eric Macek * Date 01/05/2022

Type or Print Name: Eric Macek 

1/31/22, 11:15 AM

DPX Form

THE EXECUTION OF THIS FORM CONSTITUTES THE UNEQUIVOCAL OFFER OF BIDDER/PROPOSER TO BE BOUND BY THE TERMS OF ITS PROPOSAL. FAILURE TO SIGN THIS SOLICITATION WHERE INDICATED BY AN AUTHORIZED REPRESENTATIVE SHALL RENDER THE BID/PROPOSAL NON-RESPONSIVE. THE CITY MAY, HOWEVER, IN ITS SOLE DISCRETION, ACCEPT ANY BID/PROPOSAL THAT INCLUDES AN EXECUTED DOCUMENT WHICH UNEQUIVOCALLY BINDS THE BIDDER/PROPOSER TO THE TERMS OF ITS OFFER.

Bid/RFP/RFQ Number: F-4696-21-OT Title: DEEP INJECTION WELLS NO. 3 AND NO. 4 PUMP STATION

Procurement Services Division
2600 Hollywood Boulevard, Room 303
Hollywood, Florida 33020

Supplier Response Form



CERTIFICATIONS REGARDING DEBARMENT, SUSPENSION AND OTHER RESPONSIBILITY MATTERS

The applicant certifies that it and its principals:

- (a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, sentenced to a denial of Federal benefits by a State or Federal court, or voluntarily excluded from covered transactions by any Federal department or agency;
- (b) Have not within a three-year period preceding this application been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction, violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
- (c) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State, or local) with commission of any of the offenses enumerated in paragraph (b) of this certification; and
- (d) Have not within a three-year period preceding this application had one or more public transactions (Federal, State, or local) terminated for cause or default.

Applicant Name and Address:

Cardinal Contractors, Inc.
13794 NW 4th Street, Suite 200
Sunrise, FL 33325

Application Number and/or Project Name:

Bid #F-4696-21-OT - DEEP INJECTION WELLS NO. 3 AND NO. 4 F

Applicant IRS/Vendor Number: 80-0388786

Eric Macek

Signature

Cardinal Contractors, Inc.

Name of Company

A handwritten signature in blue ink, appearing to read "EM", is written over the signature line.

Eric Macek

Printed Name

Vice President

Title

Bid/RFP/RFQ Number: F-4696-21-OT Title: DEEP INJECTION WELLS NO. 3 AND NO. 4 PUMP STATION

Please enter your password below and click Save to update your response.

Please be aware that typing in your password acts as your electronic signature, which is just as legal and binding as an original signature. (See [Electronic Signatures in Global and National Commerce Act](#) for more information.)

To take exception:

- 1) Click Take Exception.
- 2) Create a Word document detailing your exceptions.
- 3) Upload exceptions as an attachment to your offer on BidSync's system.

By completing this form, your bid has not yet been submitted. Please click on the place offer button to finish filling out your bid.

Username **emacek@prim.com**

Password *

Save

Take Exception

Close

* Required fields

1/31/22, 11:19 AM

DPX Form

Bid/RFP/RFQ Number: F-4696-21-OT Title: DEEP INJECTION WELLS NO. 3 AND NO. 4 PUMP STATION

Procurement Services Division
2600 Hollywood Boulevard, Room 303
Hollywood, Florida 33020

Supplier Response Form



Cardinal Contractors, Inc.

(Company Name and Authorized Signature, Print Name)

, the contractor, shall indemnify, defend and hold harmless the City of Hollywood, its elected and appointed officials, employees and agents for any and all suits, actions, legal or administrative proceedings, claims, damage, liabilities, interest, attorney's fees, costs of any kind whether arising prior to the start of activities or following the completion or acceptance and in any manner directly or indirectly caused, occasioned or contributed to in whole or in part by reason of any act, error or omission, fault or negligence whether active or passive by the contractor, or anyone acting under its direction, control, or on its behalf in connection with or incident to its performance of the contract.

Eric Macek

Signature

Cardinal Contractors, Inc.

Name of Company

Eric Macek

Printed Name

Vice President

Title

Bid/RFP/RFQ Number: F-4696-21-OT Title: DEEP INJECTION WELLS NO. 3 AND NO. 4 PUMP STATION

Procurement Services Division
2600 Hollywood Boulevard, Room 303
Hollywood, Florida 33020

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Username **emacek@prim.com**

Password *

Save

Take Exception

Close

* Required fields

1/31/22, 11:18 AM

DPX Form

Signature

Cardinal Contractors, Inc.

Name of Company

Vice President

Title

Bid/RFP/RFQ Number: F-4696-21-OT Title: DEEP INJECTION WELLS NO. 3 AND NO. 4 PUMP STATION

Supplier Response Form



SWORN STATEMENT PURSUANT TO SECTION 287.133 (3) (a) FLORIDA STATUTES ON PUBLIC ENTITY CRIMES

THIS FORM MUST BE SIGNED AND SWORN TO IN THE PRESENCE OF A NOTARY PUBLIC OR OTHER OFFICIAL AUTHORIZED TO ADMINISTER OATHS

1. This form statement is submitted to City of Hollywood

By Eric Macek for Cardinal Contractors, Inc.

(Print individual's name and title) (Print name of entity submitting sworn statement)

whose business address is 13794 NW 4th Street, Suite 200, Sunrise, FL 33325

and if applicable its Federal Employer Identification Number (FEIN) is 80-0388786

If the entity has no FEIN, include the Social Security Number of the individual signing this

sworn statement.

2. I understand that "public entity crime," as defined in paragraph 287.133(1)(g), Florida Statutes, means a violation of any state or federal law by a person with respect to and directly related to the transaction of business with any public entity or with an agency or political subdivision of any other state or with the United States, including, but not limited to, any bid, proposal, reply, or contract for goods or services, any lease for real property, or any contract for the construction or repair of a public building or public work, involving antitrust, fraud, theft, bribery, collusion, racketeering, conspiracy, or material misinterpretation.

3. I understand that "convicted" or "conviction" as defined in Paragraph 287.133(1)(b), Florida Statutes, means a finding of guilt or a conviction of a public entity crime, with or without an adjudication of guilt, in a federal or state trial court of record relating to charges brought by indictment or information after July 1, 1989, as a result of a jury verdict, nonjury trial, or entry of a plea of guilty or nolo contendere.

4. I understand that "Affiliate," as defined in paragraph 287.133(1)(a), Florida Statutes, means:

1. A predecessor or successor of a person convicted of a public entity crime, or
2. An entity under the control of any natural person who is active in the management of the entity and who has been convicted of a public entity crime. The term "affiliate" includes those officers, directors, executives, partners, shareholders, employees, members, and agents who are active in the management of an affiliate. The ownership by one person of shares constituting a controlling interest in another person, or a pooling of equipment or income among persons when not for fair market value under an arm's length agreement, shall be a prima facie case that one person controls another person. A person who knowingly enters into a joint venture with a person who has been convicted of a public entity crime in Florida during the preceding 36 months shall be considered an affiliate.

5. I understand that "person," as defined in Paragraph 287.133(1)(e), Florida Statutes, means any natural person or any entity organized under the laws of any state or of the United States with the legal power to enter into a binding contract and which bids or applies to bid on contracts let by a public entity, or which otherwise transacts or applies to transact business with a public

Please enter your password below and click Save to update your response.

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- 2) Create a Word document detailing your exceptions.
- 3) Upload exceptions as an attachment to your offer on BidSync's system.

By completing this form, your bid has not yet been submitted. Please click on the place offer button to finish filling out your bid.

Username **emacek@prim.com**

Password *

Save

Take Exception

Close

* Required fields

1/31/22, 11:19 AM

DPX Form

City, State, ZIP:	Galveston, TX 77550	Phone Number:	
Point of Contact:	Kim Coogan	Fax Number:	
Email:	kcoogan@galvestontx.gov		
Explain How This Referenced Work Is Similar To This Request: Please see Attachment 3 - New 59th Street Pump Station			
Date service was provided: 09/2015 - 09/2019			



1/31/2022

Supplier Response FormCity of Hollywood, Florida
IFB # F-4696-21-OT

Issue Date

1.0 GENERAL TERMS AND CONDITIONS

1.1 INSTRUCTIONS TO BIDDERS

It is the policy of the City to encourage full and open competition among all available qualified vendors. All vendors regularly engaged in the type of Work specified in the Bid Solicitation are encouraged to submit bids. To receive notification and to be eligible to bid vendor should be registered with BidSync. Vendors may register with the BidSync (registration is free) to be included on a mailing list for selected categories of goods and Services. In order to be processed for payment, any awarded vendor must register with the City by completing and returning a Vendor Application and all supporting documents. For information and to apply as a vendor, please visit our website at hollywoodfl.org to download an application and submit it to Procurement Services Division.

1.2 BIDDERS RESPONSIBILITIES

Bidders are required to submit their bids upon the following express conditions:

- A. Bidders shall thoroughly examine the drawings, specifications, schedules, instructions and all other contract documents.
- B. Bidders shall make all investigations necessary to thoroughly inform themselves regarding delivery of material, equipment or Services as required by the bid conditions. No plea of ignorance, by the bidder, of conditions that exist or that may hereafter exist as a result of failure or omission on the part of the bidder to make the necessary examinations and investigations, or failure to fulfill in every detail the requirements of the contract documents, will be accepted as a basis for varying the requirements of the City or the compensation due the bidder.
- C. Bidders are advised that all City contracts are subject to all legal requirements provided for in the City of Hollywood Charter, Code of Ordinances and applicable County Ordinances, State Statutes and Federal Statutes.

1.3 PREPARATION OF BIDS

Bids will be prepared in accordance with the following:

- A. The City's enclosed Bid Proposal Form, in its entirety, is to be used in submitting your bid. NO OTHER FORM WILL BE ACCEPTED.
- B. All information required by the bid form shall be furnished. The bidder shall sign each continuation sheet (where indicated) on which an entry is made.
- C. Unit prices shall be shown and where there is an error in extension of prices, the unit price shall govern.
- D. Alternate bids will not be considered unless authorized in the Invitation to Bid document.

D. The bid is conditional, except that the Bidder may qualify its bid for acceptance by the City on an "all or none" basis, group basis, or a "low item" basis. An "all or none" basis bid must include all items upon which bids are invited.

E. The City is under a pre-lawsuit claim from the Bidder or is involved in current litigation with the Bidder.

The City may reject all bids whenever it is deemed in the best interest of the City to do so, and may reject any part of a bid unless the bid has been qualified as provided in paragraph D above.

1.7 WITHDRAWAL OF BIDS

A. Bids shall be deemed enforceable for a period of 120 days after the time set for the bid opening.

B. Bids may be withdrawn prior to the time set for the bid opening. Such request must be in writing.

C. The City may permanently retain as liquidated damages the bid deposit furnished by any Bidder who requests to withdraw a bid after the bid opening.

1.8 LATE BIDS OR MODIFICATIONS

Only bids or proposals received as of the opening date and time will be considered timely. Bids and modifications received after the time set for the bid opening will be returned un-opened to the sender and rejected as late.

1.9 CONFLICTS WITHIN THE BID SOLICITATION

Where there appears to be a conflict between the General Terms and Conditions, Special Conditions, the Technical Specifications, the Bid Submittal Section, or any addendum issued, the order of precedence shall be the addenda in reverse chronological order, the Bid Submittal Section, the Technical Specifications, the Special Conditions, and then the General Terms and Conditions.

1.10 CLARIFICATION OR OBJECTION TO BID SPECIFICATIONS

If any person contemplating submitting a bid for this contract is in doubt as to the true meaning of the specifications or other bid documents or any part thereof, he or she may submit to the Procurement Services Division on or before the date specified for a request for clarification. All such requests for clarification shall be made in writing and the person submitting the request will be responsible for its prompt delivery. Any interpretation of the bid, if made, will be made only by Addendum duly issued. A copy of such Addendum will be made available to each person receiving an Invitation for Bids. The City will not be responsible for any other explanation or interpretation of the proposed bid made or given prior to the award of the contract. Any objection to the specifications and requirements as set forth in this bid must be filed in writing with the Director of Procurement Services on or before the date specified for a request for clarification.

1.11 INVOICING/PAYMENT

All invoices should be sent to: City of Hollywood, Financial Services Department, P.O. Box 229045, Hollywood, Florida 33022-9045. In accordance with Florida Statutes Chapter 218, payment will be made within 45 days after receipt of Services and a proper invoice. The City cannot make advance payments, make deposits in advance of receipt of goods, or pay C.O.D. Bidders should state any payment discount in the space provided on the proposal form.

To the City

Project Manager: Otis Thomas
City of Hollywood
Attention: Otis Thomas
Phone: 954-921-3628
Fax:
E-mail: Othomas@hollywoodfl.org

and,

To the Contract Compliance Officer:
Paul A. Bassar
Office of the City Manager
P.O. Box 229045
Hollywood, FL 33022-9045
Phone: (954) 921-3628 Fax: (954) 921-3086
Email: pbassar@hollywoodfl.org

To the Contractor

Notices will be sent to the contractor at the physical address, e-mail address, fax number and to the person listed in the Contractor's proposal, as applicable.

Either party may at any time designate a different address and/or contact person by giving written notice as provided above to the other party. Such notices shall be deemed given upon receipt by the addressee.

1.15 EMPLOYEES

All employees of the Contractor shall be considered to be at all times the sole employees of the Contractor, under the Contractor's sole direction, and not employees or agents of the City of Hollywood. The Contractor shall supply competent and physically capable employees and the City is authorized to require the Contractor to remove any employee it deems careless, incompetent, insubordinate or otherwise objectionable and whose presence on City property is not in the best interest of the City.

Each employee at all times shall have and display in plain view proper identification. The names of the employee and the company shall be displayed on the front of the employee's shirt.

1.16 AWARD OF BID

A. The Evaluation Committee will make a recommendation based upon the lowest responsive and responsible bidder(s) whose bid(s) conforms to the Invitation for Bids and is most advantageous to the City.

If the protest committee determines that the pending award of a contract or any element of the process leading to the award involved a significant violation of law or applicable rule or regulation, all steps necessary and proper to correct the violation shall be taken. If the committee determines that the protest is without merit, the Directory shall promptly issue a decision in writing stating the reason for the decision and furnish a copy to the protestor and any other interested party, and the process leading to the award shall proceed.

1.18 AGREEMENT

An agreement shall be sent to the awarded bidder to be executed and returned to the City for execution. The City will provide a copy of the fully executed agreement to the awarded bidder.

1.19 NOTICE TO PROCEED

A signed Purchase Order, blanket purchase order or fully executed agreement will be the Contractor's authorization to proceed and may substitute for a "Notice to Proceed" form.

1.20 OTHER GOVERNMENTAL ENTITIES

If the Bidder is awarded a contract as a result of this IFB, the bidder may, if the bidder has sufficient capacity or quantities available, provide to other governmental agencies so requesting the products or Services awarded in accordance with the terms and conditions of the IFB and resulting contract.

1.21 DISQUALIFICATION OF BIDDERS

A bidder may be disqualified temporarily or permanently and its bid(s) rejected for:

- A. Poor performance or default, in the City's opinion, on one or more previous contracts with the City.
- B. Poor performance or default, in the City's opinion, on one or more previous contracts with other public entities.
- C. Insufficient financial or company size, in the City's opinion, to perform the requirements of the contract.

1.22 RESERVATIONS FOR AWARD AND REJECTION OF BIDS

The City reserves the right to accept or reject any or all bids, part of bids, and to waive minor irregularities or variations to specifications contained in bids, and minor irregularities in the bidding process. The City also reserves the right to award the contract on a split order basis, lump sum basis, individual item basis, or such combination as shall best serve the interest of the City. The City reserves the right to make an award to the responsive and responsible bidder whose product or service meets the terms, conditions, and specifications of the IFB and whose bid is considered to best serve the City's interest. In determining the responsiveness of the offer and the responsibility of the Bidder, the following shall be considered when applicable: the ability, capacity and skill of the Bidder to perform as required; whether the Bidder can perform promptly, or within the time specified, without delay or interference; the character, integrity, reputation, judgment, experience and efficiency of the Bidder; the quality of past performance by the Bidder; the previous and existing compliance by the Bidder with related laws and ordinances; the sufficiency of the Bidder's financial resources; the availability, quality and adaptability of the Bidder's supplies or Services to the required use; the ability of the Bidder to provide future maintenance, service or parts; the number and scope of conditions attached to the bid.

If the IFB provides for a contract trial period, the City reserves the right, in the event the selected bidder does not perform satisfactorily, to award a trial period to the next ranked bidder or to award a contract to the next ranked bidder, if that bidder has successfully provided Services to the City in the past. This procedure will continue until a bidder is

1/31/22, 11:17 AM

DPX Form

The bidder certifies, by submission of a response to this solicitation, that neither it nor its principals and subcontractors are presently debarred or suspended by any Federal department or agency.

1.28 COLLUSION

The bidder, by affixing its signature to this proposal, agrees to the following: "Bidder certifies that its bid is made without previous understanding, agreement, or connection with any person, firm or corporation, making a bid for the same items, or the initiating City department, and is in all respects fair, without outside control, collusion, fraud, or otherwise illegal action."

1.29 COPELAND "ANTI-KICKBACK"

Contractor and all subcontractors will comply with the Copeland Anti-Kickback Act (18 U.S.C. 874) as supplemented in Department of Labor regulations (29 CFR Part 3).

1.30 FORCE MAJEURE

The Agreement which is awarded to the successful Bidder may provide that the performance of any act by the City or Contractor thereunder may be delayed or suspended at any time while, but only so long as, either party is hindered in or prevented from performance by acts of God, the elements, war, rebellion, strikes, lockouts or any cause beyond the reasonable control of such party, provided however, the City shall have the right to provide substitute service from third parties or City forces and in such event the City shall withhold payment due Contractor for such period of time. If the condition of force majeure exceeds a period of 14 days the City may, at its option and discretion, cancel or renegotiate the Agreement.

1.31 ASBESTOS STATEMENT

All material supplied must be 100% asbestos free. A Bidder, by virtue of bidding, certifies that if awarded any portion of the IFB, it will supply only material or equipment that is 100% asbestos free.

1.32 GOVERNING LAW

This Contract, including appendices, and all matters relating to this Contract (whether in contract, statute, tort (such as negligence), or otherwise) shall be governed by, and construed in accordance with, the substantive and procedural laws of the State of Florida. This will apply notwithstanding such factors as where the contract is entered into and the place where the accident occurs and notwithstanding conflicts of law principles that would otherwise apply.

1.33 LITIGATION VENUE

The parties waive the privilege of venue and agree that all litigation between them in the state courts shall take place in Broward County, Florida and that all litigation between them in the federal courts shall take place in the Southern District of Florida.

1.34 SOVEREIGN IMMUNITY

Nothing in this agreement shall be interpreted or construed to mean that the City waives its common law sovereign immunity or the limits on liability set forth in Section 768.28, Florida Statute.

1.35 SURVIVAL

- A. Keep and maintain public records that ordinarily and necessarily would be required by the public agency in order to perform the service.
- B. Provide the public with access to public records on the same terms and conditions that the public agency would provide the records and at a cost that does not exceed the cost provided in this chapter or as otherwise provided by law.
- C. Ensure that public records that are exempt or confidential and exempt from public records disclosure requirements are not disclosed except as authorized by law.
- D. Meet all requirements for retaining public records and transfer, at no cost, to the public agency, all public records in possession of the contractor upon termination of the contract and destroy any duplicate public records that are exempt or confidential and exempt from public records disclosure requirements. All records stored electronically must be provided to the public agency in a format that is compatible with the information technology systems of the public agency.

Non-exempt public records may be inspected and examined by anyone desiring to do so, at a reasonable time, under reasonable conditions, and under supervision by the custodian of the public record. Sealed bids become subject to this statute, notwithstanding bidders' or proposers' requests to the contrary, at the time the City provides notice of a decision or intended decision, or 30 days after bid or proposal opening, whichever is earlier.

Financial statements submitted in response to a request by the City may be confidential, and exempt from disclosure. Data processing software obtained under a licensing agreement which prohibits its disclosure is also exempt.

Bidders are hereby notified and agree that all information submitted as part of, or in support of bid submittals will be available for public inspection after opening of bids in compliance with Chapter 119 of the Florida Statutes. The bidder shall not, unless required as part of this IFB, submit any information in response to this invitation which the bidder considers to be a trade secret, proprietary or confidential. The submission, not required as part of this IFB, of any information to the City in connection with this invitation shall be deemed conclusively to be a waiver of any trade secret or other protection, which would otherwise be available to the bidder.

1.39 ACCESS TO RECORDS

The City reserves the right to require the Contractor to submit to an audit. The Contractor shall provide access to all of its records which relate directly or indirectly to this Agreement at its place of business during regular business hours. The Contractor shall retain all records pertaining to this Agreement and upon request make them available to the City for three years following expiration of the Agreement. The Contractor agrees to provide such assistance as may be necessary to facilitate the review or audit by the City to ensure compliance with applicable accounting and financial standards at no cost to the City.

1.40 INFORMATION

Further information, if desired, may be obtained from the Procurement Services Division, 2600 Hollywood, Boulevard, Room 303, Hollywood, Florida 33020, 954-921-3628.

Questions or requests for clarification of the specifications shall be in writing and received by the Procurement Services Division by the date specified for a request for clarification. They may be mailed or faxed to (954) 921-3086 or emailed to Othomas@hollywoodfl.org.

1.41 LOCAL PREFERENCE

Pursuant to §38.50 of the City of Hollywood Code of Ordinances, the City shall grant a preference to Hollywood vendors if their initial bid is within 5% of the bid of the lowest responsive responsible bidder that is a non-local Hollywood vendor. The preference shall allow the local Hollywood vendor to submit a second and final offer which must be at

1.48 MODEL NUMBER CORRECTIONS

If the model number for the make specified in this IFB is incorrect or no longer available and replaced with an updated model with new specifications, the Bidder shall enter the correct model number on the bidder proposal page. In the case of an updated model with new specifications, Bidder shall provide adequate information to allow the City to determine if the model bid meets the City's requirements.

1.49 INTERPRETATION OF THE APPROXIMATE QUANTITIES

The Bidder's attention is called to the fact that the estimate of quantities to be furnished under the specifications is approximate only and not guaranteed. The City does not assume any responsibility that the final quantities shall remain in strict accordance with the estimated quantities, nor shall the Bidder plead misunderstanding or deception because of such estimate of quantities.

1.50 QUANTITIES

The City specifically reserves the right to accept all or any part of the bid, to split the award, and to increase or decrease the quantity to meet additional or reduced requirements of the City, without such change affecting the contract unit price set forth in the bid form by the Bidder.

1.51 DELIVERY, INSPECTION & TITLE

Prices quoted and deliveries are to be FOB Destination and unloaded, unless otherwise specified in the Invitation for Bids, and made during regular business hours. Inspection and acceptance will be destination unless otherwise provided. Title to/or risk of loss or damage to all items shall be the responsibility of the successful Bidder until acceptance by the City unless loss or damage results from negligence by the City. If the materials or Services supplied to the City are found to be defective or not to conform to specifications, the City reserves the right to cancel the order upon written notice to the Bidder and return the product at the Bidder's expense.

1.52 DELIVERY TIME

Unless actual date of delivery is specified (or if specified, delivery cannot be met), the Bidder shall show the number of days required to make delivery after receipt of the purchase order in the space provided. Delivery time may become a basis for making an award. Delivery shall be within the normal Working hours of the user, Monday through Friday, excluding holidays, unless otherwise specified and incorporated into the contract document. Delivery shall be to the location specified in the bid specifications.

1.53 CLAIMS

Successful bidder(s) will be responsible for making any and all claims against carriers for missing or damaged items.

1.54 WARRANTY

Unless otherwise specified, all items proposed by the Bidder shall include a warranty covering Services, parts and/or labor for a specified period of time. The Bidder shall submit information on both manufacturer and dealer warranties, where applicable, with the bid. All goods furnished shall be fully guaranteed by the successful Bidder against factory defects and Workmanship. At no expense to the City, the successful Bidder shall correct any and all apparent and latent defects that may occur within the manufacturer's standard warranty. The Special Conditions of the Bid solicitation may supersede the manufacturer's standard warranty.

1.55 DURATION OF AGREEMENT

1.63 DRUG-FREE WORKPLACE PROGRAM

Preference shall be given to businesses with drug-free workplace programs. Whenever two or more bids which are equal with respect to price, quality, and service are received by the State or by any political subdivision for the procurement of commodities or contractual services, a bid received from a business that certifies that it has implemented a drug-free workplace program shall be given preference in the award process. Established procedures for processing tie bids will be followed if none of the tied vendors have a drug-free workplace program.

1.64 SOLICITATION, GIVING, AND ACCEPTANCE OF GIFTS POLICY

Bidders shall sign and submit this attached form indicating their understanding of and compliance with the City's and State's policies prohibiting solicitation and acceptance of gifts by public officers, employees, and candidates.

Failure to submit this signed form will result in your bid being declared non-responsive; provided, however, the bidder that otherwise is the lowest responsive responsible bidder may be given the opportunity to submit the form to the City within five calendar days after notification by the City, if this is determined to be in the best interest of the City.

1.65 PURCHASING AGREEMENTS WITH OTHER GOVERNMENT AGENCIES

It is hereby made part of this Invitation to Bid that the submission of any bid response to this advertised request constitutes a bid made under the same terms and conditions, for the same price, to other government agencies if agreeable by the bidder and the government agency.

At the option of the vendor/contractor, the use of the contract resulting from this solicitation may be extended to other governmental agencies, including the State of Florida, its agencies, political subdivisions, counties, and cities.

Each governmental agency allowed by the vendor/contractor to use this contract shall do so independently of any other governmental entity. Each agency shall be responsible for its own purchases and shall be liable only for goods or Services ordered, received, and accepted. No agency receives any liability by virtue of this bid and subsequent contract award.

1.66 INSURANCE REQUIREMENTS

Upon the City's notification, the Contractor shall furnish to the Procurement Services Division, Certificates of Insurance that indicate that insurance coverage has been obtained which meets the requirements as outlined below:

- A. Workers' Compensation Insurance for all employees of the Contractor as required by Florida Statute Chapter 440. Should the Contractor be exempt from this Statute, the Contractor and each employee shall hold the City harmless from any injury incurred during performance of the Contract. The exempt contractor shall also submit (i) a written statement detailing the number of employees and that they are not required to carry Workers' Compensation insurance and do not anticipate hiring any additional employees during the term of this contract or (ii) a copy of a Certificate of Exemption.
- B. General Liability Insurance on a comprehensive basis in an amount not less than \$1,000,000 each Occurrence for bodily injury and property damage. The City of Hollywood must be shown as an additional insured with respect to this coverage. The mailing address of City of Hollywood, Florida, 2600 Hollywood Boulevard, Hollywood, Florida 33021, as the certificate holder, must appear on the certificate of insurance.
- C. Automobile Liability Insurance covering all owned, non-owned, and hired vehicles used in connection with the Services, in an amount not less than \$1,000,000 Combined Single Limit.

City of Hollywood shall be based on the bid, which is, in the sole opinion of the City Commission of the City of Hollywood, in the best interest of the City of Hollywood. The issuance of this bid constitutes only an invitation to make presentations to the City of Hollywood. The City of Hollywood reserves the right to determine, at its sole discretion, whether any aspect of the bid satisfies the criteria established in this Bid. In all cases the City of Hollywood shall have no liability to any Contractor for any costs or expense incurred in connection with this bid or otherwise.

1.69 CONFIDENTIALITY

As a political subdivision, the City of Hollywood is subject to the Florida Sunshine Law and Public Records Law. By submitting a Bid, the Contractor acknowledges that the materials submitted with the Bid and the results of the City of Hollywood's evaluation may be open to public inspection upon proper request. The Contractor should take special note of this as it relates to proprietary information that might be included in its Bid.

1.70 ORDER OF PRECEDENCE

If there is a conflict between or among the provisions of the Agreement, the order of precedence is as follows:

- A. The terms and conditions of the agreement
- B. The City of Hollywood's IFB and any associated addenda and attachments thereto, and
- C. The Contractor's Proposal.

1.71 NATURE OF THE AGREEMENT

The Agreement incorporates and includes all negotiations, correspondence, conversations, agreements, and understandings applicable to the matters contained in the Agreement. The parties agree that there are no commitments, agreements, or understandings concerning the subject matter of the Agreement that are not contained in the Agreement, and that the Agreement contains the entire agreement between the parties as to all matters contained herein. Accordingly, it is agreed that no deviation from the terms hereof shall be predicated upon any prior representations or agreements, whether oral or written. It is further agreed that any oral representations or modifications concerning this Agreement shall be of no force or effect, and that the Agreement may be modified, altered or amended only by a written amendment duly executed by both parties hereto or their authorized representatives.

The Contractor shall provide the Services set forth in the Scope of Services, and render full and prompt cooperation with the City in all aspects of the Services performed hereunder.

The Contractor acknowledges that the Agreement requires the performance of all things necessary for or incidental to the effective and complete performance of all Work and Services under this Contract. All things not expressly mentioned in the Agreement but necessary to carrying out its intent are required by the Agreement, and the Contractor shall perform the same as though they were specifically mentioned, described and delineated.

The Contractor shall furnish all labor, materials, tools, supplies, and other items required to perform the Work and Services that are necessary for the completion of this Contract. All Work and Services shall be accomplished at the direction of and to the satisfaction of the City's Project Manager.

The Contractor acknowledges that the City shall be responsible for making all policy decisions regarding the Scope of Services. The Contractor agrees to provide input on policy issues in the form of recommendations.

- E. The Contractor shall at all times cooperate with the City and coordinate their respective Work efforts to most effectively and efficiently maintain progress in performing the Services.
- F. The Contractor shall comply with all provisions of all federal, state and local laws, statutes, ordinances, and regulations that are applicable to the performance of this Agreement.

1.76 INDEPENDENT CONTRACTOR RELATIONSHIP

The Contractor is, and shall be, in the performance of all Work Services and activities under this Agreement, an independent contractor, and not an employee, agent or servant of the City. All persons engaged in any of the Work or Services performed pursuant to this Agreement shall at all times, and in all places, be subject to the Contractor's sole direction, supervision and control. The Contractor shall exercise control over the means and manner in which it and its employees perform the Work, and in all respects the Contractor's relationship and the relationship of its employees to the City shall be that of independent contractors and not that of employees or agents of the City.

The Contractor does not have the power or authority to bind the City in any promise, agreement or representation other than specifically provided for in this Agreement.

1.77 PROPRIETARY INFORMATION

As a political subdivision of the State of Florida, the City of Hollywood is subject to the provisions of Florida's Public Records Law.

The Contractor acknowledges that all computer software in the City's possession may constitute or contain information or materials which the City has agreed to protect as proprietary information from disclosure or unauthorized use and may also constitute or contain information or materials which the City has developed at its own expense, the disclosure of which could harm the City's proprietary interest therein.

During the term of the contract, the Contractor will not use directly or indirectly for itself or for others, or publish or disclose to any third party, or remove from the City's property, any computer programs, data compilations, or other software which the City has developed, has used or is using, is holding for use, or which are otherwise in the possession of the City (hereinafter "Computer Software"). All third-party license agreements must also be honored by the Contractors and their employees, except as authorized by the City and, if the Computer Software has been leased or purchased by the City, all third party license agreements must also be honored by the Contractor's employees. This includes mainframe, minis, telecommunications, personal computers and any and all information technology software.

The Contractor will report to the City any information discovered or which is disclosed to the Contractor which may relate to the improper use, publication, disclosure or removal from the City's property of any information technology software and hardware and will take such steps as are within the Contractor's authority to prevent improper use, disclosure or removal.

1.78 PROPRIETARY RIGHTS

- A. The Contractor hereby acknowledges and agrees that the City retains all rights, title and interests in and to all materials, data, documentation and copies thereof furnished by the City to the Contractor hereunder or furnished by the Contractor to the City and/or created by the Contractor for delivery to the City, even if unfinished or in process, as a result of the Services the Contractor performs in connection with this Agreement, including all copyright and other proprietary rights therein, which the Contractor as well as its employees, agents, subcontractors and suppliers may use only in connection with the performance of Services under this Agreement. The Contractor shall not, without the prior written consent of the City, use such documentation on any other project in which the Contractor or its employees, agents, subcontractors or suppliers are or may become engaged. Submission or distribution by the Contractor to meet official regulatory requirements or for other purposes in connection with the performance of Services under this Agreement shall not be construed as publication in derogation of the City's copyrights or other proprietary rights.

herein. The effect of any decision shall not be impaired or waived by any negotiations or settlements or offers made in connection with the dispute, whether or not the City Manager participated therein, or by any prior decision of others, which prior decision shall be deemed subject to review, or by any termination or cancellation of the Agreement. All such disputes shall be submitted in writing by the Contractor to the City Manager for a decision, together with all evidence and other pertinent information in regard to such question, in order that a fair and impartial decision may be made. The parties agree that whenever the City Manager is entitled to exercise discretion or judgment or to make a determination or form an opinion pursuant to the provisions of this Article, such action shall be deemed fair and impartial when exercised or taken. The City Manager shall render a decision in writing and deliver a copy of the same to the Contractor. Except as such remedies may be limited or waived elsewhere in the Agreement, the Contractor reserves the right to pursue any remedies available under law after exhausting the provisions of this Article.

1.80 MUTUAL OBLIGATIONS

- A. This Agreement, including attachments and appendices to the Agreement, shall constitute the entire Agreement between the parties with respect hereto and supersedes all previous communications and representations or agreements, whether written or oral, with respect to the subject matter hereof unless acknowledged in writing by the duly authorized representatives of both parties.
- B. Nothing in this Agreement shall be construed for the benefit, intended or otherwise, of any third party that is not a parent or subsidiary of a party or otherwise related (by virtue of ownership control or statutory control) to a party.
- C. In those situations where this Agreement imposes an indemnity or defense obligation on the Contractor, the City may, at its expense, elect to participate in the defense if the City should so choose. Furthermore, the City may at its own expense defend or settle any such claims if the Contractor fails to diligently defend such claims, and thereafter seek indemnity for costs and attorney's fees from the Contractor.

1.81 QUALITY ASSURANCE/QUALITY ASSURANCE RECORD KEEPING

The Contractor shall maintain, and shall require that its subcontractors and suppliers maintain, complete and accurate records to substantiate compliance with the requirements set forth in the Scope of Services. The Contractor and its subcontractors and suppliers shall retain such records, and all other documents relevant to Services furnished under this Agreement for a period of three (3) years from the expiration date of this Agreement and any extension thereof.

1.82 AUDITS

The City, or its duly authorized representatives or governmental agencies shall, until the expiration of three (3) years after the expiration of this Agreement and any extension thereof, have access to and the right to examine and reproduce any of the Contractor's books, documents, papers and records and those of its subcontractors and suppliers which apply to all matters of the City. Such records shall conform to Generally Accepted Accounting Principles requirements, as applicable, and shall only address those transactions related to this Agreement.

The Contractor agrees to grant access to the City's Auditor to all financial and performance-related records, property, and equipment purchased in whole or in part with government funds. The Contractor agrees to maintain an accounting system that provides accounting records that are supported with adequate documentation, and adequate procedures for determining the allowability and allocability of costs.

1.83 SUBSTITUTION OF PERSONNEL

In the event the Contractor wishes to substitute personnel for the key personnel identified by the Contractor's Bid, the Contractor must notify the City in writing and request written approval for the substitution at least ten (10) business days prior to effecting such substitution.

- A. The City may terminate this Agreement if an individual or corporation or other entity attempts to meet its contractual obligation with the City through fraud, misrepresentation or material misstatement.
- B. The City may, as a further sanction, terminate or cancel any other contract(s) that such individual or corporation or other entity has with the City. Such individual, corporation or other entity shall be responsible for all direct and indirect costs associated with such termination or cancellation, including attorney's fees.
- C. The foregoing notwithstanding, any individual, corporation or other entity which attempts to meet its contractual obligations with the City through fraud, misrepresentation or material misstatement may be debarred from City contracting in accordance with the City debarment procedures. The Contractor may be subject to debarment for failure to perform and any other reasons related to contractor's breach or failure of satisfactory performance.

In addition to cancellation or termination as otherwise provided in this Agreement, the City may at any time, in its sole discretion, with or without cause, terminate this Agreement by written notice to the Contractor and in such event:

- D. The Contractor shall, upon receipt of such notice, unless otherwise directed by the City:
 - 1. Stop Work on the date specified in the notice ("the Effective Termination Date");
 - 2. Take such action as may be necessary for the protection and preservation of the City's materials and property;
 - 3. Cancel orders;
 - 4. Assign to the City and deliver to any location designated by the City any non-cancelable orders for Deliverables that are not capable of use except in the performance of this Agreement and which have been specifically developed for the sole purpose of this Agreement and not incorporated in the Services;
 - 5. Take no action which will increase the amounts payable by the City under this Agreement.
- E. In the event that the City exercises its right to terminate this Agreement pursuant to this Article the Contractor will be compensated, as stated in the payment Articles herein, for the:
 - 1. Portion of the Services completed in accordance with the Agreement up to the Effective Termination Date; and
 - 2. Non-cancelable Deliverables that are not capable of use except in the performance of this Agreement and which have been specifically developed for the sole purpose of this Agreement but not incorporated in the Services.
- F. All compensation pursuant to this Article is subject to audit.

1.88 EVENT OF DEFAULT

- A. An Event of Default shall mean a breach of this Agreement by the Contractor. Without limiting the generality of the foregoing and in addition to those instances referred to herein as a breach, an Event of Default, shall include the following:
 - 1. The Contractor has not delivered Deliverables on a timely basis;

During the performance of this Contract, the Contractor agrees to not discriminate against any employee or applicant for employment because of race, religion, color, sex, handicap, marital status, age or national origin, and will take affirmative action to ensure that they are afforded equal employment opportunities without discrimination. Such action shall be taken with reference to, but not be limited to, recruitment, employment, termination, rates of pay or other forms of compensation, and selection for training or retraining, including apprenticeship and on-the-job training. By entering into this Contract with the City, the Contractor attests that it is not in violation of the Americans with Disabilities Act of 1990 and related Acts (the "Act"). If the Contractor or any owner, subsidiary or other firm affiliated with or related to the Contractor is found by the responsible enforcement agency or the City to be in violation of the Act, such violation shall render this Contract void. This Contract shall be void if the Contractor submits a false affidavit or the Contractor violates the Act during the term of this Contract, even if the Contractor was not in violation at the time it submitted its affidavit.

1.91 CONFLICT OF INTEREST

The Contractor represents that:

- A. No officer, director, employee, agent, or other consultant of the City or a member of the immediate family or household of the aforesaid has directly or indirectly received or been promised any form of benefit, payment or compensation, whether tangible or intangible, in connection with the grant of this Agreement.
- B. There are no undisclosed persons or entities interested with the Contractor in this Agreement. This Agreement is entered into by the Contractor without any connection with any other entity or person submitting a bid for the same purpose, and without collusion, fraud or conflict of interest. No elected or appointed officer or official, director, employee, agent or other consultant of the City, or member of the immediate family or household of any of the aforesaid:
 - 1. Is interested on behalf of or through the Contractor directly or indirectly in any manner whatsoever in the execution or the performance of this Agreement, or in the Services, supplies or Work, to which this Agreement relates or in any portion of the revenues; or
 - 2. Is an employee, agent, advisor, or consultant to the Contractor or to the best of the Contractor's knowledge, any subcontractor or supplier to the Contractor.
- C. Neither the Contractor nor any officer, director, employee, agent, parent, subsidiary, or affiliate of the Contractor shall have an interest which is in conflict with the Contractor's faithful performance of its obligations under this Agreement; provided that the City, in its sole discretion, may consent in writing to such a relationship, and provided the Contractor provides the City with a written notice, in advance, which identifies all the individuals and entities involved and sets forth in detail the nature of the relationship and why it is in the City's best interest to consent to such relationship.
- D. The provisions of this Article are supplemental to, not in lieu of, all applicable laws with respect to conflict of interest. In the event there is a difference between the standards applicable under this Agreement and those provided by statute, the stricter standard shall apply.
- E. In the event the Contractor has no prior knowledge of a conflict of interest as set forth above and acquires information which may indicate that there may be an actual or apparent violation of any of the above, the Contractor shall promptly bring such information to the attention of the City's Project Manager. The Contractor shall thereafter cooperate with the City's review and investigation of such information, and comply with the instructions the Contractor receives from the Project Manager in regard to remedying the situation.

1.92 PRESS RELEASE OR OTHER PUBLIC COMMUNICATION

Under no circumstances shall the Contractor, its employees, agents, subcontractors and suppliers, without the express written consent of the City:

1.100 NO CONTINGENT FEES

The Vendor warrants that it has not employed or retained any company or person other than a bona fide employee Working solely for the Vendor to solicit or secure this Agreement, and that it has not paid or agreed to pay any person, company, corporation, individual, or firm, other than a bona fide employee Working solely for the Vendor, any fee, commission, percentage, gift, or other consideration contingent upon or resulting from the award or making of this Agreement. For the breach or infraction of this provision, the City shall have the right to terminate the Agreement without liability at its discretion and to deduct from the contract price or otherwise recover the full amount of such fee, commission, percentage, gift or consideration.

1.101 E-VERIFY

The Contractor acknowledges that the City may be utilizing the Contractor's Services for a project that is funded in whole or in part by State funds pursuant to a contract between the City and a State agency. The Contractor shall be responsible for complying with the E-Verify requirements in the contract and using the U.S. Department of Homeland Security's E-Verify system to verify the employment of all new employees hired by the Contractor during the Agreement term. The Contractor is also responsible for e-verifying its subcontractors, if any, pursuant to any agreement between the City and a State Agency, and reporting to the City any required information. The Contractor acknowledges that the terms of this paragraph are material terms, the breach of any of which shall constitute a default under this Agreement.

1.102 BUDGETARY CONSTRAINTS

In the event the City is required to reduce contract costs due to budgetary constraints, all Services specified in this document may be subject to a permanent or temporary reduction in budget. In such an event, the total cost for the affected service shall be reduced as required. The Contractor shall also be provided with a minimum 30-day notice prior to any such reduction in budget.

1.103 ANNEXATION

Contractor agrees to extend all terms, conditions and pricing in this agreement and any amendments thereto, to any areas annexed into the City.

1.104 DEFINITIONS & TERMS

When used in Contract Documents or in related documents, the following terms shall have the meanings given below:

Addendum: A modification of the Plans, Specifications or other Contract Documents distributed to prospective Bidders prior to the opening of Bids.

Advertisement for Bids: The public notice inviting the submission of Bids for the Work.

Bid: The written offer of a Bidder to provide product or perform Work or service.

Bid Bond: A bond executed by a Bidder and its Surety in the attached form guaranteeing that the Bidder, if awarded the Contract will execute the same and will timely furnish the required Performance Bond, Payment Bond, and evidence of Insurance.

Bidder: Any individual, firm, partnership or corporation submitting a Bid in accordance with the Instructions to Bidders.

1/31/22, 11:17 AM

DPX Form

Liquidated Damages: The amount that the Contractor accepts, as stipulated in the Bid Form, which will be deducted from the Contract Sum for each Calendar day of delay due to a Non-excusable Delay to be determined by the City's Contract Manager.

Notice To Proceed (NTP): The written communication issued by the City to the Contractor directing the Contractor to begin contract Work and establishing the date of commencement of the Work.

Owner: The term Owner as used in this Contract shall mean the City of Hollywood.

Performance and Payment Bonds: Bonds executed by the Contractor and his Surety, on the attached forms, assuring that the Contractor will, in good faith, perform and guarantee the Work in full conformity with the terms of the Contract Documents and will promptly pay all persons supplying the Contractor with labor, materials, or supplies, used directly or indirectly by the Contractor in the execution of the Work.

Plans: The drawings or reproductions thereof, prepared and sealed by the Architect/Engineer, which show the locations, character, dimensions and details of the Work to be done and which are part of the Contract Documents.

Project: The construction and Services required by the Contract Documents, which includes all labor, materials, equipment, and Services to be provided by the Contractor to fulfill the Contractor's obligations.

Project Cost: The sum of the construction costs, allowances for contingencies, the total cost of design professional and related Services provided by consultant, and allowances for such other items as charges of all other professionals and consultants.

Project Manager: The duly authorized representative designated to manage the Project.

Scope of Service: Document which details the Work to be performed by the Contractor.

Subcontractor or Sub consultant: Any person, entity, firm or corporation, other than the employees of the Contractor, who furnishes labor and/or materials, in connection with the Work, whether directly or indirectly, on behalf of and/or under the direction of the Contractor and whether or not in privity of Contract with the Contractor.

The words "Work", "Services", "Program", or "Project": All matters and things required to be done by the Contractor in accordance with the provisions of the Contract.

The words "Directed", "Required", "Permitted", "Ordered", "Designated", "Selected", "Prescribed", or words of like import to mean respectively, the direction, requirement, permission, order, designation, selection or prescription of the City's Project Manager; and similarly the words "approved", "acceptable", "satisfactory", "equal", "necessary", or words of like import to mean respectively, approved by, or acceptable or satisfactory to, equal or necessary in the opinion of the City's Project Manager. In resolving disputes and in all respects the City Manager's decision shall be final.

1/31/22, 11:16 AM

DPX Form

Supplier Response Form

City of Hollywood, Florida
Solicitation # F-4696-21-OT

Issue Date 01/05/2022

SUBMISSION

Proposal Due Date: Jan 31, 2022 3:00:00 PM EST

How to submit bids/proposals: Vendor's solicitation response must be submitted electronically through BidSync, the City's designated electronic bidding system. It is the Vendor's sole responsibility to assure its response is submitted and received through BidSync by the date and time specified in the solicitation. The City will not consider solicitation responses received by other means. Any timeframe references are in Eastern Standard Time. The official time for electronic submittals is BidSync's servers, as synchronized with the atomic clock. All parties without reservation will accept the official time.

Important Notice:

The Procurement Services Division shall distribute all official changes, modifications, responses to questions or notices relating to the requirements of this document. Any other information of any kind from any other source shall not be considered official, and bidders relying on other information do so at their own risk.

The responsibility for submitting a bid/proposal on or before the time and date is solely and strictly the responsibility of the bidder/proposer, the City will in no way be responsible for delays caused by technical difficulty or caused by any other occurrence. No part of a bid/proposal can be submitted via FAX or via direct Email to the City. No variation in price or conditions shall be permitted based upon a claim of ignorance.

Supplier Response Form

W-9

(Rev. August 2013) Department of the Treasury Internal Revenue Service

Request for Taxpayer Identification Number and Certification

Give to the requester. Do not send to the IRS.

Print or type See Specific Instructions on page 2.	Name (as shown on your income tax return) Cardinal Contractors, Inc.	
	Business name/disregarded entity name, if different from above	
	Check appropriate box for federal tax classification: <input type="checkbox"/> Individual/sole proprietor <input checked="" type="checkbox"/> C Corporation <input type="checkbox"/> S Corporation <input type="checkbox"/> Partnership <input type="checkbox"/> Trust/estate <input type="checkbox"/> Limited liability company. Enter the tax classification (C=C corporation, S=S corporation, P=partnership) * <input type="checkbox"/> Other (see instructions)	Exemptions (see instructions): Exempt payee code (if any) Exemption from FATCA reporting code (if any)
	Address (number, street, and apt. or suite no.) 13794 NW 4th St, Suite 200	Requester's name and address (optional)
City, state, and ZIP code Sunrise, FL 33325		
List account number(s) here (optional)		

Part I	Taxpayer Identification Number (TIN)	Social security number
Enter your TIN in the appropriate box. The TIN provided must match the name given on the "Name" line to avoid backup withholding. For individuals, this is your social security number (SSN). However, for a resident alien, sole proprietor, or disregarded entity, see the Part I instructions on page 3. For other entities, it is your employer identification number (EIN). If you do not have a number, see <i>How to get a TIN</i> on page 3.		
Note. If the account is in more than one name, see the chart on page 4 for guidelines on whose number to enter.		Employer Identification number 80-0388786

Part II Certification
Under penalties of perjury, I certify that:

1. The number shown on this form is my correct taxpayer identification number (or I am waiting for a number to be issued to me), and

In the cases below, the following person must give Form W-9 to the partnership for purposes of establishing its U.S. status and avoiding withholding on its allocable share of net income from the partnership conducting a trade or business in the United States:

- In the case of a disregarded entity with a U.S. owner, the U.S. owner of the disregarded entity and not the entity,
- In the case of a grantor trust with a U.S. grantor or other U.S. owner, generally, the U.S. grantor or other U.S. owner of the grantor trust and not the trust, and
- In the case of a U.S. trust (other than a grantor trust), the U.S. trust (other than a grantor trust) and not the beneficiaries of the trust.

Foreign person. If you are a foreign person or the U.S. branch of a foreign bank that has elected to be treated as a U.S. person, do not use Form W-9. Instead, use the appropriate Form W-8 or Form 8233 (see Publication 515, Withholding of Tax on Nonresident Aliens and Foreign Entities).

Nonresident alien who becomes a resident alien. Generally, only a nonresident alien individual may use the terms of a tax treaty to reduce or eliminate U.S. tax on certain types of income. However, most tax treaties contain a provision known as a "saving clause." Exceptions specified in the saving clause may permit an exemption from tax to continue for certain types of income even after the payee has otherwise become a U.S. resident alien for tax purposes.

If you are a U.S. resident alien who is relying on an exception contained in the saving clause of a tax treaty to claim an exemption from U.S. tax on certain types of income, you must attach a statement to Form W-9 that specifies the following five items:

1. The treaty country. Generally, this must be the same treaty under which you claimed exemption from tax as a nonresident alien.
2. The treaty article addressing the income.
3. The article number (or location) in the tax treaty that contains the saving clause and its exceptions.
4. The type and amount of income that qualifies for the exemption from tax.
5. Sufficient facts to justify the exemption from tax under the terms of the treaty article.

Updating Your Information

You must provide updated information to any person to whom you claimed to be an exempt payee if you are no longer an exempt payee and anticipate receiving reportable payments in the future from this person. For example, you may need to provide updated information if you are a C corporation that elects to be an S corporation, or if you no longer are tax exempt. In addition, you must furnish a new Form W-9 if the name or TIN changes for the account, for example, if the grantor of a grantor trust dies.

Penalties

Failure to furnish TIN. If you fail to furnish your correct TIN to a requester, you are subject to a penalty of \$50 for each such failure unless your failure is due to reasonable cause and not to willful neglect.

Civil penalty for false information with respect to withholding. If you make a false statement with no reasonable basis that results in no backup withholding, you are subject to a \$500 penalty.

Criminal penalty for falsifying information. Willfully falsifying certifications or affirmations may subject you to criminal penalties including fines and/or imprisonment.

Misuse of TINs. If the requester discloses or uses TINs in violation of federal law, the requester may be subject to civil and criminal penalties.

Specific Instructions

Name

If you are an individual, you must generally enter the name shown on your income tax return. However, if you have changed your last name, for instance, due to marriage without informing the Social Security Administration of the name change, enter your first name, the last name shown on your social security card, and your new last name.

If the account is in joint names, list first, and then circle, the name of the person or entity whose number you entered in Part I of the form.

Sole proprietor. Enter your individual name as shown on your income tax return on the "Name" line. You may enter your business, trade, or "doing business as (DBA)" name on the "Business name/disregarded entity name" line.

Also see *Special rules for partnerships* on page 1.

What is FATCA reporting? The Foreign Account Tax Compliance Act (FATCA) requires a participating foreign financial institution to report all United States account holders that are specified United States persons. Certain payees are exempt from FATCA reporting. See *Exemption from FATCA reporting code* on page 3 and the Instructions for the Requester of Form W-9 for more information.

Exempt payee code. Generally, individuals (including sole proprietors) are not exempt from backup withholding. Corporations are exempt from backup withholding for certain payments, such as interest and dividends. Corporations are not exempt from backup withholding for payments made in settlement of payment card or third party network transactions.

Note. If you are exempt from backup withholding, you should still complete this form to avoid possible erroneous backup withholding.

The following codes identify payees that are exempt from backup withholding:

1—An organization exempt from tax under section 501(a), any IRA, or a custodial account under section 403(b)(7) if the account satisfies the requirements of section 401(f)(2)

2—The United States or any of its agencies or instrumentalities

3—A state, the District of Columbia, a possession of the United States, or any of their political subdivisions or instrumentalities

4—A foreign government or any of its political subdivisions, agencies, or instrumentalities

5—A corporation

6—A dealer in securities or commodities required to register in the United States, the District of Columbia, or a possession of the United States

7—A futures commission merchant registered with the Commodity Futures Trading Commission

8—A real estate investment trust

G—A real estate investment trust

H—A regulated investment company as defined in section 851 or an entity registered at all times during the tax year under the Investment Company Act of 1940

I—A common trust fund as defined in section 584(a)

J—A bank as defined in section 581

K—A broker

L—A trust exempt from tax under section 664 or described in section 4947(a)(1)

M—A tax exempt trust under a section 403(b) plan or section 457(g) plan

Part I. Taxpayer Identification Number (TIN)

Enter your TIN in the appropriate box. If you are a resident alien and you do not have and are not eligible to get an SSN, your TIN is your IRS individual taxpayer identification number (ITIN). Enter it in the social security number box. If you do not have an ITIN, see *How to get a TIN* below.

If you are a sole proprietor and you have an EIN, you may enter either your SSN or EIN. However, the IRS prefers that you use your SSN.

If you are a single-member LLC that is disregarded as an entity separate from its owner (see *Limited Liability Company (LLC)* on page 2), enter the owner's SSN (or EIN, if the owner has one). Do not enter the disregarded entity's EIN. If the LLC is classified as a corporation or partnership, enter the entity's EIN.

Note. See the chart on page 4 for further clarification of name and TIN combinations.

A—An organization exempt from tax under section 501(a) or any individual retirement plan as defined in section 7701(a)(37)

B—The United States or any of its agencies or instrumentalities

C—A state, the District of Columbia, a possession of the United States, or any of their political subdivisions or instrumentalities

D—A corporation the stock of which is regularly traded on one or more established securities markets, as described in Reg. section 1.1472-1(c)(1)(i)

E—A corporation that is a member of the same expanded affiliated group as a corporation described in Reg. section 1.1472-1(c)(1)(i)

F—A dealer in securities, commodities, or derivative financial instruments (including notional principal contracts, futures, forwards, and options) that is registered as such under the laws of the United States or any state

3. Real estate transactions. You must sign the certification. You may cross out item 2 of the certification.

4. Other payments. You must give your correct TIN, but you do not have to sign the certification unless you have been notified that you have previously given an incorrect TIN. "Other payments" include payments made in the course of the requester's trade or business for rents, royalties, goods (other than bills for merchandise), medical and health care services (including payments to corporations), payments to a nonemployee for services, payments made in settlement of payment card and third party network transactions, payments to certain fishing boat crew members and fishermen, and gross proceeds paid to attorneys (including payments to corporations).

5. Mortgage interest paid by you, acquisition or abandonment of secured property, cancellation of debt, qualified tuition program payments (under section 529), IRA, Coverdell ESA, Archer MSA or HSA contributions or distributions, and pension distributions. You must give your correct TIN, but you do not have to sign the certification.

What Name and Number To Give the Requester

For this type of account:

- 1. Individual
- 2. Two or more individuals (joint account)

Give name and SSN of:

- The individual
- The actual owner of the account or, if combined funds, the first individual on the account 1
- The minor 2

3. Custodian account of a minor (Uniform Gift to Minors Act)

4. a. The usual revocable savings trust (grantor is also trustee) b. So-called trust account that is not a legal or valid trust under state law

- The grantor-trustee 1
- The actual owner 1

5. Sole proprietorship or disregarded entity owned by an individual

The owner 3

6. Grantor trust filing under Optional Form 1099 Filing Method 1 (see Regulation section 1.671-4(b)(2)(i)(A))

The grantor*

1 List first and circle the name of the person whose number you furnish. If only one person on a joint account has an SSN, that person's number must be furnished.

Note. If no name is circled when more than one name is listed, the number will be considered to be that of the first name listed.

Secure Your Tax Records from Identity Theft

Identity theft occurs when someone uses your personal information such as your name, social security number (SSN), or other identifying information, without your permission, to commit fraud or other crimes. An identity thief may use your SSN to get a job or may file a tax return using your SSN to receive a refund.

To reduce your risk:

- Protect your SSN,
- Ensure your employer is protecting your SSN, and
- Be careful when choosing a tax preparer.

If your tax records are affected by identity theft and you receive a notice from the IRS, respond right away to the name and phone number printed on the IRS notice or letter.

NOTES:

1. REFER TO SECTION 01 25 00 FOR ADDITIONAL DESCRIPTIONS OF ITEMS.
2. SUBSTANTIAL COMPLETION TIME AND PROJECT CLOSEOUT TIME FOR THE WORK SHALL BE AS DEFINED IN THE PROJECT SCHEDULE IN THE SUPPLEMENTARY GENERAL CONDITIONS (SGC'S).
3. THE CITY OF HOLLYWOOD REQUIRES THE CONTRACTOR TO PROVIDE THE UNIT PRICE/TOTAL IN TEXT AS WELL AS NUMERICAL FORMAT FOR EACH LINE ITEM LISTED IN THE PROPOSAL BID FORMS. FAILURE TO PROVIDE UNIT PRICE/TOTAL FOR EACH LINE ITEM IN TEXT AS WELL AS NUMERICAL FORMAT MAY RENDER THE ENTIRE BID PACKAGE NON-RESPONSIVE.
4. THE CITY OF HOLLYWOOD WILL EVALUATE THE BID PROPOSALS AND DETERMINE THE LOWEST, RESPONSIVE, RESPONSIBLE BIDDER FOR THE TOTAL BASE BID (ITEMS 1 THROUGH 11). IT IS THE CITY OF HOLLYWOOD'S INTENT TO AWARD THE PROJECT BASED UPON THE TOTAL BASE BID.

- END OF SECTION -

SECTION 00 41 00

APPROVED BID BOND

(Construction)

STATE OF FLORIDA

KNOW ALL MEN BY THESE PRESENTS:

That we Cardinal Contractors, Inc., as Principal, and Federal Insurance Company AND Western Surety Company as

Surety, are held and firmly bound unto the City of Hollywood in the sum of Ten Percent

of the Total Bid Price Dollars (\$ 10% T.B.P.) lawful money

of the United States, amounting to 10% of the total Bid Price, for the payment of said sum, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the principal has submitted the accompanying bid, dated January 25 20²² for

Deep Injection Well No. 3 and No. 4 Pump Station

Bid No.: F-4696-21-OT

NOW, THEREFORE, if the principal shall not withdraw said bid within 90 days after date of the same and shall within ten days after the prescribed forms are presented to him for signature, enter into a written contract with the CITY, in accordance with the bid as accepted, and give bond with good and sufficient surety or sureties, and provide the necessary Insurance Certificates as may be required for the faithful performance and proper fulfillment of such Contract, then this obligation shall be null and void.

Approved Bid Bond

In the event of the withdrawal of said bid within the specified period, or the failure to enter into such contract and give such bond and insurance within the specified time, the principal and the surety shall pay to the City of Hollywood the difference between the amount specified in said bid and such larger amount for which the City of Hollywood may in good faith contract with another party to perform the work and/or supply the materials covered by said bid.

IN WITNESS WHEREOF, the above bound parties have executed this statement under their several seals this 11th day of January, 2022, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

WHEN THE PRINCIPAL IS AN INDIVIDUAL:

Signed, sealed and delivered in the presence of:

Witness

Signature of Individual

Address

Printed Name of Individual

Witness

Address

Approved Bid Bond

WHEN THE PRINCIPAL IS A CORPORATION:

Attest:

[Signature]
Secretary

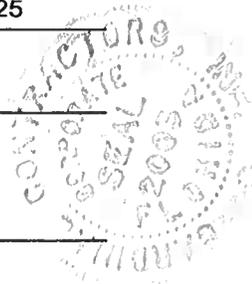
Cardinal Contractors, Inc.
Name of Corporation

13794 NW 4th Street, Suite 200, Sunrise, FL 33325
Business Address

By: [Signature]
(Affix Corporate Seal)

Eric Macek
Printed Name

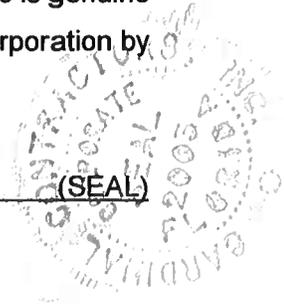
Vice President
Official Title



CERTIFICATE AS TO CORPORATE PRINCIPAL

I, John M. Perisich, certify that I am the secretary of the Corporation named as Principal in the attached bond; that Eric Macek who signed the said bond on behalf of the Principal, was then Vice President of said Corporation; that I know his signature, and his signature thereto is genuine and that said bond was duly signed, sealed and attested for and on behalf of said Corporation by authority of its governing body.

[Signature]
Secretary



Approved Bid Bond

TO BE EXECUTED BY CORPORATE SURETY:

Attest:

Maria D. Zuniga

~~Secretary~~ Maria D. Zuniga
Attorney-in-Fact
Florida Non-Resident
License No. W100173

Federal Insurance Company AND Western Surety Company

Corporate Surety

Federal: 202B Hall's Mill Road, Whitehouse Station, NJ 08889

Business Address

Western: 151 N. Franklin St., Chicago, IL 60606

BY: *Joseph R. Aulbert*

(Affix Corporate Seal)

Joseph R. Aulbert, Florida Non-Resident License No. W082518

Attorney-in-Fact

Campbell, Benjamin Richmond Jr., Florida Resident License No. A038916

Name of Local Agency

BB&T Landrum-Yaeger 3375-B Capital Circle NE, Suite B

Business Address

Tallahassee, FL 32308

STATE OF ~~FLORIDA~~ TEXAS

Before me, a Notary Public, duly commissioned, qualified and acting, personally appeared, _____

Joseph R. Aulbert to me well known, who being by me first duly sworn upon oath

says that he is the attorney-in-fact for the Federal Insurance Company AND Western Surety Company and

that the has been authorized by Western Surety Company to execute the forgoing bond

on behalf of the CONTRACTOR named therein in favor of the City of Hollywood, Florida.

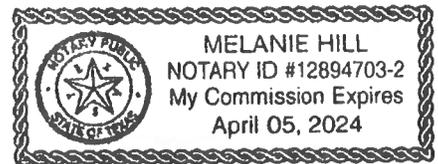
Subscribed and sworn to before me this 11th day of January, 2022

Melanie Hill

Notary Public, State of ~~Florida~~ Texas
Melanie Hill
Notary ID #: 12894703-2

My Commission Expires: April 5, 2024

- END OF SECTION -





Power of Attorney

Federal Insurance Company | Vigilant Insurance Company | Pacific Indemnity Company
Westchester Fire Insurance Company | ACE American Insurance Company

Know All by These Presents, that FEDERAL INSURANCE COMPANY, an Indiana corporation, VIGILANT INSURANCE COMPANY, a New York corporation, PACIFIC INDEMNITY COMPANY, a Wisconsin corporation, WESTCHESTER FIRE INSURANCE COMPANY and ACE AMERICAN INSURANCE COMPANY corporations of the Commonwealth of Pennsylvania, do each hereby constitute and appoint Joseph R. Aulbert, Marc W. Boots, Richard Covington, Myisha Jefferson, Ashley Koletar, Vickie Lacy, Ryan Varela and Maria D. Zuniga of Houston, Texas; Susan Golla of San Antonio, Texas-----

each as their true and lawful Attorney-in-Fact to execute under such designation in their names and to affix their corporate seals to and deliver for and on their behalf as surety thereon or otherwise, bonds and undertakings and other writings obligatory in the nature thereof (other than bail bonds) given or executed in the course of business, and any instruments amending or altering the same, and consents to the modification or alteration of any instrument referred to in said bonds or obligations.

In Witness Whereof, said FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, PACIFIC INDEMNITY COMPANY, WESTCHESTER FIRE INSURANCE COMPANY and ACE AMERICAN INSURANCE COMPANY have each executed and attested these presents and affixed their corporate seals on this 4th day of November, 2021.

Dawn M. Chloros (handwritten signature)

Dawn M. Chloros, Assistant Secretary

Stephen M. Haney (handwritten signature)

Stephen M. Haney, Vice President



STATE OF NEW JERSEY
County of Hunterdon SS.

On this 4th day of November, 2021 before me, a Notary Public of New Jersey, personally came Dawn M. Chloros and Stephen M. Haney, to me known to be Assistant Secretary and Vice President, respectively, of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, PACIFIC INDEMNITY COMPANY, WESTCHESTER FIRE INSURANCE COMPANY and ACE AMERICAN INSURANCE COMPANY, the companies which executed the foregoing Power of Attorney, and the said Dawn M. Chloros and Stephen M. Haney, being by me duly sworn, severally and each for herself and himself did depose and say that they are Assistant Secretary and Vice President, respectively, of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, PACIFIC INDEMNITY COMPANY, WESTCHESTER FIRE INSURANCE COMPANY and ACE AMERICAN INSURANCE COMPANY and know the corporate seals thereof, that the seals affixed to the foregoing Power of Attorney are such corporate seals and were thereto affixed by authority of said Companies; and that their signatures as such officers were duly affixed and subscribed by like authority.

Notarial Seal



KATHERINE J. ADELAAR
NOTARY PUBLIC OF NEW JERSEY
No. 2316685
Commission Expires July 18, 2024

Katherine J. Adelaar (handwritten signature)

Notary Public

CERTIFICATION

Resolutions adopted by the Boards of Directors of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, and PACIFIC INDEMNITY COMPANY on August 30, 2016; WESTCHESTER FIRE INSURANCE COMPANY on December 11, 2006; and ACE AMERICAN INSURANCE COMPANY on March 20, 2009:

"RESOLVED, that the following authorizations relate to the execution, for and on behalf of the Company, of bonds, undertakings, recognizances, contracts and other written commitments of the Company entered into in the ordinary course of business (each a "Written Commitment"):

- (1) Each of the Chairmen, the President and the Vice Presidents of the Company is hereby authorized to execute any Written Commitment for and on behalf of the Company, under the seal of the Company or otherwise.
(2) Each duly appointed attorney-in-fact of the Company is hereby authorized to execute any Written Commitment for and on behalf of the Company, under the seal of the Company or otherwise, to the extent that such action is authorized by the grant of powers provided for in such person's written appointment as such attorney-in-fact.
(3) Each of the Chairmen, the President and the Vice Presidents of the Company is hereby authorized, for and on behalf of the Company, to appoint in writing any person the attorney-in-fact of the Company with full power and authority to execute, for and on behalf of the Company, under the seal of the Company or otherwise, such Written Commitments of the Company as may be specified in such written appointment, which specification may be by general type or class of Written Commitments or by specification of one or more particular Written Commitments.
(4) Each of the Chairmen, the President and the Vice Presidents of the Company is hereby authorized, for and on behalf of the Company, to delegate in writing to any other officer of the Company the authority to execute, for and on behalf of the Company, under the Company's seal or otherwise, such Written Commitments of the Company as are specified in such written delegation, which specification may be by general type or class of Written Commitments or by specification of one or more particular Written Commitments.
(5) The signature of any officer or other person executing any Written Commitment or appointment or delegation pursuant to this Resolution, and the seal of the Company, may be affixed by facsimile on such Written Commitment or written appointment or delegation.

FURTHER RESOLVED, that the foregoing Resolution shall not be deemed to be an exclusive statement of the powers and authority of officers, employees and other persons to act for and on behalf of the Company, and such Resolution shall not limit or otherwise affect the exercise of any such power or authority otherwise validly granted or vested."

I, Dawn M. Chloros, Assistant Secretary of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, PACIFIC INDEMNITY COMPANY, WESTCHESTER FIRE INSURANCE COMPANY and ACE AMERICAN INSURANCE COMPANY (the "Companies") do hereby certify that

- (i) the foregoing Resolutions adopted by the Board of Directors of the Companies are true, correct and in full force and effect,
(ii) the foregoing Power of Attorney is true, correct and in full force and effect.

Given under my hand and seals of said Companies at Whitehouse Station, NJ, this 11th day of January, 2022.



Dawn M. Chloros (handwritten signature)

Dawn M. Chloros, Assistant Secretary

IN THE EVENT YOU WISH TO VERIFY THE AUTHENTICITY OF THIS BOND OR NOTIFY US OF ANY OTHER MATTER, PLEASE CONTACT US AT:
Telephone (908) 903- 3493 Fax (908) 903- 3656 e-mail: surety@chubb.com

Western Surety Company

POWER OF ATTORNEY APPOINTING INDIVIDUAL ATTORNEY-IN-FACT

Know All Men By These Presents, That WESTERN SURETY COMPANY, a South Dakota corporation, is a duly organized and existing corporation having its principal office in the City of Sioux Falls, and State of South Dakota, and that it does by virtue of the signature and seal herein affixed hereby make, constitute and appoint

Marc W Boots, Vickie Elaine Lacy, Maria D Zuniga, Richard Allen Covington, Joseph R Aulbert, Ryan Varela, Ashley Koletar, Individually

of Houston, TX, its true and lawful Attorney(s)-in-Fact with full power and authority hereby conferred to sign, seal and execute for and on its behalf bonds, undertakings and other obligatory instruments of similar nature

- In Unlimited Amounts -

and to bind it thereby as fully and to the same extent as if such instruments were signed by a duly authorized officer of the corporation and all the acts of said Attorney, pursuant to the authority hereby given, are hereby ratified and confirmed.

This Power of Attorney is made and executed pursuant to and by authority of the By-Law printed on the reverse hereof, duly adopted, as indicated, by the shareholders of the corporation.

In Witness Whereof, WESTERN SURETY COMPANY has caused these presents to be signed by its Vice President and its corporate seal to be hereto affixed on this 21st day of June, 2021.

WESTERN SURETY COMPANY



Paul T. Bruflat
Paul T. Bruflat, Vice President

State of South Dakota }
County of Minnehaha } ss

On this 21st day of June, 2021, before me personally came Paul T. Bruflat, to me known, who, being by me duly sworn, did depose and say: that he resides in the City of Sioux Falls, State of South Dakota; that he is the Vice President of WESTERN SURETY COMPANY described in and which executed the above instrument; that he knows the seal of said corporation; that the seal affixed to the said instrument is such corporate seal; that it was so affixed pursuant to authority given by the Board of Directors of said corporation and that he signed his name thereto pursuant to like authority, and acknowledges same to be the act and deed of said corporation.

My commission expires
March 2, 2026



M. Bent
M. Bent, Notary Public

CERTIFICATE

I, L. Nelson, Assistant Secretary of WESTERN SURETY COMPANY do hereby certify that the Power of Attorney hereinabove set forth is still in force, and further certify that the By-Law of the corporation printed on the reverse hereof is still in force. In testimony whereof I have hereunto subscribed my name and affixed the seal of the said corporation this 11th day of January, 2022.



WESTERN SURETY COMPANY

L. Nelson
L. Nelson, Assistant Secretary

each project) of greater than \$15 million. These projects shall have been performed within the past ten (10) years from the date of the Invitation to Bid.

See Attachments 1, 2, 3, 4, 5

b. One (1) project demonstrating the Bidders experience with pumps that are greater than 400 HP. This project shall have been performed within the past twelve (12) years from the date of the Invitation to Bid.

See Attachment 4

c. One (1) project demonstrating the Bidders experience with generators that are greater than 1200 kW. This project shall have been performed within the past ten (10) years from the date of the Invitation to Bid.

See Attachment 4

d. Three (3) projects demonstrating the Project Manager experience with large pump station projects having a total construction value (for each project) of greater than \$15 million. These projects shall have been performed within the past ten (10) years from the date of the Invitation to Bid.

See Attachment 8 & Attachment 9

e. Three (3) projects demonstrating the Pipe Subcontractor experience constructing piping projects that include 36" or larger Ductile Iron pipe with runs greater than 300 feet and which include connections to existing large diameter pipes. These projects shall have been performed within the past ten (10) years from the date of the Invitation to Bid.

See Attachments 4, 6, and 7

f. Two (2) projects demonstrating the Pipe Subcontractor Superintendent experience constructing piping projects that include 36" or larger Ductile Iron pipe with runs greater than 300 feet and which include connections to existing large diameter pipes. These projects shall have been performed within the past ten (10) years from the date of the Invitation to Bid.

See Attachment 9

g. Three (3) projects demonstrating the Electrical Subcontractor experience with medium or high voltage power supply systems, including transformers and switchgear. These projects shall have been performed within the past ten (10) years from the date of the Invitation to Bid.

See Attachment 10

h. Two (2) projects demonstrating the Electrical Subcontractor Lead Electrician experience with medium or high voltage power supply systems, including transformers and switchgear. These projects shall have been performed within the past ten (10) years from the date of the Invitation to Bid.

See Attachment 11

8. Have you ever failed to complete work awarded to you; if so, where and why?
No

9. Name three (3) individuals or corporations for which you have performed work and to which you refer:
Please see references on Bid Sync.

10. List the following information concerning all contracts on hand as of the date of submission of this proposal (in case of co-venture, list the information for all coventures).

Name of Project	City	Total Contract Value	Contracted Date of Completion	% Completion to Date
See Attachment 12				
<hr/>				

(Continue list on inset sheet, if necessary)

11. What equipment do you own that is available for the work?

See Attachment 13 & will buy as necessary

12. What equipment will you purchase for the proposed work?

Will purchase as necessary

NOTE:

If requested by CITY, the Bidder shall furnish a notarized financial statement, references and other information, sufficiently comprehensive to permit an appraisal of its current financial condition.

ATTACHMENT 1

Project Name: Lake Charles Cracker Project (LCCP) – Raw Water Pump Station

(James Industrial completed this job. They are under the Primoris umbrella just as Cardinal is as well)

Owner: Sasol Chemicals USA c/o Fluor Technip Integrated (FTI)

Contract Value: \$529,000,000

Project Contact: Guy Carriker; 337-310-8219; Guy.Carriker@Fluor.com

Duration: 11/2014 – 10/2017

Project Scope:

As part of its work on this project, the Primoris team constructed a 33-ft x 41-ft x 20-ft deep raw water pump station, which crews tied to the existing Sabine River Authority canal. Primoris also installed 12 additional sumps ranging in size from 43 CY to 359 CY of concrete. Primoris also installed 42,000 LF of underground carbon steel process drain piping up to 54-in. diameter, 47,000 LF of 24-in. to 72-in. underground reinforced concrete stormwater piping, and 50,000 CY of concrete foundations and paving

ATTACHMENT 2

Project Name: Valrico AWTP Expansion from 6 to 12 MGD Ultraviolet Disinfection

Owner: Hillsborough County

Final Contract Value: \$50,767,609.00

Project Contact: Chuck Hammett; 813-685-4006; chamm28009@aol.com

Duration: 05/2007 - 08/2010

Project Scope:

Construction of (2) new 5.0 MGD pre-stressed concrete Reclaimed Water Storage Tanks, (1) new UV electrical bldg., (2) new electrical bldgs., (4) new deep bed filters, (1) new walkway to filters, (3) new clarifiers, (1) new clarifier influent splitter box, (2) oxidation ditches, (2) cyclone degritters/classifier units, (4) aerators, (1) sodium hypochlorite feed system, (1) alum feed system, (1) reject water storage pond, (1) reject water pump station, (1) lift station, (2) anaerobic selector tanks and mixers, (1) nutrient analyzer system, (2) generators and fuel systems.

ATTACHMENT 3

Project Name: Sawgrass Wastewater Treatment Plant Reuse Facility - Phase 1

Owner: City of Sunrise

Original Contract Value: \$15,862,201.00

Final Contract Value: \$15,004,550.00

Project Contact: Eli Tilen; 305-704-4423; etilen@brwncald.com

Duration: 11/2015 - 8/2018

Project Scope:

-9MGD WWTP Expansion

-A new 4 MGD reclaimed effluent transfer pumping station that will convey the chlorine contact chamber effluent to the new water storage tank

-A new high service pumping station that will be able to convey up to 9 MGD to reuse service customers

-A new 5 million gallon pre-stressed concrete reuse water storage

-Clearing the existing allotted portion of native vegetation and removing existing construction debris.

-Constructing a new 4 MGD filter influent transfer station that will convey a portion of the existing Sawgrass treated WWTP secondary effluent from both Plants [Secondary Clarifiers (SC) 1-4 and Secondary Clarifiers (SC) 5-8] to the new conventional deep bed filters

-A new concrete structure with multiple tanks, that shall serve as the deep bed downflow filtration system, rated to meet an effluent Total Suspended Solids (TSS) concentration of 5 mg/L at a maximum flow (MDF) of 4 MGD at all times;

-A new concrete building to house a new electrical transformer, motor control center and gear associated with the new process areas

-A new concrete chemical storage area that will house chemical storage tanks and chemical metering system for the polyaluminum chloride chemical coagulation and bulk sodium hypochlorite

A new concrete structure with multiple channels that shall serve as a chlorine contact chamber with a contact time of 45 minutes at a maximum flow of 4 MGD. The disinfection system will be able to meet a chlorine residual of 1 mg/L at 4 MGD

-New yard piping connecting the new process areas

-Civil-site modifications to provide service road access to the new structures and process areas for the entire future build out condition.

-Installation of line stops, hot-taps, and restraining measures to accommodate yard piping improvements; and

-Incorporation of new facilities into the plant automated control system

-Replacement of current process water pumps

-Replacement of the current PW pumps

ATTACHMENT 4

Project Name: New 59th Street Pump Station

Owner: City of Galveston

Final Contract Value: \$21,585,284.16

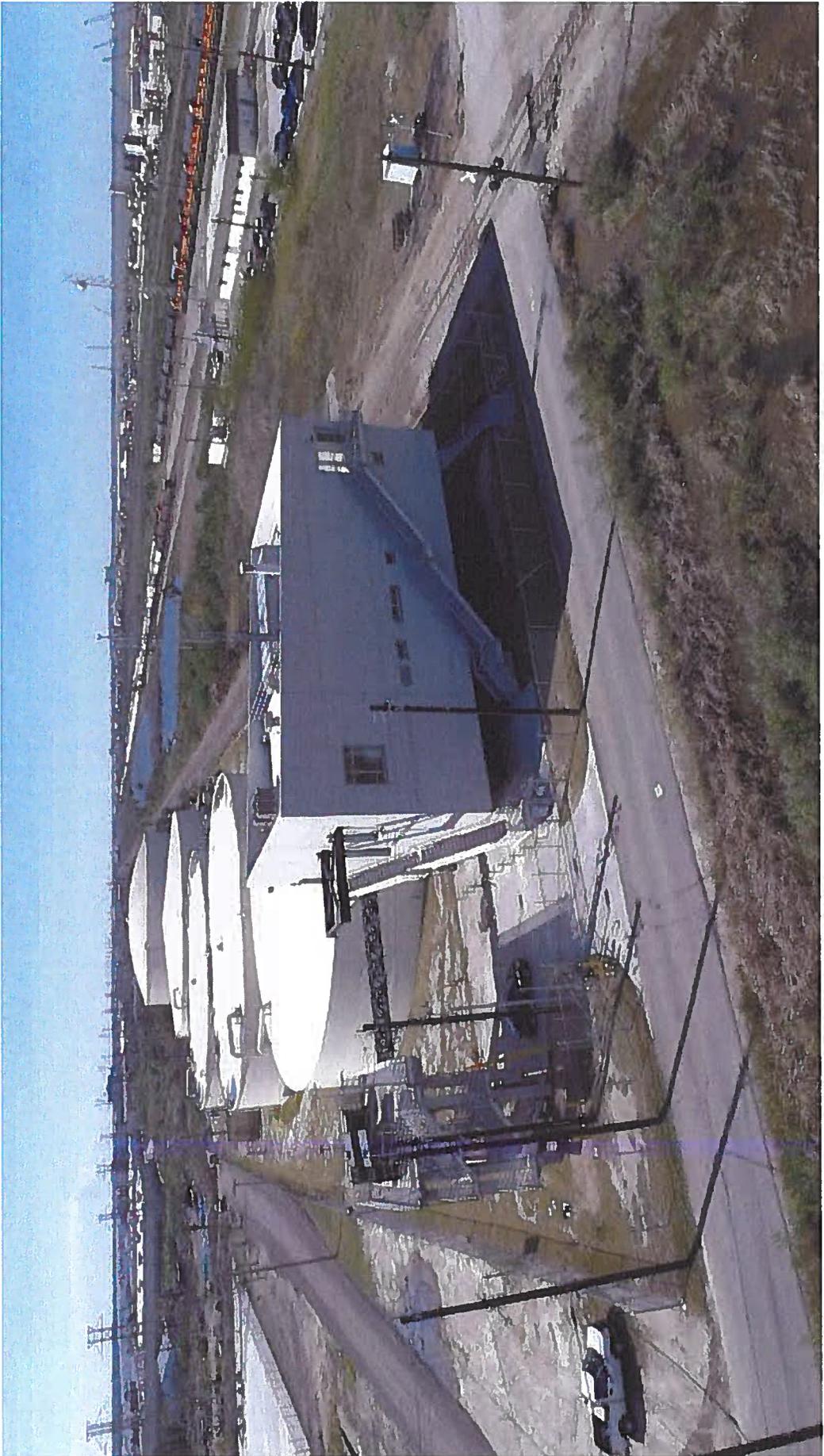
Project Contact: Kim Coogan; 409-797-3538; kcoogan@galvestontx.gov

Duration: 09/2015 - 09/2019

Project Scope:

- Existing 59th Street Pump Station Demolition
- Yard Piping Demolition
- **375' of 36" and 42" Ductile Iron Piping Yard Piping with connections to existing 36" piping - Pipe Supervisor - Fred Fasolo**
- **21,000 GPM New 59TH Street Pump Facility (4 Pumps - 400HP)**
- **1500kW Emergency Generator Set**
- Pump Station Building including Electrical, Mechanical/Control, Chlorine, and LAS/Zinc Orthophosphate Rooms, Restroom and Break Room
- Chemical Odor Scrubbing System
- Elevated Transformer Pad and Conduit Bridge
- On-Site Generator
- Drainage
- Fence Relocation
- Remote Chemical/Fuel Fill Stations
- Water Line Construction
- On-Site Paving and Driveway





ATTACHMENT 5

Project Name: Optimization and Improvements Design-Build Contract Project No. WUD 14-071

Owner: Palm Beach County

Original Contract Value: \$16,062,392.00

Final Contract Value: \$16,062,392.00

Project Contact: John Evans; 813-335-6170; John.K.Evans@mwhconstructors.com

Duration: 09/2013 - 05/2016

Project Scope:

This contract consists of various design-build improvements at both water and wastewater treatment facilities throughout Palm Beach County. Scope of work includes:

- **Replacement of 300hp High Service Pumps at Water Treatment Plant No. 8**
- **High Service Pump expansion including installation of new 350hp Pumps, new VFD's, Above Ground Piping, Under Ground Piping, Concrete Construction, Electrical work, and Instrumentation**
- Replacements of Lime Slakers at Water Treatment Plant No. 2 and No. 8 including Piping, Electrical work and Controls
- Membrane cleaning system improvements at Water Treatment Plant No. 3 including Above Ground Piping, Underground Piping, FRP tank modifications, Process Improvements, Concrete work, Electrical work, and Instrumentation & Controls.
- Clearwell Improvements at Water Treatment Plant No. 3 including Tank Coatings, Degasifier Ductwork and Blower Housing improvements
- Sodium Hypochlorite and Brine Maker Tank Replacements
- Rotary Drum Vacuum Filter Replacement at Water Treatment Plant No. 8
- Headworks and Bypass Improvements at NWRWWTP
- Sludge Thickener Replacement at WRWWTP

All projects were performed at active Water and Wastewater Treatment Plants. The work was coordinated closely with operations at the various facilities and included temporary bypassing, line stops, wet taps, and night work, all as required to properly maintain operations during construction.

ATTACHMENT 6

Project Name: SWWRF Lake Filtration System & Pond Improvements

Owner: Manatee County

Final Contract Value: \$12,984,047.61

Project Contact: Anthony Benitez; 941-737-4757; anthony.benitez@mymanatee.org

Duration: 08/2012 - 10/2014

Project Scope:

- Construct 500+ feet of 36-inch Ductile Iron Piping (UG) - Reject Intake, Lake Water Intake, 54" connection to Unfiltered Pump Station, Reclaimed Water main to Existing 10MG Tank**
- Construct a lined 18 million gallon Reject Storage Pond in the northern portion of the existing North Reclaimed Water storage pond
- Construct a lined 64 million gallon Reclaimed Water Storage Pond in the remaining area of the existing North Pond
- Install a 60 mil thick High Density Polyethylene Liner in the proposed Reject Pond and proposed North Reclaimed Water Storage Pond
- Construct a new intake structure, manhole and 36 inch intake pipe for the Reject Pump Station
- Construct a new Reclaimed Water Return Pump Station
- Replace the existing sluice gates on the North Pond Outlet Structure with stainless steel units
- Provide and install three (3) Gravity Disk Filters
- Construct a 24-inch Reclaimed Water Return pipeline from the North Pond RCWR pump station to its connection with the proposed 24 inch Reclaimed Water Return pipeline
- Provide and install a Waste Backwash Pump Station for the Disk Filters
- Provide and install a proposed 30-inch Reclaimed Water Metering Assembly at the Reclaimed Water High Service Effluent Pumping Station
- Construct approximately 750 feet of 24-inch Reclaimed Water mains from the existing 24 inch Pipeline
- Construct approximately 750 feet of 30-inch Reclaimed Water mains from the Effluent Pumping Station Meter Assembly to its connection
- Construct a new Reject Pond Outlet Assembly
- Provide and install a sodium hypochlorite chemical feed system
- Provide and install electric power, instrumentation and SCADA equipment, cables, control panels, etc., for the operation, control and monitoring of the proposed pumping stations, disk filters, flowmeters, etc

ATTACHMENT 7

Project Name: G.T. Lohmeyer 54" Force Main Emergency Replacement with 48" DIP

Owner: City of Fort Lauderdale

Contract Value: \$701,826

Project Contact: Timothy O'Neil; 954-903-6130; oneiltj@cdmsmith.com

Duration: 03/2012 – 11/2012

Project Scope:

Removal of 54-inch DIP Force Main and installing 1400' of new 48-inch DIP Force Main in the same trench, replacement of existing 12-inch, 24-inch and 48-inch forcemain connections. Assembly of new air release valve and the replacement of existing hydrogen peroxide piping and injection assemblies.

Pipe Supervisor - Fred Fasolo



John Scott

Senior Project Manager

Firm Name:

Cardinal Contractors, Inc.

Education:

*Texas Tech
College of Engineering
B.S. Chemical Engineering
Dean's Honors List*

Military Service:

*U.S. Marine Corps – 6yrs
Marine Security Forces*

Qualifications:

Mr. Scott has 16 years of experience in construction and engineering. His experiences have a foundation in engineering design and management for chemical processes. As Mr. Scott progressed in the industry, his responsibilities expanded to encompass both design and construction. Over his career, Mr. Scott has managed over a billion dollars in construction projects.

Experience:

2019-Present Cardinal Contractors, Inc.
Sr. Project Manger

2016-2019 McDermott
Project Director

2008-2016 CB&I / McDermott
Project Manager

2003-2008 BJ Services / Baker Hughes
Technical Services Engineer

Recent Project Experience:

Springtree WWTP Headworks Improvements \$9.3 MM
Rehabilitating the Headworks Structure at the Springtree Wastewater Treatment Plant and making improvements to raise the hydraulic grade of the process upstream of the Aeration Basins; rehabilitating the concrete, replacing the Headworks Structure's protective coatings; modifying the Headworks Structure and the screening, degritting and compactor areas
Sunrise, FL

Excellon Power Carbon Capture Plant \$90 MM
Design-Build Gas Fired Power Plant utilizing New Technology & Zero CO2 Emissions
LaPorte, TX

OXY Markham Facilities Ethylene Processing Plant \$120 MM
Design-Build Ethylene Treatment Facility for Salt Dome Storage & Distribution
Markham, TX

OXY Ethylene Production & Fractionation Plant \$180 MM
Design & Procurement of ethylene production facility including production, fractionation and utilities, electrical & control buildings, storage tanks and heaters
Corpus Christi, TX



ATTACHMENT 9

Project Experience for Personnel

Name: Michael Brandao
Years of Employment: 12 Years

1

Project Name: Sawgrass Wastewater Treatment Plant Reuse Facility - Phase 1
Owner: City of Sunrise
Original Contract Value: \$15,862,201.00
Final Contract Value: \$15,004,550.00
Project Contact: Eli Tilen;305-704-4423; etilen@brwncald.com
Duration: 11/2015 - 8/2018

Constructed a new 4 MGD reclaimed effluent transfer pumping station that will convey the chlorine contact chamber effluent to the new water storage tank. Constructed a new high service pumping station that will be able to convey up to 9 MGD to reuse service customers.

2

Project Name: New 59th Street Pump Station
Owner: City of Galveston
Final Contract Value: \$21,585,284.16
Project Contact: Kim Coogan; kcoogan@galvestontx.gov
Duration: 09/2015 - 09/2019

- Existing 59th Street Pump Station Demolition
- Yard Piping Demolition
- 375' of 36" and 42" Ductile Iron Piping Yard Piping with connections to existing 36" piping - Pipe Supervisor - Fred Fasolo
- 21,000 GPM New 59TH Street Pump Facility (4 Pumps - 400HP)
- Pump Station Building including Electrical, Mechanical/Control, Chlorine, and LAS/Zinc Orthophosphate Rooms, Restroom and Break Room
- Chemical Odor Scrubbing System
- Elevated Transformer Pad and Conduit Bridge
- On-Site Generator

Cardinal Contractors, Inc.

13794 NW 4th Street • Suite 200 • Sunrise, FL 33325 • p:(954) 587-0520 • f:(954) 337-0431 • www.prim.com



3

Project Name: Optimization and Improvements Design-Build Contract Project No. WUD 14-071

Owner: Palm Beach County

Original Contract Value: \$16,062,392.00

Final Contract Value: \$16,062,392.00

Project Contact: John Evans 813-335-6170; John.K.Evans@mwhconstructors.com

Duration: 09/2013 - 05/2016

- Replacement of 300hp High Service Pumps at Water Treatment Plant No. 8
- High Service Pump expansion including installation of new 350hp Pumps, new VFD's, Above Ground Piping, Under Ground Piping, Concrete Construction, Electrical work, and Instrumentation
- Replacements of Lime Slakers at Water Treatment Plant No. 2 and No. 8 including Piping, Electrical work and Controls
- Membrane cleaning system improvements at Water Treatment Plant No. 3 including Above Ground Piping, Underground Piping, FRP tank modifications, Process Improvements, Concrete work, Electrical work, and Instrumentation & Controls.
- Clearwell Improvements at Water Treatment Plant No. 3 including Tank Coatings, Degasifier Ductwork and Blower Housing improvements
- Sodium Hypochlorite and Brine Maker Tank Replacements
- Rotary Drum Vacuum Filter Replacement at Water Treatment Plant No. 8
- Headworks and Bypass Improvements at NRRWWTP
- Sludge Thickener Replacement at WRWWTP



Name: Fred Fasolo
Years of Employment: 9 Years

1

Project Name: New 59th Street Pump Station
Owner: City of Galveston
Final Contract Value: \$21,585,284.16
Project Contact: Kim Coogan; kcoogan@galvestontx.gov
Duration: 09/2015 - 09/2019

- Existing 59th Street Pump Station Demolition
- Yard Piping Demolition
- 375' of 36" and 42" Ductile Iron Piping Yard Piping with connections to existing 36" piping - Pipe Supervisor - Fred Fasolo
- 21,000 GPM New 59TH Street Pump Facility (4 Pumps - 400HP)
- Pump Station Building including Electrical, Mechanical/Control, Chlorine, and LAS/Zinc Orthophosphate Rooms, Restroom and Break Room
- Chemical Odor Scrubbing System
- Elevated Transformer Pad and Conduit Bridge
- On-Site Generator

2

Project Name: G.T. Lohmeyer 54" Force Main Emergency Replacement with 48" DIP
Owner: City of Fort Lauderdale
Contract Value: \$701,826
Project Contact: Timothy O'Neil; 954-903-6130; oneiltj@cdmsmith.com
Duration: 03/2012 – 11/2012

Removal of 54-inch DIP Force Main and installing 1400' of new 48-inch DIP Force Main in the same trench, replacement of existing 12-inch, 24-inch and 48-inch forcemain connections. Assembly of new air release valve and the replacement of existing hydrogen peroxide piping and injection assemblies.
Pipe Supervisor - Fred Fasolo



ATTACHMENT 10

Project Experience with Medium Voltage

Project Name: Central District WWTP Industrial Injection Well Surface Facilities
Owner: Miami/Dade County
Project Location: 3989 Rickenbacker Cswy
General Contractor: Poole & Kent Company of Florida
Contact Name: David Strickland
Contact Number: 305-325-1930
Architect: MWH
Completion: July 2019
Contract Amount: \$4,899,931

Project Name: Broward County North Regional WWTP Load Center Replacement
Owner: Broward County
Project Location: 2555 W. Copans Rd.
General Contractor: Florida Design Contractors, Inc.
Contact Name: Tom Clarke
Contact Phone: 561-845-1233
Architect: CDM Smith
Completion Date: August 2019
Contract Amount: \$2,833,920

Project Name: GT Lohmeyer Emergency Generator Connection & Switchgear Upgrades
Owner: City of Fort Lauderdale
Project Location: 1765 SE 18th St., Fort Lauderdale, FL
General Contractor: Florida Design Contractors
Contact Name: Tom Clarke
Contact Phone: 561-845-1233
Architect: CDM Smith
Completion Date: November 2018
Contract Amount: \$2,213,748

Project Name: GT Lohmeyer Replacement of MCCs
Owner: City of Fort Lauderdale
Project Location: 1765 SE 18th St., Fort Lauderdale, FL
General Contractor: Cardinal Contractors
Contact Name: Michael Brandao
Contact Phone: 941-377-8555
Architect: CDM Smith
Completion Date: October 2021
Contract Amount: \$3,636,000



ATTACHMENT 11

Project Experience with Medium Voltage

Name: Jeremy Warren
Years of Employment: 4 years

Project Name: GT Lohmeyer Emergency Generator Connection & Switchgear Upgrades
Owner: City of Fort Lauderdale
Project Location: 1765 SE 18th St., Fort Lauderdale, FL
General Contractor: Florida Design Contractors
Contact Name: Tom Clarke
Contact Phone: 561-845-1233
Architect: CDM Smith
Completion Date: November 2018
Contract Amount: \$2,213,748

Replacement of existing 4160V switchgear No.1, existing unit substation No. 1 & No. 2, existing 480V motor control center No. 1 & No. 1 extension, existing 4160V main air compressor "C"

Project Name: GT Lohmeyer Replacement of MCCs
Owner: City of Fort Lauderdale
Project Location: 1765 SE 18th St., Fort Lauderdale, FL
General Contractor: Cardinal Contractors
Contact Name: Michael Brandao
Contact Phone: 941-377-8555
Architect: CDM Smith
Completion Date: October 2021
Contract Amount: \$3,636,000

Replacement of Motor Control Centers (MCC) 3,4,4A, 5 and 6 and unitized substations 3, 4, 5 and 6

ATTACHMENT 12

CCI Job	Project Title	Contract Amount	Contract Date	Completion Date	% Complete	CCI's Role	Owner Address, Contact & Telephone Number
31902	City of Pembroke Pines WWTP DB-Phase 1	\$5,349,880.00	1/10/2019	11/1/2021	99.00%	DB	City of Pembroke Pines 13975 Pembroke Road Pembroke Pines, FL 33027
85003-006	Palm Beach County SRWRF Proces Blower Improvements (WUD 18-067)	\$1,866,110.00	7/14/2020	11/6/2021	91.00%	DB	Palm Beach County 8100 Forest Hills Blvd. West Palm Beach, FL 33413
85012	Master Pump Station 454	\$4,651,894.00	12/10/2019	11/4/2020	90.00%	GC	Broward County 115 S. Andrews Avenue Fort Lauderdale, FL 33301
85002	Master Pump Station Controls Upgrade	\$3,901,805.00	4/16/2019	10/16/2020	85.00%	GC	Broward County 115 S. Andrews Avenue Fort Lauderdale, FL 33301
85008	City of Sunrise Springtree WWTP Headworks Improvements	\$9,335,599.00	10/01/19	2/2021	78.00%	GC	City of Sunrise 777 Sawgrass Corporate Parkway Sunrise, FL 33325
85017	NORTHEAST WATER PURIFICATION PLANT - NORTH PLANT 501	\$4,553,224.00	6/2020	9/2022	78.00%	SUB	Balfour Betty Infrastructure, Inc. 12630 Water Works Way, Trailer #11 Humble, TX 77396
85015	Wastewater Treatment Plant Phase 2 Expansion	\$7,240,968.00	2/21/2020	5/30/2022	75.00%	GC	Gasparilla Island Water Association Inc. PO Box 310 Boca Grande, FL 33921
85020	Pines WTP IEX Instrumentation Upgrade	\$2,542,089.00	9/3/2020	10/14/2021	71.00%	GC	City of Pembroke Pines 13975 Pembroke Road Pembroke Pines, FL 33027
85021	Riviera Beach WTP Chem Feed Improvements	\$6,494,680.00	9/8/2020	9/22/2021	70.00%	DB	City of Riviera Beach Utility Special District 600 W. Blue Heron Blvd. Riviera Beach, FL 33404
85005	Lee County Fiesta Village WRF Sludge & NAOCL System	\$6,178,364.00	7/2019	7/2021	66.00%	GC	BOCC, Lee County, FL 1500 Monroe Street, 3rd Floor Fort Myers, FL 33902

CCI Job	Project Title	Contract Amount	Contract Date	Completion Date	% Complete	CCI's Role	Owner Address, Contact & Telephone Number
85022	Regional WWTP Rehab & Repair	\$2,595,755.00	2/9/2021	12/6/2021	37.00%	GC	Desoto County BOCC 201 E. Oak Street Arcadia, FL 34266
85023	D.L. Tippin WTP HSPS and Improvements	\$11,949,886.00	6/16/2021	4/7/2023	11.00%	SUB	CH2M Hill, Inc 643 SW 4th Avenue, Suite 400 Gainesville, FL 32601
85025	Carlton WTP Rehab Phase 2	\$4,419,100.00	7/13/2021	1/11/2023	0.00%	GC	Sarasota County 1001 Sarasota Center Blvd. Sarasota, FL 34240
85026	PBC - WTP 3 & SROC Electrical Improvements	\$3,414,500.00	7/13/2021		0.00%	GC	Palm Beach County 8100 Forest Hills Blvd. West Palm Beach, FL 33413
85027	PBC - SWRF Single - Zone Monitor Well	\$4,115,812.00	12/23/2021		0.00%	GC	Palm Beach County 8100 Forest Hills Blvd. West Palm Beach, FL 33413
85028	PBC - SWRF Pre Treatment Analyzers & Improvements	\$4,654,105.00	12/21/2021	10/21/2023	0.00%	GC	Palm Beach County 8100 Forest Hills Blvd. West Palm Beach, FL 33413
85029	Coral Springs WTP NAOCL System Upgrade	\$981,000.00	12/28/2021	1/2/2023	0.00%	SUB	Eckler Engineering, Inc. 4700 Riverside Dr., Suite 110 Coral Springs, FL 33067

ATTACHMENT 13

EMCo	Equipment	VINNumber	Description
10	482088	307839UAK231	01 IR P185CFM AIR COMPRESSOR
10	392062	CAT0420DJFDP09520	02 CAT 420D BACKHOE
10	482097	4FVCABAA13U33479	02 IR P185CFM AIR COMPRESSOR
10	361024	PAB04680	05 CAT 320CL EXCAVATOR
10	361025	PAB04648	05 CAT 320CL EXCAVATOR
10	392081	FDP23893	05 CAT 420D BACKHOE 4X4
10	392080	FDP23799	05 CAT 420D BACKHOE 4X4
10	392082	FDP25314	05 CAT 420D BACKHOE 4X4
10	411009	DDA02337	05 CAT 924G WHEEL LOADER
10	411007	RTA00310	05 CAT 924G WHEEL LOADER
10	411010	DJD02014	05 CAT 928G WHEEL LOADER
10	411008	DJD01585	05 CAT 928G WHEEL LOADER
10	RTH363040	BZY02298	336 EXCAVATOR/ARB UNIT
7	BT0224		35 X 12.25 X 2 WHEELER-MT
7	TW0426	RW89709002076	4 WHEEL DR TR 8970 - 400 HP
7	TW0419	6802699305	4 WHEEL DR TR 9280 375 HP
7	T80011	15331	4YD BEDDING BOX
7	TWA9515	981515	72" BRUSH CUTTER
7	TWA9515R	981515	72" BRUSH CUTTER
10	252049	140177E	77 BUD 45' STORAGE TRAILER
10	242146	166590M	79 BUDD 40' STORAGE TRAILER
7	FBS0025		80' SCREED BAKER
10	252045	16VPX1623R1E58736	94 BIGTEX UTILITY TRAILER
10	242150	1DW1A5321TS969482	96 STOUGHTON 53' ST/TRAILER
10	242149	1DW1A5325TS969470	96 STOUGHTON 53' ST/TRAILER
10	252047	1DW1A5320TS969473	96 STOUGHTON STORAGE TRAILER
7	SI0661	4845K59296	ACCUGRADE BASE STATION
7	SI0660	HGA011149	ACCUGRADE CONTROL SYSTEM 140M
7	SI0662	4837157764	ACCUGRADE ROVER
7	AC0304	126851	AIR COMPRESSOR - 185 CFM
7	AC0326J	201405190092	AIR COMPRESSOR 185
10	482098	201206210072	AIR COMPRESSOR 185 CFM SULLAIR
7	AC0323	004-13147	AIR COMPRESSOR 185 SULLAIR
7	AC0325	C16B10262	AIR COMPRESSOR PDS400
7	AC0320	32343238	AIR COMPRESSOR STATIONARY
7	AC0302	260657	AIR COMPRESSORS - PORTABLE
7	TED9351R2	TFK01351	ART TRUCK 745C
7	AP0018		ASHPALT PLANT E3-400 - PORTABLE DRUM/RAP
7	SP0135	T1F00106	ASPHALT PAVER AP1000E
7	SP0138	AC400263	ASPHALT PAVER AP1000F
7	SP0134	191810	ASPHALT PAVER PF3200
7	AP0017		Asphalt Plant - CMI PTD400
7	0056309	1L9PD3531WH209061	ASPHALT PUP TRAILER 12'
7	0056310	1L9PD13531WH209059	ASPHALT PUP TRAILER 12'
7	PS0016		ASPHALT TRANSFER VEHICLE WEILER E2850
7	SP0137	07191822	ASPHALT/CTB PAVER SUPER 2100-2
7	LH0127	161901	BACKHOE 310SJ
7	LH0128	161127	BACKHOE 310SJ
7	LH0102	FDP09609	BACKHOE 420D
7	LH0129	BLN11406	BACKHOE 420D IT
7	LH0108	DAN02242	BACKHOE 420E IT
7	LH0110	DAN01665	BACKHOE 420E IT
7	LH0098	KMW02857	BACKHOE 420E IT
7	LH0103	DAN01650	BACKHOE 420E IT
7	LH0107	DAN1525	BACKHOE 420E IT
7	LH0109	JWJ00203	BACKHOE 420E IT
7	LH0114	JWJ00731	BACKHOE 420E IT
7	LH0117	JWJ02290	BACKHOE 420F IT
7	LH0120	HWD00205	BACKHOE 420F IT
7	LH0112	JWJ00790	BACKHOE 420F IT
7	LH0113	JWJ01197	BACKHOE 420F IT
7	LH0116	JWJ01131	BACKHOE 420F IT
7	LH0125	HWD000891	BACKHOE 420F IT
7	LH0126	HWD00276	BACKHOE 420F IT
7	LH0118	JWJ03269	BACKHOE 420F IT
7	LH0119	HWD00448	BACKHOE 420F IT 4X4
7	LH0122	JWJ01924	BACKHOE 420F IT 4X4

7 LH0121	JWJ01923	BACKHOE 420F IT 4X4
7 LH0111	JWJ00787	BACKHOE 420F IT4S
7 LH0130	HWC02065	BACKHOE 420F2 IT
7 LH0131	HWC02069	BACKHOE 420F2 IT
10 392085	HWD00334	BACKHOE 420F2 IT
7 LH0115	JWJ01145	BACKHOE 420FIT
7 LH0132	HWD01301	BACKHOE LOADER 420F IT4E
7 LH0133	HWD00896	BACKHOE LOADER 420F IT4SX
7 11269	BB8607	BADGER BREAKER
7 AP0017F		BAG HOUSE/DUST SCREW - AP0017
7 AP0018D		BAG HOUSE/DUST SCREW - AP0018
7 FBS0031	NA	BAKER SCREED 45'
7 Z0584		BARRIER RAIL CLAMP
7 FBS0029	48-200881163-2-HD	BIDWELL SCREED 4800
7 FBS0027	48-20061116-2-XB	BIDWELL SCREED MODEL 4800
7 FBS0032	48-2014-1282-2-HD	BIDWELL SCREED MODEL 4800 (100') CROWN SECTION
7 SP0130	19527-46	Blaw Knox Road Widener-RW195
7 LWA0006		BOOM ATTACHMENT FOR 930
7 0021601	1FVACXBSSADAR1111	BOOM TRUCK M2/090
7 DA0157	369	BOTTOM DRIVE AUGER
7 TWA0240	1130031	BOX BLADE GB72 6'
7 H0911	500514	BOX INSERT 14"
7 H0926	802 16HD	BOX INSERT 18"
7 FBS0033	48-2017171379-2-HD	BRIDGE SCREED 4800 110' W CROWN
7 FBS0028	48-99926-2-HD	BRIDGE SCREED BIDWELL 4800
7 FBS0021	BR886792	BRIDGE SCREED BR202 48"
7 RB0125	405500	Broce Broom
7 RB0126	405591	Broce Broom
7 TWA0526	2420223	BRUSHCUTTER 60" SKID STEER
7 0056312	1T9SS5612FR719135	CEMENT STORAGE PIG W BLOWER 4000CF
7 0056283	1T9SS56147R719378	CEMENT TRAILER
7 P1374	240003	CENT WATER JETT PUMP DIESEL 4"
7 P1348	R8411	CENT WATER JETT PUMP DIESEL 6"
7 VS0002	6619360	CHIEFTAN POWERSCREEN 140TRAX
7 Z0587		CHILLER 100 TON
7 Z0600		CHILLER 90 TON
7 0056217	TTRT14M3878070	CHILLER TRAILER
7 SP0136	K4967	CHIP SPREADER
7 SP0132	K6211	CHIP SPREADER R6849
7 B0551	00EC016	CLEAN OUT BUCKET 5' 320
7 SS0066	526-285	CMI Mixer/Reclaimer RS-425B
7 FC0059	7HC00142	CMI TC250 TEXTURE CURE MACHINE
7 AP0018B		COLD FEED BINS - AP0018
7 AP0017C		COLD FEED BINS/CONVEYORS - AP0017
7 MC0076	900100-1055	COMMANDER III PAVER 4 TRACK 5000 SERIES MOLD
7 EBA0108	ENTEK WB18-3/HGA5851	COMPACTION WHEEL
7 RA0287	BYN01090	COMPACTOR 815F
7 RA0288	BYN01091	COMPACTOR 815F
7 RA0253	BYN00342	COMPACTOR 815F2
7 H0849	12079	CONC HELMENT - 12 IN
7 H0915	24H056EL	CONC HELMENT - 24 IN
7 H0857	500514	CONC INSERT SQUARE - 16 IN
7 Q0413	71968	CONCRETE BEAM TEST VAN
7 H0917	08V113	CONCRETE CAP - 14"
7 BNC0013	05032018-1	CONCRETE CENTRAL MIX BATCH PLANT
7 WC0102	1209880001	CONCRETE GROOVER RPG-2400(gutter grinder)
7 H0887	24HD1180	CONCRETE INSERT DCC 24-24
7 EBA0109	148094	CONCRETE MUNCHER 336 DB LINK
7 MC0077	905200-239	CONCRETE PAVER 2800 T4I
7 H0925	24BH2-2004A	CONCRETE PILE INSERT 24" D62
7 PS0012	904900-088	CONCRETE PLACER PS2600
7 PS0017	904900-126	CONCRETE PLACER PS2600
7 PS0009	535-126	CONCRETE PLACER PS6004
7 PS0013	906700-107	CONCRETE PLACER RTP-500
7 PS0014	904900-022	CONCRETE PLACER SPREADER PS2600
7 PS0018	904900-087	CONCRETE PLACER/SPREADER PS2600
7 BNC0010		CONCRETE PLANT - ERIE MG12CP
7 BNC0009	MG-7400	CONCRETE PLANT - ERIE MG12CP

7 BNC0011	MG-8440	CONCRETE PLANT ERIE STRAYER
7 WC0099	001277489001	CONCRETE SAW FS8400D
7 0042500	8341	Concrete Saw Trailer
7 Q0478	322317	CONCRETE TEST BEAM CONTAINER
7 Q0463	220694-10	CONNEX 20'
7 AP0017E		CONTROL RM/SCALES - AP0017
7 AP0018E		CONTROL ROOM/SCALES - AP0018
7 L0281	TFC3070001SO384-1	CONVEYOR 30"X70' W HOPPER
7 L0282	TFC3070001SO384-2	CONVEYOR 30"X70' W HOPPER
7 DA0148	HPS0226	CR DRILL A H15
7 DA0155	HPS401	CR DRILL A H20
7 DA0149	HPS0228	CR DRILL A HPS15
7 DA0147	HPS166	CR DRILL AH15
7 D0464	14001026	CRANE CRAWLER 14000 MANITOWOC
7 D0465	14001028	CRANE CRAWLER 14000 MANITOWOC
7 D0466	140001041	CRANE CRAWLER 14000 MANITOWOC
7 D0467	GN03-02187	CRANE CRAWLER CK1600-II
7 D0462	10001034	CRANE CRAWLER MT10000
7 CM0154	234465	CRANE MOTOR - RT770E
7 CM0148	228236	CRANE MOTOR GROVE RT650E
7 CM0141	225071	CRANE MOTOR - RT530E
7 CM0143	227663	CRANE RT530E
7 CM0151	233509	CRANE RT530E-2
7 CM9872R	234872	CRANE RT770
7 CM0155	234401	CRANE RT770E
7 D0457	9004AC-3513	CRANE-CRAWLER 5299-A - 3 DRUM
7 D0450	8901AC-3456	CRANE-CRAWLER 5299-A - 3 DRUM
7 D0448	88006-AT-3442	CRANE-CRAWLER 5300 - 3 DRUM
7 D0447	8712-AT-3423	CRANE-CRAWLER 5300 - 3 DRUM
7 D0438	21 HI-547-G	CRANE-CRAWLER LS-338 - 3 DRUM
7 D0446	4EV-726	CRANE-CRAWLER LS-418-A/2 DRUM
7 0021599	1HTMMAAL46H180889	CRASH ATTENUATOR TRUCK 4300
7 0021600	1HTMMAAL96H224269	CRASH ATTENUATOR TRUCK 4300
7 D0470	11001084	CRAWLER CRANE 11000-1
7 D0473	GH0403230	CRAWLER CRANE CK1100G
7 D0471	GH04-03145	CRAWLER CRANE CK1100-G
7 D0469	GN03-02305	CRAWLER CRANE CK1600
7 D0463	AC-4212	CRAWLER CRANE HC 165
7 T0634	KW200550	CRAWLER TRACTOR D5K
7 T0635	KMR00350	CRAWLER TRACTOR D6T
7 T0637	FMC00730	CRAWLER TRACTOR D8T
7 T0636	FMC00320	CRAWLER TRACTOR D8T
7 T0638	FMC00724	CRAWLER TRACTOR D8T
7 B0566	NBC04034	DIGGING BUCKET 30" 320E
7 PL0279	6TPCW-27	DISC - 12-36
7 PL0281	12TCW-2174	DISC, OFFSET TCW- 12-24
7 PL0284	6TRCW-30	DISC, OFFSET TCW 12-36
7 RA0291	CSB00224	DOUBLE DRUM ROLLER CB64
7 T0558	KFF00148	DOZER D3K XL
7 T0549	FFF00811	DOZER D3K XL
7 T0548	FFF00813	DOZER D3K XL
7 T0555	FFF00809	DOZER D3K XL
7 T0573	KFF00308	DOZER D3K XL
7 T0505	YYY00755	DOZER D5K LGP
7 T0522	YYY00982	DOZER D5K LGP
7 T0528	YYY00892	DOZER D5K LGP
7 T0551	YYY01349	DOZER D5K LGP
7 T0521	YYY00978	DOZER D5K LGP
7 T0533	YYY00893	DOZER D5K LGP
7 T0576	KYY00840	DOZER D5K LGP
7 T0508	YYY00425	DOZER D5K LGP
7 T0504	YYY00725	DOZER D5K LGP
7 T0520	YYY00966	DOZER D5K LGP
7 T0575	KYY00925	DOZER D5K LGP
7 T0602	KYY01306	DOZER D5K LGP
7 T0595	KYY00923	DOZER D5K LGP
7 T0564	KYY1029	DOZER D5K LGP C/A GPS
7 T0552	KYY00309	DOZER D5K LGP CAB AIR

7 T0620	KY200277	DOZER D5K LGP CAB AIR ARO
7 T0601	KYY01823	DOZER D5K LGP CAB/AIR
7 T0604	KYY01696	DOZER D5K2 LGP
7 T0605	KYY01691	DOZER D5K2 LGP
7 T0618	KY200716	DOZER D5K2 LGP
7 T0621	KY200717	DOZER D5K2 LGP
7 T0630	KY200896	DOZER D5K2 LGP
7 T0612	KY200825	DOZER D5K2 LGP C/A GPS
7 T0629	KY202773	DOZER D5K2 LGP CAB AIR
7 T0610	KY200715	DOZER D5K2 LGP CAB AIR
7 T0611	KY200719	DOZER D5K2 LGP CAB AIR
7 T0609	KY200720	DOZER D5K2 LGP CAB AIR GPS
7 T0619	KY200539	DOZER D5K2 LGP(RENTED GPS)
7 T0633	KW200511	DOZER D5K2 XL
7 T0631	KWW01289	DOZER D5K2 XL
7 T0632	KW200405	DOZER D5K2 XL
7 T0561	PBA00564	DOZER D6N LGP
7 T0603	PBA02310	DOZER D6N LGP
7 T0607	PBA02507	DOZER D6N LGP
7 T0599	PBA02418	DOZER D6N LGP
7 T0606	PBA02342	DOZER D6N LGP
7 T0570	PBA01586	DOZER D6N LGP
7 T0571	PBA01179	DOZER D6N LGP
7 T0578	PBA01162	DOZER D6N LGP
7 T0580	PBA01902	DOZER D6N LGP
7 T0617	PBA02428	DOZER D6N LGP
7 T0625	PBA02347	DOZER D6N LGP
7 T0626	PBA02672	DOZER D6N LGP
7 T9550R2	DOZER D6N LGP	DOZER D6N LGP RPO
7 T0507	DJY01620	DOZER D6N LGP ARO
7 T0616	PBA02430	DOZER D6N LGP JOB GPS
7 T0562	PBA00530	DOZER D6N LGP W GPS
7 T0579	PBA01947	DOZER D6N LGP W WINCH
7 T0582	PBA02304	DOZER D6N LGP W/ WINCH
7 T0581	PBA02296	DOZER D6N LGP W/WINCH
7 T0560	PBA00769	DOZER D6N LGP
7 T0596	ZJB01635	DOZER D6T LGP
7 T0583	ZJB01538	DOZER D6T LGP
7 T0627	ZJB01584	DOZER D6T LGP
7 T0563	ZJB01262	DOZER D6T LGP
7 T0574	ZJB01343	DOZER D6T LGP
7 T0598	ZJB01523	DOZER D6T LGP
7 T0628	ZJB01705	DOZER D6T LGP
7 T9628R	JML00628	DOZER D6T LGP RPO
7 T0584	KSB1585	DOZER D6T LGP 6 WAY
7 T0597	KSB01587	DOZER D6T LGP 6WAY
7 T0572	GMK01509	DOZER D6T XL
7 T0553	GMK01011	DOZER D6T XL GPS
7 T0608	KMR00317	DOZER D6T XL GPS
7 T0559	GMK01448	DOZER D6T XL RIPPER GPS
7 T0613	KMR00324	DOZER D6T XL W GPS
7 T0557	GMK01353	DOZER D6T XL W/GPS
7 T0624	FMC01233	DOZER D8T
7 T0600	FMC00240	DOZER D8T
7 T0614	FMC00629	DOZER D8T
7 T0615	FMC00737	DOZER D8T
7 T0623	FMC01231	DOZER D8T COAL BLADE
7 T0622	FMC01230	DOZER D8T COAL BLADE
7 AP0017A		DRAG SLAT CONVEYOR - AP0017
7 H0238	1277/1275/1280	DRILL LEADS 43"X50
7 H0239	843-1281;843-1639	DRILL LEADS 43"X90
7 DA0158	071165/200712165	DRILL MODEL 50
7 T0390	RS-7-6017L	DRILL TRACTOR RS-6
7 T0531	CFA00173	DRILL TRACTOR SC-50
7 H0890	DB26-1260	DRIVE CAP 26"
7 H0886	DB321128	DRIVE CAP 32" W/ STRIKER PLATE
7 H0888	32/37PH-1207	DRIVE CAP 32/37 PIPE HELMET FOR D46
7 H0921		DRIVE CAP 36" D-100

7 H0846	3073	DRIVING CA - 18 IN
7 H0845	1V-119	DRIVING CA 06 & 65 - 14 IN
7 H0806		DRIVING CA FOR 0-6 SHEET PIL
7 H0827		DRIVING CA FOR 80C 12-16"PIPE
7 H0832		DRIVING CA FOR D-30
7 H0873	500518	DRIVING CAP
7 H0883		DRIVING CAP 18" CONC
7 H0880	014V08	DRIVING CAP 24" SQ CONCRETE
7 H0803		DRIVING CAP H PILE
7 AP0017D		DRUM/RAP - AP0017
7 HLD0475	800203	Dual Laser Profiler
7 0031510	1M2AL02C96M001714	DUMP TK - MACK CT713
7 0031509	1M2AL02CX6M001513	DUMP TK - MACK CT713
7 0031513	1M2AL02C76M002778	DUMP TK - MACK CT713
7 0031508	1M2AL02C66M001797	DUMP TK - MACK CT713
7 0031501	1NKDXBTX26J133927	DUMP TK - T800 TRIAXLE
7 0031504	1NKDXBTX26J133961	DUMP TK - T800 TRIAXLE
7 0031500	1NKDXUEX66J139657	DUMP TK - T800 TRIAXLE
7 0031505	1NKDLUOX6J127384	DUMP TK - T800 TRIAXLE
7 0031503	1NKDXBTX86J133933	DUMP TK - T800 TRIAXLE.
7 0031516	1NKDLUOX36J152174	DUMP TRUCK
7 0031517	1NKDXUOX77J192232	DUMP TRUCK T800 TRI AXLE
7 0031533	2HSCNAPR26C215008	DUMP TRUCK TANDEM 9400
7 0031518	1NKDXBTX97J167915	DUMP TRUCK TRI AXLE
7 0031519	2NKDXBTX87M183189	DUMP TRUCK TRI AXLE
7 0031520	2NKDXBTX67M183188	DUMP TRUCK TRI AXLE
7 0031521	1NKDXBTX77J179304	DUMP TRUCK TRI AXLE
7 0031538	1NKDXPEX5DJ362707	DUMP TRUCK TRI AXLE T800
7 0031539	1NKDXPEX3DJ362706	DUMP TRUCK TRI AXLE T800
7 0031560	3BKDXPEX5GF121510	DUMP TRUCKS TRI AXLE T800
7 0031561	3BKDXPEX7GF121511	DUMP TRUCKS TRI AXLE T800
7 0031562	3BKDXPEX9GF121512	DUMP TRUCKS TRI AXLE T800
7 0031559	3BKDXPEX9GF121509	DUMP TRUCKS TRI AXLE T800
7 0031536	1NKDXPEX9DJ362709	DUMP TRUCKS TRI AXLE T800
7 0031537	1NKDXPEX7DJ362708	DUMP TRUCKS TRI AXLE T800
7 0021210	1HTSCABN81H288600	Etnyre Distributor
7 0055079	1E92892415E111219	Etnyre Trailer
7 0056294	1E9282294E111033	Etnyre Trailer
7 0056292	1E92813262E111095	Etnyre Trailer
7 0056293	1E92842184E111032	Etnyre Trailer
7 EB0292	XCF00448	EXAVATOR 323F
7 EB0152	HEK00874	EXC - 322
7 EB0218	JBC00602	EXCAVATOR 312DL
7 EB0234	MJD00240	EXCAVATOR 312EL
7 EB0241	MJD00356	EXCAVATOR 312EL
7 EB0237	SSZ00655	EXCAVATOR 314DL CR
7 EB0210	PHX01083	EXCAVATOR 320DL
7 EB0175	PHX01293	EXCAVATOR 320DL
7 EB0233	SPN00846	EXCAVATOR 320DL
7 EB0239	TFX00209	EXCAVATOR 320E RR
7 EB0240	TFX00186	EXCAVATOR 320E RR W/THUMB
7 EB0277	REE00211	EXCAVATOR 320EL
7 EB0232	WBK00575	EXCAVATOR 320EL
7 EB0235	WBK00573	EXCAVATOR 320EL
7 EB0279	WBK01572	EXCAVATOR 320EL
7 EB0260	WBK02307	EXCAVATOR 320EL W THUMB
7 EB0258	MPG00607	EXCAVATOR 321DL W/QC
7 EB0295	XCF00455	EXCAVATOR 323F
7 EB0293	XCF00443	EXCAVATOR 323F
7 EB0294	XCF00461	EXCAVATOR 323F
7 EB0300	XCF01344	EXCAVATOR 323FL
7 EB0194	JJG00908	EXCAVATOR 324DL
7 EB0273	PNW00989	EXCAVATOR 324EL
7 EB0230	PNW00256	EXCAVATOR 324EL LONG REACH
7 EB0191	JHJ00218	EXCAVATOR 329DL
7 EB0245	ZCD00156	EXCAVATOR 329EL
7 EB0296	ERL00720	EXCAVATOR 329FL
7 EB9964IC	RKB01964	EXCAVATOR 336

7 EB9962IC	RKB01962	EXCAVATOR 336 W\ QC	ROCKFORD# LBH1001
7 EB9445IC	SSN00445	EXCAVATOR 336 W\ QC	ROCKFORD# RBH1014
7 EB9970IC	RKB01970	EXCAVATOR 336 W\ QC & WET KIT	ROCKFORD# LBH1005
7 EB0212	BZY00147	EXCAVATOR 336E GRINDER	
7 EB0214	BZY00146	EXCAVATOR 336E W GRINDER	
7 EB0275	FJH01079	EXCAVATOR 336E W THUMB	
7 EB0264	FJH01356	EXCAVATOR 336EL	
7 EB0276	FJH01818	EXCAVATOR 336EL	
7 EB0256	JRJ00291	EXCAVATOR 336EL	
7 EB0259	FJH00950	EXCAVATOR 336EL	
7 EB0257	BZY02259	EXCAVATOR 336EL GRAPPLE MACHINE	
7 EB0242	BZY02182	EXCAVATOR 336EL MUNCHER	
7 EB0265	FJH01393	EXCAVATOR 336EL THUMB	
7 EB0266	JRJ00241	EXCAVATOR 336EL W MUNCHER	
7 EB0246	BZY02496	EXCAVATOR 336EL WET KIT FOR HAMMER	
7 EB0267	FJH01081	EXCAVATOR 336ELW GRINDER	
7 EB0290	RKB01636	EXCAVATOR 336F	
7 EB0291	RKB01635	EXCAVATOR 336F	
7 EB0288	RKB01215	EXCAVATOR 336F	
7 EB0289	RKB01392	EXCAVATOR 336F	
7 EB0274	RKB00749	EXCAVATOR 336F W THUMB	
7 EB0272	RKB00746	EXCAVATOR 336F W THUMB WET KIT	
7 EB0287	RKB00754	EXCAVATOR 336FL	
7 EB9045IC	RKB02045	EXCAVATOR 336FL L8H1035	ROCKFORD
7 EB0305	TZA00440	EXCAVATOR 336FL TC	
7 EB0302	TZA00323	EXCAVATOR 336FL TC	
7 EB0268	RKB00499	EXCAVATOR 336FL W THUMB	
7 EB0271	RKB00675	EXCAVATOR 336FL W THUMB	
7 EB0270	RKB00673	EXCAVATOR 336FL W THUMB WET KIT	
7 EB0269	RKB00501	EXCAVATOR 336FL W/THUMB	
7 EB9879R	TFG00879	EXCAVATOR 349 EL	
7 EB0297	MPZ00607	EXCAVATOR 349 LONG REACH	
7 EB0298	MPZ00315	EXCAVATOR 349 LONG REACH	
7 EB0299	MPZ00304	EXCAVATOR 349 LONG REACH	
7 EB0278	TFG01063	EXCAVATOR 349EL	
7 EB0248	TFG01081	EXCAVATOR 349EL	
7 EB0244	TFG00885	EXCAVATOR 349EL	
7 EB0281	TFG01061	EXCAVATOR 349EL	
7 EB0236	TFG00573	EXCAVATOR 349EL WET KIT QC	
7 EB9459IC	TFG00459	EXCAVATOR 349EL ARB	
7 EB0238	KCN00219	EXCAVATOR 349EL W	
7 EB0247	TFG01080	EXCAVATOR 349ELQC	
7 EB0301	BZ200523	EXCAVATOR 349FL	
7 EB0303	HPD00374	EXCAVATOR 349FL QC	
7 EB0282	OHPD00198	EXCAVATOR 349FL TC	
7 EB0306	HPD00284	EXCAVATOR 349FL TC	
7 EB0307	HPD00375	EXCAVATOR 349FL TC	
7 EB0286	BZ200550	EXCAVATOR 349FL W/QUICK CONNECT	
7 B0568		EXCAVATOR BUCKET 312 CLEANOUT	
7 B0468		EXCAVATOR BUCKET 36" 320	
7 EB0243	D8W00339	EXCAVATOR M318D	
7 EB9360R2	A36430	EXCAVATOR PC360	
7 EB0250	R936-1148-39220	EXCAVATOR R936 LONG REACH	
7 EB0251	R936-1148-39402	EXCAVATOR R936 LONG REACH	
7 EB0249	R936-1148-39140	EXCAVATOR R936 LONG REACH	
7 0021211	3FRXF75N24V685273	Ford Distributor	
7 CT0199	1FT8W3AT5DEA49389	FORD F-350 CREW CAB with Pickup Body	
7 LW0493	0160029714	FORKLIFT 10054 BUCKET FORKS JIB	
7 LW0457	PA00734	FORKLIFT STRAIGHT D80S	
7 LW0463	KDE00296	FORKLIFT TH1055	
7 0031527	1FV6JFBAXPL476060	Freightliner Dump Truck	
7 0031781	1FV6HFBA7WH923389	FREIGHTLINER Fuel/Lube Truck	
7 N0365	N/A	FUEL TANK	
7 N0342		FUEL TANK	
7 N0276		FUEL TANK - 8000 GAL	
7 N0456		FUEL TANK - 8345 GAL	
7 0042578		FUEL TRAILER W/500 GALLON TANK	
7 0021304	1HTWBAAAX9J134223	FUEL/LUBE TRUCK 4X4 7300	

7 0021314	2NKHHN7X29M246168	FUEL/LUBE TRUCK T370
7 0021358	2NKHHN7X2CM326402	FUEL/LUBE TRUCK T370
7 0021364	2NKHHJ7X8GM479042	FUEL/LUBE TRUCK T370 - PM BODY
7 0021359	2NKHHN7X1DM359005	FUEL/LUBE TRUCK T370 - PM BODY
7 CM0153	2182	GANTRY CRANE MJ70
7 EP0174	81222804	GENERATOR - CAT 3412 - 545 KW
7 EP0175	313945-1-1-100	GENERATOR 250KW for CHILLER (GEN CORP)
7 GEN0079	7109275	GENERATOR DCA25SIU
7 GEN0078	7109392	GENERATOR DCA25SS
7 EP0173	5UA1452	GENERATORS 3508-725KW
7 EP0172	6NA2057	GENERATORS 3508-825KW
7 0021297	1GBE5C1917F418794	GMC C5500 Flatbed
7 0021298	1GBE5C1927F418612	GMC C5500 Flatbed
7 MC0072	905200-146	GOMACO GHP2800 PAVER
7 MC0071	900100144	GOMACO SLIPFORM PAVER
7 FC0057	904400045	GOMACO TC600 CURE MACHINE
7 FC0056	904400030	GOMACO TC600 CURE MACHINE
7 FC0058	904400039	GOMACO TC600 TEXTURE CURE MACHINE
7 0056191	45YAG2420KE000189	GOOSENECK- HEAVY DUTY
7 0056324	46UFU322251101113	GOOSENECK TRAILER 32' CHILLER
7 0056297	4P5FD4028C1167511	GOOSENECK TRAILER 35' W/ 5' DOVETAIL
7 SI0659	4822K5626	GPS BASE STATION SPS851
7 SI0727	0425J002SW/0075J801SP,0075J794SP1595J703	GPS MACHINE CONTROL MS990
10 453008	234872	GROVE CRANE RT770E
7 H0035	4009	HAMMER - HAI - 2,250# STYLE 2
7 H0022	H244	HAMMER - HAI - 4,000# 8X30X72"
7 H0061	HJ1590	HAMMER - PILE - # 06
7 H0012	F-16405	HAMMER - PILE - #06
7 H0010	H238	HAMMER - PILE - #06
7 H0068	200708504	HAMMER D46-32
7 H0076	201310699	HAMMER D62-42
7 H0074	200704497	HAMMER DIESEL D30-32
7 H0079	201710895	HAMMER DIESEL D30-52
7 H0069	200707511	HAMMER DIESEL D46-32
7 HLS0117J	W9A00113	HAMMER H140
7 H0044	533	HAMMER-DIESEL-DELMAG D46
7 H0050	144	HAMMER-DIESEL-DELMAG D8-22
7 TWA0236	14650	HARROW - 5 1/2 DISC
7 0052691	5BNDG30277W000781	HAUL TRAILER GOOSENECK DOVE TAIL
7 0031808	1XPXP4EX4JD487963	HAUL TRUCK 389
7 0039684R	684	HAUL TRUCK HT-26
7 DA0141	00	HDY WET RT
7 H0840		HELMET IN FOR D-30
7 H0910	500512	HELMET INSERT 16"
7 0042493	SN8093	Homemade Trailer
7 DA0156	HPS1526	HYD AUGER
7 HLS0016	4020	Hydraulic Breaker 1000#
7 ICE0006	960362525	ICE MACHINE -
7 HL0002	KG95R5013	IMPACTOR 2000-CONCRETE BREAKER
7 RA0112	175227	Ingersoll Rand Vib Roller DD24
7 0021212	1HTSCAAN15H629743	International Distributor
7 LW0376	8CR04038	INTG TOOL CARRIER - IT28
7 SP0019	6C06472	JERSEY SPREADER R600C
7 C0055	221	JET CLEANER MARK IV - 147MBTU
7 ATV0486	JK1AFCE147B546024	KAWASAKI MULE
7 0021283	2NKMHZ7X46M154870	KENWORTH WATER TRUCK
7 ATV0497	51880	KUBOTA RTV-900
7 0073138	kcb-33090	LAB TRAILER ON SKIDS
10 252055	5RVCH2025EM019944	LAMA CARGO TRAILER
7 LH0123	PF400456	LANDSCAPE LOADER 415F2
7 LH0124	PF400457	LANDSCAPE LOADER 415F2
7 SI0730J	12362Y02978	LASER LEVEL 20HV AT-B4
7 SI0562	8355	LASER PLANE
7 H0231	SEE SEPPL MSTR	LEADS FOR DRILL 43" CONMACO YELLOW
7 LT0062	1172PR009	LIGHT TOWER ALLEMAND
7 SI0695	0602J1641Z/0622J003SW/0622J003SW/162H002	MACHINE CONTROL UTS
7 SI0705	3001J003SW/3632H007SR	MACHINE CONTROL UTS GSC900
7 0031778	1M2P264Y7RM016323	MACK WATER TRUCK

7 0031776	1M2P264Y3RM016321	MACK WATER TRUCK
7 0031780	1M2P264Y4RM016327	MACK WATER TRUCK
7 H0540	EC0211202	MAN BASKET REC2-600
7 H0539	0108372	MANBASKET BM2-600G
7 D0468	12001099	MANITOWOC 12000
7 PS0007	537188	MATERIAL PLACER MTP-4004
7 PS0015	906700-112	MATERIAL PLACER RTP500
7 0021348	1FDUF5GT7CEC14189	MECHANIC TRUCK - F550
7 0021346	1FDUF5GT3CEB45064	MECHANIC TRUCK - F550 SUMMIT BED
7 0021376	1FDUF5GT7GEB55683	MECHANIC TRUCK F550
7 0021377	1FDUF5GT9GEB55684	MECHANIC TRUCK F550
7 0021382	1FDUF5HT5FEC71929	MECHANIC TRUCK F550
7 0021378	1FDUF5GT0GEB55685	MECHANIC TRUCK F550
7 0021352	1FDUF5GT1CEA42290	MECHANIC TRUCK F550
7 0021383	1FDUF5GT0GEC72487	MECHANIC TRUCK F550
7 0021395	1FDUF5GT1HED71675	MECHANIC TRUCK F550
7 0021396	1FDVF56T3HED71676	MECHANIC TRUCK F550
7 0021401	1FDUF5GT5HED71677	MECHANIC TRUCK F550
7 0021402	1FDUF5GT5HEE21333	MECHANIC TRUCK F550
7 0021398	1FD0W5HT3HED84733	MECHANIC TRUCK F550 CREW CAB 4X4
7 0021366	1FDUF5GT5FEC72600	MECHANIC TRUCK F550 MAINTAINER
7 0021397	2NP2HM6X1JM479636	MECHANIC TRUCK PETERBILT 337 SUMMIT BED SWAP
7 0021354	1FDUF5GT3CEC96552	MECHANICS TRUCK - W/ MAINTAINER BED
7 0021327	1FDUF5GT1BEC34517	MECHANICS TRUCK MAINTAINER
10 WE010	KH318189	MILLER BOBCAT 225 PROPANE
7 GST0014	13.20.0293	MILLING MACHINE W210
7 G0476	M9D01206	MOTOR GRADER 140M
7 G0481	M9D01663	MOTOR GRADER 140M UTS
7 G0487	N9D00444	MOTOR GRADER 140M UTS
7 G0478	R9M00264	MOTOR GRADER 140M2
7 G0483	R9M00234	MOTOR GRADER 140M2
7 G0479	M9D01747	MOTOR GRADER 140M2 GPS/UTS
7 G0485	N9D00204	MOTOR GRADER 140M3
7 G0489	N9D00545	MOTOR GRADER 140M3 ARO
7 G0482	N9D00197	MOTOR GRADER 140M3 GPS
7 G0486	N9D00463	MOTOR GRADER 140M3 GPS
7 G0480	N9D00130	MOTOR GRADER 140M3 UTS
7 G0492	N9D00642	MOTOR GRADER 140M3 UTS
7 G0484	N9D00407	MOTOR GRADER 140M3 UTS
7 G0488	N9D00426	MOTOR GRADER 140M3 UTS
7 G0490	N9D00321	MOTOR GRADER 140M3 W CROSS SLOPE
7 G0491	N9M00322	MOTOR GRADER 140M3 W UTS
7 G0475	M9D00875	MOTORGRADER 140M
7 G0477	M9D01521	MOTORGRADER 140M2 UTS
7 LM0001	17969	MOWER ZD331LP-72
7 LM0002	18032	MOWER ZD331LP-72
7 NU0522	36873	NUCLEAR DENSITY - 3440
7 NU0521	22567	NUCLEAR GAUGE - TROXLER 3440
7 NU0520	22258	NUCLEAR MOISTURE DENSITY
7 NU0519	00639	NUCLEAR MOISTURE DENSITY 3450
7 Q0431	11610	OFFICE BUILDING,PORTABLE
7 OFF0018	0533545	OFFICE TRAILER 12x40
7 OFF0010	47025-7112	OFFICE TRAILER 48 FT
7 N0277		OIL TANK - 4000 GAL
7 OB0001	W10-162	OVERHANG STRIPPING BUGGY 835
7 OB0003	11993-4/11862-1MOD	OVERHANG STRIPPING TRAILER
7 OB0002		OVERHANG STRIPPING TRAILER 16-9 ATX
7 TWA0242		PARRELLEL ARM ROTARY RCP2660
7 0050120	23832	PARTS VAN
7 MC0070	905200076	PAVER - SLIPFORM GHP-2800
7 MC0073	900100-650	PAVER GOMACO COMMANDER III
7 H0924	24BH2-2004A	PILE CAP D62 32"
7 H0923		PILE CAP RED TIMBER PILE
7 H0205	11 X 33 IN	PILE DRIVE - #016 - 100FT
7 H0202	8.25X 20 IN	PILE DRIVE - 06 & #1 - 65FT
7 H0214		PILE DRIVE 010 & OR - 90FT
7 H0216		PILE DRIVE 8200/#0-10 95FT
7 H0922	DCB26-1328 STRIKER W6-361 INS	PILE DRIVE CAP D30 18" INSERT

7 H0211		PILE DRIVE FOR #1 - 40FT
7 H0225	8 X 26 IN	PILE DRIVE FOR 06, 65 - 105FT
7 H0230	26059,191,318 & 20	PILE DRIVE FOR 8 X 26 IN 75FT
7 H0222	9 X 33 IN	PILE DRIVE FOR D30-23 - 105FT
7 H0918	02A0515	PILE DRIVING CAP 15"
7 H0843		PILE INSERT FOR #H-50
7 H0233	8321611/8321612/8321613	PILE LEADS 32"x100' D-46
7 H0234	1634/1636/1279/1638	PILE LEADS 43"x100'
7 H0235	1635/1637/1278/1215	PILE LEADS 43"x100'
7 H0242	8261529;8261687;8261507;8260996;826-1714	PILE LEADS 8X26 120' FOR D30
7 H0241	832-1349;1368;1460;1106;1333;1476	PILE LEADS 8X32 120'
7 H0240	826-1496,826-1055,826-1321,826-1669	PILE LEADS D30 26"x100'
7 H0218		PILE LEADS D46-13 - 120 FT
7 H0207		PILE LEADS FOR OR - 130FT
7 H0824	80719	PIPE CAP FOR 80-C
7 GST0010	905500145	PLACER/TRIMMER-GOMACO 9500
7 GST0009	905500172	PLACER/TRIMMER-GOMACO 9500
7 PL0291	10TRW650	Plow Disc - 30" w/Wheels
7 11314	10TAW-3237R	PLOW DISC-ROME TAW-20S
7 PL0235	6TRCW8	PLOW OFFSET DISC TACW1236
7 PL0229	8TACW189	PLOW OFFSET DISC TACW1632
7 PL0094	12TAW806	PLOW OFFSET DISC TAW2428
7 PL0273	6TRCW50	PLOW OFFSET DISC TRCW1236
7 PL0272	6TRCW1127	PLOW OFFSET DISC TRCW1236
7 R0234	PJF00304	PNEUMATIC ROLLER - PS360C
7 R0237	162764	PNEUMATIC ROLLER-IR PT125R
7 R0239	162542	PNEUMATIC ROLLER-IR PT125R
7 R0465	TLJ00114	PNUE ROLLER CW34
7 R0466	AL300134	PNUE ROLLER CW34
7 R0240	PJF00718	PNUE ROLLER PS360C
7 R0467	LJ00277	PNEUMATIC ROLLER CW14
7 CR0105	80508	PORTABLE CRUSHER I54
7 AP0018A		PORTABLE DRAG SLAT CONVEYOR - AP0018
7 VS0108	66136	PORTABLE SCREEN S190
7 AP0018C		PORTABLE TANKS/SILOS/HEATER - AP0018
7 EA0534		PORTABLE TRAFFIC SIGNAL 2- WAY
7 C0479	2388774	PRESSURE WASHER
7 C0480	301120	PRESSURE WASHER
7 C0472	1N9US1426XC007654	PRESSURE WASHER
7 C0466	896-110	PRESSURE WASHER 5030KC
7 C0458	1C9UT1226PL347040	PRESSURE WASHER DX-250BP 5GPM
7 C0460	1T9U6121XR1181024	PRESSURE WASHER DX-250BP 5GPM
7 C0490	15032140	PRESSURE WASHER HOT
7 C0491	275240	PRESSURE WASHER HOT
7 H0856	600528	PRIMARY HE - 26 IN
7 H0864	P2604AA2	PRIMARY HELMET - 8 X 27
7 H0913	P2101AA	PRIMARY HELMET FOR 20"LEAD
7 H0914	N/A	PRIMARY HELMET FOR 26"LEAD
7 HLD00473	200899	PROFILIGRAPH - AMES S2000
7 HLD00474	10004	PROFILOGRAPH AMES 6200 W/LASER
7 M0080	1586-500B-2	PUGMILL 500 BASE
7 M0082	411767/411768	PUGMILL 52 330BBL
7 0073140	SS14025	QC LAB TRAILER ON SKIDS
7 0073141		QC LAB TRAILER ON SKIDS
7 0073139	3803	QC LAB TRAILER ON SKIDS
7 Q0479	10872	QC SHACK CONNEX
7 RB0118	89588	ROAD BROOM RJ350
7 RB0116	89856	ROAD BROOM RJ350
7 RB0120	89589	ROAD BROOM RJ350
7 RB0131	408988	ROAD BROOM CR350 CAB/AIR
7 RB0130	408987	ROAD BROOM CR-350 CAB/AIR
7 RB0128	405401	ROAD BROOM RJ350
7 0031757	2M2P267Y6PC015334	ROAD TRUCK
7 0031803	1XKDDBOX52R894112	ROAD TRUCK T800
7 0031800	1XKWPBTX57J192230	ROAD TRUCK W900L
7 0031801	1XKWPBTX47J190775 ENG S/N#NXS03138	ROAD TRUCK W900L
7 0031806	1XKWP4TX7FJ442559	ROAD TRUCK W900L
7 PS0011	809	ROADTEC SHUTTLE BUGGY SB-2500C

7 SI0725	72612551	ROBOTIC TOTAL STATION SPS 930(JOB PURCHASED)
7 SI0669	72610159	ROBOTIC TOTAL STATION SPS930
7 SI0667	72610056	ROBOTIC TOTAL STATION SPS930
7 SI0682	72610550	ROBOTIC TOTAL STATION SPS930
7 SI0670	72610276	ROBOTIC TOTAL STATION SPS930
7 SI0732	72614587	ROBOTIC TOTAL STATION SPS930
7 SI0733	72614588	ROBOTIC TOTAL STATION SPS930
7 SI0734	72614588	ROBOTIC TOTAL STATION SPS930
7 SI0735	72614133	ROBOTIC TOTAL STATION SPS930
7 SI0736	72614584	ROBOTIC TOTAL STATION SPS930
7 SI0714	72612282	ROBOTIC TOTAL STATION SPS930 STINGLESS
7 SI0715	72612381	ROBOTIC TOTAL STATION SPS930 STINGLESS
7 SI0716	72612607	ROBOTIC TOTAL STATION SPS930 STINGLESS
7 SI0717	72612612	ROBOTIC TOTAL STATION SPS930 STINGLESS
7 SI0668	72610157	ROBOTIC TOTAL STATION SPS930 STRINGLESS
7 B0543	35639	ROCK BUCKET 30" 345C
7 RA0302	MBB00308	ROLLER 815K
7 RA0303	23305019	ROLLER 825K
7 RA0114	DJM00431	ROLLER ASPHALT CB64
7 RA0115	C5600159	ROLLER ASPHALT CB64B
7 RA9260R3	P5600260	ROLLER CP56B CAB
7 RA0282	ASR01155	ROLLER CS433 W\ SHELL KIT
7 RA0290	M4C00634	ROLLER CS44 NO SHELL
7 RA0289	M4C00803	ROLLER CS44 SMOOTH DRUM ROLLER
7 RA9311R3	CS300311	ROLLER CS44B RPO
7 RA0250	DAK00617	ROLLER CS533 W/SHELL
7 RA0295	CS500220	ROLLER CS54/W SHELL KIT
7 RA0300	CS500266	ROLLER CS54B W SHELL KIT
7 RA0299	CS500263	ROLLER CS54B W/ SHELL KIT
7 RA0296	CS500260	ROLLER CS54B W/ SHELL KIT
7 RA0297	CS500261	ROLLER CS54B W/ SHELL KIT
7 RA0298	CS500262	ROLLER CS54B W/ SHELL KIT
7 RA0293	CS500170	ROLLER CS54B W/SHELL KIT
7 RA0292	CS500169	ROLLER CS54B W/SHELL KIT
7 RA0301	CS500267	ROLLER CS54B W/SHELL KIT
7 RA0294	CS500219	ROLLER CS54B/W SHELL KIT
7 R0235	PJF00396	ROLLER PNUE PS-360
7 RA0283	276226	ROLLER SMOOTH TANDEM DD90
7 TA0197	B1500194	ROOT RAKE FOR 950 FUSHION COUPLER
7 BNC0006	9024	ROSS MOBILINER 250-10 - 10 CY
7 TWA0241	12-238	ROTARY CUTTER 10' 3210
7 TWA0529		ROTARY CUTTER 7'
7 SI0718J	5136472550	ROVER R8-3 JOB PURCHASED
7 0021045	1FDNK74P8KVA08848	SCAFFOLD TRUCK K742
7 0020900	1FDWK74NOEVA22623	SCAFFOLD TRUCK K741
7 Q0107		SCALE HOUSE
7 BS0035	35088	SCALE LOAD 3030-50PR
7 TWA0229	320KSD	SCRAPER 20'
7 H0869	SH065EC	SHEET PILE FOR D8-22 - 12 IN
7 P1414J	1P9AP1613GR330295	SHOT CRETE PUMP TK40
7 LW0448	60032	SKID STEER MC80
7 LW0508	DZT01957	SKIDSTEER 242D
7 LW9506IC	GTL00506	SKIDSTEER 279D (LW0476 IN COMPANY 12)
7 LW0473	RTD01823/040923FORKS	SKIDSTEER 289C2 W FORKS
7 LW0474	TAW00477	SKIDSTEER 289D
10 483001	275074	TOPCON GTS-235w - 5" 3000m TOTAL STATION
7 SI0681	93110455	TOTAL STATION S6
7 SI0679	93110166	TOTAL STATION S6
7 SI0719J	93411490	TOTAL STATION S6 JOB PURCHASED
7 TW0479	L07230H605876	TRACTOR JD 7230S
7 TW0497	M9960FHC11082	TRACTOR M9960HF DUALS
7 TB0020	4-2452	TRENCH BOX 20' X 10' X 6 IN
7 TB0015	5-2061	TRENCH BOX 20' X 8'
7 TB0017	5-2311	TRENCH BOX 20' X 8'
7 TB0014	99-2949	TRENCH BOX 20' X 8'
7 TB0018	5-2319	TRENCH BOX 20' X 8'
7 TB0019	5-2365	TRENCH BOX 20'X10"
7 TB0021		TRENCH BOX 24'

7 TB0013	99190	TRENCH BOX 8' X 20' X 4" THICK
7 TLR0010		TRIALER - FARM 8' X 32'
7 M0082A		TRUCK LOADING CONVEYOR FOR M0082
7 F0179	N/A	TUBE FINISHER - ALLEN
7 F0090	2030889	TUBE SCREED 3 ROLLER
7 F0089	1950789	TUBE SCREED 3 ROLLER
7 F0176	VRBS9905151	TUBE SCREED- ALLEN 28
7 F0175	25580	TUBE SCREED-3 ROLLER-ALLEN 30'
7 SIO683	210H016SR/0567J180SW	UTS BLADE CONTROL
7 SIO687	MAST 1171J008RY/TARGET 0821H020SR	UTS BLADE CONTROL
7 SIO700	1602H000SR/1172J002RY	UTS SYSTEM
7 SIO724	1744J037SW 1665J503RY	UTS SYSTEM
7 RB0132	1HTMMAAN9GH743986/201711SNS64091BAH	VACUUM SWEEPER 600BAH
7 RB0133	1HTMMAAN1HH744020/201707SNS68192BAH	VACUUM SWEEPER 600BAH
7 RB0129	1HTJTSKNXEH485078	VACUUM SWEEPER TRUCK 600BAH
7 F0174	RHED951059	VIBRATING SCREED-AIR-ALLEN 30'
7 H0075	11138/11205	VIBRATORY HAMMER 150 W/375 POWER UNIT
7 H0078	830143/830438	VIBRATORY HAMMER ICE 44B
7 0029136IC	1FVABTAL34DM75136	WATER TRUCK 2000 GALLON VADNAIS #197013
7 0031511	1M2AG11C86M022226	WATER TRUCK 4000
7 0031514	1M2AL02C76M001713	WATER TRUCK 4000
7 0031502	1NKDLU0X86J127397	WATER TRUCK 4000
7 0031507	1M2AL02C56M001516	WATER TRUCK 4000
7 0031793	1M2P264C4WM025299	WATER TRUCK 4000
7 0031759	1M2AA18Y91W135487	WATER TRUCK 4000 GALLON
7 0031995	2HSCEAPR56C287885	WATER TRUCK INTL 9200
7 0031996	2HSCEAPR96C319057	WATER TRUCK INTL 9200
7 0031892	1M2P264Y6RM016328	WATER TRUCK MACK
7 0031506	1M2AL02C36M001515	WATER TRUCK MACK 4000
7 0031986	2NKMLN9X48M234127	WATER TRUCK PTO 4000
7 0031795	1M2P264C9WM025301	WATER TRUCK PTO 4000
7 0031792	1M2P264C2WM025298/TANK060807716	WATER TRUCK PTO 4000
7 0031796	1M2P264C0WM025302/TANK 060807699	WATER TRUCK PTO 4000
7 0031987	2NKMLN9X28M234126	WATER TRUCK PTO 4000
7 0031805	2NKHLN9X3DM350012	WATER TRUCK T370 SMECO
7 0031988	1NKWLT0X41J881019	WATER TRUCK W900
7 0031989	1NKWLT0X01J881020	WATER TRUCK W900
7 0031994	1NKWLT0X21J881018	WATER TRUCK W900
7 0031990	1NKWLT0X51J881014	WATER TRUCK W900
7 0031512	1M2AL02C16M001514	WATER TRUCK WT4000
7 0031719	1M2B221C8TM018682	WATER TRUCK-4000 GALLON
7 0031767	1FUY3MDB2VH696438	WATER TRUCK-PTO- 4000 GAL
7 0031773	1FVHBXAK31HH88417	WATER TRUCK-PTO- 4000 GAL no gravity bar
7 0031721	1HTSHAAR2TH291260	WATER TRUCK-PTO-4000
7 WW0059	8LJ03427	WATER WAGON 613C
7 TW0410	JCB-0004441	WH. TRACTOR 4 WH.DR.9180
7 TW0425	BD87826	WH. TRACTOR 4630
7 TW0422	JA500121	WH. TRACTOR 4630
7 TW0413	B500223 B-027772	WH. TRACTOR 585
7 TW0437	JEE0107800	WH. TRACTOR STX325
7 EB0304	PT00345	WHEEL EXCAVATOR M322D
7 LW0385	TWR00517	WHEEL LOADER - 930G
7 LW0445	37080	WHEEL LOADER - VOLVO L70
7 LW0410	TWR03427	WHEEL LOADER 930G IT
7 LW0418	DHC00674	WHEEL LOADER 930H IT
7 LW0415	DHC00606	WHEEL LOADER 930H IT
7 LW0459	DHC03679	WHEEL LOADER 930H IT
7 LW0437	DHC02837	WHEEL LOADER 930H IT
7 LW0461	RHN00517	WHEEL LOADER 930H IT
7 LW0417	DHC00609	WHEEL LOADER 930H IT
7 LW0440	DHC1880	WHEEL LOADER 930H IT
7 LW0414	DHC00603	WHEEL LOADER 930H IT
7 LW0439	DHC01723	WHEEL LOADER 930IT
7 LW0480	RHN01938	WHEEL LOADER 930IT
7 LW0485	RHN03712	WHEEL LOADER 930IT
7 LW0462	RHN00847	WHEEL LOADER 930K
7 LW0469	RHN00747	WHEEL LOADER 930K IT
7 LW0454	RHN00699	WHEEL LOADER 930K IT

7 LW0458	RHN00812	WHEEL LOADER 930K IT
7 LW0472	RHN00986	WHEEL LOADER 930K IT
7 LW0487	RHN03306	WHEEL LOADER 930K IT
7 LW0488	RHN02781	WHEEL LOADER 930K IT
7 LW0486	RHN03892	WHEEL LOADER 930K IT W JIB
7 LW0492	RHN03069	WHEEL LOADER 930KIT
7 LW0496	KTG00713	WHEEL LOADER 930M IT
7 LW0495	KTG00791	WHEEL LOADER 930M IT
7 LW0497	KTG00680	WHEEL LOADER 930M IT
7 LW9322C	SWL01322 212381115 12060002	WHEEL LOADER 938 IT ARB
7 LW0506	J3R00912	WHEEL LOADER 938 M QC
7 LW0460	MJC01836	WHEEL LOADER 938H IT
7 LW0450	SWL00363	WHEEL LOADER 938K IT
7 LW0452	SWL00366	WHEEL LOADER 938K IT
7 LW0464	SWL01471	WHEEL LOADER 938K IT
7 LW0465	SWL02101	WHEEL LOADER 938K IT
7 LW0467	SWL02107	WHEEL LOADER 938K IT
7 LW0479	SWL02106	WHEEL LOADER 938K IT
7 LW0453	SWL00494	WHEEL LOADER 938K IT
7 LW0470	SWL01772	WHEEL LOADER 938K IT
7 LW0478	SWL02099	WHEEL LOADER 938K IT W/ FORKS
7 LW0504	J3R00588	WHEEL LOADER 938M QC
7 LW0505	J3R01804	WHEEL LOADER 938M QC
7 LW0507	J3R00905	WHEEL LOADER 938M QC
7 LW0438	JAD00712	WHEEL LOADER 950H IT
7 LW0468	FER00384	WHEEL LOADER 950K IT
7 LW0471	R4A02085	WHEEL LOADER 950K IT
7 LW0484	EMB00897	WHEEL LOADER 950M
7 LW0494	EMB02390	WHEEL LOADER 950M
7 LW0490	EMB00630	WHEEL LOADER 950M IT
7 LW0503	EMB03883	WHEEL LOADER 950M IT AUTO LUBE
7 LW0500	EJA01589	WHEEL LOADER 966F ROCKLAND PIPE FORKS
7 LW0451	TFS00202	WHEEL LOADER 966K
7 LW0466	TFS00669	WHEEL LOADER 966K
7 LW0477	TFS01238	WHEEL LOADER 966K QC
7 LW0498	KJP01280	WHEEL LOADER 966M
7 LW0489	KJP01611	WHEEL LOADER 966M
7 LW0491	KJP01161	WHEEL LOADER 966M
7 LW0482	KJP01130	WHEEL LOADER 966M
7 LW0502	KJP01840	WHEEL LOADER 966M IT AUTO LUBE
7 LW0509	KJP01755	WHEEL LOADER 966M QC
7 LW9044R4	EJA02044	WHEEL LOADER 966M QC WITH EXTRA LONG FORKS RPO
7 LW0501	KRS02783	WHEEL LOADER 980 ROCKLAND FORKS
7 LW0441	JMS05691	WHEEL LOADER 980-Certified Rebuild
7 LW0425	JMS05714	WHEEL LOADER 980H CERTIFIED REBUILD
7 LW0399	JMS01840	WHEEL LOADER 980H(CERTIFIED REBUILD)
7 LW0481	KRS00989	WHEEL LOADER 980K
7 LW0449	64774	WHEEL LOADER L90
7 EB0229	D8W00617	WHEELED EXCAVATOR M318D
7 TW0496		WHEELED TRACTOR 281XE

SECTION 00 50 00

CONTRACT

THIS AGREEMENT, made and entered into, this 31 day of MARCH, A.D., 2022, by and between the CITY OF HOLLYWOOD, Florida, a municipal corporation of the State of Florida, part of the first part, (hereinafter sometimes called the "CITY"), and

Cardinal Contractors, Inc.

party of the second part (hereinafter sometimes called the "CONTRACTOR").

WITNESSETH: The parties hereto, for the considerations herein- after set forth, mutually agree as follows:

Article 1. Scope of Work: The CONTRACTOR shall furnish all labor, materials, and equipment and perform all work in the manner and form provided by the Contract Documents, for:

**Deep Injection Wells No. 3 and No. 4 Pump Station
Bid No.: F-4696-21-OT**

Article 2. The Contract Sum: The CITY shall pay to the CONTRACTOR, for the faithful performance of the Contract, in lawful money of the United States of America, and subject to additions and deductions as provided in the Contract Documents, as follows:

Based upon the prices shown in the Proposal heretofore submitted to the CITY by the CONTRACTOR, a copy of said Proposal being a part of these Contract Documents, the aggregate amount of this Contract being the sum of One Hundred Twelve Million, Two Hundred Ninety-Nine Thousand, Nine Hundred Seventy Dollars and Zero Cents (\$112,299,970.00).

Article 3. Partial and Final Payments: In accordance with the provisions fully set forth in the "General Conditions" of the "Specifications", and subject to additions and deductions as provided, the CITY shall pay the CONTRACTOR as follows:

- (a) On the 15th day, or the first business day thereafter, of each calendar month, the CITY shall make partial payments to the CONTRACTOR on the basis of a duly certified and approved estimate of work performed during the preceding calendar month by the CONTRACTOR, less five percent (5%) of the amount of such estimate which is to be retained by the CITY until all work has been performed strictly in accordance with this Agreement and until such work has been accepted by the CITY. The parties' rights and obligations regarding retainage are further specified in Florida Statute Section 218.735.

- (b) Upon submission by the CONTRACTOR of evidence satisfactory to the CITY that all payrolls, material bills and other costs incurred by the CONTRACTOR in connection with the construction of the WORK have been paid in full, and also, after all guarantees that may be required in the Specifications have been furnished and are found acceptable by the CITY, final payment on account of this Agreement shall be made within sixty (60) days after completion by the CONTRACTOR of all work covered by this Agreement and acceptance of such work by the ENGINEER and approved by the CITY.

Article 4. Time of Completion: The CONTRACTOR shall commence work to be performed under this Contract within ten (10) consecutive calendar days after date of written Notice To Proceed and shall fully complete the Contract in accordance within the Contract Documents and meet all intermediate milestone completion dates required after said date of written notice as set forth in the Proposal, as may be modified by Instructions to Bidders, and stated in the Notice to Proceed.

It is mutually agreed between the parties hereto, that time is the essence, and in the event that construction of the WORK is not completed within the Contract Time and per intermediate dates, as may have been modified solely in accordance with the General Conditions of this Contract, that from the compensation otherwise to be paid to the CONTRACTOR, the CITY is authorized and shall retain, for each day thereafter, Sundays and holidays included, the sum set forth in the Supplementary General Conditions of this Contract as liquidated damages sustained by the CITY in the event of such default by the CONTRACTOR, or shall withhold such compensation for actual and consequential damages as may be stated therein or contemplated therefrom.

Article 5. Additional Bond: It is further mutually agreed between the parties hereto, that if, at any time after the execution of this Agreement and the Payment and Performance Bonds required herein for the express purpose of assuring the faithful performance of the Contractor's work hereto attached, the CITY shall deem the surety or sureties' to be unsatisfactory, or, if for any reason, said bonds cease to be adequate to cover the performance of the work, the CONTRACTOR shall, at his expense, within five (5) days after receipt of notice from the CITY furnish an additional bond or bonds in such form and amount, and with such surety or sureties as shall be satisfactory to the CITY. In such event, no further payment to the CONTRACTOR shall be deemed to be due under this agreement until such new or additional security for the faithful performance of the work shall be furnished in manner and form satisfactory to the CITY.

Article 6. Contract Documents: All of the documents hereinafter listed form the Contract and they are as fully a part of the Contract as if hereto attached, or repeated in this Agreement:

- | | |
|--------------------------------------|--------------------------------------|
| 1. Notice to Bidders | 9. Contract |
| 2. Instruction to Bidders | 10. Performance Bond |
| 3. Proposal | 11. Payment Bond |
| 4. Proposal Bid Form | 12. General Conditions |
| 5. Bid Bond | 13. Supplementary General Conditions |
| 6. Information Required from Bidders | 14. Addenda |
| 7. Local Preference | 15. Specifications |
| 8. Trench Safety Form (N/A) | 16. Drawings |

Article 7. The rate of wages and fringe benefits, or cash equivalent, for all laborers, mechanics and apprentices employed by any contractor or subcontractor on the work covered by the contract shall be not less than the prevailing rate of wages and fringe benefit payments or cash equivalent for similar skills or classifications of work as established by the General Wage Decision by the United States Department of Labor for Broward County, Florida that is in effect prior to the date the city issues its invitation for bids. If the General Wage Decision fails to provide for a fringe benefit rate for any worker classification, then the fringe benefit rate applicable to the worker classification shall be the fringe benefit rate applicable to the worker classification with a fringe benefit rate that has a basic hourly wage closest in dollar amount to the worker classification for which no fringe benefit rate has been provided.

Article 8. No additional work or extras shall be performed unless the same be duly authorized by appropriate action of the City.

Article 9. That in the event either party brings suit for enforcement of disagreement, the prevailing party shall be entitled to attorney's fees and court costs in addition to any other remedy afforded by law.

Article 10. The Contractor shall guarantee the complete project against poor workmanship and faulty materials for a period of twelve (12) months after final payment and shall immediately correct any defects which may appear during this period upon notification by the City or the Engineer.

Article 11. The making and acceptance of the final payment shall constitute a waiver of all claims by the Contractor, except those previously made and still unsettled.

IN WITNESS WHEREOF the parties hereto have executed this Agreement on the day and date first above written in three (3) counterparts, each of which shall, without proof or accounting for the other counterparts, be deemed an original contract:

THE CITY OF HOLLYWOOD, FLORIDA
Party of the First Part

By: _____ (SEAL)
JOSH LEVY, MAYOR

7.5
v4

ATTEST:

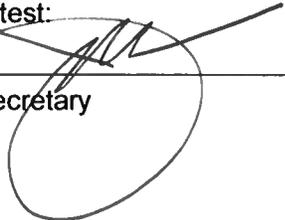

PATRICIA A. CERNY, MMC, CITY CLERK

APPROVED AS TO FORM AND LEGAL
SUFFICIENCY FOR THE USE AND RELIANCE
OF THE CITY OF HOLLYWOOD, FLORIDA, ONLY.

By: _____
CITY ATTORNEY

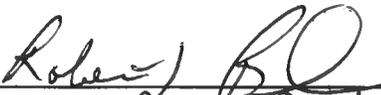
WHEN THE CONTRACTOR IS A CORPORATION:

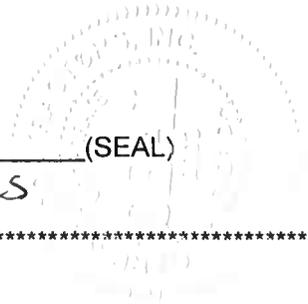
Attest:



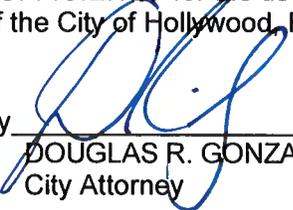
Secretary

Cardinal Contractors, Inc.
(Correct Name of Corporation)

BY:  (SEAL)
President Robert Bridges



APPROVED AS TO FORM AND LEGAL SUFFICIENCY for the use and reliance of the City of Hollywood, Florida only:

By  
DOUGLAS R. GONZALES
City Attorney

APPROVED AS TO FINANCE:

By 
DAVID E. KELLER
Financial Services Director

7.5
vk

CERTIFICATE

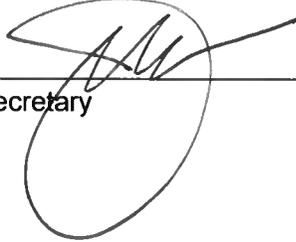
STATE OF FLORIDA)
COUNTY OF BROWARD)

I HEREBY CERTIFY that a meeting of the Board of Directors of Cardinal Contractors, Inc., a corporation under the laws of the State of Florida, was held on March 3, 2022, and the following resolution was duly passed and adopted:

"RESOLVED, that Robert Bridges as _____ President of the corporation, be and he is hereby authorized to execute the contracts on behalf of this corporation, and that his execution thereof, attested by the Secretary of the corporation and with corporate seal affixed, shall be the official act and deed of this corporation."

I further certify that said resolution is now in full force and effect.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the official seal of the corporation, this 3rd day of March, 2022.



Secretary

- END OF SECTION -

**PERFORMANCE AND PAYMENT BOND
(Public Work)**

In compliance with F.S. Chapter 255.05(1)(a)

THE PROVISIONS AND LIMITATIONS OF SECTION 255.05 FLORIDA STATUTES, INCLUDING BUT NOT LIMITED TO THE NOTICE AND TIME LIMITATIONS IN SECTIONS 255.05(2), 255.05(8) AND 255.05 (10), ARE INCORPORATED IN THIS BODY BY REFERENCE.

Bond No.: K4056214A & 30152374
CONTRACTOR:

Name: Cardinal Contractors, Inc. **Phone No.** 954-587-0520
Address: 13794 NW 4th Street, Suite 200
Sunrise, FL 33325

SURETY:

Name: Federal Insurance Company **Phone No.** 215-640-1000
Address: 202B Hall's Mill Road, Whitehouse Station, NJ 08889

Name: Western Surety Company **Phone No.** 312-822-5000
Address: 151 N. Franklin St., Chicago, IL 60606

OWNER:

Name: City of Hollywood **Phone No.** 954-921-3930
Address: Dept. of Public Utilities, Engineering & Construction Services Division
1621 N. 14th Avenue
Hollywood, FL 33020

OBLIGEE: (If contracting entity is different from the owner, the contracting public entity)

Name: _____ **Phone No.** _____
Address: _____

Bond Amount: \$112,299,970.00 **Project Number:** 9119A

Description of Work: Deep Injection Wells No. 3 and 4 Pump Station
Bid No. F-4696-21-OT

Project Location: Hollywood, FL

SECTION 00 61 00

Bond Nos. Federal: K4056214A
Western: 30152374

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS:

That we Cardinal Contractors, Inc., 13794 NW 4th Street, Suite 200, Sunrise, FL 33325 954-587-0520,

as Principal, and

Name	Address	Tel. No.
Federal Insurance Company, 202B Hall's Mill Road, Whitehouse Station, NJ 08889		(215) 640-1000 AND
Western Surety Company, 151 N. Franklin St., Chicago, IL 60606		(312) 822-5000

Name	Address	Tel. No.
------	---------	----------

 as Surety, are held and firmly bound unto the City of Hollywood in the sum of One Hundred Twelve Million, Two Hundred Ninety-Nine Thousand, Nine Hundred Seventy and Zero Cents Dollars (\$ 112,299,970.00),

for the payment of said sum we bind ourselves, our heirs, executors, administrators and assigns, jointly and severally, for the faithful performance of a certain written contract, dated the _____ day of _____, 20___ entered into between the Principal and the City of Hollywood, Florida, for the installation of **Deep Injection Wells No. 3 and No. 4 Pump Station, Bid No. F-4696-21-OT.**

A copy of said Contract, No. F-4696-21-OT, is incorporated herein by reference and is made a part hereof as if fully copied herein.

NOW, THEREFORE, THE CONDITIONS OF THIS OBLIGATION ARE SUCH, that if the Principal shall in all respects comply with the terms and conditions of said Contract and his obligations thereunder, including all of the Contract Documents (that include the Notice to Bidders, Instructions to Bidders, Proposal, Proposal Bid Form, Basis of Payment, Approved Bid Bond, Trench Safety Form, Information Required from Bidders, Contract, Performance Bond, Payment Bond, General and Supplementary General Conditions, Technical Specifications, Addenda and Drawings), therein referred to and made a part thereof, and such alterations as may be made in said Drawings and Specifications as therein provided for, and shall indemnify and save harmless the City of Hollywood against and from all expenses, damages, injury or conduct, want of care of skill, negligence or default, including patent infringement on the part of said Principal, his agents or employees, in the execution or performance of said Contract, including errors in the Drawings furnished by said Principal, and further, if the Principal shall promptly make payments to all who supply him, with labor and/or materials, used directly or indirectly by the Principal in the prosecution of the work provided for in said Contract, then this obligation shall be null and void; otherwise, the Principal and Surety, jointly and severally, agree to pay the City of Hollywood any difference between the sum that the City of Hollywood may be obliged to pay for the completion of said work, by Contract or otherwise, and the sum that the City of Hollywood would have been obliged to pay for the completion said work had the Principal properly executed all of the provisions of said Contract, and any damages, whether direct, indirect, or consequential, which the City of Hollywood may incur as a result of the failure of the said Principal to properly execute all of the provisions of said Contract.

AND, the said Principal and Surety hereby further bind themselves, their successors, executors, administrators and assigns, jointly and severally, that they will amply and fully protect the City of Hollywood against, and will pay any and all amounts, damages, costs

and judgments which may be recovered against or which the Owner may be called upon to pay to any person or corporation by reason of any damage arising from the performance of the said work, repair or maintenance thereof, or the manner of doing the same, or his agents or his servants, or the infringements of any patent rights by reason of the use of any material furnished or work done, as aforesaid or otherwise.

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

WHEN THE PRINCIPAL IS AN INDIVIDUAL:

Signed, sealed and delivered in the presence of:

(Witness)

(Signature of Individual)

(Address)

(Printed Name of Individual)

(Witness)

(Address)

WHEN THE PRINCIPAL IS A SOLE PROPRIETORSHIP OR OPERATES UNDER A TRADE NAME:

Signed, sealed and delivered in the presence of:

(Witness)

(Name of Firm)

(Address)

By: _____
(Seal)
(Signature of Individual)

(Witness)

Address

WHEN THE PRINCIPAL IS A PARTNERSHIP:

Signed, sealed and delivered in the presence of:

(Witness)

(Name of Partnership)

(Address)

By: _____
(Seal)
(Partner)

(Witness)

(Printed Name of Partner)

Address

WHEN THE PRINCIPAL IS A CORPORATION:

Attest:



(Secretary)

Cardinal Contractors, Inc.

(Name of Corporation)

By: 

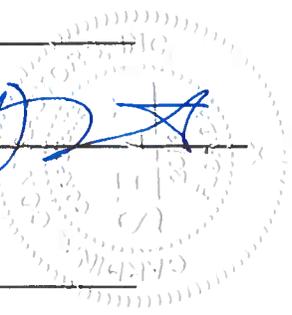
(Seal)
(Affix Corporate Seal)

MICHAEL BRANDAO

(Printed Name)

VICE PRESIDENT

(Official Title)

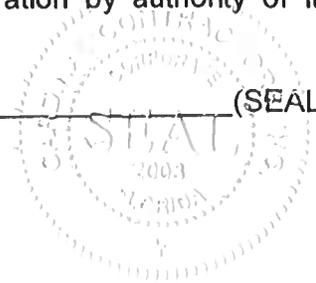


CERTIFICATE AS TO CORPORATE PRINCIPAL

I, John M. Parisich, certify that I am the Secretary of the corporation named as Principal in the within bond; that Mike Brandao, who signed the said bond on behalf of the Principal was then Vice President of said corporation; that I know his signature, and his signature thereto is genuine; and that said Bond was duly signed, sealed and attested for and on behalf of said corporation by authority of its governing body.



Secretary (SEAL)



TO BE EXECUTED BY CORPORATE SURETY

Attest: [Signature]
(Secretary) Heather Notes, Attorney-in-Fact

Federal Insurance Company AND
Western Surety Company
(Corporate Surety)

Federal: 202B Hall's Mill Road, Whitehouse Station, NJ 08889
Western: 151 N. Franklin St. Chicago, IL 60606
(Business Address)

By: [Signature]
(Affix Corporate Seal)

Richard Covington, Attorney-In-Fact
FL License No. W501312
(Attorney-In-Fact)

McGriff Insurance Services, Inc.
(Name of Local Agency)

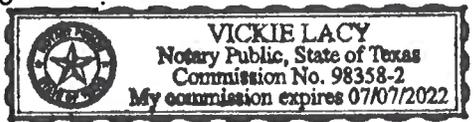
BB&T Landrum-Yaeger, 3375-B Captial Circle NE Suite B
(Business Address)

Tallahassee, FL 32308

STATE OF ~~FLORIDA~~ TEXAS

Before me, a Notary Public, duly commissioned, qualified and acting, personally appeared, Richard Covington to me well known, who being by me first duly sworn upon oath, says that he is the attorney-in-fact for the Federal Insurance Company AND Western Surety Company and that he has been authorized by Federal Insurance Company AND Western Surety Company to execute the foregoing bond on behalf of the CONTRACTOR named therein in favor of the City of Hollywood, Florida.

Subscribed and sworn to before me this 14th day of March, 2022



[Signature]
Notary Public, State of ~~Florida~~ TEXAS

My Commission Expires:

APPROVED AS TO FORM
AND LEGAL SUFFICIENCY
for the use and reliance of the
City of Hollywood, Florida only:

APPROVED AS TO FINANCE:

By: [Signature]
Douglas R. Gonzales
City Attorney

By: [Signature]
David E. Keller
Financial Services Director

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CHUBB

Power of Attorney

Federal Insurance Company | Vigilant Insurance Company | Pacific Indemnity Company

Westchester Fire Insurance Company | ACE American Insurance Company

Know All by These Presents, that FEDERAL INSURANCE COMPANY, an Indiana corporation, VIGILANT INSURANCE COMPANY, a New York corporation, PACIFIC INDEMNITY COMPANY, a Wisconsin corporation, WESTCHESTER FIRE INSURANCE COMPANY and ACE AMERICAN INSURANCE COMPANY corporations of the Commonwealth of Pennsylvania, do each hereby constitute and appoint Joseph R. Aubert, Marc W. Boots, Richard Covington, Myisha Jefferson, Ashley Koletar, Vickie Lacy, Heather Noles, Ryan Varela and Maria D. Zuniga of Houston, Texas; Susan Golla of San Antonio, Texas-----

each as their true and lawful Attorney-in-Fact to execute under such designation in their names and to affix their corporate seals to and deliver for and on their behalf as surety thereon or otherwise, bonds and undertakings and other writings obligatory in the nature thereof (other than bail bonds) given or executed in the course of business, and any instruments amending or altering the same, and consents to the modification or alteration of any instrument referred to in said bonds or obligations.

In Witness Whereof, said FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, PACIFIC INDEMNITY COMPANY, WESTCHESTER FIRE INSURANCE COMPANY and ACE AMERICAN INSURANCE COMPANY have each executed and attested these presents and affixed their corporate seals on this 21st day of January, 2022.

Dawn M. Chloros

Dawn M. Chloros, Assistant Secretary

Stephen M. Haney

Stephen M. Haney, Vice President



STATE OF NEW JERSEY
County of Hunterdon ss.

On this 21st day of January, 2022 before me, a Notary Public of New Jersey, personally came Dawn M. Chloros and Stephen M. Haney, to me known to be Assistant Secretary and Vice President, respectively, of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, PACIFIC INDEMNITY COMPANY, WESTCHESTER FIRE INSURANCE COMPANY and ACE AMERICAN INSURANCE COMPANY, the companies which executed the foregoing Power of Attorney, and the said Dawn M. Chloros and Stephen M. Haney, being by me duly sworn, severally and each for herself and himself did depose and say that they are Assistant Secretary and Vice President, respectively, of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, PACIFIC INDEMNITY COMPANY, WESTCHESTER FIRE INSURANCE COMPANY and ACE AMERICAN INSURANCE COMPANY and know the corporate seals thereof, that the seals affixed to the foregoing Power of Attorney are such corporate seals and were thereto affixed by authority of said Companies; and that their signatures as such officers were duly affixed and subscribed by like authority.

Notarial Seal



KATHERINE J. ADELAAR
NOTARY PUBLIC OF NEW JERSEY
No. 2316685
Commission Expires July 16, 2024

Katherine J. Adelaar
Notary Public

CERTIFICATION

Resolutions adopted by the Boards of Directors of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, and PACIFIC INDEMNITY COMPANY on August 30, 2016; WESTCHESTER FIRE INSURANCE COMPANY on December 11, 2006; and ACE AMERICAN INSURANCE COMPANY on March 20, 2009:

"RESOLVED, that the following authorizations relate to the execution, for and on behalf of the Company, of bonds, undertakings, recognizances, contracts and other written commitments of the Company entered into in the ordinary course of business (each a "Written Commitment"):

- (1) Each of the Chairman, the President and the Vice Presidents of the Company is hereby authorized to execute any Written Commitment for and on behalf of the Company, under the seal of the Company or otherwise.
- (2) Each duly appointed attorney-in-fact of the Company is hereby authorized to execute any Written Commitment for and on behalf of the Company, under the seal of the Company or otherwise, to the extent that such action is authorized by the grant of powers provided for in such person's written appointment as such attorney-in-fact.
- (3) Each of the Chairman, the President and the Vice Presidents of the Company is hereby authorized, for and on behalf of the Company, to appoint in writing any person the attorney-in-fact of the Company with full power and authority to execute, for and on behalf of the Company, under the seal of the Company or otherwise, such Written Commitments of the Company as may be specified in such written appointment, which specification may be by general type or class of Written Commitments or by specification of one or more particular Written Commitments.
- (4) Each of the Chairman, the President and the Vice Presidents of the Company is hereby authorized, for and on behalf of the Company, to delegate in writing to any other officer of the Company the authority to execute, for and on behalf of the Company, under the Company's seal or otherwise, such Written Commitments of the Company as are specified in such written delegation, which specification may be by general type or class of Written Commitments or by specification of one or more particular Written Commitments.
- (5) The signature of any officer or other person executing any Written Commitment or appointment or delegation pursuant to this Resolution, and the seal of the Company, may be affixed by facsimile on such Written Commitment or written appointment or delegation.

FURTHER RESOLVED, that the foregoing Resolution shall not be deemed to be an exclusive statement of the powers and authority of officers, employees and other persons to act for and on behalf of the Company, and such Resolution shall not limit or otherwise affect the exercise of any such power or authority otherwise validly granted or vested."

I, Dawn M. Chloros, Assistant Secretary of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, PACIFIC INDEMNITY COMPANY, WESTCHESTER FIRE INSURANCE COMPANY and ACE AMERICAN INSURANCE COMPANY (the "Companies") do hereby certify that

- (i) the foregoing Resolutions adopted by the Board of Directors of the Companies are true, correct and in full force and effect,
- (ii) the foregoing Power of Attorney is true, correct and in full force and effect.

Given under my hand and seals of said Companies at Whitehouse Station, NJ, this



Dawn M. Chloros

Dawn M. Chloros, Assistant Secretary

IN THE EVENT YOU WISH TO VERIFY THE AUTHENTICITY OF THIS BOND OR NOTIFY US OF ANY OTHER MATTER, PLEASE CONTACT US AT:
Telephone (908) 903-3493 Fax (908) 903-3656 e-mail: surety@chubb.com

Western Surety Company

POWER OF ATTORNEY APPOINTING INDIVIDUAL ATTORNEY-IN-FACT

Know All Men By These Presents, That WESTERN SURETY COMPANY, a South Dakota corporation, is a duly organized and existing corporation having its principal office in the City of Sioux Falls, and State of South Dakota, and that it does by virtue of the signature and seal herein affixed hereby make, constitute and appoint

Marc W Boots, Vickie Lacy, Richard Covington, Maria D Zuniga, Heather Noles, Joseph R Aulbert, Ashley Koletar, Ryan Varela, Individually

of Houston, TX, its true and lawful Attorney(s)-in-Fact with full power and authority hereby conferred to sign, seal and execute for and on its behalf bonds, undertakings and other obligatory instruments of similar nature

- In Unlimited Amounts -

and to bind it thereby as fully and to the same extent as if such instruments were signed by a duly authorized officer of the corporation and all the acts of said Attorney, pursuant to the authority hereby given, are hereby ratified and confirmed.

This Power of Attorney is made and executed pursuant to and by authority of the By-Law printed on the reverse hereof, duly adopted, as indicated, by the shareholders of the corporation.

In Witness Whereof, WESTERN SURETY COMPANY has caused these presents to be signed by its Vice President and its corporate seal to be hereto affixed on this 26th day of January, 2022.



WESTERN SURETY COMPANY

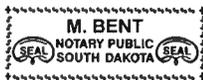
Paul T. Bruflat, Vice President

State of South Dakota }
County of Minnehaha } ss

On this 26th day of January, 2022, before me personally came Paul T. Bruflat, to me known, who, being by me duly sworn, did depose and say: that he resides in the City of Sioux Falls, State of South Dakota; that he is the Vice President of WESTERN SURETY COMPANY described in and which executed the above instrument; that he knows the seal of said corporation; that the seal affixed to the said instrument is such corporate seal; that it was so affixed pursuant to authority given by the Board of Directors of said corporation and that he signed his name thereto pursuant to like authority, and acknowledges same to be the act and deed of said corporation.

My commission expires

March 2, 2026



M. Bent, Notary Public

CERTIFICATE

I, L. Nelson, Assistant Secretary of WESTERN SURETY COMPANY do hereby certify that the Power of Attorney hereinabove set forth is still in force, and further certify that the By-Law of the corporation printed on the reverse hereof is still in force. In testimony whereof I have hereunto subscribed my name and affixed the seal of the said corporation this day of .



WESTERN SURETY COMPANY

L. Nelson, Assistant Secretary

Authorizing By-Law

ADOPTED BY THE SHAREHOLDERS OF WESTERN SURETY COMPANY

This Power of Attorney is made and executed pursuant to and by authority of the following By-Law duly adopted by the shareholders of the Company.

Section 7. All bonds, policies, undertakings, Powers of Attorney, or other obligations of the corporation shall be executed in the corporate name of the Company by the President, Secretary, and Assistant Secretary, Treasurer, or any Vice President, or by such other officers as the Board of Directors may authorize. The President, any Vice President, Secretary, any Assistant Secretary, or the Treasurer may appoint Attorneys in Fact or agents who shall have authority to issue bonds, policies, or undertakings in the name of the Company. The corporate seal is not necessary for the validity of any bonds, policies, undertakings, Powers of Attorney or other obligations of the corporation. The signature of any such officer and the corporate seal may be printed by facsimile.

SIGNED AND SEALED, this 24th day of MARCH, 2022.

PRINCIPAL: Cardinal Contractors, Inc.

ATTEST:

[Signature]
[Signature]

[Signature]
(Signature)
Michael Brandao, Vice President
(Title)



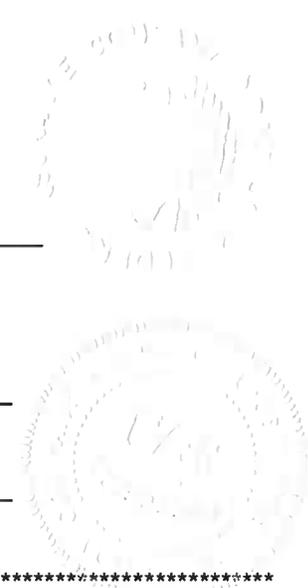
(SEAL)

SURETY:

Federal Insurance Company AND
Western Surety Company
(Surety)

ATTEST:
[Signature]
Heather Noles, Attorney-in-Fact
[Signature]
Maria D. Zuniga, Attorney-in-Fact

[Signature]
(Signature)
Richard Covington
FL License No. W501312
(Attorney-in-Fact)



APPROVED AS TO FORM AND
LEGAL SUFFICIENCY
for the use and reliance of the
City of Hollywood, Florida only:

APPROVED AS TO FINANCE:

By [Signature] DR
Douglas R. Gonzales
City Attorney

By [Signature]
David E. Keller
Financial Services Director

7. J
vc

- END OF SECTION -

CHUBB

Power of Attorney

Federal Insurance Company | Vigilant Insurance Company | Pacific Indemnity Company

Westchester Fire Insurance Company | ACE American Insurance Company

Know All by These Presents, that FEDERAL INSURANCE COMPANY, an Indiana corporation, VIGILANT INSURANCE COMPANY, a New York corporation, PACIFIC INDEMNITY COMPANY, a Wisconsin corporation, WESTCHESTER FIRE INSURANCE COMPANY and ACE AMERICAN INSURANCE COMPANY corporations of the Commonwealth of Pennsylvania, do each hereby constitute and appoint Joseph R. Aulbert, Marc W. Boots, Richard Covington, Myisha Jefferson, Ashley Koletar, Vickie Lacy, Heather Noles, Ryan Varela and Maria D. Zuniga of Houston, Texas; Susan Golla of San Antonio, Texas-----

each as their true and lawful Attorney-in-Fact to execute under such designation in their names and to affix their corporate seals to and deliver for and on their behalf as surety thereon or otherwise, bonds and undertakings and other writings obligatory in the nature thereof (other than bail bonds) given or executed in the course of business, and any instruments amending or altering the same, and consents to the modification or alteration of any instrument referred to in said bonds or obligations.

In Witness Whereof, said FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, PACIFIC INDEMNITY COMPANY, WESTCHESTER FIRE INSURANCE COMPANY and ACE AMERICAN INSURANCE COMPANY have each executed and attested these presents and affixed their corporate seals on this 21st day of January, 2022.

Dawn M. Chloros

Dawn M. Chloros, Assistant Secretary

Stephen M. Haney

Stephen M. Haney, Vice President



STATE OF NEW JERSEY

County of Hunterdon

ss.

On this 21st day of January, 2022 before me, a Notary Public of New Jersey, personally came Dawn M. Chloros and Stephen M. Haney, to me known to be Assistant Secretary and Vice President, respectively, of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, PACIFIC INDEMNITY COMPANY, WESTCHESTER FIRE INSURANCE COMPANY and ACE AMERICAN INSURANCE COMPANY, the companies which executed the foregoing Power of Attorney, and the said Dawn M. Chloros and Stephen M. Haney, being by me duly sworn, severally and each for herself and himself did depose and say that they are Assistant Secretary and Vice President, respectively, of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, PACIFIC INDEMNITY COMPANY, WESTCHESTER FIRE INSURANCE COMPANY and ACE AMERICAN INSURANCE COMPANY and know the corporate seals thereof, that the seals affixed to the foregoing Power of Attorney are such corporate seals and were thereto affixed by authority of said Companies; and that their signatures as such officers were duly affixed and subscribed by like authority.

Notarial Seal



KATHERINE J. ADELAAR
NOTARY PUBLIC OF NEW JERSEY
No. 2316685
Commission Expires July 16, 2024

Katherine J. Adelaar

Notary Public

CERTIFICATION

Resolutions adopted by the Boards of Directors of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, and PACIFIC INDEMNITY COMPANY on August 30, 2016; WESTCHESTER FIRE INSURANCE COMPANY on December 11, 2006; and ACE AMERICAN INSURANCE COMPANY on March 20, 2009:

"RESOLVED, that the following authorizations relate to the execution, for and on behalf of the Company, of bonds, undertakings, recognizances, contracts and other written commitments of the Company entered into in the ordinary course of business (each a "Written Commitment"):

- (1) Each of the Chairman, the President and the Vice Presidents of the Company is hereby authorized to execute any Written Commitment for and on behalf of the Company, under the seal of the Company or otherwise.
- (2) Each duly appointed attorney-in-fact of the Company is hereby authorized to execute any Written Commitment for and on behalf of the Company, under the seal of the Company or otherwise, to the extent that such action is authorized by the grant of powers provided for in such person's written appointment as such attorney-in-fact.
- (3) Each of the Chairman, the President and the Vice Presidents of the Company is hereby authorized, for and on behalf of the Company, to appoint in writing any person the attorney-in-fact of the Company with full power and authority to execute, for and on behalf of the Company, under the seal of the Company or otherwise, such Written Commitments of the Company as may be specified in such written appointment, which specification may be by general type or class of Written Commitments or by specification of one or more particular Written Commitments.
- (4) Each of the Chairman, the President and the Vice Presidents of the Company is hereby authorized, for and on behalf of the Company, to delegate in writing to any other officer of the Company the authority to execute, for and on behalf of the Company, under the Company's seal or otherwise, such Written Commitments of the Company as are specified in such written delegation, which specification may be by general type or class of Written Commitments or by specification of one or more particular Written Commitments.
- (5) The signature of any officer or other person executing any Written Commitment or appointment or delegation pursuant to this Resolution, and the seal of the Company, may be affixed by facsimile on such Written Commitment or written appointment or delegation.

FURTHER RESOLVED, that the foregoing Resolution shall not be deemed to be an exclusive statement of the powers and authority of officers, employees and other persons to act for and on behalf of the Company, and such Resolution shall not limit or otherwise affect the exercise of any such power or authority otherwise validly granted or vested."

I, Dawn M. Chloros, Assistant Secretary of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, PACIFIC INDEMNITY COMPANY, WESTCHESTER FIRE INSURANCE COMPANY and ACE AMERICAN INSURANCE COMPANY (the "Companies") do hereby certify that

- (i) the foregoing Resolutions adopted by the Board of Directors of the Companies are true, correct and in full force and effect,
- (ii) the foregoing Power of Attorney is true, correct and in full force and effect.

Given under my hand and seals of said Companies at Whitehouse Station, NJ, this



Dawn M. Chloros

Dawn M. Chloros, Assistant Secretary

IN THE EVENT YOU WISH TO VERIFY THE AUTHENTICITY OF THIS BOND OR NOTIFY US OF ANY OTHER MATTER, PLEASE CONTACT US AT:
Telephone (908) 903-3493 Fax (908) 903-3656 e-mail: surety@chubb.com

Western Surety Company

POWER OF ATTORNEY APPOINTING INDIVIDUAL ATTORNEY-IN-FACT

Know All Men By These Presents, That WESTERN SURETY COMPANY, a South Dakota corporation, is a duly organized and existing corporation having its principal office in the City of Sioux Falls, and State of South Dakota, and that it does by virtue of the signature and seal herein affixed hereby make, constitute and appoint

Marc W Boots, Vickie Lacy, Richard Covington, Maria D Zuniga, Heather Noles, Joseph R Aulbert, Ashley Koletar, Ryan Varela, Individually

of Houston, TX, its true and lawful Attorney(s)-in-Fact with full power and authority hereby conferred to sign, seal and execute for and on its behalf bonds, undertakings and other obligatory instruments of similar nature

- In Unlimited Amounts -

and to bind it thereby as fully and to the same extent as if such instruments were signed by a duly authorized officer of the corporation and all the acts of said Attorney, pursuant to the authority hereby given, are hereby ratified and confirmed.

This Power of Attorney is made and executed pursuant to and by authority of the By-Law printed on the reverse hereof, duly adopted, as indicated, by the shareholders of the corporation.

In Witness Whereof, WESTERN SURETY COMPANY has caused these presents to be signed by its Vice President and its corporate seal to be hereto affixed on this 26th day of January, 2022.



WESTERN SURETY COMPANY

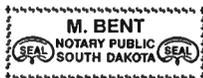
Paul T. Bruflat

Paul T. Bruflat, Vice President

State of South Dakota }
County of Minnehaha } ss

On this 26th day of January, 2022, before me personally came Paul T. Bruflat, to me known, who, being by me duly sworn, did depose and say: that he resides in the City of Sioux Falls, State of South Dakota; that he is the Vice President of WESTERN SURETY COMPANY described in and which executed the above instrument; that he knows the seal of said corporation; that the seal affixed to the said instrument is such corporate seal; that it was so affixed pursuant to authority given by the Board of Directors of said corporation and that he signed his name thereto pursuant to like authority, and acknowledges same to be the act and deed of said corporation.

My commission expires
March 2, 2026



M. Bent

M. Bent, Notary Public

CERTIFICATE

I, L. Nelson, Assistant Secretary of WESTERN SURETY COMPANY do hereby certify that the Power of Attorney hereinabove set forth is still in force, and further certify that the By-Law of the corporation printed on the reverse hereof is still in force. In testimony whereof I have hereunto subscribed my name and affixed the seal of the said corporation this _____ day of _____, 2022.



WESTERN SURETY COMPANY

L. Nelson

L. Nelson, Assistant Secretary

Authorizing By-Law

ADOPTED BY THE SHAREHOLDERS OF WESTERN SURETY COMPANY

This Power of Attorney is made and executed pursuant to and by authority of the following By-Law duly adopted by the shareholders of the Company.

Section 7. All bonds, policies, undertakings, Powers of Attorney, or other obligations of the corporation shall be executed in the corporate name of the Company by the President, Secretary, and Assistant Secretary, Treasurer, or any Vice President, or by such other officers as the Board of Directors may authorize. The President, any Vice President, Secretary, any Assistant Secretary, or the Treasurer may appoint Attorneys in Fact or agents who shall have authority to issue bonds, policies, or undertakings in the name of the Company. The corporate seal is not necessary for the validity of any bonds, policies, undertakings, Powers of Attorney or other obligations of the corporation. The signature of any such officer and the corporate seal may be printed by facsimile.

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SECTION 00 70 00
GENERAL CONDITIONS

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SECTION 00 70 00

GENERAL CONDITIONS

**CITY OF HOLLYWOOD, FLORIDA
GENERAL CONDITIONS
FOR CONSTRUCTION CONTRACTS**

ARTICLE 1 - DEFINITIONS

In the interpretation of these Contract Documents the following terms shall have the meaning indicated:

ADDENDA - Written or graphic instruments issued prior to the opening of Bids which clarify, correct or change the Contract Documents.

CHANGE ORDER - A written order to CONTRACTOR executed in accordance with City procurement procedures, as amended authorizing an addition, deletion or revision in the work, or an adjustment in the Contract Price or the Contract Time, issued after the date of Award.

CITY (OWNER) - The City of Hollywood, Florida.

COMMERCIALY USEFUL FUNCTION - shall exist when the Local MBE/SBE is responsible for execution of the work for the contract and is carrying out the responsibilities by actually performing, managing and supervising the work involved. The Local MBE/SBE must also be responsible, with respect to materials and supplies used on the contract, for negotiating price, determining quality and quantity, and ordering the material, and installing. A commercially useful function is not performed if the role of the qualified Local MBE/SBE is that of an extra participant in a transaction, contract, or project through which funds are passed in order to obtain the appearance of qualified local MBE or qualified local SBE participation.

COMMISSION - The City Commission of the City of Hollywood, Florida, being the legislative body of the CITY as set forth in the City of Hollywood Charter.

CONTRACT - The written agreement between the CITY and the CONTRACTOR covering the work to be performed in accordance with the other Contract Documents which are attached to the Contract and made a part thereof.

CONTRACTOR - The person, firm, or corporation with whom the CITY has entered into the Contract.

CONTRACT DOCUMENTS - The Notice to Bidders, Instruction to Bidders, Proposal, Information Required of Bidders, all Bonds, Agreement, and all supporting documents, these General Requirements and Covenants, the Specifications, Drawings and Permits, together with all Addenda and Change Orders issued with respect thereto.

CONTRACT PRICE - Total monies payable by the CITY to the CONTRACTOR under the terms and conditions of the Contract Documents.

CONTRACT TIME - The number of days agreed to in the Proposal, commencing with the date of the Notice to Proceed for completion of the work.

CONTROL - shall mean having the primary power, direct or indirect, to influence the management of a business enterprise. The controlling party must have the demonstrable ability to make independent and

unilateral business decisions on a day-to-day basis, as well as the independent and unilateral ability to make decisions which may influence and chart the future course of the business.

DATE OF SUBSTANTIAL COMPLETION - The date when the work on the project, or specified part thereof, is substantially completed in accordance with the Contract Documents, such that the CITY can occupy or utilize the project or specified part thereof for the use and purpose for which it was intended as determined and accepted by the Engineer.

DAYS - Calendar days of 24 hours measured from midnight.

DRAWINGS - The drawings which show the character and scope of the work to be performed and which have been prepared by the DESIGN ENGINEER approved by ENGINEER and are referred to in and are a part of the Contract Documents.

ENGINEER - The Director of Utilities of the CITY of Hollywood, Florida, or his authorized designee.

EXCUSABLE DELAY - Delay caused by the CITY, hurricane, tornadoes, fires, floods, epidemics or labor strikes.

GENERAL CONDITIONS - That segment of the Contract Specifications incorporating the Provisions common to all CITY Construction Contracts.

INEXCUSABLE DELAY - Any delay caused either (i) by events or circumstances within the control of the CONTRACTOR not specified in the definition of excusable delay.

INSPECTOR - The authorized field representative of the ENGINEER.

LIQUIDATED DAMAGES - The amount prescribed in the General Requirements to be paid the CITY, or to be deducted from any payments due the CONTRACTOR for each day's delay in completing the whole or any specified portion of the work beyond the Contract Time.

LOCAL BUSINESS – shall mean a business which is duly licensed and authorized to engage in the business at issue and which maintains a permanent principal place of operation with full time personnel within the corporate limits of the City of Hollywood, Florida. A Post Office Box(P.O. Box) shall not be sufficient to constitute a “local business.” The business has the burden of demonstrating that it meets this definition.

MINORITY – shall mean a person who is a citizen or lawful permanent resident of the United States and who is a Woman, Black American, Hispanic American, Native American, Asian Pacific American, Subcontinent Asian American or other minorities found to be disadvantaged by the SBA.

NOTICE OF AWARD - The written notice by the CITY to the successful Bidder stating that upon his execution of the Agreement and other requirements as listed therein within the time specified the CITY will sign and deliver the Agreement.

MINORITY BUSINESS ENTERPRISE – shall mean a currently functioning business enterprise which (a) is an independent for profit business concern that is at least 51% owned by minority group member(s); (b) is independently operated and controlled by the minority group member(s); (c) demonstrates the capability to perform a line of business; (d) provides a commercially useful function according to the customs and practices of the industry and (e) is qualified by the City of Hollywood, Florida.

NOTICE TO PROCEED - A written notice by the ENGINEER to the CONTRACTOR fixing the date on which the Contract Time will commence to run and on which the CONTRACTOR shall start to perform his obligation under the Contract Documents.

"OR EQUAL" - Equivalent or superior in construction, efficiency and effectiveness to a type, brand, model or process called out in the Contract Documents to establish a basis of quality as determined by the ENGINEER.

SHOP DRAWINGS - All certified affidavits, drawings, diagrams, illustrations, schedules and other data which are specifically prepared by CONTRACTOR, a Subcontractor, manufacturer, fabricator, supplier or distributor to illustrate some portion of the work and all illustrations, brochures, standard schedules, performance charts, instructions, diagrams and other information prepared by a manufacturer, fabricator, supplier or distributor and submitted by CONTRACTOR to illustrate material or equipment for some portion of the WORK.

SMALL BUSINESS ENTERPRISE – shall mean a currently functioning business enterprise which (a) is an independent for profit concern that is at least 51% owned by non-minority group member(s); (b) is independently operated and controlled by the non-minority group member(s); (c) demonstrates the capability to perform in a line of business; (d) provides a commercially useful function according to the customs and practices of the industry; and (e) is qualified by the City of Hollywood, Florida.

NOTE: In the event 50% of the local business is owned by a minority group member and 50% of the local business is owned by a non-minority group member, the designation selected on the Local Minority Business Enterprise and Local Small Business Enterprise Program application will be accepted.

SMALL BUSINESS NET WORTH SIZE STANDARD – The size standard for a minority business enterprise and a small business enterprise that participates in the City of Hollywood's Local MBE/SBE Program shall mean an independently owned and operated business concern that employs 50 or fewer permanent full-time employees and whose annual net worth does not exceed \$2,000,000. To determine the net worth, the City shall consider the most recent annual financial statement for the business or; in the case of sole proprietorships, annual financial statements for the business and the business owner. The applicant must provide documentation to demonstrate that the business employs 50 or fewer permanent full-time employees averaged over a two year period.

SPECIFICATIONS - Division 1 through 50 of these Contract Documents, consisting of administrative details and written technical descriptions of materials, equipment, standards and workmanship.

SUPPLEMENTARY CONDITIONS - Division 1 of the Contract Specifications incorporating the provisions peculiar to a specific project.

SUBCONTRACTOR - An individual, firm or corporation having a direct contract with CONTRACTOR or with any other Subcontractor for the performance of a part of the work

SURETY - The person, firm or corporation responsible for the Bidder's acts in the execution of the Contract, or which is bound to the CITY with and for the CONTRACTOR to insure performance of the Contract and payment of all obligations pertaining to the work.

WORK - All the work materials or products specified, indicated, shown or contemplated in the Contract Documents to construct and complete the improvement, including all alterations, modifications, amendments or extension thereto made by Change Orders.

ARTICLE 2 - ORGANIZATIONAL ABBREVIATIONS

Abbreviations of organizations which may be used in these Specifications are:

AASHTO: American Association of State Highway and Transportation Officials

ACI: American Concrete Institute

AIA: American Institute of Architects

AISC: American Institute of Steel Construction

AITC: American Institute of Timber Construction

ANSI: American National Standards Institute

APWA: American Public Works Association

ASTM: American Society for Testing and Materials

ASCE: American Society of Civil Engineers

ASME: American Society of Mechanical Engineers

ASHRAE: American Society of Heating, Refrigerating and Air Conditioning Engineers

AWPA: American Wood Preservers Association

AWWA: American Water Works Association

AWS: American Welding Society

BCEQCB: Broward County Environmental Quality Control Board

CRSI: Concrete Reinforcing Steel Institute

FDEP: Florida Department of Environmental Protection

FDNR: Florida Department of Natural Resources

FDOT: Florida Department of Transportation

FPL: Florida Power and Light

IEEE: Institute of Electrical and Electronic Engineers

NACE: National Association of Corrosion Engineers

NCPI: National Clay Pipe Institute

NEC: National Electrical Code

NEMA: National Electrical Manufacturers Association
NFPA: National Fire Protection Association
OSHA: Occupational Safety and Health Act
PCI: Prestressed Concrete Institute
SFBC: South Florida Building Code, Broward Edition, Latest Revision
SFWMD: South Florida Water Management District
SSPC: Structural Steel Painting Council
UL: Underwriters' Laboratories, Inc.
UNCLE: Utility Notification Center for Location before Excavation (1-800-432-4770)
USEPA: United States Environmental Protection Agency
USGS: United States Geological Survey
WWEMA: Water and Wastewater Equipment Manufacturers Association

ARTICLE 3 - MISCELLANEOUS PRELIMINARY MATTERS

3.1 Contract Document Discrepancies:

Any discrepancies, conflicts, errors or omissions found in the Contract Documents shall be promptly reported to the ENGINEER who will issue a correction, if necessary, in writing. The CONTRACTOR shall comply with any corrective measures regarding the same as prescribed by the ENGINEER.

3.2 Submissions:

Unless indicated otherwise in the Contract Documents, within seven days subsequent to the CONTRACTOR executing and submitting the required documents of Article 15 in the Instructions to Bidders, the CONTRACTOR shall submit to the ENGINEER an estimated progress schedule indicating the starting and completion days of the various stages of the work. A preliminary Schedule of Values and a preliminary schedule of Shop Drawing submissions may also be required by Section 01 34 00 of Division 1 - General Requirements.

3.3 Pre-construction Conference:

The Contractor will be required to attend a mandatory Pre- Construction Conference for review of the above schedules, establishing procedures and establishing a working understanding among the parties as to the work.

3.4 Contract Time:

The Contract Time will commence on the date of the Notice to Proceed and shall exist for the total number of days as specified in the Proposal Bid Form as modified by any subsequent Change Orders, Unless the CONTRACTOR fails to complete the requirements of the Instructions to Bidders, the additional time in days (including weekends) required to correctly complete the documents will be deducted by CITY from the Contract Time specified by the CONTRACTOR in this Proposal.

3.5 Computation of Time:

When any period of time is referred to the Contract Documents by days, it shall be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a legal holiday, such day shall be omitted from the computation.

3.6 Commencement of Work:

The CONTRACTOR shall not perform work at the site prior to the date of the Notice to Proceed.

3.7 Extension of Contract Time:

Extensions of time shall be based solely upon the effect of delays to the work as a whole. Extensions of time shall not be granted for delays to the work, unless the CONTRACTOR can clearly demonstrate, through schedule analysis, that the delay to the work as a whole arose in accordance with Article 11, Changes in Contract Time and that such delays did or will, in fact, delay the progress of work as a whole. Time extensions shall not be allowed for delays to parts of the work that are not on the critical path of the Project schedule. Time extensions shall not be

granted until all float or contingency time, at the time of the delay, available to absorb specific delays and associated impacts, is used.

3.8 Notice and Service Thereof:

All notices, demands, requests, instructions, approvals and claims shall be in writing. Notices, demands, etc. shall be deemed to have been validly given if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered at or sent by registered or certified mail, postage prepaid, to the business address as defined at the Pre-Construction Conference.

3.9 Separate Contract:

The CITY reserves the right to let other Contracts in connection with this Project. The CONTRACTOR shall afford other Contractors reasonable opportunity for the introduction and storage for their materials and the execution of their work and shall properly connect and coordinate his work with theirs.

3.10 Assignments of Contract:

No assignment by the CONTRACTOR of the Contract or of any part thereof, or any monies due or to become due thereunder shall be made.

3.11 Patents:

It is mutually understood and agreed that without exception, Contract prices are to include all royalties and costs arising from patents, trademarks, and copyrights in any way involved in the work. It is the intent that whenever the Contractor is required or desired to use any design, device, material or process covered by letters, patent, or copyright, the right for such use shall be provided for by suitable legal agreements with the Patentee or Owner and a copy of this agreement shall be filed with the ENGINEER. However, whether or not such an agreement is made or filed as noted, the CONTRACTOR and the Surety in all cases shall indemnify and save harmless the CITY from any and all claims for infringement by reason of the use of any such patented design, device, material or process, to be performed under the Contract, and shall indemnify the said CITY from any costs, expenses, and damages which it may be obliged to pay, by reason of such infringement, at any time during the prosecution or after the completion of the work.

3.12 Federal Excise Tax:

The forms needed for applying for exemption certificates for materials and equipment, normally subject to the Federal Excise Tax, may be obtained from the Director of Internal Revenue, Jacksonville, Florida.

The CONTRACTOR is solely responsible for obtaining the desired exemption certificate from the Federal Government.

3.13 Savings Due to Excise Tax Exemptions:

The Bidder shall include in the Bid price the estimated cost of all goods, supplies and equipment which will be incorporated in the Work and the taxes that the Bidder would be required to pay if the Bidder were to purchase such goods, supplies or equipment. By subsequent Change Order(s), the parties shall reduce the Bid price to reflect any goods, supplies and equipment purchased directly by City and the resulting tax savings due to City's exemption from Excise Taxes.

CONTRACTOR shall pay all sales, consumer, use and other similar taxes required to be paid by CONTRACTOR in accordance with the laws and regulations of the State of Florida and its political subdivisions. Consistent with the tax exemption for municipalities provided by state law, CITY and CONTRACTOR shall jointly operate so that CITY may purchase directly, goods, supplies and equipment which will be incorporated into the Work. The goods, supplies and equipment that will be purchased by CITY shall be approved in advance by the parties.

With respect to all goods, supplies and equipment to be purchased by CITY, CONTRACTOR shall, on behalf of CITY, take all actions necessary and appropriate to cause all purchases to be made and shall be responsible for delivery of all such goods, supplies and equipment, including verification of correct quantities and documents or orders, coordination of purchases and delivery schedules, sequence of delivery, unloading, handling and storage through installation, obtaining warranties and guarantees required by the Contract Documents, inspection and acceptance of the goods, supplies and equipment at the time of delivery, and other arrangements normally required for the particular goods, supplies or equipment purchased. Unless otherwise directed by CITY, such actions shall also include taking the lead in efforts to resolve any and all disputes with the vendor. CONTRACTOR shall ensure that each vendor of goods, supplies and equipment purchased by CITY agrees in writing to the terms and conditions contained in CITY'S standard purchase order, which terms and conditions are set forth in Section 00 80 00 of the Contract Documents. Even though CITY may purchase such goods, supplies and equipment, the goods, supplies and equipment shall be stored at the site in the same manner as goods, supplies and equipment purchased by CONTRACTOR.

CONTRACTOR shall hold CITY harmless from delays in manufacturing, delivery, and other unforeseen conditions that may arise as part of the procurement of CITY-purchased goods, supplies and equipment.

3.14 Overtime Work:

The CONTRACTOR shall receive no additional compensation for overtime work, i.e., work in excess of eight hours in any one calendar day or 40 hours in any one calendar week, even though such overtime work may be required under emergency conditions and may be ordered by the ENGINEER in writing. Additional compensation will be paid the CONTRACTOR for overtime work only in the event extra work is ordered by the ENGINEER and the Change Order specifically authorizes the use of overtime work and then only to such extent as overtime wages are regularly being paid by the CONTRACTOR for overtime work of a similar nature in the same locality.

3.15 Inspections and Testing during Overtime:

The CONTRACTOR shall establish a normal work schedule which does not exceed eight hours per day in a normal work day nor forty hours per week in a normal work week. Normal work days shall be Monday through Friday. Whenever CONTRACTOR's work requires scheduled overtime,

unless such overtime work is specifically required by the Contract Documents, CONTRACTOR shall reimburse the CITY for the extra costs incurred for providing Inspectors. Overtime shall be scheduled only after CONTRACTOR obtains written permission from the CITY. A change order shall be prepared to cover the CITY costs. Inspector costs shall be charged to the CONTRACTOR at a rate of \$80.00 per hour with a minimum of four hours charged for weekends and holidays. If the CONTRACTOR has an overtime work force size of fifty or more persons a second Inspector will be required and the costs for two Inspectors will be \$160.00 per hour.

3.16 Nights, Sunday or Holiday Work:

Except upon specific permission of the ENGINEER, the CONTRACTOR shall not perform any work on Sundays or on legal State or Municipal holidays. In accordance with City of Hollywood Code of Ordinances, Section 21.49, no work between 6:00 p.m. and 8:00 a.m. will be permitted, except in case of an emergency, that violates Section 21.49 concerning noise levels. All costs of testing and inspection performed during night, Sunday or holiday work shall be borne by the CONTRACTOR. The CONTRACTOR shall notify all regulatory agencies, including but not limited to the City Police Department, Fire Department, and Code Enforcement Department.

3.17 Injury or Damage Claims:

Should CITY or CONTRACTOR suffer injury or damage to their person or property because of any error, omission or act of the other party or of any of the other party's employees or agents or others for whose acts the other party is legally liable, claim shall be made in writing to the other party within a reasonable time of the first observance of such injury or damage. However, nothing herein shall be deemed to affect the rights, privileges and immunities of City as are set forth in Section 768.28, Florida Statutes.

ARTICLE 4 - CONTRACT DOCUMENTS

4.1 Intent:

The Contract Documents comprise the entire Agreement between the CITY and CONTRACTOR concerning the work. The Contract Documents can be altered only by Change Order. The Contract Documents are complementary; what is called for by one is as binding as if called for by all. It is the intent of the Contract Documents that the CONTRACTOR, for due consideration, shall furnish all equipment, material, supervision and labor, (except as may be specifically noted otherwise) required or necessary to complete the work in total accordance with said Documents. It is the intent of the Drawings and Specifications to describe the Project to be constructed in accordance with the Contract Documents. Any work that may reasonably be inferred from the Drawings or Specifications as being required to produce the intended result shall be supplied whether or not it is specifically called for.

4.2 Order of Precedence of Contract Documents:

In resolving differences resulting from conflicts, errors or discrepancies in any of the following Contract Documents, the order of precedence shall be as follows:

1. Permits
2. Change Orders
3. Contract Agreement
4. Specification
5. Drawings

Within the Specifications the order of precedence is as follows:

1. Addenda
2. Notice to Bidders
3. Instructions to Bidders
4. Supplementary General Conditions
5. General Conditions
6. Division 1, General Requirements
7. Technical Specifications
8. Referenced Standard Specifications

With reference to the Drawings the order of precedence is as follows:

1. Figures Govern over Scaled Dimensions
2. Detail Drawings Govern over General Drawings
3. Change Order Drawings Govern over Contract Drawings
4. Contract Drawings Govern over Standard or Shop Drawings

4.3 Reference To Standards:

Any reference to standard Specifications, manuals or codes of any organization or governmental authority shall mean the latest edition, in effect as of the Bid Opening Date.

ARTICLE 5 - BONDS AND INSURANCE

5.1 Bid Guarantee:

Bidders maybe required to submit a Bid Guarantee in an amount indicated in the NOTICE TO BIDDERS. This Guarantee may be a Certified or Cashier's Check on a solvent National or State Bank, or a Bid Bond written by a Surety licensed to do business in Florida and rated at least "A", Class X in the latest edition of "Best's Key Rating Guide" published by A.M. Best Company.

5.2 Performance and Payment Bond:

CONTRACTOR shall furnish Performance and Payment Bonds, in amounts equal to the Contract Price as Security for the faithful performance and payment of CONTRACTOR's obligations. The Bond or Bonds shall remain in effect one year after the date of final payment. The Surety must be qualified as specified above in Paragraph 5.1. However, the City reserves the right to require additional bonds as set forth in Article 5 of the Contract.

5.3 Signatures:

All Bonds signed by an Agent must be accompanied by a Certified copy of the authority to act, with said copy having been signed (not typed nor printed) by an Officer of the Surety and carrying the seal of the Surety.

5.4 Insurance Coverage:

Within ten days from Notice of Award the CONTRACTOR shall purchase and maintain such insurance as will protect him from claims set forth below which may arise out of or result from the CONTRACTOR's operations under the Contract or Contract Documents, whether such operations be by himself or by any Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

- A. Claims under Workmen's Compensation, Disability Benefit and other similar employer's liability acts;
- B. Claims for damages because of bodily injury, sickness or disease, or death, or death of his employees;
- C. Claims for damages because of bodily injury, sickness or disease, or death of any person other than his employees;
- D. Claims for damages covered by personal injury liability which are sustained (1) by any person as a result of any offense directly or indirectly related to the employment of such person by the CONTRACTOR, or (2) by any other person;
- E. Claims for damages, other than to the work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom; and
- F. Claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.

5.5 Certificates of Insurance:

Within ten days of award, the Contractor shall obtain a Certificate of Insurance reflecting the necessary coverages as required by the Contract Documents. Certificates of Insurance shall contain a provision that coverages afforded under the policies will not be canceled until at least 30 days prior written notice has been given to the CITY. The City of Hollywood must be named as additional insured on all coverage with the exception of Workmen's Compensation. Policies shall be issued by companies authorized to do business under the Laws of the State of Florida. Policyholders and Financial Ratings must be no less than "A" and Class X respectively in the latest edition of "Best Key Rating Guide", published by A.M. Best Company.

5.6 Insurance Limits of Liability:

The insurance required by this Article shall be written for no less than the level of liability specified in "Insurance Requirements", Section 2 of the Supplementary General Conditions, or required by law, whichever is greater. The insurance shall include contractual liability insurance applicable to the CONTRACTOR's obligations under this contract.

The level required in Section 2 of the Supplementary General Conditions will not be reduced for any reason.

ARTICLE 6 - AVAILABILITY OF LAND; REFERENCE POINTS

6.1 Rights-of-Way:

Lands or Rights-of-Way for the work to be constructed under the Contract will be provided by the CITY. Nothing contained in the Contract Documents shall be interpreted as giving the CONTRACTOR exclusive occupancy of the lands or Rights-of-Way provided. Any additional lands or Rights-of-Way required for construction operations shall be provided by the CONTRACTOR at his own expense; provided, that the CONTRACTOR shall not; and the CITY nor the ENGINEER shall not be liable for any claims or damages resulting from the CONTRACTOR's unauthorized trespass or use of any such properties.

6.2 Permits:

When required by Article 21 of the Instruction to Bidders, the CONTRACTOR shall secure, from the agencies having jurisdiction, the necessary permits to create obstructions, to make excavations if required under the Contract, and to otherwise encroach upon Rights-of-Way, and to present evidence to the ENGINEER that such permission has been granted, before work is commenced. Regulations and requirements of all agencies concerned shall be strictly adhered to in the performance of the Contract. The enforcement of such requirements under the Contract shall not be made the basis for additional compensation.

6.3 Lines and Grades:

The CONTRACTOR shall furnish all grades and all other lines required for the proper execution of the work.

ARTICLE 7 - CONTRACTOR'S RESPONSIBILITIES

7.1 Laws/Regulations to Be Observed:

The CONTRACTOR shall familiarize himself and comply with all Federal, State, County and CITY laws, by-laws, ordinances or regulations controlling the action or operation of those engaged or employed in the work or affecting material used, and govern himself in accordance with them. He shall indemnify and save harmless the CITY and all of its officers, agents and employees against any claims or liability arising from or based on the violation of any such laws, by-laws, ordinances, regulations, orders or decrees, whether by himself or his employees or Subcontractors.

7.2 Indemnification of City:

- (a) CONTRACTOR shall, at all times hereafter, indemnify, hold harmless and defend CITY, its agents, servants and employees from and against any claim, demand or cause of action of any kind or nature arising out of error, omission or negligent act of CONTRACTOR, its agents, servants or employees in the performance of services under this Agreement.
- (b) CONTRACTOR further agrees, at all times hereafter, to indemnify, hold harmless and defend CITY, its agents, servants and employees from and against any claim, demand or cause of action of any kind or nature arising out of any conduct or misconduct of CONTRACTOR resulting from the performance of services under the Contract Documents.
- (c) The obligations of the CONTRACTOR above shall not extend to the liability of the City of Hollywood.
- (d) The provisions of (a) and (b) above shall survive the expiration or earlier termination of the Contract Documents.

7.3 Guarantee of Payments:

The CONTRACTOR guarantees the payments of all just claims for materials, supplies, tools, labor and other just claims against him, or any Subcontractor in connection with this Contract, and his bond will not be released by final acceptance and payment by the CITY unless all such claims are paid or released.

7.4 Permits and Licenses:

The CONTRACTOR shall obtain all permits and licenses required by the Contract Documents. A copy of the permit(s) and such conditions and requirements thereon are a part of the Contract Documents. Failure to obtain such permits or licenses shall subject the CONTRACTOR to the provisions of the South Florida Building Code, Broward Edition.

7.5 Emergencies:

In emergencies affecting the safety or protection of persons or the work or property at the site or adjacent thereto, CONTRACTOR, without special instruction or authorization from ENGINEER or CITY, is obligated to act to prevent threatened damage, injury or loss. CONTRACTOR shall give ENGINEER prompt written notice of any significant changes in the work or deviations from the Contract Documents caused thereby.

7.6 Substitutes or "Or Equal":

A. Substitutes or "Or-Equal" Materials or Equipment:

Whenever materials or equipment are specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular supplier the naming of the item is intended to establish the type, function and quality required. Unless the name is followed by words indicating that no substitution is permitted, materials or equipment of other Suppliers may be accepted by the ENGINEER if sufficient information submitted by the CONTRACTOR to allow the ENGINEER to determine that the material or equipment proposed is equivalent or equal to that named. The ENGINEER will be allowed 30 days within which to evaluate each proposed substitute. The ENGINEER will be the sole judge of acceptability, and NO SUBSTITUTE WILL BE ORDERED, INSTALLED OR UTILIZED WITHOUT THE ENGINEER'S PRIOR WRITTEN ACCEPTANCE which will be evidenced by either a Change Order or an approved set of Shop Drawings. Requests for review of substitute items of material and equipment will not be accepted by the ENGINEER from anyone other than the CONTRACTOR. The procedure for review by the ENGINEER is as follows:

If the CONTRACTOR wishes to furnish or use a substitute item of material or equipment, the CONTRACTOR shall make written application to the ENGINEER for acceptance thereof, certifying that the proposed substitute will perform adequately the functions and achieve the results called for by the general design, be similar and of equal substance to that specified and be suited to the same use as that specified. In addition, the application shall

1. State that the evaluation and acceptance of the proposed substitute will not prejudice the CONTRACTOR's achievement of completion on time.
2. State whether or not acceptance of the substitute for use in the WORK will require a change in any of the Contract Documents to adapt design to the proposed substitute. The CONTRACTOR shall be responsible for any extra design adaptation costs associated with a proposed substitute.
3. State whether or not incorporation or use of the substitute in connection with the work is subject to payment of any license fee or royalty.

4. Provide complete substitute identification and description, including manufacturer's and local distributor's name and address, performance and test data, and reference standards.
5. Provide samples, as required by ENGINEER.
6. Provide name and address of similar projects on which the proposed substitute has been used, and date of installation.
7. Identify all variations of the proposed substitute from that specified.
8. Indicate available maintenance, repair and replacement service.
9. Submit an itemized estimate of all costs that will result directly or indirectly from acceptance of such substitute, including costs of redesign and claims of other Contractors affected by the resulting change. The CONTRACTOR shall be responsible for the costs of redesign and claims of other Contractors.
10. Provide any additional data about the proposed substitute as the ENGINEER may require of the CONTRACTOR.

B. Substitute means, method, technique, sequence or procedure of construction:

If a specific means, method, technique, sequence or procedure of construction is indicated in or required by the Contract Documents, the CONTRACTOR may furnish or utilize a substitute means, method, sequence, technique or procedure of construction acceptable to the ENGINEER, if the CONTRACTOR submits sufficient information to allow the ENGINEER to determine that the substitute proposed is equivalent to that indicated or required by the Contract Documents. The procedure for review by the ENGINEER will be similar to that provided in Paragraph 7.6 A.

- C. The CITY may require the CONTRACTOR to furnish at the CONTRACTOR's expense, a special performance guarantee or other surety with respect to any substitute.
- D. The ENGINEER will record time required by the ENGINEER and/or the ENGINEER's consultants in evaluating substitutions proposed by the CONTRACTOR and in making changes in the Contract Documents occasioned thereby. Whether or not the ENGINEER accepts a proposed substitute, THE CONTRACTOR SHALL REIMBURSE THE CITY FOR THE CHARGES OF THE ENGINEER AND THE ENGINEER's CONSULTANTS FOR EVALUATING EACH PROPOSED SUBSTITUTE.
- E. Any and all costs which result from changes to/adaptations of the work shall be paid by the CONTRACTOR including but limited to design, materials, installation, etc.

7.7 Shop Drawings:

Shop Drawing submittals shall be as follows:

- A. The CONTRACTOR shall submit a sufficient number of copies of each Shop Drawing to enable the ENGINEER to retain three copies unless additional copies are specified in the Contract Documents. Resubmissions of Shop Drawings shall be made in the same quantity until final approval is obtained.

- B. The CONTRACTOR shall submit Shop Drawings for all equipment, apparatus, machinery, fixtures, piping, fabricated structures, manufactured articles and structural components Manufacturer's Certified Affidavit that the item supplied complies with the design Specifications, and all other submittal requirements.
- C. Shop Drawings for structural components, electrical or mechanical systems shall be Certified by a Registered Engineer of the discipline involved.
- D. The CONTRACTOR shall thoroughly review and check the Shop Drawings, and each and every copy shall show his approval thereon. If the Shop Drawings show or indicate departures from the Contract requirements, the CONTRACTOR shall make specific mention thereof in his letter of transmittal. Failure to point out such departures shall not relieve the CONTRACTOR from his responsibility to comply with the Drawings and Specifications.
- E. No approval will be given to partial submittals of Shop Drawings for items which interconnect and/or are interdependent. It is the CONTRACTOR's responsibility to assemble the Shop Drawings for all such interconnecting and/or interdependent items, check them himself and then make one submittal to the ENGINEER along with his comments as to compliance, non-compliance, or features requiring special attention.
- F. If catalog sheets or prints of manufacturer's standard drawings are submitted as Shop Drawings, any additional information or changes on such Drawings shall be typewritten or lettered in ink.
- G. The CONTRACTOR shall keep one set of Shop Drawings marked with the ENGINEER's approval at the job site at all times.
- H. Where a Shop Drawing or sample is required by the Specifications, no related work shall be commenced until the submittal has been reviewed and approved by the ENGINEER.
- I. Approval of the Shop Drawings shall constitute approval of the subject matter thereof only, and not of any structure, material, equipment or apparatus shown or indicated. The approval of the Shop Drawings will be general and shall not relieve the CONTRACTOR of responsibility for the accuracy of such Drawings, nor for the proper fitting and construction of the work, nor for the furnishing of materials or work required by the contract and not indicated on the Drawings. Approval shall not relieve the CONTRACTOR from responsibility for errors or omissions of any sort on the Shop Drawings.

7.8 Personnel:

- A. Supervision and Superintendence:
 - 1. The CONTRACTOR shall supervise and direct the work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the work in accordance with the Contract Documents. The CONTRACTOR shall be solely responsible for the means, methods, techniques, sequences and procedures of construction, but the CONTRACTOR shall not be solely responsible for the negligence of others in the design or selection of a specific means, method, technique, sequence or procedure of construction which is indicated in and required by the Contract Documents. The CONTRACTOR shall be

responsible to see that the finished work complies accurately with the Contract Documents.

2. The CONTRACTOR shall keep on the work at all times during its progress a competent resident Superintendent fluent in both oral and written communication in the English language, who shall not be replaced without written notice to the ENGINEER except under extraordinary circumstances. The Superintendent will be the CONTRACTOR's representative at the site and shall have authority to act on behalf of the CONTRACTOR. All communications given to the Superintendent shall be as binding as if given to the CONTRACTOR.

B. Workforce:

1. None but skilled workers shall be employed on work requiring special qualifications. When required in writing by the ENGINEER, the CONTRACTOR or any Subcontractor shall discharge any person who is, in the opinion of the ENGINEER, incompetent, disorderly or otherwise unsatisfactory, and shall not again employ such discharged person on the work except with the consent of the ENGINEER. Such discharge shall not be the basis of any claim for damages against the CITY or any CITY agents.
2. With respect to all skilled, semi-skilled and unskilled workers employed on the Project under this Contract, preference in employment shall be given to persons residing in Hollywood when such persons are available and qualified to perform the work to which the employment relates. No person shall be employed in violation of the State or National Labor Laws. No person under the age of 16 years shall be employed on a Project under the Contract. No person whose age or physical condition is such as to make his employment dangerous to his health or safety or to the health or safety of others shall be employed on the Project under this Contract; provided that this shall not operate against the employment of physically handicapped persons, otherwise employable where such persons may be safely assigned to work which they can ably perform. No person currently serving sentences in a penal or correctional institution and no inmate of an institution for mentally defective shall be employed on a Project under this Contract without specific approval of the ENGINEER.
3. No discrimination shall be made in the employment of persons on the work by the CONTRACTOR or by any Subcontractor under him, because of the race, color, sex, age or religion of such persons, and there shall be full compliance with the provisions of applicable State and Federal laws in this regard.

7.9 Safety and Protection:

A. Federal Safety and Health Regulations:

The CONTRACTOR and Subcontractors shall comply with the provisions of the Occupational Safety and Health Standards, promulgated by the Secretary of Labor under the "Occupational Safety and Health Act of 1970".

B. Responsibilities:

The CONTRACTOR shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the work. The CONTRACTOR shall

take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

1. All employees on the work and other persons who may be affected thereby.
2. All the work and all materials or equipment to be incorporated therein, whether in storage on or off the site.
3. Other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocating or replacement in the course of construction.

C. Designated Safety Officer:

The CONTRACTOR shall designate a responsible member of his organization at the site whose duty shall be the prevention of accidents. This person shall be the CONTRACTOR's Superintendent unless otherwise designated in writing by the CONTRACTOR to the ENGINEER.

D. Protection of the Work:

Until acceptance of the work by the CITY, it shall be under the charge and in care of the CONTRACTOR and he shall take every necessary precaution against injury or damage to the work by action of the elements or from the execution or from the non-execution of the work. The CONTRACTOR shall rebuild, restore and make good, at his own expense, all injuries or damages to any portion of the work occasioned by any of the above causes before its completion and acceptance.

7.10 Traffic Control, Public Safety and Convenience:

- A. The CONTRACTOR shall at all times conduct his work so as to assure the least possible obstruction to traffic and inconvenience to the general public, and provide adequate protection of persons and property in the vicinity of the work.
- B. WHEN THE NORMAL FLOW OF TRAFFIC WILL BE IMPAIRED OR DISRUPTED IN ANY MANNER ON ANY STREET, THE CONTRACTOR SHALL NOTIFY THE POLICE TRAFFIC SERGEANT AT (954) 921-3610 AT LEAST 48 HOURS IN ADVANCE.
- C. Streets shall not be closed, except when and where directed by the ENGINEER, and whenever a street is not closed the work must be conducted with the provision for safe passageway for traffic at all times. The CONTRACTOR shall make all necessary arrangements concerning maintenance of traffic and selection of detours required.
- D. When permission has been granted to close an existing roadway, or portion thereof, the CONTRACTOR shall furnish and erect signs, barricades, lights, flags and other protective devices as necessary subject to the approval of the ENGINEER. From sunset to sunrise, the CONTRACTOR shall furnish and maintain as many yellow lights as the ENGINEER may direct.
- E. During working hours the CONTRACTOR shall furnish watchmen in sufficient numbers to protect and divert the vehicular and pedestrian traffic from working areas closed to traffic, or to protect any new work. Failure to comply with this requirement will result in the

ENGINEER shutting down the work until the CONTRACTOR shall have provided the necessary protection.

- F. No separate payment will be made for such signs, barricades, lights, flags, watchmen or other protective devices as required, with all costs thereof deemed to be included in the prices bid for the various items scheduled in the bid.
- G Sidewalks, gutters, drains, fire hydrants and private drives shall, insofar as practicable, be kept in condition for their intended uses. While the work is actually going on at any location, as much as half the street width at that location may be barricaded to exclude traffic entirely, but street traffic shall not be obstructed needlessly. Fire hydrants on or adjacent to the work shall be kept accessible to fire apparatus at all times, and no material or obstruction shall be placed within ten feet of any such hydrant.
- H. Construction material stored upon the public street shall be placed so as to cause as little obstruction to the general public as is reasonably possible.

7.11 Use of Explosives:

When the use of explosives is necessary for the prosecution of the work, the CONTRACTOR shall observe the utmost care so as not to endanger life or property, and whenever directed, the number and size of charges shall be limited. All explosives shall be stored in a secure manner and all such storage places shall be marked clearly "DANGEROUS EXPLOSIVES" and shall be in care of a competent watchman at all times. The CONTRACTOR must familiarize himself with all laws and ordinances pertaining thereto, and govern himself and his employees accordingly.

7.12 Loading of Structures:

The CONTRACTOR shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall the CONTRACTOR subject any part of the work or adjacent property to stresses or pressures that will endanger it.

7.13 Concerning Subcontractors:

- A. The CONTRACTOR, with his own forces, shall perform no less than 25% of the work as determined by the Contract price. Each Subcontractor shall be properly licensed for the type of work he is to perform.
- B. A copy of each Sub-Contract shall be filed promptly with the ENGINEER upon request. Each Sub-Contract shall contain a reference to the Contract between the CITY and the CONTRACTOR, and the terms and conditions of the Contract shall be made a part of each Sub-Contract. Each Sub-Contract shall provide for annulment of same by the CONTRACTOR upon written order of the ENGINEER if the Subcontractor fails to comply with the requirements of this Contract.
- C. The CONTRACTOR shall be responsible to the CITY and ENGINEER for the acts and omissions of his Sub-Contractors and their employees to the same extent as he is responsible for the acts and omissions of his own employees. Nothing contained in this Contract shall create any contractual relationship between any Subcontractor and the

CITY or ENGINEER nor relieve the CONTRACTOR of any liability or obligation under this Contract.

7.14 Materials and Equipment:

A. Material for the Work:

1. The CONTRACTOR shall furnish all materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water and sanitary facilities and all other facilities and incidentals necessary for the execution, testing, initial operation and completion of the work.
2. Unless otherwise specified, shown or permitted by the ENGINEER, all material and equipment incorporated in the work shall be new and of current manufacture. The ENGINEER may request the CONTRACTOR to furnish manufacturer's certificates to this effect.
3. The ENGINEER may require any or all materials to be subjected to test by means of samples or otherwise, at production points or after delivery. The CONTRACTOR shall afford such facilities as the ENGINEER may require for collecting and forwarding samples, which samples shall be furnished by the CONTRACTOR without charge. The CONTRACTOR shall furnish evidence satisfactory to the ENGINEER that the materials and finished articles have passed the required test prior to the incorporation of such materials and finished articles in the work. Unless otherwise provided, the cost of such inspection and testing shall be as provided in Article 12.2.
4. All packaged manufactured products for use on the work shall be delivered to the work in their original, unopened packages, bearing thereon the manufacturer's name and the brand name of the product.
5. Wherever any product or material is selected to be used on the work, all such products or material shall be of the same brand and manufacture throughout the work.
6. All equipment, tools and machinery used for handling material or executing any part of the work shall be maintained in a satisfactory working condition. All equipment utilized on any portion of the work shall be such that no injury to personnel, the work, adjacent property or other objects will result from its use.
7. All materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with the instructions of the applicable manufacturer, fabricator, supplier or distributor, except as otherwise provided in the Contract Documents.

B. Storage of Materials:

1. All materials and equipment including that ordered by the CITY designed for permanent installation in the work shall be properly stored by the CONTRACTOR to insure protection against deterioration of any type. These materials shall be placed

as to cause a minimum of inconvenience to other contractors on the work and to the public. The storage piles shall be arranged to facilitate inspections, and any deterioration shall be grounds for rejection.

2. Materials stored in public Rights-of-Way, shall be stored in such a manner so as to be compatible with the Traffic Control requirements set forth in Paragraph 7.10. Materials shall be stored so as not to deny access to public or private property. Stored materials shall be adequately marked with barricades and/or flashing warning lights, where necessary, so as to protect the materials from damage and to protect the public health, safety and welfare.
3. Lawns, grass plots or other private property shall not be used for storage purposes without written permission of the Owner or Lessee of that private property. Should the CONTRACTOR desire to store equipment or materials of any kind on the property of the CITY, he must obtain permission from the ENGINEER. The CITY reserves the right to order materials to be removed or relocated in such approved storage areas, if necessary.
4. The protection of stored materials shall be the CONTRACTOR's responsibility and the CITY OF HOLLYWOOD shall not be liable for any loss of materials, by theft or otherwise, nor for any damage to the stored materials.

C. Salvage of Materials and Equipment:

The CITY reserves the right to retain title to all soil, sand, stone, gravel, equipment, machinery or any other material that was a part of the structure, site or Right- of-Way and which was developed from excavations or other operations connected with the work. The CONTRACTOR will be permitted to use in the work, without charge, any such material which meets the requirements of the Contract Documents. For that material which the CITY desires to retain the CONTRACTOR shall, at his expense, transfer to a site within the CITY as designated by the ENGINEER. That material which the CITY does not wish to retain shall be the property of the CONTRACTOR and removed from the site at CONTRACTOR's expense.

7.15 Temporary Utilities:

The CONTRACTOR shall provide and maintain at his own expense, all water, power, telephone and sanitary facilities as required to comply with State and/or local Codes and Regulations. If water, including that for testing is required, it is the CONTRACTOR's responsibility to arrange through the CITY Water Department for a water meter. A deposit to be paid by the CONTRACTOR is required for meter rental and all water shall be purchased at the prevailing rate.

7.16 Review of Records:

The CONTRACTOR shall allow and permit the ENGINEER or his duly authorized representative to inspect and review all payrolls, records of personnel, conditions of employment, invoice of materials, books of accounts and other relevant data and records pertinent to the CONTRACT and Sub-Contracts.

7.17 Use of Premises:

CONTRACTOR shall confine construction equipment, the storage of materials and equipment and the operations of workmen to areas permitted by law, ordinances, permits or required by the Contract Documents, and shall not interfere with the premises or operation of the City Utilities facilities with construction equipment or other materials or equipment. Construction which interferes with Plant Operations shall be fully coordinated and approved by the ENGINEER.

7.18 CONTRACTOR's Daily Reports:

Except where otherwise provided, the CONTRACTOR shall complete a daily report indicating manpower, major equipment, Subcontractors, etc., involved in the performance of the work. The daily report shall be completed on forms approved by the ENGINEER, and shall be submitted to the ENGINEER at the conclusion of each work day.

7.19 Record Documents:

The CONTRACTOR shall keep one record copy of all Specifications, Drawings, Addenda, Modifications, Shop Drawings and samples at the site, in good order and annotated to show all changes made during the construction process. These shall be available to ENGINEER for examination and shall be delivered to ENGINEER upon completion of the work.

7.20 Cleanliness of the Site:

During the progress of the work, The CONTRACTOR shall keep the premises free from accumulations of waste materials, rubbish and other debris resulting from the work. At the completion of the work the CONTRACTOR shall remove all waste materials, rubbish and debris from and about the premises as well as all tools, appliances, construction equipment and machinery and surplus materials, and shall leave the site clean and ready for occupancy by the CITY. The CONTRACTOR shall restore to their original condition those portions of the site not designated for alteration by the Contract Documents.

7.21 Dust Control:

It shall be the CONTRACTOR's responsibility to control dust by watering as directed by the ENGINEER. The water used shall be paid for by the CONTRACTOR. Should the CONTRACTOR fail to control dust to the satisfaction of the ENGINEER, the CITY will control the dust by whatever means the CITY desires and the CONTRACTOR shall pay all expenses incurred by the CITY associated with the control of the dust.

7.22 Continuing the Work:

The CONTRACTOR shall carry on the work and maintain the Progress Schedule during all disputes or disagreements with the CITY. No work shall be delayed or postponed pending resolution of any disputes or disagreements, except as the CONTRACTOR and the CITY may otherwise agree in writing.

7.23 Indemnification:

In consideration of the amount listed in the Schedule of Prices Bid and other valuable consideration, the Contractor shall defend, indemnify and save harmless the CITY, its officers, agents, and employees from or on account of any personal injury, loss of life or damage to property received or sustained by any person or persons during or on account of any operations connected with the construction of this Project; or by or in consequence of any negligence (excluding negligence of the CITY), in connection with the same; or by use of any improper materials or by or on account of any use of any improper materials or by or on account of any act or omission of the said Contractor or his subcontractor, agents, servants or employees.

Contractor agrees to indemnify and save harmless the CITY against any liability arising from or based upon the violation of any federal, state, county or city laws, by-laws, ordinances or regulations by the Contractor, his subcontractor, agents, servants or employees. Contractor further agrees to indemnify and save harmless the CITY from all such claims and fees, and from any and all suits and actions of every name and description that may be brought against the CITY on account of any claims, fees, royalties, or costs for any invention or patent, and from any and all suits and actions that may be brought against the CITY for the infringement of any and all patents or patent rights claimed by any person, firm, or corporation.

The indemnification provided above shall obligate the Contractor to defend at his own expense or to provide for such defense, at the CITY's option, any and all claims or liability and all suits and actions of every name and description that may be brought against the Owner which may result from the operations and activities under this Contract whether the construction operations be performed by the Contractor, his subcontractor or by anyone directly or indirectly employed by either.

Nothing in this indemnification shall be deemed to affect the rights, privileges or immunities of the CITY as set forth in Section 768.28, Florida Statutes.

The CITY will pay to the Contractor the specific consideration, in the amount stated in the Schedule of Prices Bid. The Contractor shall acknowledge the receipt of payment and other good and valuable consideration from the Owner which has been paid to him as specific consideration for the indemnification provided herein and in accordance with the provisions of Chapter F.S.A., Section 725.06.

ARTICLE 8 - CITY'S RESPONSIBILITIES

8.1 Communications:

The CITY shall issue all communications to the CONTRACTOR through the ENGINEER.

8.2 Furnish Contract Documents:

The CITY shall furnish the number of Contract Documents as specified in the Supplementary General Conditions to the CONTRACTOR at no cost. Referenced Standard Specifications Manuals, guidebooks, etc., will not be provided.

8.3 Furnish Right-of-Way:

The CITY shall furnish the necessary land or Right-of-Way on which the work is to be accomplished, and will provide lines and grades as specified in Article 6.

8.4 Timely Delivery of Materials:

The CITY shall be responsible for the delivery of any CITY furnished material, equipment or labor as specified in the Contract Documents.

ARTICLE 9 - ENGINEER'S STATUS

9.1 Authority of the Engineer:

- A. The general supervision of the execution of this Contract is vested in the ENGINEER who is the CITY's sole representative during the construction period. The instructions of the ENGINEER are to be strictly and promptly followed in every case. The CONTRACTOR's representative (Article 7.8 A. 1.) shall be responsible for the execution of any instructions given by the ENGINEER during the absence of the CONTRACTOR.
- B. The ENGINEER is the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the work. Claims, disputes and other matters relating to the acceptability of work or requirements of the Contract Documents shall be referred in writing to the ENGINEER within 15 days of the event, with a request for a formal decision, which the ENGINEER will render in writing within a reasonable time. This rendering of a decision by the ENGINEER will be a condition precedent to any exercise by the CITY or CONTRACTOR of rights or remedies as either may otherwise have under the Contract Documents or at law in respect to any such claim, dispute or other matter.
- C. The ENGINEER will issue with reasonable promptness any written clarifications or interpretations of the Contract Documents as he shall deem necessary, which shall be consistent with or reasonably inferable from the overall intent of the Contract Documents. If, as a result of a clarification or interpretation, either the CONTRACTOR or ENGINEER believes a Change Order is justified, it shall be submitted.
- D. The ENGINEER has approval authority over the acceptability of all material or equipment furnished, Shop Drawings, Change Orders, work performed and the rate of progress of the work. Verification of the quantities of work performed for pay purposes is the responsibility of the ENGINEER.
- E. The ENGINEER also has the authority to disapprove or reject work which is defective, and may require special inspection or testing of the work, whether or not it is fabricated, installed or completed.
- F. The ENGINEER has the authority to suspend the work wholly or in part for such period or periods as may be deemed necessary, due to the unsuitable prosecution of the work, or for such time as is necessary due to failure on the part of the CONTRACTOR to carry out orders given or perform any or all provisions of the Contract. The CONTRACTOR shall not suspend the work and shall not remove any equipment, tools, lumber or other materials without the written permission of the ENGINEER.

9.2 Access to the Work:

The ENGINEER is to have free access to the materials and work at all times for laying out, measuring or inspecting same, and the CONTRACTOR is to afford him all necessary facilities and assistance for so doing.

9.3 Limitations on The ENGINEER's Responsibilities:

- A. Neither the ENGINEER's authority to act under this Article or elsewhere in the Contract Documents nor any decision made by the ENGINEER in good faith either to exercise or not exercise such authority shall give rise to any duty or responsibility of the ENGINEER

to the CONTRACTOR, any Subcontractor, any manufacturer, fabricator, supplier or distributor or any of their agents or employees or any other person performing any of the work.

- B. Whenever in the Contract Documents the terms "as ordered", "as directed", "as required", "as allowed" or terms of like effect or import are used, or the adjectives "reasonable", "suitable", "acceptable", "proper" or "satisfactory" or adjectives of like effect or import are used, to describe requirement, direction, review or judgment of the ENGINEER as to the work, it is intended that such requirement, direction, review or judgment will be solely to evaluate the work for compliance with the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective never indicates that the ENGINEER has authority to supervise or direct performance of the work.
- C. The ENGINEER will not be responsible for the CONTRACTOR's means, methods, techniques, sequences or procedures of construction, nor the safety precautions and programs incident thereto, and the ENGINEER will not be responsible for the CONTRACTOR's failure to perform the work in accordance with the Contract Documents.
- D. The ENGINEER will not be responsible for the acts or omissions of the CONTRACTOR or of any Subcontractors, or of the agents or employees of any CONTRACTOR or subcontractor, or of any other persons at the site or otherwise performing any of the work.

9.4 Inspectors:

- A. Inspectors employed by the CITY assist the ENGINEER in ascertaining the work conforms to the Contract Documents and are authorized to inspect all work done and material furnished as representatives of the ENGINEER. Inspectors shall be stationed at the site of the work to report to the ENGINEER as to the progress of the work and the quality of workmanship and material.
- B. In case of any dispute arising between the CONTRACTOR and the Inspector, the Inspector shall have the authority to reject material or to suspend the work until the question of issue can be referred to and decided upon by the ENGINEER.
- C. If the CONTRACTOR refuses to suspend operation on verbal order, the Inspector shall issue a written order giving the reason for shutting down the work. After placing the order in the hands of the man in charge, the Inspector shall immediately leave the job. work done during the absence of the Inspector, after such written notice, will not be accepted nor paid for.
- D. Inspectors are not authorized to revoke, alter, enlarge, relax or release any requirements of these Contract Documents, nor to issue instructions contrary to them. Inspectors shall in no case act as foreman or perform other duties for the CONTRACTOR, nor interfere with management of the work by the latter. Any instructions which Inspectors may give the CONTRACTOR shall in no way be construed as releasing the CONTRACTOR from fulfillment of the terms of the Contract.
- E. The payment of any compensation, whatever may be its character or form, or the giving of any gratuity, or the granting of any valuable favor, by the CONTRACTOR to any Inspector, directly or indirectly, is strictly prohibited and any such act on the part of the CONTRACTOR will constitute a violation of this Contract and may subject the CONTRACTOR to other penalties provided for by law or ordinance.

9.5 Inspections:

- A. The ENGINEER will make, or have made, such inspections and tests as he deems necessary to assure that the work is being accomplished in accordance with the requirements of the Contract. In the event such Inspections or tests reveal non-compliance with the requirements of the Contract, the CONTRACTOR shall bear the cost of such corrective measures as well as the cost of subsequent reinspection and retesting.

- B. Work done in the absence of a prescribed inspection may be required to be removed and replaced under proper inspection. The entire cost of removal and replacement, including the cost of all material which may be furnished by the CITY and used in the work thus removed, shall be borne by the CONTRACTOR, regardless of whether the work removed is found to be defective or not. Work covered up without the authority of the ENGINEER, shall, upon order of the ENGINEER, be uncovered to the extent required, and the CONTRACTOR shall similarly bear the entire cost of performing all the work and furnishing all the material necessary for the removal of the covering and its subsequent replacement.

- C. Unless otherwise provided, the cost of inspection and all inspection fees imposed by public agencies other than the fees associated with the issuance of the Master Building Permit by the City of Hollywood shall be paid by the CONTRACTOR.

- D. No inspection nor any failure to inspect at any time or place shall relieve the CONTRACTOR from any obligation to perform all of the work in strict conformance with the requirements of the Contract Documents.

ARTICLE 10 - CHANGES IN THE WORK/CONTRACT PRICE

10.1 Changes in the Work or Terms of Contract Documents:

- A. Without invalidating the Contract and without notice to any surety CITY reserves and shall have the right, from time to time to make such increases, decreases or other changes in the character or quantity of the Work as may be considered necessary or desirable to complete fully and acceptably the proposed construction in a satisfactory manner. Any extra or additional work within the scope of this Project must be accomplished by means of appropriate Clarifications, or Change Orders.
- B. Any changes to the terms of the Contract Documents must be contained in a written document, executed by the parties hereto, with the same formality and of equal dignity prior to the initiation of any work reflecting such change.

This section shall not prohibit the issuance of Change Orders executed only by CITY as hereinafter provided.

10.2 Supplemental Instructions - Clarifications:

- A. The CITY, through the ENGINEER, shall have the right to approve and issue Clarifications setting forth written interpretations of the intent of the Contract Documents and ordering minor changes in Work execution, providing the Clarifications involve no change in the Contract Price or the Contract Time.
- B. The ENGINEER shall have the right to approve and issue Clarifications setting forth written orders, instructions, or interpretations concerning the Contract Documents or its performance, provided such Clarifications involve no change in the Contract Price or the Contract Time.

10.3 Change Orders:

- A. Changes in the quantity or character of the Work within the scope of the Project which are not properly the subject of Clarifications, including all changes resulting in changes in the Contract Price or the Contract Time, shall be authorized only by or Change Orders approved in advance and issued in accordance with the provisions of the CITY Procurement Code, as amended from time to time.
- B. CONTRACTOR shall not start work on any changes requiring an increase in the Contract Price or the Contract Time until a or Change Order setting forth the adjustments is approved by the CITY. Upon receipt of a Change Order CONTRACTOR shall promptly proceed with the work set forth within the document.
- C. Change Orders shall be issued for change in Contract Price related to Cost Allowances specifically included on the Proposal Bid Form. Change Orders shall be issued when required for all other Contract Price Changes. Hereinafter, the term "Change Order(s)" shall be used to include "Change Orders" with the exception that Change Order shall not be used for any Contract Time adjustments.

- D. In the event satisfactory adjustment cannot be reached for any item requiring a change in the Contract Price or Contract Time, and a Change Order has not been issued, CITY reserves the right at its sole option to either terminate the Contract as it applies to the items in question and make such arrangements as may be deemed necessary to complete the disputed work; or the work shall be performed on the "cost of work" basis as described in Article 10.4.
- E. On approval of any Contract change increasing the Contract Price, CONTRACTOR shall ensure that the performance bond and payment bond are increased so that each reflects the total Contract Price as increased.
- F. Under circumstances determined necessary by CITY, Change Orders may be issued unilaterally by CITY.

10.4 Value of Change Order Work:

- A. The value of any work covered by a Change Order or of any claim for an increase or decrease in the Contract Price shall be determined in one of the following ways:
 - A.1 Where the work involved is covered by unit prices contained in the Contract Documents, by application of unit prices to the quantities of items involved, subject to the provisions of Article 10.4.G.
 - A.2 By mutual acceptance of a lump sum which CONTRACTOR and CITY acknowledge contains a component for overhead and profit.
 - A.3 On the basis of the "cost of work," determined as provided in this Article, plus a CONTRACTOR's fee for overhead and profit which is determined as provided in Article 10.4.D.
- B. The term "cost of work" means the sum of all direct costs necessarily incurred and paid by CONTRACTOR in the proper performance of the Work described in the Change Order. Except as otherwise may be agreed to in writing by CITY, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall include only the following items and shall not include any of the costs itemized in Article 10.4.C.
 - B.1 Payroll costs for employees in the direct employ of CONTRACTOR in the performance of the work described in the Change Order under schedules of job classifications agreed upon by CITY and CONTRACTOR. Payroll costs for employees not employed full time on the work covered by the Change Order shall be apportioned on the basis of their time spent on the work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits which shall include social security contributions, unemployment, excise and payroll taxes, workers' or workmen's compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay application thereto. Such employees shall include superintendents and foremen at the site. The expenses

of performing the work after regular working hours, on Sunday or legal holidays shall be included in the above to the extent authorized by CITY.

- B.2 Cost of all materials and equipment furnished and incorporated in the work, including costs of transportation and storage thereof, and manufacturers' field services required in connection therewith. All cash discounts shall accrue to CONTRACTOR unless CITY deposits funds with CONTRACTOR with which to make payments, in which case the cash discounts shall accrue to CITY. All trade discounts, rebates and refunds, and all returns from sale of surplus materials and equipment shall accrue to CITY and CONTRACTOR shall make provisions so that they may be obtained. Rentals of all construction equipment and machinery and the parts thereof whether rented from CONTRACTOR or others in accordance with rental agreements approved by CITY with the advice of ENGINEER and the costs of transportation, loading, unloading, installation, dismantling and removal thereof, all in accordance with the terms of said agreements. The rental of any such equipment, machinery or parts shall cease when the use thereof is no longer necessary for the work.
- B.3 Payments made by CONTRACTOR to Subcontractors for work performed by Subcontractors, If required by CITY, CONTRACTOR shall obtain competitive bids from Subcontractors acceptable to CONTRACTOR and shall deliver such bids to CITY who will then determine, with the advice of ENGINEER, which bids will be accepted. If the Subcontract provides that the Subcontractor is to be paid on the basis of cost of the work plus a fee, the Subcontractor's cost of the work shall be determined in the same manner as CONTRACTOR'S cost of the work. All Subcontractors shall be subject to the other provisions of the Contract Documents insofar as applicable.
- B.4 Cost of special engineers, including, but not limited to, engineers, architects, testing laboratories, and surveyors employed for services specifically related to the performance of the work described in the Change Order.
- B.5 Supplemental costs including the following:
The proportion of necessary transportation, travel and subsistence expenses of CONTRACTOR's employees incurred in discharge of duties connected with the work except for local travel to and from the site of the work.

Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office and temporary facilities at the site and hand tools not owned by the workmen, which are consumed in the performance of the work, and cost less market value of such items used but not consumed which remains the property of CONTRACTOR.

Sales, use, or similar taxes related to the work, and for which CONTRACTOR is liable, imposed by any governmental authority. Deposits lost for causes other than CONTRACTOR's negligence; royalty payments and fees for permits and licenses. The cost of utilities, fuel and sanitary facilities at the site. Receipted minor expenses such as telegrams, long distance telephone calls, telephone service at the site, expressage and similar petty cash items in connection with the work.

Cost of premiums for additional bonds and insurance required because of changes in the work.

C. The term "cost of the work" shall not include any of the following:

- C.1 Payroll costs and other compensation of CONTRACTOR's officers, executives, principals (of partnership and sole proprietorships), general managers, engineers, architects, estimators, lawyers, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks and other personnel employed by CONTRACTOR whether at the site or in its principal or a branch office for general administration of the work and not specifically included in the agreed-upon schedule of job classifications referred to in this Article, all of which are to be considered administrative costs covered by CONTRACTOR's fee.
- C.2 Expenses of CONTRACTOR's principal and branch offices other than CONTRACTOR's office at the site.
- C.3 Any part of CONTRACTOR's capital expenses, including interest on CONTRACTOR's capital employed for the work and charges against CONTRACTOR for delinquent payments.
- C.4 Cost of premiums for all Bonds and for all insurance whether or not CONTRACTOR is required by the Contract Documents to purchase and maintain the same, except for additional bonds and insurance required because of changes in the work.
- C.5 Costs due to the negligence or neglect of CONTRACTOR, any Subcontractors, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective work, disposal of materials or equipment wrongly supplied and making good any damage to property.
- C.6 Other overhead or general expense costs of any kind and the cost of any item not specifically and expressly included in this Section.

D. CONTRACTOR's fee allowed to CONTRACTOR for overhead and profit shall be determined as follows:

- D.1 A mutually acceptable fixed fee or if none can be agreed upon,
- D.2 A fee based on the following percentages of the various portions of the cost of the work:

For costs incurred under Article 10.4.B.1, CONTRACTOR's fee shall not exceed ten percent (10%).

For costs incurred under Article 10.4.B.3 and B.4, CONTRACTOR's fee shall not exceed seven and one half percent (7.5%); and if a subcontract is on the basis of

cost of the work plus a fee, the maximum allowable to the Subcontractor as a fee for overhead and profit shall not exceed ten percent (10%);

No fee shall be payable on the basis of costs itemized under Article 10.4.B.5 and Article 10.4.C.

- E. The amount of credit to be allowed by CONTRACTOR to CITY for any such change which results in a net decrease in cost, will be the amount of the actual net decrease. When both additions and credits are involved in anyone change, the combined overhead and profit shall be figured on the basis of the net increase, if any, however, CONTRACTOR shall not be entitled to claim lost profits for any Work not performed.
- F. Whenever the cost of any work is to be determined pursuant to Articles 10.4.B and 10.4.C, CONTRACTOR will submit in a form acceptable to CONSUL T ANT an itemized cost breakdown together with the supporting data.
- G. Where the quantity of any item of the Work that is covered by a unit price is increased or decreased by more than twenty percent (20%) from the quantity of such work indicated in the Contract Documents, an appropriate Change Order shall be issued to adjust the unit price, if warranted.
- H. Whenever a change in the Work is to be based on mutual acceptance of a lump sum, whether the amount is an addition, credit or no change-in-cost, CONTRACTOR shall submit an initial cost estimate acceptable to ENGINEER and CITY.
 - H.1 Breakdown shall list the quantities and unit prices for materials, labor, equipment and other items of cost.
 - H.2 Whenever a change involves CONTRACTOR and one or more Subcontractors and the change is an increase in the Contract Price, overhead and profit percentage for CONTRACTOR and each Subcontractor shall be itemized separately.
- I. Each Change Order must state within the body of the Change Order whether it is based upon unit price, negotiated lump sum, or "cost of the work."

10.5 Notification and Claim for Chance of Contract Price:

- A. Any claim for a change in the Contract Price shall be made by written notice by CONTRACTOR to the CITY and to ENGINEER within five (5) calendar days of the commencement of the event giving rise to the claim and stating the general nature and cause of the claim. Thereafter, within twenty (20) calendar days of the termination of the event giving rise to the claim, written notice of the extent of the claim with supporting information and documentation shall be provided unless ENGINEER allows an additional period of time to ascertain more accurate data in support of the claim and such notice shall be accompanied by CONTRACTOR's

written notarized statement that the adjustment claimed is the entire adjustment to which the CONTRACTOR has reason to believe it is entitled as a result of the occurrence of said event. All claims for changes in the Contract Price shall be in accordance with Articles 10.3 and 10.4 hereof, if CITY and CONTRACTOR cannot otherwise agree. **IT IS EXPRESSLY AND SPECIFICALLY AGREED THAT ANY AND ALL CLAIMS FOR CHANGES TO THE CONTRACT PRICE SHALL BE WAIVED IF NOT SUBMITTED IN STRICT ACCORDANCE WITH THE REQUIREMENTS OF THIS SECTION.**

10.6 Notice of Change:

If notice of any change affecting the general scope of the work or change in the Contract Price is required by the provisions of any Bond to be given to the Surety, it will be CONTRACTOR's responsibility to so notify the Surety, and the amount of each applicable Bond shall be adjusted accordingly. The CONTRACTOR shall furnish proof of such adjustment to the CITY. Failure of the CONTRACTOR to obtain such approval from the Surety may be a basis for termination of this Contract by the CITY.

10.7 Records:

The CONTRACTOR's representative and the ENGINEER shall compare records of extra work done at the end of the day. Such records shall be made in duplicate upon a form provided for such purpose by the ENGINEER and shall be signed by both the Inspector and the CONTRACTOR's representative, one copy being submitted to the ENGINEER and the other being retained by the CONTRACTOR.

10.8 Cancelled Items and Payments Therefore:

The CITY COMMISSION shall have the right to cancel those portions of the Contract relating to the construction of any item provided therein. Such cancellation shall entitle the CONTRACTOR to payment in a fair and equitable amount covering all items of cost incurred by him prior to the date of cancellation or suspension of the work. The CONTRACTOR shall be allowed a profit percentage on the materials used and on construction work actually performed, at the same rates as provided for "Extra Work", but no allowance will be made for anticipated profits. Acceptable materials ordered by the CONTRACTOR or delivered on the work, prior to date of such cancellation or suspension, may be purchased from the CONTRACTOR by the CITY at actual cost and shall thereupon, become property of the CITY, or may be returned to the manufacturer for a reasonable restocking charge.

10.9 Full Payment:

The Compensation herein provided shall be received and accepted by the CONTRACTOR as payment in full for all extra work done or costs incurred in event of cancellation.

ARTICLE 11 - CHANGES IN THE CONTRACT TIME

11.1 Change Order:

The Contract Time may only be changed by a Change Order. A FULLY EXECUTED CHANGE ORDER MUST EXIST PRIOR TO EXTENSION OR SHORTENING OF THE CONTRACT TIME.

11.2 Notification and Claim for Change of Contract Time:

- A. Any claim for a change in the Contract Time shall be made by written notice by the CONTRACTOR to the CITY and to ENGINEER within five (5) calendar days of the commencement of the event giving rise to the claim and stating the general nature and cause of the claim. Thereafter within twenty (20) calendar days of the termination of the event giving rise to the claim, written notice of the extent of the claim with supporting information and documentation shall be provided unless ENGINEER allows an additional period of time to ascertain more accurate data in support of the claim and such notice shall be accompanied by CONTRACTOR's written notarized statement that the adjustment claimed is the entire adjustment to which the CONTRACTOR has reason to believe it is entitled as a result of the occurrence of said event. All claims for changes in the Contract Time shall be determined in accordance with Articles 10.3 and 10.4 hereof, if CITY and CONTRACTOR cannot otherwise agree. **IT IS EXPRESSLY AND SPECIFICALLY AGREED THAT ANY AND ALL CLAIMS FOR CHANGES TO THE CONTRACT TIME SHALL BE WAIVED IF NOT SUBMITTED IN STRICT ACCORDANCE WITH THE REQUIREMENTS OF THIS SECTION.**
- B. The Contract Time will be extended an amount equal to time lost on critical Work items due to delays beyond the control of and through no fault or negligence of CONTRACTOR if a claim is made thereafter as provided in Article 11.2. Such delays shall include, but not be limited to, acts or neglect by any separate contractor employed by CITY, fire, floods, labor disputes, epidemics, abnormal weather conditions or acts of God

11.3 Basis for Extension:

Extensions of time shall be considered and will be based solely upon the effect of delays to the work as a whole. Extensions of time shall not be granted for delays to the work, unless the CONTRACTOR can clearly demonstrate, through schedule analysis, that the delay to the work as a whole arose in accordance with Article 12.3 or Article 15.1, and that such delays did or will, in fact, delay the progress of work as a whole. Time extensions shall not be allowed for delays to parts of the work that are not on the critical path of the project schedule. Time extensions shall not be granted until all float or contingency time, at the time of the delay, available to absorb specific delays and associated impacts is used.

11.4 Change of Time Due to Contract Execution Problems:

Refer to Article 3.4 for a decrease in Contract Time when the CONTRACTOR fails to return the correctly executed Contract Documents within the time allowed.

11.5 Change of Time Due to Change Order Evaluation:

When evaluating a proposed Change Order, the ENGINEER shall have access to any available float or contingency time. Extension will only be considered in accordance with Article 11.3.

11.6 Change of Time and Inspection and Testing:

Neither observations by the ENGINEER, nor inspections, tests or approvals by others, passing or failing, will be cause for consideration of time extension.

11.7 Change of Time and Defective Work:

- A. If WORK is found to be defective, CONTRACTOR shall bear all remedial expenses including any additional costs experienced by CITY due to delays to others performing additional WORK. CONTRACTOR shall further bear the responsibility for maintaining schedule, and will be excluded from a time extension and the recovery of delay damages due to the uncovering.
- B. If the WORK is found to be defective per the Specifications, but the CITY chooses to accept it at its sole discretion, CONTRACTOR shall bear the responsibility for maintaining schedule, and will be excluded from a time extension and the recovery of delay damages due to the uncovering.

11.8 Liquidated Damages:

All time limits stated in the Contract Documents are of the essence. The provisions of this Article 11 shall not exclude recovery for damages by CITY as indicated in Section 3 of the Supplementary General Conditions.

ARTICLE 12 - WARRANTY AND GUARANTEE;
TEST AND INSPECTIONS;
CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

12.1 Warranty and Guarantee:

The CONTRACTOR warrants and guarantees to the CITY and the ENGINEER that all work will be in accordance with the Contract Documents and will not be defective. Prompt notice of all defects shall be given to the CONTRACTOR. All defective work, whether or not in place, may be rejected, corrected or accepted as provided in this Article.

12.2 Tests and Inspections:

- A. The CONTRACTOR shall give the ENGINEER and, when appropriate, the Building Department and other regulatory authorities which have jurisdiction over the work, timely notice of readiness of the work for all required inspections, tests or approvals.
- B. All inspections performed as a result of the issuance of the Master Building Permit shall be performed by the CITY. All costs associated with such inspections shall be paid by the CITY, EXCEPT THAT should said test or inspection fail to pass the CONTRACTOR shall pay all costs associated with the rework and the retesting.
- C. When any other regulatory authority, by virtue of its rules or regulations, requires specific tests or inspections, the CONTRACTOR shall assume full responsibility for and pay all costs in connection with said tests and inspections.
- D. The CONTRACTOR shall also be responsible for and shall pay all costs in connection with any inspection or testing required in connection with the ENGINEER's acceptance of a manufacturer, fabricator, supplier or distributor of materials or equipment proposed to be incorporated in the work, or of materials or equipment submitted for approval prior to ENGINEER's acceptance thereof for incorporation in the work and as otherwise specified in the Contract Documents.
- E. Neither observations by the ENGINEER nor inspections, tests or approvals by others shall relieve the CONTRACTOR from his obligations to perform the work in accordance with the Contract Documents.

12.3 Uncovering Work:

- A. If any work that is to be inspected, tested or approved is covered without written concurrence of the ENGINEER, it must, if requested, by the ENGINEER, be uncovered. Such uncovering and replacement shall be at the CONTRACTOR's expense.
- B. CONTRACTOR must contact all regulatory agencies issuing construction permits to make all necessary inspections. If CONTRACTOR fails to have the necessary inspections performed and such failure results in uncovering of work already performed, CONTRACTOR shall be responsible for all related time delays and monetary costs.
- C. If the ENGINEER considers it necessary or advisable that work previously covered with his permission or cognizance be observed, inspected or tested, the CONTRACTOR, at the ENGINEER's request, shall uncover, expose or otherwise make available for observation, inspection or testing as the ENGINEER may require, that portion of the work

in question, furnishing all necessary labor, material and equipment. If it is found that such work is defective, the CONTRACTOR shall bear all the expenses of such uncovering, exposure, observation, inspection and testing and of satisfactory reconstruction, including compensation for additional professional services. If, however, such work is not found to be defective the CONTRACTOR shall be allowed an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to such uncovering, exposure, observation, inspection, testing and reconstruction if he makes a claim therefor in accordance with Article 10.2 and Article 11.2.

12.4 City May Stop the Work:

If the work is defective, or the CONTRACTOR fails to supply sufficient skilled workmen or suitable materials or equipment, the CITY may order the CONTRACTOR to stop the work, or any portion thereof, until the cause for such order has been eliminated; however, this right of the CITY to stop the work shall not give rise to any duty on the part of the CITY to exercise this right for the benefit of the CONTRACTOR or any other party.

12.5 Correction or Removal of Defective Work:

If required by the ENGINEER, the CONTRACTOR shall promptly, without cost to the CITY and as specified by the ENGINEER either correct any defective work, whether or not fabricated, installed or completed, or if the work has been rejected by the ENGINEER, remove it from the site and replace it with nondefective work.

12.6 One- Year Correction Period:

If within one year after the date of Substantial Completion or Final Completion as applicable, or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents or by any specific provision of the Contract Documents, any work is found to be defective, the CONTRACTOR shall promptly without cost to the CITY and in accordance with the ENGINEER's written instructions, either correct such defective work, or if it has been rejected by the ENGINEER remove it from the site and replace it with nondefective work. If the CONTRACTOR does not promptly comply with the terms of such instructions, or in an emergency where delay would cause serious risk of loss or damage, the ENGINEER may have the defective work corrected or the rejected work removed and replaced, and all direct and indirect costs of such removal and replacement, including compensation for additional professional services, shall be paid by the CONTRACTOR.

12.7 Acceptance of Defective Work:

If instead of requiring correction or removal and replacement of defective work, the ENGINEER prefers to accept it, he may do so. In such case, if acceptance occurs prior to the ENGINEER's recommendation of final payment, a Change Order shall be issued incorporating the necessary revisions in the Contract Documents, including appropriate reduction in the Contract Price; or if the acceptance occurs after such recommendation, an appropriate amount shall be paid by the CONTRACTOR to the CITY.

12.8 City May Correct Defective Work:

If the CONTRACTOR fails within a reasonable time after written notice of the ENGINEER to proceed to correct and to correct defective work or to remove and replace rejected work as required by the ENGINEER in accordance with Paragraph 12.5, or if the CONTRACTOR fails to perform the work in accordance with the Contract Documents, (including any requirements of the progress schedule), the CITY may, after seven days' written notice to the CONTRACTOR, correct and remedy any such deficiency. In exercising its rights under this Paragraph the CITY shall proceed expeditiously. To the extent necessary to complete corrective and remedial action, the CITY may exclude the CONTRACTOR from all or part of the site, take possession of all or part of the work, and suspend the CONTRACTOR's services related thereto, take possession of the CONTRACTOR's tools, appliances, construction equipment and machinery at the site and incorporate in the work all materials and equipment stored at the site or for which the CITY has paid the CONTRACTOR but which are stored elsewhere. The CONTRACTOR shall allow the CITY, the CITY's representatives, agents and employees such access to the site as may be necessary to enable the CITY to exercise his rights under this Paragraph. All direct and indirect costs of the CITY in exercising such rights shall be charged against the CONTRACTOR in an amount verified by the ENGINEER, and a Change Order shall be issued incorporating the necessary revisions in the Contract Documents and a reduction in the Contract Price. Such direct and indirect costs shall include, in particular but without limitations, compensation for additional professional services required and all costs of repair and replacement of work of others destroyed or damaged by correction, removal or replacement of the CONTRACTOR's defective work. The CONTRACTOR shall not be allowed an extension of the Contract Time because of any delay in performance of the work attributable to the exercise by the CITY of the CITY's rights hereunder.

ARTICLE 13 - PAYMENTS TO THE CONTRACTOR

13.1 Basis of Payment:

Progress payments shall be based on the aggregate of the unit price amounts listed in the Proposal or in the Schedule of Values which have been incorporated in the work acceptable to the ENGINEER.

13.2 Unit Price Inclusion:

The unit prices stated in the Proposal include all costs and expenses for materials, labor, tools, equipment, transportation, commissions, patent fees and royalties, removing crossings or other obstructions, protection or maintaining pipes, drains, railroad tracks, buildings, bridges, or other structures furnishing temporary crossings or bridges, furnishing all supplemental construction stakes, batter boards, templets, common and ordinary labor for handling materials during inspection replacing any property damage, together with any and all costs or expenses for performing and completing the work as specified.

13.3 Schedule of Values: (Lump Sum Price Breakdown)

A Schedule of Values must be submitted within seven days subsequent to the CONTRACTOR executing and submitting the Documents required of Article 16 of the Instructions to Bidders. The schedules shall be satisfactory in form and substance to the ENGINEER, and shall include quantity and unit prices aggregating the Contract Price, and shall subdivide the work into component parts in sufficient detail to serve as the basis for progress payments during construction. Upon acceptance of the schedule of values by the ENGINEER, it shall be incorporated into a form of Application for Payment acceptable to the ENGINEER.

13.4 Changed Conditions: (Unit Price Only)

It is mutually agreed that due to latent field conditions which can not be foreseen at the time of advertising for bids, adjustments of the Plans to field conditions will be necessary during construction; and, therefore, such changes in the plans shall be recognized as constituting a normal and accepted margin of adjustment not unusual and not involving or permitting any change or modification of unit prices, in which case payment will be made for the revised quantities at the unit price bid in the Proposal.

13.5 Application for Progress Payment:

On the 20th day of the month or the first working day thereafter, the CONTRACTOR shall submit to the ENGINEER for review an Application for Payment form filled out and signed by the CONTRACTOR. The form shall be notarized, and shall cover the work completed as of the date of the application. The Application for Payment shall be accompanied by a Schedule of Values, and any other supporting documentation as the ENGINEER may reasonably require.

13.6 Payment for Materials:

If payment is requested on the basis of materials and equipment not incorporated in the work but delivered and suitably stored at the site or at another location agreed to in writing, the Application for Payment shall also be accompanied by such data, satisfactory to the ENGINEER, as will establish the CITY's title to the material and equipment and protect the CITY's interest therein, including applicable insurance.

13.7 Affidavit Required:

All Applications for Payment shall include an Affidavit of the CONTRACTOR stating that all previous progress payments received on account of the work have been applied to discharge in full all of CONTRACTOR's obligations reflected in prior Applications for Payment. The amount of retainage with respect to progress payments will be 10%.

13.8 Retainage:

The amount of retainage with respect to progress payments will be 10% until 50-percent completion of the construction services purchased pursuant to the Contract. After 50-percent completion of the construction services purchased pursuant to the Contract, the CITY shall reduce to 5 percent the amount of retainage withheld from each subsequent progress payment made to the CONTRACTOR. For purposes of this paragraph, the term "50-percent completion" means the point at which the CITY has expended 50 percent of the total cost of the construction services purchased as identified in the Contract together with all costs associated with existing change orders and other additions or modifications to the construction services provided for in the Contract.

13.9 CONTRACTOR's Warranty of Title:

The CONTRACTOR warrants and guarantees that title to all work, materials and equipment covered by any Application for Payment whether incorporated in the Project or not, will pass to the CITY at the time of payment free and clear of all liens, claims, security interests and encumbrances (hereinafter in these General Conditions referred to as "Liens").

13.10 Review of Application for Payment:

The ENGINEER will, within seven (7) days, review the Application for Payment and either approve and submit it for payment or notify the CONTRACTOR of the deficiencies such that the CONTRACTOR may make the necessary corrections and resubmit in time for the month's payment. However, the ENGINEER may refuse to recommend the whole or any part of any payment if, in his opinion, it would be incorrect to make such representations. He may also refuse to recommend any such payment, or because of subsequently discovered evidence or the results of subsequent inspections or tests, nullify any such payment previously recommended to such extent as may be necessary in the ENGINEER's opinion to protect the CITY from loss because:

- A. The work is defective, or completed work has been damaged requiring correction or replacement.
- B. Written claims have been made against the CITY or Liens have been filed in connection with the work.
- C. The Contract Price has been reduced because of Change Order.
- D. The CITY has been required to correct defective work or complete the work in accordance with Article 12.8.

- E. The CONTRACTOR's unsatisfactory prosecution of the work in accordance with the Contract Documents.
- F. The CONTRACTOR's failure to make payment to Sub- Contractors, or for labor, materials or equipment.

13.11 Payment to the Contractor:

Payments are made only on the fifteenth day or first workday thereafter of each month.

ARTICLE 14 - SUBSTANTIAL COMPLETION, PARTIAL UTILIZATION,
FINAL CLEAN UP, INSPECTION, PAYMENT AND ACCEPTANCE

14.1 Substantial Completion:

When the CONTRACTOR considers the entire work ready for its intended use, the CONTRACTOR shall, in writing to the ENGINEER, certify that the entire work is substantially complete and request that the ENGINEER issue a Certificate of Substantial Completion. Within a reasonable time thereafter the CONTRACTOR and the ENGINEER shall make an inspection of the work to determine the status of completion. If the ENGINEER does not consider the work substantially complete, the ENGINEER will notify the CONTRACTOR in writing giving his reasons therefor. If the ENGINEER considers the work substantially complete, the ENGINEER will prepare and deliver to the CONTRACTOR a Certificate of Substantial Completion, which shall fix the date of Substantial Completion. There shall be attached to the certificate a proposed Punch List, developed by the CONTRACTOR, of items to be completed or corrected before final payment.

Within 10 days after delivery of the certificate, the CITY shall review the proposed Punch List and either approve it or contact the CONTRACTOR to commence good faith efforts to develop a Punch List that is satisfactory to both parties. If the parties are unable to resolve any differences they may have in the development of the Punch List, the ENGINEER shall resolve their differences. The parties shall expedite the process of developing the Punch List with the intent of finalizing the Punch List within 30 days after the date of Substantial Completion.

At the time of delivery of the Certificate of Substantial Completion the ENGINEER will deliver to the CONTRACTOR written notice as to division of responsibilities pending final payment between the CITY and the CONTRACTOR with respect to security, operation, safety, maintenance, heat, utilities and insurance, said responsibilities will be binding on the CITY and the CONTRACTOR until final payment. Unless otherwise stated herein or on the Certificate of Substantial Completion, all building, product, equipment, and machinery warranties will commence on the date of Substantial Completion. The CITY shall have the right to exclude the CONTRACTOR from the work after the date of Substantial Completion, but the CITY shall allow the CONTRACTOR reasonable access to complete or correct items on the Punch List.

14.2 Partial Utilization:

Use by the CITY of any finished part of the work which has specifically been identified in the Contract Documents or which the ENGINEER and the CONTRACTOR agree constitutes a separately functioning and usable part of the work that can be used by the CITY 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:

- A. The ENGINEER at any time may request the CONTRACTOR in writing to permit the CITY to use any such part of the work which the ENGINEER believes to be ready for its intended use and substantially complete. If the CONTRACTOR agrees, the CONTRACTOR will certify to the ENGINEER that said part of the work is substantially complete and request the ENGINEER to issue a Certificate of Substantial Completion for that part of the work. The CONTRACTOR, at any time, may notify the ENGINEER in writing that the CONTRACTOR considers any such part of the work ready for its intended use and substantially complete and request the ENGINEER to issue a Certificate of Substantial Complete for the part of the work. Within a reasonable time after either such request, the CONTRACTOR and the ENGINEER shall make an inspection of that part of

the work to determine its status of completion. If the ENGINEER does not consider that part of the work to be substantially complete, the ENGINEER will notify the CONTRACTOR in writing giving the reasons therefore. If the ENGINEER considers that part of the work to be substantially complete, the provisions of Article 14.1 will apply with respect to Certificate of Substantial Completion of that part of the work and the division of responsibility in respect thereof and access thereto. It shall be understood by the CONTRACTOR that until such written notification is issued, all responsibility for care and maintenance of all of the WORK shall be borne by the CONTRACTOR. Upon issuance of said written notice of partial utilization, the OWNER will accept responsibility for the protection and maintenance of all such items or portions of the WORK described in the written notice.

14.3 Final Clean-Up:

Upon completion of the work and before final inspection shall be made, the CONTRACTOR shall clean and remove from the site, the Right-of-Way and adjacent property, all surplus and discarded materials, rubbish, and temporary structures; restore in an acceptable manner all property, both public and private, which has been damaged during the prosecution of the work; and shall leave the site and vicinity unobstructed in a neat and presentable condition throughout the entire area or length of the work under Contract. The placing of materials of every character, rubbish, or equipment on the abutting property, with or without the consent of the property owners, shall not constitute the satisfactory disposal. If the work is of such a character as may be done by block or sections, the CONTRACTOR may be required to promptly remove and dispose of accumulated rubbish, debris or surplus materials from blocks or sections as completed or partially completed. No separate payment will be made for final cleaning up and restoration of property, but all costs thereof shall be included in the prices bid for the various scheduled items of work.

14.4 Final Inspection:

Upon written notice from the CONTRACTOR that the entire work or an agreed portion thereof is complete and final clean-up has been completed, the ENGINEER will make a final inspection with the CONTRACTOR and will notify the CONTRACTOR in writing of all particulars in which this inspection reveals that the work is incomplete or defective. The CONTRACTOR shall immediately take such measures as are necessary to remedy such deficiencies.

14.5 Final Application for Payment:

After the CONTRACTOR has completed all such corrections to the satisfaction of the ENGINEER and delivered all maintenance and operating instructions, schedules, guarantees, Bonds, certificates of inspection, marked-up record documents (as provided in Article 7.19 of the General Conditions and other documents; all as required by the Contract Documents and after the ENGINEER has indicated that the work is acceptable (subject to the provisions of Article 14.9) the CONTRACTOR may make Application for Final Payment following the procedure for progress payments. The final Application for Payment shall be accompanied by all documentation called for in the Contract Documents, together with complete and legally effective releases or waivers (satisfactory to the CITY) of all Liens arising out of or filed in connection with the work. In lieu thereof and as approved by the CITY, the CONTRACTOR may furnish receipts or releases in full; an affidavit of the CONTRACTOR that the releases and receipts include all labor, services, material and equipment for which a Lien could be filed, and that all payrolls, material and

equipment bills, and other indebtedness connected with the work for which the CITY or the CITY's property might in any way be responsible, have been paid or otherwise satisfied; and consent of the Surety, if any, to final payment. If any Subcontractor or Supplier fails to furnish a release or receipt in full, the CONTRACTOR may furnish a Bond or other collateral satisfactory to the CITY to indemnify the CITY against any Lien.

14.6 Final Payment and Acceptance:

If on the basis of the ENGINEER's observation of the work during construction and final inspection, and the ENGINEER's review of the final Application for Payment and accompanying documentation, all as required by the Contract Documents, the ENGINEER is satisfied that the work has been completed and the CONTRACTOR's other obligations under the Contract Documents have been fulfilled, the ENGINEER will recommend payment. Thereupon the ENGINEER will give written notice to the CITY and the CONTRACTOR that the work is acceptable subject to the provisions of Article 14.9.

14.7 Payment of Retainage Without Final Completion:

If through no fault of the CONTRACTOR, final completion of the work is significantly delayed and if the ENGINEER so confirms, the CITY shall, upon receipt of the CONTRACTOR's final Application for Payment and recommendation of the ENGINEER, and without terminating the Agreement, make payment of the balance due for the portion of the work fully completed and accepted. If the remaining balance to be held by the CITY for work not fully completed or corrected is less than the retainage stipulated in the Agreement and if Bonds have been furnished as required in Article 5.2, the written consent of the Surety to the payment of the balance due for that portion of the work fully completed and accepted shall be submitted by the CONTRACTOR to the ENGINEER with the application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

14.8 CONTRACTOR's Continuing Obligation:

The CONTRACTOR's obligation to perform and complete the work in accordance with the Contract Documents shall be absolute. Neither recommendation of any progress or final payment by the ENGINEER, nor the issuance of a Certificate of Substantial Completion, nor any payment by the CITY to the CONTRACTOR under the Contract Documents, nor any use or occupancy of the work or any part thereof by the CITY nor any act of acceptance by the CITY nor any failure to do so, nor any review and approval of a Shop Drawing or sample submission, nor the issuance of a notice of acceptability by the ENGINEER pursuant to Article 14.6, nor any correction of defective work by the CITY will constitute an acceptance of work not in accordance with the Contract Documents or a release of the CONTRACTOR's obligation to perform the work in accordance with the Contract Documents (except as provided in Article 14.9).

14.9 Waiver of Claims:

The making and acceptance of final payment will constitute:

- A. A waiver of all claims by the CITY against the CONTRACTOR, except claims arising from unsettled Liens, from defective work appearing after final inspection pursuant to Article 14.4 or from failure to comply with the Contract Documents or the terms of any special guarantees specified therein; however, it will not constitute a waiver by the CITY of any

rights in respect of the CONTRACTOR's continuing obligations under the Contract Documents.

- B. A waiver of all claims by the CONTRACTOR against the CITY other than those previously made in writing and still unsettled.

ARTICLE 15 - SUSPENSION OF WORK AND TERMINATION

15.1 City May Suspend Work:

The CITY may, at any time and without cause, suspend the work or any portion thereof for a period of not more than 90 days by notice in writing to the CONTRACTOR which will fix the date on which work will be resumed. The CONTRACTOR shall resume the work on the date so fixed. The CONTRACTOR shall be allowed an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to any suspension.

15.2 City May Terminate:

- A. Upon the occurrence of any one or more of the following events:
1. If the CONTRACTOR commences a voluntary case under any chapter of the Bankruptcy Code (Title 11, United States Code), as now or hereafter in effect, or if the CONTRACTOR takes any equivalent or similar action by filing a petition or otherwise under any other federal or state law in effect at such time relating to the bankruptcy or insolvency.
 2. If a petition is filed against the CONTRACTOR under any chapter of the Bankruptcy Code as now or hereafter in effect at the time of filing, or if a petition is filed seeking any such equivalent or similar relief against the CONTRACTOR under any other federal or state law in effect at the time relating to bankruptcy or insolvency.
 3. If the CONTRACTOR makes a general assignment for the benefit of creditors.
 4. If a trustee, receiver, custodian or agent of the CONTRACTOR is appointed under applicable law or under contract, whose appointment or authority to take charge of property of the CONTRACTOR is for the purpose of enforcing a Lien against such property or for the purpose of general administration of such property for the benefit of the CONTRACTOR's creditors.
 5. If the CONTRACTOR admits in writing an inability to pay its debts generally as they become due.
 6. If the CONTRACTOR persistently fails to perform the work in accordance with the Contract Documents (including, but not limited to, failure to supply a qualified superintendent or sufficient skilled workers or suitable materials or equipment or failure to adhere to the approved progress schedule revised from time to time).
 7. If the CONTRACTOR disregards laws or regulations of any public body having jurisdiction.
 8. If the CONTRACTOR disregards the authority of the ENGINEER.
 9. If the CONTRACTOR otherwise violates in any substantial way any provisions of the Contract Documents.
- B. The CITY may, after giving the CONTRACTOR and the Surety seven days' written notice and to the extent permitted by laws and regulations, terminate the services of the CONTRACTOR, exclude the CONTRACTOR from the site and take possession of the

work and of all the CONTRACTOR's tools, appliances, construction equipment and machinery at the site and use the same to the full extent they could be used by the CONTRACTOR (without liability to the CONTRACTOR for trespass or conversion), incorporate in the work all materials and equipment stored at the site or for which the CITY has paid the CONTRACTOR but which are stored elsewhere, and finish the work as the CITY may deem expedient. In such case the CONTRACTOR shall not be entitled to receive any further payment until the work is finished. If the unpaid balance of the Contract Price exceeds the direct, indirect and consequential costs of completing the work (including but not limited to fees and charges of engineers, architects, attorneys and other professionals, and court and arbitration costs) such excess will be paid to the CONTRACTOR. If such costs exceed such unpaid balance, the CONTRACTOR, or CONTRACTOR's Surety, shall pay the difference to the CITY.

- C. Where the CONTRACTOR's services have been so terminated by the CITY, the CITY alone shall determine the scope and description of the work to be completed and the method and schedule for completing it.
- D. Where the CONTRACTOR's services have been so terminated by the CITY the termination will not affect any rights or remedies of the CITY against the CONTRACTOR then existing or which may thereafter accrue. Any retention or payment of moneys due the CONTRACTOR by the CITY will not release the CONTRACTOR from liability.
- E. Upon seven days' written notice to the CONTRACTOR the CITY may, without cause and without prejudice to any other right or remedy, elect to abandon the work and terminate the Contract. In such case the CONTRACTOR shall be paid for all work executed and any expense sustained plus reasonable termination expenses, which will include, but not be limited to, direct, indirect and consequential costs (including, but not limited to, fees and charges of engineers, architects, attorneys and other professionals and court and arbitration costs).

15.3 Contractor May Stop Work or Terminate:

If through no act or fault of the CONTRACTOR, the work is suspended for a period of more than 90 days by the CITY or under an order of court or other public authority, or the CITY fails for 60 days to pay the CONTRACTOR any sum finally determined to be due, then the CONTRACTOR may, upon seven days' written notice to the CITY terminate the Contract and recover from the CITY payment for all work executed and any expense sustained plus reasonable termination expenses. In addition and in lieu of terminating the Contract, if the CITY has failed to make any payment as aforesaid, the CONTRACTOR may upon seven days' written notice to the CITY stop the work until payment of all amounts then due are paid. The provisions of this paragraph shall not relieve the CONTRACTOR of the obligations to carry on the work in accordance with the progress schedule and without delay during disputes and disagreements with the CITY.

- END OF SECTION -

SECTION 00 80 00
SUPPLEMENTARY GENERAL CONDITIONS
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General Note:

The General Conditions refer to specific section numbers in the Supplementary General Conditions. These reference numbers may not coordinate with the actual Article numbers utilized in the Supplementary General Conditions. The CONTRACTOR shall comply with all General Conditions and all Supplementary General Conditions as well as related conditions included in the General Requirements, Division 1 of the Technical Specifications. Incorrect cross-reference numbers shall not relieve this requirement.

1. Project Schedule

Time is of the essence for this work. The following defines the schedule for the project:

CONSTRUCTION WORK SCHEDULE
CONSTRUCTION / STARTUP / ACCEPTANCE:

<u>Major Milestones</u>	<u>Completion Time (calendar days)</u>
1. Intermediate Milestone – Phase 1 – Milestone Completion	214
2. Major Milestone – Phase 2 - Substantial Completion ⁽¹⁾	734
3. Major Milestone – Project Closeout ⁽²⁾	818

Failure to meet any of the above defined construction/startup/acceptance completion dates shall subject the CONTRACTOR to pay damages as specified in these Supplementary General Conditions in Article 3.

⁽¹⁾Substantial Completion

1. Refer to General Conditions Articles 14.1 and 14.2. (Certification of Substantial Completion Services appended to the Supplementary General Conditions).
2. Substantial Completion shall also include:
 - Completion of all construction work associated with the specific “Major Milestone” listed in the construction work schedule including completion of punch list items.
 - “Completion of punch list items” shall be as determined by the Engineer in the field.
 - Record shop drawings and O&M submittals received and accepted by the Engineer.
 - Record drawings received and accepted by the Engineer
 - The systems shall be tested and demonstrated for the Engineer’s acceptance. The Engineer shall determine testing and demonstration sufficient for acceptance.
 - Guarantee certifications, performance affidavits, and all other certifications received and accepted by the Engineer.

Contractor shall also conform to construction sequence constraints as defined on the Drawings and in Specifications.

(2)Project Closeout

1. Refer to Division 1 General Requirement, Section 01 70 00 Project Closeout.
2. Project Closeout shall also include:
 - All requirements of substantial completion met plus the following
 - Site cleanup and restoration completed
 - All other site work completed
 - Minor punch list items completed (minor as defined by the Engineer in the field)
 - Demobilization completed
 - Releases from all parties who are entitled to claims

The title "Engineer" utilized in these descriptions for substantial and final completion shall mean the City staff engineer assigned to this project, or his designated representative.

2. Insurance Requirements

The insurance required by Article 5.6 of the General Conditions shall be as follows:
Any Sub-Contractor used by the contractor shall supply such similar insurance required of the contractor. Such certificates shall name the City of Hollywood as an Additional Insured.

1. BUILDERS RISK (BR 1) - Installation Floater: (Not Applicable)

The Contractor shall be required to purchase and maintain, throughout the life of the contract, and until the project is accepted by the City, Builder's Risk Insurance on an All Risk of Loss form. Coverage shall include:

Theft	Aircraft
Windstorm	Vehicles
Hail	Smoke
Explosion	Fire
Riot	Collapse
Civil Commotion	Flood

The policy limits shall be no less than the amount of the finished project and coverage shall be provided on a completed value basis.

Property located on the construction premises, which is intended to become a permanent part of the building, shall be included as property covered.

The policy shall be endorsed permitting the City to occupy the building prior to completion without effecting the coverage.

The City of Hollywood shall be named as Additional Insured and Loss Payee.

2. GENERAL LIABILITY (GL3):

Prior to the commencement of work governed by this contract, the Contractor shall obtain General Liability Insurance. Coverage shall be maintained throughout the life of the contract and include, as a minimum:

- Premises Operations
- Products and Completed Operations
- Blanket Contractual Liability
- Personal Injury Liability
- Expanded Definition of Property Damage

The minimum limits acceptable shall be:

\$2,000,000 Combined Single Limit (CSL)

An Occurrence Form policy is preferred. If coverage is provided on a Claims Made policy, its provisions should include coverage for claims filed on or after the effective date of this contract. In addition, the period for which claims may be reported should extend for a minimum of twelve (12) months following the acceptance of work by the City.

The City of Hollywood shall be named as Additional Insured on all policies issued to satisfy the above requirements.

3. GENERAL LIABILITY (GLXCU):

Recognizing that the work governed by this contract involves either underground exposures, explosive activities, or the possibility of collapse of a structure, the Contractor's General Liability Policy shall include coverage for the XCU (explosion, collapse, and underground) exposures with limits of liability equal to those of the General Liability Insurance policy.

4. VEHICLE LIABILITY (VL3):

Recognizing that the work governed by this contract requires the use of vehicles, the Contractor, prior to the commencement of work, shall obtain Vehicle Liability Insurance. Coverage shall be maintained throughout the life of the contract and include, as a minimum, liability coverage for:

- Owned, Non-Owned, and Hired Vehicles

The minimum limits acceptable shall be:

\$1,000,000 Combined Single Limit (CSL)

If split limits are provided, the minimum limits acceptable shall be:

\$500,000 per Person
\$1,000,000 per Occurrence
\$100,000 Property Damage

The City of Hollywood shall be named as Additional Insured on all policies issued to satisfy the above requirements.

5. WORKERS' COMPENSATION (WC2):

Prior to the commencement of work governed by this contract, the Contractor shall obtain Workers' Compensation Insurance with limits sufficient to respond to the applicable state statutes.

In addition, the Contractor shall obtain Employers' Liability Insurance with limits of not less than:

- \$500,000 Bodily Injury by Accident
- \$500,000 Bodily Injury by Disease, policy limits
- \$500,000 Bodily Injury by Disease, each employee

Coverage shall be maintained throughout the entire term of the contract.

Coverage shall be provided by a company or companies authorized to transact business in the state of Florida and the company or companies must maintain a minimum rating of "A" and Class X, as assigned by the A.M. Best Company.

The policy must be endorsed to provide the City with (30) days notice of cancellation.

If the Contractor has been approved by the Florida's Department of Labor, as an authorized self-insurer, the City shall recognize and honor the Contractor's status. The Contractor may be required to submit a Letter of Authorization issued by the Department of Labor and a Certificate of Insurance, providing details on the Contractor's Excess Insurance Program.

If the Contractor participates in a self-insurance fund, a Certificate of Insurance will be required. In addition, the Contractor may be required to submit updated financial statements from the fund upon request from the City.

3. Liquidated Damages

Liquidated damages shall be paid by the CONTRACTOR to the CITY for failure to complete work on time in accordance with the following schedule:

CONSTRUCTION/STARTUP/ACCEPTANCE:		
<u>Major Milestones</u>	<u>Completion Time (calendar days)</u>	<u>Liquidated Damages</u>
1. Intermediate Milestone - Phase 1 Milestone Completion	214	\$2,500/day
2. Major Milestone Phase 2 – Substantial Completion	734	\$2,500/day
2. Major Milestone Project Closeout	818	\$1,000/day

The CITY is hereby authorized to deduct the sums described above from the monies which may be due to the CONTRACTOR for the work under this contract. Liquidated damages shall be additive such that the maximum total which may be deducted shall be \$3,000/day. Other damages for failure to meet warranty conditions as defined in other sections of the Specifications shall also be added with liquidated damages for failure to meet completion times.

4. **Restricted Area**

The CONTRACTOR shall, in installing the new facilities, confine all activities within the CITY property, easement, and right-of-ways indicated.

5. **Existing Facilities and Structures**

All existing facilities shall be protected, and if damaged, shall be repaired by the CONTRACTOR at no additional cost to the CITY.

6. **Explosives**

Explosives shall not be used on this project.

7. **Contract Documents**

The CITY will provide the CONTRACTOR with 1 (1) set of Contract Documents after the Notice to Proceed.

8. **Required Notifications**

When provisions of the pertinent codes, standards or regulations conflict with this Specification, the more stringent shall apply.

Prior to any site work, the CONTRACTOR shall notify the Engineering and Construction Services Division Inspector at (954) 921-3930.

Prior to excavation at the site, the CONTRACTOR shall notify the appropriate utilities and Sunshine State One-Call of Florida, Inc. (formerly U.N.C.L.E.) at 1-800-432-4770 for locations of buried utilities.

Prior to closure of any CITY streets or alleyways, or other activity which requires the diversion of traffic, the CONTRACTOR shall notify and obtain the permission of the CITY of Hollywood Fire and Police Communications Section at (954) 967-4321.

9. **Notice of Completion**

See attached form.

10. **Prevailing Wage Requirement**

- A. The CONTRACTOR shall be responsible for ensuring payment of the rate of wages and fringe benefits, or cash equivalent, for all laborers, mechanics and apprentices employed by him/her or his/her SUBCONTRACTORS on the work covered by this contract which shall be not less than the prevailing rate of wages and fringe benefits payment or cash equivalent for similar skills or classifications of work as established by the General Wage Decision by the United States Department of Labor for Broward County, Florida that is in effect prior to the date the CITY issued the invitation for bids for this project (the prevailing rate of wages and fringes can be obtained at website <http://www.access.gpo.gov/davisbacon>).

If the General Wage Decision fails to provide for a fringe benefit rate for any worker classification, then the fringe benefit rate applicable to such worker classification shall be the fringe benefit rate that has a basic wage rate closest in dollar amount to the work classification for which no fringe benefit rate has been provided.

- B. Upon commencement of work, the CONTRACTOR and all of his/her SUB-CONTRACTORS shall post a notice in a prominent place at the work site stating the requirements of this Article.
- C. As per the City of Hollywood Code of Ordinances, Prevailing Wage Requirements and Fringe Benefits are applicable to the following: (A) Utilities projects over \$1,000,000.00 (one million dollars) and (B) All other projects over \$500,000.00 (five hundred thousand dollars).

11. Inspections and Testing During Overtime

- A. The following supplement Article 3.15 and 3.16 of the General Conditions:

For weekend work, CONTRACTOR shall submit a written request to the CITY by the preceding Wednesday. A separate request is required for each week that the CONTRACTOR wished to work on a weekend. For evening and holiday work, CONTRACTOR shall submit a written request to the CITY 3 days in advance. The CITY will provide inspection services for all overtime work and the COTNRACOTR shall pay for inspection services per Article 3.15, no exceptions.

Similarly, holiday and other overtime work shall be requested a minimum of 36-hours in advance and CITY will provide inspection for all overtime.

- B. Exceptions to the hours and days of the week for work and other related limitations are allowed only for tie-ins during low flow periods / early morning hours, coatings that need to be applied during lower temperature times of the day and whenever the Documents specifically define that work shall be completed outside of the limitations for "normal" work hours, days, etc.

Inspection for tie-ins during low flow/early morning and specialty coating application performed during nighttime will not be cause for extra inspection costs unless such work is remedial in nature as a result of defective work.

12. Retainage

After 50-percent completion of the construction services purchased pursuant to this contract, CONTRACTOR may present to CITY a payment request for one-half of the retainage then held by CITY. CITY shall promptly make payment to CONTRACTOR, unless CITY has grounds for withholding the payment of retainage. CITY shall have grounds for withholding the payment of retainage with respect to any amounts that are the subject of a good-faith dispute, the subject of a claim brought pursuant to Florida Statute Section 255.05, or otherwise the subject of a claim or demand by CITY or CONTRACTOR.

At acceptance of Substantial Completion, CITY shall promptly make payment to CONTRACTOR of one-half of the retainage then held by CITY. At acceptance of completion of all punch list items, CITY shall promptly make payment to CONTRACTOR the balance of retainage then held by CITY.

13. Owner's Contingency

This allowance is in its entirety dedicated for the use of the Owner (The City of Hollywood) to address conditions (or work) associated with undefined conditions. All work resulting from undefined conditions shall be authorized in writing and in advance by the Owner, specifically the Director of Public Services, through the full execution of a Change Order. The actual amount to be paid per Change Order will be negotiated and agreed by both parties (the Owner and the Contractor). The final/negotiated amount of the Change Order will be deducted from the Owner's Allowance designated in the Bid Proposal and Schedule of Values. The Owner reserves the right to award none, any portion of, or all of the money associated with this allowance. By executing the CONTRACT between the City of Hollywood and the Contractor, the Contractor acknowledges that under no circumstances he or she should assume that he or she would be entitled to any amounts set aside by the City of Hollywood within the Owner's Allowance.

14. SRF Funding Requirements:

Pursuant to the Florida Department of Environmental Protection, State Revolving Fund (SRF) Program as a funding source, this project is subject to SRF requirements, which the Bidder shall be fully aware of and comply with when bidding for the Project:

- A. Davis-Bacon Act see attached for of the most current Davis-Bacon wage rates for the Broward County. The successful bidder is required to pay all laborers and mechanics employed by the contractor or subcontractors wages at rates not less than those prevailing in the most current Davis-Bacon Wages. The successful bidder is required to pay all laborers and mechanics employed by the contractor or subcontractors wages at rates not less than those prevailing in the most current Davis-Bacon Wages.
- B. American Iron and Steel (AIS) see attached for "American Iron and Steel (AIS) Guidance Document". The provision requires the use of iron and steel products that are produced in the United States. By statute, "iron and steel products" means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials.
- C. SRF Supplementary Conditions for Construction requirements. See attached for "SRF Supplementary Conditions for Construction" document.
- D. SRF Supplementary Conditions for Equipment Purchase. See attached for "SRF Supplementary Conditions for Equipment Purchase" document.

CERTIFICATE OF SUBSTANTIAL COMPLETION

PROJECT: INJECTION WELLS NO. 3 AND NO. 4 PUMP STATION (BID # 19-9119A)
ENGINEER: Engineering Construction Services Division

TO: **CONTRACTOR:**

CONTRACT FOR:

NOTICE TO PROCEED DATE:

DATE OF ISSUANCE:

PROJECT OR DESIGNATED PORTION SHALL INCLUDE:

Portions of the work performed under this Contract as described above, have been reviewed and found to be substantially complete. The Date of Substantial Completion of Project or designated portion thereof designated above is hereby established as _____ which is also the date of commencement of applicable warranties required by the Contract Documents for the noted area.

DEFINITION OF DATE OF SUBSTANTIAL COMPLETION

The Date of Substantial Completion of the work or designated portion thereof is the date certified by the ENGINEER ("Date of Issuance" above) when construction is sufficiently complete, in accordance with the Contract Documents, so the CITY can occupy or utilize the work or designated portion thereof for the use for which it is intended, as expressed in the Contract Documents.

A list of items to be completed or corrected, prepared by the CONTRACTOR and verified and amended by the ENGINEER, for the above referenced "Project or Designated Portion" is attached to this form (attached "Punch List" dated _____).

The failure to include any items on such list does not alter the responsibility of the CONTRACTOR to complete all work in accordance with the Contract Documents.

CERTIFICATE OF SUBSTANTIAL COMPLETION

Please note that in accordance with Article 14 General Conditions, the Contractor retains full responsibility for the satisfactory completion of all work regardless of whether the Owner occupies and / or operates a part of the facility and that the taking possession and use of such work shall not be deemed an acceptance of any work not completed in accordance with the Contract Documents.

City of Hollywood ECSD

ENGINEER	BY	DATE
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CONTRACTOR	BY	DATE
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The CITY OF HOLLYWOOD, through the City's authorized representative, accepts the work or designated portion thereof as substantially complete and will assume full possession thereof at _____(time) on _____
(date).

BY	DATE
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- END OF SECTION -



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

WASHINGTON, D.C. 20460

MAR 20 2014

OFFICE OF WATER

MEMORANDUM

SUBJECT: Implementation of American Iron and Steel provisions of P.L. 113-76, Consolidated Appropriations Act, 2014

FROM: f (Andrew D. Sawyers, Director
- ° Office of Wastewater Management (4201M)

Peter C. Grevatt, Director
Office of Ground Water and Drinking Water (4601M)

TO: Water Management Division Directors
Regions I - X

P.L. 113-76, Consolidated Appropriations Act, 2014 (Act), includes an "American Iron and Steel (AIS)" requirement in section 436 that requires Clean Water State Revolving Loan Fund (CWSRF) and Drinking Water State Revolving Loan Fund (DWSRF) assistance recipients to use iron and steel products that are produced in the United States for projects for the construction, alteration, maintenance, or repair of a public water system or treatment works if the project is funded through an assistance agreement executed beginning January 17, 2014 (enactment of the Act), through the end of Federal Fiscal Year 2014.

Section 436 also sets forth certain circumstances under which EPA may waive the AIS requirement. Furthermore, the Act specifically exempts projects where engineering plans and specifications were approved by a State agency prior to January 17, 2014.

The approach described below explains how EPA will implement the AIS requirement. The first section is in the form of questions and answers that address the types of projects that must comply with the AIS requirement, the types of products covered by the AIS requirement, and compliance. The second section is a step-by-step process for requesting waivers and the circumstances under which waivers may be granted.

Implementation

The Act states:

Sec. 436. (a)(1) None of the funds made available by a State water pollution control revolving fund as authorized by title VI of the Federal Water Pollution Control Act (33 U.S.C. 1381 et seq.) or made available by a drinking water treatment revolving loan fund as authorized by section 1452 of the Safe Drinking Water Act (42 U.S.C. 300j-12) shall be used for a project for the construction, alteration, maintenance, or repair of a public water system or treatment works unless all of the iron and steel products used in the project are produced in the United States.

(2) In this section, the term “iron and steel products” means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials.

(b) Subsection (a) shall not apply in any case or category of cases in which the Administrator of the Environmental Protection Agency (in this section referred to as the “Administrator”) finds that—

(1) applying subsection (a) would be inconsistent with the public interest;

(2) iron and steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality; or

(3) inclusion of iron and steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

(c) If the Administrator receives a request for a waiver under this section, the Administrator shall make available to the public on an informal basis a copy of the request and information available to the Administrator concerning the request, and shall allow for informal public input on the request for at least 15 days prior to making a finding based on the request. The Administrator shall make the request and accompanying information available by electronic means, including on the official public Internet Web site of the Environmental Protection Agency.

(d) This section shall be applied in a manner consistent with United States obligations under international agreements.

(e) The Administrator may retain up to 0.25 percent of the funds appropriated in this Act for the Clean and Drinking Water State Revolving Funds for carrying out

the provisions described in subsection (a)(1) for management and oversight of the requirements of this section.

(f) This section does not apply with respect to a project if a State agency approves the engineering plans and specifications for the project, in that agency's capacity to approve such plans and specifications prior to a project requesting bids, prior to the date of the enactment of this Act.

The following questions and answers provide guidance for implementing and complying with the AIS requirements:

Project Coverage

1) What classes of projects are covered by the AIS requirement?

All treatment works projects funded by a CWSRF assistance agreement, and all public water system projects funded by a DWSRF assistance agreement, from the date of enactment through the end of Federal Fiscal Year 2014, are covered. The AIS requirements apply to the entirety of the project, no matter when construction begins or ends. Additionally, the AIS requirements apply to all parts of the project, no matter the source of funding.

2) Does the AIS requirement apply to nonpoint source projects or national estuary projects?

No. Congress did not include an AIS requirement for nonpoint source and national estuary projects unless the project can also be classified as a 'treatment works' as defined by section 212 of the Clean Water Act.

3) Are any projects for the construction, alteration, maintenance, or repair of a public water system or treatment works excluded from the AIS requirement?

Any project, whether a treatment works project or a public water system project, for which engineering plans and specifications were approved by the responsible state agency prior to January 17, 2014, is excluded from the AIS requirements.

4) What if the project does not have approved engineering plans and specifications but has signed an assistance agreement with a CWSRF or DWSRF program prior to January 17, 2014?

The AIS requirements do not apply to any project for which an assistance agreement was signed prior to January 17, 2014.

5) What if the project does not have approved engineering plans and specifications, but bids were advertised prior to January 17, 2014 and an assistance agreement was signed after January 17, 2014?

If the project does not require approved engineering plans and specifications, the bid advertisement date will count in lieu of the approval date for purposes of the exemption in section 436(f).

6) What if the assistance agreement that was signed prior to January 17, 2014, only funded a part of the overall project, where the remainder of the project will be funded later with another SRF loan?

If the original assistance agreement funded any construction of the project, the date of the original assistance agreement counts for purposes of the exemption. If the original assistance agreement was only for planning and design, the date of that assistance agreement will count for purposes of the exemption only if there is a written commitment or expectation on the part of the assistance recipient to fund the remainder of the project with SRF funds.

7) What if the assistance agreement that was signed prior to January 17, 2014, funded the first phase of a multi-phase project, where the remaining phases will be funded by SRF assistance in the future?

In such a case, the phases of the project will be considered a single project if all construction necessary to complete the building or work, regardless of the number of contracts or assistance agreements involved, are closely related in purpose, time and place. However, there are many situations in which major construction activities are clearly undertaken in phases that are distinct in purpose, time, or place. In the case of distinct phases, projects with engineering plans and specifications approval or assistance agreements signed prior to January 17, 2014 would be excluded from AIS requirements while those approved/signed on January 17, 2014, or later would be covered by the AIS requirements.

8) What if a project has split funding from a non-SRF source?

Many States intend to fund projects with “split” funding, from the SRF program and from State or other programs. Based on the Act language in section 436, which requires that American iron and steel products be used in any project for the construction, alteration, maintenance, or repair of a public water system or treatment works receiving SRF funding between and including January 17, 2014 and September 30, 2014, any project that is funded in whole or in part with such funds must comply with the AIS requirement. A “project” consists of all construction necessary to complete the building or work regardless of the number of contracts or assistance agreements involved so long as all contracts and assistance agreements awarded are closely related in purpose, time and place. This precludes the intentional splitting of SRF projects into separate and smaller contracts or assistance agreements to avoid AIS coverage on some portion of a larger

project, particularly where the activities are integrally and proximately related to the whole. However, there are many situations in which major construction activities are clearly undertaken in separate phases that are distinct in purpose, time, or place, in which case, separate contracts or assistance agreement for SRF and State or other funding would carry separate requirements.

9) What about refinancing?

If a project began construction, financed from a non-SRF source, prior to January 17, 2014, but is refinanced through an SRF assistance agreement executed on or after January 17, 2014 and prior to October 1, 2014, AIS requirements will apply to all construction that occurs on or after January 17, 2014, through completion of construction, unless, as is likely, engineering plans and specifications were approved by a responsible state agency prior to January 17, 2014. There is no retroactive application of the AIS requirements where a refinancing occurs for a project that has completed construction prior to January 17, 2014.

10) Do the AIS requirements apply to any other EPA programs, besides the SRF program, such as the Tribal Set-aside grants or grants to the Territories and DC?

No, the AIS requirement only applies to funds made available by a State water pollution control revolving fund as authorized by title VI of the Federal Water Pollution Control Act (33 U.S.C. 1381 et seq.) or made available by a drinking water treatment revolving loan fund as authorized by section 1452 of the Safe Drinking Water Act (42 U.S.C. 300j-12)

Covered Iron and Steel Products

11) What is an iron or steel product?

For purposes of the CWSRF and DWSRF projects that must comply with the AIS requirement, an iron or steel product is one of the following made primarily of iron or steel that is permanently incorporated into the public water system or treatment works:

- Lined or unlined pipes or fittings;
- Manhole Covers;
- Municipal Castings (defined in more detail below);
- Hydrants;
- Tanks;
- Flanges;
- Pipe clamps and restraints;
- Valves;
- Structural steel (defined in more detail below);
- Reinforced precast concrete; and
- Construction materials (defined in more detail below).

12) What does the term ‘primarily iron or steel’ mean?

‘Primarily iron or steel’ places constraints on the list of products above. For one of the listed products to be considered subject to the AIS requirements, it must be made of greater than 50% iron or steel, measured by cost. The cost should be based on the material costs.

13) Can you provide an example of how to perform a cost determination?

For example, the iron portion of a fire hydrant would likely be the bonnet, body and shoe, and the cost then would include the pouring and casting to create those components. The other material costs would include non-iron and steel internal workings of the fire hydrant (i.e., stem, coupling, valve, seals, etc). However, the assembly of the internal workings into the hydrant body would not be included in this cost calculation. If one of the listed products is not made primarily of iron or steel, United States (US) provenance is not required. An exception to this definition is reinforced precast concrete, which is addressed in a later question.

14) If a product is composed of more than 50% iron or steel, but is not listed in the above list of items, must the item be produced in the US? Alternatively, must the iron or steel in such a product be produced in the US?

The answer to both question is no. Only items on the above list must be produced in the US. Additionally, the iron or steel in a non-listed item can be sourced from outside the US.

15) What is the definition of steel?

Steel means an alloy that includes at least 50 percent iron, between .02 and 2 percent carbon, and may include other elements. Metallic elements such as chromium, nickel, molybdenum, manganese, and silicon may be added during the melting of steel for the purpose of enhancing properties such as corrosion resistance, hardness, or strength. The definition of steel covers carbon steel, alloy steel, stainless steel, tool steel and other specialty steels.

16) What does ‘produced in the United States’ mean?

Production in the United States of the iron or steel products used in the project requires that all manufacturing processes, including application of coatings, must take place in the United States, with the exception of metallurgical processes involving refinement of steel additives. All manufacturing processes includes processes such as melting, refining, forming, rolling, drawing, finishing, fabricating and coating. Further, if a domestic iron and steel product is taken out of the US for any part of the manufacturing process, it becomes foreign source material. However, raw materials such as iron ore, limestone and iron and steel scrap are not covered by the AIS requirement, and the

material(s), if any, being applied as a coating are similarly not covered. Non-iron or steel components of an iron and steel product may come from non-US sources. For example, for products such as valves and hydrants, the individual non-iron and steel components do not have to be of domestic origin.

17) Are the raw materials used in the production of iron or steel required to come from US sources?

No. Raw materials, such as iron ore, limestone, scrap iron, and scrap steel, can come from non-US sources.

18) If an above listed item is primarily made of iron or steel, but is only at the construction site temporarily, must such an item be produced in the US?

No. Only the above listed products made primarily of iron or steel, permanently incorporated into the project must be produced in the US. For example trench boxes, scaffolding or equipment, which are removed from the project site upon completion of the project, are not required to be made of U.S. Iron or Steel.

19) What is the definition of ‘municipal castings’?

Municipal castings are cast iron or steel infrastructure products that are melted and cast. They typically provide access, protection, or housing for components incorporated into utility owned drinking water, storm water, wastewater, and surface infrastructure. They are typically made of grey or ductile iron, or steel. Examples of municipal castings are:

- Access Hatches;
- Ballast Screen;
- Benches (Iron or Steel);
- Bollards;
- Cast Bases;
- Cast Iron Hinged Hatches, Square and Rectangular;
- Cast Iron Riser Rings;
- Catch Basin Inlet;
- Cleanout/Monument Boxes;
- Construction Covers and Frames;
- Curb and Corner Guards;
- Curb Openings;
- Detectable Warning Plates;
- Downspout Shoes (Boot, Inlet);
- Drainage Grates, Frames and Curb Inlets;
- Inlets;
- Junction Boxes;
- Lampposts;
- Manhole Covers, Rings and Frames, Risers;

Meter Boxes;
Service Boxes;
Steel Hinged Hatches, Square and Rectangular;
Steel Riser Rings;
Trash receptacles;
Tree Grates;
Tree Guards;
Trench Grates; and
Valve Boxes, Covers and Risers.

20) What is ‘structural steel’?

Structural steel is rolled flanged shapes, having at least one dimension of their cross-section three inches or greater, which are used in the construction of bridges, buildings, ships, railroad rolling stock, and for numerous other constructional purposes. Such shapes are designated as wide-flange shapes, standard I-beams, channels, angles, tees and zees. Other shapes include H-piles, sheet piling, tie plates, cross ties, and those for other special purposes.

21) What is a ‘construction material’ for purposes of the AIS requirement?

Construction materials are those articles, materials, or supplies made primarily of iron and steel, that are permanently incorporated into the project, not including mechanical and/or electrical components, equipment and systems. Some of these products may overlap with what is also considered “structural steel”. This includes, but is not limited to, the following products: wire rod, bar, angles, concrete reinforcing bar, wire, wire cloth, wire rope and cables, tubing, framing, joists, trusses, fasteners (i.e., nuts and bolts), welding rods, decking, grating, railings, stairs, access ramps, fire escapes, ladders, wall panels, dome structures, roofing, ductwork, surface drains, cable hanging systems, manhole steps, fencing and fence tubing, guardrails, doors, and stationary screens.

22) What is not considered a ‘construction material’ for purposes of the AIS requirement?

Mechanical and electrical components, equipment and systems are not considered construction materials. Mechanical equipment is typically that which has motorized parts and/or is powered by a motor. Electrical equipment is typically any machine powered by electricity and includes components that are part of the electrical distribution system.

The following examples (including their appurtenances necessary for their intended use and operation) are NOT considered construction materials: pumps, motors, gear reducers, drives (including variable frequency drives (VFDs)), electric/pneumatic/manual accessories used to operate valves (such as electric valve actuators), mixers, gates, motorized screens (such as traveling screens), blowers/aeration equipment, compressors, meters, sensors, controls and switches, supervisory control and

data acquisition (SCADA), membrane bioreactor systems, membrane filtration systems, filters, clarifiers and clarifier mechanisms, rakes, grinders, disinfection systems, presses (including belt presses), conveyors, cranes, HVAC (excluding ductwork), water heaters, heat exchangers, generators, cabinetry and housings (such as electrical boxes/enclosures), lighting fixtures, electrical conduit, emergency life systems, metal office furniture, shelving, laboratory equipment, analytical instrumentation, and dewatering equipment.

23) If the iron or steel is produced in the US, may other steps in the manufacturing process take place outside of the US, such as assembly?

No. Production in the US of the iron or steel used in a listed product requires that all manufacturing processes must take place in the United States, except metallurgical processes involving refinement of steel additives.

24) What processes must occur in the US to be compliant with the AIS requirement for reinforced precast concrete?

While reinforced precast concrete may not be at least 50% iron or steel, in this particular case, the reinforcing bar and wire must be produced in the US and meet the same standards as for any other iron or steel product. Additionally, the casting of the concrete product must take place in the US. The cement and other raw materials used in concrete production are not required to be of domestic origin.

If the reinforced concrete is cast at the construction site, the reinforcing bar and wire are considered to be a construction material and must be produced in the US.

Compliance

25) How should an assistance recipient document compliance with the AIS requirement?

In order to ensure compliance with the AIS requirement, specific AIS contract language must be included in each contract, starting with the assistance agreement, all the way down to the purchase agreements. Sample language for assistance agreements and contracts can be found in Appendix 3 and 4.

EPA recommends the use of a step certification process, similar to one used by the Federal Highway Administration. The step certification process is a method to ensure that producers adhere to the AIS requirement and assistance recipients can verify that products comply with the AIS requirement. The process also establishes accountability and better enables States to take enforcement actions against violators.

Step certification creates a paper trail which documents the location of the manufacturing process involved with the production of steel and iron materials. A step certification is a process under which each handler (supplier, fabricator, manufacturer,

processor, etc) of the iron and steel products certifies that their step in the process was domestically performed. Each time a step in the manufacturing process takes place, the manufacturer delivers its work along with a certification of its origin. A certification can be quite simple. Typically, it includes the name of the manufacturer, the location of the manufacturing facility where the product or process took place (not its headquarters), a description of the product or item being delivered, and a signature by a manufacturer's responsible party. Attached, as Appendix 5, are sample certifications. These certifications should be collected and maintained by assistance recipients.

Alternatively, the final manufacturer that delivers the iron or steel product to the worksite, vendor, or contractor, may provide a certification asserting that all manufacturing processes occurred in the US. While this type of certification may be acceptable, it may not provide the same degree of assurance. Additional documentation may be needed if the certification is lacking important information. Step certification is the best practice.

26) How should a State ensure assistance recipients are complying with the AIS requirement?

In order to ensure compliance with the AIS requirement, States SRF programs must include specific AIS contract language in the assistance agreement. Sample language for assistance agreements can be found in Appendix 3.

States should also, as a best practice, conduct site visits of projects during construction and review documentation demonstrating proof of compliance which the assistance recipient has gathered.

27) What happens if a State or EPA finds a non-compliant iron and/or steel product permanently incorporated in the project?

If a potentially non-compliant product is identified, the State should notify the assistance recipient of the apparent unauthorized use of the non-domestic component, including a proposed corrective action, and should be given the opportunity to reply. If unauthorized use is confirmed, the State can take one or more of the following actions: request a waiver where appropriate; require the removal of the non-domestic item; or withhold payment for all or part of the project. Only EPA can issue waivers to authorize the use of a non-domestic item. EPA may use remedies available to it under the Clean Water Act, the Safe Drinking Water Act, and 40 CFR part 31 grant regulations, in the event of a violation of a grant term and condition.

It is recommended that the State work collaboratively with EPA to determine the appropriate corrective action, especially in cases where the State is the one who identifies the item in noncompliance or there is a disagreement with the assistance recipient.

If fraud, waste, abuse, or any violation of the law is suspected, the Office of Inspector General (OIG) should be contacted immediately. The OIG can be reached at 1-

888-546-8740 or OIG_Hotline@epa.gov. More information can be found at this website: <http://www.epa.gov/oig/hotline.htm>.

28) How do international trade agreements affect the implementation of the AIS requirements?

The AIS provision applies in a manner consistent with United States obligations under international agreements. Typically, these obligations only apply to direct procurement by the entities that are signatories to such agreements. In general, SRF assistance recipients are not signatories to such agreements, so these agreements have no impact on this AIS provision. In the few instances where such an agreement applies to a municipality, that municipality is under the obligation to determine its applicability and requirements and document the actions taken to comply for the State.

Waiver Process

The statute permits EPA to issue waivers for a case or category of cases where EPA finds (1) that applying these requirements would be inconsistent with the public interest; (2) iron and steel products are not produced in the US in sufficient and reasonably available quantities and of a satisfactory quality; or (3) inclusion of iron and steel products produced in the US will increase the cost of the overall project by more than 25 percent.

In order to implement the AIS requirements, EPA has developed an approach to allow for effective and efficient implementation of the waiver process to allow projects to proceed in a timely manner. The framework described below will allow States, on behalf of the assistance recipients, to apply for waivers of the AIS requirement directly to EPA Headquarters. Only waiver requests received from states will be considered. Pursuant to the Act, EPA has the responsibility to make findings as to the issuance of waivers to the AIS requirements.

Definitions

The following terms are critical to the interpretation and implementation of the AIS requirements and apply to the process described in this memorandum:

Reasonably Available Quantity: The quantity of iron or steel products is available or will be available at the time needed and place needed, and in the proper form or specification as specified in the project plans and design.

Satisfactory Quality: The quality of iron or steel products, as specified in the project plans and designs.

Assistance Recipient: A borrower or grantee that receives funding from a State CWSRF or DWSRF program.

Step-By-Step Waiver Process

Application by Assistance Recipient

Each local entity that receives SRF water infrastructure financial assistance is required by section 436 of the Act to use American made iron and steel products in the construction of its project. However, the recipient may request a waiver. Until a waiver is granted by EPA, the AIS requirement stands, except as noted above with respect to municipalities covered by international agreements.

The waiver process begins with the SRF assistance recipient. In order to fulfill the AIS requirement, the assistance recipient must in good faith design the project (where applicable) and solicit bids for construction with American made iron and steel products. It is essential that the assistance recipient include the AIS terms in any request for proposals or solicitations for bids, and in all contracts (see Appendix 3 for sample construction contract language). The assistance recipient may receive a waiver at any point before, during, or after the bid process, if one or more of three conditions is met:

1. Applying the American Iron and Steel requirements of the Act would be inconsistent with the public interest;
2. Iron and steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality; or
3. Inclusion of iron and steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

Proper and sufficient documentation must be provided by the assistance recipient. A checklist detailing the types of information required for a waiver to be processed is attached as Appendix 1.

Additionally, it is strongly encouraged that assistance recipients hold pre-bid conferences with potential bidders. A pre-bid conference can help to identify iron and steel products needed to complete the project as described in the plans and specifications that may not be available from domestic sources. It may also identify the need to seek a waiver prior to bid, and can help inform the recipient on compliance options.

In order to apply for a project waiver, the assistance recipient should email the request in the form of a Word document (.doc) to the State SRF program. It is strongly recommended that the State designate a single person for all AIS communications. The State SRF designee will review the application for the waiver and determine whether the necessary information has been included. Once the waiver application is complete, the State designee will forward the application to either of two email addresses. For CWSRF waiver requests, please send the application to: cwsrfwaiver@epa.gov. For DWSRF waiver requests, please send the application to: dwsrfwaiver@epa.gov.

Evaluation by EPA

After receiving an application for waiver of the AIS requirements, EPA Headquarters will publish the request on its website for 15 days and receive informal comment. EPA Headquarters will then use the checklist in Appendix 2 to determine whether the application properly and adequately documents and justifies the statutory basis cited for the waiver – that it is quantitatively and qualitatively sufficient – and to determine whether or not to grant the waiver.

In the event that EPA finds that adequate documentation and justification has been submitted, the Administrator may grant a waiver to the assistance recipient. EPA will notify the State designee that a waiver request has been approved or denied as soon as such a decision has been made. Granting such a waiver is a three-step process:

1. Posting – After receiving an application for a waiver, EPA is required to publish the application and all material submitted with the application on EPA’s website for 15 days. During that period, the public will have the opportunity to review the request and provide informal comment to EPA. The website can be found at: http://water.epa.gov/grants_funding/aisrequirement.cfm
2. Evaluation – After receiving an application for waiver of the AIS requirements, EPA Headquarters will use the checklist in Appendix 2 to determine whether the application properly and adequately documents and justifies the statutory basis cited for the waiver – that it is quantitatively and qualitatively sufficient – and to determine whether or not to grant the waiver.
3. Signature of waiver approval by the Administrator or another agency official with delegated authority – As soon as the waiver is signed and dated, EPA will notify the State SRF program, and post the signed waiver on our website. The assistance recipient should keep a copy of the signed waiver in its project files.

Public Interest Waivers

EPA has the authority to issue public interest waivers. Evaluation of a public interest waiver request may be more complicated than that of other waiver requests so they may take more time than other waiver requests for a decision to be made. An example of a public interest waiver that might be issued could be for a community that has standardized on a particular type or manufacturer of a valve because of its performance to meet their specifications. Switching to an alternative valve may require staff to be trained on the new equipment and additional spare parts would need to be purchased and stocked, existing valves may need to be unnecessarily replaced, and portions of the system may need to be redesigned. Therefore, requiring the community to install an alternative valve would be inconsistent with public interest.

EPA also has the authority to issue a public interest waiver that covers categories of products that might apply to all projects.

EPA reserves the right to issue national waivers that may apply to particular classes of assistance recipients, particular classes of projects, or particular categories of iron or steel products. EPA may develop national or (US geographic) regional categorical waivers through the identification of similar circumstances in the detailed justifications presented to EPA in a waiver request or requests. EPA may issue a national waiver based on policy decisions regarding the public's interest or a determination that a particular item is not produced domestically in reasonably available quantities or of a sufficient quality. In such cases, EPA may determine it is necessary to issue a national waiver.

If you have any questions concerning the contents of this memorandum, you may contact us, or have your staff contact Jordan Dorfman, Attorney-Advisor, State Revolving Fund Branch, Municipal Support Division, at dorfman.jordan@epa.gov or (202) 564-0614 or Kiri Anderer, Environmental Engineer, Infrastructure Branch, Drinking Water Protection Division, at anderer.kirsten@epa.gov or (202) 564-3134.

Attachments

Appendix 1: Information Checklist for Waiver Request

The purpose of this checklist is to help ensure that all appropriate and necessary information is submitted to EPA. EPA recommends that States review this checklist carefully and provide all appropriate information to EPA. This checklist is for informational purposes only and does not need to be included as part of a waiver application.

Items	✓	Notes
<p>General</p> <ul style="list-style-type: none"> • Waiver request includes the following information: <ul style="list-style-type: none"> — Description of the foreign and domestic construction materials — Unit of measure — Quantity — Price — Time of delivery or availability — Location of the construction project — Name and address of the proposed supplier — A detailed justification for the use of foreign construction materials • Waiver request was submitted according to the instructions in the memorandum • Assistance recipient made a good faith effort to solicit bids for domestic iron and steel products, as demonstrated by language in requests for proposals, contracts, and communications with the prime contractor 		
<p>Cost Waiver Requests</p> <ul style="list-style-type: none"> • Waiver request includes the following information: <ul style="list-style-type: none"> — Comparison of overall cost of project with domestic iron and steel products to overall cost of project with foreign iron and steel products — Relevant excerpts from the bid documents used by the contractors to complete the comparison — Supporting documentation indicating that the contractor made a reasonable survey of the market, such as a description of the process for identifying suppliers and a list of contacted suppliers 		
<p>Availability Waiver Requests</p> <ul style="list-style-type: none"> • Waiver request includes the following supporting documentation necessary to demonstrate the availability, quantity, and/or quality of the materials for which the waiver is requested: <ul style="list-style-type: none"> — Supplier information or pricing information from a reasonable number of domestic suppliers indicating availability/delivery date for construction materials — Documentation of the assistance recipient's efforts to find available domestic sources, such as a description of the process for identifying suppliers and a list of contacted suppliers. — Project schedule — Relevant excerpts from project plans, specifications, and permits indicating the required quantity and quality of construction materials • Waiver request includes a statement from the prime contractor and/or supplier confirming the non-availability of the domestic construction materials for which the waiver is sought • Has the State received other waiver requests for the materials described in this waiver request, for comparable projects? 		

Appendix 2: HQ Review Checklist for Waiver Request

Instructions: To be completed by EPA. Review all waiver requests using the questions in the checklist, and mark the appropriate box as Yes, No or N/A. Marks that fall inside the shaded boxes may be grounds for denying the waiver. If none of your review markings fall into a shaded box, the waiver is eligible for approval if it indicates that one or more of the following conditions applies to the domestic product for which the waiver is sought:

1. The iron and/or steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality.
2. The inclusion of iron and/or steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

Review Items	Yes	No	N/A	Comments
Cost Waiver Requests <ul style="list-style-type: none"> • Does the waiver request include the following information? <ul style="list-style-type: none"> – Comparison of overall cost of project with domestic iron and steel products to overall cost of project with foreign iron and steel products – Relevant excerpts from the bid documents used by the contractors to complete the comparison – A sufficient number of bid documents or pricing information from domestic sources to constitute a reasonable survey of the market • Does the Total Domestic Project exceed the Total Foreign Project Cost by more than 25%? 				
Availability Waiver Requests <ul style="list-style-type: none"> • Does the waiver request include supporting documentation sufficient to show the availability, quantity, and/or quality of the iron and/or steel product for which the waiver is requested? <ul style="list-style-type: none"> – Supplier information or other documentation indicating availability/delivery date for materials – Project schedule – Relevant excerpts from project plans, specifications, and permits indicating the required quantity and quality of materials • Does supporting documentation provide sufficient evidence that the contractors made a reasonable effort to locate domestic suppliers of materials, such as a description of the process for identifying suppliers and a list of contacted suppliers? • Based on the materials delivery/availability date indicated in the supporting documentation, will the materials be unavailable when they are needed according to the project schedule? (By item, list schedule date and domestic delivery quote date or other relevant information) • Is EPA aware of any other evidence indicating the non-availability of the materials for which the waiver is requested? Examples include: <ul style="list-style-type: none"> – Multiple waiver requests for the materials described in this waiver request, for comparable projects in the same State – Multiple waiver requests for the materials described in this waiver request, for comparable projects in other States – Correspondence with construction trade associations indicating the non-availability of the materials • Are the available domestic materials indicated in the bid documents of inadequate quality compared those required by the project plans, specifications, and/or permits? 				

Appendix 3: Example Loan Agreement Language

ALL ASSISTANCE AGREEMENT MUST HAVE A CLAUSE REQUIRING COMPLIANCE WITH THE AIS REQUIREMENT. THIS IS AN EXAMPLE OF WHAT COULD BE INCLUDED IN SRF ASSISTANCE AGREEMENTS. EPA MAKES NO CLAIMS REGARDING THE LEGALITY OF THIS CLAUSE WITH RESPECT TO STATE LAW:

Comply with all federal requirements applicable to the Loan (including those imposed by the 2014 Appropriations Act and related SRF Policy Guidelines) which the Participant understands includes, among other, requirements that all of the iron and steel products used in the Project are to be produced in the United States (“American Iron and Steel Requirement”) unless (i) the Participant has requested and obtained a waiver from the Agency pertaining to the Project or (ii) the Finance Authority has otherwise advised the Participant in writing that the American Iron and Steel Requirement is not applicable to the Project.

Comply with all record keeping and reporting requirements under the Clean Water Act/Safe Drinking Water Act, including any reports required by a Federal agency or the Finance Authority such as performance indicators of program deliverables, information on costs and project progress. The Participant understands that (i) each contract and subcontract related to the Project is subject to audit by appropriate federal and state entities and (ii) failure to comply with the Clean Water Act/Safe Drinking Water Act and this Agreement may be a default hereunder that results in a repayment of the Loan in advance of the maturity of the Bonds and/or other remedial actions.

Appendix 4: Sample Construction Contract Language

ALL CONTRACTS MUST HAVE A CLAUSE REQUIRING COMPLIANCE WITH THE AIS REQUIREMENT. THIS IS AN EXAMPLE OF WHAT COULD BE INCLUDED IN ALL CONTRACTS IN PROJECTS THAT USE SRF FUNDS. EPA MAKES NO CLAIMS REGARDING THE LEGALITY OF THIS CLAUSE WITH RESPECT TO STATE OR LOCAL LAW:

The Contractor acknowledges to and for the benefit of the City of _____ (“Purchaser”) and the _____ (the “State”) that it understands the goods and services under this Agreement are being funded with monies made available by the Clean Water State Revolving Fund and/or Drinking Water State Revolving Fund that have statutory requirements commonly known as “American Iron and Steel;” that requires all of the iron and steel products used in the project to be produced in the United States (“American Iron and Steel Requirement”) including iron and steel products provided by the Contractor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Purchaser and the State that (a) the Contractor has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirement, as may be requested by the Purchaser or the State. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Purchaser or State to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney’s fees) incurred by the Purchaser or State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State or any damages owed to the State by the Purchaser). While the Contractor has no direct contractual privity with the State, as a lender to the Purchaser for the funding of its project, the Purchaser and the Contractor agree that the State is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State.

Appendix 5: Sample Certifications

The following information is provided as a sample letter of **step** certification for AIS compliance. Documentation must be provided on company letterhead.

Date

Company Name

Company Address

City, State Zip

Subject: American Iron and Steel Step Certification for Project (XXXXXXXXXX)

I, (company representative), certify that the (melting, bending, coating, galvanizing, cutting, etc.) process for (manufacturing or fabricating) the following products and/or materials shipped or provided for the subject project is in full compliance with the American Iron and Steel requirement as mandated in EPA's State Revolving Fund Programs.

Item, Products and/or Materials:

1. XXXX
2. XXXX
3. XXXX

Such process took place at the following location:

If any of the above compliance statements change while providing material to this project we will immediately notify the prime contractor and the engineer.

Signed by company representative

The following information is provided as a sample letter of certification for AIS compliance. Documentation must be provided on company letterhead.

Date

Company Name

Company Address

City, State Zip

Subject: American Iron and Steel Certification for Project (XXXXXXXXXXXX)

I, (company representative), certify that the following products and/or materials shipped/provided to the subject project are in full compliance with the American Iron and Steel requirement as mandated in EPA's State Revolving Fund Programs.

Item, Products and/or Materials:

1. XXXX
2. XXXX
3. XXXX

Such process took place at the following location:

If any of the above compliance statements change while providing material to this project we will immediately notify the prime contractor and the engineer.

Signed by company representative

"General Decision Number: FL20210107 04/09/2021

Superseded General Decision Number: FL20200107

State: Florida

Construction Type: Heavy

County: Broward County in Florida.

HEAVY CONSTRUCTION PROJECTS (Including Sewer and Water Lines)

Note: Under Executive Order (EO) 13658, an hourly minimum wage of \$10.95 for calendar year 2021 applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least \$10.95 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2021. If this contract is covered by the EO and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must pay workers in that classification at least the wage rate determined through the conformance process set forth in 29 CFR 5.5(a)(1)(ii) (or the EO minimum wage rate, if it is higher than the conformed wage rate). The EO minimum wage rate will be adjusted annually. Please note that this EO applies to the above-mentioned types of contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but it does not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60). Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/01/2021
1	04/09/2021

* ELEC0728-006 03/01/2021

	Rates	Fringes
ELECTRICIAN.....	\$ 34.78	12.89

ENGI0487-014 07/01/2013

Rates Fringes

OPERATOR: Crane

All Tower Cranes Mobile, Rail, Climbers, Static-Mount; All Cranes with Boom Length 150 Feet & Over (With or without jib) Friction, Hydraulic, Electric or Otherwise; Cranes 150 Tons & Over; Cranes with 3 Drums (When 3rd drum is rigged for work); Gantry & Overhead Cranes; Hydraulic Cranes Over 25 Tons but not more than 50 Tons;

Hydraulic/Friction Cranes; & All Types of Flying

Cranes; Boom Truck. \$ 29.05 8.80

Cranes with Boom Length Less than 150 Feet (With or without jib); Hydraulic Cranes 25 Tons & Under, & Over 50 Tons (With Oiler);

Boom Truck. \$ 28.32 8.80

OPERATOR: Drill. \$ 25.80 8.80

OPERATOR: Oiler. \$ 22.99 8.80

IRON0272-005 10/01/2019

Rates Fringes

IRONWORKER, STRUCTURAL. \$ 25.79 13.34

LAB01652-004 05/01/2018

Rates Fringes

LABORER: Grade Checker. \$ 22.05 7.27

PAIN0365-007 08/01/2020

Rates Fringes

PAINTER: Brush, Roller and Spray. \$ 20.21 11.83

 SUFL2009-146 06/24/2009

	Rates	Fringes
CARPENTER, Includes Form Work. . .	\$ 17.00	2.51
CEMENT MASON/CONCRETE FINISHER . . .	\$ 15.00	8.64
LABORER: Common or General.	\$ 9.87	3.24
LABORER: Landscape.	\$ 7.25	0.00
LABORER: Pipelayer.	\$ 14.00	2.42
LABORER: Power Tool Operator (Hand Held Drills/Saws, Jackhammer and Power Saws Only).	\$ 10.63	2.20
OPERATOR: Asphalt Paver.	\$ 11.59	0.00
OPERATOR: Backhoe Loader Combo.	\$ 16.10	2.44
OPERATOR: Backhoe/Excavator.	\$ 18.77	1.87
OPERATOR: Bulldozer.	\$ 14.95	0.81
OPERATOR: Grader/Blade.	\$ 16.00	2.84
OPERATOR: Loader.	\$ 14.00	2.42
OPERATOR: Mechanic.	\$ 14.32	0.00
OPERATOR: Roller.	\$ 10.95	0.00
OPERATOR: Scraper.	\$ 11.00	1.74
OPERATOR: Trackhoe.	\$ 20.92	5.50
OPERATOR: Tractor.	\$ 10.54	0.00
TRUCK DRIVER, Includes Dump Truck.	\$ 9.60	0.00
TRUCK DRIVER: Lowboy Truck.	\$ 12.73	0.00
TRUCK DRIVER: Off the Road		

Truck.....\$ 12.21 1.97

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

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

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

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

Union Rate Identifiers

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

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

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

Survey Rate Identifiers

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

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

Union Average Rate Identifiers

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

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current

negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

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

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

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

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

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

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

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

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material,

etc.) that the requestor considers relevant to the issue.

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

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

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

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END OF GENERAL DECISION"

SUPPLEMENTARY CONDITIONS (EQUIPMENT/MATERIALS)

Florida Department of Environmental Protection
State Revolving Fund Program
Supplementary Conditions
for
Formally Advertised
Materials/Equipment Procurement

TABLE OF CONTENTS FOR THE FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

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*NOTE: Articles 13, 14, 15 and Appendix A only apply to Federal CAP Grant Projects.		

**FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
SUPPLEMENTARY CONDITIONS**

The intent of the Florida Department of Environmental Protection (FDEP) Supplementary Conditions is to complement and supplement other provisions of the Bidding Documents. However, if there is any conflict between the FDEP Supplementary Conditions and other provisions of the Bidding Documents, the FDEP Supplementary Conditions shall take precedence over the other provisions except when the other provisions are similar to, but more stringent than, the FDEP Supplementary Conditions. When other provisions of the Bidding Documents are similar to, but more stringent than, the FDEP Supplementary Conditions, the more stringent provisions shall apply.

ARTICLE 1 - DEFINITIONS

1.1. Wherever used in these Supplementary Conditions (except in the appendix to these Supplementary Conditions), the following terms have the meanings indicated, which are applicable to both the singular and plural thereof.

1.1.1. Addendum - A written or graphic instrument that is issued prior to the opening of bids and that clarifies, corrects, or changes the Bidding Documents.

1.1.2. Agreement or Contract - The written agreement between the Owner and the Contractor covering the furnishing of the Goods and Special Services; these Supplementary Conditions and other Contract Documents are attached to the Agreement/Contract and made a part thereof as provided therein.

1.1.3. Application for Payment - The form that is accepted by the Engineer and used by the Contractor in requesting progress and/or final payments and that is to include such supporting documentation as is required by the Contract Documents.

1.1.4. Bid - The offer or proposal of a bidder submitted on the prescribed form and setting forth the price(s) for furnishing the Goods and Special Services.

1.1.5. Bidder - Any person, firm, or corporation that submits a bid directly to the Owner.

1.1.6. Bidding Documents - The Advertisement for Bids or the Invitation to Bid, the Instructions to Bidders or the Information for Bidders, the Bid Form, the proposed Contract Documents, and all addenda.

1.1.7. Change Order - A document that is recommended by the Engineer and signed by the Contractor and the Owner; that authorizes an addition, deletion, or revision in the Goods or Special Services or an adjustment in the Contract Price or the Contract Time; and that is issued on or after the Effective Date of the Agreement/Contract.

1.1.8. Contract Documents - The Agreement/Contract; the Contractor's Bid when attached as an exhibit to the Agreement/Contract; the General Conditions; the Supplementary Conditions (including these Supplementary Conditions); the Specifications (written technical descriptions of material, equipment, standards, and workmanship as applied to the Goods and Special Services and certain administrative details applicable thereto); any Drawings (drawings that show the character and scope of the Goods to be furnished); all addenda that pertain to the Contract Documents; and all change orders.

1.1.9. Contract Price - The moneys payable by the Owner to the Contractor under the Contract Documents as stated in the Agreement/Contract.

1.1.10. Contract Time - The number of days or the date(s) stated in the Contract Documents for furnishing the Goods and Special Services.

1.1.11. Contractor - The person, firm, or corporation with whom or which the Owner enters into the Agreement/Contract.

1.1.12. Effective Date of the Agreement/Contract - The date indicated in the Agreement/Contract on which the Agreement/Contract becomes effective, or if no such date is indicated in the Agreement/Contract, the date on which the Agreement/Contract is signed and delivered by the last of the two parties to sign and deliver the Agreement/Contract.

1.1.13. Engineer - The person, firm, or corporation named as such in the Contract Documents.

1.1.14. Goods - All material, equipment, and other tangible personal property required to be furnished under the Contract Documents.

1.1.15. Minority Business Enterprise (MBE) - A historically Black college or university or a business that is (a) certified as socially and economically disadvantaged by the Small Business Administration, (b) certified as an MBE by a state or Federal agency, or (c) an independent business concern which is at least 51-percent owned and controlled by minority group members. (A minority group member is an individual who is a citizen of the United States and one of the following: [i] Black American; [ii] Hispanic American [with origins from Puerto Rico, Mexico, Cuba, or South or Central America]; [iii] Native American [American Indian, Eskimo, Aleut, or native Hawaiian]; or [iv] Asian-Pacific American [with origins from Japan, China, the Philippines, Vietnam, Korea, Samoa, Guam, the U.S. Trust Territories of the Pacific, Northern Marianas, Laos, Cambodia, Taiwan, or the Indian Subcontinent].)

1.1.16. Owner - The local government (municipality, county, district, or authority; or any agency thereof; or a combination of two or more of the foregoing acting jointly) with which the Florida Department of Environmental Protection may execute, or has executed, a State revolving fund loan agreement and to which the Goods and Special Services are to be furnished.

1.1.17. Project - The total construction or facilities described in a State revolving fund loan agreement between the Florida Department of Environmental Protection and the Owner, of which the Goods and Special Services to be furnished under the Contract Documents may be the whole or a part.

1.1.18. Special Services - All field services to be furnished by the Contractor as required by the Contract Documents.

1.1.19. Subcontract - A direct contract between a subcontractor and the Contractor, or any other subcontractor at any tier, for the furnishing of any of the Goods or Special Services required by the Contract Documents.

1.1.20. Subcontractor - A person, firm, or corporation having a direct contract with the Contractor, or any other subcontractor at any tier, for the furnishing of any of the Goods or Special Services required by the Contract Documents.

1.1.21. Successful Bidder - The lowest responsive, responsible bidder to whom or which the Owner intends to award the Agreement/Contract.

1.1.22. Women's Business Enterprise (WBE) - A business that is (a) certified as a WBE by a state or Federal agency or (b) an independent business concern which is at least 51-percent owned and controlled/operated by women. (Determination of whether a business is at least 51-percent owned by women shall be made without regard to community property laws [e.g., an otherwise qualified WBE that is 51-percent owned by a married woman in a community property state will not be disqualified because the married woman's husband has a 50-percent interest in the married woman's share of the business; similarly, a business that is 51-percent owned by a married man and 49-percent owned by women will not become a qualified WBE by virtue of the married man's wife having a 50-percent interest in the married man's share of the business].)

ARTICLE 2 - PRIVACY OF AGREEMENT/CONTRACT

2.1. The Owner expects to finance this Agreement/Contract with assistance from the Florida Department of Environmental Protection, which administers a State revolving fund loan program supported in part with funds directly made available by grants from the United States Environmental Protection Agency. Neither the State of Florida nor the United States (nor any of their departments, agencies, or employees) will be a party to this Agreement/Contract or any lower-tier subcontract.

ARTICLE 3 - PROCUREMENT REQUIREMENTS

3.1. This Agreement/Contract and the Owner's solicitation and award of this Agreement/Contract are subject to requirements contained in Chapter 62-503 (Clean Water State Revolving Fund Loan Program) or Chapter 62-552 (Drinking Water State Revolving Fund Loan Program), Florida Administrative Code as applicable.

ARTICLE 4 - RESOLUTION OF PROTESTS AND CLAIMS/DISPUTES

Resolution of Protests Concerning the Owner's Solicitation and/or Award of this Agreement/Contract:

4.1. Protests concerning the Owner's solicitation and/or award of this Agreement/Contract must be filed in writing with the Owner to be considered.

4.2. All timely written protests concerning the Owner's solicitation and/or award of this Agreement/Contract are to be resolved in accordance with the Owner's dispute resolution process. A copy of the ordinance(s), resolution(s), or written policy (policies) that set forth the Owner's dispute resolution process is included elsewhere in the Bidding Documents or is to be made available by the Owner upon request.

4.3. Neither the Florida Department of Environmental Protection (FDEP) nor the United States Environmental Protection Agency (USEPA) will become a party to, or have any role in resolving, protests concerning the Owner's solicitation and/or award of this Agreement/Contract. Protest decisions made by the Owner can not be appealed to the FDEP or the USEPA.

Resolution of Claims and Disputes between the Owner and the Contractor:

4.4. Unless otherwise provided in the Contract Documents, all claims and disputes between the Owner and the Contractor arising out of, or relating to, the Contract Documents or the breach thereof are to be decided by arbitration (if the Owner and the Contractor mutually agree) or in a court of competent jurisdiction within the State of Florida.

4.5. Neither the Florida Department of Environmental Protection nor the United States Environmental Protection Agency will become a party to, or have any role in resolving, claims and disputes between the Owner and the Contractor.

ARTICLE 5 - CHANGES TO THE BIDDING AND CONTRACT DOCUMENTS

5.1. All changes to the Bidding Documents made subsequent to the Florida Department of Environmental Protection's (FDEP's) acceptance of the Bidding Documents and prior to the opening of bids are to be documented via addendum (addenda) to the Bidding Documents; all changes to the Contract Documents made after the opening of bids are to be documented by change order(s) to the Contract Documents. The Owner shall submit all addenda and change orders to the FDEP.

ARTICLE 6 - ADVERTISEMENT FOR BIDS; SUBMISSION OF BIDS; OPENING OF BIDS

Advertisement for Bids:

6.1. At a minimum, this Agreement/Contract is to be advertised for bids in local and statewide newspapers.

Submission of Bids:

6.2. Bidders shall submit their bids at the place and by the deadline indicated elsewhere in the Bidding Documents.

Opening of Bids:

6.3. Bids are to be opened and read aloud publicly at the time and place indicated elsewhere in the Bidding Documents.

ARTICLE 7 - AWARD OF AGREEMENT/CONTRACT

7.1. If this Agreement/Contract is awarded, it is to be awarded to the lowest responsive, responsible bidder. A fixed-price (lump-sum or unit-price or both) agreement/contract is to be used. A clear explanation of the method of evaluating bids and the basis for awarding this Agreement/Contract are included elsewhere in the Bidding Documents. All bids may be rejected when in the best interest of the Owner.

ARTICLE 8 - CONTRACT TIME

8.1. The number of days within which, or the date(s) by which, the Goods and Special Services are to be furnished and ready for final payment (the Contract Time) is set forth elsewhere in the Contract Documents. Unless otherwise provided in the Contract Documents, the Contract Time will commence to run on the Effective Date of this Agreement/Contract.

ARTICLE 9 - PROGRESS AND PAYMENT SCHEDULES

9.1. The Contractor shall submit progress and payment schedules to the Owner within ten calendar days after the Effective Date of this Agreement/Contract.

9.1.1. The progress schedule is to indicate the Contractor's estimated dates for furnishing the various Goods and Special Services and is to show both the projected cost of Goods and Special Services furnished and the projected percentage of Goods and Special Services furnished versus Contract Time.

9.1.2. The payment schedule is to show the Contractor's projected progress and/or final payment(s) cumulatively by month.

ARTICLE 10 - INSURANCE

10.1. Unless otherwise provided in the Contract Documents, the Contractor shall assume all risk of loss or damage to the Goods prior to the Owner's acceptance of delivery of the Goods and shall purchase and maintain, during fabrication and/or delivery of the Goods, such property insurance upon the Goods as the Owner requires or as the Contractor deems appropriate, whichever is greater.

10.2. Unless otherwise provided in the Contract Documents, the Owner shall assume all risk of loss or damage to the Goods after it accepts delivery of the Goods. After assuming all risk of loss or damage to the Goods, the Owner shall purchase and maintain property insurance upon the Goods. This insurance is to be in the amount recommended by a competent insurance counselor and is to insure against such risks as are customarily insured against in connection with the storage or operation of like goods (to the extent that such insurance is obtainable from time to time against any one or more such risks). In addition, this insurance is to be obtained from responsible insurance companies licensed to do business in the State of Florida.

ARTICLE 11 - APPLICATION(S) FOR PAYMENT

11.1. The Contractor's application(s) for payment are to be accompanied by such certificates or documents as may be reasonably required. The Owner shall forward a copy of such certificates or documents as may be reasonably required to the Florida Department of Environmental Protection.

ARTICLE 12 - ACCESS TO RECORDS

12.1. Authorized representatives of the Owner, the Florida Department of Environmental Protection, and the United States Environmental Protection Agency shall have access to, for the purpose of inspection, any books, documents, papers, and records of the Contractor that are pertinent to this Agreement/Contract. The Contractor shall retain all books, documents, papers, and records pertinent to this Agreement/Contract for a period of five years after receiving and accepting final payment under this Agreement/Contract.

NOTE: Articles 13, 14, and 15 only apply to Federal CAP Grant Projects.

ARTICLE 13 - MINORITY AND WOMEN'S BUSINESS ENTERPRISES

13.1. A goal of _____* percent of the Contract Price is established for Minority Business Enterprise (MBE) participation in the furnishing of the Goods and Special Services, and a goal of _____* percent of the Contract Price is established for Women's Business Enterprise (WBE) participation in the furnishing of the Goods and Special Services. If bidders or prospective contractors (including the Contractor) intend to let any lower-tier subcontracts for any portion of the furnishing of the Goods and Special Services, they shall physically include these percentage goals for MBE and WBE participation in all solicitations for subcontracts and shall take affirmative steps to assure that MBEs and WBEs are utilized, when possible, as sources of the Goods and Special Services. Affirmative steps are to include the following: (a) including small, minority, and women's businesses on solicitation lists; (b) assuring

that small, minority, and women's businesses are solicited whenever they are potential sources; (c) dividing total requirements, when economically feasible, into small tasks or quantities to permit maximum participation by small, minority, and women's businesses; (d) establishing delivery schedules, when requirements permit, that will encourage participation by small, minority, and women's businesses; and (e) using the services of the Small Business Administration and the Office of Minority Business Enterprise of the United States Department of Commerce as appropriate.

*The percentage goals for MBE and WBE participation are to be inserted by the Owner and are to be based upon the percentage goals that have been, or will be, stipulated in the State revolving fund loan agreement for the Owner's FDEP-assisted Project.

13.2. Within ten calendar days after being notified of being the apparent Successful Bidder, the apparent Successful Bidder shall submit to the Owner documentation of the affirmative steps it has taken to utilize Minority and Women's Business Enterprises (MBEs and WBEs) in the furnishing of the Goods and Special Services and documentation of its intended use of MBEs and WBEs in the furnishing of the Goods and Special Services. The Owner shall keep this documentation on file and shall forward to the Florida Department of Environmental Protection a copy of the apparent Successful Bidder's documentation concerning its intended use of MBEs and WBEs in the furnishing of the Goods and Special Services.

13.3. Minority and Women's Business Enterprise (MBE and WBE) participation in the furnishing of the Goods and Special Services is to be considered in the award of this Agreement/Contract. The Owner shall not execute this Agreement/Contract until the Florida Department of Environmental Protection has approved the extent of MBE and WBE participation in the furnishing of the Goods and Special Services.

ARTICLE 14 - VIOLATING FACILITIES (SECTION 306 OF THE CLEAN AIR ACT, SECTION 508 OF THE CLEAN WATER ACT, AND EXECUTIVE ORDER 11738)

14.1. The Contractor, and all subcontractors at any tier, shall comply with all applicable standards, orders, or requirements issued under Section 306 of the Clean Air Act (42 U.S.C. 1857[h]), Section 508 of the Clean Water Act (33 U.S.C. 1368), Executive Order 11738 (Administration of the Clean Air Act and the Federal Water Pollution Control Act with Respect to Federal Contracts, Grants, or Loans), and 40 CFR Part 15, which prohibit the use, under nonexempt Federal contracts, grants, or loans, of facilities included on the United States Environmental Protection Agency's List of Violating Facilities.

14.2. In accordance with 40 CFR Part 15, if the price of this Agreement/Contract exceeds \$100,000 and/or if this Agreement/Contract is otherwise nonexempt from 40 CFR Part 15, the Contractor agrees to the following:

14.2.1. the Contractor will not use any facility on the United States Environmental Protection Agency's List of Violating Facilities in the performance of this Agreement/Contract for the duration of time that the facility remains on the List;

14.2.2. the Contractor will notify the Florida Department of Environmental Protection/United States Environmental Protection Agency (USEPA) if a facility it intends to use in the performance of this Agreement/Contract is on the USEPA's List of Violating Facilities or if it knows that a

facility it intends to use in the performance of this Agreement/Contract has been recommended to be placed on the USEPA's List of Violating Facilities; and

14.2.3. in the performance of this Agreement/Contract, the Contractor will comply with all requirements of the Clean Air Act and the Clean Water Act, including the requirements of Section 114 of the Clean Air Act and Section 308 of the Clean Water Act, and all applicable clean air standards and clean water standards.

14.3. If the Contractor, or any subcontractor at any tier, awards any lower-tier subcontracts for any portion of the Goods or Special Services, it shall physically include in all such subcontracts the following provision:

14.3.1. The Subcontractor shall comply with all applicable standards, orders, or requirements issued under Section 306 of the Clean Air Act (42 U.S.C. 1857[h]), Section 508 of the Clean Water Act (33 U.S.C. 1368), Executive Order 11738 (Administration of the Clean Air Act and the Federal Water Pollution Control Act with Respect to Federal Contracts, Grants, or Loans), and 40 CFR Part 15, which prohibit the use, under nonexempt Federal contracts, grants, or loans, of facilities included on the United States Environmental Protection Agency's (USEPA's) List of Violating Facilities. In accordance with 40 CFR Part 15, if the price of this Subcontract exceeds \$100,000 and/or if this Subcontract is otherwise nonexempt from 40 CFR Part 15, the Subcontractor agrees to the following: (a) the Subcontractor will not use any facility on the USEPA's List of Violating Facilities in the performance of this Subcontract for the duration of time that the facility remains on the List; (b) the Subcontractor will notify the Florida Department of Environmental Protection/USEPA if a facility it intends to use in the performance of this Subcontract is on the USEPA's List of Violating Facilities or if it knows that a facility it intends to use in the performance of this Subcontract has been recommended to be placed on the USEPA's List of Violating Facilities; and (c) in the performance of this Subcontract, the Subcontractor will comply with all requirements of the Clean Air Act and the Clean Water Act, including the requirements of Section 114 of the Clean Air Act and Section 308 of the Clean Water Act, and all applicable clean air standards and clean water standards. In addition, if the Subcontractor awards any lower-tier goods or special services subcontracts under this Subcontract, the Subcontractor shall physically include this provision in all such subcontracts.

ARTICLE 15 - DEBARMENT AND SUSPENSION (EXECUTIVE ORDER 12549)

15.1. If the price of this Agreement/Contract equals or exceeds \$25,000, the Owner shall not award this Agreement/Contract, nor permit any lower-tier goods or special services subcontract with a price equaling or exceeding \$25,000 to be awarded, to any party that is debarred or suspended or is otherwise excluded from, or ineligible for participation in, Federal assistance programs under Executive Order 12549 (Debarment and Suspension).

15.2. The attention of all bidders or prospective contractors (including the Contractor) is directed to the certification/clause entitled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions", which has been extracted from Appendix B to 40 CFR Part 32 and included as Appendix A to these Supplementary Conditions. The certification/clause entitled "Certification Regarding Debarment, Suspension, Ineligibility and

Voluntary Exclusion - Lower Tier Covered Transactions" is applicable to this Agreement/Contract if the price of this Agreement/Contract equals or exceeds \$25,000.

15.3. If bidders or prospective contractors (including the Contractor), or any prospective subcontractors at any tier, intend to let any lower-tier subcontracts for any portion of the Goods or Special Services, they shall physically include the certification/clause entitled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions", which is included as Appendix A to these Supplementary Conditions, in all lower-tier goods and special services subcontracts with a price equaling or exceeding \$25,000 and in all solicitations for such subcontracts.

ARTICLE 16 – AMERICAN IRON AND STEEL PROVISION

Contracts being constructed with assistance from the State Revolving Fund Program are currently required to comply with the American Iron and Steel Provision provisions as provided in Appendix B.

ARTICLE 17 - PROHIBITED LOCAL GOVERNMENT CONSTRUCTION PREFERENCES

- A. Pursuant to Section 255.0991, F.S., for a competitive solicitation for construction services in which 50 percent or more of the cost will be paid from state-appropriated funds which have been appropriated at the time of the competitive solicitation, a state, college, county, municipality, school district, or other political subdivision of the state may not use a local ordinance or regulation that provides a preference based upon:
1. The contractor's maintaining an office or place of business within a particular local jurisdiction;
 2. The contractor's hiring employees or subcontractors from within a particular local jurisdiction; or
 3. The contractor's prior payment of local taxes, assessments, or duties within a particular local jurisdiction.
- B. For any competitive solicitation that meets the criteria in Paragraph A., a state college, county, municipality, school district, or other political subdivision of the state shall disclose in the solicitation document that any applicable local ordinance or regulation does not include any preference that is prohibited by Paragraph A.

APPENDIX A TO THE FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION SUPPLEMENTARY CONDITIONS

CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION - LOWER TIER COVERED TRANSACTIONS

[Note: This certification/clause has been extracted from Appendix B to 40 CFR Part 32 and is applicable to all FDEP-assisted goods and services (including construction) contracts and subcontracts with a price equaling or exceeding \$25,000; this certification/clause is to be included in all FDEP-assisted goods and services (including construction) contracts and subcontracts with a price equaling or exceeding \$25,000 and in all solicitations for such contracts and subcontracts.]

Instructions for Certification

1. By signing and submitting this proposal, the prospective lower tier participant is providing the certification set out below.
2. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.
3. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.
4. The terms "covered transaction", "debarred", "suspended", "ineligible", "lower tier covered transaction", "participant", "person", "primary covered transaction", "principal", "proposal", and "voluntarily excluded", as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations.
5. The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.
6. The prospective lower tier participant further agrees by submitting this proposal that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions", without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.
7. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that it is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the Non-procurement List.

8. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of a participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

9. Except for transactions authorized under paragraph 5 of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions

(1) The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.

(2) Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

(3) The prospective lower-tier participant also certifies that it and its principals:

(a) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State anti-trust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(b) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (3)(a) of this certification; and

(c) Have not within a three-year period preceding this proposal had one or more public transactions (Federal, State or local) terminated for cause or default. Where the prospective lower-tier participant is unable to certify to any of the above, such prospective participant shall attach an explanation to this proposal.

**APPENDIX B TO THE FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
SUPPLEMENTARY CONDITIONS
AMERICAN IRON AND STEEL PROVISION**

The Contractor acknowledges to and for the benefit of _____ (“Owner”) and the State of Florida (the “State”) that it understands that iron and steel products to be installed as a part of this contract must be in compliance with the Federal American Iron Steel (AIS) requirements. For Clean Water SRF funded projects, the AIS requirements can be found in Section 608 of the Federal Water Pollution Control Act (Clean Water Act). Section 608 of the Clean Water Act (33 U.S.C. 1388) includes the following language:

(a) In general

Funds made available from a State water pollution control revolving fund established under this title may not be used for a project for the construction, alteration, maintenance, or repair of treatment works unless all of the iron and steel products used in the project are produced in the United States.

(b) Definition of iron and steel products

In this section, the term "iron and steel products" means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials.

(c) Application

Subsection (a) shall not apply in any case or category of cases in which the Administrator finds that—

- (1) applying subsection (a) would be inconsistent with the public interest;
- (2) iron and steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality; or
- (3) inclusion of iron and steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

(d) Waiver

If the Administrator receives a request for a waiver under this section, the Administrator shall make available to the public, on an informal basis, a copy of the request and information available to the Administrator concerning the request, and shall allow for informal public input on the request for at least 15 days prior to making a finding based on the request. The Administrator shall make the request and accompanying information available by electronic means, including on the official public Internet site of the Environmental Protection Agency.

(e) International agreements

This section shall be applied in a manner consistent with United States obligations under international agreements.

For Drinking Water SRF funded projects, the AIS requirements are in Public Law 113-76 and continue in force under continuing resolutions that use similar language, including Section 424 of the "Consolidated Appropriations Act, 2016."

Notwithstanding any other provision of this Agreement, any failure to comply with AIS requirements by the Contractor shall permit the Purchaser or State to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney’s fees) incurred by the Purchaser or State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State or any damages owed to the State by the Purchaser). While the Contractor has no direct contractual privity with the State, as a lender to the Purchaser for the funding of its project, the Purchaser and the Contractor agree that the State is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State.

For waivers to these requirements based on (c) above, contact the State Revolving Fund Program at (850) 245-2835 or SRF_Reporting@dep.state.fl.us.

I certify that the equipment provided under this contract meets the above requirements.

Name of Equipment Supplier

Date

Name of Authorized Official (printed or typed)

Title

Signature of Authorized Official

SUPPLEMENTARY CONDITIONS (CONSTRUCTION)

Florida Department of Environmental Protection
State Revolving Fund Program
Supplementary Conditions
for

Formally Advertised
Construction Procurement

Revised October 2017

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ENVIRONMENTAL PROTECTION
SUPPLEMENTARY CONDITIONS**

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FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION SUPPLEMENTARY CONDITIONS

The intent of the Florida Department of Environmental Protection (FDEP) Supplementary Conditions is to complement and supplement other provisions of the Bidding Documents. However, if there is any conflict between the FDEP Supplementary Conditions and other provisions of the Bidding Documents, the FDEP Supplementary Conditions shall take precedence over the other provisions except when the other provisions are similar to, but more stringent than, the FDEP Supplementary Conditions. When other provisions of the Bidding Documents are similar to, but more stringent than, the FDEP Supplementary Conditions, the more stringent provisions shall apply.

ARTICLE 1 - DEFINITIONS

Wherever used in these Supplementary Conditions (except in the appendices to these Supplementary Conditions), the following terms have the meanings indicated, which are applicable to both the singular and plural thereof.

- 1.1 Addendum - A written or graphic instrument that is issued prior to the opening of bids and that clarifies, corrects, or changes the Bidding Documents.
- 1.2 Agreement or Contract - The written agreement between the Owner and the Contractor covering the Work to be performed and furnished; these Supplementary Conditions and other Contract Documents are attached to the Agreement/Contract and made a part thereof as provided therein.
- 1.3 Bid - The offer or proposal of a bidder submitted on the prescribed form and setting forth the price(s) for the Work to be performed and furnished.
- 1.4 Bidder - Any person, firm, or corporation that submits a bid directly to the Owner.
- 1.5 Bidding Documents - The Advertisement for Bids or the Invitation to Bid, the Instructions to Bidders or the Information for Bidders, the Bid Form, the proposed Contract Documents, and all addenda.
- 1.6 Bond - An instrument of security.
- 1.7 Change Order - A document that is recommended by the Engineer and signed by the Contractor and the Owner; that authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Time; and that is issued on or after the Effective Date of the Agreement/Contract.
- 1.8 Contract Documents - The Agreement/Contract; the Contractor's Bid when attached as an exhibit to the Agreement/Contract; the Performance and Payment Bond(s); the General Conditions; the Supplementary Conditions (including these Supplementary Conditions); the Specifications (written technical descriptions of material, equipment, construction systems, standards, and workmanship as applied to the Work and certain administrative details applicable thereto); the Drawings (drawings that show the character and scope of the Work to be performed and furnished); all addenda that pertain to the Contract Documents; and all change orders.
- 1.9 Contract Time - The number of days or the date stated in the Contract Documents for completion of the Work.
- 1.10 Contractor - The person, firm, or corporation with whom or which the Owner enters into the Agreement/Contract.
- 1.11 Effective Date of the Agreement/Contract - The date indicated in the Agreement/Contract on which the Agreement/Contract becomes effective, or if no such date is indicated in the Agreement/Contract, the date on which the Agreement/Contract is signed and delivered by the last of the two parties to sign and deliver the Agreement/Contract.
- 1.12 Engineer - The person, firm, or corporation named as such in the Contract Documents.
- 1.13 Minority Business Enterprise (MBE) - A historically Black college or university or a business that is (a) certified as socially and economically disadvantaged by the Small Business Administration, (b) certified as an MBE by a state or federal agency, or (c) an independent business concern which is at least 51-percent owned and controlled by minority group members. (A minority group member is an individual who is a citizen of the United States and one of the following: [i] Black American; [ii] Hispanic American [with origins from Puerto Rico, Mexico, Cuba, or South or Central America]; [iii] Native American [American Indian, Eskimo, Aleut, or native Hawaiian]; or [iv] Asian-Pacific American

[with origins from Japan, China, the Philippines, Vietnam, Korea, Samoa, Guam, the U.S. Trust Territories of the Pacific, Northern Marianas, Laos, Cambodia, Taiwan, or the Indian Subcontinent].)

1.14 Notice to Proceed -The written notice given by the Owner to the Contractor fixing the date on which the Contract Time will commence to run and on which the Contractor shall start to perform its obligations under the Contract Documents.

1.15 Owner - The local government (municipality, county, district, or authority; or any agency thereof; or a combination of two or more of the foregoing acting jointly) with which the Florida Department of Environmental Protection (FDEP) may execute, or has executed, a State Revolving Fund loan agreement and for which the Work is to be provided.

1.16 Project - The total construction or facilities described in a State Revolving Fund loan agreement between the FDEP and the Owner, of which the Work to be provided under the Contract Documents may be the whole or a part.

1.17 Sponsor – The recipient of the State Revolving Fund loan agreement that provides funds for the project.

1.18 Subcontract - A direct contract between a subcontractor and the Contractor, or any other subcontractor at any tier, for the furnishing of goods (material and equipment) or the performance of services (including construction) necessary to complete the Work.

1.19 Subcontractor - A person, firm, or corporation having a direct contract with the Contractor, or any other subcontractor at any tier, for the furnishing of goods (material and equipment) or the performance of services (including construction) necessary to complete the Work.

1.20 Successful Bidder - The lowest responsive, responsible bidder to whom or which the Owner intends to award the Agreement/Contract.

1.21 Women's Business Enterprise (WBE) - A business that is (a) certified as a WBE by a state or federal agency or (b) an independent business concern which is at least 51-percent owned and controlled/operated by women. (Determination of whether a business is at least 51-percent owned by women shall be made without regard to community property laws [e.g., an otherwise qualified WBE that is 51-percent owned by a married woman in a community property state will not be disqualified because the married woman's husband has a 50-percent interest in the married woman's share of the business; similarly, a business that is 51-percent owned by a married man and 49-percent owned by women will not become a qualified WBE by virtue of the married man's wife having a 50-percent interest in the married man's share of the business].)

1.22 Work - The entire completed construction or the various separately identifiable parts thereof required to be performed and furnished under the Contract Documents; Work is the result of performing services, furnishing labor, furnishing material and equipment, and incorporating material and equipment into the construction as required by the Contract Documents.

ARTICLE 2 - PRIVACY OF AGREEMENT/CONTRACT

2.1. The Owner expects to finance this Agreement/Contract with assistance from the FDEP, which administers a State Revolving Fund loan program supported in part with funds directly made available by grants from the United States Environmental Protection Agency (USEPA). Neither the State of Florida nor the United States (nor any of their departments, agencies, or employees) will be a party to this Agreement/Contract or any lower-tier subcontract.

ARTICLE 3 - PROCUREMENT REQUIREMENTS

3.1. This Agreement/Contract and the Owner's solicitation and award of this Agreement/Contract are subject to requirements contained in Chapter 62-503 (Revolving Loan Program) and/or Chapter 62-552, Florida Administrative Code as applicable.

ARTICLE 4 - RESOLUTION OF PROTESTS AND CLAIMS/DISPUTES

Resolution of Protests Concerning the Owner's Solicitation and/or Award of this Agreement/Contract:

4.1. Protests concerning the Owner's solicitation and/or award of this Agreement/Contract must be filed in writing with the Owner to be considered.

4.2. All timely written protests concerning the Owner's solicitation and/or award of this Agreement/Contract are to be resolved in accordance with the Owner's dispute resolution process. A copy of the ordinance(s), resolution(s), or written policy (policies) that set forth the Owner's dispute resolution process is included elsewhere in the Bidding Documents or is to be made available by the Owner upon request.

4.3. Neither the (FDEP) nor the USEPA will become a party to, or have any role in resolving, protests concerning the Owner's solicitation and/or award of this Agreement/Contract. Protest decisions made by the Owner cannot be appealed to the FDEP or the USEPA.

Resolution of Claims and Disputes Between the Owner and the Contractor:

4.4. Unless otherwise provided in the Contract Documents, all claims and disputes between the Owner and the Contractor arising out of, or relating to, the Contract Documents or the breach thereof are to be decided by arbitration (if the Owner and the Contractor mutually agree) or in a court of competent jurisdiction within the State of Florida.

4.5. Neither the FDEP nor the USEPA will become a party to, or have any role in resolving, claims and disputes between the Owner and the Contractor.

ARTICLE 5 - CHANGES TO THE BIDDING AND CONTRACT DOCUMENTS

5.1. All changes to the Bidding Documents made subsequent to the FDEP's acceptance of the Bidding Documents and prior to the opening of bids are to be documented via addendum (addenda) to the Bidding Documents; all changes to the Contract Documents made after the opening of bids are to be documented by change order(s) to the Contract Documents. The Owner shall submit all addenda and change orders to the FDEP.

ARTICLE 6 - BONDS AND INSURANCE

Bid Guarantees:

6.1. Each bidder's bid is to be accompanied by a bid guarantee made payable to the Owner in an amount at least equal to five percent of the bidder's maximum bid price and in the form of a certified check or bid bond.

Performance and Payment Bond(s):

6.2. The Contractor shall furnish a combined performance and payment bond in an amount at least equal to 100 percent of the Contract Price (or, if required elsewhere in the Contract Documents, the Contractor shall furnish separate performance and payment bonds, each in an amount at least equal to 100 percent of the Contract Price) as security for the faithful performance and payment of all the Contractor's obligations under the Contract Documents. This(these) bond(s) are to be delivered to the Owner by the Contractor along with the executed Agreement/Contract. The Owner shall forward a copy of this (these) bond(s) to the FDEP.

Insurance:

6.3. The Owner and/or the Contractor (as required elsewhere in the Contract Documents) shall purchase and maintain, during the period of construction, such liability insurance as is appropriate for the Work being performed and furnished and as will provide protection from claims that may arise out of, or result from, the Contractor's performance and furnishing of the Work (whether the Work is to be performed or furnished by the Contractor or any subcontractor at the Work site) and the Contractor's other obligations under the Contract Documents. This insurance is to include workers' compensation insurance, comprehensive general liability insurance, comprehensive automobile liability insurance, and contractual liability insurance applicable to the Contractor's indemnification obligations and is to be written for not less than the limits of liability and coverages determined by the Owner or required by law, whichever is greater.

6.4. The Owner and/or the Contractor (as required elsewhere in the Contract Documents) shall purchase and maintain, during the period of construction, property insurance upon the Work at the Work site in an amount equal to the full replacement cost of the Work or the full insurable value of the Work. This insurance is to include the interests of the Owner, the Contractor, and all subcontractors at the Work site (all of whom are to be listed as insured or additional insured parties); is to insure against the perils of fire and extended coverage; and is to include "all-risk" insurance for physical loss or damage due to theft, vandalism and malicious mischief, collapse, water damage, and/or all other risks against which coverage is obtainable.

6.5. Before any Work at the Work site is started, the Contractor shall deliver to the Owner certificates of insurance that the Contractor is required to purchase and maintain in accordance with Paragraphs 6.3 and 6.4 of this Article and other provisions of the Contract Documents, and the Owner shall deliver to the Contractor certificates of insurance that the Owner is required to purchase and maintain in accordance with Paragraphs 6.3 and 6.4 of this Article and other provisions of the Contract Documents.

ARTICLE 7 - AWARD OF AGREEMENT/CONTRACT

7.1. If this Agreement/Contract is awarded, it is to be awarded to the lowest responsive, responsible bidder. A fixed price (lump sum or unit price or both) agreement/contract is to be used. A clear explanation of the method of evaluating bids and the basis for awarding this Agreement/Contract are included elsewhere in the Bidding Documents. All bids may be rejected when in the best interest of the Owner. After the contract has been awarded, the Owner shall give the Contractor a notice to proceed fixing the date on which the Contract Time will commence to run. The Owner shall forward a copy of this notice to proceed to the FDEP.

ARTICLE 8 - ITEMIZED CONSTRUCTION COST BREAKDOWN; CONSTRUCTION AND PAYMENT SCHEDULES

8.1. The Contractor shall submit to the Owner, within ten calendar days after the Effective Date of this Agreement/Contract, an itemized construction cost breakdown and construction and payment schedules.

8.1.1. The itemized construction cost breakdown, or schedule of values, is to include quantities and prices of items aggregating the Contract Price and is to subdivide the Work into component parts in sufficient detail to serve as the basis for progress payments during construction. Such prices are to include an appropriate amount of overhead and profit applicable to each item of Work.

8.1.2. The construction, or progress, schedule is to indicate the Contractor's estimated starting and completion dates for the various stages of the Work and is to show both the projected cost of Work completed and the projected percentage of Work completed versus Contract Time.

8.1.3. The payment schedule is to show the Contractor's projected payments cumulatively by month.

ARTICLE 9 – FDEP/USEPA ACCESS TO RECORDS AND PROJECT SITE

9.1. Authorized representatives of the Owner, the FDEP, and the USEPA shall have access to, for the purpose of inspection, the Work site(s), any books, documents, papers, and records of the Contractor that are pertinent to this Agreement/Contract at any reasonable time. The Contractor shall retain all books, documents, papers, and records pertinent to this Agreement/Contract for a period of five years after receiving and accepting final payment under this Agreement/Contract.

NOTE: ARTICLE 10 ONLY APPLIES TO FEDERAL CAP GRANT PROJECTS

ARTICLE 10 - DISADVANTAGED BUSINESS ENTERPRISES

10.1 A goal of five percent of the Contract Price is established for Minority Business Enterprise (MBE) participation in the Work, and a goal of five percent of the Contract Price is established for Women's Business Enterprise (WBE) participation in the Work. If bidders or prospective contractors (including the Contractor) intend to let any lower-tier goods

or services (including construction) subcontracts for any portion of the Work, they shall physically include these percentage goals for MBE and WBE participation in all solicitations for subcontracts and shall take good faith efforts to assure that MBEs and WBEs are utilized, when possible, as sources of goods and services. Good faith efforts are to include the following:

10.1.1. Require Disadvantaged Business Enterprises (DBEs) are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities. For Indian Tribal, State and Local and Government recipients, this will include placing DBEs on solicitation lists and soliciting them whenever they are potential sources.

10.1.2. Make information on forthcoming opportunities available to DBEs and arrange time frames for contracts and establish delivery schedules, where the requirements permit, in a way that encourages and facilitates participation by DBEs in the competitive process. This includes, whenever possible, posting solicitations for bids or proposals for a minimum of 30 calendar days before the bid or proposal closing date.

10.1.3. Consider in the contracting process whether firms competing for large contracts could subcontract with DBEs. For Indian Tribal, State and local Government recipients, this will include dividing total requirements when economically feasible into smaller tasks or quantities to permit maximum participation by DBEs in the competitive process.

10.1.4. Encourage contracting with a consortium of DBEs when a contract is too large for one of these firms to handle individually.

10.1.5. Use the services and assistance of the Small Business Administration and the Minority Business Development Agency of the Department of Commerce.

10.1.6. If the prime contractor awards subcontracts, require the prime contractor to take the steps in paragraphs 10.1.1 through 10.1.5 of this section.

10.2. Within ten calendar days after being notified of being the apparent Successful Bidder, the apparent Successful Bidder shall submit to the Owner documentation of the affirmative steps it has taken to utilize Minority and Women's Business Enterprises (MBEs and WBEs) in the Work and documentation of its intended use of MBEs and WBEs in the Work. The Owner shall keep this documentation on file and shall forward to the FDEP a copy of the apparent Successful Bidder's documentation concerning its intended use of MBEs and WBEs in the Work.

ARTICLE 11 - DEBARMENT AND SUSPENSION (EXECUTIVE ORDER 12549)

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions

11.1. The bidder certifies, by submission of this proposal, that neither the bidder nor its principals, nor the bidder's subcontractors nor their principals, are presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any federal department or agency.

11.2. Where the bidder is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

11.3. The bidder also certifies that it and its principals and the bidder's subcontractors and their principals:

11.3.1. Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (federal, state or local) transaction or contract under a public transaction; violation of federal or state anti-trust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

11.3.2. Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (federal, state or local) with commission of any of the offenses enumerated in paragraph 11.3.1 of this certification; and

11.3.3. Have not within a three-year period preceding this proposal had one or more public transactions (federal, state or local) terminated for cause or default. Where the bidder is unable to certify to any of the above, such owner shall attach an explanation to this proposal.

11.3.4. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the federal government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

11.3.5. The bidder shall incorporate the foregoing requirements 11.1 through 11.3 in all subcontracts.

ARTICLE 12 - EQUAL EMPLOYMENT OPPORTUNITY (EXECUTIVE ORDER 11246)

12.1. Notice of Requirement for Affirmative Action to Ensure Equal Employment Opportunity (Executive Order 11246). (Applicable to contracts/subcontracts exceeding \$10,000)

12.1.1. The Offeror's or Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Specifications" set forth herein.

12.1.2. The goals and timetables for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in Florida, are as follows:

Goal for female participation: 6.9 percent statewide

Goal for minority participation: (See Appendix B at FDEP-20 for goals for each county)

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

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

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

12.1.4. As used in this Notice, and in the contract resulting from this solicitation, the "covered area" is the State of Florida.

12.1.5. Contractors shall incorporate the foregoing requirements in all subcontracts.

12.2. Equal Opportunity Clause (Applicable to contracts/subcontracts exceeding \$10,000)

During the performance of this contract, the contractor agrees as follows:

12.2.1. The Contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Contractor shall take affirmative action to ensure that applicants for employment are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship.

12.2.2. The Contractor shall post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this nondiscrimination clause. The notice can be obtained online at http://www.eeoc.gov/employers/upload/eeoc_self_print_poster.pdf. The Contractor shall state that all qualified applicants be considered without regard to race, color, religion, sex or national origin.

12.2.3. The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive considerations for employment without regard to race, color, religion, sex, or national origin.

12.2.4. 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 advising the said labor union or workers' representatives of the contractor's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

12.2.5. The contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

12.2.6. The contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

12.2.7. In the event of the contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated, or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

12.2.8. The contractor will include the portion of the sentence immediately preceding paragraph (1) and the provisions of paragraphs 12.2.1 through 12.2.8 in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance: Provided, however, that in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the administering agency, the contractor may request the United States to enter into such litigation to protect the interests of the United States.

12.3. The Standard Federal Equal Employment Opportunity Construction Contract Specifications (Executive Order 11246)

12.3.1. As used in these specifications:

- a. "Covered area" means the geographical area described in the solicitation from which this contract resulted;
- b. "Director" means Director, Office of Federal Contract Compliance Programs, United States Department of Labor, or any person to whom the Director delegates authority;
- c. "Employer identification number" means the Federal Social Security number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941.
- d. "Minority" includes:
 - (i) Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);
 - (ii) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish Culture or origin, regardless of race);
 - (iii) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and

(iv) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

12.3.2. Whenever the Contractor, or any Subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of \$10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this contract resulted.

12.3.3. If the Contractor is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each Contractor or Subcontractor participating in an approved Plan is individually required to comply with its obligations under the EEO clause, and to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other Contractors or Subcontractors toward a goal in an approved Plan does not excuse any covered Contractor's or Subcontractor's failure to take good faith efforts to achieve the Plan goals and timetables.

12.3.4. The Contractor shall implement the specific affirmative action standards provided in paragraphs 7a through p of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. Covered construction Contractors performing construction work in geographical areas where they do not have a federal or federally assisted construction contract shall apply the minority and female goals established for the geographical area where the work is being performed. Goals are published periodically in the FEDERAL REGISTER in notice form, and such notices may be obtained from any Office of Federal Contract Compliance Programs office or from federal procurement contracting officers. The Contractor is expected to make substantially uniform progress in meeting its goals in each craft during the period specified.

12.3.5. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement, to refer either minorities or women shall excuse the Contractor's obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant thereto.

12.3.6. In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

12.3.7. The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:

- a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the Contractor's employees are assigned to work. The Contractor, where possible, will assign two or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.
- b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

- c. Maintain a current file of the names, addresses and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefore, along with whatever additional actions the Contractor may have taken.
- d. Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.
- e. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under 12.3.7b above.
- f. Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.
- g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination or other employment decisions including specific review of these items with onsite supervisory personnel such as Superintendents, General Foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.
- h. Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor's EEO policy with other Contractors and Subcontractors with whom the Contractor does or anticipates doing business.
- i. Direct its recruitment efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the Contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.
- j. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer and vacation employment to minority and female youth both on the site and in other areas of a Contractor's work force.
- k. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR Part 60-3.
- l. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.
- m. Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the Contractor's obligations under these specifications are being carried out.

- n. Ensure that all facilities and company activities are nonsegregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.
- o. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.
- p. Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's EEO policies and affirmative action obligations.

12.3.8. Contractors are encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative action obligations (12.3.7a through 12.3.7p). The efforts of a contractor association, joint contractor-union, contractor-community, or other similar group of which the contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under 7a through p of these specifications provided that the contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female workforce participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor's and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

12.3.9. A single goal for minorities and a separate single goal for women have been established. The Contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the Contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example, even though the Contractor has achieved its goals for women generally, the Contractor may be in violation of the Executive Order if a specific minority group of women is underutilized).

12.3.10. The Contractor shall not use the goals and timetables or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.

12.3.11. The Contractor shall not enter into any Subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.

12.3.12. The Contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any Contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.

12.3.13. The Contractor, in fulfilling its obligation under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph 7 of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 CFR 60-4.8.

12.3.14. The Contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government and to keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.

12.3.15. Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

12.4. Pursuant to 41 CFR 60-1.7, if the price of this bid exceeds \$10,000, the bidder, by signing and submitting this proposal, certifies the following:

12.4.1. Affirmative action programs pursuant to 41 CFR 60-2 have been developed and are on file;

12.4.2. Documentation of a previous contract or subcontract subject to the equal opportunity clause is available;

12.4.3. All reports due under the applicable filing requirements have been filed with the Joint Reporting Committee, the Deputy Assistant Secretary or the Equal Employment Opportunity Commission; and

12.4.4. Each prospective construction subcontractor that may be awarded a lower-tier construction subcontract with a price exceeding \$10,000 shall meet the above requirements 12.4.1 through 12.4.3.

12.5. Pursuant to 41 CFR 60-1.8, if the price of this bid exceeds \$10,000, the bidder, by signing and submitting this proposal, certifies the following:

12.5.1. That he/she does not maintain or provide for his/her employees any segregated facility at any of his/her establishments;

12.5.2. That he/she does not permit employees to perform their services at any location, under his/her control, where segregated facilities are maintained;

12.5.3. That he/she will not maintain or provide for employees any segregated facilities at any of his/her establishments;

12.5.4. That he/she will not permit employees to perform their services at any location under his/her control where segregated facilities are maintained;

12.5.5. That a breach of this certification is violation of the Equal Opportunity Clause of this contract; and

12.5.6. That he/she will obtain identical certifications from proposed Subcontractors prior to the award of Subcontracts exceeding \$10,000 which are not exempt from the provisions of the Equal Opportunity clause, and that he will retain such certifications in his/her files.

As used in this certification, the term “segregated facilities” means any waiting rooms, work eating areas, time clocks, locker rooms, and other storage or dressing areas, transportation and housing facilities provided for employees which are in fact segregated on the basis of race, color, religion, or otherwise.

12.6. If the price of this Agreement/Contract exceeds \$10,000, the Owner shall give written notice to the Director of the Office of Federal Contract Compliance Programs within ten working days of award of this Agreement/Contract. The notice is to include the name, address, and telephone number of the Contractor; the employer identification number of the Contractor; the dollar amount of this Agreement/Contract; the estimated starting and completion dates of this Agreement/Contract; the number of this Agreement/Contract; and the geographical area in which the Work is to be performed.

12.7. If the price of this Agreement/Contract equals or exceeds \$50,000 and if the Contractor has 50 or more employees, the Contractor shall electronically file Standard Form 100 (EEO-1) online at <https://egov.eeoc.gov/eeo1/eeo1.jsp> within 30 calendar days after the award of this Agreement/Contract, unless the Contractor has submitted such a report within 12 months preceding the date of award of this Agreement/Contract. In addition, the Contractor shall ensure that each construction subcontractor having 50 or more employees and a lower-tier construction subcontract with a price equaling or exceeding \$50,000 also electronically files this form within 30 calendar days after the award to it of the lower-tier construction subcontract, unless the construction subcontractor has submitted such a report within 12 months preceding the date of award of the lower-tier construction subcontract.

ARTICLE 13 - IMMIGRATION REFORM AND CONTROL ACT OF 1986 (STATE OF FLORIDA EXECUTIVE ORDER 11-116)

The Immigration Reform and Control Act of 1986 prohibits employers from knowingly hiring illegal workers. The Contractor shall only employ individuals who may legally work in the United States – either U.S. citizens or foreign citizens who are authorized to work in the U.S. The Contractor shall use the U.S. Department of Homeland Security’s E-Verify Employment Eligibility Verification system (<http://www.uscis.gov/portal/site/uscis>) to verify the employment eligibility of:

- all new employees, during the term of this Agreement, to perform employment duties within Florida; and,
- all new employees (including subcontractors and subrecipients) assigned by the Contractor to perform work pursuant to this Agreement.

The Contractor shall include this provision in all subcontracts/subgrants it enters into for the performance of work under this Agreement.

ARTICLE 14 – ENVIRONMENTAL COMPLIANCE

The Contractor, and all subcontractors at any tier, shall comply with all applicable standards, orders, or requirements issued under Section 306 of the Clean Air Act (42 U.S.C. 1857[h]), Section 508 of the Clean Water Act (33 U.S.C. 1368), Executive Order 11738 (Administration of the Clean Air Act and the Federal Water Pollution Control Act with Respect to Federal Contracts, Grants, or Loans).

ARTICLE 15 – FEDERAL LABOR STANDARDS PROVISION

Contracts being constructed with assistance from the State Revolving Fund Program are currently required to comply with the Federal Labor Standards Provisions as provided in Appendix C. Signing Appendix A certifies compliance with these provisions.

ARTICLE 16 – AMERICAN IRON AND STEEL PROVISION

Contracts being constructed with assistance from the State Revolving Fund Program are currently required to comply with The American Iron and Steel Provision as provided in Appendix D. Signing Appendix A certifies compliance with these provisions.

ARTICLE 17 - PROHIBITED LOCAL GOVERNMENT CONSTRUCTION PREFERENCES

- A. Pursuant to Section 255.0991, F.S., for a competitive solicitation for construction services in which 50 percent or more of the cost will be paid from state-appropriated funds which have been appropriated at the time of the competitive solicitation, a state, college, county, municipality, school district, or other political subdivision of the state may not use a local ordinance or regulation that provides a preference based upon:
1. The contractor’s maintaining an office or place of business within a particular local jurisdiction;
 2. The contractor’s hiring employees or subcontractors from within a particular local jurisdiction; or
 3. The contractor’s prior payment of local taxes, assessments, or duties within a particular local jurisdiction.
- B. For any competitive solicitation that meets the criteria in Paragraph A., a state college, county, municipality, school district, or other political subdivision of the state shall disclose in the solicitation document that any applicable local ordinance or regulation does not include any preference that is prohibited by Paragraph A.

**APPENDIX A TO THE FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
SUPPLEMENTARY CONDITIONS**

**CERTIFICATION OF COMPLIANCE WITH THE FLORIDA DEPARTMENT OF
ENVIRONMENTAL PROTECTION SUPPLEMENTARY CONDITIONS**

This certification relates to a construction contract proposed by _____,
(insert the name of the Owner)

which expects to finance the proposed construction contract with assistance from the Florida Department of Environmental Protection (which administers a State Revolving Fund loan program supported in part with funds directly made available by grants from the United States Environmental Protection Agency). I am the undersigned prospective construction contractor or subcontractor.

I certify that I have read the Florida Department of Environmental Supplementary Conditions and agree to incorporate the following articles into the bid and/or contract:

- ARTICLE 11 DEBARMENT AND SUSPENSION (EXECUTIVE ORDER 12549)
- ARTICLE 12 EQUAL EMPLOYMENT OPPORTUNITY (EXECUTIVE ORDER 11246)
- ARTICLE 13 IMMIGRATION REFORM AND CONTROL ACT OF (STATE OF FLORIDA EXECUTIVE ORDER 11-116)
- ARTICLE 14 ENVIRONMENTAL COMPLIANCE
- ARTICLE 15 FEDERAL LABOR STANDARDS PROVISION
- ARTICLE 16 AMERICAN IRON AND STEEL PROVISION

I agree that I will obtain identical certifications from prospective lower-tier construction subcontractors prior to the award of any lower-tier construction subcontracts with a price exceeding \$2,000. I also agree that I will retain such certifications in my files.

(Signature of Authorized Official)

(Date)

(Name and Title of Authorized Official [Print or Type])

(Name of Prospective Construction Contractor or Subcontractor [Print or Type])

(Address and Telephone Number of Prospective Construction Contractor or Subcontractor [Print or Type])

(Employer Identification Number of Prospective Construction Contractor or Subcontractor)

**APPENDIX B TO THE FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
SUPPLEMENTARY CONDITIONS**

GOALS AND TIMETABLES FOR MINORITIES AND FEMALES

[Note: These goals and timetables are the goals and timetables referred to in Paragraph 2 of the "Notice of Requirement for Affirmative Action to Ensure Equal Employment Opportunity (Executive Order 11246)"; these goals and timetables are to be included in all FDEP assisted construction contracts and subcontracts with a price exceeding \$10,000 and in all solicitations for such contracts and subcontracts.]

The following goals and timetables for female utilization shall be included in all federal and federally assisted construction contracts and subcontracts in excess of \$10,000. The goals are applicable to the contractor's aggregate on-site construction workforce whether or not part of that workforce is performing work on a federal or federally assisted construction contract or subcontract.

Area covered: Goals for Women apply nationwide.

Goals and Timetables

Timetable	Goals (percent)
Indefinite	6.9

Goals for minority utilization can be found in the Department of Labor's Technical Assistance Guide for Federal Construction Contractors (May 2009), available on the internet at <http://www.civilrightsusa.gov/pdf/TAG%20-%20Constuction.pdf>. These goals shall be included for each craft and trade in all federal or federally assisted construction contracts and subcontracts in excess of \$10,000 to be performed in the respective geographical areas. The goals are applicable to each nonexempt contractor's total onsite construction workforce, regardless of whether or not part of that workforce is performing work on a federal, federally assisted or non-federally related project, contract or subcontract.

Construction contractors which are participating in an approved Hometown Plan (see 41 CFR 60-4.5) are required to comply with the goals of the Hometown Plan with regard to construction work they perform in the area covered by the Hometown Plan. With regard to all their other covered construction work, such contractors are required to comply with the applicable SMSA or EA goal contained in this Appendix.

APPENDIX C
TO THE FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
SUPPLEMENTARY CONDITIONS

Davis-Bacon Requirements

FEDERAL LABOR STANDARDS PROVISIONS

(Davis-Bacon Act, Copeland Act, and Contract Works Hours & Safety Standards Act)

The Project to which the construction work covered by this contract pertains is being assisted by the United States of America and the following Federal Labor Standards Provisions are included in this Contract pursuant to the provisions applicable to such federal assistance.

1 Minimum Wages.

(i) All laborers and mechanics employed or working upon the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act, 29 CFR Part 3, the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under Section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of 29 CFR 5.5(a)(1)(iv); also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs, which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period.

Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR Part 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein; provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under 29 CFR Part 5.5(a)(1)(ii) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

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

- (1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and
- (2) The classification is utilized in the area by the construction industry; and
- (3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(b) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the sponsor(s) agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the sponsor to the FDEP. The FDEP will transmit the request to the Administrator of the Wage and Hour Division, employment Standards Administration, U. S. Department of Labor. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional

classification action within 30 days of receipt and so advise the FDEP or will notify FEDP within the 30-day period that additional time is necessary. (Approved by the Office of Management and Budget under OMB control number 1215-0140.)

(c) In the event that the Contractor, the laborers or mechanics to be employed in the Classification or their representatives, and the sponsor do not agree on the proposed classification and wage rate (including the amount designed for fringe benefits, where appropriate), the FDEP shall refer the request and the local wage determination, including the views of all interested parties and the recommendation of FDEP, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt of the request and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary. (Approved by the Office of Management and Budget under OMB Control Number 1215-0140.)

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

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

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program. Provided, that the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account, assets for the meeting of obligations under the plan or program. (Approved by the Office of Management and Budget under OMB Control Number 1215-0140.)

2. Withholding.

The sponsor shall, upon written request of the EPA or an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract or any other federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees and helpers employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee or helper, employed or working on the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), all or part of the wages required by the contract, EPA may, after written notice to the contractor, sponsor, applicant, or owners, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

3. Payrolls and Basic Records.

(i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work (or under the United States Housing Act of 1937, or under the Housing Act of 1949, in the construction or development of the project). Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in Section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in Section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs. (Approved by the Office of Management and Budget under OMB Control Numbers 1215-0140 and 1215-0017).

(ii) (a) The contractor shall submit weekly for each week in which any contract work is performed, a copy of all payrolls to the sponsor. Such documentation shall be available upon request by FDEP. As to each payroll copy received, the sponsor shall provide a certification that the project is in compliance with the requirements of 29 CFR 5.5(a)(1) with each disbursement request. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR Part 5.5(a)(3)(I), except that full social security numbers and home addresses shall not be included on the weekly payrolls. Instead, the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site <http://www.dol.gov/whd/forms/wh347instr.htm> or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current addresses of each covered worker, and shall provide them upon request to the sponsor for transmission to the FDEP or EPA if requested by EPA, the FDEP, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the sponsor. (Approved by the Office of Management and Budget under OMB Control Number 1215-0149).

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

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

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

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

(c) The weekly submission of a properly executed certification set forth on the reverse side of Option Form WH-347 shall satisfy the requirement for submission of the Statement of Compliance required by paragraph A. 3(ii)(b) of this section.

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

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

4. Apprentices and Trainees.

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U. S. Department of Labor, the Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio

of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program, shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with the determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

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

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

5. Compliance with Copeland Act Requirements.

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

6. Subcontracts.

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

7. Contract Termination, Debarment.

A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

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

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

9. Disputes Concerning Labor Standards.

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

10. Certification of Eligibility.

(i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded government contracts by virtue of Section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1) or to be awarded EPA contracts or participate in EPA programs pursuant to Executive Order 12549.

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a government contract by virtue of Section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1) or to be awarded EPA contracts or participate in EPA programs pursuant to Executive Order 12549.

(iii) The penalty for making false statements is prescribed in the U. S. Criminal Code, 18 U. S. C. 1001. Additionally, U. S. Criminal Code, Section 1010, Title 18, U. S. C., Federal Housing Administration transactions, provides in part "Whoever, for the purpose of . . . influencing in any way the action of such Administration . . . makes, utters or publishes any statement, knowing the same to be false . . . shall be fined not more than \$5,000 or imprisoned not more than two years, or both".

11. Complaints, Proceedings, or Testimony by Employees.

A. No laborer or mechanic to whom the wage, salary, or other labor standards provisions of this contract are applicable shall be discharged or in any other manner discriminated against by the contractor or any subcontractor because such employee has filed any complaint or instituted or caused to be instituted any proceeding or has testified or is about to testify in any proceeding under or relating to the labor standards applicable under this contract to his employer.

B. Contract Work Hours and Safety Standards Act. The sponsor shall insert the following clauses set forth in paragraphs B.(1), (2), (3), and (4) of this section in full in any contract in an amount in excess of \$100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by item 3 above or 29 CFR 4.6. As used in the paragraph, the terms laborers and mechanics include watchmen and guards.

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

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

(3) Withholding for unpaid wages and liquidated damages. The sponsor, upon written request of the FDEP or an authorized representative of the Department of Labor, may withhold or cause to be withheld, from any moneys payable on

account of work performed by the contractor or subcontractor under any such contract or any other federal contract with the same prime contract, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in subparagraph (2) of this paragraph.

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

C. Health and Safety

(1) No laborer or mechanic shall be required to work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous to his health and safety as determined under construction safety and health standards promulgated by the Secretary of Labor by regulation.

(2) The contractor shall comply with all regulations issued by the Secretary of Labor pursuant to Title 29 Part 1926 (formerly part 1518) and failure to comply may result in imposition of sanctions pursuant to the Contract Work Hours and Safety Standards Act (Public Law 91-54.83 State 96).

(3) The contractor shall include the provisions of this Article in every subcontract so that such provisions will be binding on each subcontractor. The contractor shall take such action with respect to any subcontract as the Secretary of Housing and Urban Development or the Secretary of Labor shall direct as a means of enforcing such provisions.

12. Guidance to Contractor for Compliance with Labor Standards Provisions

a) Contracts with Two Wage Decisions

If the contract includes two wage decisions, the contractor, and each subcontractor who works on the site, must submit either two separate payrolls (one for each wage decision) or one payroll which identifies each worker twice and the hours worked under each wage decision. One single payroll, reflecting each worker once, may be submitted provided the Contractor uses the higher rate in the wage decisions for each identical job classification. However, where a job classification is not listed in a wage decision and is needed for that portion of the work, the classification **must** be added to the wage decision. A worker may not be paid at the rate for a classification using the hourly rate for that same classification in another wage decision. After the additional classification is approved, the contractor may pay the higher of the two rates and submit one payroll, if desired.

b) Complying with Minimum Hourly Amounts

- 1) The minimum hourly amount due to a worker in each classification is the total of the amounts in the Rates and Fringe Benefits (if any) columns of the applicable wage decision.
- 2) The contractor may satisfy this minimum hourly amount by any combination of cash and bona fide fringe benefits, regardless of the individual amounts reflected in the Rates and Fringe Benefits columns.
- 3) A contractor payment for a worker which is required by law is not a fringe benefit in meeting the minimum hourly amount due under the applicable wage decision. For example, contractor payments for FICA or unemployment insurance are not a fringe benefit; however, contractor payments for health insurance or retirement are a fringe benefit. Generally, a fringe benefit is bona fide if (a) it is available to most workers and (b) involves payments to a third party.
- 4) The hourly value of the fringe benefit is calculated by dividing the contractor's annual cost (excluding any amount contributed by the worker) for the fringe benefit by 2080. Therefore, for workers with overtime, an additional payment may be required to meet the minimum hourly wages since generally fringe benefits have no value for any time worked over 40 hours weekly. (If a worker is paid more than the minimum rates required by the wage decision, this should not be a problem. As long as the total wages received by a worker for straight time equals the hours worked times the minimum hourly rate in the wage decision, the requirement of the Davis-Bacon and Related Acts has been satisfied.)

c) Overtime

For any project work over 40 hours weekly, a worker generally must be paid 150% of the actual hourly cash rate received, not the minimum required by the wage decision. (The Davis-Bacon and Related Acts only establishes minimum rates and does not address overtime. The Contract Work Hours Act contains the overtime requirement and uses basic rate of pay as the base for calculation, not the minimum rates established by the Davis-Bacon and Related Acts.)

d) Deductions

Workers who have deductions, not required by law, from their pay must authorize these deductions in writing. The authorization must identify the purpose of each deduction and the amount, which may be a specific dollar amount or a percentage. A copy of the authorization must be submitted with the first payroll containing the deduction. If deducted amounts increase, another authorization must be submitted. If deducted amounts decrease, no revision to the original authorization is needed. Court-ordered deductions, such as child support, may be identified by the responsible payroll person in a separate document. This document should identify the worker, the amount deducted and the purpose. A copy of the court order should be submitted.

e) Classifications Not Included in the Wage Decision

If a classification not in the wage decision is required, please advise the owner's representative in writing and identify the job classification(s) required. In some instances, the state agency may allow the use of a similar classification in the wage decision.

Otherwise, the contractor and affected workers must agree on a minimum rate, which cannot be lower than the lowest rate for any trade in the wage decision. Laborers (including any subcategory of the laborer classification) and truck drivers are not considered a trade for this purpose. If the classification involves a power equipment operator, the minimum cannot be lower than the lowest rate for any power equipment operator in the wage decision. The owner will provide forms to document agreement on the minimum rate by the affected workers and contractor.

The U.S. Department of Labor (USDOL) must approve the proposed classification and rate. The contractor may pay the proposed rate until the USDOL makes a determination. Should the USDOL require a higher rate, the contractor must make wage restitution to the affected worker(s) for all hours worked under the proposed rate.

f) Supervisory Personnel

Foremen and other supervisory personnel who spend at least 80% of their time supervising workers are not covered by the Davis-Bacon and Related Acts. Therefore, a wage decision will not include such supervisory classifications and their wages are not subject to any minimums under the Davis-Bacon and Related Act or overtime payments under the Contract Work Hours and Safety Standards Act. However, foremen and other supervisory personnel who spend less than 80% of their time engaged in supervisory activities are considered workers/mechanics for the time spent engaged in manual labor and must be paid at least the minimum in the wage decision for the appropriate classification(s) based on the work performed.

g) Sole Proprietorships / Independent Contractors / Leased Workers

The nature of the relationship between a prime contractor and a worker does not affect the requirement to comply with the labor standards provisions of this contract. The applicability of the labor standards provisions is based on the nature of the work performed.

If the work performed is primarily manual in nature, the worker is subject to the labor standards provisions in this contract. For example, if John Smith is the owner of ABC Plumbing and performs all plumbing work himself, then Mr. Smith is subject to the labor standards provisions, including minimum wages and overtime. His status as owner is irrelevant for labor standards purposes.

If a worker meets the IRS standards for being an independent contractor, and is employed as such, this means that the worker must submit a separate payroll as a subcontractor rather than be included on some other payroll. The worker is still subject to the labor standards provisions in this contract, including minimum wages and overtime.

If a contractor or subcontractor leases its workers, they are subject to the labor standards provisions in this contract, including minimum wages and overtime. The leasing firm must submit payrolls and these payrolls must reflect information required to determine compliance with the labor standards provisions of this contract, including a classification for each worker based on the nature of the work performed, number of regular hours worked, and number of overtime hours worked.

h) Apprentices / Helpers

A worker may be classified as an apprentice **only if participating in a federal or state program**. Documentation of participation must be submitted. Generally, the apprentice program specifies that the apprentice will be compensated at a percentage of journeyman rate. For Davis-Bacon Act purposes, the hourly rate cannot be lower than the percentage of the hourly rate for the classification in the applicable wage decision.

If the worker does not participate in a federal or state apprentice program, then the worker must be classified according to duties performed. This procedure may require classification in the trade depending on tools used, or as a laborer if specialized tools of the trade are not used. The contractor may want to consult with the Wage and Hour Division of the U.S. Department of Labor located in most large cities regarding the appropriate classification.

Presently, no worker may be classified as a helper. As with apprentices not participating in a formal apprentice program, the worker must be classified according to duties performed and tools used.

APPENDIX D TO THE FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION SUPPLEMENTARY CONDITIONS

American Iron and Steel Requirement

The Contractor acknowledges to and for the benefit of the _____ (“Owner”) and the State of Florida (the “State”) that it understands that iron and steel products to be installed as a part of this contract must be in compliance with the requirements in H.R. 3547, “Consolidated Appropriations Act, 2014,” (Appropriations Act). H.R. 3547 includes the following language in Division G, Title IV, Sec. 436, under the heading, “Use of American Iron and Steel,”:

(a) (1) None of the funds made available by a State water pollution control revolving fund as authorized by title VI of the Federal Water Pollution Control Act (33 U.S.C. 1381 et seq.) or made available by a drinking water treatment revolving loan fund as authorized by section 1452 of the Safe Drinking Water Act (42 U.S.C. 300j-12) shall be used for a project for the construction, alteration, maintenance, or repair of a public water system or treatment works unless all of the iron and steel products used in the project are produced in the United States.

(2) In this section, the term “iron and steel products” means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials.

(b) Subsection (a) shall not apply in any case or category of cases in which the Administrator of the Environmental Protection Agency (in this section referred to as the “Administrator”) finds that--

(1) applying subsection (a) would be inconsistent with the public interest;

(2) iron and steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality; or

(3) inclusion of iron and steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

(c) If the Administrator receives a request for a waiver under this section, the Administrator shall make available to the public on an informal basis a copy of the request and information available to the Administrator concerning the request, and shall allow for informal public input on the request for at least 15 days prior to making a finding based on the request. The Administrator shall make the request and accompanying information available by electronic means, including on the official public Internet Web site of the Environmental Protection Agency.

(d) This section shall be applied in a manner consistent with United States obligations under international agreements.

Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Purchaser or State to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney’s fees) incurred by the Purchaser or State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State or any damages owed to the State by the Purchaser). While the Contractor has no direct contractual privity with the State, as a lender to the Purchaser for the funding of its project, the Purchaser and the Contractor agree that the State is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State.

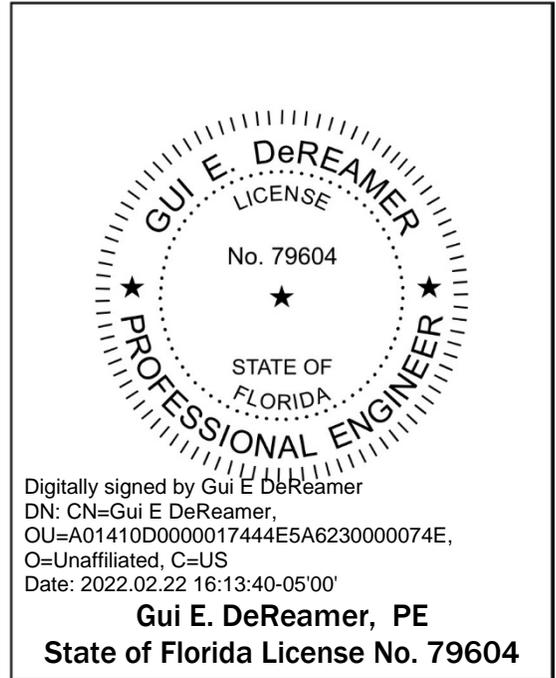
For waivers to these requirements based on (2)(b) above, contact Sheryl Parsons at USEPA Region IV. She can be reached by phone at (404) 562-9337.

**CITY OF HOLLYWOOD
DEEP INJECTION WELLS NO. 3 AND NO. 4 PUMP STATION
PROJECT NO. 19-9119A**

CONFORMED – FOR CONSTRUCTION SPECIFICATIONS

PROFESSIONAL ENGINEER – RESPONSIBLE CHARGE CERTIFICATIONS

Division 01 – General Requirements	
01 10 00	Summary of Work
01 11 80	Environmental Conditions
01 20 00	Project Meetings
01 25 00	Basis of Payment
01 30 00	Submittals
01 40 00	Testing and Inspection
01 41 00	Contractor's Health and Safety Plan
01 50 00	Construction Considerations
01 51 00	Temporary Utility Services and Staging
01 52 00	Maintenance of Facilities and Sequence of Construction
01 53 00	Protection of Existing Facilities
01 55 00	Site Access and Storage
01 56 00	Special Controls
01 57 00	Traffic Regulations and Maintenance of Traffic
01 60 00	Equipment and Materials
01 70 00	Project Closeout
01 73 24	Design Requirements Non-Structural Components
01 74 00	Permits
01 78 23	Operation and Maintenance Data
01 79 00	Demonstration and Training
01 80 00	Warranties
01 90 00	Applicable Standards and Codes
01 91 00	Commissioning
01 99 90	Reference Forms



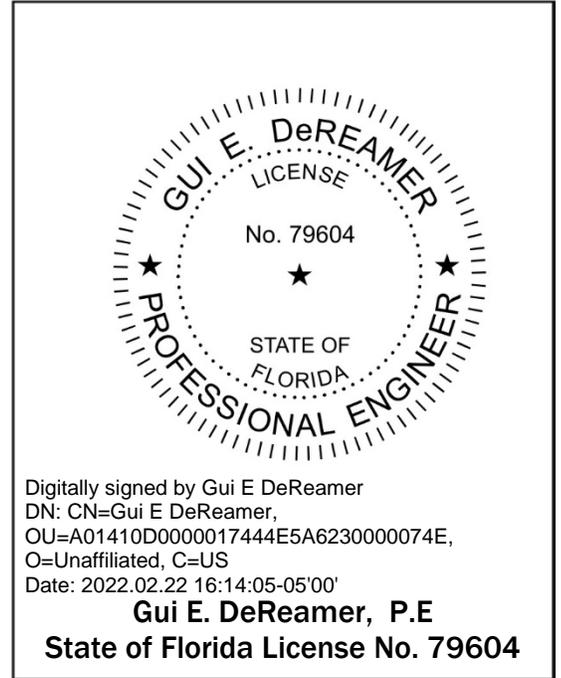
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**CITY OF HOLLYWOOD
DEEP INJECTION WELLS NO. 3 AND NO. 4 PUMP STATION
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CONFORMED – FOR CONSTRUCTION SPECIFICATIONS

PROFESSIONAL ENGINEER – RESPONSIBLE CHARGE CERTIFICATIONS

Division 43 – Process Gas and Liquid Handling, Purification, and Storage Equipment	
43 05 11	General Requirements for Equipment
43 05 13	Rigid Equipment Mounts
43 05 14	Machine Alignment
43 05 16	Noise Requirements and Control
43 05 17	Vibration and Critical Speed Limitations
43 05 18	Vibration Isolation Systems
43 05 21	Common Motor Requirements for Equipment
43 16 23	Surge Control Systems
43 23 03	General Requirements for Centrifugal and Axial-Flow Pumping Equipment
43 26 67	Variable Speed Vertical Turbine Pumps, Enclosed Lineshaft Externally Water Lubricated
43 23 80.11 - Supplement 1	Area 0603 – Headworks 3 Influent Flow Meter
43 23 80.13	Submersible Wastewater Pumps Constant Speed
43 23 94	Sample Pumps
43 41 13.13	Aboveground Double-Walled Steel Storage Tanks
43 41 43.13	High Density Crosslinked Polyethylene Tanks
Division 46 – Water and Wastewater Equipment	
46 05 19	Refrigerated Automatic Sampler
46 07 53	Package Seal Water System
46 61 73	Automatic Straining Equipment



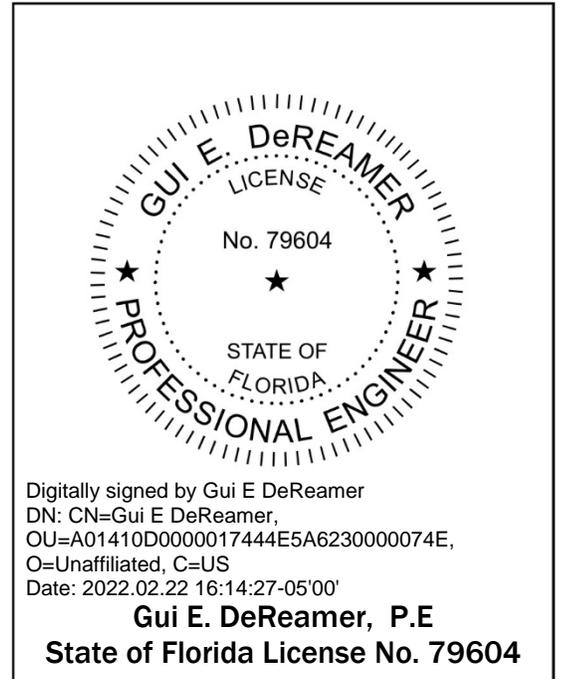
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PROFESSIONAL ENGINEER – RESPONSIBLE CHARGE CERTIFICATIONS

Division 40 – Process Integration	
40 05 01	Piping Systems
40 05 02	Piping System Schedules
40 05 02.05	Piping System Schedule – Service Air
40 05 02.23	Piping System Schedule – Potable Water
40 05 02.29	Piping System Schedule – Medium Pressure Plant Utility Water
40 05 02.43	Piping System Schedule – Pressurized Wastewater and Drainage
40 05 02.47	Piping System Schedule – Treated Wastewater
40 05 02.56	Piping System Schedule – Glass Lined Pipe
40 05 02.61	Piping System Schedule – Petroleum Vent
40 05 02.63	Piping System Schedule – Chemical Solution (PVC)
40 05 02.66	Piping System Schedule – Chemical Solution (SST)
40 05 02.89	Piping System Schedule – Building Mechanical Drainage
40 05 02.97	Piping System Schedule – Engine Exhaust (SST)
40 05 02.99	Piping System Schedule – Fuel Oil
40 05 06.16	Piping Connections
40 05 07	Hangers and Supports for Process Piping
40 05 17	Copper Piping and Tubing
40 05 23	Stainless Steel Process Piping and Tubing
40 05 24	Steel Pipe
40 05 31	Thermoplastic Process Pipe



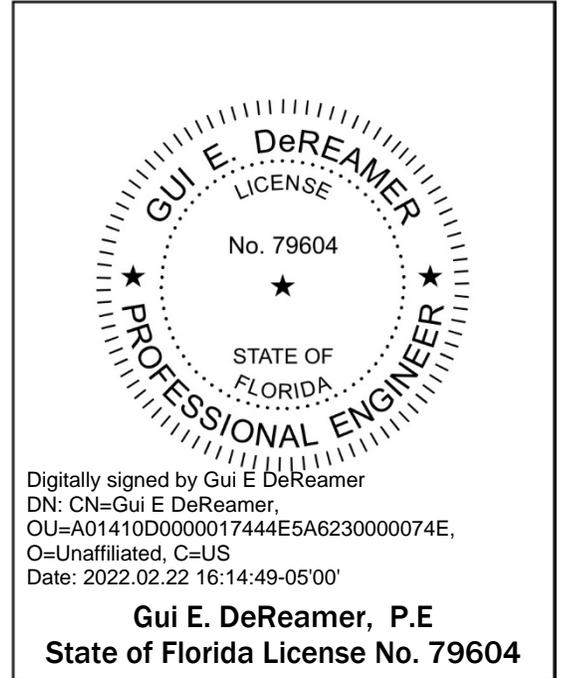
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PROFESSIONAL ENGINEER – RESPONSIBLE CHARGE CERTIFICATIONS

Division 40 – Process Integration (cont.)	
40 05 40.04	Corrugated HDPE
40 05 45	Piping System Identification
40 05 57.13	Manual Actuators
40 05 57.23	Powered Actuators
40 05 59.23	Fabricated Stainless Steel Slide Gates
40 05 60	Valves
40 05 61.07	Gate Valve - Bronze/Ductile Iron
40 05 62.02	Eccentric Plug Valves - Non-Lubricated
40 05 63.01	Ball Valve - Bronze Brass
40 05 63.03	Ball Valve - Stainless Steel Threaded
40 05 63.06	Ball Valve - CPVC
40 05 63.09	Ball Valve - Steel
40 05 64.05	Butterfly Valve – AWWA C5402, Class 150B
40 05 65.20	Check Valves – Stainless Steel Swing Check
40 05 65.23	Check Valves - Swing Check
40 05 65.26	Check Valves – Tilting Disc Check Valves
40 05 67.36	Pressure Relief Valves
40 05 67.47	Surge Relief Valves
40 05 71.16	Seal Water Control Unit
40 05 78.23	Air-Vacuum Valve for Water and Wastewater Service
40 05 82	Solenoid Valve and Schedule
40 06 20.13	Power Actuated Valve Schedule
40 06 20.16	Seal Water Control Unit
40 72 83	Diesel Fuel Leak Detection System



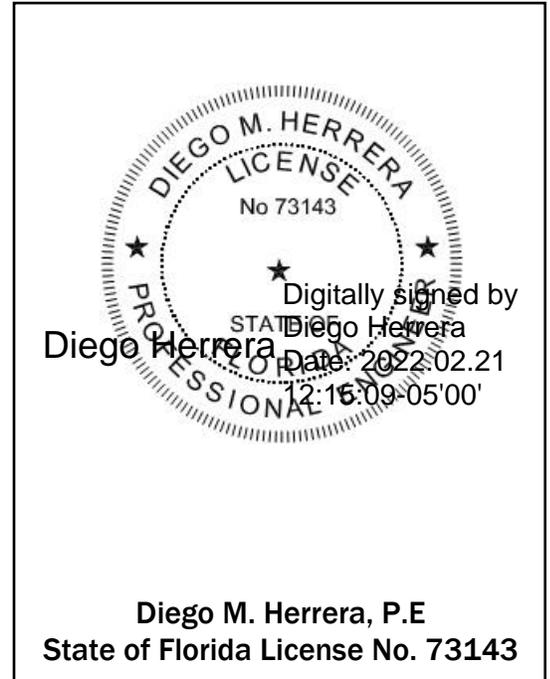
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PROFESSIONAL ENGINEER – RESPONSIBLE CHARGE CERTIFICATIONS

Division 01 – General Requirements	
01 53 00	Protection of Existing Facilities
Division 02 – Existing Conditions	
02 41 00	Demolition
Division 08 – Doors and Windows	
08 92 00	Removable Aluminum Flood Barrier
Division 09 – Finishes	
09 97 24	Epoxy Coating System for Refurbishing and Protection of Concrete Structures
Division 31 - Earthwork	
31 10 00	Site Preparation
31 23 00	Excavation and Fill
31 23 19	Dewatering
31 25 00	Erosion, Sedimentation, and Dust Controls
31 41 00	Sheeting, Shoring, and Bracing
Division 32 – Exterior Improvements	
32 11 13	Limerock Base
32 11 14	Soil Stabilization
32 12 16	Asphaltic Paving
32 13 00	Concrete Paving Curbs and Gutters
32 31 13	Chain Link Fences and Gates
Division 33 – Utilities	
33 01 30.50	Temporary By-pass and Dewatering Pumping Systems
33 01 30.53	Sewer Cleaning
33 05 13 16	Precast Manholes, Frames, and Covers
Division 40 – Process Integration	
40 05 19	Ductile Iron Pipe
40 05 31	Thermoplastic Process Pipe
40 05 33.13	High Density Polyethylene Pipe - Solid Wall
40 05 34.11	Polyvinyl Chloride (PVC) Distribution Pipe C900
40 05 39.23	Reinforced Concrete Pipe
40 05 76	Hot Tapping



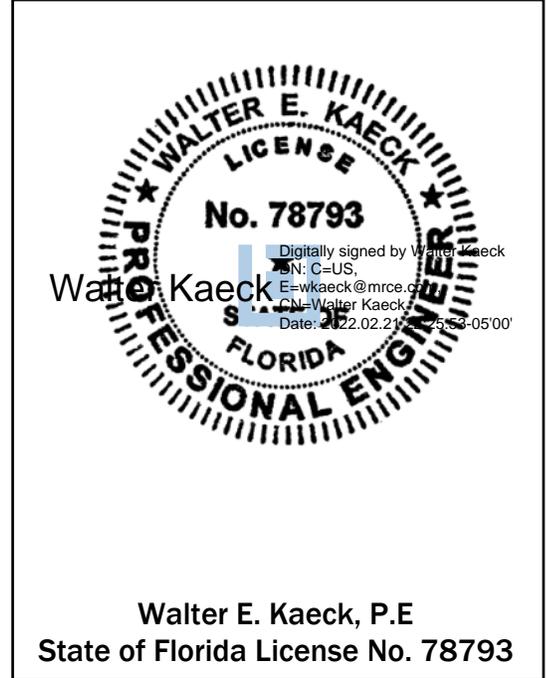
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Division 31 - Earthwork	
31 09 00	Geotechnical Instrumentation and Monitoring
Division 32 – Exterior Improvements	
32 32 15	Precast Modular Block Gravity Retaining Wall



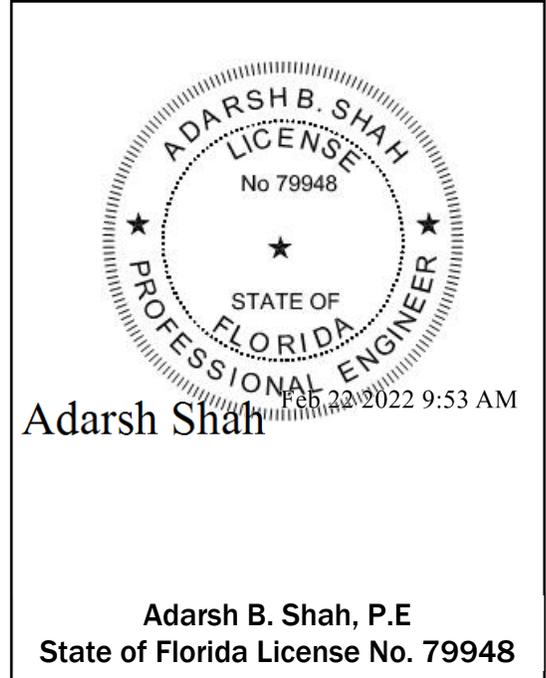
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Division 03 – Concrete	
03 11 00	Concrete Forming
03 20 00	Concrete Reinforcing
03 30 00	Cast-In-Place Concrete
03 41 33	Precast Structural Pretensioned Concrete
03 48 11	Precast Concrete Vaults
03 60 00	Grouting
03 70 00	Mass Concrete
Division 05 - Metals	
05 05 14	Hot-Dip Galvanizing
05 05 20	Anchor Bolts
05 10 00	Structural Metal Framing
Division 31 - Earthwork	
31 63 16	Auger Cast Piles
31 66 15	Helical Pier Foundations



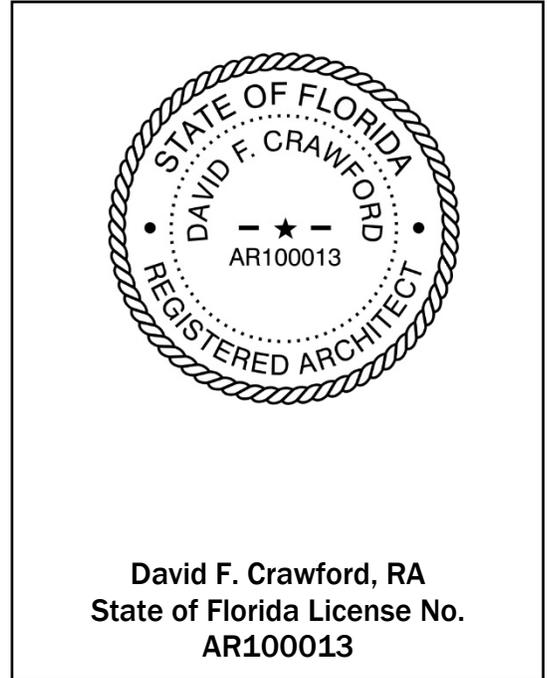
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Division 04 - Masonry	
04 20 00	Unit Masonry
Division 05 - Metals	
05 50 00	Metal Fabrications
05 51 00	Metal Stairs
05 52 10	Aluminum Railings
05 53 10	Metal Gratings and Stair Treads
Division 06 – Woods, Plastics, and Composites	
06 10 00	Rough Carpentry
Division 07 – Thermal and Moisture Protection	
07 21 05	Building Insulation
07 22 16	Roof Board Insulation
07 24 00	Exterior Insulation and Finish System
07 53 23	Ethylene-Propylene-Diene-Monomer Roofing
07 62 00	Sheet Metal Flashing and Trim
07 71 00	Roof Specialties
07 84 00	Fire Safing and Fire Stopping Sealants
07 91 26	Joint Fillers
07 92 00	Joint Sealants
Division 08 – Doors and Windows	
08 11 16	Aluminum Doors and Frames
08 31 00	Access Doors and Panels
08 31 20	Floor Access Doors
08 33 00	Shutters
08 33 23	Overhead Coiling Doors
08 51 13	Aluminum Windows
08 71 00	Door Hardware
08 81 00	Glass Glazing
08 91 19	Fixed Louvers



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PROFESSIONAL ENGINEER – RESPONSIBLE CHARGE CERTIFICATIONS

Division 09 - Finishes	
09 51 13	Acoustical Panel Ceiling
09 61 53	Concrete Hardener
09 84 05	Acoustical Panels
09 90 00	Painting and Coating
Division 10 - Specialties	
10 11 00	Visual Display Units
10 14 00	Signage
10 28 05	Toilet and Bath Accessories
10 43 16	First Aid Cabinets
10 44 00	Fire Protection Specialties



**David F. Crawford, RA
State of Florida License No.
AR100013**

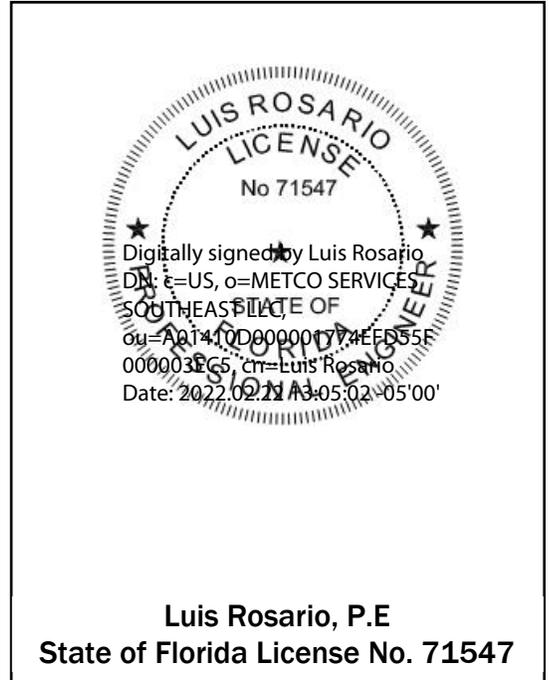
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PROFESSIONAL ENGINEER – RESPONSIBLE CHARGE CERTIFICATIONS

Division 22 - Plumbing	
22 05 14	Plumbing Specialties
Division 23 – Heating, Ventilating, and Air Conditioning (HVAC)	
23 05 29	Hangers and Supports for HVAC
23 05 93	Testing, Adjusting and Balancing for HVAC
23 07 13	HVAC Insulation
23 07 19	HVAC Piping Insulation
23 09 23	HVAC Controls
23 23 00	Refrigerant Lines
23 31 13	HVAC Duct
23 34 16	HVAC Fans
23 37 13	Diffusers, Grilles and Registers
23 60 00	Air Conditioning Equipment
Division 28 – Electronic Safety and Security	
28 31 00	Fire Detection and Alarms



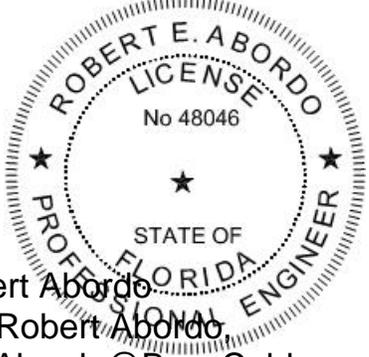
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PROFESSIONAL ENGINEER – RESPONSIBLE CHARGE CERTIFICATIONS

Division 26 - Electrical	
26 00 00	Electrical Work, General
26 01 26	Electrical Tests
26 05 10	Electric Motors
26 05 15	Local Control Stations and Miscellaneous Electrical Equipment
26 05 19	Wire and Cable
26 05 26	Grounding
26 05 33	Electrical Raceway Systems
26 05 36	Wiring Devices
26 05 43	Underground Raceway Systems
26 05 53	Electrical Identification
26 05 73	Protective Device Studies
26 08 00	Commissioning of Electrical Systems
26 09 13	Electrical Power Monitoring
26 11 16	Low-Voltage, Arc-Resistant, Drawout Switchgear
26 11 16.13	Primary Unit Substation Transformers – Liquid Filled
26 12 16	Medium-Voltage Transformers – Dry Type
26 12 17	Panelboards and General Purpose Dry-Type Transformers
26 13 13	Medium Voltage Switching Center
26 18 40	Medium Voltage Vertical Type Electric Motors
26 18 43	Medium Voltage Variable Frequency Drives
26 23 14	Medium-Voltage Generator Switchgear
26 24 13	Switchboards
26 28 13	Fuses
26 29 00	Low-Voltage Motor Control Centers
26 29 23	Variable Frequency Drive Units
26 32 13.13	Medium-Voltage Tier 4 Diesel Engine Generators
26 32 13.14	Tier 4 Diesel Engine Generator Unit
26 36 23	Automatic Transfer Switches
26 41 23	Lightning Protection System
26 43 13	Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits
26 50 00	Lighting



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THIS ITEM HAS BEEN DIGITALLY SIGNED AND SEALED ROBERT E. ABORDO, P.E THE DATE ADJACENT TO THE SEAL. PRINTED COPIES OF THIS DOCUMENT ARE NOT CONSIDERED SIGNED AND SEALED AND THE SIGNATURE MUST BE VERIFIED ON ANY ELECTRONIC COPIES

**CITY OF HOLLYWOOD
DEEP INJECTION WELLS NO. 3 AND NO. 4 PUMP STATION
PROJECT NO. 19-9119A**

CONFORMED – FOR CONSTRUCTION SPECIFICATIONS

PROFESSIONAL ENGINEER – RESPONSIBLE CHARGE CERTIFICATIONS

Division 40 – Process Integration	
40 06 70	Schedules for Instrumentation of Process Systems
40 06 70 - Attachment A	Instrument Index
40 13 19	Thermoset Fiberglass Reinforced Plastic Ducts
40 42 00	Insulation for Exposed Piping and Equipment
40 61 13	Process Control System General Provisions
43 61 13 - A	Process Control System General Provisions - Attachment A
40 61 21	Process Control System Testing
40 61 96	Process Control Descriptions
40 62 00	Computer System Hardware and Ancillaries
40 63 43	Programmable Logic Controllers
40 66 00	Network and Communication Systems Testing
40 66 13	Network and Communication Equipment
40 66 33	Metallic and Fiber Optic Communication Cabling and Connectors
40 67 00	Control System Equipment Panels and Racks
40 67 23	Control Room Console
40 68 00	Process Control Software
40 68 03	Process Control Software Coordination and Documentation
40 68 13	Process Control HMI Software
40 71 00	Flow Measurement
40 72 00	Level Management
40 72 83	Diesel Fuel Leak Detection System
40 73 00	Pressure, Strain, and Force Measurement
40 74 00	Temperature Measurement
40 75 00	Process Liquid Analytical Measurement
40 76 00	Process Gas Analytical Measurement
40 79 00	Miscellaneous Instruments, Calibration Equipment, Instrument Valves, and Fittings



THIS ITEM HAS BEEN DIGITALLY SIGNED AND SEALED HECTOR FELPE SERRANO, P.E THE DATE ADJACENT TO THE SEAL. PRINTED COPIES OF THIS DOCUMENT ARE NOT CONSIDERED SIGNED AND SEALED AND THE SIGNATURE MUST BE VERIFIED ON ANY ELECTRONIC COPIES

SECTION 01 10 00
SUMMARY OF WORK

PART 1 GENERAL

1.01 THE REQUIREMENT

- A. The work to be performed under this Contract shall consist of furnishing all tools, equipment, materials, supplies, and manufactured articles and for furnishing all transportation and services, including fuel, power, water, and essential communications, and for the performance of all labor, work, or other operations required for the fulfillment of the Contract in strict accordance with the Contract Documents. The work shall be complete, and all work, materials, and services not expressly shown or called for in the Contract documents which may be necessary for the complete and proper construction of the work in good faith shall be performed, furnished, and installed by the CONTRACTOR as though originally so specified or shown, at no increase in cost to the CITY.

- B. Prior to construction, the CONTRACTOR shall verify existing utilities identified on the Drawings and locate other potential utilities in their working area may not shown on the Drawings. The utility verifications consist of excavation to verify tie-in points and to locate potential conflicts that may affect the work as shown on the Contract Drawings. The CONTRACTOR shall be responsible for the coordination of this work with the associated utility owners and permitting agencies having jurisdiction over the specific locations to be verified.

1.02 SCOPE

- A. It is the intent of the CITY to obtain a complete and working installation under this contract and any items of labor, materials or equipment, which may reasonably be assumed as necessary to accomplish this end, should be supplied whether or not specifically shown on the plans or described herein. The project is divided into two phases of work with an interim milestone established for Phase I. The following components comprise the major project elements:
 - B. Phase I Work:
 - 1. Injection Well (IW) 3 and IW-4 and Surge Tanks piping connections including control valves and flow meters including structural pads around Injection well and above grade piping and equipment.
 - 2. Electrical and I&C components to temporary connect IW-3 and IW-4 control valves and flow meters into the existing injection well pump station systems.
 - 3. Yard piping and valve vaults to connect the existing injection well pump station to the IW-3 and IW-4.
 - 4. Temporary piping to extend the WTP concentrate force main to the effluent box for clarifier 1 to 4.
 - 5. IW 3 and 4 startup and one year conditioning period.
 - 6. Monitoring Well (MW) 2 sampling pumps and associated piping, valves, fittings and structural pad.

7. Rehabilitation of IW-1 and IW-2 brushing the inside wall of the final casing and acidization of both IWS. This work shall be performed during the startup / testing of IW- 3 and IW-4

C. Phase II Work:

1. Civil site work including yard piping required for the IW-3 and IW-4 Pump Station and associated site improvements to support new facilities.
2. New retention walls based on a performance specification provided as part of this package.
3. New IW-3 and IW-4 Pump Station No 2 building with integrated wet well.
4. Concentrate transfer system, with integrated wet well, to IW-3 and IW-4 to be housed in the same building as the IW-3 and IW-4 Pump Station.
5. Electrical work including power and I&C work required for the IW-3 and IW-4 Pump Station.
6. New Injection Well Electrical Service Center building with standby electrical power generation for IW-3 and IW-4 Pump Station
7. New Plant Drain Pump Station including all appurtenances
8. Surge Control Tanks Pad
9. Fuel Storage Tanks Pad
10. Strainer Equipment Pad
11. Actuated valve addition at the Water Treatment Plant on the WTP Concentrate Injection Well Pumping system.
12. Connection of the generators to the North Electric Service Center (NESC)
13. Integration of the new facilities into the existing plant SCADA system.
14. FPL power extension
15. Project permitting including Air Permitting

1.03 SUGGESTED WORK SEQUENCE

- A. A suggested work sequence is being provided by the ENGINEER to be considered by the CONTRACTOR and can be found on Drawings YD-10-2101 through YD-10-2104 with further constraints outlined in specification section 01 52 00.
- B. A detailed sequence of construction shall be submitted by the CONTRACTOR and accepted by the CITY and ENGINEER prior to the commencement of any work. The CITY reserves the right to make changes to the sequence as necessary to facilitate the Work or to minimize any operations conflict with no cost impact from the CONTRACTOR.

1.04 WORK BY OTHERS

- A. The CONTRACTOR shall cooperate fully with all utility forces of the CITY, or other public or private agencies engaged in the relocation, altering, or otherwise rearranging any facilities which interfere with the progress of the work, and shall schedule the work to minimize interference with said relocation, altering, or rearranging of facilities.
- B. The CONTRACTOR'S attention is directed to the fact that work will be conducted at the site by other CONTRACTORS during the performance of the work under this Contract. The CONTRACTOR shall conduct its operations to cause a minimum of interference with the

Work of such other CONTRACTORS, and shall cooperate fully with such CONTRACTORS to provide continued safe access to their respective portions of the site, as required to perform their respective contracts.

- C. When two or more contracts are being executed at one time on the same or adjacent land in such manner that Work on one contract may interfere with that on another, the CITY shall determine the sequence and order of the Work. When the territory of one contract is the necessary or convenient means of access for the execution of another CONTRACTOR, such privilege of access or any other reasonable privilege may be granted by the CITY to CONTRACTOR.

1.05 LOCATION OF THE PROJECT

- A. The project is located at the City of Hollywood's Southern Regional Wastewater Treatment Plant at 1621 North 14th Avenue, Hollywood, Florida.

1.06 CONTRACTOR FURNISHED MATERIAL AND EQUIPMENT

- A. All equipment, materials, or devices incorporated in this project shall be new and unused, unless indicated otherwise in the Contract Documents and shall be the products of reliable manufacturers who, unless otherwise specified, have been regularly engaged in the manufacture of such material and equipment for at least five (5) years. Procedures and additional requirements regarding manufacturer's experience and substitutions are included in Section 01 33 00 - Submittals.

1.07 DRAWINGS OF EXISTING FACILITIES

- A. Drawings of the existing facilities may be inspected at the City's Engineering and Construction Services Office. These drawings are for information only and are not a part of the Contract Documents. In making these drawings available for inspection, the CITY makes no guarantee, either expressed or implied, as to their accuracy or completeness.
- B. The CONTRACTOR shall contact representatives for other utilities, facilities in proximity of the work and Sunshine State One Call Inc., to obtain the as-built information from them directly. The utilities shown on Drawings are based upon available records supplied from various sources. The CITY makes no guarantee, either expressed or implied, as to their accuracy or completeness.

1.08 ITEMS SPECIFIED ON DRAWINGS

- A. Certain items of material and/or equipment, and their installation may be specified on the Drawings and not mentioned in the Specifications. Such items are to be considered as both shown on the Drawings and noted in the Specifications and be provided by the CONTRACTOR in accordance with the Specification on the Drawings.

1.09 FIELD LAYOUT OF WORK

- A. All work under this Contract shall be constructed in accordance with the Contract Drawings or as directed by the ENGINEER. Elevations of existing ground, structures and appurtenances are believed to be reasonably correct but are not guaranteed to be absolute and therefore are presented only as an approximation. Any error or apparent

discrepancy in the data shown or omissions of data required for accurately accomplishing the stake-out survey shall be referred immediately to the ENGINEER for interpretation or correction.

- B. All survey work for construction control purposes shall be made by the CONTRACTOR at CONTRACTOR'S expense.
- C. The CONTRACTOR shall establish all base lines for the location of the principal component parts of the work together with benchmarks and batter boards adjacent to the work. Based upon the information provided by the Contract Drawings, the CONTRACTOR shall develop and make all detail surveys necessary for construction. The CITY will furnish information and location of existing benchmarks.
- D. The CONTRACTOR shall have the responsibility to carefully preserve the benchmarks, reference points and stakes. In case of destruction thereof by the CONTRACTOR or resulting from CONTRACTOR'S negligence, he shall be held liable for any expense and damage resulting therefrom and shall be responsible for any mistakes that may be caused by the unnecessary loss or disturbance of such bench marks, reference points and stakes.
- E. Existing or new control points, property markers, and monuments that will be established or are destroyed during the normal causes of construction shall be re-established by the CONTRACTOR; and all reference ties recorded therefore shall be furnished to the ENGINEER. All computations necessary to establish the exact position of the work shall be made and preserved by the CONTRACTOR.
- F. The ENGINEER may check all or any portion of the work, and the CONTRACTOR shall afford all necessary assistance to the ENGINEER in carrying out such checks. Any necessary corrections to the work shall be performed immediately by the CONTRACTOR and he shall accept all responsibility for the accuracy and completeness of CONTRACTOR'S work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

**SECTION 01 11 80
ENVIRONMENTAL CONDITIONS**

PART 1 GENERAL

1.01 ENVIRONMENTAL CONDITIONS

- A. This section describes the environmental conditions which have been observed at the site of the work and which may reasonably be anticipated throughout the life of the project.

1.02 CLIMATE CONDITIONS

- A. The site of the work is at an elevation of 5.0 feet above mean sea level.
- B. Climate conditions are described as follows:

Description	Range of Conditions
Winter	Generally sunny with about 7 to 10 rain days per month. Temperatures from 45 to 85 ° F.
Summer	Generally sunny with about 15 to 20 rain days per month. Temperatures 75-100 ° F. Heavy rain storms may occur at any time of the day.
Relative humidity, percent	60 to 80

END OF SECTION

SECTION 01 20 00
PROJECT MEETINGS

PART 1 GENERAL

1.01 PRECONSTRUCTION

- A. A mandatory preconstruction meeting will be held to acquaint representatives of the Department and various other agencies with those in responsible charge of the CONTRACTOR's activities for the project. Unless otherwise directed by the Department, no construction activities relating to this contract shall commence until after the pre-construction meeting has been adjourned, and until any pending business from the meeting has been addressed by the CONTRACTOR to the satisfaction of the Department and ENGINEER. The meeting will cover such subjects as the following:
1. Insurance certificates
 2. Permits and licenses
 3. Affirmative action employment
 4. Construction schedules
 5. Cost breakdown and applications for payment
 6. Material deliveries, storage and payments
 7. Shop drawings and submittals
 8. Job-site inspection by the ENGINEER
 9. Safety and emergency action procedures
 10. Operations of the existing utilities
 11. Field offices, security and other housekeeping procedures
 12. List of subcontractors
 13. Liquidated damages
 14. Communications
 15. Coordinating
 16. All other appropriate matters.

1.02 PROGRESS

- A. A progress meeting shall be held on a once-per-week basis for the purpose of coordinating and expediting the work. The CONTRACTOR, as a part of his obligations under the Contract, shall attend in person or by an authorized representative to attend and to act on his behalf. The ENGINEER will conduct such meetings and as necessary, with the CONTRACTOR's input, issue an agenda.
- B. In addition, the ENGINEER or CONTRACTOR may call for special job site meetings for the purpose of resolving unforeseen problems or conflicts which may impede the construction schedule. The ENGINEER will prepare a brief summary report of the decisions or understandings concerning each of the items discussed at the meeting.
- C. At weekly progress meetings, the CONTRACTOR shall submit to the ENGINEER for review a current three (3) week progress schedule. This schedule submission shall include a two

week look ahead schedule and reflect status of the work performed during the preceding week.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 25 00
BASIS OF PAYMENT

PART 1 – GENERAL

1.01 GENERAL

- A. Payments to the CONTRACTOR shall be made on the basis of the bid items listed on the Proposal Bid Form as full and complete payment for furnishing all materials, labor, tools, and equipment, and for performing all operations necessary to complete the work included in the Contract Documents. Such compensation shall also include payments for any loss or damages arising directly or indirectly from the work, or from any discrepancies between the actual quantities of work and those shown in the Contract Documents, or from any unforeseen difficulties which may be encountered during the prosecution of the work until the final acceptance by the CITY.

- B. The prices stated in the proposal include full compensation for overhead and profit, all costs and expenses for taxes, labor, equipment, materials, commissions, transportation charges and expenses, patent fees and royalties, labor for handling materials during inspection, furnishing and repairing small tools and ordinary equipment, mobilization, home office expenses and general supervision, bond, insurance, labor for handling materials during inspection, together with any and all other costs and expenses for performing and completing the work as shown on the Drawings and specified herein. In addition, the CONTRACTOR shall include the actual cost of social security taxes, unemployment insurance, worker's compensation, fringe benefits, inclusive of life and health insurance, union dues, pension, Drawings, vacations, and insurance and CONTRACTOR's public liability and property damage insurance involved in the work based on the actual wages paid to such labor and all other general costs and profits, prorated to each Item.

- C. Unless otherwise specifically stated elsewhere herein, the CONTRACTOR shall include in the prices bid all materials, electrical supply, fuel, lubricants, temporary equipment, temporary wiring, temporary piping and fittings, pumps, gages, and all other items of whatever nature required to completely test, balance, disinfect if required, and put into fully operational condition all equipment and/or systems supplied by either the CITY or the CONTRACTOR and installed as a part of this Project. Further, any test materials supplied by the CONTRACTOR shall be completely satisfactory to the CITY. Any decision as to whether a particular material is suitable for test purposes shall be at the sole discretion of the ENGINEER whose decision shall be final. Any material considered not suitable shall be immediately replaced by the CONTRACTOR with suitable material and no extra compensation will be allowed.

- D. The Basis of Payment for an item at the price shown in the Proposal shall be in accordance with its description of the item in this Section and as related to the work specified and as shown on the Drawings. Unit prices, where used, will be applied to the actual quantities furnished and installed in conformance with the Contract Documents.

- E. The CONTRACTOR'S attention is called to the fact that the quotations for the various items of work are intended to obtain a complete and working installation under this Contract, and any items of labor, equipment or materials which may reasonably be assumed as necessary to accomplish this end shall be supplied whether or not they are specifically shown on the Drawings or stated herein. Should the CONTRACTOR feel that the cost of any item of work has not been established by the Proposal Bid Form, he shall include the cost for that work in the Bid Item most closely associated with that work so that his proposal for the Project does reflect his total price for completing the work in its entirety.
- F. The CONTRACTOR shall submit, with each Payment Request, a list of MBE/WBE SUBCONTRACTOR's, that he is or will be utilizing for his contract. For each MBE/WBE SUBCONTRACTOR, the following information shall be provided:
 - 1. Total sub-contract dollar amount.
 - 2. Amount paid to date.

1.02 MEASUREMENT

The quantities for payment under this Contract shall be determined by actual measurement of the completed items, in place, ready for service and accepted by the CITY, in accordance with the Proposal Bid Form as described in Section 00 30 10 and 00 30 10A, unless otherwise specified. A representative of the CITY shall witness all field measurements.

1.03 PAYMENT ITEMS

For purposes of determining the monthly payments to be made to the CONTRACTOR for work accomplished, the percentage of work completed shall be determined in the following manner:

- A. Excavation, installation of pipe, valves, fittings, hydrants, and other appurtenances completed, removal and disposal of excavation, completed backfill and temporary paving repairs shall constitute eighty-five percent (85%) of the price bid for these Proposal Items.
- B. Completion of all interior work in the pipeline including cleaning, hydrostatic testing and disinfection of water mains shall constitute five percent (5%) of the price bid for these Proposal Items.
- C. Completion of all surface repairs, restoration of public or private facilities, appurtenances, and all other work not provided for under other Proposal Items shall constitute the remaining ten percent (10%) of the price bid for these Proposal Items.
- D. Descriptions, method of measurement and basis of payment for each pay item:

PHASE 1

Site Work and Demolition Bid Items

1. **Bid Item No. 1 – Pipe Demolition:** The lump sum price for this item shall be payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to demolish the existing piping. This includes, but is not limited to, cutting and removing sections of existing pipe of various diameters, excavation, hauling, provision of a dumpster for rubbish handling, and responsibility for hauling and disposal.
2. **Bid Item No. 2 – Site Demolition:** The lump sum price for this item shall be payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to demolish the existing site. This includes, but is not limited to, saw cutting of asphalt, removal of pavement and curb, hauling and disposal of demolished materials, provision of a dumpster for rubbish handling, and responsibility for hauling and disposal.
3. **Bid Item No. 3. – Site Clearing:** The lump sum price for this item shall be payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to clear the site of selected trees and shrubs. This work includes, but is not limited to, selective felling of trees, large tract clearing, selective clearing and grubbing, selective shrub removal and clearing of brush, piling, hauling, and rubbish handling, and responsibility for hauling and disposal.
4. **Bid Item No. 4 – Site Grading:** The lump sum price for this item shall be payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to complete fine and finish grading.

Temporary Yard Piping Construction Bid Items

5. **Bid Item No. 5 – Concentrate Pipe System:** The lump sum price for this item shall be payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish and install D.I. pipe and fittings. This work shall include, but not be limited to: survey, swale restoration, locating and protection of all existing utilities, preparation and submittal of shop drawings, installing storm water pollution prevention devices, dewatering, pipe and all D.I. fittings/appurtenances, restrained joints, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, removal and disposal of all removed asphalt pavement and lime rock base, and concentrate piping system pressure testing. Payment shall include traffic steel plates where necessary.
6. **Bid Item No. 6 – Drain Pipe System:** The lump sum price for this item shall be payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish and install PVC pipe and fittings. This work shall include, but not be limited to: survey, swale restoration, locating and protection of all existing utilities, preparation and submittal of shop drawings, installing storm water pollution prevention devices, dewatering, pipe and all PVC fittings/appurtenances, restrained joints, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, removal and disposal of all removed asphalt pavement and lime rock base, and sewer system testing.

Permanent Yard Piping Construction Bid Items

7. **Bid Item No. 7 – Sheet Piling:** Payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to provide steel sheet piling as required for excavation. Payment shall be at the unit price for the item times

the square feet of sheet piling installed, tested, ready for service, and accepted by the ENGINEER.

8. **Bid Item No. 8 – Concentrate Pipe System South of Clarifiers:** The lump sum price for this item shall be payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish and install PVC pipe and fittings. This work shall include, but not be limited to: survey, clearing and grubbing, swale restoration, locating and protection of all existing utilities, preparation and submittal of shop drawings, installing storm water pollution prevention devices, dewatering, pipe and all PVC fittings/appurtenances, restrained joints, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, removal and disposal of all removed asphalt pavement and lime rock base, and concentrate piping system pressure testing. Payment shall include traffic steel plates where necessary.
9. **Bid Item No. 9 – Concentrate Pipe System North Area:** The lump sum price for this item shall be payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish and install PVC pipe and fittings. This work shall include, but not be limited to: survey, swale restoration, locating and protection of all existing utilities, preparation and submittal of shop drawings, installing storm water pollution prevention devices, dewatering, pipe and all PVC fittings/appurtenances, restrained joints, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, removal and disposal of all removed asphalt pavement and lime rock base, concentrate system pressure testing. Payment shall include traffic steel plates where necessary .
10. **Bid Item No. 10 – Secondary Effluent Pipe System and Fittings (Subitems a through m):** Payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish and install D.I. pipe and fittings. This work shall include, but not be limited to: survey, swale restoration, locating and protection of all existing utilities, preparation and submittal of shop drawings, installing storm water pollution prevention devices, dewatering, pipe and all D.I. fittings/appurtenances, restrained joints, flanged joints, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, removal and disposal of all removed asphalt pavement and lime rock base, and piping system testing. Payment shall be at the individual unit price for each subitem times the quantity of that bid item installed, tested, ready for service, and accepted by the ENGINEER.
11. **Bid Item No. 11 – Mixed Concentrate Pipe System and Fittings (Subitems a through I):** Payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish and install D.I. pipe and fittings, all of which are to be ceramic epoxy lined. This work shall include, but not be limited to: survey, swale restoration, locating and protection of all existing utilities, preparation and submittal of shop drawings, installing storm water pollution prevention devices, dewatering, pipe and all D.I. fittings/appurtenances, restrained joints, flanged joints, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, removal and disposal of all removed asphalt pavement and lime rock base, and piping system testing. Payment shall be at the individual unit price for each subitem times the quantity of that bid item installed, tested, ready for service, and accepted by the ENGINEER.

12. **Bid Item No. 12 – Sanitary Sewer System (Subitems a through d)**: Payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish, transport, store, protect, and install new a PVC sanitary sewer system. This work shall include, but not be limited to: survey, swale restoration, locating and protection of all existing utilities, preparation and submittal of shop drawings, installing storm water pollution prevention devices, dewatering, pipe and all PVC fittings/appurtenances, sanitary laterals and manholes, connection to existing manholes including coring of existing structures, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, removal and disposal of all removed asphalt pavement and lime rock base, and sewer system testing. Payment shall be at the individual unit price for each subitem times the quantity of that bid item installed, tested, ready for service, and accepted by the ENGINEER.
13. **Bid Item No. 13 – 6-Inch Backwash PVC Pipe**: The lump sum price for this item shall be payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish and install PVC pipe and fittings. This work shall include, but not be limited to: survey, swale restoration, locating and protection of all existing utilities, preparation and submittal of shop drawings, installing storm water pollution prevention devices, dewatering, pipe and all PVC fittings/appurtenances, restrained joints, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, removal and disposal of all removed asphalt pavement and lime rock base, and piping system pressure testing.

Structural, Process, Electrical, and I&C Bid Items

14. **Bid Item No. 14 – Injection Well No. 3 and No. 4 Wellhead Piping, Fittings, and Valves (Subitems a through I)**: Payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish and install above grade pipe and fittings, all of which are to be ceramic epoxy lined. This work shall include, but not be limited to: survey, swale restoration, locating and protection of all existing utilities, preparation and submittal of shop drawings, installing storm water pollution prevention devices, dewatering, pipe and all D.I. fittings/appurtenances, restrained joints, pipe coupling, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, removal and disposal of all removed asphalt pavement and lime rock base, and piping system testing. Payment shall be at the individual unit price for each subitem times the quantity of that bid item installed, tested, ready for service, and accepted by the ENGINEER.
15. **Bid Item No. 15 – Injection Wells No. 3 and No. 4 Slabs**: The lump sum price for this item shall be payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish, transport, store, protect, and install new concrete slabs for Injection Wells No. 3 and No. 4. This includes, but is not limited to: survey, locating and protection of all existing utilities, preparation and submittal of shop drawings, placing of concrete as a slab on grade, all necessary additives and treatments, concrete finishing, and removal and disposal of all rubbish.
16. **Bid Item No. 16 – Monitoring Well No. 2 Slab and Piping**: The lump sum price for this item shall be payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish, transport, store, protect,

and install new concrete slabs for Monitoring Well No. 2 and supply sampling equipment such as piping, fittings, and pumps. For the Monitoring Well slab, this includes, but is not limited to: survey, locating and protection of all existing utilities, preparation and submittal of shop drawings, concrete as a slab on grade, all necessary additives and treatments, concrete finishing, and removal and disposal of all rubbish. For the Monitoring Well sampling equipment this includes, but is not limited to: survey, clearing and grubbing, swale restoration, locating and protection of all existing utilities, preparation and submittal of shop drawings, installing storm water pollution prevention devices, dewatering, pipe and all D.I. fittings/appurtenances, unloading of existing pump, installation of sample pump and anchors, restrained joints, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, removal and disposal of all removed asphalt pavement and lime rock base, and piping system testing.

17. **Bid Item No. 17 – Valve Vault for Secondary 42-inch Piping, Fittings, and Valves:** The lump sum price for this item shall be payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish, transport, store, protect, and install a new plug valve vault for the secondary effluent pipe system, including the following: survey; locating and protection of all existing utilities; preparation and submittal of shop drawings; trench excavation; shoring; bedding; backfilling; removal and disposal of unsuitable/excess fill; removal and disposal of all removed sidewalk/curb and gutter; removal and disposal of all removed asphalt pavement and lime rock base, water distribution system pressure testing and disinfection (sampling points, etc.); mud mat; concrete sloped grout fill; access ladders; specialty access doors; concrete slab on grade base slab, concrete walls, and concrete elevated top slabs; slab on grade pipe supports; finishing; chemical anchoring; concrete finishing; pipe and all D.I. fittings/appurtenances; 42” motorized plug valve with actuator; pipe supports; restrained push joint, and flanged coupling adapters.
18. **Bid Item No. 18 Valve Vault for Concentrate 12-inch, Piping, Fittings, and Valves:** The lump sum price for this item shall be payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish, transport, store, protect, and install a new plug valve vault for the mixed concentration pipe system, including the following: survey; locating and protection of all existing utilities; preparation and submittal of shop drawings; trench excavation; shoring; bedding; backfilling; removal and disposal of unsuitable/excess fill; removal and disposal of all removed sidewalk/curb and gutter; removal and disposal of all removed asphalt pavement and lime rock base, water distribution system pressure testing and disinfection (sampling points, etc.); concrete mud mat; concrete sloped grout fill; access ladders; specialty access doors; concrete slab on grade base slab, concrete walls, and concrete elevated top slabs; slab on grade pipe supports; finishing; chemical anchoring; concrete finishing; pipe and all D.I. fittings/appurtenances; pipe coupling; pipe supports; 12” plug valve; restrained push joints; and flanged coupling adapters.
19. **Bid Item No. 19 – Valve Vault for Concentrate 42-inch, Piping, Fittings, and Valves:** The lump sum price for this item shall be payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish, transport, store, protect, and install a new check valve vault for the secondary effluent pipe system, including the following: survey; locating and protection of all existing utilities; preparation and submittal of shop drawings; trench excavation; shoring; bedding; backfilling; removal and disposal of unsuitable/excess fill; removal and disposal of all removed sidewalk/curb and gutter; removal and disposal of all removed

asphalt pavement and lime rock base, water distribution system pressure testing and disinfection (sampling points, etc.); concrete mud mat; concrete sloped grout fill; access ladders; specialty access doors; concrete slab on grade base slab, concrete walls, and concrete elevated top slabs; slab on grade pipe supports; finishing; chemical anchoring; concrete finishing; pipe and all D.I. fittings/appurtenances; 42" motorized plug valve with actuator; pipe supports; restrained push joint, and flanged coupling adapters.

20. **Bid Item No. 20 – Miscellaneous Electrical**: The lump sum price for this item shall be payment for all labor, equipment, materials, delivery, storage, testing and commissioning for all work necessary and required to connect all necessary electrical equipment to process and mechanical features, as described in the Drawings.
21. **Bid Item No. 21 – Miscellaneous I&C**: The lump sum price for this item shall be payment for all labor, equipment, materials, delivery, storage, testing and commissioning for all work necessary and required to connect all necessary instrumentation and controls to process and mechanical features, as described in the Drawings.

PHASE 2

Site Work and Demolition Bid Items

22. **Bid Item No. 22 – Stormwater Pipe, Manholes, and Below and Above Ground Features Demolition:** The lump sum price for this item shall be payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to demolish the existing stormwater piping and existing manholes structures. This includes, but is not limited to, cutting and removing sections of existing piping of various diameters as shown on the drawings, excavation, hauling, provision of a dumpster for rubbish handling and disposal. It also includes removing sections of structures of existing manholes, sidewalks, and other features, as described in the Drawings.
23. **Bid Item No. 23 – Site Clearing:** The lump sum price for this item shall be payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to clear the site of selected trees and shrubs. This work includes, but is not limited to, selective felling of trees, large tract clearing, selective clearing and grubbing, selective shrub removal and clearing of brush, piling, hauling, rubbish handling and disposal, to the limits described in the Drawings.
24. **Bid Item No. 24 – Site Grading:** The lump sum price for this item shall be payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to complete fine and finish grading within green areas, landscape areas, and storm retention ponds, as described in the Drawings.

Permanent Yard Piping Bid Items

25. **Bid Item No. 25 – Sheet Piling:** Payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to provide steel sheet piling as required for excavation. Payment shall be at the unit price for the item times the square feet of sheet piling installed, tested, ready for service, and accepted by the ENGINEER measured from the bottom of the pile to a maximum of two (2) feet above grade.
26. **Bid Item No. 26 – Sanitary Sewer (SAN) System (Subitems a through j):** Payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish and install pipe, manholes, connectors, and coating systems for manholes. This work shall include, but not be limited to: survey, swale restoration, locating and protection of all existing utilities, preparation and submittal of shop drawings, installing storm water pollution prevention devices, dewatering, all pipes of various diameters and depths below grade, all fittings/appurtenances, new manholes of various depths below grade, restrained joints, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, removal and disposal of all removed asphalt pavement and lime rock base, and piping system testing. Payment shall be at the individual unit price for each subitem times the quantity of that bid item installed, tested, ready for service, and accepted by the ENGINEER.
27. **Bid Item No. 27 – Process Drain (PD) System (Subitems a through f):** Payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish and install pipes, manholes, connectors, and coating systems for manholes. This work shall include, but not be limited to survey, swale restoration, locating and protection of all existing utilities, preparation and submittal of shop

drawings, installing storm water pollution prevention devices, dewatering, all pipes of various diameters and depths below grade, all fittings/appurtenances, new manholes of various depths below grade and connections to existing manholes, restrained joints, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, removal and disposal of all removed asphalt pavement and lime rock base, and piping system testing. Payment shall be at the individual unit price for each subitem times the quantity of that bid item installed, tested, ready for service, and accepted by the ENGINEER.

28. **Bid Item No. 28 – Storm Drain (STD) System (Subitems a through q)**: Payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish and install pipe, fittings, storm structures, control structures, head walls, grates, and mitered end sections. This work shall include, but not be limited to: survey, swale restoration, locating and protection of all existing utilities, preparation and submittal of shop drawings, installing storm water pollution prevention devices, dewatering, all pipe systems of various diameters and depths below grade, all fittings/appurtenances, new storm structures of various depths below grade and connections to existing structures, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, removal and disposal of all removed asphalt pavement and lime rock base, and piping system testing. Payment shall be at the individual unit price for each subitem times the quantity of that bid item installed, tested, ready for service, and accepted by the ENGINEER
29. **Bid Item No. 29 – Chlorine Solution (CLS) System**: The lump sum price for this item shall be payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish and install the pipe system and fittings. This work shall include, but not be limited to: survey, swale restoration, locating and protection of all existing utilities, preparation and submittal of shop drawings, installing storm water pollution prevention devices, dewatering, pipe and all fittings/appurtenances, valves, containment pipe, carrier pipe, restrained joints, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, removal and disposal of all removed asphalt pavement and lime rock base, and system testing, as described in the Drawings.
30. **Bid Item No. 30 – Concentrate (CON) System**: The lump sum price for this item shall be payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish and install the pipe system and fittings. This work shall include, but not be limited to: survey, swale restoration, locating and protection of all existing utilities, preparation and submittal of shop drawings, installing storm water pollution prevention devices, dewatering, pipe and all fittings/appurtenances, restrained joints, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, removal and disposal of all removed asphalt pavement and lime rock base, and system testing, as described in the Drawings.
31. **Bid Item No. 31 – Force Main (FM) System (Subitems a through e)**: Payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish and install the pipe system and fittings. This work shall include, but not be limited to: survey, swale restoration, locating and protection of all existing utilities, preparation and submittal of shop drawings, installing storm water pollution prevention devices, dewatering, all pipe of various diameters and depths below grade,

all fittings/appurtenances, restrained joints, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, removal and disposal of all removed asphalt pavement and lime rock base, and piping system testing. Payment shall be at the individual unit price for each subitem times the quantity of that bid item installed, tested, ready for service, and accepted by the ENGINEER, as described in the Drawings.

32. **Bid Item No. 32 – Non-Potable Water (NPW) System (Subitems a through m):** Payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish and install the pipe system and fittings. This work shall include, but not be limited to: survey, swale restoration, locating and protection of all existing utilities, preparation and submittal of shop drawings, installing storm water pollution prevention devices, dewatering, all pipe of various diameters and depths below grade, all fittings/appurtenances, restrained joints, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, removal and disposal of all removed asphalt pavement and lime rock base, and piping system testing. Payment shall be at the individual unit price for each subitem times the quantity of that bid item installed, tested, ready for service, and accepted by the ENGINEER, as described in the Drawings.
33. **Bid Item No. 33 – Pressurized Process Drain (PPD) System (Subitems a through f):** Payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish and install the pipe system and fittings. This work shall include, but not be limited to: survey, swale restoration, locating and protection of all existing utilities, preparation and submittal of shop drawings, installing storm water pollution prevention devices, dewatering, all pipe of various diameters and depths below grade, all fittings/appurtenances, restrained joints, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, removal and disposal of all removed asphalt pavement and lime rock base, and piping system testing. Payment shall be at the individual unit price for each subitem times the quantity of that bid item installed, tested, ready for service, and accepted by the ENGINEER, as described in the Drawings.
34. **Bid Item No. 34 – Potable Water (PW) System (Subitems a through k):** Payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish and install the pipe system and fittings. This work shall include, but not be limited to: survey, swale restoration, locating and protection of all existing utilities, preparation and submittal of shop drawings, installing storm water pollution prevention devices, dewatering, all pipe of various diameters and depths below grade, all fittings/appurtenances including air release valves, fire hydrants, restrained joints, connection to existing systems, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, removal and disposal of all removed asphalt pavement and lime rock base, and piping system testing. Payment shall be at the individual unit price for each subitem times the quantity of that bid item installed, tested, permitted, ready for service, and accepted by the ENGINEER, as described in the Drawings.
35. **Bid Item No. 35 – Scum System:** The lump sum price for this item shall be payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish and install the pipe system and fittings. This work shall include, but not be limited to: survey, swale restoration, locating and protection

of all existing utilities, preparation and submittal of shop drawings, installing storm water pollution prevention devices, dewatering, pipe and all fittings/appurtenances, connection to existing systems, restrained joints, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, removal and disposal of all removed asphalt pavement and lime rock base, and system testing, as described in the Drawings.

36. **Bid Item No. 36 – Secondary Effluent (SEC) System (Subitems a through k)**: Payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish and install pipes and fittings. This work shall include, but not be limited to: survey, swale restoration, locating and protection of all existing utilities, preparation and submittal of shop drawings, installing storm water pollution prevention devices, dewatering, all pipes of various diameters and depths below grade, all fittings/appurtenances, restrained joints, connection to existing systems, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, removal and disposal of all removed asphalt pavement and lime rock base, and piping system testing. Payment shall be at the individual unit price for each subitem times the quantity of that bid item installed, tested, ready for service, and accepted by the ENGINEER.
37. **Bid Item No. 37 – Seal Water (SW) System (Subitems a through d)**: Payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish and install pipe system and fittings. This work shall include, but not be limited to: survey, swale restoration, locating and protection of all existing utilities, connection to existing systems, preparation and submittal of shop drawings, installing storm water pollution prevention devices, dewatering, all pipe of various diameters and depths below grade, all fittings/appurtenances, restrained joints, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, removal and disposal of all removed asphalt pavement and lime rock base, and piping system testing. Payment shall be at the individual unit price for each subitem times the quantity of that bid item installed, tested, ready for service, and accepted by the ENGINEER.
38. **Bid Item No. 38 – Waste Activated Sludge (WAS) System (Subitems a through d)**: Payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish and install the pipe system and fittings. This work shall include, but not be limited to: survey, swale restoration, locating and protection of all existing utilities, connection to existing systems, preparation and submittal of shop drawings, installing storm water pollution prevention devices, dewatering, all pipe of various diameters and depths below grade, all fittings/appurtenances, restrained joints, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, removal and disposal of all removed asphalt pavement and lime rock base, and piping system testing. Payment shall be at the individual unit price for each subitem times the quantity of that bid item installed, tested, ready for service, and accepted by the ENGINEER.
39. **Bid Item No. 39 – Sampling Line (SMP) System**: The lump sum price for this item shall be payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish, transport, store, protect, and install all sampling line piping and fittings. This work shall include, but not be limited to: survey, swale restoration, locating and protection of all existing utilities, preparation and

submittal of shop drawings, installing storm water pollution prevention devices, dewatering, all pipe of various diameters and depths below grade, all fittings/appurtenances, connection to existing systems, restrained joints, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, removal and disposal of all removed asphalt pavement and lime rock base, and piping system testing, as described in the Drawings.

40. **Bid Item No. 40 – Water Services:** The price bid shall be full compensation for each new meter connected, ready for service, and shall include but not be limited to: survey, swale restoration, locating and protection of all existing utilities, preparation and submittal of shop drawings, installing storm water pollution prevention devices, dewatering, coordination with CITY forces for temporary system deactivation; “U-branches”, header piping and fittings; furnishing and installing new ball valve curb stop(s), “U-branches” and header piping and fittings; furnishing and installing HDPE tubing for domestic water service, gate valves, valve boxes, risers, concrete collars, double-strap or band service saddle and corporation stop; making connection to proposed water mains; furnishing and installing 3-inch minimum diameter Sch. 80 PVC or black iron casing (for services crossing under roadway pavement); replacement of concrete sidewalks, curbs and pedestrian ramps (including detectable warning surface); restoration of stabilized subgrade, compacted limerock base and asphalt surface course for trench restoration, in excess of that required to restore the new water main trench, in accordance with the Drawings, details, and all other appurtenant and miscellaneous items and work necessary for a complete installation in accordance with the details, Specifications and locations shown on the Drawings. Payment shall be at the individual unit price for each subitem times the quantity of that bid item installed, tested, ready for service, and accepted by the ENGINEER.
41. **Bid Item No. 41 – Pipe Encasement:** Payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish and install concrete encasement around piping system and fittings. This work shall include, but not be limited to: survey, clearing and grubbing, swale restoration, locating and protection of all existing utilities, preparation and submittal of shop drawings, installing storm water pollution prevention devices, dewatering, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, removal and disposal of all removed asphalt pavement and lime rock base, and piping system testing. Payment shall be at the individual unit price for each subitem times the quantity of that bid item installed, tested, ready for service, and accepted by the ENGINEER.

Civil, Structural, Process, Electrical, and I&C Bid Items

42. **Bid Item No. 42 – Injection Well Pump Station No. 2 Strainer Improvements:** The lump sum price for this item shall be payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish, transport, store, protect, and install all above and below grade piping, connection to existing and proposed pipe systems, equipment, and concrete pad for the strainer area. This is including, but not limited to: survey, locating and protection of all existing utilities, preparation and submittal of shop drawings, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, removal and disposal of all removed asphalt pavement and lime rock base, pipe system pressure testing, system testing and start-up of all materials, mud mat, concrete slab on grade base slab, slab on grade pipe supports, finishing, chemical anchoring, concrete finishing, pipe and all fittings/appurtenances, pipe supports, strainers, and other improvements for a complete and operational system required by the Contract Documents, and accepted by the ENGINEER.
43. **Bid Item No. 43 – Plant Drain Pump Station Improvements:** The lump sum price for this item shall be payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish, transport, store, protect, and install all above and below grade piping, equipment, wet well, and concrete pad for the plant drain pump station area. This is including, but not limited to: survey, locating and protection of all existing utilities, preparation and submittal of shop drawings, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, removal and disposal of all removed asphalt pavement and lime rock base, pipe system pressure testing, system testing and start-up of all materials, concrete mud mat, concrete sloped grout fill, access ladders, specialty access doors, concrete slab on grade base slab, slab on grade pipe supports, finishing, chemical anchoring, concrete finishing, pipe and all fittings/appurtenances, pipe supports, pumping equipment, and other improvements for a complete and operational system required by the Contract Documents, and accepted by the ENGINEER.
44. **Bid Item No. 44 – Surge Tanks and Fuel Storage Tanks Improvements:** The lump sum price for this item shall be payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish, transport, store, protect, and install all above and below grade piping, equipment, foundations, and concrete pad for the surge tank and fuel storage tank area. This is including, but not limited to: survey, locating and protection of all existing utilities, preparation and submittal of shop drawings, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, removal and disposal of all removed asphalt pavement and lime rock base, pipe system pressure testing, system testing and start-up of all materials, concrete mud mat, access ladders, specialty access doors, concrete on grade base slab, slab on grade pipe supports, finishing, chemical anchoring, concrete finishing, pipe and all fittings/appurtenances, pipe supports, fuel tanks and surge tanks, and other improvements for a complete and operational system required by the Contract Documents, and accepted by the ENGINEER.
45. **Bid Item No. 45 – Existing Injection Well No. 1 and Injection Well No. 2 Modifications:** The lump sum price for this item shall be payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish,

transport, store, protect, and install all above and below grade piping, equipment, foundations, and concrete pads for the existing injections wells No.1 and No.2. This is including, but not limited to: survey, locating and protection of all existing utilities, preparation and submittal of shop drawings, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, removal and disposal of all removed asphalt pavement and lime rock base, pipe system pressure testing, system testing and start-up of all materials, concrete on grade base slab, slab on grade pipe supports, finishing, chemical anchoring, concrete finishing, pipe and all fittings/appurtenances, pipe supports, fuel utility trenches and related piping across proposed perpendicular to the proposed road, and other improvements for a complete and operational system required by the Contract Documents, and accepted by the ENGINEER.

46. **Bid Item No. 46 – Splitter Box Improvements at Clarifier No. 2:** The lump sum price for this item shall be payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish, transport, store, protect, and install all above and below grade piping, equipment, foundations, connect to proposed and existing piping systems, and install the concrete structure. This is including, but not limited to: survey, locating and protection of all existing utilities, preparation and submittal of shop drawings, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, removal and disposal of all removed asphalt pavement and lime rock base, pipe system pressure testing, system testing and start-up of all materials, concrete mud mat, concrete sloped grout fill, access ladders, specialty access doors, concrete slab on grade base slab, slab on grade pipe supports, finishing, chemical anchoring, concrete finishing, pipe and all fittings/appurtenances, pipe supports, and other improvements for a complete and operational system required by the Contract Documents, and accepted by the ENGINEER.
47. **Bid Item No. 47 – Injection Well Pump Station Building No. 2:** The lump sum price for this item shall be payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish, transport, store, protect, and install all above and below grade piping, equipment, foundations, connect to proposed and existing piping systems, and erect the new building. This is including, but not limited to: survey, locating and protection of all existing utilities, preparation and submittal of shop drawings, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, removal and disposal of all removed asphalt pavement and lime rock base, pipe system pressure testing, system testing and start-up of all materials, concrete mud mat, access ladders, specialty access doors, concrete on grade base slab, slab on grade pipe supports, finishing, chemical anchoring, concrete finishing, pipe and all fittings/appurtenances, pipe supports, pumping equipment, metering equipment, electrical equipment, instrumentation and controls equipment, and other improvements for a complete and operational system required by the Contract Documents, and accepted by the ENGINEER.
48. **Bid Item No. 48 – Electrical Service and Generator Building:** The lump sum price for this item shall be payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish, transport, store, protect, and install all above and below grade piping, equipment, foundations, connect to proposed and existing piping systems, and erect the new building. This is including, but not limited to: survey, locating and protection of all existing utilities, preparation

and submittal of shop drawings, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, removal and disposal of all removed asphalt pavement and lime rock base, pipe system pressure testing, system testing and start-up of all materials, concrete mud mat, access ladders, specialty access doors, concrete on grade base slab, slab on grade pipe supports, finishing, chemical anchoring, concrete finishing, pipe and all fittings/appurtenances, pipe supports, pumping equipment, metering equipment, power generation equipment, electrical equipment, instrumentation and controls equipment, and other improvements for a complete and operational system required by the Contract Documents, and accepted by the ENGINEER.

49. **Bid Item No. 49 – Gravity Retaining Wall:** The lump sum price for this item shall be payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish, transport, store, protect, and install the retaining wall. This is including, but not limited to: survey, locating and protection of all existing utilities, preparation and submittal of shop drawings, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, installation of vehicular guardrails, installation of handrailings, installation of drain system, removal and disposal of all removed asphalt pavement and lime rock base, pipe system pressure testing, system testing and start-up of all materials, finishing, anchoring, concrete finishing, and all other improvements for a complete and operational system required by the Contract Documents, and accepted by the ENGINEER.
50. **Bid Item No. 50 – Sidewalks, Parking Pads, Stair Landing Pads, and Miscellaneous Concrete Pads:** The lump sum price for this item shall be payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish and install sidewalks, parking pads, stair landing pads, and miscellaneous concrete pads. This work shall include, but not be limited to: survey, clearing and grubbing, swale restoration, locating and protection of all existing utilities, preparation and submittal of shop drawings, installing storm water pollution prevention devices, dewatering, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, removal and disposal of all removed asphalt pavement and lime rock base, and all other improvements for a complete and operational system required by the Contract Documents, and accepted by the ENGINEER.
51. **Bid Item No. 51 – Fuel Delivery Trench Box:** Payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish and install the fuel delivery trench box. This work shall include, but not be limited to: survey, clearing and grubbing, swale restoration, locating and protection of all existing utilities, preparation and submittal of shop drawings, installing storm water pollution prevention devices, dewatering, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, and removal and disposal of all removed asphalt pavement and lime rock base. Payment shall be at the unit price bid times the number of linear feet installed, ready for service, completed and accepted by the ENGINEER.
52. **Bid Item No. 52 – Concrete Curbs and Valley Gutters:** Payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish and install concrete curbs and valley gutters. This work shall include, but not be limited to: survey, clearing and grubbing, swale restoration, locating and protection of all existing utilities, preparation and submittal of shop drawings, installing storm

water pollution prevention devices, dewatering, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, and removal and disposal of all removed asphalt pavement and lime rock base. Payment shall be at the unit price bid times the number of linear feet installed, ready for service, completed and accepted by the ENGINEER.

53. **Bid Item No. 53 – Site Fill and Grading:** The lump sum price for this item shall be payment for all labor, equipment, materials, delivery, and commissioning for all work necessary and required to furnish, transport, store, protect, grade, install, and compact the site fill to the elevations shown in the Contract Documents. This is including, but not limited to compaction, document control, coordination with ENGINEER for testing and retesting of all fill material not meeting compaction requirements, re-compaction of retested material, and removal of material not meeting testing requirements or compaction requirements. The price bid shall be full compensation for a complete fill material installation. Payment shall also be contingent on approved laboratory testing of fill which shall be paid under the allowance in Bid Item 68.
54. **Bid Item No. 54 – Guard Rails:** Payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish and install vehicular guard rails. This work shall include, but not be limited to: survey, clearing and grubbing, swale restoration, locating and protection of all existing utilities, preparation and submittal of shop drawings, installing storm water pollution prevention devices, dewatering, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, and removal and disposal of all removed asphalt pavement and lime rock base. Payment shall be at the unit price bid times the number of linear feet installed, ready for service, completed, and accepted by the ENGINEER.
55. **Bid Item No. 55 – Installation of New Perimeter Fencing:** Payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish and install new fencing and appurtenances (including concrete for post foundations) where shown on the Drawings in accordance with the Specifications and Standard Details. Payment shall be at the unit price bid times the number of linear feet of fencing installed, ready for service, completed and accepted by the ENGINEER. Such payment shall be full payment and include, but not limited to survey, locating and protection of existing utilities, preparation and submittal of shop drawings, and all other appurtenant and miscellaneous items and work necessary to obtain a complete installation of the new chain link fencing and appurtenances in accordance with the details, Specifications and locations shown on the Drawings.
56. **Bid Item No. 56 – Geotechnical Instrumentation and Monitoring:** The lump sum price for this item shall be payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to monitor activities related to the installation of proposed structures and utilities in such a manner that damage is prevented to adjacent parts of the site and facility. This is including, but not limited to collecting baseline data, monitoring of ground and existing structures, developing a pre-construction condition survey, providing data for determining trends, developing a geotechnical instrumentation plan, frequent monitoring and all other items specified in the scope of the Geotechnical Instrumentation and Monitoring Specification (31 09 00). The price bid shall be full compensation for all instrumentation and monitoring needs as outlined in the specification.

Roads and Site Restoration Bid Items

57. **Bid Item No. 57 – Road Construction:** Payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish and install sub-base material, base material, and asphaltic surfaces for new or reconstructed roadways, including work necessary and required to furnish and install 1.5-inch min. thick S-III. Permanent paving in streets will be paid for at the unit price bid times the number of square yards (SY) of asphaltic concrete installed and accepted by the ENGINEER. The pavement shall be placed in the full width of the street. Greater widths are at the CONTRACTOR's option and expense. The bid price shall be full compensation for furnishing all materials, labor and equipment required for a complete machine-laid asphaltic concrete surface course installation. This work shall include, but not be limited to: survey, clearing and grubbing, swale restoration, locating and protection of all existing utilities, preparation and submittal of shop drawings, installing storm water pollution prevention devices, dewatering, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, removal and disposal of all removed asphalt pavement and lime rock base, installation of lime rock base, compaction and testing, and re-compaction and retesting.
58. **Bid Item No. 58 - Milling of Asphaltic Course to 1-inch Nominal Thickness:** Payment for all labor, equipment, materials and delivery for all work necessary and required to mill 1-inch from the existing asphaltic concrete surface course for permanent asphalt pavement repairs within the boundaries outlined in the Drawings will be paid for at the unit price bid times the number of square yards (SY) of such surface course milled as required and as approved by the ENGINEER. Milling of pavement shall be performed for the full width of the street. Greater widths are at CONTRACTOR's option and expense. The bid price shall be full compensation for saw-cutting, furnishing all materials, labor and equipment required. Asphalt cold milling shall be performed using an automated pavement planer capable of maintaining an accurate depth. Cold milling equipment shall meet the approval of the ENGINEER and the governing agency having jurisdiction at the location of the pavement milling operation. The ENGINEER's word as to the acceptability of the equipment shall be final.
59. **Bid Item No. 59 – 1.5-inch Thick Asphaltic Concrete Structural Course for Trench Restoration:** Payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish and install sub-base material, base material, and asphaltic concrete for trench restoration for 1.5-inch thick (min.) S-III asphaltic patch. Payment shall be at the unit price bid times the number of linear feet installed following the corresponding pavement restoration sections and meeting the compaction requirements provided on the Drawings, Specifications, and standard details (whichever is more stringent), completed and accepted by the CITY, with surface at the proper elevations. Trench restoration shall be placed on City streets. Greater widths, lengths, and thicknesses are at the CONTRACTOR's option and expense.
60. **Bid Item No. 60 – 1.5-inch Thick Asphaltic Concrete Surface Course for Pavement Overlay:** Payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish and install 1.5-inch min. thick S-III. Permanent paving overlay in streets will be paid for at the unit price bid times the number of square yards (SY) of asphaltic concrete overlay installed and accepted by the ENGINEER. The pavement overlay shall be placed in the full width of the street. Greater widths are at the CONTRACTOR's option and expense. The price bid shall be full compensation for furnishing all materials, labor and equipment required for a complete machine-laid asphaltic concrete surface course installation.

61. **Bid Item No. 61 – Install New Thermoplastic or Painted Pavement Markings, Reflective Pavement Markers, and Traffic Signs:** Payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish and install temporary and permanent thermoplastic pavement markings and messages, traffic signs, and reflective pavement markers damaged or removed by the CONTRACTOR's operation, or as indicated on the Drawings, in accordance with MUTCD. Payment shall be at the lump sum amount bid for the entire project. New pavement markings, signs and other traffic controls shall replace existing, or comply with the most current, traffic standards from the CITY.
62. **Bid Item No. 62 – Site Restoration:** Payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish to restore the site with sod. This work shall include, but not be limited to: survey, clearing and grubbing, swale restoration, locating and protection of all existing utilities, preparation and submittal of shop drawings, installing storm water pollution prevention devices, dewatering, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, and removal and disposal of all removed asphalt pavement and lime rock base. Payment shall be at the unit price bid times the number of square yards installed, ready for service, completed, and accepted by the ENGINEER.
63. **Bid Item No. 63 – South Electrical Service Center:** The lump sum price for this item shall be payment for all labor, equipment, materials, delivery, testing and commissioning for all work necessary and required to furnish, transport, store, protect, and install all above grade and below grade piping, equipment, foundations, connect to proposed and existing electrical systems, instrumentation, site demolition, site restoration, asphalt removal, asphalt placement, regrading of swales, install of generator enclosure, and other features associated as shown in the Contract Drawings. This is including, but not limited to: survey, locating and protection of all existing utilities, preparation and submittal of shop drawings, trench excavation, shoring, bedding, backfilling, removal and disposal of unsuitable/excess fill, removal and disposal of all removed sidewalk/curb and gutter, removal and disposal of all removed asphalt pavement and lime rock base, pipe system pressure testing, system testing and start-up of all materials, access stairs, specialty access doors, concrete on grade base slab, sidewalks, finishing, chemical anchoring, concrete finishing, pipe and all fittings/appurtenances, pipe supports, pumping equipment, metering equipment, electrical equipment, instrumentation and controls equipment, and other improvements for a complete and operational system required by the Contract Documents, and accepted by the ENGINEER.

General

64. **Bid Item No. 64 - Mobilization / Gen. Requirements:** The lump sum price bid for this item shall be full compensation for all mobilization activities required for the project, including but not limited to: Multiple mobilizations that may be required to comply with project phasing, providing bonds and insurance; preparing schedules and permit packages; complying with all submittal requirements; furnishing, installing and maintaining erosion and sedimentation control measures; providing/securing temporary construction facilities including engineer's and contractor's trailers, staging areas, space required for laydown and storage, parking, etc.; furnishing, installing and removal of temporary water main interconnections require for project phasing; survey work involving pre-construction project layout and controls; and pre-construction

audio-video. The payment items for mobilization shall not exceed three (3) percent of the sum of Bid Items No. 1 through 63.

65. **Bid Item No. 65 – Demobilization / General Requirements:** Payment for completing all other work including but not limited to finish grading, demobilization, site cleanup, pass lamp inspection for the cleaning of project drainage system, final restoration, recording horizontal and vertical locations of proposed improvements as they are constructed, and providing all necessary final record (“as-built”) documents; providing post-construction audio- video documentation of the site; finished grading; demobilization; restoration of any site items that do not relate to specific pay items in this bid; site cleanup; removal of temporary facilities including engineer’s and contractor’s trailers; and all other activities necessary to complete the contract work as per the Technical Specification and Contract Drawings. The payment items for demobilization shall not exceed two (2) percent of the sum of Bid Items No. 1 through 63.
66. **Bid Item No. 66 - Maintenance of Traffic, Including Design and Permitting:** The lump sum price bid for this item shall be full compensation for all labor, equipment, material, delivery, design and permitting for all work necessary and required for temporary traffic controls within the limits of the project for the duration of the construction period. Payment shall constitute full compensation for providing traffic controls throughout project area during the duration of construction, including but not limited to: preparing maintenance of traffic (MOT) drawings and obtaining approvals from CITY, furnishing and installing sufficient traffic signs, advance warning signs, electronic message boards, temporary pavement markings, reflective pavement markers (RPMs), barricades, temporary asphalt pavement, flagmen, and similar items and work for maintaining and/or re-directing pedestrian and vehicular traffic flow during construction in order to maintain safety. Provide facilities needed to maintain access to residences, businesses, etc. within the project limits.
67. **Bid Item No. 67 - Permit, Licenses, and Fees Allowance:** The allowance indicated for this item is to pay for all permits, licenses, and other fees required of the CONTRACTOR per the Contract Documents. The allowance shown on the Schedule of Bid Prices is an estimate of fees required. Payment will be based on the actual permit, license or fee paid directly to agency, documented by paid receipts, specifically excluding any labor, mark-up, overhead and profit, administration and other costs involved in obtaining permits or licenses or paying fees. Fees specifically excluded from this allowance include but are not limited to re-inspection fees, expired permit fees, standby time, and failed tests.
68. **Bid Item 68 – Materials Testing Allowance:** Included in this allowance is work associated with testing fill within the limits of the project for the duration of the construction period to meet City, FDOT, Broward County and any other applicable standards. This allowance excludes testing of materials associated with the pipeline as listed in previous bid items. The allowances shall cover the costs of the services provided by a firm selected by the Engineer or Owner. The Contractor shall enter into an agreement with the selected firm and shall coordinate the activities of the firm at the direction of the Engineer. Testing for multiple mobilizations due to limited testing as ordered by the Contractor will not be paid for by this allowance nor will stand-by time be paid for by this allowance. Any lack of Contractor coordination and scheduling which creates additional trips or downtime by the testing company will not be accepted or paid for by this allowance. The Contractor’s costs associated with the allowance items listed to include labor, overhead, profit and other expenses, shall be included in other bid items. Should the cost of the allowance be less than the

amount shown, the Contract will be adjusted as needed, in accordance with provisions in the Contract Documents. The cost of any required inspection or any required test which CONTRACTOR fails shall be paid for by CONTRACTOR.

69. **Bid Item 69 – Third Party Special Inspections Allowance:** Included, but not limited, in this allowance is work associated with special inspection within the limits of the project for the duration of the construction period. Payment shall constitute full compensation for providing the necessary special inspections. The allowances shall cover the costs of the services provided by a firm selected by the Engineer or Owner. The Contractor shall enter into an agreement with the selected firm and shall coordinate the activities of the firm at the direction of the Engineer. The Contractor's costs associated with the allowance items listed to include labor, overhead, profit and other expenses, shall be included in other bid items. Should the cost of the allowance be less than the amount shown, the Contract will be adjusted as needed, in accordance with provisions in the Contract Documents. The cost of any required inspection or any required test which CONTRACTOR fails shall be paid for by CONTRACTOR.
70. **Bid Item 70 - Miscellaneous Work Allowance/Contingency:** Included in this allowance is work associated with undefined conditions or conflicts developing from undefined conditions. All work authorized for payment will be authorized in writing by the CITY. Amount to be paid per undefined conditions or conflict shall be negotiated or agreed to by both parties. The CITY reserves the right to award any, all, or none of the money associated with this allowance.
71. **Bid Item 71 – Unforeseen Utility Locates or Break Repair:** Measurement and payment for unforeseen utility locates, break repairs, and other tasks that need immediate action will be based on the number of hours needed to perform such work in accordance with the requirements of the Contract Documents. Payment will be made at the unit price per hour of time spent to perform such tasks, which shall constitute full compensation for CONTRACTOR's standard mechanical crew and utilization of CONTRACTOR's equipment on site for excavation, backfill, mechanical, restoration work and coordination needed. The quantity for each task needs to be approved by the ENGINEER and CITY in advance.
- CONTRACTOR is responsible for potholing existing utilities sufficiently ahead of construction to avoid conflicts with the design alignment and grade of structures, culverts, storm drains and exfiltration trenches. Conflicts with utilities shown on the Drawings which result from the CONTRACTOR's negligence to pothole sufficiently ahead of construction (a minimum of two days ahead of construction of the pipeline or as approved by the ENGINEER) shall be resolved by the CONTRACTOR at no additional cost to the OWNER.
72. **Bid Item 72 – Consideration for Indemnification:** In recognition of CONTRACTOR's indemnification obligations, the CITY will pay to the CONTRACTOR the specific consideration of ten dollars (\$10.00). Payment of said specific consideration shall be made at the time of the payment of the first progress estimate and the CONTRACTOR shall acknowledge payment of this consideration by letter to the CITY after receipt of the progress payment.

- E. The price bid for each item shall be stated in figures in the appropriate places in the Proposal Bid Form. All blank spaces for bid prices must be filled in with ink, or with a typewriter. The Bidder is further directed that any and all alterations, changes, corrections, and modifications made to the Proposal Bid Form prior to submission of the

bids, must be initialed by the Bidder. Non-compliance by the Bidder of this directive may be grounds for rejection of his bid.

- F. In the event that there is a discrepancy between the price written in words and the price written in numbers, the price written in words shall govern except where the number of units multiplied by the unit price shown in numbers equals the total price for that bid item. In such case, the unit price shown in numbers shall govern over the unit price shown in words.
- G. Where an error is made in the calculation of the total bid price of an item, the unit price shall govern.
- H. If the bidder makes an error in his addition of the bid prices of the applicable items in the Bid Proposal, the correct sum of its' applicable bid item totals shall be the Total Bid.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 33 00

SUBMITTALS

PART 1 GENERAL

1.01 THE REQUIREMENT

- A. This section specifies the means of all submittals. All submittals, whether their final destination is to the City, ENGINEER, or other representatives of the City, shall be directed through the ENGINEER. A summary of the key types of submittals and the number of copies required is as follows:

Copies to Engineer	Type of Submittal
4	Construction schedule
4	Schedule of payment items
1	Audio visual preconstruction record
6	Progress estimates
4	Shop drawings
4	Certificates of compliance
2	Warranties
1*	Product samples
1	Record drawings
5	Final Record Drawings

*Unless otherwise required in the specific Section where requested.

1.02 SUBMITTAL PROCEDURES

- A. Transmit each submittal with a form acceptable to the ENGINEER, clearly identifying the project CONTRACTOR, the enclosed material and other pertinent information specified in other parts of this section. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed Work.
- B. Revise and resubmit submittals as required, identify all changes made since previous submittals. Resubmittals shall be noted as such.
- C. Distribute electronic copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

1.03 CONSTRUCTION PROGRESS SCHEDULE

- A. The CONTRACTOR shall have the capability of preparing and utilizing the specified construction progress scheduling techniques. A statement of capability shall be submitted in writing to the ENGINEER with the return of the executed Agreement to the City and will verify that either the CONTRACTOR's organization has in-house capability qualified to use the technique or that the CONTRACTOR employs a consultant who is so qualified. Capability shall be verified by description of the construction projects to which the CONTRACTOR or its consultant has successfully applied the scheduling technique and which were controlled throughout the duration of the project by means of systematic use and updating of the construction progress schedule, the network analysis and associated reports. The submittal shall include the name of the individual on the CONTRACTOR's staff who will be responsible for the construction progress schedule, and associated reports and for providing the required updating information of same. The CONTRACTOR shall submit its proposed progress (baseline) schedule to the ENGINEER for review and comment within thirty days of the Notice to Award. The ENGINEER shall have the authority to determine acceptability/correctness of the schedule logic and activity interrelationships. The use of extraneous, nonworking activities and activities which add restraints to the construction schedule shall not be accepted. Baseline schedules that do not meet their contract completion dates shall not be accepted.
- B. The CONTRACTOR's progress schedule (baseline and monthly updates) shall be computer generated and resource loaded. Each construction progress schedule, and associated report shall include the following tabulations: a list of activities in numerical order, a list of activity precedence, schedules sequenced by Early Start Date, Total Float, and Late Start Date. Each schedule and report shall include the following minimum items.
1. Activity Numbers
 2. Estimated Duration
 3. Activity Description
 4. Early Start Date (Calendar Dated)
 5. Early Finish Date (Calendar Dated)
 6. Latest Allowable Start Date (Calendar Dated)
 7. Latest Allowable Finish Date (Calendar Dated)
 8. Status (whether critical)
 9. Estimated Cost of The Activity
 10. Total Float and Free Float
- C. In addition, each construction progress schedule, network analysis and report shall be prefaced with the following summary data:
1. Contract Name and Number
 2. CONTRACTOR's Name
 3. Contract Duration and Float
 4. Contract Schedule
 5. The Effective or Starting Date of The Schedule (the date indicated in the Notice-to-Proceed)

- D. The work day to calendar date correlation shall be based on an 8-hour day and 40-hour week with adequate allowance for holidays and all other special requirements of the Work. A total of six (6) days for adverse weather shall also be allowed for in the progress schedule.
- E. If the CONTRACTOR desires to make changes in its method of operating which affect the construction progress schedule and related items, the CONTRACTOR shall notify the ENGINEER in writing stating what changes are proposed and the reason for the change. If the ENGINEER accepts these changes, in writing, the CONTRACTOR shall revise and submit, without additional cost to the City, all of the affected portions of the construction progress schedule, and associated reports. The construction progress schedule and related items shall be adjusted by the CONTRACTOR only after prior acceptance, in writing by the ENGINEER. Adjustments may consist of changing portions of the activity sequence, activity durations, division of activities, or other adjustments as may be required. The addition of extraneous, nonworking activities and activities which add restraints to the construction progress schedule shall not be accepted.
- F. Except where earlier completions are specified, schedule dates which show completion of all Work prior to the contract completion date shall, in no event, be the basis for claim for delay against the City by the CONTRACTOR.
- G. Construction progress schedules and related items which contain activities showing negative float or which extend beyond the contract completion date will not be accepted by the ENGINEER.
- H. Whenever it becomes apparent from the current construction progress schedule and associated reports that delays to the critical path have resulted and the contract completion date will not be met, or when so directed by the ENGINEER, the CONTRACTOR shall take some or all of the following actions at no additional cost to the City. They shall submit to the ENGINEER for approval, a written statement of the steps they intend to take to remove or arrest the delay to the critical path in the current construction progress schedule, including a computer-generated schedule revision to reflect proposed actions.
 - 1. Increase construction manpower in such quantities and crafts as will substantially eliminate the backlog of work.
 - 2. Increase the number of working hours per shift, shifts per day, working days per week, the amount of construction equipment, or any combination of the foregoing, sufficiently to substantially eliminate the backlog of work.
 - 3. Reschedule activities to achieve maximum practical concurrency of accomplishment of activities, and comply with the revised schedule.
- I. If when so requested by the ENGINEER, the CONTRACTOR should fail to submit a written statement of the steps they intend to take or should fail to take such steps as reviewed and accepted in writing by the ENGINEER, the ENGINEER may direct the CONTRACTOR to increase the level of effort in manpower (trades), equipment and work schedule (overtime, weekend and holiday work, etc.) to be employed by the CONTRACTOR in order to remove or arrest the delay to the critical path in the current construction progress schedule, and the CONTRACTOR shall promptly provide such level of effort at no additional cost to the City.
- J. If the completion of any activity, whether or not critical, falls more than 100 percent behind its previously scheduled and accepted duration, the CONTRACTOR shall submit

for approval a schedule adjustment showing each such activity divided into two activities reflecting completed versus uncompleted work.

- K. Shop drawings which are not approved on the first submittal or within the time scheduled, and equipment which does not pass the specified tests and certifications shall be immediately rescheduled.
- L. The contract time will be adjusted only in accordance with the General Requirements and other portions of the Contract Documents as may be applicable. If the ENGINEER finds that the CONTRACTOR is entitled to any extension of the contract completion date, the ENGINEER's determination as to the total number of days extension shall be based upon the current construction progress schedule and on all data relevant to the extension. Such data shall be included in the next updating of the schedule and related items. Actual delays in activities which, according to the construction progress schedule, do not affect any contract completion date will not be the basis for a change therein.
- M. From time to time it may be necessary for the contract schedule of completion time to be adjusted by the City in accordance with the General Requirements and other portions of the Contract Documents as may be applicable. Under such conditions, the ENGINEER will direct the CONTRACTOR to reschedule the Work or contract completion time to reflect the changed conditions, and the CONTRACTOR shall revise the construction progress schedule and related items accordingly, at no additional cost to the City.
- N. Available float time may be used by the City through the City's ENGINEER.
- O. The City controls the float time and, therefore, without obligation to extend either the overall completion date or any intermediate completion dates, the City may initiate changes that absorb float time only. City initiated changes that affect the critical path on the network diagram shall be the sole grounds for extending the completion dates. CONTRACTOR initiated changes that encroach on the float time may be accomplished only with the City's concurrence. Such changes, however, shall give way to City initiated changes competing for the same float time.
- P. To the extent that the construction project schedule, or associated report or any revision thereof shows anything not jointly agreed upon or fails to show anything jointly agreed upon, it shall not be deemed to have been accepted by the ENGINEER. Failure to include on a schedule any element of Work required for the performance of this Contract shall not excuse the CONTRACTOR from completing all Work required within any applicable completion date, notwithstanding the review of the schedule by the ENGINEER.
- Q. Review and acceptance of the construction progress schedule, and related reports, by the ENGINEER is advisory only and shall not relieve the CONTRACTOR of the responsibility for accomplishing the Work within the contract completion date. Omissions and errors in the construction progress schedule, and related reports shall not excuse performance less than that required by the Contract and in no way make the ENGINEER an insurer of the CONTRACTOR's success or liable for time or cost overruns flowing from any shortcomings in the construction progress schedule, and related reports.
- R. The CONTRACTOR shall present and discuss the proposed schedule at the preconstruction conference.

- S. The construction progress schedule shall be based upon the precedence diagramming method of scheduling and shall be prepared in the form of a horizontal bar chart showing in detail the proposed sequence of the Work and identifying all construction activities included but not limited to yard piping, all structures and treatment units and all related Work specified herein to be performed under the Contract. The schedule shall be time scaled, identifying the first day of each week, with the estimated date of starting and completion of each stage of the Work in order to complete the project within the contract time. The project critical path shall be clearly identified in color or by other means acceptable to the ENGINEER.
- T. The progress schedule shall be plotted on 22-inch by 34-inch and 11-inch by 17-inch paper and shall be revised and updated monthly, depicting progress through the last day of the current month and scheduled progress through completion. Ten (one 22-inch by 34-inch and nine 11-inch by 17-inch), schedules, required schedule "sorts" (tabulations) and an electronic copy of the baseline schedule shall be submitted for review and acceptance. Five (one 22-inch by 34-inch and four 11-inch x 17-inch) up-to-date copies of the schedule and five copies of tabulations and an electronic copy shall be submitted along with the application for monthly progress payments for the same period.
- U. The construction progress schedule shall be developed and maintained using Primavera Sure Trak as manufactured by Primavera Systems, Inc., or equal.

1.04 SCHEDULE OF PAYMENT VALUES

- A. The CONTRACTOR shall submit a Schedule of Payment Values, in accordance with Section 01025, for all items in the proposal that are to be paid for on a lump sum basis. The schedule shall contain the labor and material values of the component parts of Work for the purpose of making progress payments during the construction period. The Schedule of Payment Values shall directly correlate on an item by item basis (unless otherwise accepted by the ENGINEER) to each individual activity detailed in the construction progress schedule.
- B. The schedule shall be given in sufficient detail for the proper identification of Work accomplished. Each item shall include its proportional share of all costs including the CONTRACTOR's overhead, contingencies and profit. The sum of all scheduled items shall equal the total value of the Contract.
- C. If the CONTRACTOR anticipates the need for payment for materials stored on the project site, it shall also submit a separate list covering the cost of materials, delivered and unloaded with taxes paid. This list shall also include the installed value of the item with coded reference to the Work items in the Schedule of Payment Items.
- D. The CONTRACTOR shall expand or modify the above schedule and materials listing as required by the ENGINEER's initial or subsequent reviews.
- E. The CONTRACTOR shall update the Schedule of Payment Values monthly for reviewing by the ENGINEER. The payment applications shall be reviewed by the ENGINEER in accordance with the updated Schedule of Payment Values.

1.05 SHOP DRAWINGS, PROJECT DATA AND SAMPLES

- A. General: A Shop Drawing Submittal Schedule shall be provided by the CONTRACTOR within thirty (30) days of the Notice to Proceed.
- B. The CONTRACTOR shall furnish for review four (4) electronic copies of shop drawings, project data, samples and other submittal items required by the Contract Documents. Two (2) copies shall be returned to the CONTRACTOR stamped "Furnish as Submitted" or "Furnish as Corrected". Where major corrections are indicated, two (2) electronic copies will be returned stamped "Revise and Resubmit" and a new submittal is required (4 electronic copies).
- C. The review of the CONTRACTOR's submissions shall in no way relieve the CONTRACTOR of any of his responsibilities under the Contract. An acceptance of a submission shall be interpreted to mean that there are no specific objections to the submitted material, subject to conformance with the Contract Drawings and Specifications.
- D. All submissions shall be dated and properly referenced to the specifications section and Contract Drawing number. The submittal number shall match the following submittal numbering system (or an equivalent system as approved by the ENGINEER):
 - 1. Submittal Numbering System
 - a. Package ID: The package number will reflect the CSI (specification) section number as it appears in the specifications.
 - b. Subgroup ID: The submittal number will include the CSI number followed by two additional codes. The first will define the type of submittal as follows:
 - 01 - Product Data, Specifications, Cut Sheets, Manufacturers certification or approval letters.
 - 02 - Shop Drawings
 - 03 - Product Samples and Mock-Ups
 - 04 - Special requirements as required in the contract documents
 - 05 - As-Built Drawings
 - 06 - Warranties
 - 07 - O&M
 - 08 - Spare Parts

The second code will identify individual submittals within that submittal type. The number to the left of the decimal represents the submittal number and the number to the right of the decimal represents the revision number.

Example:

<u>Package</u>	<u>Submittal</u>	<u>Description</u>
03300	03300-01-1.1	Concrete Admixture A, First Submittal
06400	06400-01-1.2	Re-submittal
		First Submittal
		Product Data
		Finish Carpentry

By the following this code system, all submittals may be entered into the Document Tracking System prior to receipt of submittals. When a particular submittal is received, locate the entry in the Document Tracking project file, add the appropriate information and process. The Document Tracking System will provide the next sequence number.

- E. Shop Drawings and Project Data within practical limits shall be submitted as a single complete package for any operating system and shall include all items of equipment and mechanical units involved in the functioning of such system. Where applicable, the submission shall include elementary wiring diagrams showing circuit functioning and necessary interconnection wiring diagrams for construction.
- F. All submissions shall bear the CONTRACTOR's stamp certifying that they have been checked for conformance and accuracy. Submissions without the CONTRACTOR's stamp of approval will not be reviewed by the ENGINEER and will be returned to the CONTRACTOR.
- G. For any submission containing any departure from the Contract Documents and the CONTRACTOR shall include proper explanation in his letter of submittal.
- H. Work on fabricated or special items shall not be commenced until the required submission information has been reviewed and accepted.
- I. Standard items shall not be assembled or shipped until the required submission information has been reviewed and accepted.
- J. Prior review actions shall not relieve the CONTRACTOR of the responsibility for correcting errors, deviations, and/or omissions discovered at a later date.
- K. Shop Drawings: Shop Drawings include, but are not limited to, layout drawings, installation drawings, construction drawings, certified and interconnecting wiring diagrams, etc. The CONTRACTOR shall be responsible for security of all the information, details, dimension, drawings, etc. necessary to prepare submission drawings required and necessary under this Contract and to fulfill all other requirements of his Contract. The CONTRACTOR shall secure such information, details, drawings, etc. from all possible sources including the Contract Drawings, drawings prepared by subcontractor's, ENGINEER, manufacturers, Contractors, etc.

- L. Submission drawings shall accurately and clearly present the following:
 - 1. All working and installation dimensions.
 - 2. Arrangement and sectional views.
 - 3. Units of equipment in the proposed position for installation, details of required attachments and connections and dimensioned locations between units and in relation to the structures.
 - 4. Necessary details and information for making connections between the various trades including but not limited to, power supplies and interconnection wiring between units, accessories, appurtenances, etc.
- M. Product Data: Where manufacturer's publications in the form of catalogs, brochures, illustrations, or other data sheets are submitted in lieu of prepared shop drawings, such submission shall specifically indicate the particular item offered. Identification of such items and relative pertinent information shall be made with indelible ink. Submissions showing only general information will not be accepted.
- N. Product data shall include materials of construction, dimensions, performance characteristics, capacities, wiring diagrams, piping and controls, etc.
- O. Samples: CONTRACTOR shall furnish for review all samples as required by the Contract Documents or requested by the ENGINEER.
- P. Samples shall be of sufficient size or quantity to clearly illustrate the quality, type, range of color, finish or texture and shall be properly labeled to show the nature of the work where the material represented by the sample will be used.
- Q. Samples shall be checked by the CONTRACTOR for conformance to the Contract Documents before being submitted to the ENGINEER and shall bear the CONTRACTOR's stamp certifying that they have been so checked. Transportation charges on samples submitted to the ENGINEER shall be prepaid by the CONTRACTOR.
- R. ENGINEER's review will be for compliance with the Contract Documents, and his comments will be transmitted to the CONTRACTOR with reasonable promptness.
- S. Accepted samples will establish the standards by which the completed work will be judged.

1.06 OPERATION AND MAINTENANCE INSTRUCTIONS (MANUALS)

- A. Individual Instructions: The CONTRACTOR, through manufacturer's representatives or other qualified individuals, shall provide instruction of designated employees of the CITY in the operation and care of all equipment furnished.
- B. Written Instructions: The CONTRACTOR shall furnish and deliver to the ENGINEER, prior to the fifty percent completion point of construction, and no later than thirty (30) days prior to operator training, ten (10) complete sets of instructions, technical bulletins, and any other printed matter such as diagrams, prints or drawings, containing full information required for the proper operation, maintenance, and repair of the equipment. As a minimum, the following shall be included in this submittal:
 - 1. Operating Instructions

2. Troubleshooting Information
 3. Maintenance Schedule(s)
 4. Lubrication Schedule
 5. Location of Service Centers
 6. Parts Diagram and List
 7. Spare Parts List (spare parts furnished shall be defined)
 8. Special Tools List
 9. Installation Instructions
 10. Assembly & Erection Drawings
 11. Dimensional Drawings
 12. Wiring Diagram(s)
 13. Storage Instructions
- C. These requirements are a prerequisite to the operation and acceptance of equipment. Each set of instructions shall be bound together in appropriate three-ring binders. A detailed Table of Contents shall be provided for each set. Written operation and maintenance instructions shall be required for all equipment items supplied for this project. The amount of detail shall be commensurate with the complexity of the equipment item. Submittal shall be made for all mechanical and electrical equipment included but not limited to pumps, valves, gates, etc.
- D. Information not applicable to the specific piece of equipment installed on this project shall be struck from the submission. Information provided shall include a source of replacement parts and names of service representatives, including address and telephone number.
- E. Extensive pictorial cuts of equipment are required for operator reference in servicing.
- F. When written instructions include shop drawings and other information previously reviewed by the ENGINEER, only those editions thereof which were accepted by the ENGINEER, and which accurately depict the equipment installed, shall be incorporated in the instructions.

1.07 RECORD DRAWINGS

- A. The CONTRACTOR shall keep and maintain, at the job site, one record set of Drawings. On these, it shall mark all project conditions, locations, configurations, and any other changes or deviations which may vary from the details represented on the original Contract Drawings, including buried or concealed construction and utility features which are revealed during the course of construction. Special attention shall be given to recording the horizontal and vertical location of all buried utilities that differ from the locations indicated, or which were not indicated on the Drawings. As-Built furnished grade information shall be included on the record drawings. Said record drawings shall be supplemented by detailed sketches as necessary or directed to indicate, fully, the Work as actually constructed. These master record drawings of the CONTRACTOR's representation of as-build conditions, including all revisions made necessary by addenda and change orders shall be maintained up-to-date during the progress of Work.

- B. The record drawings shall be received on the 20th working day of every third month after the month in which the final notice to proceed is given as well as on completion of Work. Failure to maintain the record drawings up-to-date shall be grounds of withholding monthly progress payments until such time as the record drawings are brought up-to-date.
- C. In the case of those drawings which depict the detail requirement for equipment to be assembled and wired in the factory, such as motor control centers and the like, the record drawing shall be updated by indicating those portions which are superseded by change order drawings or final shop drawings, and by including appropriate reference information describing the change orders by number and the shop drawings by manufacturer, drawing, and revision numbers.
- D. Record drawings shall be accessible to the ENGINEER at all times during the construction period.
- E. Upon substantial completion of the Work and prior to final acceptance, the CONTRACTOR shall finalize and deliver a complete set of final record drawings to the ENGINEER for transmittal to the City, conforming to the construction records of the CONTRACTOR. This set of drawings shall consist of corrected drawings showing the reported location of the Work. The information submitted by the CONTRACTOR and incorporated in the Final Record Drawings will be assumed to be correct, and the ENGINEER will not be responsible for the accuracy of such information, and for any errors or omissions which may appear on the Final Record Drawings as a result.
- F. The information submitted by the CONTRACTOR in the Final Record Drawings shall be certified by a land surveyor registered in the State of Florida. For clarity, Final Record Drawings needs to be redrawn and clearly labeled as "Record Drawings". Notations indicated in the drawings shall be legible and printed in black ink. No handwritten notes are allowed.
- G. Final payment will not be acted upon until the ENGINEER certifies the record drawings as required by the agencies having jurisdiction. Said up-to-date record drawings shall be in the form of a set of prints with carefully plotted information.
- H. All final record drawings shall be certified by the ENGINEER of Record. Such certification shall evidence that ENGINEER has reviewed the information, finds it in substantial accordance with the design; and where deviations from the design exist, that said deviations are not to the detriment of the system. ENGINEER's certification shall read as follows:
 - 1. "I HEREBY NOTIFY THE CITY OF THE COMPLETION OF CONSTRUCTION OF ALL THE COMPONENTS OF THE WATER, SEWER AND STORMWATER FACILITIES FOR THE ABOVE REFERENCED PROJECT AND CERTIFY THAT THEY HAVE BEEN CONSTRUCTED IN SUBSTANTIAL CONFORMANCE WITH THE PLANS AND SPECIFICATIONS PERMITTED BY THE AGENCIES HAVING JURISDICTION"
- I. The CONTRACTOR shall submit all electronic media files of the paving, grading, water, sewer and drainage plans, reports, other supporting information, and the final version of as-builts drawings shall be submitted to the ENGINEER's office. The information provided shall contain an index file with a brief description of the electronic filing contents, and shall be labeled with project name, company name, and point of contact. Documents and

spreadsheets shall be submitted in either MS Word, Word Perfect, Excel, Lotus, or other format approved by the ENGINEER. Drawings shall be submitted in AutoCad, Microstation, or other format approved by the ENGINEER.

- J. Final Record Drawings submitted to the City as part of the project acceptance shall contain at least the following information:
 - 1. Drawings shall be legibly marked to record actual construction.
 - 2. Drawings shall show actual location of all underground and above ground water and wastewater, stormwater piping and related appurtenances. All changes to piping location including horizontal and vertical locations of utilities and appurtenances shall be clearly shown and referenced to permanent surface improvements. Drawings shall also show actual installed pipe material, class, etc. Profile sheets shall be updated to include all field measurements and elevations taken during construction.
 - 3. Drawings shall clearly show all field changes of dimension and detail including changes made by field order or by change order.
 - 4. Drawings shall clearly show all details not on original contract drawings but constructed in the field. All equipment and piping relocation shall be clearly shown.
 - 5. Location of all manholes, hydrants, tees, reducers, crosses, valves, and valve boxes shall be shown. All tees, reducers, crosses, and valves shall be referenced from at least two (2) and preferably three (3) permanent points such as building corners and roadway intersections.
 - 6. Dimensions between all manholes shall be field verified and shown. The rim, inverts and grade elevations of all manholes shall be shown.

1.08 WARRANTIES

- A. Original warranties, called for in the Contract Documents, shall be submitted to the City through the ENGINEER. When warranties are required, they shall be submitted prior to request for payment.
- B. When advance copies of warranties are requested, they shall be submitted with, and considered as shop drawings.
- C. The CONTRACTOR shall warrant to the City that all material and labor used in the construction are covered by his warrantee for a minimum of a one-year period upon approval and acceptance by the City. The CONTRACTOR shall replace or repair defects at no cost to the City during the warrantee period. No visible or potential leakage shall be allowed during the warrantee period.

1.09 CERTIFICATES

- A. Copies of certificates of compliance and test reports shall be submitted for requested items to the ENGINEER prior to request for payment.

1.10 AUDIO-VISUAL PRECONSTRUCTION RECORD

- A. General: Prior to commencing work, the CONTRACTOR shall have a continuous color audio-video DVD recording taken of the entire Project, including existing areas that will be disturbed by the CONTRACTOR's operations, to serve as a record of preconstruction

- conditions. No construction shall begin prior to review and acceptance of the tapes covering the respective, affected construction area by the ENGINEER. The ENGINEER shall have the authority to reject all or any portion of the video DVD not conforming to the specifications and order that it be redone at no additional charge. The CONTRACTOR shall reschedule unacceptable coverage within five days after being notified. The ENGINEER shall designate those areas, if any, to be omitted from or added to the audio-video coverage. Audio-video recordings shall not be performed more than ninety days prior to construction in any area. All DVDs and written records shall become property of the City.
- B. Services: The CONTRACTOR shall engage the services of a professional electrographer. The color audio-video tapes shall be prepared by a responsible commercial firm known to be skilled and regularly engaged in the business of preconstruction color audio-video tape documentation. The electrographer shall furnish to the ENGINEER a list of all equipment to be used for the audio-video taping, i.e., manufacturer's name, model number, specifications and other pertinent information. Additional information to be furnished by the electrographer is the names and addresses of two references that the electrographer has performed color audio-video taping for on projects of a similar nature within the last twelve months.
- C. Audio-Video DVDs: Audio-video DVDs shall be new. The DVDs shall be compatible for with a standard player-receiver.
- D. Equipment: All equipment, accessories, materials and labor to perform this service shall be furnished by the CONTRACTOR.
1. The total audio-video system shall reproduce bright, sharp, clear pictures with accurate colors and shall be free from distortion, tearing, rolls or any other form of imperfection. The audio portion of the recording shall reproduce the commentary of the camera operator with proper volume and clarity, and be free from distortion and interruptions.
 2. When conventional wheeled vehicles are used, the distance from the camera lens to the ground shall not be less than twelve feet. In some instances, audio-video tape coverage may be required in areas not accessible by conventional wheeled vehicles. Such coverage shall be obtained by walking or special conveyance acceptable to the ENGINEER.
 3. The color video camera used in the recording system shall have a horizontal resolution of 300 lines at center, a luminance signal to noise ratio of 45 dB and a minimum illumination requirement of twenty-five foot-candles.
- E. Recorded Information - Audio: Each tape shall begin with the current date, project name and municipality and be followed by the general location; i.e., process structure, or area, viewing side and direction of progress. The audio track shall consist of an original live recording. The recording shall contain the narrative commentary of the electrographer, recorded simultaneously with his fixed elevation video record of the zone of influence of construction.
- F. Recorded Information - Video: All video recordings must, by electronic means, display continuously and simultaneously, generated with the actual taping, transparent digital information to include the date and time of recording. The date information shall contain the month, day and year. The time information shall contain the hours, minutes, and seconds. Additional information shall be displayed periodically. Such information shall

include, but not be limited to, project name, bid package number, process structure or area, and the viewing side. This transparent information shall appear on the extreme upper left hand third of the screen.

- G. Conditions for Taping: All taping shall be done during times of good visibility. No taping shall be done during precipitation, mist or fog. The recording shall only be done when sufficient sunlight is present to properly illuminate the subjects of recordings and to produce bright, sharp video recordings of those subjects.
- H. Tape Coverage: Tape coverage shall include all surface features located within the zone of influence of construction supported by appropriate audio coverage. Such coverage shall include, but not be limited to, existing road, driveways, sidewalks, curbs, pavement, landscaping, fences, signs and interior and exterior of existing structures affected by the work and the exteriors of structures adjacent to the work, and any other on-site area that will be occupied or impacted by the CONTRACTOR or any of his subcontractors or suppliers within the area covered.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 35 43
ENVIRONMENTAL PROCEDURES

PART 1 GENERAL

1.01 SITE MAINTENANCE

- A. The Contractor shall keep the work site clean and free from rubbish and debris. Materials and equipment shall be removed from the site when they are no longer necessary. Upon completion of the work and before final acceptance, the work site shall be cleared of equipment, unused materials, and rubbish to present a clean and neat appearance.

1.02 TEMPORARY DAMS

- A. Except in time of emergency, earth dams are not acceptable at catch basin openings, local depressions, or elsewhere. Temporary dams of sand bags, asphaltic concrete, or other acceptable material will be permitted when necessary to protect the work, provided their use does not create a hazard or nuisance to the public. Such dams shall be removed from the site as soon as they are no longer necessary.

1.03 AIR POLLUTION CONTROL

- A. The Contractor shall not discharge smoke, dust, and other contaminants into the atmosphere that violate the regulations of any legally constituted authority. He shall also abate dust nuisance by cleaning, sweeping, and sprinkling with water, or other means as necessary. The use of water, in amounts which result in mud on public streets, is not acceptable as a substitute for sweeping or other methods.

1.04 NOISE CONTROL

- A. Between 7:30 p.m. and 7:00 a.m., noise from Contractor's operations shall not exceed limits established by applicable laws or regulations and in no event shall exceed 86 dBA at a distance of 50 feet from the noise source.

END OF SECTION

SECTION 01 40 00
TESTING AND INSPECTION

PART 1 GENERAL

1.01 DESCRIPTION

- A. All testing and inspection will be in accordance with Article 12 of the General Conditions.
- B. The work or actions of the testing laboratory shall in no way relieve the CONTRACTOR of his obligations under the Contract. The laboratory testing work will include such inspections and testing required by the Contract Document, existing laws, codes, ordinances, etc. The testing laboratory will have no authority to change the requirements of the Contract Documents, nor perform or approve any of the CONTRACTOR'S work.
- C. The CONTRACTOR shall allow the ENGINEER ample time and opportunity for testing materials and equipment to be used in the work. He shall advise the ENGINEER promptly upon placing orders for materials and equipment so that arrangements may be made, if desired, for inspection before shipment from the place of manufacture. The CONTRACTOR shall at all times furnish the ENGINEER and his representatives, facilities including labor, and allow proper time for inspecting and testing materials, equipment, and workmanship. The CONTRACTOR must anticipate that possible delays may be caused him in the execution of his work due to the necessity of materials and equipment being inspected and accepted for use. The CONTRACTOR shall furnish, at his own expense, all samples of materials required by the ENGINEER for testing, and shall make his own arrangement for providing water, electric power, or fuel for the various inspections and tests of structures and equipment. As a minimum, 24-hours advance written notice shall be provided by the CONTRACTOR for rebar, structural and similar inspections by the ENGINEER. The amount of time required for advance written notice by the CONTRACTOR to the ENGINEER for other inspections depends upon other factors and shall be solely at the ENGINEER's discretion.
- D. The CONTRACTOR shall furnish the services of representatives of the manufacturers of certain equipment, as prescribed in other sections of the Specifications. The CONTRACTOR shall also place his orders for such equipment on the basis that, after the equipment has been tested prior to final acceptance of the work, the manufacturer will furnish to the CITY the certified statements that the equipment has been installed properly and is ready to be placed in functional operation. Tests and analyses required of equipment shall be paid for by the CONTRACTOR, unless specified otherwise in the section which covers a particular piece of equipment.
- E. The CITY will bear the cost of all additional tests, inspections, or investigations undertaken by the order of the ENGINEER for the purpose of determining conformance with the Contract Documents if such test, inspection, or investigations are not specifically required by the Contract Documents, and if conformance is ascertained thereby. Whenever nonconformance is determined by the ENGINEER as a result of such test, inspections, or investigations, the CONTRACTOR shall bear the full cost thereof or shall reimburse the CITY for said cost. The cost of any additional tests and investigations, which are ordered by the ENGINEER to ascertain subsequent conformance with the Contract Documents, shall be borne by the CONTRACTOR.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 41 00
CONTRACTOR'S HEALTH AND SAFETY PLAN

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope

1. This Section describes CONTRACTOR's responsibilities for a written site-specific health and safety plan (SSHP). CONTRACTOR shall conduct all construction activities in a safe manner so as not to result in:
 - a. injuries to employees, Subcontractors or other persons with an interest at or near the Site;
 - b. employee exposures to health hazards above the occupational limits established by the Occupational Health and Safety Administration (OSHA), the American Conference of Governmental Industrial Hygienists (ACGIH), or the Nuclear Regulatory Commission (NRC);
 - c. exposure of area residents to air contaminants above the levels established for general public exposure by the Environmental Protection Agency (EPA), NRC, or the State in which the Project is located;
 - d. significant increases in the levels of contaminants in soil, water, or sediment near the Site; or
 - e. violations of OSHA, or other Laws or Regulations.
- B. Any disregard of the provisions of the SSHP may, without limitation, be deemed just and sufficient reason for termination of CONTRACTOR's services for cause.

1.02 QUALITY ASSURANCE

A. Qualifications

1. Engage an industrial hygienist certified by the American Board of Industrial Hygiene or a safety professional certified by the Board of Certified Safety Professionals to prepare or supervise the preparation of the SSHP.
 2. Submit qualifications along with SSHP.
- B. Regulatory Requirements: CONTRACTOR's health and safety practices shall follow the standards and guidelines established in the following:
1. 29 CFR 1904, OSHA, Record Keeping.
 2. 29 CFR 1910, OSHA, General Industry Standards.
 3. 29 CFR 1926, OSHA, Construction Industry Standards.
 4. 29 CFR 1926.65, OSHA, Hazardous Waste Operations and Emergency Response.
 5. 49 CFR 171.8, DOT, Hazardous Materials in Transport.
 6. 40 CFR Parts 261.3, 264 and 265, EPA, Resource Conservation and Recovery Act.
 7. 29 CFR 1910.146, OSHA, Permit-Required Confined Spaces.
 8. 29 CFR 1926.1101, OSHA, Asbestos

1.03 SUBMITTALS

- A. Submit to ENGINEER the following:
 - 1. CONTRACTOR's SSHP.
 - 2. Qualifications of industrial hygienist or safety professional.
 - 3. Health and safety reports.
 - 4. Accident reports.

PART 2 GENERAL

2.01 GENERAL PROVISIONS

- A. Submit SSHP to ENGINEER one week prior to the Preconstruction Conference, or 30 days prior to planned mobilization at the Site, whichever is sooner.
- B. The SSHP shall bear a stamp or specific written indication that CONTRACTOR has satisfied CONTRACTOR's obligations under the Contract Documents with respect to CONTRACTOR's review and approval of the SSHP.
- C. ENGINEER will review and either accept or return for revision CONTRACTOR's SSHP in accordance with the Schedule of Submittals acceptable to ENGINEER. ENGINEER's review and acceptance will be only to determine if the topics covered by the SSHP conform to the Contract Documents.
- D. ENGINEER's review and acceptance will not extend to means, methods, techniques, procedures of construction, or to whether the representations made in the SSHP comply with regulatory standards or standards of good practice.
- E. At the time of submittal, CONTRACTOR shall give ENGINEER specific written notice of variations, if any, that the SSHP may have from the requirements of the Contract Documents. This notice shall be both a written communication separate from the submittal; and, in addition, by a specific notation made on each submittal to ENGINEER for review and acceptance of each such variation.
- F. No Work shall be performed on the Site until the written SSHP has been accepted by the ENGINEER.
- G. Notwithstanding any other provision of the Contract Documents, extensions to the Contract Times will not be granted if caused by undue delay by CONTRACTOR in developing or revising the SSHP.

2.02 WRITTEN HEALTH AND SAFETY PROGRAM

- A. The SSHP, which shall be kept on the Site, shall address the safety and health hazards of each phase of operations on the Site and include the requirements and procedures for employee protection. The SSHP as a minimum, shall address and include the following:
 - 1. The organizational structure of CONTRACTOR's organization.
 - 2. A comprehensive work plan.
 - 3. A safety and health risk or hazard analysis for each task and operation found in the work plan.

4. Employee training assignments including copies of 40-hour, 24-hour Supervised Field Activities, 8-hour Supervisors, and 8-hour Refresher Training Certificates for all CONTRACTOR's employees assigned to the Project.
5. Personal protective equipment to be used by employees for each of the tasks and operations being conducted. Respirator fit test certificates for all CONTRACTOR employees assigned to the Project.
6. Medical Surveillance Requirements: Medical clearance certificates for all CONTRACTOR's employees assigned to the Project.
7. Frequency and types of air monitoring, personnel monitoring, and environmental sampling techniques and instrumentation to be used, including methods of maintenance and calibration of monitoring and sampling equipment.
8. Site control measures for purposes, including but not limited to:
 - a. preventing trespassing;
 - b. preventing unqualified or unprotected workers from entering restricted areas;
 - c. preventing tracking of contaminants out of the Site;
 - d. maintaining log of employees on and visitors to the Site;
 - e. delineating hot, cold and support zones;
 - f. locating personnel and equipment decontamination zones; and
 - g. communicating routes of escape and gathering points.
9. Decontamination procedures.
10. An emergency response plan for safe and effective responses to emergencies, including the necessary PPE and other equipment.
11. Confined space entry procedures (if applicable).
12. A spill containment program.

B. Organizational Structure

1. The organizational structure part of the SSHP shall refer to or incorporate information on the specific chain of command and specify the overall responsibilities of supervisors and employees, and shall include, at a minimum, the following elements:
 - a. designation of a general supervisor who has the responsibility and authority to direct all hazardous waste operations.
 - b. a Site safety and health supervisor who has the responsibility and authority to implement and modify the SSHP and verify compliance.
 - c. all other personnel needed for hazardous waste Site operations and emergency response and their general functions and responsibilities.
 - d. The lines of authority, responsibility, and communication.
2. The organizational structure shall be reviewed and updated as necessary to reflect the current status of Site operations.

C. Work Plan

1. The comprehensive work plan part of the SSHP shall refer to or incorporate information on the following:
 - a. The tasks and objectives of the Site operations and the logistics and resources required to achieve those tasks and objectives.
 - b. The anticipated activities as well as the CONTRACTOR's normal operating procedures.

- c. The personnel and equipment requirements for implementing the work plan.
- D. The SSHP shall include procedures that will be used to ensure safe waste handling during the excavating, handling, loading, and transporting activities.

2.03 ACCIDENT REPORTING AND INVESTIGATION

- A. Document all accidents resulting in bodily injury using OSHA 301 form.
- B. Submit copies of completed OSHA 301 forms to the ENGINEER weekly.
- C. Based upon the results of an accident investigation, make modifications to the SSHP by changing tasks or procedures to prevent a reoccurrence.
- D. Post a copy of CONTRACTOR's OSHA 300A report in a conspicuous place onsite.

2.04 DAILY HEALTH AND SAFETY FIELD REPORTS

- A. Submit to ENGINEER daily health and safety field reports including, but not limited to, weather conditions, delays encountered in construction, and acknowledgment of deficiencies noted along with corrective actions taken on current and previous deficiencies. In addition, the daily health and safety air monitoring results, documentation of instrument calibration, new hazards encountered, and PPE utilized shall be included.
- B. The daily health and safety field reports shall include a description of problems, real or anticipated, encountered during the course of Work that should be brought to the attention of the ENGINEER and notification of deviations from planned Work shown in the previously submitted daily health and safety field report(s).

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 45 00
CONTRACTOR QUALITY CONTROL

PART 1 GENERAL

1.01 SUMMARY

- A. This Section specifies administrative and procedural requirements for quality control services, field inspections and field testing of civil and structural constructs required for this project.
- B. The Contractor is responsible for the quality assurance and quality control of their respective work for the construction of this project in accordance with the Contract Documents.

1.02 RELATED SECTIONS

- A. This section contains specific references to the following related section. Additional related sections may apply that are not specifically listed below.
 - 1. Section 01 40 00 Testing and Inspection Services

1.03 DEFINITIONS

- A. Quality Control System (QCS): The quality control, assurance, and inspection system established and carried out to ensure compliance with the Plans and specifications.
- B. QCS Supervisor: That person in responsible charge of the work occurring, as designated by the Contractor in the QCS Plan.
- C. QCS Inspector: Responsible, certified personnel inspecting the various constructs at specified milestones and during the project overall and designated by the Construction Manager.
- D. Factory Test: Tests made on various materials, products and component parts prior to shipment to the job site.
- E. Field Tests: Tests and analyses made at or in the vicinity of the job site in connection with the actual construction.
- F. Certified Inspection Report: Reports signed by approved inspectors attesting that the items inspected meet the specification requirements other than any exceptions included in the report.
- G. Certificate of Compliance: Certificate from the manufacturer of the material or equipment identifying said manufacturer, product and stating that the material or equipment meet specified standards, and shall be signed by a designated officer of the manufacturer.
- H. Standard Compliance: Condition whereby specified materials or equipment must conform to the standards of organizations such as the American National Standard Institute (ANSI), American Society for Testing and Materials (ASTM), Underwriters Laboratories (UL) or similar organization.

- I. Quality Assurance: The day-to-day, in-process supervisory observations of work and materials conducted by the Contractor to assure that the proper methods and materials are being used and installed by tradesmen.
- J. Source Quality Control: The in-process testing and inspections conducted by the QCS Inspector(s) to verify that the materials, equipment; workmanship and shop manufactured constructs are in compliance with the Contract Documents, applicable Codes and standards.
- K. Field Quality Control: The testing and inspections conducted by the QCS Inspector(s) in the field during and at the completion of each construct to verify that the in-process and completed construction is in compliance with the Contract Documents, applicable Codes and standards.
- L. Special Inspector – A qualified individual employed or retained by an approved agency and approved by the local governing authorities having jurisdiction (AHJ) as having the competency necessary to inspect a particular type of construction requiring special inspection.

1.04 SUBMITTALS

A. Action Submittals:

1. Procedures: Section 01 33 00.
2. A copy of this specification section with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.
3. Check-marks (✓) denote full compliance with a paragraph as a whole. Deviations shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined signify compliance with the specification. Include a detailed, written justification for each deviation. Failure to include a copy of this marked-up specification section, along with justification(s) for requested deviations, with the submittal, is cause for rejection of the entire submittal with no further consideration.
4. Written description of Contractor's proposed QCS plan in sufficient detail to illustrate adequate measures for verification and conformance to defined requirements. The QCS plan and submittal shall include a log showing anticipated inspections, QCS Inspectors, Special Inspections, and source and field Quality Assurance procedures. Submittal of the QCS plan shall be made prior to commencing field work.
5. Contractor's proposed QCS Supervisor and QCS Inspectors (other than the Special Inspectors provided by City), including qualifications, responsibilities, and if requested, references.
6. Complete structural system information describing Contractor designed structural systems, including sealed calculations, shop and erection drawings, product literature for the various components, International Code Council (ICC) Evaluation Reports for structural components, and a discussion of risk issues associated with the proposed system which could adversely impact overall project completion.
7. If requested by the Construction Manager during the work, manufacturer's field services and reports.

A. Informational Submittals:

1. Procedures: Section 01 33 00.
2. Manufacturers' field services and reports unless requested by Construction Manager to be submitted for review.
3. Special Inspection reports, unless otherwise directed in each technical specification Section.

1.05 REGULATORY REQUIREMENTS

- A. **GENERAL:** Comply with all Federal, State, and local Codes as referenced herein. Such regulations apply to activities including, but not limited to, site work and zoning, building practices and quality, on and offsite disposal, safety, sanitation, nuisance, and environmental quality.
- B. **SPECIAL INSPECTION:** Special Inspection shall be performed by the Special Inspector under contract with the City or registered design professional in responsible charge acting as the City's agent in conformance with the IBC. Special Inspection is in addition to, but not replacing, other inspections and quality control requirements herein. Where sampling and testing required herein conforms to Special Inspection standards, such sampling and testing need not be duplicated.
- C. **STRUCTURAL OBSERVATION:** Registered Design Professional shall make visual inspections of the work to assess general conformance with the Contract Documents at significant construction stages and at completion of the structural system in accordance with IBC 1704.6 Structural Observations requirements.

1.06 CONTRACTOR'S RESPONSIBILITIES

- A. Monitor quality assurance over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
- B. Coordinate with, schedule specified inspections by, and provide normal and customary assistance to the QCS Inspectors and City provided Special Inspectors.
- C. Coordinate with, schedule specified structural observations by Engineer, and provide normal and customary assistance to Engineer performing structural observations.
- D. Comply fully with manufacturers' instructions, including each step in sequence.
- E. Should manufacturers' instructions conflict with Contract Documents, request clarification before proceeding from Construction Manager.
- F. Comply with specified standards as a minimum quality for the work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- G. The Contractor shall retain the services of a licensed land surveyor, registered in the State of Florida, to perform survey work including but not limited to establishing line and grade, in advance of the construction; and to perform other surveying services for the work included under the Contract. The surveyor to be retained by the Contractor shall not be the same surveyor engaged for the Engineer's use. The surveyor shall be subject

to the approval of the Engineer. Survey drawings shall be submitted to the Engineer for approval.

- H. The Contractor shall take all necessary measurements in the field to verify pertinent data and dimensions shown on the Drawings or to determine the exact dimensions of the Work.

1.07 FIELD SAMPLE PROCEDURES

- A. When field samples are specified in a unit of work, construct each field sample to include work of all trades required to complete the field sample prior to starting related field work. Field samples may be incorporated into the project after acceptance by Construction Manager. Remove unacceptable field samples when directed by Construction Manager. Acceptable samples represent a quality level for the work.

1.08 CONTRACTOR DESIGNED STRUCTURAL SYSTEMS

- A. DESIGN ENGINEERING: Contractor shall employ and pay for engineering services from a Professional Engineer registered in the State of Florida for structural design of Contractor designed structural systems including but not limited to temporary shoring and bracing, formwork support, interior wall and ceiling systems, and support systems for fire sprinkler, plumbing, mechanical, and electrical systems and equipment.
- B. TESTS AND INSPECTIONS OF CONTRACTOR DESIGNED STRUCTURAL SYSTEMS: Contractor shall pay for preliminary testing of concrete, grout, and mortar mix designs where required by Code or these specifications prior to start of work. Contractor shall pay for required shop and site inspection of Contractor designed structural systems where required by Code or these specifications.

1.09 JOB SITE CONDITIONS

- A. Schedule to ensure all preparatory work has been accomplished prior to proceeding with current work. Proceeding with the work constitutes acceptance of conditions. Allow adequate time for materials susceptible to temperature and humidity to “stabilize” prior to installation. Establish and maintain environmental conditions (i.e., temperature, humidity, lighting) as recommended by the various material manufacturers for the duration of the work.

PART 2 PRODUCTS

2.01 SOURCE QUALITY CONTROL

- A. CONTRACTOR RESPONSIBILITIES: Provide source quality control according to the reviewed and accepted QCS plan and paragraph 1.06 herein. Coordinate with Construction Manager to facilitate the work of the Testing Laboratory specified in Section 01 45 23 and Special Inspector. Provide ready access to sampling and inspection locations and incidental labor customary in such sampling and inspections. Timely prepare and submit submittals, and revise as indicated by review comments. Comply with technical requirements in each specification Section that applies to the work.
- B. CONSTRUCTION MANAGER RESPONSIBILITIES: Review Contractor’s tracking of QCS activities at [monthly] meetings. Facilitate completion of submittal review per Section 01

33 00. Assist Contractor to ensure that Special Inspection occurs where and when specified.

- C. ACCEPTANCE CRITERIA: Acceptable characteristics and quality of a particular item or construct is defined in that item's or construct's specification Section.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

- A. Field quality control responsibilities of the Contractor and Construction Manager are substantially the same as described in paragraph 2.01, with the exception that this work occurs primarily on the jobsite as the work progresses, and Special Inspection will occur more often than at the source.
- B. Acceptable characteristics and quality of a particular item or construct is defined in that item's or construct's specification Section.

3.02 REGULATORY COMPLIANCE – SPECIAL INSPECTIONS

- A. The types of work requiring Special Inspection are specified in the Construction Documents and required to obtain regulatory approval by State or required by local governing authorities having jurisdiction over the building permit of the project.
- B. Section 01 45 23 describes Testing Laboratory sampling, testing and reporting.
- C. Contractor designed structural systems are subject to the same Special Inspection requirements as all other work.

3.03 CORRECTION OF DEFECTIVE WORK

- A. Any defective or imperfect Work, equipment, or materials furnished by the Contractor which is discovered before the Final Acceptance of the Work, or during a warranty period, shall be removed immediately even though it may have been overlooked by the Engineer and approved for payment. The Contractor shall repair such defect, without compensation, in a manner satisfactory to the Engineer.
- B. Unsuitable materials and equipment may be rejected, notwithstanding that such defective Work, materials and equipment may have been previously overlooked by the Engineer and accepted or approved for payment.
- C. If any workmanship, materials or equipment shall be rejected by the Engineer as unsuitable or not in conformity with the Specifications or Drawings, the Contractor shall promptly replace such materials and equipment with acceptable materials and equipment at no additional cost to City . Equipment or materials rejected by the Engineer shall be tagged as such and shall be immediately removed from the site.
- D. The Engineer may order tests of imperfect or damaged Work equipment, or materials to determine the required functional capability for possible acceptance, if there is no other reason for rejection. The cost of such tests shall be borne by the Contractor, and the nature, tester, extent and supervision of the tests will be as determined by the Engineer. If the results of the tests indicate that the required functional capability of the Work,

equipment, or material was not impaired, the Work, equipment or materials may be deemed acceptable, in the discretion of the Engineer. If the results of such tests reveal that the required functional capability of the questionable Work, equipment or materials has been impaired, then such Work, equipment or materials shall be deemed imperfect and shall be replaced. The Contractor may elect to replace the imperfect Work, equipment or material in lieu of performing the tests.

END OF SECTION

SECTION 01 45 20

EQUIPMENT AND SYSTEM PERFORMANCE AND OPERATIONAL TESTING

PART 1 GENERAL

1.01 DESCRIPTION

- A. This section contains requirements for the Contractor's performance in documenting testing work required under this contract. In addition, this section contains requirements for the Contractor's performance during installed performance testing of all mechanical, electrical, instrumentation, and HVAC equipment and systems, including structures for watertight construction, provided under this contract. This section supplements but does not supersede specific testing requirements found elsewhere in this project manual.

1.02 QUALITY ASSURANCE

- A. Contractor's Quality Assurance Manager:
1. The Contractor shall appoint an operations engineer or equally qualified operations specialist as Quality Assurance Manager to manage, coordinate, and supervise the Contractor's quality assurance program. The Quality Assurance Manager shall have at least 5 years of total experience, or experience on at least five separate projects, in managing the startup commissioning of mechanical, electrical, instrumentation, HVAC, and piping systems. Operations engineers shall be graduates from a minimum 4-year course in mechanical or civil engineering. Operations specialists shall have equivalent experience in plant operation and maintenance. The quality assurance program shall include:
 - a. A testing plan setting forth the sequence in which all testing work required under this project manual will be implemented.
 - b. A documentation program to record the results of all equipment and system tests.
 - c. An installed performance testing program for all mechanical, electrical, instrumentation, and HVAC equipment and systems installed under this contract.
 - d. A calibration program for all instruments, meters, monitors, gages, and thermometers installed under this contract.
 - e. A calibration program for all instruments, gages, meters, and thermometers used for determining the performance of equipment and systems installed under this contract.
 - f. A testing schedule conforming to the requirements specified in paragraph 2.02 Testing Schedule.
 2. For the purposes of this section, a system shall include all items of equipment, devices and appurtenances connected in such a fashion as their operation or function complements, protects or controls the operation or function of the others. The Quality Assurance Manager shall coordinate the activities of all subcontractors and suppliers to implement the requirements of this section.
- B. Calibration:
1. All test equipment (gages, meters, thermometers, analysis instruments, and other equipment) used for calibrating or verifying the performance of equipment installed

under this contract shall be calibrated to within plus or minus 2 percent of actual value at full scale. Test equipment employed for individual test runs shall be selected so that expected values as indicated by the detailed performance specifications will fall between 60 and 85 percent of full scale. Pressure gages shall be calibrated in accordance with ANSI/ASME B40.1. Thermometers shall be calibrated in accordance with ASTM E77 and shall be furnished with a certified calibration curve.

2. Test instruments shall be calibrated to references traceable to the National Institute of Standards and Technology and shall have a current sticker showing date of calibration, deviation from standard, name of calibration laboratory and technician, and date recalibration is required.
 3. Calibration equipment/test instruments utilized for Start-Up and Equipment Testing shall be documented to include identification (by make, manufacturer, model, and serial number) of the test equipment, date of original calibration, subsequent calibrations, calibration method, and test laboratory as well as documentation of current calibration.
 4. All analysis instruments, sensors, gauges, and meters used for performance testing shall be subject to recalibration to confirm accuracy after the testing has been completed. All analysis instruments, sensors, gauges, and meters installed under this contract shall be subject to recalibration prior to acceptance.
 5. Test equipment used to simulate inputs and read outputs shall have a rated accuracy at the point of measurement at least three times greater than the component under test. Buffer solutions and reference fluids shall be provided as necessary for tests of analytical equipment.
 6. Liquid flow meters, including all open channel flow meters and all meters installed in pipelines with diameters greater than 2 inches shall be calibrated in situ using either the total count or dye dilution methods. Gas flow meters installed in piping systems with diameters greater than 6 inches shall be calibrated in situ using the pitot tube velocity averaging method. Flow meter calibration work shall be performed by individuals skilled in the techniques to be employed. Calibration tests for flow metering systems shall be performed over a range of not less than 10 percent to at least 75 percent of system full scale. At least five confirmed valid data points shall be obtained within this range. Confirmed data points shall be validated by not less than three test runs with results which agree within plus or minus 2 percent.
- C. References:
1. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.
 2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that

date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ANSI/ASME B40.1	Gauges Pressure Indicating Dial Type—Elastic Element
ASTM E77	Method for Verification and Calibration of Liquid-in-Glass Thermometers
ASHRAE 41.8	Standard Methods of Measurement of Flow of Gas
Dye Dilution Calibration Method	Flow Measurements in Sanitary Sewers By Dye Dilution, Turner Designs Mountain View, California,
	Flow Measurement in Sewer Lines by the Dye Dilution Method, <u>Journal of the Water Pollution Control Federation</u> , Vol. 55, Number 5, May, 1983, pg. 531
	Flow Measurement in Open Channels and Closed Conduits, Vol 1, U.S. Department of Commerce, National Bureau of Standards, pg. 361
	<u>Techniques of Water-Resources Investigations of the United States Geological Survey</u> , Chapter 16, Measurement of Discharge Using Tracers

1.03 SUBMITTALS

- A. Submittal material, to be submitted in accordance with Section 01 33 00, shall consist of the following:
1. A complete description of the Contractor's plan for documenting the results from the test program in conformance with the requirements of paragraph 2.02 Documentation Plans, including:
 - a. Proposed plan for documenting the calibration of all test instruments.
 - b. Proposed plan for calibration of all instrument systems, including flow meters and all temperature, pressure, weight, and analysis systems.
 - c. Sample forms for documenting the results of field pressure and performance tests.
 2. The credentials and certification of the testing laboratory proposed by the Contractor for calibration of all test equipment.
 3. Preoperational check-out procedures, reviewed and approved by the respective equipment manufacturers.
 4. Detailed testing plans, setting forth step-by-step descriptions of the procedures proposed by the Contractor for the systematic testing of all equipment and systems installed under this contract.
 5. A schedule and subsequent updates, presenting the Contractor's plan for testing the equipment and systems installed under this contract.
 6. A schedule establishing the expected time period (calendar dates) when the Contractor plans to commence operational testing of the completed systems, along with a description of the temporary systems and installations planned to allow operational testing to take place.
 7. A summary of the Quality Assurance Manager's qualifications, showing conformance to paragraph 1.02 Contractor's Quality Assurance Manager requirements.

PART 2 PRODUCTS

2.01 GENERAL

- A. The Contractor shall prepare test plans and documentation plans as specified in the following paragraphs. The Construction Manager will not witness any test work for the purpose of acceptance until all test documentation and calibration plans and the specified system or equipment test plans have been submitted and accepted.

2.02 DOCUMENTATION

A. Documentation Plans:

1. The Contractor shall develop a records keeping system to document compliance with the requirements of this Section. Calibration documentation shall include identification (by make, manufacturer, model, and serial number) of all test equipment, date of original calibration, subsequent calibrations, calibration method, and test laboratory.
2. Equipment and system documentation shall include date of test, equipment number or system name, nature of test, test objectives, test results, test instruments employed for the test and signature spaces for the Construction manager's witness and the Contractor's quality assurance manager. A separate file shall be established for each system and item of equipment. These files shall include the following information as a minimum:
 - a. Metallurgical tests
 - b. Factory performance tests
 - c. Accelerometer recordings made during shipment
 - d. Field calibration tests¹
 - e. Field pressure tests¹
 - f. Field performance tests¹
 - g. Field operational tests¹
3. Section 01 99 90 contains samples showing the format and level of detail required for the documentation forms. The Contractor is advised that these are samples only and are not specific to this project nor to any item of equipment or system to be installed under this contract. The Contractor shall develop test documentation forms specific to each item of equipment and system installed under this contract. Acceptable documentation forms for all systems and items of equipment shall be produced for review by the Construction Manager as a condition precedent to the Contractor's receipt of progress payments in excess of 50 percent of the contract amount. Once the Construction Manager has reviewed and taken no exception to the forms proposed by the Contractor, the Contractor shall produce sufficient forms, at his expense, to provide documentation of all testing work to be conducted as a part of this contract.

B. Test Plans:

1. The Contractor shall develop test plans detailing the coordinated, sequential testing of each item of equipment and system installed under this contract. Each test plan

¹Each of these tests is required even though not specifically noted in detailed specification section.

shall be specific to the item of equipment or system to be tested. Test plans shall identify by specific equipment or tag number each device or control station to be manipulated or observed during the test procedure and the specific results to be observed or obtained. Test plans shall also be specific as to support systems required to complete the test work, temporary systems required during the test work, subcontractors' and manufacturers' representatives to be present and expected test duration. As a minimum, the test plans shall include the following features:

- a. Step-by-step proving procedure for all control and electrical circuits by imposing low voltage currents and using appropriate indicators to affirm that the circuit is properly identified and connected to the proper device.
 - b. Calibration of all analysis instruments and control sensors.
 - c. Performance testing of each individual item of mechanical, electrical, and instrumentation equipment. Performance tests shall be selected to duplicate the operating conditions described in the project manual.
 - d. System tests designed to duplicate, as closely as possible, operating conditions described in the project manual.
2. Test plans shall contain a complete description of the procedures to be employed to achieve the desired test environment.
 3. As a condition precedent to receiving progress payments in excess of 75 percent of the contract amount, or in any event, progress payments due to the Contractor eight weeks in advance of the date the Contractor wishes to begin any testing work (whichever occurs earliest in the project schedule), the Contractor shall have submitted all test plans required for the systematic field performance and operational tests for all equipment and systems installed under this contract. Once the Construction Manager has reviewed and taken no exception to the Contractor's test plans, the Contractor shall reproduce the plans in sufficient number for the Contractor's purposes and an additional ten copies for delivery to the Construction Manager. No test work shall begin until the Contractor has delivered the specified number of final test plans to the Construction Manager.

C. Testing Schedule:

1. The Contractor shall produce a testing schedule setting forth the sequence contemplated for performing the test work. The schedule shall be in bar chart form, plotted against calendar time, shall detail the equipment and systems to be tested, and shall be coordinated with the Contractor's construction schedule specified in Section 01 32 16. The schedule shall show the contemplated start date, duration of the test and completion of each test. The test schedule shall be submitted no later than 4 weeks in advance of the date testing is to begin. The Construction Manager will not witness any testing work for the purpose of acceptance until the Contractor has submitted a schedule to which the Construction Manager takes no exception. The test schedule shall be updated weekly, showing actual dates of test work, indicating systems and equipment testing completed satisfactorily and meeting the requirements of this project manual.

2.03 SYSTEM AND EQUIPMENT PERFORMANCE TESTS

- A. Each item of mechanical, electrical, instrumentation, and HVAC equipment installed under this contract shall be tested to demonstrate compliance with the performance requirements of this project manual. Each electrical, instrumentation, mechanical,

pipng, and HVAC system installed or modified under this contract shall be tested in accordance with the requirements of this project manual.

2.04 OPERATIONAL TESTS

- A. Once all equipment and systems have been tested individually, the Contractor shall fill all systems except wastewater, scum sludge and other wastewater derived systems with the intended process fluids. Wastewater-derived process systems shall be filled with water. After filling operations have been completed, the Contractor shall operate all systems for a continuous period of not less than 5 days, simulating actual operating conditions to the greatest extent possible. The Contractor shall install temporary connections, bulkheads and make other provisions to recirculate process fluids or otherwise simulate anticipated operating conditions. During the operational testing period, the Contractor's Quality Assurance Manager and testing team shall monitor the characteristics of each machine and system and report any unusual conditions to the Construction Manager.

2.05 PRODUCT DATA

- A. Product data, to be provided in accordance with Section 01 33 00, shall be the original and three copies of all records produced during the testing program.

PART 3 EXECUTION

3.01 GENERAL

- A. The Contractor's quality control manager shall organize teams made up of qualified representatives of equipment suppliers, subcontractors, the Contractor's independent testing laboratory, and others, as appropriate, to efficiently and expeditiously calibrate and test the equipment and systems installed and constructed under this contract. The objective of the testing program shall be to demonstrate, to the Construction Manager's complete satisfaction, that the structures, systems, and equipment constructed and installed under this contract meet all performance requirements and the facility is ready for the commissioning process to commence. In addition, the testing program shall produce baseline operating conditions for the City to use in a preventive maintenance program.

3.02 CALIBRATION OF FIXED INSTRUMENTS

- A. Calibration of analysis instruments, sensors, gages, and meters installed under this contract shall proceed on a system-by-system basis. No equipment or system performance acceptance tests shall be performed until instruments, gages, and meters to be installed in that particular system have been calibrated and the calibration work has been witnessed by the Construction Manager.
- B. All analysis instruments, sensors, gages, and meters used for performance testing shall be subject to recalibration to confirm accuracy after completion, but prior to acceptance of each performance test. All analysis instruments, sensors, gages, and meters installed under this contract shall be subject to recalibration as a condition precedent to commissioning under the provisions of Section 01 91 00.

3.03 PERFORMANCE TESTS

A. General:

1. Performance tests shall consist of the following:
 - a. Pressure and/or leakage tests.
 - b. Electrical testing as specified in Division 26.
 - c. Wiring and piping, individual component, loop, loop commissioning and tuning testing as described in Division 40.
 - d. Preoperational checkout for all mechanical and HVAC equipment. Preoperational check-out procedures shall be reviewed and approved by the respective equipment manufacturers.
 - e. Initial operation tests of all mechanical, electrical, HVAC, and instrumentation equipment and systems to demonstrate compliance with the performance requirements of this project manual.
2. In general, performance tests for any individual system shall be performed in the order listed above. The order may be altered only on the specific written authorization of the Construction Manager after receipt of a written request, complete with justification of the need for the change in sequence.

B. Pressure And Leakage Tests:

1. Pressure and leakage tests shall be conducted in accordance with applicable portions of Divisions 3 and 40. All acceptance tests shall be witnessed by the Construction Manager. Evidence of successful completion of the pressure and leakage tests shall be the Construction Manager's signature on the test forms prepared by the Contractor.

C. Functional Checkout:

1. Prior to energization (in the case of electrical systems and equipment), all circuits shall be rung out and tested for continuity and shielding in accordance with the procedures required in Division 26.

D. Component Calibration And Loop Testing:

1. Prior to energization (in the case of instrumentation system and equipment), all loops and associated instruments shall be calibrated and tested in accordance with the procedures required in Division 40.

E. Electrical Resistance:

1. Electrical resistance testing shall be in accordance with Division 26.

F. Preoperational Tests:

1. Preoperational tests shall include, but are not limited to, the following:
 - 1) Check for proper installation, alignment, support, and anchorage per the applicable manufacturer's operation and maintenance manual and in accordance with the contract documents.
 - 2) Check the equipment for proper adjustment, packing of seals, lubrication, drive connection, motor connection, and belt/chain tension per the applicable manufacturer's operation and maintenance manual and in accordance with the Contract Documents.

- 3) Check the associated process, seal water, drain, and vent pipe connections for proper routing and connection. Check to ensure the pipe testing was performed and signed-off on as completed for all the associated piping.
 - 4) Ensure that the equipment is clean and free of any construction debris that could potentially cause a malfunction.
- b. Ensure that all safety guards, signage, and other safety measures such as hearing protection, etc., are in place.
 - c. Manufacturer's representatives shall perform all pre-operational tests per the manufacturer's recommendations and review the equipment installation and sign the manufacturer's installation portion of the certification form. If the manufacturer's representative brings his own checklist, obtain a copy of the completed form and attach it to the Design-Builder's completed forms. Note that the manufacturer must also fill out the contract approved checkout form (manufacturer's own form will not serve as a substitute).
 - d. All gates and valves associated with the equipment system must be checked for proper installation, adjustment, and lubrication per the manufacturer's recommendations.
2. Electrical Pre-Operational Checks/Tests
 - a. Prior to energizing electrical circuits, use a 1,000-volt megohmmeter to measure insulation resistance on conductors and insulated parts of electrical equipment. All measurements shall meet or exceed the appropriate ICEA, NEMA, or ANSI standard. Any insulation resistance less than 10 megohms is unacceptable. Record results, as well as ambient temperature.
 - b. Measure phase-to-ground insulation resistance for all circuits 120 volts and above, with the exception of lighting circuits. Measurements may be made with motors and other equipment connected, except that solid-state equipment shall be disconnected unless the equipment is normally tested by the manufacturer at voltages in excess of 1,000 volts DC.
 - c. Complete Test Form for each installed motor. Measure the insulation resistance of all motors before connection. Measure the insulation resistance for all motors at the time of delivery as well as when connected. Insulation resistance values less than 10 megohms are not acceptable.
 - d. Adjust and make operative all protective devices. Perform a functional check of the control circuit prior to energization of the equipment.
 - e. Review all associated electrical terminations, switches, and breakers for satisfactory installation.
 3. Individual Component/Instrument Calibration Pre-Operational Check/Test
 - a. Each instrument and final element shall be field calibrated in accordance with the manufacturer's recommended procedure. Instruments shall then be tested in compliance with ISA S51.1 and the data entered on the applicable test report form. Alarm trips, control trips, and switches shall be set to initial values specified in the design at this time. Final elements shall be checked for range, dead band, and speed of response.
 - b. Calibration of analysis instruments, sensors, gauges, and meters installed under this contract shall proceed on a system-by-system basis. No equipment or system start-up, or acceptance tests shall be performed until instruments, gauges, and meters to be installed in that particular system have been calibrated and the calibration work has been witnessed by the City's Representative.

- c. Testing of instrument process piping/tubing, wiring and individual components shall be completed and documented on the approved test forms provided to the Engineer or City's Representative as part of the pre-operational testing phase and prior to commencement of individual loop testing conducted during the pre-operational functional test phase.
 - d. Any component which fails to meet the required tolerances shall be repaired by the manufacturer or replaced, and the above tests repeated until the component is within tolerance. System instrumentation equipment supplied and installed must also be reviewed for proper installation and termination as part of the pre-operational checkout.
4. Pre-Operational Checkout Summary
- a. The pre-operational checkout and testing for each item shall be carried out in accordance with the Design-Builder's submitted and approved procedures and documented on the Design-Builder's approved pre-operational test forms.
 - b. The Design-Builder shall complete the pre-operational testing requirements listed above, at a minimum, for each item of mechanical, electrical, instrumentation equipment prior to beginning any functional testing with regard to the equipment or the systems in which the equipment functions

G. Functional Tests:

1. General: Once all affected equipment has been subjected to the required preoperational check-out procedures and the Construction Manager has witnessed and has not found deficiencies in that portion of the work, individual items of equipment and systems may be started and operated under simulated operating conditions to determine as nearly as possible whether the equipment and systems meet the requirements of these specifications. If available, plant effluent may be employed for the testing of all liquid systems except gaseous, oil, or chemical systems. If not available, potable water shall be employed as the test medium. Test media for these systems shall either be the intended fluid or a compatible substitute. The equipment shall be operated a sufficient period of time to determine machine operating characteristics, including noise, temperatures and vibration; to observe performance characteristics; and to permit initial adjustment of operating controls. When testing requires the availability of auxiliary systems such as looped piping, electrical power, compressed air, control air, or instrumentation which have not yet been placed in service, the Contractor shall provide acceptable substitute sources, capable of meeting the requirements of the machine, device, or system at no additional cost to the City. Disposal methods for test media shall be subject to review by the Construction Manager. During the functional test period, the Contractor shall obtain baseline operating data on all equipment with motors greater than 1 horsepower to include amperage, bearing temperatures, and vibration. The baseline data shall be collected for the City to enter in a preventive maintenance system.
- a. Test results shall be within the tolerances set forth in the detailed specification sections of this project manual. If no tolerances have been specified, test results shall conform to tolerances established by recognized industry practice. Where, in the case of an otherwise satisfactory functional test, any doubt, dispute, or difference should arise between the Construction Manager and the Contractor regarding the test results or the methods or equipment used in the performance of such test, then the Construction Manager may order the test to be repeated. If the repeat test, using such modified methods or equipment as the Construction Manager may require, confirms the previous test, then all costs in connection

with the repeat test will be paid by the City . Otherwise, the costs shall be borne by the Contractor. Where the results of any functional test fail to comply with the contract requirements for such test, then such repeat tests as may be necessary to achieve the contract requirements shall be made by the Contractor at his expense.

- b. The Contractor shall provide, at no expense to the City , all power, fuel, compressed air supplies, water, and chemicals, all labor, temporary piping, heating, ventilating, and air conditioning for any areas where permanent facilities are not complete and operable at the time of functional tests, and all other items and work required to complete the functional tests. Temporary facilities shall be maintained until permanent systems are in service.
 - c. The Functional Tests results shall be reviewed and approved by the respective equipment manufacturers. Approval documentation of the Functional Tests shall be submitted to the Engineer to complete the Functional Tests procedures.
2. Retesting: If under test, any portion of the work should fail to fulfill the contract requirements and is adjusted, altered, renewed, or replaced, tests on that portion when so adjusted, altered, removed, or replaced, together with all other portions of the work as are affected thereby, shall, unless otherwise directed by the Construction Manager, be repeated within reasonable time and in accordance with the specified conditions. The Contractor shall pay to the City all reasonable expenses incurred by the City , including the costs of the Construction Manager, as a result of repeating such tests.
 3. Post-test Inspection: Once functional testing has been completed, all machines shall be rechecked for proper alignment and realigned, as required. All equipment shall be checked for loose connections, unusual movement, or other indications of improper operating characteristics. Any deficiencies shall be corrected to the satisfaction of the Construction Manager. All machines or devices which exhibit unusual or unacceptable operating characteristics shall be disassembled and inspected. Any defects found during the course of the inspection shall be repaired or the specific part or entire equipment item shall be replaced to the complete satisfaction of the Construction Manager at no cost to the City .

3.04 OPERATIONAL TESTS

- A. The Contractor shall provide system operation testing. After completion of all performance testing and certification by the Construction Manager that all equipment complies with the requirements of the specifications, the Contractor shall fill all process units and process systems, except those employing domestic water, oil, air, or chemicals, with plant effluent water. All domestic water, oil, air, and chemical systems shall be filled with the specified fluid.
- B. Upon completion of the filling operations, the Contractor shall circulate water through the completed facility for a period of not less than 48 hours, during which all parts of the system shall be operated as a complete facility at various loading conditions, as directed by the Construction Manager. The operational testing period shall commence after this initial period of variable operation. The operational testing period shall be at least 30 days. Should the operational testing period be halted for any reason related to the facilities constructed or the equipment furnished under this contract, or the Contractor's temporary testing systems, the operational testing program shall be repeated until the

specified continuous period has been accomplished without interruption. All process units shall be brought to full operating conditions, including temperature, pressure, and flow.

- C. As-built documents specified in Section 01 78 39 of facilities involved shall be accepted and ready for turnover to the City at the time of operational testing.

END OF SECTION

SECTION 01 50 00
CONSTRUCTION CONSIDERATIONS

PART 1 GENERAL

1.01 HYDRAULIC UPLIFT ON STRUCTURES

- A. The CONTRACTOR shall be completely responsible for any structures, stormwater conflicting structure, tanks, wet wells, pipelines, manholes, foundations, cellars, or similar structures that may become buoyant during the construction operations due to the ground water, floods or buoyancy of piping caused due to the placement of flowable backfills before the structure is put into operation. Should there be any possibility of buoyancy of a pipeline or structure, the CONTRACTOR shall take the necessary steps to prevent its buoyancy. Damage to any structures due to floating or flooding shall be repaired, or the structures replaced at the CONTRACTOR'S expense.

1.02 WATER TIGHTNESS OF STRUCTURES

- A. General: It is the intent of these specifications that all concrete work, sealing work around built-in items and penetrations be performed as required to ensure that groundwater, rainwater, wastewater, chemical solutions or other process liquids in tanks, wetwells, channels, and containers will not leak into any buildings and/or equipment rooms, pipe galleries, habitable areas, or other generally dry areas.
1. The required watertightness shall be achieved by quality concrete construction and proper sealing of all joints and penetrations.
 2. Each unit shall be tested separately, and the leakage tests shall be made prior to backfilling and before equipment is installed unless otherwise approved by the ENGINEER. Only potable water shall be used for the tests.
 3. The watertightness of buildings exclusive of the portions designed to contain liquids will consist of checking for leaks due to rain or groundwater infiltration.
 4. The CONTRACTOR shall provide at his own expense all labor, material, temporary bulkheads, pumps, water, measuring devices, etc., necessary to perform the required test.
- B. Built-in Items and Penetrations: All pipe sleeves, built-in items and penetrations shall be sealed as detailed and as required to ensure a continuous watertight seal.

1.03 CUTTING AND PATCHING

- A. The CONTRACTOR shall perform all cutting and patching of his work that may be required to make its several parts come together properly and fit it to receive or be received by such other work. The CONTRACTOR shall not endanger any work of others by cutting, excavating or otherwise altering their work and shall only cut or alter work with the written consent of the ENGINEER and of the other contractors whose work will be affected.

1.04 ABANDONMENT AND SALVAGE OF EXISTING FACILITIES

- A. General: The scope of work requires the CONTRACTOR to interface with existing structures, and piping which will be abandoned or otherwise removed and/or relocated

as part of the work. Prior to beginning any work associated with existing facilities to be abandoned, salvaged, or otherwise removed or relocated, the CONTRACTOR shall inform the CITY and the ENGINEER of his intent so that all arrangements can be made with the CITY for isolating pipelines (where possible) or otherwise removing existing facilities from service to the extent possible. The CONTRACTOR shall not proceed without written authorization from the CITY. The CONTRACTOR shall contact and coordinate accordingly with utilities companies prior to and during the execution of the relocation, removal or abandonment of existing utilities structures. Existing utilities coordination is exclusively the responsibility of the CONTRACTOR.

- B. Pipelines: The CONTRACTOR shall abandon, salvage or otherwise remove existing pipelines or segments of existing pipelines shown to be abandoned in place, salvaged, or removed as part of the contract work. Unless otherwise indicated in the Contract Documents, all piping shown on the Drawings to be abandoned shall be abandoned in place. Pipe shown to be abandoned need only be removed a minimum three feet clear of new utilities to be installed. Abandon-in-place shall be defined as installing plugs, or other permanent closure, as reviewed and accepted by the CITY, on all termination's, open ends or ends of pipe designated as being cut, capped and anchored in an acceptable manner. The pipe will remain buried unless otherwise noted.
- C. Piping indicated on the Drawings as being removed, or any piping to be abandoned which interferes with new structures or piping, shall be excavated and removed using methods which will not disturb adjacent piping or other facilities. All pipe materials shall be subject to salvage by the CITY as defined below. Any remaining piping on both ends of pipe segments removed shall be abandoned in-place, per the above definition. After piping has been removed, the CONTRACTOR shall backfill the evacuated area in accordance with requirements set forth in other sections of these specifications.
- D. Equipment: The CONTRACTOR shall abandon, salvage or otherwise remove existing equipment or other facilities as shown on the Contract Drawings or indicated herein. In all cases, the CONTRACTOR shall exercise caution when handling the existing equipment so as not to disturb or damage adjacent facilities. The CONTRACTOR shall make all repairs to adjacent facilities which may be damaged as a result of the CONTRACTOR's efforts in abandoning, salvaging or otherwise removing existing facilities, at no additional cost to the CITY.
- E. Salvage: The CITY may desire to salvage certain items of existing equipment which are to be dismantled and removed during the course of construction. Prior to removal of any existing equipment or piping from the site of work, the CONTRACTOR shall ascertain from the CITY whether or not the particular item or items are to be salvaged. Items to be salvaged shall be stockpiled on the site, in a location as designated by the CITY. All other items of equipment shall be disposed of off-site by the CONTRACTOR at his own expense, in accordance with applicable laws, ordinances and regulations.

1.05 DIMENSIONS OF EXISTING STRUCTURES

- A. Where the dimensions and locations of existing structures are of critical importance in the installation or connection of new work, the CONTRACTOR shall verify such dimensions and locations in the field before the fabrication of any materials or equipment which is dependent on the correctness of such information.

1.06 REHABILITATION

- A. Certain areas of existing structures, piping, conduits, and the like will be affected by work necessary to complete modifications under this Contract. The CONTRACTOR shall be responsible to rehabilitate those areas affected by its construction activities.
- B. Where new rectangular openings are to be installed in concrete or concrete masonry walls or floors, the CONTRACTOR shall score the edges of each opening (both sides of wall or elevated slab) by saw cutting clean straight lines to a minimum depth of one inch and then chipping out the concrete. Alternately, the opening can be formed by saw cutting completely through the slab or wall. Saw cuts deeper than one inch (or the depth of cover over existing reinforcing steel, whichever is less) shall not be allowed to extend beyond the limits of the opening. Corners shall be made square and true by a combination of core drilling, chipping, or grinding. All necessary precautions shall be taken during removal of concrete to prevent debris from falling and damaging adjacent equipment or piping. Saw cuts allowed to extend beyond the opening shall be repaired by filling with non-shrink grout. The concrete around any exposed reinforcement steel shall be chipped back and exposed reinforcement steel cut a minimum of 1-1/2 inches from the finished face of the new opening. The inside face of the new opening shall be grouted to fill any voids and cover the exposed aggregate and shall be trowel-finished to provide a plumb and square opening.
- C. Where new conduit or piping is to be installed through existing concrete walls, the CONTRACTOR shall accurately position the core-drill openings. Openings shall be adequately sized to allow alignment of piping or conduit and fittings without deflection and to provide adequate clearance for satisfactory packing in the annular space between the piping or conduit and the core drilling opening as shown on the Drawings.
- D. Where new piping is to be connected to existing piping, the existing piping shall be cut square and the ends properly prepared for the connection shown on the drawings. Any damage to the lining and coating of the existing piping shall be repaired by the CONTRACTOR.
- E. Where existing equipment, equipment pads and bases, piping, piping supports, electrical panels and devices, conduits, and associated appurtenances are removed, the CONTRACTOR shall rehabilitate the affected area such that little or no evidence of the previous installation remains. Opening in concrete floors, walls, and ceiling from piping, conduit, and fastener penetrations shall be filled with non-shrink grout and finished to match the adjacent area. Concrete pads and bases for equipment and supports shall be removed by chipping away concrete and cutting any exposed reinforced steel and anchor bolts a minimum of 1-1/2 inches below finished grade. The area of concrete to be rehabilitated shall be scored by saw cutting clean, straight lines to a minimum depth of 1-1/2 inches, and all concrete within the scored lines removed to a minimum depth of 1-1/2 inches. The area within the scored lines shall be patched with non-shrink grout to match the adjacent grade and finish. Abandoned connections to piping and conduits shall be terminated with blind flanges, caps, and plugs suited for the material, type, and service of the pipe or conduit.
- F. Where existing structural steel members are removed or modified, the surface of the remaining existing steel members damaged by construction activities shall be repaired. The affected areas shall be surface prepared and coated in accordance with Section entitled "Painting".

- G. Disposal of Debris: All debris, materials, piping, and miscellaneous waste products from the work described in this section shall be removed from the project as soon as possible. They shall be disposed of in accordance with applicable federal, state, and local regulations. The CONTRACTOR is responsible for determining these regulations and shall bear all costs or retain any profit associated with disposal of these items.

1.07 INSTALLATION OF EQUIPMENT

- A. CONTRACTOR shall have on hand sufficient personnel, proper equipment, and machinery of ample capacity to facilitate the work.
- B. CONTRACTOR shall be responsible for locating, aligning and leveling all equipment and shall employ a licensed surveyor to set all lines and levels of equipment to the accuracy required.
- C. Complete manufacturers installation instructions, including permissible tolerances, shall be furnished in duplicate with each unit of equipment or set of identical units.
- D. All equipment shall be installed in accordance with the shop drawings; inclusive of manufacturers specifications, drawings and tolerances; under the direct supervision of the required manufacturers ENGINEER. No instructions shall be issued that are contrary to written specifications without prior written approval by the CITY's ENGINEER.
- E. Equipment shall be erected in a neat and workmanlike manner on the foundations at the locations and elevations shown on the drawings unless otherwise indicated by the ENGINEER during installation.

1.08 SUPERVISION BY MANUFACTURER'S REPRESENTATIVES

- A. The CONTRACTOR shall provide the services of qualified equipment manufacturers technical representatives who shall adequately supervise the installation and testing of all equipment furnished under this Contract and instruct the CONTRACTOR's personnel and CITY's operating personnel in its maintenance and operation.

1.09 EQUIPMENT MANUFACTURER'S CERTIFICATION

- A. As a condition precedent to acceptance of equipment installed and operating, the CONTRACTOR will provide the CITY with written certification, obtained from each company manufacturing equipment for the project, that the equipment is installed and does operate in accordance with the specifications and manufacturers recommendations.

1.10 SLEEVES AND OPENINGS

- A. The CONTRACTOR shall provide all openings, chases, etc., to fit his own work and that of any other subcontractors and contractors. All such openings or chases shown on the Contract Drawings, or reasonably implied thereby, or as confirmed or modified by shop, setting or erecting drawings approved by the ENGINEER, shall be provided by the CONTRACTOR.
- B. Where pipes or conduits are to pass through slabs or walls, or where equipment frames or supports are to be installed as integral part of an opening, the sleeves, opening, forms

or frames shall be furnished by the installer of the pipes, conduits or equipment, but shall be placed by the CONTRACTOR.

- C. Where hanger inserts, anchor bolts and similar items are to be embedded in concrete as an integral part of a slab or wall, they shall be furnished by the installer of the pipe or other equipment requiring the hanger, etc. but shall be placed by the CONTRACTOR.
- D. When requested by the CONTRACTOR, the installer of the pipes, conduit, or equipment, including those contractors or subcontractors who require openings or chases in slabs and walls for passage of ducts, mounting or equipment, etc., shall furnish all necessary information, instructions, and materials to effect accurate installation of the required openings, chases, sleeves, frames, inserts, etc. When such items are secured in position, and just prior to construction of the surrounding slab or wall, the subcontractor or contractor for whom the items are installed shall ascertain the proper number, locations, and settings thereof; and the CONTRACTOR shall schedule his operations so as to provide a reasonable opportunity and time interval for such inspection.
- E. Any cost resulting from correction of defective, ill-timed, or mislocated work, or for subsequent work which becomes necessary because of omitted openings, chases, sleeves, frames, inserts, etc., shall be borne by the subcontractor or contractor responsible therefor. No contractor or subcontractor shall arbitrarily cut, drill, alter, damage, or otherwise endanger the work of another Contractor. In no case shall beams lintels, or other structural members be cut without the approval of the ENGINEER. The nature and extent of any corrective or additional work shall be subject to the approval of the ENGINEER following consultation with the affected parties.

1.11 OBSTRUCTIONS

- A. All water pipes, storm drains, sanitary sewers, force mains, gas or other pipe, telephone or power cables or conduits and all other obstructions, whether or not shown, shall be temporarily supported across utility line excavations. The CONTRACTOR shall be responsible for any damage to any such pipes, conduits, or structures. Approximate locations of known water, sanitary, drainage, power and telephone installations along route of new pipelines or in the vicinity of new work are shown, but must be verified in the field by the CONTRACTOR. The CONTRACTOR shall uncover these pipes, ducts, cables, etc., carefully, by hand, prior to installing new lines. Any discrepancies or differences found shall be brought to the attention of the ENGINEER in order that necessary changes may be made to permit installation of new work. These conditions are supplemental to general requirements elsewhere in the Contract Documents.

1.12 SITE CONDITIONS

- A. The CONTRACTOR acknowledges that he has investigated prior to bidding and satisfied himself as to the conditions affecting the Work, including but not restricted to those bearing upon transportation, disposal, handling and storage of materials, availability of labor, water, electric power, roads and uncertainties of weather, canal stages, tides, water tables 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 prosecution of the Work. The CONTRACTOR further acknowledges that he has satisfied himself as to the character, quality and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, or any contiguous site, as well as from information presented by

the Drawings and Specifications made a part of this Contract, or any other information made available to him prior to receipt of Bids. Any failure by the CONTRACTOR to acquaint himself with the available information will not relieve him from responsibility for estimating properly the difficulty or cost of successfully performing the Work. The CITY assumes no responsibility for any conclusions or interpretations made by the CONTRACTOR on the basis of the information made available by the CITY.

1.13 SUBSURFACE INVESTIGATIONS

- A. The CONTRACTOR shall be responsible for having determined to his satisfaction, prior to the submission of his bid, the nature and location of the work, the conformation of the ground, the character and quality of the substrata, the types and quantity of materials to be encountered, the nature of the groundwater condition, the character of equipment and facilities required preliminary to and during the performance of the work, the general and local conditions and all other matters which can in any way affect the work under this Contract. The prices established for the work to be done shall reflect all costs pertaining to the work. Any claims for extras based on the substrata or ground water table conditions will be disallowed.
- B. The CONTRACTOR further acknowledges that he assumes all risk contingent upon the nature of the subsurface conditions actually encountered by him in performing the work covered by the Contract, even though such actual conditions may result in the CONTRACTOR performing more or less work than he originally anticipated.

1.14 DIFFERING SITE CONDITIONS

- A. The CONTRACTOR shall promptly and before such conditions are disturbed, notify the CITY in writing of: (1) subsurface or latent physical conditions at the site differing materially from those indicated in this contract, or (2) unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for this contract. The CITY will promptly investigate the conditions, and if he finds that such conditions do materially so differ and cause an increase or decrease in the CONTRACTOR's cost of, or the time required for, performance of any part of the work under this contract, whether or not changed as a result of such conditions, an equitable adjustment shall be made and the contract modified in writing accordingly.

1.15 PROTECTION OF PROPERTY

- A. The CONTRACTOR shall protect all property that may be affected by his work or operations. The location and extent of underground and covered facilities are not guaranteed and the CONTRACTOR is cautioned to proceed with care in order to prevent the undermining or damage to existing utilities including piping, power cable, utility poles, conduit, duck bank, fiber optic cable, gas, telephone and cable TV services, structures, piping, and other facilities.
- B. The CONTRACTOR shall take all measures necessary to protect new and existing mechanical equipment from dust and debris. All protective measures shall be furnished, installed, lighted, ventilated, maintained, and removed at the CONTRACTOR'S own cost.
- C. When city water is being used, the supply source shall be protected against contamination in accordance with existing codes and regulations.

- D. In the event any of the CONTRACTOR'S activities were to disrupt or endanger any facilities, he shall at his own expense make all necessary repairs or replacements necessary to correct the situation to the satisfaction of the ENGINEER. Such work shall progress continuously to completion on a 24-hour per day, seven workday basis. The CONTRACTOR shall be responsible for the services of repair crews on call 24 hours per day for emergencies that arise involving work under this Contract.

1.16 WEATHER CONDITIONS

- A. Work that may be affected by inclement weather shall be suspended until proper conditions prevail. In the event of impending storms, the CONTRACTOR shall take necessary precautions to protect all work, materials and equipment from exposure. The CITY reserves the right, through the opinion of the ENGINEER, to order that additional protection measures over and beyond those proposed by the CONTRACTOR, be taken to safeguard all components of the project. The CONTRACTOR shall not claim any compensation for such precautionary measures so ordered, nor claim any compensation from the CITY for damage to the work from the elements of weather.

1.17 FIRE PROTECTION

- A. The CONTRACTOR shall take all necessary precautions to prevent fires at or adjacent to the work, including his own buildings and trailers. Adequate fire extinguisher and hose line stations shall be provided throughout the work area.

1.18 SAFETY AND HEALTH REQUIREMENTS

- A. The CONTRACTOR shall comply in every respect with all Federal, State and local safety and health regulations. Copies of the Federal Regulations may be obtained from the U.S. Department of Labor, Occupational Safety and Health Administration, 3200 East Oakland Park Boulevard, Room 204, Bridge Building, Fort Lauderdale, Florida 33300.
- B. The CONTRACTOR shall provide all barricades and flashing warning lights or other devices necessary to warn pedestrians and area traffic.

1.19 PROTECTION OF EXISTING VEGETATION

- A. The CONTRACTOR shall protect all protected vegetative species in the area of construction. These vegetative species are listed in the Appendix D, Tree Survey. The CONTRACTOR shall follow all local requirements from the City of Hollywood Building Department and Broward County to work around this protected vegetation. The CONTRACTOR shall coordinate with ENGINEER any requests for trimming and cutting of this vegetation.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 51 00
TEMPORARY UTILITY SERVICES AND STAGING AREA

PART 1 GENERAL

1.01 GENERAL

- A. The CONTRACTOR shall provide for temporary utilities and services for CONTRACTOR'S own operations. These shall include electrical power, water, ventilation, sanitary facilities. The CONTRACTOR shall furnish, install and maintain all temporary utilities during the contract period including removal upon completion of the work. Such facilities shall comply with regulations and requirements of the National Electrical Code, OSHA, Florida Power and Light, and applicable Federal, State and local codes, etc. In addition, the CONTRACTOR shall provide the following:

1.02 TEMPORARY WATER

- A. The CONTRACTOR shall supply all water used for construction, flushing, testing, and temporary sanitary facilities. The CONTRACTOR shall provide and maintain all piping, fittings, adapters, and valving required. It is the CONTRACTOR'S responsibility to arrange through the City Underground Utilities Division for a 2-inch fire hydrant water meter. A deposit to be paid by the CONTRACTOR is required for meter rental and all water shall be purchased at the prevailing rate.

1.03 TEMPORARY SANITARY FACILITIES

- A. The CONTRACTOR shall provide and maintain adequate and clean sanitary facilities for the construction work force and visitors. The facilities shall comply with local codes and regulations and be situated at approved locations.

1.04 STAGING AREA

- A. The CONTRACTOR shall arrange, coordinate and take all necessary steps regarding CONTRACTOR'S work effort to comply with constraints defined in Section 01520, including off site parking, staging, storage, etc., as required. Costs associated with these efforts shall be included in the bid for this project.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 52 00

MAINTENANCE OF FACILITIES AND SEQUENCE OF CONSTRUCTION

PART 1 GENERAL

1.01 GENERAL

- A. The CONTRACTOR shall ensure the continuous operation of The City of Hollywood's Southern Regional Wastewater Treatment Plant during construction. Portions of the existing Injection Well system will be removed from service to accomplish the work as specified herein. In performing the work shown and specified, the CONTRACTOR shall plan and schedule CONTRACTOR'S work as outlined in this Section.

1.02 CONSTRUCTION SCHEDULE

- A. The Construction Schedule shall be submitted by the CONTRACTOR in accordance with Section 01 33 00 of these Specifications

1.03 USE OF FACILITIES BEFORE COMPLETION

- A. The CITY reserves the right to enter and use any portion of the constructed facilities before final completion of the whole work to be done under this Contract in accordance with Article 14-2, Partial Utilization of the General Conditions.

1.04 CONNECTION OF EXISTING SYSTEMS

- A. All connections to existing systems shall be performed in such a manner that no damage and minimal interruption is caused to the existing installation. On completion of its installation, the CONTRACTOR shall complete the connection to the existing systems in a proper manner. Any damage caused to existing installations shall be repaired or replaced by the responsible CONTRACTOR at no additional cost to the CITY.
- B. The CONTRACTOR shall note that some of the work in this contract will require the CONTRACTOR to connect to existing pipelines and structures. The CONTRACTOR shall be responsible for the proper containment and disposal of wastewater or other materials drained from existing pipelines and structures during construction, unless otherwise specifically noted to be performed by the CITY.

1.05 COORDINATION WITH UTILITIES PERSONNEL

- A. Before commencing work involving removing or placing in operation existing or new facilities or tie-ins to existing facilities, the CONTRACTOR shall notify the CITY at least ten (10) business days in advance in writing. The CITY shall be responsible for removing facilities from operation as deemed necessary.
- B. The CONTRACTOR shall, under no circumstances, interfere with wastewater treatment plant and existing potable water, sewer and stormwater facilities without the CITY's authorization, in writing, and supervision. The CONTRACTOR shall notify the CITY's representative in writing a minimum of three work days prior to each scheduled service request. This notification shall be provided on the CITY's standard form, or on an approved equivalent form completed in full by the CONTRACTOR.

1.06 GENERAL SEQUENCE OF CONSTRUCTION AND OPERATION REQUIREMENTS

- A. Work under the Contract shall be scheduled and performed in such a manner as to result in the least possible disruption to the operation of the treatment plant public's use of roadways, driveways, parking areas, and utilities. Utilities shall include but not be limited to water, sewerage, irrigation, drainage structures, gas, electrical service, cable TV services, fiber optic cables, and telephone. Prior to commencing with the WORK, CONTRACTOR shall perform a location investigation of all existing underground and above ground utilities and facilities in accordance with Section 01 53 00 entitled "Protection of Existing Facilities". Utilities that present potential conflict with the proposed piping shall be field verified with soft digging.
- B. The outlined sequence of construction does not include all items necessary to complete the work, but is intended to identify the sequence of critical events necessary to minimize any disruptions and to avoid any impact to continued collection system service. It shall be understood by the CONTRACTOR that the critical events identified are not all inclusive and that additional items of work not shown may be required. The sequence of construction is a precedence requirement and does not attempt to schedule the CONTRACTOR' work. It is intended only to indicate which activities must precede other activities in order to minimize interference's and disruptions.
- C. All work by the CONTRACTOR that disrupts the normal treatment plant operations shall be shown on the Construction Schedule specified in Section 01 33 00 and specifically scheduled with the CITY. Schedule notification shall consist of a written notice defining the work to be accomplished, the normal treatment plant that will be interrupted, the duration of the interruption, and the mitigating effort to be performed by the CONTRACTOR. The written notice shall be submitted to the CITY ten days in advance of the proposed work and the CITY will respond to the CONTRACTOR in writing within five days of receipt of the notice regarding the acceptability of the proposed plan.
- D. At no time, the CONTRACTOR shall undertake closing off any pipelines, or opening valves, or take any other action which would affect the operation of the existing system, except as specifically required by the drawings and specifications, and until authorization is granted by the CITY or ENGINEER and after proper notification.
- E. Temporary installations required to complete a particular aspect of the work during the allowed time period shall be determined by the CONTRACTOR and implemented by the CONTRACTOR at no additional cost to the CITY. All such temporary installations shall be subject to the review and acceptance of the ENGINEER.
- F. The Contractor shall be responsible for supporting and protecting existing underground and above ground pipes, ductbanks, conduits and other utilities as required to complete the Work.
- G. Backfilling and compaction shall in be kept up with the rate of pipe laying. Backfill consisting of the specified material shall be placed and properly compacted, to the degree specified hereinafter. Unless otherwise ordered or approved by the Engineer, in writing, no temporary fill, refill, or uncompacted fill shall be installed. Under no circumstances shall backfill material other than that specified or an Approved Equal be installed. Backfill shall be placed and compacted immediately after installation of piping

- H. The CONTRACTOR shall fully comply with all requirements of the Permits, at no additional cost to the CITY. Working hours noted in permits or the Specifications are subject to change. In the event that changed working hours affect the Contractor's work, the Contractor's sole remedy shall be a non-compensable time extension. Said extension to be full compensation for all direct and indirect costs, including but not limited to loss of efficiency, loss of opportunity, increased bond or insurance premiums, or home office or extended overhead, incurred by the Contractor as a result of such change, and no additional compensation shall be considered. Night work may be required as a part of the construction
- I. Sequence of certain major events and identification of time constraints for removing existing facilities from active service and installation of new facilities are described below in paragraph 1.07. No phase of work (or tasks within a phase) shall preclude or be performed in parallel with a subsequent phase unless specifically defined so in these documents. In all cases, work in each phase shall be checked out and accepted for satisfactory use, subject to the ENGINEER's approval, prior to the CONTRACTOR proceeding to the next phase of construction.

1.07 DETAILED SEQUENCE OF CONSTRUCTION AND OPERATION REQUIREMENTS

- A. General Initial Steps - Mobilization / Site Preparation: Mobilize for work – Video working areas, set up staging and storage areas, obtain permits, develop and submit construction schedule, submit shop drawing schedule, survey, locate existing utilities and elevations with soft digging, verify existing fittings to be connected, shop drawing submittals, and procure materials.
- B. Phase I -The tasks included under this phase consist of installation of proposed improvements as described in the approved construction plans labeled as Phase I. This Phase includes the piping system to connect the existing Injection well Pump Station to Injection Wells No. 3 and No.4
 1. Complete and test all Phase I work except for tie into existing Injection Well Pump Station suction header pipe allowing existing injection well system to operate and the tie into the WTP Concentrate force main.
 2. The CONTRACTOR to notify the CITY in writing 10 days in advance of tie into existing Injection Well Pump Station suction header. CITY will shut down the injection well system and isolate the wastewater flow. CONTRACTOR to complete tie into existing system.
 3. The CONTRACTOR to notify the CITY in writing 10 days in advance of tie into WTP Concentrate force main. CITY will confirm the WTP Concentrate Force main is out of service. CONTRACTOR to complete tie into existing system.
 4. CITY to start up existing Injection Well Pump Station system to start up Phase I piping system and discharge effluent to Injection Wells No 3 and No 4. Note that existing injection well Pump Station shall not be allowed to discharge to Injection Well No 1 and No 2 while the temporary WTP concentrate piping can discharge to the final clarifier 1 to 4 effluent box.
- C. Phase II - The tasks included under this phase consist of installation of the remainder of the proposed improvements as described in the approved construction plans. This includes the Injection Well Pump Station No 2 facility, the Injection Well Electrical Service center facility, the plant drain pump station, surge relief system, fuel storage, Clarifier diversion box, all associated piping and civil site work. Construction of Phase II facilities

can be completed concurrently with the Phase I improvements and shall not impact the completion of the Phase I work per the interim milestone.

1. Complete and test all remaining work except for the tie into the existing Injection Well Pump Station suction main and all work on the South side of the Final Clarifiers No 1 through No 4.
 2. See detailed Suggested Sequencing plan for the work identified South of the Final Clarifiers on Drawings YD-10-2101 through YD-10-2104. Constraints for this work include the following:
 - a. Existing Drain line shall not be removed from service until new plant drain pump station is constructed, tested and in service.
 - b. Relocation of existing utilities must remain in service with minimal shut downs to make connections by either installing new location first and making connection before removal or by providing a temporary system to allow for installation of the new system and removal of the existing. All shut downs to complete tie ins shall be coordinated with the CITY and 10 day written notification provided in advance.
 - c. Opening / connection between existing clarifier 1 to 4 effluent box and the new Clarifier 1 to 4 effluent box shall not be made until the New Injection well pump Station No 2 is complete and ready to start up. CONTRACTOR to Notify City in writing 21 days in advance of connection work and CITY will shut down the existing Injection well system and the clarifier 1 to 4 to allow connection to be made. This connection is limited to one shut down of 4 hours in duration during a low flow period to perform the required work. The low flow period may be during early morning hours and shall not be scheduled during a rain event.
 - d. Connection to the existing injection well pump station suction main shall not be completed until new Injection Well Pump Station No. 2 is complete and ready for startup. CONTRACTOR to Notify City in writing 10 days in advance of tie in work and CITY will shut down the existing Injection well system to allow connection to be made. This connection is limited to one shut down of one week in duration to perform the required work.
 - e. Connection of new WTP concentrate force main to existing WTP concentrate FM shall not occur until new injection well pump station has been tested and started up. CONTRACTOR to Notify City in writing 10 days in advance of tie in work and CITY will shut down the WTP concentrate flow to allow connection to be made. The demolition of the temporary WTP concentrate force main and the demolition of the existing force main portion to the Ocean Outfall Pump Station can be completed concurrently with the tie in. Once tie in is complete, CONTRACTOR to notify CITY and coordinate the start up of the new WTP Concentrate Pump Station in the IWPS2 facility.
- D. Final Sitework and Closeout: Final pavement and asphalt overlay of the affected road sections, final restoration, final grading, sodding, miscellaneous work, demobilization and related closeout activities as described in Section 01 70 00 - Project Closeout.
- E. Construction Constraints: CONTRACTOR shall comply with the following constraints during construction and utilize constraints in determining a sequence of construction:
1. The excavation area shall be surrounded with barricades and obstructions illuminated with temporary light furnished, installed and maintained by the CONTRACTOR.

2. Contractor is expected to work regular hours between the hours of 8:00 AM and 5:00 PM, Monday through Friday. Requests for approval to work during other than regular hours must be submitted to the ENGINEER at least 72 hours in advance of the period proposed for such overtime work and shall set forth the proposed schedule for overtime work to give ENGINEER ample time to arrange for CONTRACTOR'S personnel to be at the site of the Work, even for work required to occur by contract. Contractor shall pay for the additional engineering charges on account of the overtime work, except when overtime is associated with contract-required. Such additional engineering charges shall be a subsidiary obligation of CONTRACTOR, and no extra payment shall be made by CITY on account of such overtime work. The CONTRACTOR shall not violate the Hollywood Code of Noise Ordinance.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 COORDINATION WITH EXISTING UTILITIES AND OTHER AGENCIES

- A. The CONTRACTOR shall coordinate with Sunshine One-Call Notification at 1-800-432-4770 a minimum of 48 business hours prior to any excavation for location of existing underground facilities.
- B. CONSTRUCTION DEWATERING
 1. All dewatering equipment such as pumps, air compressors, generators, etc. proposed for use during construction in residential areas shall be provided with noise enclosures suitable to meet the requirements of the City of Hollywood Noise Ordinance and/or Broward County Noise Ordinance, whichever is more stringent.
 2. There is no dewatering permit for this project. If the CONTRACTOR considers that as part of its means and methods of construction, a dewatering permit is required, it is the responsibility of the CONTRACTOR to secure the required permit in order to proceed with the execution of the construction.

3.02 COOPERATION

- A. The CONTRACTOR shall allow the CITY or its agents, and other project contractors or their agents, to enter facilities being constructed under this Contract for the purpose of constructing, installing, operating, maintaining, removing, repairing, altering or replacing such equipment pipes, sewers, conduits, manholes, wires, or other structures and appliances which may be required to be installed at or in the work. The CONTRACTOR shall cooperate with all the aforesaid parties and shall allow reasonable provisions for the prosecution of any other work by the CITY, or others, to be done in connection with CONTRACTOR'S work, or in connection with normal use of the facilities.

END OF SECTION

SECTION 01 53 00
PROTECTION OF EXISTING FACILITIES

PART 1 GENERAL

1.01 THE REQUIREMENT

- A. The CONTRACTOR shall protect all existing utilities and improvements not designated for removal and shall restore damaged or temporarily relocated utilities and improvements to a condition equal to or better than they were prior to such damage or temporary relocation, all in accordance with requirements of the Contract Documents.
- B. The CONTRACTOR shall verify the exact locations and depths of all utilities shown and the CONTRACTOR shall make exploratory excavations of all utilities that may interfere with the Work. All such exploratory excavations shall be performed as soon as practicable after award of Contract and, in any event, a sufficient time in advance of construction to avoid possible delays to the CONTRACTOR'S Work. When such exploratory excavations show the utility location as shown to be in error, the CONTRACTOR shall so notify the CITY.
- C. The number of exploratory excavations required shall be that number which is sufficient to determine the alignment and grade of the utility.

1.02 RESTORATION OF FACILITIES

- A. General: All paved areas including asphaltic concrete berms cut or damaged during construction shall be replaced with similar materials and of equal thickness to match the existing adjacent undisturbed areas, except where specific resurfacing requirements have been called for in the Contract Documents or in the requirements of the agency issuing the permit. All temporary and permanent pavement shall conform to the requirements of the affected pavement CITY. All pavements which are subject to partial removal shall be neatly saw cut in straight lines.
- B. Temporary Restoration: Temporary restoration includes repair to all driveways, sidewalks and roadways. They shall be swept clean and be maintained free of dirt and dust. All areas disturbed by the construction activities shall be restored to proper grade, cleaned up, including the removal of debris, trash, and deleterious materials. All construction materials, supplies, or equipment, including piles of debris shall be removed from the area. All temporarily restored areas shall be maintained by the CONTRACTOR. These areas shall be kept clean and neat, free of dust and dirt, until final restoration operations are completed. The CONTRACTOR is responsible to utilize dust abatement operations in the temporarily restored areas as required, to the satisfaction of the ENGINEER.
- C. Temporary Resurfacing: Wherever required by the public authorities having jurisdiction, the CONTRACTOR shall place temporary surfacing promptly after backfilling and shall maintain such surfacing for the period of time fixed by said authorities before proceeding with the final restoration and improvements.
- D. Permanent Resurfacing: In order to obtain a satisfactory junction with adjacent surfaces, the CONTRACTOR shall saw cut back and trim the edge so as to provide a clean, sound, vertical joint before permanent replacement of an excavated or damaged portion of

pavement. Damaged edges of pavement along excavations and elsewhere shall be trimmed back by saw cutting in straight lines. All pavement restoration and other facilities restoration shall be constructed to finish grades compatible with adjacent undisturbed pavement, unless otherwise shown on the drawings.

- E. Final Restoration: Final restoration shall include the completion of all required pavement replacement of roadways, driveways, curbs, gutters, sidewalks and other existing improvements disturbed by the construction: final grading, placement of sod, installation or replacement of any trees or shrubs, repair of irrigation systems, pavement markings, etc., all complete and finished, acceptable to the ENGINEER.

1.03 EXISTING UTILITIES AND IMPROVEMENTS

- A. General: The CONTRACTOR shall protect all underground utilities and other improvements which may be impaired during construction operations. It shall be the CONTRACTOR'S responsibility to ascertain the actual location of all existing utilities and other improvements that will be encountered in its construction operations, and to see that such utilities or other improvements are adequately protected from damage due to such operations.
- B. Utilities to be Moved: In case it shall be necessary to move the property of any public utility or franchise holder, such utility company or franchise holder will, upon request of the CONTRACTOR, be notified by the CITY to move such property within a specified reasonable time. When utility lines that are to be removed are encountered within the area of operations, the CONTRACTOR shall notify the CITY a sufficient time in advance for the necessary measures to be taken to prevent interruption of service.
- C. Where the proper completion of the Work requires the temporary or permanent removal and / or relocation of an existing utility or other improvement which is shown, the CONTRACTOR shall remove and temporarily replace or relocate such utility or improvement in a manner satisfactory to the CITY and the OWNER of the utility/facility. In all cases of such temporary removal or relocation, restoration to former location shall be accomplished by the CONTRACTOR in a manner that will restore or replace the utility or improvement as nearly as possible to its former locations and to as good or better condition than found prior to removal.
- D. CITY'S Right of Access: The right is reserved to the CITY and to the OWNER'S of public utilities and franchises to enter at any time upon any public street, alley, right-of-way, or easement for the purpose of making changes in their property made necessary by the Work of this Contract.
- E. Underground Utilities Shown or Indicated: Existing utility lines that are shown or the locations of which are made known to the CONTRACTOR prior to excavation and that are to be retained, and all utility lines that are constructed during excavation operations shall be protected from damage during excavation and backfilling and, if damaged, shall be immediately repaired by the CONTRACTOR.
- F. Underground Utilities Not Shown or Indicated: In the event that the CONTRACTOR damages any existing utility lines that are not shown or the locations of which are not made known to the CONTRACTOR prior to excavation by the CITY and Sunshine One-Call Notification, a written report thereof shall be made immediately to the CITY. The

CONTRACTOR shall make the repairs immediately under the provisions for changes and extra work contained in the General Conditions.

- G. Approval of Repairs: All repairs to a damaged improvement are subject to inspection and approval by an authorized representative of the CITY before being concealed by backfill or other Work.
- H. No fill, excavation material, construction generated debris or equipment shall obstruct water valves, gas meters or sewer manholes. Water, sewer and gas service shall be made accessible to repair or maintenance crews representing the CITY or a privately-owned utility company.
- I. Maintaining in Service: All oil and gasoline pipelines, power, and telephone or other communication cable ducts, gas and water mains, irrigation lines, reuse lines, sewer lines, storm drain lines, poles, and overhead power and communication wires and cables encountered along the line of the Work shall remain continuously in service during all the operations under the Contract, unless other arrangements satisfactory to the CITY are made with the owner of said utilities. The CONTRACTOR shall be responsible for and shall repair all damage due to its operations, and the provisions of this Section shall not be abated even in the event such damage occurs after backfilling or is not discovered until after completion of the backfilling.

1.04 TREES WITHIN STREET RIGHTS-OF-WAY AND PROJECT LIMITS

- A. If any tree removal or relocation is required, the CONTRACTOR needs to coordinate with the ENGINEER, accordingly. All required permits related to tree removal are the responsibility of the CONTRACTOR.
- B. Appendix D shows the Tree Survey provided for this project. The CONTRACTOR shall familiarize him/herself with this document to determine the location of existing protected vegetative species within the project site.
- C. Trimming or removal of existing protected vegetative species shall be coordinated with ENGINEER. The CONTRACTOR shall be responsible for permits needed to trim or remove this vegetation with Broward County and the City of Hollywood Building Department.
- D. Refer to Section 01 74 00 for permits obtained for this project. The CONTRACTOR shall abide by the General License issued by Broward County for protection of protected vegetative species.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 55 00
SITE ACCESS AND STORAGE

PART 1 GENERAL

1.01 SITE ACCESS

- A. The CONTRACTOR shall make its own investigation of the condition of available public and private roads and of clearances, restrictions, bridge load limits, and other limitations affecting transportation and ingress and egress to the site of the Work. It shall be the CONTRACTOR's responsibility to construct and maintain any haul roads required for its construction operations.
- B. The CONTRACTOR will be responsible for monitoring the main gate for its personnel, equipment and material deliveries.

1.02 STORAGE

- A. Limited storage area is available within the work areas shown on the Drawings. Any equipment and materials stored here shall be in accordance with the manufacturer's recommendations and as indicated by the CITY.
- B. Responsibility for protection and safekeeping of equipment and materials will be solely that of the CONTRACTOR, and no claim shall be made against the CITY by reason of any act of an employee or trespasser. Should an occasion arise necessitating access to an area occupied by stored equipment and/or materials, the CONTRACTOR shall immediately move them.
- C. If the CONTRACTOR requires additional staging and storage area than shown on the Drawings, the CONTRACTOR shall obtain such areas from off site sources at no additional cost to the CITY.
- D. Upon completion of the Contract, the CONTRACTOR shall remove from the storage and work areas all of their equipment, temporary fencing, surplus materials, rubbish, etc., and restore the area to its original or better conditions.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 56 00
SPECIAL CONTROLS

PART 1 GENERAL

1.01 CHEMICALS

- A. All chemicals used during project construction or furnished for testing of project operation, whether herbicide, pesticide, disinfectant, polymer, reactant of other classification, will be required to show approval of either EPA or HUD. The handling, use, storage and disposal of such materials, containers or residues shall be in strict conformance with manufacturer and/or CONTRACTOR'S secured storage. Copies of antidote literature and a supply of antidotes shall be kept at the job site office.

1.02 DUST

- A. During all work for this Contract, the CONTRACTOR shall by the application of water and/or calcium chloride or other means, approved by the ENGINEER, eliminate dust annoyance to adjacent property, business establishments and the plant site in accordance with Article 7.21, Dust Control, of the General Conditions. The CONTRACTOR shall take all protective measures, to the satisfaction of the ENGINEER, necessary to ensure that dust and debris does not enter any of the mechanical or electrical equipment. The CONTRACTOR shall be responsible for the cleanup of existing buildings, equipment, controls, etc., which have become soiled due to the lack of proper dust control as determined by the ENGINEER. The CONTRACTOR shall provide daily application of water to all unpaved areas designated by the ENGINEER in the field and to the satisfaction of the ENGINEER in the field.

1.03 NOISE

- A. Noise resulting from the CONTRACTOR'S work shall not violate the Hollywood Code of Ordinance Chapter 100, with specific note to the restrictions of paragraph 100.05 or exceed the noise levels and other requirements stated in the Broward County Chapter 27 Pollution Control, relating to noise abatement in Broward County. The CONTRACTOR shall be responsible for curtailing noise resulting from CONTRACTOR'S operation. He shall, upon written notification from the ENGINEER or the noise control officers, make any repairs, replacements, adjustments, additions and furnish mufflers when necessary to fulfill requirements.

1.04 EROSION ABATEMENT AND WATER POLLUTION

- A. It is imperative that the CONTRACTOR'S dewatering operations not contaminate or disturb the plant environment or properties adjacent to the Work. The CONTRACTOR, shall, therefore, schedule and control CONTRACTOR'S operations to confine all runoff water from disturbed surfaces, water from dewatering and/or from excavation below the ground water table operations that becomes contaminated with lime silt, muck and other deleterious matter, fuels, oils, bitumens, calcium chloride, chemicals and other polluting materials.
- B. The CONTRACTOR shall construct temporary stilling basin(s) of adequate size and provide all necessary temporary materials, operations and controls including, but not limited to,

filters, coagulants, screens and other means necessary to attain the required discharge water quality.

- C. The CONTRACTOR shall be responsible for providing, operating and maintaining materials and equipment used for conveying the clear water to the point of discharge. All pollution prevention procedures, materials, equipment and related items shall be operated and maintained until such time as the dewatering operation is discontinued. Upon the removal of the materials, equipment and related items the CONTRACTOR shall restore the area to the condition prior to CONTRACTOR'S commencing work.

1.05 HURRICANE AND STORM WARNINGS

- A. As the schedule for this project coincides, in part, with the recognized South Florida hurricane season, the CONTRACTOR's attention is drawn to the possibility of hurricane conditions, or severe storm conditions, occurring at the plant site during the course of Contract work.
- B. Within 30-days of the date of Notice-to-Proceed, the CONTRACTOR shall submit to the ENGINEER and City a Hurricane Preparedness Plan. The plan should outline the necessary measures which the CONTRACTOR proposes to perform at no additional cost to the City in case of a hurricane warning.
- C. In the event of inclement weather, or whenever the ENGINEER shall direct, the CONTRACTOR shall, and will cause Sub-Contractors to protect carefully the Work and materials against damage or injury by reasons of failure on the part of the CONTRACTOR to so protect the Work. Such Work and materials so damaged shall be removed and replaced at the expense of the CONTRACTOR.
 - 1. Hurricane Watch: Upon designation of a hurricane watch, CONTRACTORS shall be responsible for storing all loose supplies and equipment on the job site that may pose a danger. In addition, the CONTRACTOR shall remove all bulkheads and plugs in pipelines that would impede drainage in the case of flooding. Structures that may be in danger of floatation shall be flooded. The CONTRACTOR shall also cooperate with CITY personnel in protecting other structures at the site.
 - 2. Hurricane Warning: No mobile "temporary facility" under the control of the City of Hollywood, or on CITY property, shall be staffed during a hurricane warning. CONTRACTOR facilities meeting these criteria shall comply.
- D. The CONTRACTOR is advised to take all necessary precautions to protect CONTRACTOR'S equipment by moving it to higher ground if in an area subject to flooding. Known areas of Hollywood that would be subject to flooding from storm tides include:

Hollywood Blvd.	North Lake Area	South Lake Area
A1A	Sheridan Street	Dania Beach Blvd.
US Highway 1	46 th Avenue	Hallandale Beach Blvd.

1.06 PESTS AND RODENTS

- A. The CONTRACTOR shall be responsible for maintaining the jobsite free from litter, rubbish and garbage. CONTRACTOR shall provide containers for the disposal of garbage and other materials that attract and are breeding places for pests and rodents. The

CONTRACTOR shall provide the services of an exterminator to inspect the jobsite on a periodic basis and to provide service as required to control pests and rodents.

1.07 PERIODIC CLEAN-UP; BASIC SITE RESTORATION

- A. During construction, the CONTRACTOR shall regularly remove from the site all accumulated debris and surplus materials of any kind which result from CONTRACTOR'S operations, or whenever the accumulation in excess of one truck load. Unused equipment and tools shall be stored at the CONTRACTOR'S yard or base of operations for the project.
- B. When the work involves installation of sewers, drains, water mains, manholes, underground structures, or other disturbance of existing features in or across streets, rights-of-way, easements, or private property, the CONTRACTOR shall (as the work progresses) promptly backfill, compact, grade and otherwise restore the disturbed area to a basic condition which will permit resumption of pedestrian or vehicular traffic and any other critical activity or function consistent with the original use of the land. Unsightly mounds of earth, large stones, boulders, and debris shall be removed so that the site presents a neat appearance.
- C. The CONTRACTOR shall perform the clean-up work on a regular basis and as frequently as ordered by the ENGINEER. Basic site restoration in a particular area shall be accomplished immediately following the installation or completion of the required facilities in that area. Furthermore, such work shall also be accomplished, when ordered by the ENGINEER, if partially completed facilities must remain incomplete for some time period due to unforeseen circumstances.
- D. Upon failure of the CONTRACTOR to perform periodic clean-up and basic restoration of the site to the ENGINEER'S satisfaction, the ENGINEER may, upon five (5) days prior written notice to the CONTRACTOR, employ such labor and equipment as he deems necessary for the purpose, and all costs resulting therefrom shall be charged to the CONTRACTOR and deducted from the amounts of money that may be due him.

1.08 SECURITY

- A. The CONTRACTOR shall care for and protect against loss or damage of all material to be incorporated in the construction for the duration of the Contract and shall repair or replace damaged or lost materials and damage to structures.
- B. The CONTRACTOR shall be responsible for providing, and maintaining temporary fencing and gates and the daily securing of temporary fencing and gates used for construction purposes for the duration of the project.
- C. The CONTRACTOR shall strictly comply with working hours on the project site. Prior to any work outside of the standard working hours, the CONTRACTOR shall request the CITY'S approval via written request (at least 8 hours in advance). The written request shall clearly define the work to be performed, the names of the employees, their employer and their trade and the hours and days during which the work is planned.
- D. The CITY is considering and the CONTRACTOR shall comply with additional security requirements including employee photo identification at all times on-site and employee parking passes.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 57 00

TRAFFIC REGULATIONS AND MAINTENANCE OF TRAFFIC

PART 1 GENERAL

1.01 TRAFFIC CONTROL

- A. CONTRACTOR shall obey all traffic laws and comply with all the requirements, rules and regulations of the State of Florida Department of Transportation (FDOT), the City of Hollywood, Broward County and other local authorities having jurisdiction, to maintain adequate warning signs, lights, barriers, etc., for the protection of traffic on public roadways and the treatment plant site.
- B. The CONTRACTOR shall maintain traffic and protect the public from all damage to persons and property within the Contract Limits, in accordance with the Contract Documents and all applicable state, city and local regulations. The CONTRACTOR shall conduct its construction operations so as to maintain and protect access, for vehicular and pedestrian traffic, to and from all properties and business establishments adjoining or adjacent to those streets affected by CONTRACTOR'S operations, and to subject the public to a minimum of delay and inconvenience. Suitable signs, barricades, railing, etc. shall be erected and the work outlined by adequate lighting at night. Danger lights shall be provided as required. Watchmen, flagmen, and crossing guards shall be provided as may be necessary for the protection of traffic. Traffic Control and Maintenance of traffic during construction shall be included in the CONTRACTOR's bid and no additional payment shall be requested to the City for these activities
- C. For the protection of traffic in public or private streets and alleyways, the CONTRACTOR shall provide, place, and maintain all necessary barricades, traffic cones, warning signs, lights, and other safety devices in accordance with the requirements of the "Manual of Uniform Traffic Control Devices (MUTCD), Part VI, Traffic Controls for Street and Highway Construction and Maintenance Operations", published by U.S. Department of Transportation, Federal Highway Administration (ANSI D6.1).
- D. The CONTRACTOR shall submit a Maintenance of Traffic (MOT) Plan for ENGINEER and/or CITY approval at least 60 days prior to construction work.
- E. Prior to performing any work within or abutting the State rights-of-way, the Contractor shall submit a Maintenance of Traffic (MOT) Plan to FDOT for approval as required by the FDOT Utility Permit.
- F. All signs, signals, and barricades shall conform to the requirements of Subpart G, Part 1926, of the OSHA Safety and Health Standards for Construction.
- G. All dirt spilled from the CONTRACTOR'S trucks on existing pavements shall be removed by the CONTRACTOR immediately and whenever in the opinion of the CITY the accumulation is sufficient to cause the formation of mud, dust, interference with traffic or create a traffic hazard.
- H. Areas designated by the Broward County Traffic Engineering Division as "Safe Walk Routes" shall adhere to the requirements of the Broward County Maintenance of Traffic School/Pedestrian.

1.02 TEMPORARY CROSSINGS

- A. General: Wherever necessary or required for the convenience of the public or individual residents at street or highway crossings, private driveways, or elsewhere, the CONTRACTOR shall provide suitable temporary bridges over unfilled excavations, except in such cases as the CONTRACTOR shall secure the written consent of the individuals or authorities concerned to omit such temporary bridges, which written consent shall be delivered to the CITY prior to excavation. All such bridges shall be maintained in service until access is provided across the backfilled excavation. Temporary bridges for street and highway crossing shall conform to the requirements of the authority having jurisdiction in each case, and the CONTRACTOR shall adopt designs furnished by said authority for such bridges, or shall submit designs to said authority for approval, as may be required.
- B. Street Use: Nothing herein shall be construed to entitle the CONTRACTOR to the exclusive use of any public street, alleyway, or parking area during the performance of Work hereunder, and it shall so conduct its operations as not to interfere unnecessarily with the authorized work of utility companies or other agencies in such streets, alleyways, or parking areas. No street shall be closed to the public without first obtaining permission of the CITY and proper governmental authority. Where excavation is being performed in primary streets or highways, one lane in each direction shall be kept open to traffic at all times unless otherwise provided or shown. Toe boards shall be provided to retain excavated material if required by the CITY or the agency having jurisdiction over the street or highway. Fire hydrants on or adjacent to the Work shall be kept accessible to fire-fighting equipment at all times. Temporary provisions shall be made by the CONTRACTOR to assure the use of sidewalks and the proper functioning of all gutters, sewer inlets, and other drainage facilities.
- C. The CONTRACTOR shall take all necessary precautions for the protection of the Work and the safety of the public. All barricades and obstructions shall be illuminated at night, and all lights shall be kept burning from sunset until sunrise. The CONTRACTOR shall station such guards or flaggers and shall conform to such special safety regulations relating to traffic control as may be required by the public authorities within their respective jurisdictions. All signs, signals, and barricades shall conform to the requirements of Subpart G, Part 1926, of the OSHA Safety and Health Standards for Construction.
- D. The CONTRACTOR shall remove traffic control devices when no longer needed, repair all damage caused by installation of the devices, and shall remove post settings and backfill the resulting holes to match grade.
- E. Temporary Street Closure: If closure of any street is required during construction, a formal application for a street closure shall be made to the authority having jurisdiction at least 30 days prior to the required street closure in order to determine necessary sign and detour requirements. Detour signs shall be provided, installed prior to street closure, and removed after construction by the CONTRACTOR.
- F. Temporary Driveway Closure: The CONTRACTOR shall notify the CITY or occupant (if not owner-occupied) of closure of driveways to be closed more than one eight-hour work day, at least three working days prior to the closure. The CONTRACTOR shall minimize the inconvenience and minimize the time period that the driveways will be closed. The

CONTRACTOR shall fully explain to the owner/occupant how long the work will take and when closure is to start.

- G. Temporary Bridges: Whenever necessary, the CONTRACTOR shall provide suitable temporary bridges or steel plates over unfilled excavations, except in such cases as the CONTRACTOR shall secure the written consent of the individuals or authorities concerned to omit such temporary bridges or steel plates, which written consent shall be delivered to the ENGINEER prior to excavation. All such bridges or steel plates shall be maintained in service until access is provided across the backfilled excavation. Temporary bridges or steel plates for street and highway crossing shall conform to the requirements of the authority having jurisdiction in each case, and the CONTRACTOR shall adopt designs furnished by said authority for such bridges or steel plates, or shall submit designs to said authority for approval, as may be required.

1.03 CONTRACTOR PARKING

- A. The CONTRACTOR shall obtain off-site parking for all personnel vehicles as required.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 60 00
COMMON PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

- A. This Section describes the requirements for the factory and witness testing, proper handling, storage and protection, and in some cases origin or assembly/manufacturing location, of project materials and equipment.
- B. All costs for receiving, inspection, handling, storage, insurance, inventory control, and equipment maintenance for both the Contractor-supplied, shall be included in the bid price and no extra compensation will be allowed.
- C. The Contractor shall inform all subcontractors, suppliers, and Suppliers of the requirements herein specified, and shall include expenses for the following services in his costs for compliance with the requirements hereinafter specified.

1.02 PRODUCTS

- A. Material and equipment incorporated in the Work shall be new, unless otherwise specified or indicated; in a condition acceptable to the Engineer; and suitable for the use intended.
- B. No material or equipment shall be used for any purpose other than that for which it is designed, specified or indicated.

1.03 QUALITY ASSURANCE

- A. Include within the Contractor's quality control program procedures for full protection of materials and equipment in accordance with Supplier's recommendations.
- B. The Engineer may perform quality assurance sampling and testing on materials to be incorporated into the Work. The Engineer may use test results from the Contractor's quality control efforts to determine acceptability of materials, rather than perform additional and separate testing of materials and equipment. Sampling and testing performed at the Engineer's discretion may not be used by the Contractor as part of the Contractor's responsibility for quality control.
- C. When requested by the Engineer, the Contractor shall furnish, without charge, samples of materials entering the Work. No material shall be used prior to approval by the Engineer. Samples shall be taken in the presence of the Engineer. The number of the samples and test specimens required shall be entirely at the discretion of the Engineer.
- D. Reports and records of inspections made, and tests performed by the City , when available at the job site, may be examined by the Contractor.
- E. The Engineer shall have access to materials and free entry to any parts of any manufacturing plant producing materials and/or equipment for the Work.

1.04 FACTORY AND WITNESS TESTING

- A. Factory Testing: Unless otherwise specified, all equipment shall be factory tested prior to shipment. Specific test requirements are defined within these Contract Documents. Tests shall be performed by the Supplier at the manufacturing or assembly facility prior to shipment of the equipment and shall prove compliance with the requirements of these Contract Documents.
- B. Witness Testing: Where specifically required, the Supplier shall facilitate a Witness Testing, for the City of key portions of the Factory Testing regime and possibly other tests as may be specified to prove performance of the equipment specified. Witness Testing, if required, are identified in the Specifications for the given equipment system.

1.05 SUPPLIER'S NAMEPLATES

- A. Each major component of equipment to have Supplier's name, address, model number and rating on a plate securely affixed in a conspicuous place. Nameplate of a distributing agent will not be acceptable in lieu of Supplier's nameplate.
- B. Nameplate shall be die-stamped, engraved, or etched to guarantee long term legibility. Nameplate shall be brass, bronze, aluminum, or stainless steel as required for corrosion resistance in the environment where the equipment is located.

1.06 WARRANTIES

- A. Unless otherwise specified, Contractor shall furnish a written warranty in accordance with the General Conditions covering all workmanship and materials for a period of one (1) year, from the date of Substantial Completion. Note that if partial Substantial Completions are allowed for certain areas of the Work, these are noted in Section 01 01 00 – Summary of Work. All warranties shall include an agreement to repair or replace, at the Contractor's expense, all defects that may appear in that time, which in the opinion of the Engineer, are due to defective workmanship or materials.
- B. Copies of factory warranties on all equipment furnished shall be submitted with the above described, written guarantee, and included in maintenance manuals.
- C. The Contractor shall guarantee that all new equipment has the capacity specified and that it will operate without excess noise or vibration.

1.07 SUPPLIERS SERVICE

- A. The Contractor shall require material suppliers and product Suppliers to provide site representation on the request of the Engineer for qualifying and verifying the use of their materials for the project purpose and conditions.
- B. Prior to final acceptance of the equipment, the Contractor shall have the Supplier inspect the equipment and certify that its condition has not been detrimentally affected by the long storage period. Such certifications by the Supplier shall be deemed to mean that the equipment is judged by the Supplier 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 Supplier will guarantee 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.

1.08 MANUFACTURER'S RECOMMENDATIONS

- A. Except as otherwise approved by the Engineer, the Contractor shall comply with Supplier's recommendations on product handling, storage, and protection.
- B. Provide the required or Supplier's recommended maintenance during storage, during the installation, and until such time as the City accepts the equipment for full-time operation.

1.09 PREPARATION FOR SHIPMENT

- A. When practical, equipment shall be factory-assembled. The equipment parts and assemblies that are shipped unassembled shall be furnished with an assembly plan and instructions. The separate parts and assemblies shall be factory match-marked or tagged in a manner to facilitate assembly. All assemblies are to be made by the Contractor at no additional cost to the City .
- B. Machined and unpainted parts subject to damage by the elements shall be protected with an application of a strippable protective coating, or other protective method approved by the Engineer.
- C. Equipment shall be packaged or crated in a manner that will provide protection from damage during shipping, handling, and storage.
- D. The outside of the package or crate shall be adequately marked or tagged to indicate its contents by name and equipment number, if applicable; approximate weight; state any special precautions for handling; and indicate the recommended requirements for storage prior to installation.
- E. Packing and Delivery of Spare Parts and Special Tools. Properly mark to identify the associated equipment by name, equipment, and part number. Parts shall be packaged in a manner for protection against damage from the elements during shipping, handling, and storage. Ship in boxes that are marked to indicate the contents. Delivery of spare parts and special tools shall be made prior to the time associated equipment is scheduled for the initial test run.

1.10 TRANSPORTATION AND DELIVERY

- A. All equipment and material shall be shipped with freight and shipping paid Freight on Board (FOB) jobsite.
- B. The Contractor shall request a 7-day advance notice of shipment from Suppliers, and, upon receipt of such notice, provide the Engineer with a copy of the current delivery information concerning all equipment and other items and materials of critical importance to the Work schedule.
- C. Schedule delivery to reduce long term on-site storage prior to installation and/or operation. Under no circumstances shall equipment be delivered to the jobsite more than one month prior to installation without written authorization from the Engineer.

- D. Coordinate delivery with installation to ensure minimum holding time
- E. The Contractor shall unload and record the receipt of all equipment and materials at the jobsite.
- F. The Contractor shall transport and handle products, including spare parts and special tools, in accordance with Supplier's instructions.
- G. The Contractor shall transport and deliver manufactured products, undamaged, in Supplier's original, unbroken containers or packaging, clearly identified with Supplier's name, product name, and instructions.
- H. The Contractor shall handle products to avoid soiling and damaging the products and their packaging.
- I. Immediately upon delivery, the Contractor shall inspect shipments to assure compliance with the Contract Documents and reviewed submittals, and to verify that products are undamaged and properly protected from potential damage.
- J. The Contractor shall maintain packaged materials with seals unbroken and labels intact until time of use.
- K. The Contractor shall promptly remove damaged material and unsuitable items from the job site, and promptly replace with material meeting the specified requirements at no increase in Contract Sum.
- L. Unsuitable materials and products not removed promptly from the job site by the Contractor may be removed by the City . Removal costs shall be paid by the Contractor.
- M. The transfer of spare parts for an equipment system shall be completed before Functional Testing begins. The Contractor shall designate and provide one or more persons to be responsible for the inventory of spare parts to be provided under the Contract Documents and as specified in the Technical Specifications. After completion of the Supplier's Certificate of Installation for an equipment system, this person or persons shall deliver the specified spare parts (with each item securely tagged / identified) on that equipment or system to a storage site designated by the City . The Contractor, in the presence of the Supplier's representative and the City , shall physically inventory, and document each spare part and shall transfer responsibility for storage of the spare parts to the City .
- N. The Engineer may reject as non-complying such material and products that do not bear identification satisfactory to the Engineer as to Supplier, grade, quality, and other pertinent information.

1.11 STORAGE

- A. Store and protect products, including spare parts and special tools, in accordance with Supplier's instructions, with seals and labels intact and legible. Spare parts and special tools shall remain with the equipment to which they belong until they are officially transferred to the Engineer.
- B. Store sensitive products in weather tight, climate-controlled enclosures.

- C. Store items subject to vandalism or theft in secure buildings.
- D. Store fabricated products above the ground, on blocking or skids, to prevent soiling and staining of the products.
- E. Provide off-site storage and protection when site does not permit on-site storage or protection.
- F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation or potential degradation of product.
- G. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- H. Arrange storage to facilitate inspection of products and inventory control.
- I. Periodically inspect stored products to assure that products are maintained under specified conditions and free from damage and deterioration.
- J. Keep a running account of all materials in storage to facilitate inspection and to estimate progress payments for materials delivered but not yet installed in the Work.
- K. Coordinate delivery with installation to ensure minimum holding time for items that are hazardous, flammable, easily damaged or sensitive to deterioration.
- L. Store products subject to damage from the elements in weather tight enclosures, maintaining temperature and humidity within the ranges specified by the Suppliers.
- M. Electrical and instrumentation and control equipment shall have space heaters energized or be provided with a suitable temporary heat source such as light bulbs in order to prevent condensation/moisture damage.
- N. Items requiring environmental control for protection shall be provided with the necessary environmentally controlled storage facilities at no cost to the City .
- O. Cement and lime shall be stored under a roof and off the ground and shall be kept completely dry at all times. All structural, miscellaneous and reinforcing steel shall be stored off the ground or otherwise to prevent accumulations of dirt or grease, and in a position to prevent accumulations of standing water and to minimize rusting. Beams shall be stored, with the webs in a vertical position. Precast concrete shall be handled and stored in a manner to prevent accumulations of dirt, standing water, staining, chipping or cracking. Brick, block and similar masonry products shall be handled and stored in a manner to reduce breakage, cracking and spalling to a minimum.
- P. Mechanical equipment shall be properly lubricated and periodically rotated to prevent seizing or binding, as recommended by the Supplier.
- Q. 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.

- R. 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 final acceptance.
- S. Equipment having bare metal or only shop applied primer shall receive special attention to ensure that it is adequately covered/protected to prevent rust.
- T. Store all bolts, nuts, gaskets and other joint materials for use in pipes stored under cover.
- U. Store gaskets in their original packing bags or containers; care shall be exercised to keep them away from heat, light, oil gasoline or other petroleum products. Gaskets shall be kept clean at all times and not handled with greasy or dirty hands.
- V. Store plastic pipe and other elastomeric products under cover to preclude damage by ultraviolet radiation even if the product has UV inhibitors in its compound.
- W. Supply valves, and other equipment having heating elements to eliminate moisture accumulation, with the electrical power required for that equipment.
- X. Provide coverings as necessary to protect installed products from damage from traffic and construction operations including due to dust and moisture. Remove coverings when no longer needed.
- Y. Use protective covering and blocking materials that do not soil, stain, or damage materials and equipment being protected.
- Z. Contractor shall maintain a preventive maintenance record for all material and equipment requiring preventive maintenance by the Supplier. A monthly report of all maintenance performed shall be submitted to the Engineer to certify maintenance has been performed as recommended by the Supplier.

1.12 HANDLING

- A. The Contractor shall use means necessary to protect the materials and equipment of this Section before, during and after installation and to protect the installed work and materials and equipment of other trades.
- B. Protect finished surfaces, including jambs and soffits of openings used as passageways, through which equipment and materials are handled.
- C. Provide protection for finished floor surfaces in traffic areas prior to allowing equipment or material to be moved over such surfaces.
- D. Maintain finished surfaces clean, unmarred, and suitably protected until accepted by the City .
- E. Pipe and fittings shall at all times be handled with great care to avoid damage. In loading and unloading, they shall be lifted with cranes or hoists or slid or rolled on skid ways in such a manner as to avoid shock. Under no circumstances shall this material be dropped or allowed to roll or slide against obstructions. No cables, lifting arms, hooks or other devices shall be inserted into the pipe or fitting. All lifting, pulling or pushing mechanisms

shall be applied to the exterior of the pipe or fitting. Pipe and other material shall be distributed along areas near vehicular traffic in advance of installation, only to the extent approved by the Engineer. Pipe shall be stored on blocking or timber. It shall not be stored on rocks, boulders, or other supports which in the opinion of the Engineer are unsuitable. Such materials shall be so placed as to keep obstruction to all traffic to a minimum.

- F. The Contractor shall clean exposed materials and equipment at the time of acceptance of the installation for Substantial Completion.

1.13 INSURANCE

- A. The Contractor's insurance shall adequately cover the value of materials delivered but not yet incorporated into the Work. The Contractor and the City shall be named as co-insured insofar as their respective interests may appear. Proof of this coverage must be submitted to the Engineer at the time request for progress or partial payments.

1.14 REPAIRS AND REPLACEMENTS

- A. The Contractor shall promptly replace lost or damaged materials and equipment with replacements of like kind and quality or repair them at no additional cost to the City
- B. Damage to any of the Work and/or existing premises prior to acceptance by the City is the responsibility of the Contractor. Should any new materials and equipment become damaged, the Contractor shall restore it to its original condition and finish before Final Acceptance.
- C. Additional time or costs required to secure replacements and to make repairs will not justify an extension in the Contract Time nor an increase in the Contract Sum.
- D. All materials which the Engineer has determined are not in conformance with the requirements of the plans and specifications will be rejected whether in place or not. The rejected materials shall be removed immediately from the Work Site, unless otherwise permitted by the Engineer. No rejected material, the defects of which have been subsequently corrected, shall be used in the Work, unless approval in writing has been given by the Engineer.
- E. Should the Contractor fail to promptly comply with any order by the Engineer to remove and replace rejected material or equipment, the Engineer may deduct the cost for removal or replacement from any moneys due or to become due to the Contractor.

1.15 INSPECTION, QUALITY SURVEILLANCE, REJECTION OF MATERIALS AND WORKMANSHIP

- A. All materials and equipment furnished, and work performed shall be satisfactorily inspected by the Contractor at its expense. The City and its authorized representatives or other persons deemed necessary by any of them acting within the scope of the duties entrusted to them (collectively, "City ") may, at any time conduct quality surveillance or quality audit of materials and equipment furnished and work performed.
- B. Contractor shall provide the City with full and free access to worksites, shops, factories, storage facilities and other places of business of Contractor and its Subcontractors and Suppliers and Manufacturers, and major component sub-vendors, for such quality

surveillance or audit. Contractor shall provide safe and adequate facilities, drawings, documents, un-priced purchase orders, schedules or Supplier contact information, and samples as requested, and provide assistance and cooperation including stoppage of work to perform such examination as may be necessary to determine compliance with the requirements of the Contract Documents.

- C. Any work covered prior to any quality surveillance or test by the City shall be uncovered and, after such surveillance or test, recovered at the expense of Contractor. Failure by the City to conduct such quality surveillance or to discover defective design, materials, or workmanship shall not relieve Contractor of its obligation under the Contract Documents nor prejudice the rights of the City thereafter to reject or require the correction of defective work in accordance with the provisions of the Contract Documents.
- D. If any work is determined to be defective or not in conformance with the Contract Documents, Contractor will be notified in writing and shall, at Contractor's expense, immediately remove and replace or correct such defective work.
- E. City intends to perform Supplier Quality Surveillance of Contractor furnished materials and equipment listed below. As part of the required submittals for these materials and equipment, and no later than 3 weeks prior to the Work beginning, contractor shall provide Supplier location and contract information, copies of un-priced purchase orders that include quality control requirements, technical specifications, Scope of Supply, Material Data Sheets, Inspection and Test Plans, Factory Acceptance Test procedures and fabrication schedules of the supplier and major component sub-vendors.

1.16 EXPEDITING

- A. Contractor is solely responsible for completing all work in accordance with the Construction Schedule. As provided in the General Conditions, any material and equipment furnished, and work performed by Contractor under the Contract Documents will also be subject to expediting by the City .
- B. Contractor shall provide the City with full and free access to worksites, shops, factories, storage facilities and other places of business of Contractor and its Subcontractors and Suppliers for expediting purposes.
- C. As requested by City , Contractor shall promptly provide un-priced copies of all purchase orders, detailed schedules and progress reports for use in expediting and shall cooperate with City in expediting activities.

1.17 SALVAGED EQUIPMENT

- A. Any pipe, fitting, or other miscellaneous material or equipment removed or salvaged during construction, and not reused in the Work, shall be cleaned, hauled, and stored by the Contractor at their own expense, where directed by the Engineer, and shall remain the property of the City until the City is ready to take possession of the items. The Contractor will be responsible for storage for up to 90—days prior to the City accepting possession. All other material shall be disposed of by the Contractor at their own expense.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 66 00
PRODUCT STORAGE AND HANDLING REQUIREMENTS

PART 1 GENERAL

1.01 DAMAGE

- A. Equipment, products and materials shall be shipped, handled, stored, and installed in ways which will prevent damage to the items. Damaged items will not be permitted as part of the work except in cases of minor damage that have been satisfactorily repaired and are acceptable to the Construction Manager.

1.02 PIPE

- A. Pipe and appurtenances shall be handled, stored, and installed as recommended by the manufacturer. Pipes with paint, tape coatings, linings or the like shall be stored to protect the coating or lining from physical damage or other deterioration. Pipes shipped with interior bracing shall have the bracing removed only when recommended by the pipe manufacturer.

PART 2 EQUIPMENT

2.01 PACKAGE AND MARKING

- A. All equipment shall be protected against damage from moisture, dust, handling, or other cause during transport from manufacturer's premises to site. Each item or package shall be marked with the number unique to the specification reference covering the item.
- B. Stiffeners shall be used where necessary to maintain shapes and to give rigidity. Parts of equipment shall be delivered in assembled or subassembled units where possible.

2.02 IDENTIFICATION

- A. Each item of equipment and valve shall have permanently affixed to it a label or tag with its equipment or valve number designated in this contract. Marker shall be of stainless steel. Location of label will be easily visible.

2.03 SHIPPING

- A. Bearing housings, vents and other types of openings shall be wrapped or otherwise sealed to prevent contamination by grit and dirt.
- B. Damage shall be corrected to conform to the requirements of the contract before the assembly is incorporated into the work. The Contractor shall bear the costs arising out of dismantling, inspection, repair and reassembly.

2.04 FACTORY APPLIED COATINGS

- A. Unless otherwise specified, each item of equipment shall be shipped to the site of the work with the manufacturer's shop applied epoxy prime coating as specified in Section 09 90 00 . The prime coating shall be applied over clean dry surfaces in accordance with the coating manufacturer's recommendations. The prime coating will serve as a base for

field-applied finish coats. Electrical equipment and materials shall be painted by manufacturer as specified in Section 09 90 00-3.03 Electrical and Instrumentation Equipment and Materials.

2.05 STORAGE

- A. During the interval between the delivery of equipment to the site and installation, all equipment, unless otherwise specified, shall be stored in an enclosed space affording protection from weather, dust and mechanical damage and providing favorable temperature, humidity and ventilation conditions to ensure against equipment deterioration. Manufacturer's recommendations shall be adhered to in addition to these requirements.
- B. Equipment and materials to be located outdoors may be stored outdoors if protected against moisture condensation. Equipment shall be stored at least 6 inches above ground. Temporary power shall be provided to energize space heaters or other heat sources for control of moisture condensation. Space heaters or other heat sources shall be energized without disturbing the sealed enclosure.

2.06 PROTECTION OF EQUIPMENT AFTER INSTALLATION

- A. After installation, all equipment shall be protected from damage from, including but not limited to, dust, abrasive particles, debris and dirt generated by the placement, chipping, sandblasting, cutting, finishing and grinding of new or existing concrete, terrazzo and metal; and from the fumes, particulate matter, and splatter from welding, brazing and painting of new or existing piping and equipment. As a minimum, vacuum cleaning, blowers with filters, protective shieldings, and other dust suppression methods will be required at all times to adequately protect all equipment. During concreting, including finishing, all equipment that may be affected by cement dust must be completely covered. During painting operations, all grease fittings and similar openings shall be covered to prevent the entry of paint. Electrical switchgear, unit substation, and motor load centers shall not be installed until after all concrete work and sandblasting in those areas have been completed and accepted and the ventilation systems installed.

END OF SECTION

SECTION 01 70 00
PROJECT CLOSEOUT

PART 1 GENERAL

1.01 PROJECT CLOSEOUT

- A. As construction of the project enters the final stages of completion, the CONTRACTOR shall, in accordance with the requirements set forth in the Contract Documents, attend to or have already completed the following items:
1. Scheduling start-up and initial operation.
 2. Correcting or replacing defective work, including completion of items previously overlooked or work which remains incomplete, all as evidenced by the CITY's "Punch" lists.
 3. Make final submittals.
 4. Attend to any other items listed herein or brought to the CONTRACTOR's attention by the CITY.

1.02 CLOSEOUT TIMETABLE

- A. The CONTRACTOR shall establish dates for equipment testing, acceptance periods, and on-site instructional periods (as required under the Contract). Such dates shall be established not less than one week prior to beginning any of the foregoing items, to allow the CITY, the ENGINEER, and their authorized representatives sufficient time to schedule attendance at such activities.

1.03 FINAL SUBMITTALS

- A. Before the acceptance of the project major milestones for substantial completion, the CONTRACTOR shall submit to the ENGINEER (or to the CITY if indicated) certain records, certifications, etc., which are specified elsewhere in the Contract Documents. Missing, incomplete or unacceptable items, as determined by the ENGINEER or the CITY, shall indicate non-compliance with substantial completion major milestone dates. A partial list of such items appears below, but it shall be the CONTRACTOR'S responsibility to submit any other items which are required in the Contract Documents:
1. Written Test results of project components.
 2. Performance affidavits for equipment and materials.
 3. Operation and Maintenance Manuals for equipment.
 4. Record Drawings: during the entire construction operation, the CONTRACTOR shall maintain records of all deviations from the Drawings and Specifications and shall prepare therefrom record drawings showing correctly and accurately all changes and deviations from the Work made during construction to reflect the Work as it was actually constructed. These drawings shall conform to recognized standards of drafting, shall be neat, legible and on mylar or other reproducible material acceptable to the ENGINEER.
 5. Written guarantees, where required.
 6. Certificates of inspection and acceptance by local governing agencies having jurisdiction.

7. Releases from all parties who are entitled to claims against the subject project, property, or improvement pursuant to the provisions of law.

1.04 PUNCH LISTS

- A. Final cleaning and repairing shall be scheduled upon completion of the project.
- B. The ENGINEER will make his final inspection whenever the CONTRACTOR has notified the ENGINEER that the work is ready for the inspection. Any work not found acceptable and requiring cleaning, repair and/or replacement will be noted on the "Punch" list. Work that has been inspected and accepted by the ENGINEER shall be maintained by the CONTRACTOR, until final acceptance of the entire project.
- C. Whenever the CONTRACTOR has completed the items on the punch list, he shall again notify the ENGINEER that it is ready for final inspection. This procedure will continue until the entire project is accepted by the ENGINEER. The "Final Payment" will not be processed until the entire project has been accepted by the ENGINEER and all of the requirements in previous Article 1.03 "Final Submittals" have been satisfied.

1.05 MAINTENANCE AND GUARANTEE

- A. The CONTRACTOR shall comply with all maintenance and guarantee requirements of the Contract Documents.
- B. Replacement of earth fill or backfill, where it has settled below the required finish elevations, shall be considered as a part of such required repair work, and any repair or resurfacing constructed by the CONTRACTOR which becomes necessary by reason of such settlement shall likewise be considered as a part of such required repair work unless the CONTRACTOR shall have obtained a statement in writing from the affected private CITY or public agency releasing the CITY from further responsibility in connection with such repair or resurfacing.
- C. The CONTRACTOR shall make all repairs and replacements promptly upon receipt of written order from the CITY. If the CONTRACTOR fails to make such repairs or replacements promptly, the CITY reserves the right to do the Work and the CONTRACTOR and CONTRACTOR'S surety shall be liable to the CITY for the cost thereof.

1.06 TOUCH-UP AND REPAIR

- A. The CONTRACTOR shall touch-up and repair damage to all field painted and factory finished equipment. Touch-up of equipment panels, etc., shall match as nearly as possible the original finish. If in the opinion of the ENGINEER the touch-up work is not satisfactory, the CONTRACTOR shall repaint the item.

1.07 FINAL CLEANUP

- A. The CONTRACTOR shall promptly remove from the vicinity of the completed Work, all rubbish, unused materials, concrete forms, construction equipment, and temporary structures and facilities used during construction. Final acceptance of the Work by the CITY will be withheld until the CONTRACTOR has satisfactorily complied with the foregoing requirements for final cleanup of the project site.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 73 24
DESIGN REQUIREMENTS FOR
NON-STRUCTURAL COMPONENTS AND NON-BUILDING STRUCTURES

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Minimum structural requirements for the design, anchorage, and bracing of non-structural components such as architectural/mechanical/HVAC/electrical components, equipment, or systems, and non-building structures such as tanks.
- B. The requirements of this section apply to design of the structural elements and features of equipment and to platforms/walkways that are provided with equipment or non-building structures.
- C. This section applies to non-building structures and non-structural components that are permanently attached to structures as defined below and in ASCE 7.
- D. Design and conform to criteria and design codes listed within this section. Engineering design is not required for attachments, anchorage, or bracing detailed on the Drawings or where the size of attachments, anchorage, or bracing is defined in specific technical specification sections.
- E. The following non-structural components are exempt from seismic design loading requirements of this section.
 - 1. Components in Seismic Design Category A.

1.02 RELATED SECTIONS

- A. This section contains specific references to the following related section. Additional related sections may apply that are not specifically listed below.
 - 1. Section 05 05 20 Anchor Bolts
 - 2. Section 05 50 00 Metal Fabrications

1.03 REFERENCES

- A. The references listed below are a part of this section. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
Aluminum Design Manual	Aluminum Association, Aluminum Design Manual with Specifications and Guidelines for Aluminum Structures
AAMA	American Architectural Manufacturer's Association
ACI 318	Building Code Requirements for Structural Concrete
ACI 350	Code Requirements for Environmental Engineering Concrete Structures
ACI 350.3	Seismic Design of Liquid-Containing Concrete Structures

Reference	Title
ACI 360	Specification for Structural Steel Buildings
ASCE 7	Minimum Design Loads for Buildings and Other Structures
ASTM C635	Manufacture, Performance and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
ASTM C636	Installation for Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
AWS D1.1	Structural Welding Code - Steel
AWS D1.2	Structural Welding Code - Aluminum
AWS D1.6	Structural Welding Code - Stainless Steel
AWS D1.8	Structural Welding Code - Seismic Supplement
FBC	Florida Building Code with local amendments
NFPA-13	Installation of Sprinkler Systems
OSHA	U.S. Dept. of Labor, Occupational Safety and Health Administration

1.04 DEFINITIONS

- A. Structure: The structural elements of a building that resist gravity, wind, and other types of loads. Structural components include columns, posts, beams, girders, joists, bracing, floor or roof sheathing, slabs or decking, load-bearing walls, and foundations.
- B. Non-structural Components: Non-structural portions of a building include every part of the building and all its contents, except the structural portions, that carry gravity loads and that may also be required to resist effects of wind, impact, and temperature loads. Non-structural components include, but are not limited to, ceilings, partitions, windows, equipment, piping, ductwork, furnishings, lights, etc.
- C. Non-building Structures: Self-supporting structures that carry gravity loads and that may also be required to resist the effects of wind, impact, and temperature loads. Non-building structures include, but are not limited to, pipe racks, storage racks, stacks, tanks, vessels and structural towers that support tanks and vessels.

1.05 SUBMITTALS

- A. Action Submittals:
 1. Procedures: Section 01 33 00.
 2. A copy of this specification section with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.
 3. Check-marks (✓) shall denote full compliance with a paragraph as a whole. Deviations shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Include a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for requested deviations to specification requirements, with the submittal is sufficient cause for rejection of the entire submittal with no further consideration.
 4. For structural elements of non-structural components and non-building structures required to be designed per this section, provide Drawings and design calculations

stamped by a Florida licensed professional engineer qualified to perform structural engineering.

5. List of non-structural components and non-building structures requiring wind design and anchorage.
6. Shop drawings showing details of complete wind and seismic bracing and anchorage attachment assemblies including connection hardware, and embedment into concrete.
7. Shop drawings showing plans, elevations, sections and details of equipment support structures and non-building structures, including anchor bolts, structural members, platforms, stairs, ladders, and related attachments.
8. Identify interface points with supporting structures or foundations, as well as size, location, and grip of required attachments and anchor bolts. Clearly indicate who will be providing each type of attachment/anchor bolt. Equipment vendor shall design anchor bolts, including embedment into concrete, and submit stamped calculations.
9. Calculations for supports, bracing, and attachments shall clearly indicate design criteria applied. Coordinate concrete embedment calculations with thickness and strength of concrete members. Submit a tabulation of the magnitude of unfactored (service level) equipment loads at each support point, broken down by type of loading (dead, live, wind, etc.). Indicate impact factors applied to these loads in design calculations.

1.06 QUALITY ASSURANCE

A. Quality Control By City:

1. Special Inspection of non-structural components and non-building structures, and their anchorages shall be performed by the Special Inspector under contract with the City and in conformance with FBC Chapter 17. Special Inspector(s) and laboratory shall be acceptable to the City in their sole discretion. Special Inspection is in addition to, but not replacing, other inspections and quality control requirements. Where sampling and testing required conforms to Special Inspection standards, such sampling and testing need not be duplicated.

PART 2 PRODUCTS

2.01 GENERAL

- A. Provide materials in conformance with information shown on the Drawings and in other technical specification sections. See individual component and equipment specifications for additional requirements.

2.02 DESIGN CRITERIA

A. Design Codes

Design	Code
Buildings/Structures:	Florida Building Code 2020 and ASCE 7-16
Reinforced concrete:	ACI 350-06 and ACI 350.3-06 for Concrete Liquid Containing Structures, ACI 318-14 for all other reinforced concrete

Design	Code
Structural steel:	AISC 360-10
Aluminum:	Aluminum Design Manual, Latest Edition
Welding:	AWS Welding Codes, Latest Edition
Occupational health and safety requirements:	OSHA

Note: When conflicting requirements occur, the most stringent requirements will govern the design.

B. Design Loads

1. Design non-structural components and non-building structures for the following minimum loads: (Do not apply wind loads to non-structural components and non-building structures that are located inside buildings.)
2. Dead Loads:
 - a. Add an additional allowance for piping and conduit when supported and hung from the underside of equipment and platforms.
 - b. Typical allowance for piping and conduit: 20 psf
3. Uniform Live Loads:

Elevated grating floors:	100 psf
Columns:	No column live load reduction allowed
Exitways, stairs and landings:	100 psf
Equipment platforms, walkways/catwalks (other than exitways):	100 psf
Utility bridges:	75 psf per level

4. Snow Loads:

Code:	FBC 2020 & ASCE 7
Risk Category:	IV
Ground Snow Load (p_g):	0 psf

5. Wind Loads:

Code:	FBC 2020 & ASCE 7-16
Risk Category:	IV
Basic Wind Speed (Ultimate, 3-second gust) for Risk Category Shown Above:	185 mph
Exposure:	C
Topographic Factor (K_{zt})	1.0

Note:

1. Design exterior non-structural components and non-building structures, unless located in a pit or basin, to withstand design wind loads without consideration of shielding effects by other structures.
2. Facility is in a wind-borne debris region.
3. Facility is in a high-velocity hurricane zone.

6. Seismic Loads:

Code:	FBC 2020 & ASCE 7-16
Risk Category:	IV

0.2 Sec. Mapped Spectral Response, S_s :	0.042 g
1.0 Sec. Mapped Spectral Response, S_1 :	0.021 g
Site Class:	C
0.2 Sec. Design Spectral Response, S_{DS} :	0.034 g
1.0 Sec. Design Spectral Response, S_{D1} :	0.024 g
Importance Factor (I_e):	1.25
Component Importance Factor (I_p):	1.0, except $I_p=1.5$ for components identified in Section 13.1.3 of ASCE 7
Seismic Design Category	A

7. Impact Loads:

- a. Consider impact loads in design of support systems.
- b. Use the following impact load factors unless recommendations of the equipment manufacturer will cause a more severe load case:

Rotating machinery:	20% of moving load
Reciprocating machinery:	50% of moving load
Monorail Hoists:	
• Vertical	25% of lifted load
• Longitudinal	10% of lifted load
Hangers supporting floors and platforms:	33% of live and dead load

8. Temperature:

- a. Include effects of temperature in design where non-structural components and non-building structures are exposed to differential climatic conditions. See climatic conditions below for temperature extremes.

C. Load Combinations

1. Design non-structural components and non-building structures to withstand load combinations as specified in the governing building code. Where the exclusion of live load or impact load would cause a more severe load condition for the member under investigation, ignore the load when evaluating that member.

D. Design Considerations

1. Design non-structural components and non-building structures for the following conditions:
2. Climatic Conditions:

Maximum design temperature:	100	degrees Fahrenheit
Minimum design temperature:	50	degrees Fahrenheit

E. Column Base Fixity

1. Design column bases as pinned connections. No moments shall be assumed to be transferred to foundations.
2. Where significant shear loads (greater than 5,000 lb. per anchor bolt) are transferred at column base plates, provide a shear key designed to transfer shear load.

F. Deflection

1. Maximum beam deflection as a fraction of span for walkways and platforms: $L/240$ for total load and $L/360$ for live load.
2. Maximum total load deflection for equipment support: $L/450$.

PART 3 EXECUTION

3.01 GENERAL

- A. Make attachments and braces in such a manner that component force is transferred to the lateral force-resisting system of the structure. Base attachment requirements and size and number of braces per calculations submitted by Contractor.
- B. Anchorage of equipment is specified to be made by cast-in anchor bolts in concrete elements unless specifically noted otherwise on the Drawings or other specification sections. Contractor is responsible for remedial work or strengthening if anchor bolts are improperly installed or omitted due to lack of submittal review or improper placement for any reason, at no additional cost to City.
- C. Provide anchor bolts in accordance with Section 05 05 20. Base size of anchor bolts and embedment on submitted calculations.
- D. Submit details of and calculations for anchorages prior to placement of concrete or erection of other structural supporting members. Submittals received after structural supports are in place will be rejected if proposed anchorage method would create an overstressed condition of the supporting member. Contractor is responsible for revisions to anchorages and/or strengthening of structural support so that there is no overstress condition, at no additional cost to City.

END OF SECTION

SECTION 01 74 00

PERMITS

PART 1 GENERAL

1.01 DESCRIPTION

- A. The City has obtained or will obtain the following permits for the Work:
1. The Florida Department of Environmental Protection Domestic Wastewater Facility Construction Permit: Substantial Modification to a Wastewater Facility or Activity – Dry-run permit has been approved – Permit No. FL0026255
 2. The Florida Department of Environmental Protection Modification to Existing Environmental Resource Permit – Dry-run permit has been approved – Permit No. 0156419-010-EM
 3. The Florida Department of Environmental Protection Permit to Construct Potable Water System Components – Permit No. 0126758-341-DSGP
 4. City of Hollywood Building Department Permit – Dry-run permit has been approved – Permit No. B21-101066.
 5. Broward County Modification to Existing Surface Water Management License– Dry-run License has been approved – License No. L2021-031 (0000154753) and modification to existing License SWIM1996-062-2
 6. Broward County Surface Water Management License – Permit has been granted (SWM1996-062-4).
 7. Broward County Modification to Existing Domestic Wastewater Treatment Plant License – Dry-run License has been approved – License No. WW-62883
 8. Broward County Environmental Resource General License – Dry-run permit has been approved
- B. The City has obtained or will obtain the following permits for the Work associated with the South Electrical Service Center portion of the project:
1. Broward County Modification to Existing Surface Water Management License– Dry-run License has been approved – License No. L2021-264 (0000186579) and modification to existing License SWIM1996-062-2
- C. Copies of these permits will be provided to the Contractor following award of the Contract. The Contractor shall keep copies of these permits on the project site at all times. The Contractor shall familiarize himself with, and comply with, all requirements of these permits.
- D. The CONTRACTOR shall obtain construction permits as deemed necessary to comply with the conditions of the above-referenced permits and/or licenses.
- E. The CONTRACTOR shall obtain and pay for all permits and fees in connection with the work. The CONTRACTOR shall also initiate the City's review and secure City approval prior to commencement of the work. Inspection by City personnel is required in addition to, not in lieu of, municipal and County department inspections. No project will be accepted until it has passed all inspections, including pavement installation or replacement.

- F. The CONTRACTOR shall familiarize himself with, and comply with, all requirements of required permits governing all work under this Contract. The CONTRACTOR's particular attention is called to any Special Conditions of the permits relating to construction procedures, excavation and backfill requirements, open trench restrictions, turbidity control, traffic control, pavement restoration and all other general and special conditions. In the event any of the conditions of the permits are in conflict with the requirements of these Specifications, the most stringent conditions shall take precedence.
- G. Any deviations from the Plans, Specifications or required permits, must first be approved by the City even if approval for the change has been given by the permitting agency.
- H. The CONTRACTOR shall fully assume all obligations and responsibilities, monetary and otherwise, imposed by the permits throughout the life of the project, including but not limited to:
 - 1. Proper maintenance of permit documentation and field records
 - 2. Proper maintenance of all permit-required field controls, including but not limited to the following:
 - 3. Chemical spill prevention
 - 4. Erosion, sedimentation, turbidity and dust retention
 - 5. Protection of storm drainage facilities
 - 6. Temporary vehicular and pedestrian traffic controls
 - 7. Payment of fines resulting from permit non-compliance
 - 8. Maintaining active permits and obtaining permit extensions when needed
 - 9. Providing certifications of all materials and equipment installed
 - 10. Performing successful inspections and tests required by the permits
 - 11. Correcting any work that is not in compliance with permits
 - 12. Performing successful equipment start-ups
 - 13. Providing Operation and Maintenance (O&M) manuals for installed equipment as required by permits
 - 14. Repair of any permanent traffic controls impacted by CONTRACTOR
 - 15. Close-out of all permits
- I. All surveying required by the project permits will be done by the CONTRACTOR's Florida registered Land Surveyor. This includes staking out limits of construction.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 77 50
WARRANTIES AND BONDS

PART 1 GENERAL

1.01 SUMMARY

A. Scope

1. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including standard warranties on products and special warranties required of the Contractor and Suppliers.

1.02 RELATED WORK

- A. Refer to the General Requirements for additional requirements relating to warranties and bonds.
- B. General closeout requirements are included in Section 01 70 00 – Contract Closeout.
- C. Specific requirements for warranties for the Work and products and installations that are specified to be warranted are included in the individual Sections.
- D. Certifications and other commitments and agreements for continuing services to City are specified elsewhere in the Contract Documents.

1.03 SUBMITTALS

- A. The following minimum submittals shall be submitted in accordance with Section 01 33 00 - Submittals.
 1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.
 2. Warranty information, including standard and special warranties, shall be provided with the submittals for the equipment and materials included in the Work and as specified in the Technical Specifications.
 3. Warranty information, including standard and special warranties, shall also be provided with the O&M Manual submittals for equipment included in the Work in accordance with Section 01 77 30 – Operating and Maintenance Instructions.
 4. A compiled set of warranty information with the warranty commencement date fixed, including standard and special warranties, shall be provided 15 days prior to the date fixed as Substantial Completion by the Engineer as follows:

- a. Submit two copies of each warranty and bond, properly executed by the Contractor, or Subcontractor, Supplier, or Manufacturer in two 3-ring binders (one set of warranties and bonds per binder). Organize the warranty documents into an orderly sequence based on the sequential number of the related Technical Specification.
 - b. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents and sized to receive 8-1/2-in by 11-in paper.
 - c. Provide a Table of Contents neatly typed, in the sequence of the Table of Contents of the Technical Specifications, with each item identified with the number and title of the Section in which specified and the name of the product or Work item
 - d. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the 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 the installer, supplier and manufacturer.
 - e. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS", the project title or name and the name, address and telephone number of the Contractor and equipment supplier(s).
5. If partial Substantial Completions are defined in Section 01 01 00 – Summary of Work, then specified warranties and bonds for all equipment and scope of supply which are part of the partial Substantial Completion shall be compiled and submitted in accordance with the requirements noted for overall project Substantial Completion.

1.04 FORMAT OF WARRANTIES

- A. Warranties shall be provided on standard 8-1/2 by 11 paper, portrait landscaped.
- B. When a special warranty is required, a written document that contains the appropriate terms and identification, ready for execution by the required parties shall be provided.
- C. Refer to individual Sections for specific content requirements, and particular requirements for submittal of special warranties.

1.05 SCHEDULE OF SPECIAL WARRANTIES

- A. Special warranties shall be provided as specified in the specific equipment Section.

1.06 WARRANTY REQUIREMENTS

- A. All equipment and Work whether or not specified in the relevant equipment or Work sections shall have a minimum warranty of one (1) year from the date of the Notice of Substantial Completion certificate issued for the Work and shall at a minimum conform to the requirements of this Section. Additional warranty time or special warranties requirements may be required in the Technical Specifications.
- B. Note that if partial Substantial Completions are allowed for certain areas of the Work, these are noted in Section 01 01 00 – Summary of Work.

- C. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.
- D. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- E. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the City has benefited from use of the Work through a portion of its anticipated useful service life.
- F. City's Recourse: Written warranties made to the City are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the City can enforce such other duties, obligations, rights, or remedies.
- G. Rejection of Warranties: The City reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.
- H. The City reserves the right to refuse to accept Work for the project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.
- I. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers and subcontractors required to countersign special warranties with the Contractor.
- J. Separate Prime Contracts: Each Prime Contractor is responsible for warranties related to its own Contract.

1.07 MANUFACTURERS CERTIFICATIONS

- A. Where required, the Contractor shall supply evidence, satisfactory to the Engineer, that the Contractor can obtain manufacturers' certifications as to the Contractor's installation of equipment.

1.08 DEFINITIONS

- A. Standard warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the Manufacturer to the City .
- B. Special warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the City .

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 78 23
OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.01 SCOPE

- A. Operation and maintenance (O&M) instructions shall be provided in accordance with this section and as required in the technical sections of this project manual. O&M information shall be provided for each maintainable piece of equipment, equipment assembly or subassembly, and material provided or modified under this contract.
- B. O&M instructions must be submitted and accepted before on-site training may start.

1.02 TYPES OF INFORMATION REQUIRED

- A. General:
 - 1. O&M information shall contain the names, addresses, and telephone numbers of the manufacturer, the nearest representative of the manufacturer, and the nearest supplier of the manufacturer's equipment and parts. In addition, one or more of the following items of information shall be provided as applicable.
- B. Operating Instructions:
 - 1. Specific instructions, procedures, and illustrations shall be provided for the following phases of operations:
 - a. Safety Precautions: List personnel hazards for equipment and list safety precautions for all operating conditions.
 - b. Operator Prestart: Provide requirements to set up and prepare each system for use.
 - c. Start-Up, Shutdown, And Post shutdown Procedures: Provide a control sequence for each of these operations.
 - d. Normal Operations: Provide control diagrams with data to explain operation and control of systems and specific equipment.
 - e. Emergency Operations: Provide emergency procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Include emergency shutdown instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance on emergency operations of all utility systems including valve locations and portions of systems controlled.
 - f. Operator Service Requirements: Provide instructions for services to be performed by the operator such as lubrication, adjustments, and inspection.
 - g. Environmental Conditions: Provide a list of environmental conditions (temperature, humidity, and other relevant data) which are best suited for each product or piece of equipment and describe conditions under which equipment should not be allowed to run.
- C. Preventive Maintenance:
 - 1. The following information shall be provided for preventive and scheduled maintenance to minimize corrective maintenance and repair:

- a. Lubrication Data: Provide lubrication data, other than instructions for lubrication in accordance with paragraph 1.02 Operator Service Requirements.
 - 1) A table showing recommended lubricants for specific temperature ranges and applications;
 - 2) Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities; and
 - 3) A lubrication schedule showing service interval frequency.
- b. Preventive Maintenance Plan And Schedule: Provide manufacturer's schedule for routine preventive maintenance, inspections, tests, and adjustments required to ensure proper and economical operation and to minimize corrective maintenance and repair. Provide manufacturer's projection of preventive maintenance man-hours on a daily, weekly, monthly, and annual basis including craft requirements by type of craft.

D. Corrective Maintenance:

- 1. Manufacturer's recommendations shall be provided on procedures and instructions for correcting problems and making repairs.
 - a. Troubleshooting Guides And Diagnostic Techniques: Provide step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.
 - b. Wiring Diagrams And Control Diagrams: Wiring diagrams and control diagrams shall be point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job-specific wiring and control work. On diagrams, number electrical and electronic wiring and pneumatic control tubing and the terminals for each type identically to actual installation numbering.
 - c. Maintenance And Repair Procedures: Provide instructions and list tools required to restore product or equipment to proper condition or operating standards.
 - d. Removal And Replacement Instructions: Provide step-by-step procedures and list required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings, and adjustments required. Instructions shall include a combination of test and illustrations.
 - e. Spare Parts And Supply Lists: Provide lists of spare parts and supplies required for maintenance and repair to ensure continued service or operation without unreasonably delays. Special consideration is required for facilities at remote locations. List spare parts and supplies that have a long lead time to obtain.
 - f. Corrective Maintenance Manhours: Provide manufacturer's projection of corrective maintenance man-hours including craft requirements by type of craft. Corrective maintenance that requires participation of the equipment manufacturer shall be identified and tabulated separately.

E. Appendices:

- 1. The following information shall be provided; include information not specified in the preceding paragraphs but pertinent to the maintenance or operation of the product or equipment.

- a. **Parts Identification:** Provide identification and coverage for all parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing shall show the index, reference, or key number which will cross-reference the illustrated part to the listed part. Parts shown in the listings shall be grouped by components, assemblies, and subassemblies.
- b. **Warranty Information:** List and explain the various warranties and include the servicing and technical precautions prescribed by the manufacturers or contract documents to keep warranties in force.
- c. **Personnel Training Requirements:** Provide information available from the manufacturers to use in training designated personnel to operate and maintain the equipment and systems properly.
- d. **Testing Equipment And Special Tool Information:** Provide information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components.

1.03 TRANSMITTAL PROCEDURE

- A. Unless otherwise specified, O&M manuals, information, and data shall be transmitted in accordance with Section 01 33 00 accompanied by Transmittal Form 01 78 23-A and Equipment Record Forms 01 78 23-B and/or 01 78 23-C, as appropriate, all as specified in Section 01 99 90. The transmittal form shall be used as a checklist to ensure the manual is complete. Only complete sets of O&M instructions will be reviewed for acceptance.
- B. 3 copies of the specified O&M information shall be provided after approval. For ease of identification, each manufacturer's brochure and manual shall be appropriately labeled with the equipment name and equipment number as it appears in the project manual. The information shall be organized in the binders in numerical order by the equipment numbers assigned in the project manual. The binders shall be provided with a table of contents and tab sheets to permit easy location of desired information. Binders shall be locking three-ring/"D"-ring type. Three-ring binders shall be riveted to back cover include plastic sheet lifter (page guard) at front of each volume.
- C. If manufacturers' standard brochures and manuals are used to describe O&M procedures, such brochures and manuals shall be modified to reflect only the model or series of equipment used on this project. Extraneous material shall be crossed out neatly or otherwise annotated or eliminated.

1.04 PAYMENT

- A. Acceptable O&M information for the project must be delivered to the Construction Manager prior to the project being 65 percent complete. Progress payments for work in excess of 65 percent completion will not be made until the specified acceptable O&M information has been delivered to the Construction Manager.

1.05 FIELD CHANGES

- A. Following the acceptable installation and operation of an equipment item, the item's instructions and procedures shall be modified and supplemented by the Contractor to reflect any field changes or information requiring field data.

END OF SECTION

SECTION 01 79 00
DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 DESCRIPTION

- A. This section contains requirements for training the City 's personnel, by persons retained by the Contractor specifically for the purpose, in the proper operation and maintenance of the equipment and systems installed under this contract.

1.02 QUALITY ASSURANCE

- A. Where required by the detailed specifications, the Contractor shall provide on-the-job training of the City 's personnel. The training sessions shall be conducted by qualified, experienced, factory-trained representatives of the various equipment manufacturers. Training shall include instruction in both operation and maintenance of the subject equipment.

1.03 SUBMITTALS

- A. The following information shall be submitted to the Construction Manager in accordance with the provisions of Section 01 33 00. The material shall be reviewed and accepted by the Construction Manager as a condition precedent to receiving progress payments in excess of 50 percent of the contract amount and not less than 3 weeks prior to the provision of training.
 - 1. Lessons plans for each training session to be conducted by the manufacturer's representatives. In addition, training manuals, handouts, visual aids, and other reference materials shall be included.
 - 2. Subject of each training session, identity and qualifications of individuals to be conducting the training, and tentative date and time of each training session.

PART 2 PRODUCTS

2.01 GENERAL

- A. Where specified, the Contractor shall conduct training sessions for the City 's personnel to instruct the staff on the proper operation, care, and maintenance of the equipment and systems installed under this contract. Training shall take place at the site of the work and under the conditions specified in the following paragraphs. Approved operation and maintenance manuals shall be available at least 30 days prior to the date scheduled for the individual training session.

2.02 LOCATION

- A. Training sessions shall take place at the site of the work. Training sessions requiring hands-on lessons shall be located at the respective equipment.

2.03 LESSON PLANS

- A. Formal written lesson plans shall be prepared for each training session. Lesson plans shall contain an outline of the material to be presented along with a description of visual aids to be utilized during the session. Each plan shall contain a time allocation for each subject.
- B. One complete set of originals of the lesson plans, training manuals, handouts, visual aids, and reference material shall be the property of the City and shall be suitably bound for proper organization and easy reproduction. The Contractor shall furnish ten copies of necessary training manuals, handouts, visual aids and reference materials at least 1 week prior to each training session.

2.04 FORMAT AND CONTENT

- A. Each training session shall be comprised of time spent both in the classroom and at the specific location of the subject equipment or system. As a minimum, training session shall cover the following subjects for each item of equipment or system:
 - 1. Familiarization
 - a. Review catalog, parts lists, drawings, etc., which have been previously provided for the plant files and operation and maintenance manuals.
 - b. Check out the installation of the specific equipment items.
 - c. Demonstrate the unit and indicate how all parts of the specifications are met.
 - d. Answer questions.
 - 2. Safety
 - a. Using material previously provided, review safety references.
 - b. Discuss proper precautions around equipment.
 - 3. Operation
 - a. Using material previously provided, review reference literature.
 - b. Explain all modes of operation (including emergency).
 - c. Check out City 's personnel on proper use of the equipment.
 - 4. Preventive Maintenance
 - a. Using material previously provided, review preventive maintenance (PM) lists including:
 - 1) Reference material.
 - 2) Daily, weekly, monthly, quarterly, semiannual, and annual jobs.
 - b. Show how to perform PM jobs.
 - c. Show City 's personnel what to look for as indicators of equipment problems.
 - 5. Corrective Maintenance
 - a. List possible problems.
 - b. Discuss repairs--point out special problems.
 - c. Open up equipment and demonstrate procedures, where practical.
 - 6. Parts
 - a. Show how to use previously provided parts list and order parts.
 - b. Check over spare parts on hand. Make recommendations regarding additional parts that should be available.

- 7. Local Representatives
 - a. Where to order parts: name, address, telephone.
 - b. Service problems:
 - 1) Who to call.
 - 2) How to get emergency help.
- 8. Operation and Maintenance Manuals
 - a. Review any other material submitted.
 - b. Update material, as required.

2.05 VIDEO RECORDING:

- A. The Contractor will provide videos and copy of the videos for each training session. After taping, the material will be edited and supplemented with professionally produced graphics to provide a permanent record. The Contractor shall advise all manufacturers providing training sessions that the material will be video taped and shall make available to the City's video taping contractor such utility services and accommodation as may be required to facilitate the production of the video tape record.

PART 3 EXECUTION

3.01 SUMMARY

- A. Training shall be conducted in conjunction with the operational testing and commissioning periods. Classes shall be scheduled such that classroom sessions are interspersed with field instruction in logical sequence. The Contractor shall arrange to have the training conducted on consecutive days, with no more than 6 hours of classes scheduled for any one day. Concurrent classes shall not be allowed. Training shall be certified on Form 43 05 11-B specified in Section 01 99 90.
- B. Acceptable operation and maintenance manuals for the specific equipment shall be provided to the City prior to the start of any training. Video taping shall take place concurrently with all training sessions.
- C. The following services shall be provided for each item of equipment or system as required in individual specification sections. Additional services shall be provided, where specifically required in individual specification sections.
 - 1. As a minimum classroom equipment training for operations personnel will include:
 - a. Using slides and drawings, discuss the equipment's specific location in the plant and an operational overview.
 - b. Purpose and plant function of the equipment.
 - c. A working knowledge of the operating theory of the equipment.
 - d. Start-up, shutdown, normal operation, and emergency operating procedures, including a discussion on system integration and electrical interlocks, if any.
 - e. Identify and discuss safety items and procedures.
 - f. Routine preventative maintenance, including specific details on lubrication and maintenance of corrosion protection of the equipment and ancillary components.

- g. Operator detection, without test instruments, of specific equipment trouble symptoms.
 - h. Required equipment exercise procedures and intervals.
 - i. Routine disassembly and assembly of equipment if applicable (as judged by the City on a case-by-case basis) for purposes such as operator inspection of equipment.
2. As a minimum, hands-on equipment training for operations personnel will include:
- a. Identify location of equipment and review the purpose.
 - b. Identifying piping and flow options.
 - c. Identifying valves and their purpose.
 - d. Identifying instrumentation:
 - 1) Location of primary element.
 - 2) Location of instrument readout.
 - 3) Discuss purpose, basic operation, and information interpretation.
 - e. Discuss, demonstrate, and perform standard operating procedures and round checks.
 - f. Discuss and perform the preventative maintenance activities.
 - g. Discuss and perform start-up and shutdown procedures.
 - h. Perform the required equipment exercise procedures.
 - i. Perform routine disassembly and assembly of equipment if applicable.
 - j. Identify and review safety items and perform safety procedures, if feasible.
3. Classroom equipment training for the maintenance and repair personnel will include:
- a. Theory of operation.
 - b. Description and function of equipment.
 - c. Start-up and shutdown procedures.
 - d. Normal and major repair procedures.
 - e. Equipment inspection and troubleshooting procedures including the use of applicable test instruments and the "pass" and "no pass" test instrument readings.
 - f. Routine and long-term calibration procedures.
 - g. Safety procedures.
 - h. Preventative maintenance such as lubrication; normal maintenance such as belt, seal, and bearing replacement; and up to major repairs such as replacement of major equipment part(s) with the use of special tools, bridge cranes, welding jigs, etc.
4. Hands-on equipment training for maintenance and repair personnel shall include:
- a. Locate and identify equipment components.
 - b. Review the equipment function and theory of operation.
 - c. Review normal repair procedures.
 - d. Perform start-up and shutdown procedures.

- e. Review and perform the safety procedures.
- f. Perform City approved practice maintenance and repair job(s), including mechanical and electrical adjustments and calibration and troubleshooting equipment problems.

END OF SECTION

SECTION 01 90 00
APPLICABLE STANDARDS AND CODES

PART 1 GENERAL

1.01 THE REQUIREMENT

- A. Wherever references are made in these specifications to any published standards, codes, standard specifications, or other published data of the various national, regional, or local organizations, such organizations may be referred to by their acronym or abbreviation only. References shall be to the latest versions currently in effect, unless otherwise specified by the CITY and/or ENGINEER. As a guide to the user of these specifications, the following acronyms or abbreviations which may appear in these specifications shall have the meanings indicated herein.
- B. The following is a partial list of typical abbreviations which may be used in the Specifications, and the organizations to which they refer. Abbreviated titles for other governing standards are used throughout these specifications and, although most of them are widely known, their complete titles are given below to avoid misunderstanding:
1. AAMA - Architectural Aluminum Manufacturer's Association
 2. AASHTO - American Association of the State Highway and Transportation Officials
 3. ACI - American Concrete Institute
 4. ACI - American Concrete Institute
 5. ACIFS - American Cast Iron Flange Standards
 6. ACOE - Army Corps of Engineers
 7. ACPA - American Concrete Pipe Association
 8. AFBMA - Anti-Friction Bearing Manufacturer's Association
 9. AGMA - American Gear Manufacturer's Association
 10. AGA - American Gas Association
 11. AGMA - American Gear Manufacturers Association
 12. AHGDA - American Hot Dip Galvanizers Association
 13. AI - The Asphalt Institute
 14. AIA - American Institute of Architects
 15. AISC - American Institute of Steel Construction
 16. AISI - American Iron and Steel Institute
 17. AITC - American Institute of Timber Construction
 18. AMCA - Air Moving and Conditioning Association
 19. ANSI - American National Standards Institute, Inc.
 20. APA - American Plywood Association
 21. API - American Petroleum Institute
 22. APHA - American Public Health Association
 23. APWA - American Public Works Association
 24. ASA - Acoustical Society of America
 25. ASAE - American Society of Agriculture Engineers
 26. ASCE - American Society of Civil Engineers

27. ASHRAE - American Society of Heating, Refrigerating, and Air-Conditioning Engineers
28. ASLE - American Society of Lubricating Engineers
29. ASME - American Society of Mechanical Engineers
30. ASMM - Architectural Sheet Metal Manual
31. ASSE - American Society of Sanitary Engineers
32. ASTM - American Society for Testing and Materials
33. AWI - Architectural Woodwork Institute
34. AWPA - American Wood Preservers Association
35. AWPI - American Wood Preservers Institute
36. AWS - American Welding Society
37. AWWA - American Water Works Association
38. BCEPGMD - Broward County Environmental Protection and Growth Management Department (formerly BCEPD)
39. BCHD - Broward County Health Department
40. BHMA - Builders Hardware Manufacturer's Association
41. CMA - Concrete Masonry Association
42. CRSI - Concrete Reinforcing Steel Institute
43. CSA - Canadian Standards Association
44. DHI - Door and Hardware Institute
45. DIPRA - Ductile Iron Pipe Research Association
46. EIA - Electronic Industries Association
47. ETL - Electrical Test Laboratories
48. FBC - Florida Building Code
49. FDEP - Florida Department of Environmental Protection
50. FDOT - Florida Department of Transportation
51. FS - Federal Specifications
52. ICEA - Insulated Cable Engineers Association
53. IEEE - Institute of Electrical and Electronics Engineers
54. IES - Illuminating Engineering Society
55. IPCEA - Insulated Power Cable Engineers Association
56. ISA - Instrument Systems and Automation
57. ISO - International Organization for Standardization
58. MBMA - Metal Building Manufacturers Association
59. MMA - Monorail Manufacturers Association
60. MTI - Marine Testing Institute
61. NAAMM - National Association of Architectural Metal Manufacturers
62. NACE - National Association of Corrosion Engineers
63. NBS - National Bureau of Standards
64. NCPI - National Clay Pipe Institute
65. NEC - National Electrical Code
66. NEMA - National Electrical Manufacturer's Association

67. NFPA - National Fire Protection Association
 68. NLMA - National Lumber Manufacturers Association
 69. NIOSH - National Institute of Occupational Safety and Health
 70. NIST - National Institute of Standards and Testing
 71. NRCA - National Roofing Contractors Association
 72. NSF - National Science Foundation
 73. OSHA - Occupational Safety and Health Administration
 74. PCA - Portland Cement Association
 75. SMACCNA - Sheet Metal and Air Conditioning Contractors National Association
 76. SAE - Society of Automotive Engineers Standards
 77. SHBI - Steel Heating Boiler Institute
 78. SMACCNA - Sheet Metal and Air Conditioning Contractors National Association
 79. SSPC - Steel Structures Painting Council
 80. SSPWC - Standard Specifications for Public Works Construction
 81. SFWMD - South Florida Water Management District
 82. UL - Underwriters Laboratories, Inc.
- C. CONTRACTOR shall, when required, furnish evidence satisfactory to the ENGINEER that materials and methods are in accordance with such standards where so specified.
- D. In the event any questions arise as to the application of these standards or codes, copies shall be supplied on site by the CONTRACTOR.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 91 00
COMMISSIONING

PART 1 GENERAL

1.01 DESCRIPTION

- A. This section contains requirements for the Contractor's performance during the commissioning of the structures, equipment and systems constructed and installed during the course of this contract. All commissioning work, as described in this section, shall be performed by the Contractor.

1.02 QUALITY ASSURANCE

- A. Cleanup:
1. Following completion of the operational testing period, the Contractor shall remove, clean, and replace all permanent and temporary filters and strainers in all pipeline systems; replace all HVAC filters; dewater and clean all sumps; and dewater all process units for final inspection as a condition precedent to commissioning.
- B. Commissioning Team:
1. The Contractor shall assemble a commissioning team under the direction of an individual duly authorized to commit the Contractor's personnel and resources to respond to requests for assistance on the part of the Construction Manager or, through the Construction Manager, the City . The commissioning team shall consist of representatives of the Contractor's mechanical, electrical, and instrumentation subcontractors, and others as appropriate. The commissioning team shall be available at the site of the work during normal working hours (8 hours a day, 5 days a week, Saturdays, Sundays, and legal holidays excepted) and shall be available within 2 hours' notice at all other times upon notice by telephone. The commissioning team shall at all times be equipped and ready to provide for emergency repairs, adjustments, and corrections to the equipment and systems installed and modified as a part of this contract.

1.03 SUBMITTALS

- A. The following information shall be submitted to the Construction Manager in accordance with the provisions of Section 01 33 00:
1. Detailed plans for commissioning each process unit and each system constructed or modified as a part of the work performed under this contract.
 2. The Contractor's plan for providing a commissioning team conforming to the requirements of paragraph 1.02 Commissioning Team during the commissioning period. The plan shall be complete with a daytime staffing plan and names, qualifications, and telephone numbers of those assigned to off-hour standby duty.

PART 2 PRODUCTS

2.01 SUMMARY

- A. Working with representatives of the City and the Construction Manager, the Contractor shall develop and produce a detailed, written plan for the startup and initial operation, under actual operating conditions, of the equipment and systems installed and constructed under this contract. The document, after acceptance by the Construction Manager, shall serve as the guidance manual for the commissioning process.

PART 3 EXECUTION

3.01 SUMMARY

- A. After completion of the equipment and system performance and operational testing, where required, and agreement on the part of the Construction Manager that the systems did meet all test requirements, commissioning will begin. The commissioning period for each modified or new unit process system shall be 4 weeks. The Contractor shall remove all temporary piping, bulkheads, controls and other alterations to the permanent systems that may have been needed during the performance and operational testing and shall perform the tasks necessary to make the improvements constructed under this contract fully operational. The Construction Manager shall confirm in writing the date(s) that the system is ready for commissioning and on which actual commissioning activities commence. Activities conducted prior to such written confirmation shall not constitute commissioning. The following specific tasks are to be performed as a part of the commissioning process:
 - 1. [To finalize once Client's input is received]
- B. The City 's operation and maintenance personnel will be responsible for operation of the systems to be commissioned. The portion of the work to be commissioned shall be fully operational, performing all functions for which it was designed.
- C. The Contractor shall be available at all times during commissioning periods to provide immediate assistance in case of failure of any portion of the system being constructed. At the end of the commissioning period and when all corrections required by the Construction Manager to assure a reliable and completely operational facility are complete, the Construction Manager shall issue a completion certificate. Each system shall have been issued a completion certificate as a condition precedent to the final acceptance of the work of this contract.
- D. During the commissioning period, the City shall be responsible for all normal operational costs and the Contractor shall bear the costs of all necessary repairs or replacements, including labor and materials, required to keep the portion of the plant being commissioned, operational.

END OF SECTION

SECTION 01 99 90
REFERENCE FORMS

PART 1 FORMS

1.01 DESCRIPTION

- A. The forms listed below and included in this section are referenced from other sections of the project manual:

Form No.	Title
01 33 00-A	Submittal Transmittal Form
01 45 20-A	Equipment Test Report Form
01 78 23-A	Operation and Maintenance Transmittal Form
01 78 23-B	Equipment Record Form
01 78 23-C	Equipment Record Form
09 90 00-A	Coating System Inspection Checklist
26 05 00-A	Wire and Cable Resistance Test Data Form
26 05 00-B	Installed Motor Test Data Form
26 05 00-C	Dry Transformer Test Data Form
26 05 00-D	Motor Control Center Test Form
26 05 00-E	Medium Voltage Motor Starter Test Form
26 05 00-F	Medium Voltage Switchgear Test Form
26 05 00-G	Protective Relay Test Form
26 05 00-H	Low Voltage Switchgear Test Form
26 05 00-I	Medium Voltage Load Interrupter Switch Test Form
26 05 00-J	Liquid-Filled Transformer Test Form
26 05 00-K	Automatic Transfer Switch Test Form
26 05 00-L	Neutral Grounding Resistor Test
40 61 13-A	Loop Wiring and Insulation Resistance Test Data Form
40 61 13-B	Control Circuit Piping Leak Test Form
40 61 13-C	Controller Calibration Test Data Form
40 61 13-D	Panel Indicator Calibration Test Data Form
40 61 13-E	Recorder Calibration Test Data Form
40 61 13-F	Signal Trip Calibration Test Data Form
40 61 13-G	Field Switch Calibration Test Data Form
40 61 13-H	Transmitter Calibration Test Data Form
40 61 13-I	Miscellaneous Instrument Calibration Test Data Form
40 61 13-J	Individual Loop Test Data Form
40 61 13-K	Loop Commissioning Test Data Form
43 05 11-A	Manufacturer's Installation Certification Form
43 05 11-B	Manufacturer's Instruction Certification Form
43 05 11-C	Unit Responsibility Certification Form
43 05 13-A	Rigid Equipment Mount Installation Inspection Checklist
43 05 21-A	Motor Data Form

01 33 00-A. SUBMITTAL TRANSMITTAL FORM

Submittal Transmittal

Submittal Description:	Submittal No: ¹	Spec Section:
------------------------	----------------------------	---------------

	Routing	Sent	Received
Owner:	Contractor/CM		
Project:	CM/Engineer		
	Engineer/CM		
Contractor:	CM/Contractor		

We are sending you:

- Attached
- Under separate cover via _____
- Submittals for review and comment
- Product data for information only

Remarks: _____

Item	Copies	Date	Section No.	Description	Review action ^a	Reviewer initials	Review comments attached

^aNote: NET = No exceptions taken; MCN = Make corrections noted; A&R = Amend and resubmit; R = Rejected
Attach additional sheets if necessary.

Contractor

Certify either a or b:

- a. We have verified that the material or equipment contained in this submittal meets all the requirements, including coordination with all related work, specified (no exceptions).
- b. We have verified that the material or equipment contained in this submittal meets all the requirements specified except for the attached deviations.

No.	Deviation

Certified by: _____

Contractor's Signature: _____

¹See Section 01 33 00-1.04. A, Transmittal Procedure.

01 45 20-A. EQUIPMENT TEST REPORT FORM

NOTE: This example equipment test report is provided for the benefit of the Contractor and is not specific to any piece of equipment to be installed as a part of this project. The example is furnished as a means of illustrating the level of detail required for the preparation of equipment test report forms for this project.

City Of Sample

Example Water Treatment Plant
 Stage IV Expansion Project

ABC Construction Company, Inc., General Contractor
 XYZ Engineering, Inc., Construction Manager

Equipment Test Report

- Equipment Name: Sludge Pump 2
- Equipment Number: P25202
- Specification Ref: 11390
- Location: East Sedimentation Basin Gallery

	Contractor		Construction Manager	
	Verified	Date	Verified	Date
A. Preoperational Checklist				
1. Mechanical				
a. Lubrication				
b. Alignment				
c. Anchor bolts				
d. Seal water system operational				
e. Equipment rotates freely				
f. Safety guards				
g. Valves operational				
h. Hopper purge systems operational				
i. Sedimentation tank/hopper clean				
j. O&M manual information complete				
k. Manufacturer's installation certificate complete				
2. Electrical (circuit ring-out and high-pot tests)				
a. Circuits:				
1) Power to MCC 5				
2) Control to HOA				
3) Indicators at MCC:				
a) Red (running)				
b) Green (power)				
c) Amber (auto)				
4) Indicators at local control panel				
b. Wiring labels complete				
c. Nameplates:				
1) MCC				
2) Control station				
3) Control panel				

	Contractor		Construction Manager	
	Verified	Date	Verified	Date
d. Equipment bumped for rotation				
3. Piping Systems				
a. Cleaned and flushed:				
1) Suction				
2) Discharge				
b. Pressure tests				
c. Temporary piping screens in place				
4. Instrumentation and Controls				
a. Flowmeter FE2502F calibration				
1) Calibration Report No.				
b. Flow recorder FR2502G calibrated against transmitter				
c. VFD speed indicator calibrated against independent reference				
d. Discharge overpressure shutdown switch calibration				
e. Simulate discharge overpressure Shutdown				
B. Functional Tests				
1. Mechanical				
a. Motor operation temperature satisfactory				
b. Pump operating temperature satisfactory				
c. Unusual noise, etc?				
d. Pump operation: 75 gpm/50 psig				
(1) Measurement:				
(a) Flow:				
(b) Pressure:				
(c) Test gage number:				
e. Alignment hot				
f. Dowelled in				
g. Remarks:				
2. Electrical				
a. Local switch function:				
1) Runs in HAND				
2) No control power in OFF				
3) Timer control in AUTO				
b. Overpressure protection switch PS2502C functional in both HAND and AUTO				
c. Overpressure protection switch PS2502C set at 75 psig				
d. PLC 2500 set at 24-hour cycle, 25 min ON				
C. Operational Test				
1. 48-hour continuous test. Pump cycles as specified, indicators functional, controls functional, pump maintains capacity, overpressure protection remains functional, hour meter functional				

RECOMMENDED FOR BENEFICIAL OCCUPANCY:

Construction Manager	Date
----------------------	------

ACCEPTED FOR BENEFICIAL OCCUPANCY

Owner's Representative	Date
------------------------	------

01 78 23-A. OPERATION AND MAINTENANCE TRANSMITTAL FORM

Date:	Submittal No: ²
To:	Contract No:
	Spec. Section:
	Submittal Description:
Attention:	From:

Checklist	Contractor		Construction Manager	
	Satisfactory	N/A	Accept	Deficient
1. Table of contents				
2. Equipment record forms				
3. Manufacturer information				
4. Vendor information				
5. Safety precautions				
6. Operator prestart				
7. Start-up, shutdown, and postshutdown procedures				
8. Normal operations				
9. Emergency operations				
10. Operator service requirements				
11. Environmental conditions				
12. Lubrication data				
13. Preventive maintenance plan and schedule				
14. Troubleshooting guides and diagnostic techniques				
15. Wiring diagrams and control diagrams				
16. Maintenance and repair procedures				
17. Removal and replacement instructions				
18. Spare parts and supply list				
19. Corrective maintenance man-hours				
20. Parts identification				
21. Warranty information				
22. Personnel training requirements				
23. Testing equipment and special tool information				

Remarks:

Contractor's Signature : _____

² See Section 01 33 00-1.04.A, Transmittal Procedure.

01 78 23-B. EQUIPMENT RECORD FORM

Equip Descrip		Equip Loc	
Equip No.	Shop Dwg No.	Date Inst	Cost
Mfgr		Mfgr Contact	
Mfgr Address			Phone
Vendor		Vendor Contact	
Vendor Address			Phone

Maintenance Requirements	D	W	M	Q	S	A	Hours

Lubricants: Recommended: _____
Alternative: _____

Misc. Notes:

Recommended Spare Parts				Electrical Nameplate Data			
Part No	Quan	Part Name	Cost	Equip			
				Make			
				Serial No.		Id No.	
				Model No.		Frame No.	
				Hp	V	Amp	Hz
				Ph	Rpm	Sf	Duty
				Code	Insl. Cl	Des	Type
				Nema Des	C Amb	Temp Rise	Rating
				Misc.			
				Mechanical Nameplate Data			
				Equip			
				Make			
				Serial No.		Id No.	
				Model No.		Frame No.	
				Hp	Rpm	Cap	Size
				Tdh	Imp Sz	Belt No.	Cfm
				Psi	Assy No.	Case No.	
				Misc			

09 90 00-A COATING SYSTEM INSPECTION CHECKLIST

Project Name			
Owner		Coating System Manufacturer (CSM)	
General Contractor (GC)		Coating System Applicator (CSA)	
Area or Structure		Location within Structure	
Coating System (eg E-1)		Coating Type (eg Epoxy, etc.)	

Coating System Inspection Checklist

Step	Description		Name	Signature	Date
1	Completion of cleaning and substrate decontamination prior to abrasive blast cleaning.	GC QC			
		CSM QC			
		CSA QC			
2	Installation of protective enclosure of structure or area and protection of adjacent surfaces or structures that are not to be coated.	GC QC			
		CSM QC			
		CSA QC			
3	Completion of ambient condition control in structure or building area and acceptance of ventilation methods in structure or Area.	GC QC			
		CSM QC			
		CSA QC			
4	Completion of Surface Preparation for Substrates to Be Coated.	GC QC			
		CSM QC			
		CSA QC			
5	Completion of Primer Application.	GC QC			
		CSM QC			
		CSA QC			
6	Completion of Concrete Repairs If Required and Related Surface Preparation Rework Prior to Coating System Application.	GC QC			
		CSM QC			
		CSA QC			
7	Completion of Concrete Filler/ Surface Application to Concrete.	GC QC			
		CSM QC			
		CSA QC			

Coating System Inspection Checklist

Step	Description		Name	Signature	Date
8	Completion of First Finish Coat Application and of Detail Treatment at Transitions or Terminations.	GC QC			
		CSM QC			
		CSA QC			
9	Completion of Second Finish Coat Application and of Detail Treatment at Transitions and Terminations.	GC QC			
		CSM QC			
		CSA QC			
10	Completion of Full and Proper Cure of Coating System.	GC QC			
		CSM QC			
		CSA QC			
11	Completion of Testing of Cured Coating System including Adhesion, Holiday (Continuity) Testing and Dry Film Thickness.	GC QC			
		CSM QC			
		CSA QC			
12	Completion of Localized Repairs to Coating System Following Testing.	GC QC			
		CSM QC			
		CSA QC			
13	Final Acceptance of Coating System Installation Including Final Clean-Up Complying with Specification Requirements and the CSM's Quality Requirements.	GC QC			
		CSM QC			
		CSA QC			

26 05 00-A. WIRE AND CABLE RESISTANCE TEST DATA FORM

Wire or Cable No.: _____ Temperature, °F: _____

Location of Test	Insulation resistance, megohms
1.	
2.	
3.	
4.	
5.	
6.	
7.	

CERTIFIED _____ Date _____

Contractor's Representative

WITNESSED _____ Date _____

Owner's Representative

26 05 00-B. INSTALLED MOTOR TEST DATA FORM

Motor Equipment Number: _____ Date of test: _____

Equipment Driven: _____

MCC Location: _____

				Ambient temp	°F
Resistance:					
Insulation resistance phase-to-ground megohms:					
Phase A		Phase B		Phase C	
Current at Full Load:					
Phase		Current, amps			
Phase		Current, amps			
Phase		Current, amps			
Thermal Overload Device:	Manufacturer/catalog #			Amperes	
Circuit breaker (MCP) setting:					

Motor Nameplate Markings:

Mfr		Mfr Model		Frame		HP	
Volts		Phase		RPM		Service factor**	
Amps		Freq		Ambient temp rating			°C
Time rating				Design letter**			
	(NEMA 1-10.35)				(NEMA MG-1.16)		
Code letter				Insulation class			

**Required for 3-phase squirrel cage induction motors only.

CERTIFIED _____ Date _____

Contractor's Representative

WITNESSED _____ Date _____

Owner's Representative

26 05 00-C. DRY TRANSFORMER TEST DATA FORM

(Note: Use Data Form for dry type transformers with voltage rating of 600 Vac or less and sizes to 167 kVA single phase and 500 kVA three phase. Use NETA Test Forms and Test Procedures for higher voltages and larger transformers.)

Equipment Tag No.: _____ Temperature Rating: _____

Description/Location: _____ Feeder size/Source: _____

Primary Voltage: _____ Secondary Voltage: _____ Winding Connection: _____

A. VISUAL INSPECTION

Transformer Inspection	Pass	Fail	Note
1. Nameplate data as specified			
2. Mechanical condition			
a. Free of dents and scratches			
b. Anchored properly			
c. Shipping brackets removed			
d. Spacing from wall per nameplate			
3. Grounding *			
a. Equipment grounding			
b. System grounding			

B. INSULATION-RESISTANCE TESTS:

Perform tests with calibrated megohmmeter. Apply 1000 Vdc test voltage for 60 seconds and record readings in megohms at 30-seconds and 60-seconds intervals.

Test Group	Resistance between		30-second reading	60-second reading	Absorption Ratio Index 60-sec. / 30-sec.
	A	GRD			
Primary Winding to ground	A	GRD			
	B	GRD			
	C	GRD			
Secondary Winding to ground with * N-G Bond removed	a	GRD			
	b	GRD			
	c	GRD			
Primary Winding to Secondary Winding	A	a			
	B	b			
	C	c			

Submit resistance readings to the Construction Manager immediately after the tests that are less than the manufacturer's recommended value or less than 10-megohms. Record the Absorption Ratio Index values for future reference. Ratio must be 1.0 or greater, with infinity (∞) equal to 1.0.

Contractor Representative Certified: _____ Date _____

Owner Representative Witnessed: _____ Date _____

26 05 00-D. MOTOR CONTROL CENTER TEST FORM

Equipment No.: _____ Ambient room temperature: _____

Location: _____

A. MECHANICAL CHECK:

All bolted connections either bus to bus or cable to bus shall be torqued to the manufacturer's recommendations.

B. ELECTRICAL TESTS:

1. Measure insulation resistance of each bus section phase to phase and phase to ground for 1 minute using a megohmmeter at 1000 volts.

Test results (megohms)			
Phase		Phase	
A-GRD		A-B	
B-GRD		B-C	
C-GRD		C-A	

2. Set the circuit breaker in the starter unit to comply with the requirements of NEC, Article 430-52 and Table 430-152.
3. Motor overload heater elements shall be sized and installed based on the actual nameplate full load amperes of the motor connected to the starter.

CERTIFIED _____ Date _____

Contractor's Representative

WITNESSED _____ Date _____

Owner's Representative

26 05 00-E. MEDIUM VOLTAGE MOTOR STARTER TEST FORM

Equipment No.: _____

Location: _____

Room Temperature: _____

The protective devices shall be set in accordance with the specification before the tests are performed.

1. Measure contact resistance (micro-ohms)

Phase:	A		B		C	
--------	---	--	---	--	---	--

Contacts shall be replaced if resistance exceeds 50 micro-ohms.

2. Perform an insulation resistance test (1000 volts DC for 1 minute).

Phase	A		B		C		
Pole to ground							megohms
Across open pole							megohms
Pole to pole	AB		BC		CA		megohms

3. Perform minimum pickup voltage tests on trip and close coils.
4. Motor RTDs shall be tested by using a hot oil bath. The temperature at which the sensor trips shall be recorded for each RTD.
5. The Contactor shall be tripped by operation of each protective device.

26 05 00-F. MEDIUM VOLTAGE SWITCHGEAR TEST FORM

Equipment No.: _____

Location: _____

Room Temperature: _____

The protective devices shall be set in accordance with the specification before the tests are performed.

1. Measure contact resistance (micro-ohms).

Phase:	A		B		C	
--------	---	--	---	--	---	--

Contacts shall be replaced if resistance exceeds 50 micro-ohms.

2. Perform an insulation resistance test (1000 volts DC for 1 minute).

Phase	A		B		C		
Pole to ground							megohms
Across open pole							megohms
Pole to pole	AB		BC		CA		megohms

3. Perform minimum pickup voltage tests on trip and close coils.
4. Verify the instrument transformer ratios. Check the transformer's polarity electrically.
5. The Contactor shall be tripped by operation of each protective device.

26 05 00-G. PROTECTIVE RELAY TEST FORM

Location: _____

Switchgear Breaker No.: _____

Protective Relay Description: _____

The protective relays shall be tested in the following manner:

1. Each protective relay circuit shall have its insulation resistance tested to ground.
2. Perform the following tests on the specified relay setting:
 - a. Pickup parameters on each operating element.
 - b. Timing test shall be performed at three points on the time dial curve.
 - c. Pickup target and seal-in units.

The results shall be recorded and signed. A copy shall be given to the Construction Manager in accordance with paragraph 26 05 00-1.05 Corrosive Areas.

26 05 00-H. LOW VOLTAGE SWITCHGEAR TEST FORM

Equipment No.: _____

Location: _____

Room Temperature: _____

The protective devices shall be set in accordance with the specification before the tests are performed.

1. Measure contact resistance (micro-ohms).

Phase:	A		B		C	
--------	---	--	---	--	---	--

Contacts shall be replaced if resistance exceeds 50 micro-ohms.

2. Perform an insulation resistance test (1000 volts DC for 1 minute).

Phase	A		B		C		
Pole to ground							megohms
Across open pole							megohms
Pole to pole	AB		BC		CA		megohms

3. Minimum pickup current shall be determined by primary current injection.
4. Long time delay shall be determined by primary injection at three hundred percent (300%) pickup current.
5. Short time pickup and time delay shall be determined by primary injection of current.
6. Instantaneous pickup current shall be determined by primary injection.
7. Trip unit reset characteristics shall be verified.
8. Auxiliary protective devices, such as ground fault or under voltage relays, shall be activated to ensure operation of shunt trip devices.

26 05 00-I. MEDIUM VOLTAGE LOAD INTERRUPTER SWITCH TEST FORM

Equipment Number: _____

Location: _____

Date: _____

1. Measure switch blade resistance (micro-ohms).

Phase:	A		B		C	
--------	---	--	---	--	---	--

Contacts shall be replaced if resistance exceeds 50 micro-ohms.

2. Perform an insulation resistance test (1000 volts DC for 1 minute).

Phase	A		B		C		
Pole to ground							megohms
Across open pole							megohms
Pole to pole	AB		BC		CA		megohms

The results shall be recorded and signed. A copy shall be given to the Construction Manager in accordance with paragraph 26 05 00-2.06 Product Data.

CERTIFIED _____ Date _____
Contractor's Representative

WITNESSED _____ Date _____
Owner's Representative

26 05 00-J. LIQUID-FILLED TRANSFORMER TEST FORM

Equipment Number: _____

Location: _____

Date/Weather Conditions: _____

- A. Perform the "Insulation-Resistance Test" and "Dielectric Absorption Test" using Form 26 05 00-C, Dry Transformer Test Data Form.
- B. Perform an applied voltage (low frequency dielectric) test in accordance with ANSI C57.12.90, paragraph 10.5, Applied Voltage Test. Applied voltage levels shall be 75 percent of recommended factory test levels or recommended test levels of ANSI C57.12.00, Table 5.
- C. Insulating oil shall be sampled and shall be laboratory tested for the following:
 - 1. Dielectric strength.
 - 2. Acid neutralization.
 - 3. Interfacial tension.
 - 4. Color.
 - 5. Power factor.
- D. Perform a turns ratio test between the windings for all tap positions.
- E. The temperature and pressure switches shall be tested using a hot oil bath and air pump.
- F. The results shall be recorded and signed by the Contractor and Construction Manager. A copy shall be given to the Construction Manager in accordance with paragraph 26 05 00-2.06 Product Data. Any readings which are abnormal to ANSI industry standards shall be reported to the Construction Manager.

26 05 00-K. AUTOMATIC TRANSFER SWITCH TEST FORM

Equipment Number: _____

Location: _____

Date: _____

1. Perform an insulation resistance test (1000 volts DC for 1 minute):

Phase	A		B		C		
Pole to ground							megohms
Pole to pole	AB		BC		CA		megohms

2. Perform the following operations and initial:
 - a. Manual transfer _____
 - b. Loss of normal power; __sec delay
 - c. Return to normal power; _____sec delay

The results shall be recorded and signed. A copy shall be given to the Construction Manager in accordance with paragraph 26 05 00-2.06 Product Data.

CERTIFIED _____ Date _____
 Contractor's Representative

WITNESSED _____ Date _____
 Owner's Representative

26 05 00-L. NEUTRAL GROUNDING RESISTOR TEST

Equipment No.: _____

Location: _____

The pickup and time delay setting on the ground fault relay shall be set in accordance with Section 26 05 74.

1. The transformer neutral insulation resistance shall be measured with and without the grounding resistor connected to insure no parallel ground paths exist.
2. The protective relay pickup current shall be determined by injecting test current into the current sensor. The pickup current should be within 10 percent of the dial setting. Record the dial setting and actual pickup tie.
3. The relay timing shall be tested by injecting 150 and 300 percent of pickup current into the current sensor. The relay timing shall be in accordance with the manufacturer's published time-current characteristic curves. Record the relay timing at 150 and 300 percent of pickup current.
4. The circuit interrupting device shall be operated by operating the relay.

The results shall be recorded and signed by the Contractor and Construction Manager. A copy shall be given to the Construction Manager in accordance with paragraph 26 05 00-2.06 Product Data.

40 61 13-A. LOOP WIRING AND INSULATION RESISTANCE TEST DATA FORM

Loop No.: _____

List all wiring associated with a loop in table below. Make applicable measurements as indicated after disconnecting wiring.

Wire No.	Panel Tie	Field TB	Continuity Resistance ^a		Insulation Resistance ^b			
			Cond./ Cond.	Cond./ Shield	Shield/ Gnd.	Shield/ Cond.	Cond./ Gnd.	Shield/ Shield
A			--	(A/SH)				
B			(A/B)	--				
C			(A/C)	--				
D			(A/D)	--				
etc.								

NOTES:

- a. Continuity Test. Connect ohmmeter leads between wires A and B and jumper opposite ends together. Record resistance in table. Repeat procedure between A and C, A and D, etc. Any deviation of ± 2 ohms between any reading and the average of a particular run indicates a poor conductor, and corrective action shall be taken before continuing with the loop test.
- b. Insulation Test. Connect one end of a 500 volt megger to the panel ground bus and the other sequentially to each completely disconnected wire and shield. Test the insulation resistance and record each reading.

CERTIFIED _____ Date _____

Contractor's Representative

WITNESSED _____ Date _____

Owner's Representative

40 61 13-B. CONTROL CIRCUIT PIPING LEAK TEST FORM

Loop No.: _____

List tubing associated with loop in table below. Make applicable measurements after isolating any air consuming pilots from circuit.

Tube No.	Tubing Equivalent Length of 1/4-Inch Copper ^a	Test Period (seconds)	Permitted Pressure Drop (psi) ^b	Measured Pressure Drop (psi)
A				
B				
C				
D				
etc.				

NOTES:

- a. Convert actual tubing and air motor volume to equivalent 1/4-inch copper tubing.
- b. Pressure drop shall not exceed 1 psi per hundred feet 1/4-inch tubing per 5 seconds.

CERTIFIED _____ Date _____
 Contractor's Representative

WITNESSED _____ Date _____
 Owner's Representative

40 61 13-C. CONTROLLER CALIBRATION TEST DATA FORM

Tag No. and Description: _____

Make & Model No.: _____ Serial No.: _____

Input: _____ Process Variable (PV) Scale: _____

Output: _____ Output Scale: _____

PV Scale Calibration

% of Range	Input	Expected Reading	Actual Reading	% Deviation
0				
50				
100				
% Deviation Allowed:				

Connect output to PV for following tests:

Set Point (SP) Indicator Accuracy			Output Meter Accuracy			Controller Accuracy		
SP	PV Reading	Expected % Dev.	Actual Reading	Expected Reading	Actual % Dev.	OUTPUT	OUTPUT	% Dev.
(0%)								
(50%)								
(100%)								
% Deviation Allowed:			% Deviation Allowed:			% Deviation Allowed:		

CERTIFIED _____ Date _____

Contractor's Representative

WITNESSED _____ Date _____

Owner's Representative

40 61 13-D. PANEL INDICATOR CALIBRATION TEST DATA FORM

Tag No. and Description: _____

Make & Model No.: _____ Serial No.: _____

Input: _____

Scale: _____ Range: _____

PV Scale Calibration

% of Range	Input	Expected Reading	Actual Reading	% Deviation
0				
50				
100				
% Deviation Allowed:				

CERTIFIED _____ Date _____

Contractor's Representative

WITNESSED _____ Date _____

Owner's Representative

40 61 13-E. RECORDER CALIBRATION TEST DATA FORM

Tag No. and Description: _____

Make & Model No.: _____ Serial No.: _____

Input: _____ Chart: _____

Scale: _____ Range: _____

% of Range	Input	Expected Reading	Actual Reading	% Deviation
0				
50				
100				
% Deviation Allowed:				

CERTIFIED _____ Date _____

Contractor's Representative

WITNESSED _____ Date _____

Owner's Representative

40 61 13-H. TRANSMITTER CALIBRATION TEST DATA FORM

Tag No. and Description: _____

Make & Model No.: _____ Serial No.: _____

Input: _____

Output: _____

Range: _____ Scale: _____

Simulate process variable (flow, pressure, temperature, etc.) and measure output with appropriate meter.

% of Range	Input	Expected Reading	Actual Reading	% Deviation
0				
50				
100				
% Deviation Allowed:				

CERTIFIED _____ Date _____

Contractor's Representative

WITNESSED _____ Date _____

Owner's Representative

40 61 13-I. MISCELLANEOUS INSTRUMENT CALIBRATION TEST DATA FORM

(For instruments not covered by any of the preceding test forms, the Contractor shall create a form containing all necessary information and calibration procedures.)

CERTIFIED _____ Date _____
Contractor's Representative

WITNESSED _____ Date _____
Owner's Representative

40 61 13-J. INDIVIDUAL LOOP TEST DATA FORM

Loop No.: _____

Description: (Give complete description of loop's function using tag numbers where appropriate.)

P&ID No.: (Attach copy of P&ID.)

- a. Wiring tested:
(Attach test form 40 61 13-A)
- b. Instrumentation tubing/piping tested:
(Attach test form 40 61 13-B)
- c. Instruments calibrated:
(Attach test forms 40 61 13-C through I)
- d. List step-by-step procedures for testing loop parameters. Test loop with instruments, including transmitters and control valves, connected and functioning. If it is not possible to produce a real process variable, then a simulated signal may be used with the Construction Manager's approval.

CERTIFIED _____ Date _____
Contractor's Representative

WITNESSED _____ Date _____
Owner's Representative

40 61 13-K. LOOP COMMISSIONING TEST DATA FORM

Loop No.: _____

- a. Loop tested:
(Attach test form 40 61 13-J)
- b. Controlled or connected equipment tests confirmed:
- c. Give complete description of loop's interface with process.
- d. With associated equipment and process in operation, provide annotated chart trace of loop response to changes in set points for verification of performance. This chart should demonstrate 1/4-amplitude damping as output adjusts to set point change. Show set points, starting and finishing times on chart, as well as any other pertinent data.

Connect 2-pen recorder to process variable (PV) and to controller output. Use 1 inch/second chart speed.

Pen 1 - PV - Connections:
Pen 2 - Output - Connections:

CERTIFIED _____ Date _____
Contractor's Representative

WITNESSED _____ Date _____
Owner's Representative

43 05 11-A. MANUFACTURER'S INSTALLATION CERTIFICATION FORM

Contract No: _____ Specification section: _____

Equipment name: _____

Contractor: _____

Manufacturer of equipment item: _____

The undersigned manufacturer of the equipment item described above hereby certifies that he has checked the installation of the equipment and that the equipment, as specified in the project manual, has been provided in accordance with the manufacturer's recommendations, and that the trial operation of the equipment item has been satisfactory.

Comments: _____

Manufacturer

Contractor

Signature of Authorized Representative

Signature of Authorized Representative

Date

Date

43 05 11-B. MANUFACTURER'S INSTRUCTION CERTIFICATION FORM

Contract No: _____ Specification Section: _____

Equipment name: _____

Contractor: _____

Manufacturer of equipment item: _____

The undersigned manufacturer certifies that a service engineer has instructed the wastewater treatment plant operating personnel in the proper maintenance and operation of the equipment designated herein.

Operations Check List (check appropriate spaces)

Start-up procedure reviewed	_____
Shutdown procedure reviewed	_____
Normal operation procedure reviewed	_____
Others:	_____

Maintenance Check List (check appropriate spaces)

Described normal oil changes (frequency)	_____
Described special tools required	_____
Described normal items to be reviewed for wear	_____
Described preventive maintenance instructions	_____
Described greasing frequency	_____
Others:	_____

Manufacturer

Signature of Contractor Representative Date

Signature of Authorized Representative

Date

Signature of Authorized Representative Date

43 05 11-C. UNIT RESPONSIBILITY CERTIFICATION FORM

[PROJECT TITLE]

CERTIFICATE OF UNIT RESPONSIBILITY
FOR SPECIFICATION SECTION _____

[SECTION TITLE]

In accordance with Section 43 05 11-1.02 Unit Responsibility of the contract documents, the undersigned manufacturer of driven equipment ("manufacturer") accepts unit responsibility for all components of equipment furnished to the Project under specification Section _____, and for related equipment manufactured under sections _____, _____, and _____.

We have reviewed the requirements for sections 43 05 11 and 43 23 03 where applicable) and all sections referencing this (these) section(s), including but not limited to drivers, supports for driving and driven equipment and all other specified appurtenances to be furnished to the Project by manufacturer. And, we have further reviewed, and modified as necessary, the requirements for associated variable speed drives and motor control centers. We hereby certify that all specified components are compatible and comprise a functional unit suitable for the specified performance and design requirements whether or not the equipment was furnished by us. We will make no claim nor establish any condition that problems in operation for the product provided under this specification Section _____ are due to incompatibility of any components covered by this Certificate of Unit Responsibility. Nor will we condition or void any warranty for the performance of the product of this specification Section _____ due to incompatibility of any components covered under this Certificate of Unit Responsibility.

Our signature on this Certificate of Unit Responsibility does not obligate us to take responsibility for, nor to warrant the workmanship, quality, or performance of related equipment provided by others under specification sections _____, _____, and _____. Our obligation to warranty all equipment provided by us shall remain unaffected.

Notary Public

Name of Corporation

Commission expiration date

Address

Seal:

By:

Duly Authorized Official

Legal Title of Official

Date

43 05 13-A. RIGID EQUIPMENT MOUNT INSTALLATION CHECKLIST

[CLIENT, PROJECT NAME]

Equipment Tag No.: _____ Date: _____

Grout Product Name and Type: _____

Grouting System Manufacturer: _____

Grouting Application Contractor: _____

General Contractor: _____

Step 1: Verify Equipment Anchor Installation Conformance to Equipment Pad Details

Name: Contractor Rep.		Date
Name: Construction Manager		Date
Name: Millwright		Date

Step 2: Completion of Cleaning and Concrete Substrate Preparation Prior to Grouting

Name: Contractor Rep.		Date
Name: Construction Manager		Date
Name: Grouting Contractor Rep.		Date
Name: Grout Manufacturer's Technical Rep.		Date

Step 3: Equipment Leveling

Name: Contractor Rep.		Date
Name: Construction Manager		Date
Name: Millwright		Date

Step 4: Installation of Protection of Adjacent Surfaces or Structures NOT TO BE GROUTED

Name: Contractor Rep.		Date
Name: Construction Manager		Date
Name: Grouting Contractor Rep.		Date
Name: Grout Manufacturer's Technical Rep.		Date

Step 5: Preparation and Construction of Forms and Epoxy Grout Filling Standpipes

Name: Contractor Rep.		Date
Name: Construction Manager		Date
Name: Grouting Contractor Rep.		Date
Name: Grout Manufacturer's Technical Rep.		Date

Step 6: Completion of Ambient Condition Control in Structure or Building Area and Acceptance of Ambient Conditions as They Apply to Application and Curing Requirements for the Grouting System

Name: Contractor Rep.		Date
Name: Construction Manager		Date
Name: Grouting Contractor Rep.		Date
Name: Grout Manufacturer's Technical Rep.		Date

Step 7: Epoxy Grout Installation

Name: Contractor Rep.		Date
Name: Construction Manager		Date
Name: Grouting Contractor Rep.		Date
Name: Grout Manufacturer's Technical Rep.		Date

Step 8: Completion of Full and Proper Cure of Epoxy Grout

Name: Contractor Rep.		Date
Name: Construction Manager		Date
Name: Grouting Contractor Rep.		Date

Name: Grout Manufacturer's Technical Rep.		Date
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Step 9: Completion of Localized Repair of Grout Voids

Name: Contractor Rep.		Date
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Name: Construction Manager		Date
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Name: Grouting Contractor Rep.		Date
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Name: Grout Manufacturer's Technical Rep.		Date
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Step 10: Final Acceptance of Grouting System Installation Including Final Clean-Up of the Work Site Complying with All Specification Requirements and the GSM's Quality Requirements

Name: Contractor Rep.		Date
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Name: Construction Manager		Date
----------------------------	--	------

Name: Grouting Contractor Rep.		Date
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Name: Grout Manufacturer's Technical Rep.		Date
---	--	------

43 05 21-A. MOTOR DATA FORM

Equipment Name: _____ Equipment No(s): _____

Project Site Location: _____

Nameplate Markings

Mfr:	Mfr Model:	Frame:	Horsepower:
Volts:	Phase:	RPM:	Service Factor:
FLA:	LRA:	Frequency:	Amb Temp Rating: °C
Time rating:	(NEMA MG1-10.35)	Design Letter:	(NEMA MG-1.16)
KVA Code Letter:		Insulation Class:	

The following information is required for explosion-proof motors only:

- A. Approved by UL for installation in Class _____, Div _____, Group _____
- B. UL frame temperature code _____ (NEC Tables 500-8B)

The following information is required for all motors 1/2 horsepower and larger:

- A. Guaranteed minimum efficiency _____
(Section 43 05 21-2.04 Motor Efficiency)
- B. Nameplate or nominal efficiency _____

Data Not Necessarily Marked on Nameplate

Type of Enclosure:	Enclosure Material:
Temp Rise:	°C (NEMA MG1-12.41,42)
Space Heater included?	<input type="checkbox"/> Yes <input type="checkbox"/> No
If Yes:	Watts Volts
Type of motor winding over-temperature protection, if specified:	

Provide information on other motor features specified:

SECTION 02 41 00

DEMOLITION

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope

1. This section specifies all labor, materials, equipment, and incidentals, as shown, specified, and required for demolitions, removal and disposal work. Included, but not limited to, are demolitions and removals of existing materials, equipment, or work necessary to install the work for this Contract as shown and specified and to connect same with existing work in an approved manner. Demolition includes structural concrete, foundations, walls, doors, windows, structural steel, metals, masonry, attachments, appurtenances, piping, electrical and mechanical equipment, paving, curbs, walks, fencing, and similar existing facilities. Contractor shall pay for all landfill disposal fees. Contractor shall conduct site visit to determine extent of work and the problems anticipated to perform the work.
2. The Engineer did not perform a survey of asbestos containing materials or lead based paints during the design efforts. However, the Contractor shall include in their scope a limited survey to determine if asbestos containing materials or lead based paint is present. This survey shall be performed between the period of the Notice to Proceed and the Notice to Commence. The results of this survey shall be provided to the City and shall be performed by a competent and certified specialist in this type of work. The Contractor will be required to use this information to show Broward County the presence or the lack of asbestos containing materials and lead based paints in the demolition to be performed.

1.02 SUBMITTALS

- ###### A. Submittals shall be made in accordance with Section 01 30 00. In addition, the following specific information shall be provided:
1. Contractor shall develop and submit demolition plan within 14 days of the Notice to Proceed which includes a demolition schedule and detail methods to use on each facility to be demolished.
 2. Qualifications of firm contracted by the Contractor to perform the survey for asbestos containing materials and lead based paint.
 3. Results of the survey for asbestos containing materials and lead based paint.
 4. Submit Asbestos Notification form from Broward County.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

- A. All materials and equipment removed from existing work shall become the property of Contractor, except for those identified in the Contract Documents for City salvage. All materials and equipment to be salvaged shall be carefully removed by Contractor so as not to be damaged and shall be cleaned and stored on or adjacent to the site in a protected place specified by the Engineer.
- B. Contractor shall dispose of all demolition materials, equipment, debris, and all other items not marked by the City to remain, off site and in conformance with all existing applicable laws and regulations.
- C. Demolished items shall not be used in backfill.
- D. Use water sprinkling, temporary enclosures, and other suitable methods to limit amount of dust and dirt rising and scattering to the lowest practical level. Comply with governing regulations pertaining to environmental protection.

3.02 DEMOLITION AND REMOVAL

- A. Structures
 - 1. Demolition and removal of structures consist of removal of abandoned superstructures, foundation walls, footings, slabs and any other structures. Excavations caused by existing foundations shall be cleared of waste, debris and loose soil, and refilled as specified.
 - 2. Remove structures to the lines and grades shown, unless otherwise directed by the Engineer. Where no limits are shown the limits shall be 4 inches outside the item to be installed. The removal of masonry beyond these limits shall be at the Contractor's expense and these excess removals shall be reconstructed to the satisfaction of the Engineer with no additional compensation to Contractor.
 - 3. Where depth of removal is not shown, remove structures to 6-inches below existing footing elevation and backfill to the original grade.
- B. Pavement
 - 1. All pavement demolition shall terminate at cut edges, and all edges shall be neat linear lines and have a vertical cut face or be saw cut at right angles to curb face. When portions of pavements are to be removed and later construction is to be connected, Contractor shall preserve, intact, the existing reinforcing steel that would/will project into the new concrete one lap length into the new concrete. Where preserving existing reinforcing steel to a proper length is not possible, Contractor shall splice new reinforcing steel by welding to existing bars. Welds shall be of such size and length as to develop the full strength of the existing bars, and shall conform to AWS D12.1, Reinforcing Steel Welding Code.

- C. Mechanical
 - 1. Mechanical removals shall comply with applicable Mechanical Drawings and Specifications.
 - 2. When existing underground piping is to be altered or removed, the remaining piping shall be properly capped. Abandoned underground piping shall be removed. Underground piping to be demolished shall be removed. Removals shall comply with applicable Civil Drawings and Specifications.
- D. Electrical
 - 1. Electrical removals shall comply with applicable Electrical Drawings and Specifications and in accordance with Section 01 35 43.

3.03 SALVAGE

- A. The Contractor may salvage for their use any equipment or material scheduled for demolition. The Contractor shall notify the Engineer 5 days prior to any salvage or demolition work.
- B. During the course of the Work, the Engineer may determine that certain piping and valving which is scheduled for demolition may be re-used. The Contractor shall propose to the Engineer to salvage portions of the Work scheduled for demolition that in the opinion of the Contractor is reusable and good condition. The Contractor shall retain from the contract value 10% of the cost of the material salvaged as if it were purchased new; and the City shall receive a credit in the amount of 90% of the cost of the new item which did not need to be purchased. The Engineer shall have the final decision on whether a piece of equipment, valving or piping may be re-used. In the instance of re-use, the Contractor shall coat to new in accordance with Section 09 90 00. Valving, piping and equipment submittals and purchases shall be preceded by an evaluation by the Contractor and the Engineer of the equipment, piping and valving scheduled for demolition.

3.04 ALTERATIONS AND CLOSURES

- A. Alterations shall conform to all Contract Documents and the directions and approvals of the Engineer.
- B. Alterations resulting in openings in existing concrete slabs, ceilings, masonry walls shall be closed and sealed, as shown or otherwise directed by Engineer. The work shall be keyed into the existing work in a manner approved by Engineer. In general, use the same or matching materials as the existing adjacent surface. The finished closure shall be a smooth, tight, sealed, permanent closure acceptable by Engineer.

3.05 CLEAN-UP

- A. Contractor shall remove from the site all debris resulting from the demolition operations as it accumulates. Upon completion of the work, all materials, equipment, waste, and all debris shall be removed, and premises shall be left clean, neat and orderly.

END OF SECTION

**SECTION 03 11 00
CONCRETE FORMING**

PART 1 GENERAL

1.01 DESCRIPTION

- A. Formwork requirements for concrete construction.

1.02 QUALITY ASSURANCE

A. References

1. The references listed below are part of this section. Where a referenced document cites other standards, such standards are included as references under this section as if referenced directly. In the event of conflict, the requirements of this section shall prevail.

Reference	Title
ACI 117	Tolerances for Concrete Construction and Materials
ACI 301	Specifications for Structural Concrete
ACI 318	Building Code Requirements for Structural Concrete
ACI 350	Code Requirements for Environmental Engineering Concrete Structures
ACI 350.5	Specifications for Environmental Concrete Structures
National Institute of Standards - PS1	Construction and Industrial Plywood

B. Design – General

1. Provide design of formwork, shoring and reshoring systems by the Contractor's Professional Engineer currently registered in the State of Florida.
2. Design, engineering, inspection and construction of formwork, shoring, and reshoring systems is the responsibility of the Contractor. Contractor's professional engineer who provided the design of formwork, shoring and reshoring system shall provide initial inspection of the formwork, shoring and any adjustment(s) after initial inspection and reshoring inspection prior to concrete pouring. Contractor shall provide a certification or a report(s) of the satisfactory completion of shoring and reshoring inspection to the Owner/Engineer.
3. Develop a procedure and schedule for removal of shores (and installation of reshores).
4. Structural record calculations, signed and sealed by the Contractor's Engineer, are required to prove that all portions of the structure, in combination with the remaining forming and shoring systems, have sufficient strength to safely support their own weight plus the loads placed thereon.
5. When developing procedures, schedules, and structural calculations; consider the structural system that exists, effects of imposed loads, and the strength of concrete at each stage of construction.

C. Design Criteria

1. Design formwork in accordance with ACI 301 and ACI 318 for building structures and ACI 350 and 350.5 for environmental structures to provide concrete finishes as specified in Section 03 30 00.
2. Design systems for full height of wet concrete pressure.
3. Design formwork to limit maximum deflection of form facing materials, as reflected in concrete surfaces exposed to view, to 1/240 of span.

1.03 SUBMITTALS

- A. Action Submittals
 1. Procedures: Section 01 33 00.
 2. Manufacturer's product data with installation instructions:
 - a. Form materials.
 - b. Form ties (with waterstops).
 - c. Form release compound.
- B. Informational Submittals
 1. Procedures: Section 01 33 00.
 2. Letter of certification:
 - a. Stating that formwork has been designed in accordance with this specification and referenced documents, sealed and stamped by the Contractor's registered design Engineer.

PART 2 PRODUCTS

2.01 FORMS

- A. Wood Forms:
 1. Provide new and unused exterior grade plywood panels manufactured in accordance with American Plywood Association (APA) and bearing the trademark of that group.
 - a. Forms for concrete surfaces exposed to view: use APA High Density Overlay (HDO) Plyform Class I Exterior 48" X 96" X 3/4".
 - b. Forms for other concrete surfaces: use APA Douglas Fir B-B Plyform Class I Exterior 48" X 96" X 3/4-inch.
 2. When approved, plywood may be reused.
- B. Metal Forms:
 1. Do not use aluminum. Provide forms free of rust and straight without dents to provide members of uniform thickness.

2.02 FORM TIES

- A. Commercially fabricated for use in form construction. Fabricated so that ends or end fasteners can be removed without causing spalling at surfaces of the concrete. Cone on ends shall be 3/4 inch to 1 inch diameter. Provide embedded portion of tie not less than 1 1/2 inch from face of concrete after cone ends have been removed. Provide ties with integral waterstops at water-retaining and below grade structures.

- B. Tapered through-bolts may be used when approved. Use 1-inch minimum diameter at the smallest end. Fill tapered tie holes after cleaning to produce watertight construction. Use a mechanical waterstop plug near the center of the wall and fill each side with non-shrink cement grout. Mechanical waterstop plug shall be Greenstreak Group, Inc. "X-Plug"; or equal.

2.03 FORM RELEASE COMPOUND

- A. Coat form surfaces in contact with concrete using a non-staining, non-residual, water based, bond-breaking form coating.

PART 3 EXECUTION

3.01 PREPARATION

- A. Cover surface of forms with form release compound prior to form installation in accordance with manufacturer's recommendations.
- B. Do not permit excess form coating material to stand in puddles on forms or hardened concrete surfaces against which fresh concrete is to be placed.
- C. Clean surfaces of forms, reinforcing steel and other embedded items of accumulated mortar, grout, or other foreign materials from previous concreting or construction activities before concrete is placed.

3.02 FORMWORK CONSTRUCTION

- A. Form vertical surfaces of cast-in-place concrete including sides of footings.
- B. Construct and place forms so that the resulting concrete will be of the shape, lines, dimensions, and appearance indicated on the Drawings. Brace or tie forms together to maintain position and shape under the load of freshly-placed concrete.
- C. Tighten forms to prevent leakage.
- D. Provide temporary openings (windows) at base of column and wall forms and at other points where necessary to facilitate cleaning and observation immediately before concrete is placed.
- E. Provide temporary openings to limit height of free fall of concrete and to limit the lateral movement of concrete during placement. Openings are required in wall placements greater than 20 feet in height, spaced no more than 8 feet on center measured horizontally and vertically.
- F. Place a 3/4-inch chamfer strip at exposed to view corners of formed surfaces.
- G. At construction joints, overlap hardened concrete surface by at least 1 inch. Brace forms against hardened concrete to prevent movement, offsets, or loss of mortar at construction joint and to maintain a true surface. Where possible, locate juncture of built-in-place forms at architectural lines, control joints, or at other inconspicuous lines.

- H. Construct wood forms for openings to facilitate loosening. Anchor forms so that movement of any part of the formwork system is prevented during concrete placement.
- I. At platforms constructed to move equipment over in-place reinforcement, provide beams, struts, and/or legs, supported directly on formwork or other structural members without resting on reinforcing steel.
- J. Provide a positive means of adjustment (wedges or jacks) at shores and struts to take up settlement during concrete placement. Brace forms against lateral deflection. Fasten in-place wedges and shims used for final adjustment of forms prior to concrete placement.
- K. Place tapered through-bolt form ties with the larger end on the side of the structure in contact with liquid.

3.03 TOLERANCES

- A. Install formwork with tolerances in accordance with ACI 117 and the following (the more stringent requirement controls):
 - 1. Install formwork in accordance with manufacturer's written instructions.
 - 2. Vertical surface tolerance from plumb; walls, columns, piers, and risers:
 - ± 1/2 inch for entire height
 - ± 1/4 inch in any 10 feet of height
 - 3. Vertical surface tolerance from plumb; exposed wall corners, end columns, control-joint grooves, and other exposed to view vertical lines:
 - ± 1/2 inch for entire height
 - ± 1/4 inch in any 20 feet of height
 - 4. Horizontal variation from level or from grade; top of slabs, slab soffits, ceilings, and beam soffits, measured before removal of supporting shores:
 - ± 3/4 inch for entire length
 - ± 3/8 inch for any bay or 20 foot length
 - ± 1/4 inch in any 10 feet of length
 - 5. Horizontal variation from level or from grade; exposed lintels, sills, parapets, horizontal grooves, and other exposed-to-view horizontal lines:
 - ± 1/2 inch for entire length
 - ± 1/4 inch in any 20 feet of length.
 - 6. Plan position variation; columns, walls, and partitions:
 - ± 3/4 inch for entire length
 - ± 3/8 inch for any bay or 20 foot length
 - 7. Plan location and size; sleeves, floor openings, walls, wall openings, beams, and columns:
 - ± 1/2 inch
 - 8. Cross sectional dimensions; columns and beams and thickness of slabs and walls:
 - ± 3/8 inch
 - 9. Plan dimensions; footings and foundations:
 - minus 1/2 inch
 - + 2 inches

10. Misplacement or eccentricity; footings and foundations:
2 percent of footing width in direction of misplacement
not more than 2 inches
 11. Thickness; footings and foundations:
minus 5 percent
no limit on the maximum increase except that which may interfere with other construction.
 12. Step variance in flight of stairs:
Rise $\pm 1/16$ inch
Tread from level $\pm 1/8$ inch
- B. Use control points and benchmarks for reference purposes to check tolerances. Establish and maintain reference points in an undisturbed condition until final completion and acceptance of the work.
 - C. Regardless of tolerances listed, no portion of a structure shall extend beyond the legal boundary of work site.
 - D. Camber formwork to compensate for anticipated deflections in formwork under wet load of concrete. Adjust camber to maintain above specified tolerances in hardened concrete after forms and shoring are removed.

3.04 REMOVAL OF FORMS

- A. Do not impose construction loads or remove shoring from any part of the structure until that portion of the structure in combination with remaining forming and shoring systems has sufficient strength to safely support its weight and loads placed thereon.
- B. If forms are loosened and not removed, proceed same day with wet curing operations to soak surfaces of concrete where forms are loosened. When wet curing is not practical or not planned, loosen, remove, and start approved curing procedures on the same day.
- C. When required for concrete curing in hot weather, required for repair of surface defects, or when required for finishing at an early age; remove forms as soon as concrete has hardened sufficiently to resist damage from removal operations or lack of support.
- D. Remove top forms on sloping surfaces as soon as concrete has attained sufficient stiffness to prevent sagging. Make repairs or finishing treatment on such sloping surfaces immediately after form removal.
- E. Remove wood forms for wall openings as soon as this can be accomplished without damage to concrete.
- F. Remove formwork from columns, walls, sides of beams, and other parts not supporting weight of concrete as soon as concrete has hardened sufficiently to resist damage from removal.
- G. When shores and supports are so arranged such that non-load-carrying form facing material can be removed without loosening or disturbing other shores and supports, facing material may be removed when concrete has sufficiently hardened to resist damage from removal.

- H. In all cases, proceed with curing same day as form removal.
- I. Where no reshoring is planned, forms and shoring used to support weight of concrete shall be left in place until concrete has attained its specified 28-day compressive strength.

3.05 RESHORING

- A. Do not impose construction loads or remove shoring from any part of the structure until that portion of the structure, in combination with remaining forming and shoring systems, has sufficient strength to safely support its weight and loads placed thereon.
- B. While reshoring is underway, no superimposed dead or live loads are permitted on the new construction.
- C. During reshoring, do not subject concrete in structural members to combined dead and construction loads in excess of loads that the structural members can adequately support.
- D. Place reshores as soon as practicable after stripping operations are complete, but in no case later than the end of working day on which stripping occurs.
- E. Place reshores to carry their required loads without overstressing.
- F. Where a reshoring procedure is planned, supporting formwork may be removed when concrete has reached the concrete strength specified by the formwork engineer's structural calculations and verified by field cured test cylinders or other approved method.

END OF SECTION

SECTION 03 20 00
CONCRETE REINFORCING

PART 1 GENERAL

1.01 DESCRIPTION

A. Section includes: Reinforcing steel for use in reinforced concrete.

1.02 REFERENCES

A. The references listed below are a part of this section. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
ACI 117	Specification for Tolerances for Concrete Construction and Materials
ACI 315	Details and Detailing of Concrete Reinforcement
ACI 318	Building Code Requirements For Structural Concrete
ACI SP-66	ACI Detailing Manual
ASTM A615	Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A706	Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A1064	Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
AWS D1.4	Structural Welding Code - Reinforcing Steel
CRSI-PRB	Placing Reinforcing Bars
CRSI-MSP	Manual of Standard Practice
FEDSPEC QQ-W-461H	Wire, Steel, Carbon (Round, Bare, and Coated)

1.03 SUBMITTALS

A. Action Submittals

1. Procedures: Section 01 33 00.
2. A copy of this specification section with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.
3. Check-marks (✓) shall denote full compliance with a paragraph as a whole. Deviations shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Include a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
4. Mill certificates of mill analysis, tensile, and bend tests for all reinforcing.

5. Manufacturer and type of proprietary reinforcing steel splices. Submit a current ICC Report and manufacturer's literature that contains instructions and recommendations for each type of coupler used.
6. Qualifications of welding operators, welding processes and procedures.
7. Reinforcing steel shop drawings showing reinforcing steel bar quantities, sizes, spacing, dimensions, configurations, locations, mark numbers, lap splice lengths and locations, concrete cover and reinforcing steel supports. Reinforcing steel shop drawings shall be of sufficient detail to permit installation of reinforcing steel without reference to the contract drawings. Shop drawings shall not be prepared by reproducing the plans and details indicated on the contract drawings but shall consist of completely redrawn plans and details as necessary to indicate complete fabrication and installation of reinforcing steel, including large scale drawings at joints detailing bar placement in congested areas. Placement drawings shall be in accordance with ACI 315. Reinforcing details shall be in accordance with ACI SP-66.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Ship reinforcing steel to the jobsite with attached plastic or metal tags having permanent mark numbers which match the shop drawing mark numbers. All reinforcing shall be supported and stored above ground. Use only plastic tags secured to the reinforcing steel bars with nylon or plastic tags for epoxy coated reinforcing steel bars.

PART 2 PRODUCTS

2.01 BAR REINFORCEMENT

- A. Reinforcing steel bars shall be deformed billet steel in conformance with ASTM A615, Grade 60. Bars to be welded shall be deformed billet steel conforming to ASTM A706.

2.02 WIRE FABRIC

- A. Wire fabric shall be welded steel mesh conforming to ASTM A1064.

2.03 WIRE AND PLAIN BARS

- A. Wire used as reinforcement and bars used as spiral reinforcement in structures shall be cold drawn steel conforming to ASTM A1064.

2.04 SMOOTH DOWEL BARS

- A. Smooth dowel bars shall conform to ASTM A615, Grade 60, with a metal end cap at the greased or sliding end to allow longitudinal movement.

2.05 REINFORCING STEEL MECHANICAL SPLICES

- A. Reinforcing steel mechanical splices shall be a positive connecting threaded type mechanical splice system manufactured by Erico, Inc., Dayton Superior, Williams Form Engineering Company, or approved equal.
- B. Type 1 mechanical splices shall develop in tension or compression a strength of not less than 125 percent of the ASTM specified minimum yield strength of the reinforcement and shall meet all other ACI 318 requirements. Where splices at the face of wall are

shown or approved, form saver-type mechanical couplers may be used. Form-saver couplers shall have integral plates designed to positively connect coupler to formwork. Type 1 mechanical splices are typical except for locations as noted on drawings..

2.06 TIE WIRE

- A. The wire shall be minimum 16 gage annealed steel conforming to FEDSPEC QQ-W-461H.

2.07 BAR SUPPORTS

- A. Bar supports coming into contact with forms shall be CRSI Class 1 plastic protected or Class 2 stainless steel protected and shall be located in accordance with CRSI-MSP and placed in accordance with CRSI-PRB. Plastic coating on legs shall extend at least 0.5-inch upward from form surface.
- B. Provide precast concrete blocks, four inches square in plan, with embedded tie wires (wire dobies) as specified by CRSI 1 MSP for footing and slabs on grade. Do not use brick, broken concrete masonry units, spalls, rocks, construction debris, or similar material for supporting reinforcing steel. Precast concrete blocks shall have same or higher compressive strength as specified for concrete in which they are located.
- C. Provide stainless steel or plastic protected plain steel supports for other work.

2.08 FABRICATION:

- A. Fabricate reinforcing steel bars in accordance with ACI 315 and the following tolerances:
 - 1. Sheared lengths: +/-1 inch.
 - 2. Overall dimensions of stirrups, ties, and spirals: +/-1/2 inch.
 - 3. All other bends: +0 inch, -1/2 inch
 - 4. Minimum diameter of bends of reinforcing steel bars: Per ACI 318.

PART 3 EXECUTION

3.01 PLACEMENT TOLERANCE

- A. Reinforcing steel placement tolerance shall conform to the requirements of ACI 117, ACI 318, and the following:
 - 1. Reinforcing steel bar clear distance to formed surfaces shall be within +/-1/4 inch of specified clearance and minimum spacing between bars shall be a maximum of 1/4 inch less than specified.
 - 2. Reinforcing steel top bars in slabs and beams shall be placed +/-1/4 inch of specified depth in members 8 inches deep or less and -1/4", +1/2 inch of specified depth in members greater than 8 inches deep.
 - 3. Reinforcing steel spacing shall be placed within +/- one bar diameter or +/- 1 inch, whichever is greater.
 - 4. The minimum clear distance between reinforcing steel bars shall be equal to the greater of 1 inch or the reinforcing steel bar diameter for beams, walls and slabs, and the greater of 1 1/2 inches or 1.5 times the reinforcing steel bar diameter for columns.

5. Beam and slab reinforcing steel bars shall be threaded through column vertical reinforcing steel bars without displacing the column reinforcing steel bars and still maintain clear distances for beam and slab reinforcing steel bars.

3.02 CONCRETE COVER

- A. Unless specified otherwise on the Drawings, reinforcing steel bar cover shall conform to the following:
 1. Reinforcing steel bar cover shall be 3 inches for concrete cast against earth.
 2. Reinforcing steel bar cover shall be 2 inches for reinforcing steel bars for formed concrete surfaces exposed to earth and weather.
 3. Reinforcing steel bar cover shall be 2 inches for any formed surfaces exposed to or above any liquid.
 4. Reinforcing steel bar cover shall be 1 ½ inches for reinforcing not in the above categories unless noted otherwise on the design drawings.

3.03 SPLICING

- A. Reinforcing steel splicing shall conform to the following:
 1. Use Class B splice lengths in accordance with ACI 318 for all reinforcing steel bars unless shown otherwise on the drawings.
 2. For welded wire fabric the splice lap length measured between the outermost cross wires of each fabric sheet shall not be less than one spacing of cross wires plus 2 inches, nor less than 1.5 times the development length nor less than 6 inches.
 3. Splices of reinforcement steel bars not specifically indicated or specified shall be subject to the approval of the Owner's Representative. Mechanical proprietary splice connections may be used when approved by the Owner's Representative or as indicated on the drawings.
 4. Welding of reinforcing steel bars is not allowed unless approved by the Owner's Representative.

3.04 CLEANING

- A. Reinforcing steel bars at time of concrete placement shall be free of mud, oil, loose rust, or other materials that may affect or reduce bond. Reinforcing steel bars with rust, mill scale or a combination of both may be accepted without cleaning or brushing provided dimensions and weights including heights of deformation on a cleaned sample are not less than required by applicable ASTM standards.

3.05 PLACEMENT

- A. Reinforcing steel bar placement shall conform to the following:
 1. Uncoated reinforcing steel bars shall be supported and fastened together to prevent displacement by construction loads or concrete placement. For concrete placed on ground, furnish concrete block supports or metal bar supports with non-metallic bottom plates. For concrete placed against forms furnish plastic or plastic coated metal chairs, runners, bolsters, spacers and hangers for the reinforcing steel bar support. Only tips in contact with the forms require a plastic coating.

2. Where parallel horizontal reinforcement in beams is indicated to be placed in two or more layers, reinforcing steel bars in the upper layers shall be placed directly over the reinforcing steel bars in the bottom layer with the clear distance between each layer to be 2 inches unless otherwise noted on the Drawings. Place spacer reinforcing steel bars at a maximum of 3'-0" on center to maintain the minimum clear spacing between layers.
3. Extend reinforcement to within 2 inches of formed edges and 3 inches of the concrete perimeter when concrete is placed against earth.
4. Reinforcing steel bars shall not be bent after embedding in hardened concrete unless approved by the Owner's Representative.
5. Tack welding or bending reinforcing steel bars by means of heat is prohibited.
6. Where required by the contract documents, reinforcing steel bars shall be embedded into the hardened concrete utilizing an adhesive anchoring system specifically manufactured for that application. Installation shall be per the manufacturer's written instructions.
7. Bars with kinks or with bends not shown shall not be used.
8. Heating or welding bars shall be performed in accordance with AWS D1.4 and shall only be permitted where specified or approved by the Owner's Representative. Bars shall not be welded at the bend.

3.06 FIELD QUALITY CONTROL

- A. Field quality control shall include the following:
 1. Notify the Owner's Representative whenever the specified clearances between the reinforcing steel bars cannot be met. The concrete shall not be placed until the Contractor submits a solution to the congestion problem and it has been approved by the Owner's Representative.
 2. The reinforcing steel bars may be moved as necessary to avoid other reinforcing steel bars, conduits or other embedded items provided the tolerance does not exceed that specified in this section. The Engineer's approval of the modified reinforcing steel arrangement is required where the specified tolerance is exceeded. No cutting of the reinforcing steel bars shall be done without written approval of the Owner's Representative.
 3. An independent laboratory shall be employed to review and approve Contractor welding procedures and qualify welders in accordance with AWS D1.4. The laboratory shall visually inspect each weld for visible defects and conduct non-destructive field testing (radiographic or magnetic particle) on not less than one sample for each 10 welds. If a defective weld is found, the previous 5 welds by the same welder shall also be tested.

END OF SECTION

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Cast-in-place concrete, which consists of providing material, mixing, transporting equipment, and labor for the proportioning, mixing, transporting, placing, consolidating, finishing, curing, and protection of concrete in the structure.

1.02 RELATED SECTIONS

- A. This section contains specific references to the following related specification sections. Additional related sections may apply that are not specifically listed below.
1. Section 03 60 00 Grouting
 2. Section 03 70 00 Mass Concrete
 3. Section 05 50 00 Metal Fabrications
 4. Section 07 91 26 Joint Fillers
 5. Section 07 92 00 Joint Sealants
 6. Section 09 90 00 Painting and Coating

1.03 REFERENCES

- A. The references listed below are a part of this section. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
ACI 117	Specification for Tolerances for Concrete Construction and Materials
ACI 211.1	Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete
ACI 214R	Guide to Evaluation of Strength Test Results in Concrete
ACI 301	Specifications for Structural Concrete
ACI 305.1	Specification for Hot Weather Concreting
ACI 306.1	Standard Specification for Cold Weather Concreting
ACI 318	Building Code Requirements for Structural Concrete
ACI 350	Code Requirements for Environmental Engineering Concrete Structures
ACI 350.1	Specification for Tightness Testing of Environmental Engineering Concrete Containment Structures
ACI 503.7	Specification for Crack Repair by Epoxy Injection
ASTM A126	Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM C31	Making and Curing Concrete Test Specimens in the Field
ASTM C33	Concrete Aggregates
ASTM C39	Compressive Strength of Cylindrical Concrete Specimens
ASTM C42	Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C94	Ready-Mixed Concrete

Reference	Title
ASTM C117	Materials Finer Than 75- μ m (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C131	Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136	Sieve Analysis of Fine and Coarse Aggregates
ASTM C143	Slump of Hydraulic Cement Concrete
ASTM C150	Portland Cement
ASTM C157	Length Change of Hardened Hydraulic-Cement Mortar and Concrete
ASTM C172	Sampling Freshly Mixed Concrete
ASTM C192	Making and Curing Concrete Test Specimens in the Laboratory
ASTM C231	Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260	Air-Entraining Admixtures for Concrete
ASTM C309	Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C494	Chemical Admixtures for Concrete
ASTM C511	Mixing Rooms, Moist Cabinets, Moist Rooms, and Water Storage Tanks Used in the Testing of Hydraulic Cements and Concretes
ASTM C595	Blended Hydraulic Cements
ASTM C618	Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C881	Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C989	Slag Cement for use in Concrete and Mortars
ASTM C1059	Latex Agents for Bonding Fresh to Hardened Concrete
ASTM C1077	Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
ASTM C1240	Silica Fume Used in Cementitious Mixtures
ASTM C1260	Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C1293	Determination of Length Change of Concrete Due to Alkali-Silica Reaction
ASTM C1315	Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete
ASTM C1567	Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)
ASTM C1602	Mixing Water Used in the Production of Hydraulic Cement Concrete
ASTM D75	Sampling Aggregates
ASTM D2419	Sand Equivalent Value of Soils and Fine Aggregate
ASTM E329	Agencies Engaged in Construction Inspection, Testing, or Special Inspection
CRD-C572	U.S. Corps of Engineer's Specifications for Polyvinylchloride Waterstop
FBC	Florida Building Code with local amendments

1.04 SUBMITTALS

A. Action Submittals:

1. Procedures: Section 01 33 00.
2. A copy of this specification section with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.
3. Check-marks (✓) denote full compliance with a paragraph as a whole. Deviations shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined signify compliance with the specification. Include a detailed, written justification for each

deviation. Failure to include a copy of this marked-up specification section, along with justification(s) for requested deviations, with the submittal, is cause for rejection of the entire submittal with no further consideration.

4. Each proposed mix design showing:
 - a. Expected strength at 7 and 28-days
 - b. Slump, before and after introduction of high-range water-reducing admixture
 - c. Water/cement ratio
 - d. Weights and test results, certifications, and mill reports of the ingredients
 - e. Chemical analysis report and report of other specified test analyses for supplementary cementitious material
 - f. Aggregate gradation and documentation of test results classifying aggregate as non-potentially reactive
 - g. Test results of mix design prepared by an independent testing laboratory
 - h. Shrinkage test results for liquid containing structures
 - i. Other physical properties necessary to review each mix design for conformance with these specifications
5. Mix designer shall be certified as NRMCA Concrete Technologist Level 2 or DOT certified mix designer in jurisdiction of Work.
6. Product literature and technical data for aggregates, cement, and pozzolan.
7. Product literature, technical data, and dosage of proposed admixtures including, but not limited to, air entraining, water reducing, retarding, shrinkage reducing, crystalline waterproofing, etc.
8. Anticipated average delivery time from batch plant to site. If this time exceeds the limit specified in Part 3, include proposed method to extend set time without deleterious effects on final product. Owner's Representative reserves the right to accept or reject such proposed methods.
9. Lift Drawings: Submit shop drawings for concrete placements on the project before on-site construction begins. The drawings shall be organized by structure and submitted as a complete set for the Engineer's review. The drawings shall be drawn to scale and show dimensions, forming details, and placement volumes. Show location of construction joints, details of surface preparation, scheduled finish, embedments (including conduits, inserts, and anchor bolts), penetrations (including pipe sleeves), openings, keyways, blockouts, bulkheads, etc. The drawings shall clearly show the placement sequence and will be accompanied by a schedule that shows the schedule dates for forming, placement, and stripping for each section of concrete placed within each structure.
10. Curing program description in sufficient detail to demonstrate that the Contractor will provide acceptable strength, finish, and crack control within the completed structure. Detailed plan for curing and protection of concrete in cold and hot weather.
11. Product literature and technical data for waterstops, curing and sealing compounds, bonding compounds, surface hardeners, epoxy and chemical grout for crack injection, retardant, bearing pads, and trench drains.
12. Sample panels at least 12-inches by 12-inches by three inches thick to demonstrate formed wall surface finishes as specified in Part 3.
13. Samples of concrete floor and slab for each finish specified in Part 3 approximately four feet square and a minimum of four inches thick, with one construction joint and one expansion joint, if used.

14. Concrete delivery truck tickets showing the information listed in ASTM C94, section 14.
15. Neoprene bearing pad sample, 4 inches x 4 inches; material data sheets verifying conformance with specification; shop drawing of each bearing pad showing splice locations, if any, and description of manufacturing and splice procedure.
16. Product data for prefabricated trench drains: material properties, cover, dimensions, and manufacturer's installation instructions
17. Product data for floor type pressure relief valves

1.05 QUALITY ASSURANCE

A. Quality Control By Owner

1. Special Inspection of concrete work shall be performed by the Special Inspector under contract with the Owner and in conformance with the IBC Chapter 17. Special Inspection of concrete is in addition to, not replacing, other inspections and quality control requirements specified herein. Where sampling and testing specified herein conforms to Special Inspection standards, such sampling and testing need not be duplicated.
2. All structural concrete work shall receive Special Inspection in accordance with IBC Chapter 17. Structural concrete includes elements which resist code-defined loads and whose failure would impact life safety. Non-structural site work concrete does not require Special Inspection. Anchor bolts and anchors installed in hardened concrete require Special Inspection.
3. Refer to Section 01 45 20 Testing and Inspection Services for Owner provided testing.

B. Quality Control By Contractor

1. Where required to demonstrate conformance with the specified requirements for cast-in-place concrete, the Contractor shall provide the services of an independent testing laboratory which complies with the requirements of ASTM E329 and ASTM C1077. The testing laboratory shall sample and test concrete materials as specified in this section. Costs of testing laboratory services shall be borne by the Contractor.
2. Concrete testing laboratory personnel shall be certified in accordance with the ACI Concrete Laboratory Testing Technician – Level 1 Certification Program or the ACI Concrete Strength Testing Technician Certification Program, or an equivalent program.
3. Refer to Section 01 45 00 Contractor Quality Control.

C. Basis For Quality

1. Cast-in-place concrete shall conform to the requirements of ACI 301, except as modified herein.

D. Concrete Conference

1. Contractor shall schedule and conduct a meeting to review the specification requirements and the proposed concrete design mixes, including procedures for producing proper concrete construction. Hold the meeting no later than 28 days after the Notice to Proceed.
2. All parties involved in the concrete work shall be included to attend the conference, including the following: Contractor's representative, testing laboratory, concrete

subcontractor, concrete supplier, reinforcing steel subcontractor, Owner's Representative, and Engineer.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cement

1. Portland cement shall be ASTM C150, Type II or Type V, low alkali, containing less than 0.60 percent alkalis. In addition to standard requirements, cement shall satisfy optional chemical and physical requirements of ASTM C150, Tables 2 and 4, respectively.
2. If low alkali portland cement is not available, test results shall be submitted showing aggregates meet the alkali-silica reactivity criteria in 2.01.D.1.b below
3. Portland-pozzolan cement shall be ASTM C595, Type IP (MS), interground, low alkali.
4. Portland blast-furnace slag cement shall be ASTM C595, Type IS (MS), interground, low alkali.
5. Use cementitious materials that are of the same brand and type and from the same plant of manufacture as the cementitious materials used in the concrete represented by the submitted field test records or used in the trial mixtures. See Change of Materials paragraph below.

B. Ground granulated blast-furnace slag (GGBFS), if used in conjunction with portland cement, shall be per ASTM C989, Grade 100 or Grade 120, limited to 50 percent of the weight of cementitious materials. If GGBFS is combined with pozzolans and/or silica fume, the total weight of GGBFS, pozzolans, and silica fume shall not exceed 50 percent of the weight of cementitious materials.

C. Silica fume, if used in conjunction with portland cement, shall be per ASTM C1240, limited to 10 percent of the weight of cementitious materials. Silica fume shall be used with a high-range water-reducing admixture.

D. Aggregates

1. General

- a. Except as modified herein, fine and coarse aggregates shall conform to ASTM C33. Fine and coarse aggregates are regarded as separate ingredients. Aggregates shall be non-reactive and washed before use.
- b. Check aggregates for alkali-silica reactivity to meet the following criteria. Aggregates or combinations of cementitious materials and aggregates shall have less than 0.10% expansion at 16 days when tested in accordance with ASTM C1260 or ASTM C1567. Alternatively, aggregate tested independently in accordance with ASTM C1293 shall have less than 0.04% expansion at one-year, or combinations of aggregate and cementitious materials tested in accordance with ASTM C1293 shall have less than 0.04% expansion at two years. Test results shall be no older than two years.
- c. Tests for size and grading of fine and coarse aggregates shall be in accordance with ASTM C136. Combined aggregates shall be well and uniformly graded from coarse to fine sizes to produce a concrete that has optimum workability and consolidation characteristics. Establish the final combined aggregate gradation during mix design.

- d. Aggregates used in the project production concrete shall be obtained from the same sources and have the same size ranges as the aggregates used in the concrete represented by the submitted historical data or trial mixtures. See Change of Materials paragraph below.
2. Fine Aggregate
- a. Fine aggregate shall be hard, dense, durable particles of either sand or crushed stone regularly graded from coarse to fine. Gradation shall conform to ASTM C33. For classes of concrete which will be used in liquid retaining structures, fine aggregate shall not exceed 40 percent by weight of combined aggregate total, except for concrete with coarse aggregate of less than maximum size 1/2 inch.
 - b. Variations from the specified gradations in individual tests will be acceptable if the average of three consecutive tests is within the specified limits and the variation is within the permissible variation listed below:

U.S. standard sieve size	Permissible variation in individual tests, percent
30 and coarser	2
50 and finer	0.5

- c. Other tests shall be in accordance with the following specifications:

Test	Test method	Requirements
Amount of material	ASTM C117	3 percent passing No. 200 sieve maximum by weight
Sand equivalent	ASTM D2419	Minimum 70 percent

3. Coarse Aggregate
- a. Coarse aggregate shall be hard, dense and durable gravel or crushed rock free from injurious amounts of soft and friable particles, alkali, and organic matter. Other deleterious substances shall not exceed the limits listed in ASTM C33, Table 4 for Class Designation 4S. Gradation of each coarse aggregate size specified shall conform to ASTM C33, Table 3.
 - b. Variations from the specified gradations will be acceptable in individual tests if the average of three consecutive tests is within the specified limits.

E. Pozzolan

- 1. Pozzolan shall be Class N, natural pozzolan, or Class F fly ash conforming to ASTM C618. Class C fly ash is not allowed. Pozzolan supplied during the life of the project shall have been formed at the same single source. See Change of Materials paragraph below.
- 2. The pozzolan color shall not substantially alter the resulting concrete from the normal gray color and appearance.
- 3. Use pozzolan materials that are of the same brand and type and from the same plant of manufacture as the materials used in the concrete represented by the submitted field test records or used in the trial mixtures.
- 4. The loss on ignition shall be a maximum of four percent.
- 5. The maximum percent of sulfur trioxide (SO₃) shall be 4.0

F. Admixtures

- 1. General

- a. Admixtures shall be compatible with the concrete and with each other. Calcium chloride or admixtures containing calcium chloride are not acceptable. Use admixtures in accordance with the manufacturer's recommendations and add separately to the concrete mix. Water reducing retarders and admixtures shall reduce the water required by at least 11 percent for a given concrete consistency and shall comply with the water/cement ratio standards of ACI 211.1. Retarder dosage shall result in set time consistent with requirements specified in Part 3.
2. Water Reducing Admixtures
 - a. Conform to ASTM C494, Type A. Acceptable products include: BASF Corporation "MasterPozzolith Series"; Sika Chemical Corp. "Plastocrete 161"; Euclid Chemical Co. "Eucon WR 91"; or approved equal.
3. Water Reducing and Retarding Admixtures
 - a. Conform to ASTM C494, Type D. Acceptable products include: BASF Corporation "MasterSet R Series"; Sika Chemical Corp. "Plastiment"; Euclid Chemical Co. "Eucon Retarder 75"; or approved equal.
4. High Range Water Reducing (Superplasticizing) Admixtures
 - a. Conform to ASTM C494, Type F. Acceptable products include: BASF Corporation "MasterGlenium" Series; Sika Chemical Corp. "Viscocrete 2100" or "Viscocrete 2110" (Hot Weather) or "Viscocrete 6100" (Cold Weather); Euclid Chemical Co. "Eucon 37"; GCP Applied Technologies "ADVA 195"; or approved equal.
5. High Range Water Reducing And Retarding Admixtures
 - a. Conform to ASTM C494, Type G. Acceptable products include: GCP Applied Technologies "Daracem 100"; Sika Chemical Corp. "Sikaplast 200" ; Euclid Chemical Co. "Eucon 537"; or approved equal.
6. Air Entraining Agent
 - a. Conform to ASTM C260 and produce air entrained concrete as specified in the Mix Proportioning table below. Acceptable products include: BASF Corporation "MasterAir Series"; Sika Chemical Corp. "Sika AEA-14" or "Sika AIR" ; Euclid Chemical Co. "Eucon AEA-92"; or approved equal.
7. Shrinkage Reducing Admixture
 - a. Select admixture for compatibility with air entrainment admixture and other ingredients in the concrete mix. Acceptable products include: BASF Corporation "MasterLife SRA Series"; GCP Applied Technologies "Eclipse 4500"; or approved equal.
8. Crystalline Waterproofing Admixture:
 - a. Select admixture for compatibility with other ingredients in the concrete mix. Acceptable products include: Penetron International "PENETRON ADMIX SB", Xypex "Admix C-Series", Kryton "Krystol Internal Membrane (KIM)", BASF Corporation "MasterLife 300D", or approved equal.
9. Corrosion Inhibiting Admixture
 - a. Select admixture for compatibility with other ingredients in the concrete mix. Acceptable products include: BASF "MasterLife CI 222", GCP Applied Technologies "DCI S", Sika "CNI" or approved equal.

G. Water

1. For washing aggregate, mixing, and for curing shall be free from oil and deleterious amounts of acids, alkalis, and organic materials; comply with the requirements of

ASTM C1602. Additionally, water used for curing shall not contain an amount of impurities sufficient to discolor the concrete.

H. Change of Materials

1. After each concrete mix design is approved, no changes of any sort or source will be allowed without prior written approval from the Engineer. When brand, type, size, or source of cementitious materials, aggregates, water, ice, or admixtures are proposed to be changed, new field data, data from new trial mixtures, or evidence that indicates that the change will not affect adversely the relevant properties of the concrete shall be submitted for approval by the Engineer before use in concrete.

2.02 CONCRETE CHARACTERISTICS

A. Mix Proportioning

1. Concrete shall be normal weight concrete composed of cement, pozzolan, admixtures, aggregates, and water; proportioned and mixed to produce a workable, strong, dense, and impermeable concrete. It is acceptable to substitute interground Portland-pozzolan cement conforming to ASTM C595, containing the specified amount of pozzolan in lieu of Portland cement and pozzolan. Water-cementitious material (w/cm) ratio is based on the combined contents of cement and pozzolan.
2. Add crystalline waterproofing admixture to Class C-1 concrete used for liquid containing structures and below-grade walls and slabs which are common with rooms, tunnels, and galleries to be occupied by equipment, piping, conduit, or personnel. Dosage rates in accordance with manufacturer's recommendations.
3. Add corrosion inhibiting admixture to Class A, C-1, and C-2 mixes.
4. Provide concrete mix designs in accordance with the following guidelines:

Concrete class	Minimum ^a 28-day compressive strength, psi	ASTM coarse aggregate size	Maximum water-cementitious materials (w/cm) ratio	Minimum cementitious materials content (pounds/CY)	Pozzolan, percent by weight of cementitious materials	Air content (percent)	Slump range ^f (inches)
A ^h	4000 ^b	467	0.42	515	20-35	4-6	3-5
B	3000	57 or 67	0.45	560	15-25 ^d	4-6	3-5
C-1 ^h	4500	57 or 67	0.40	560	15-25	4-6	3-5
C-2 ^h	5000	57 or 67	0.42	560	15-25 ^d	4-6	3-5
C-3 ^h	4500	57 or 67	0.4	560	15-20	4-6	3-5
D-1 ^h	4000	8	0.42	600	15-25 ^d	4-6	3-5
E ^c	2000	57	--	-	15-25 ^d	Not Required	4-8

^a Determine compressive strength at the end of 28 days based on test cylinders made and tested in accordance with ASTM C39.

^b Compressive strength of Class A concrete may be determined at 56 days.

^c Concrete encasement for electrical conduit shall contain 3 pounds of red oxide per sack of cement.

^d Pozzolan use is optional for this class of concrete.

^e Minimum 28-day compressive strength shall be 500 psi and maximum 28-day compressive strength shall be 1,000 psi.

^f Slump before addition of high range water reducing admixture (superplasticizer). Maximum slump after addition of high range water reducing admixture shall be 8".

^g The CONTRACTOR shall be responsible for producing a flowable mixture using these guidelines and by adjusting his mixture design and submit for review and approval. Flowable fill material shall be proportioned to produce a 28-day compressive strength of approximately 50-125 psi. Flowable fill general mix design quantities are as follows : Cement = 75-100 pounds/CY, Fly Ash or Granulated Blast Furnace Slag = 0-600 pounds/CY, Fine Sand = 2,750 pounds/CY (adjusted to yield one cubic yard of flowable fill), Water = As required to produce a consistency that will result in a flowable self-leveling product at time of placement. Unit weight of flowable fill material shall be between 90-110 pounds/cubic feet. The flowability can be measured by afflux time determined in accordance with ASTM C 939 and shall be 30 seconds ± 5 seconds as measured on mortar passing the No. 4 sieve. The equipment required to perform this test shall be provided by the CONTRACTOR. Approved mixes for flowable fill are per FDOT Design Mixes for Excavatable Flowable Fill per FDOT Section 121.

^h Use 5 to 6% microsilica by weight of cement in the mix design & approximately 5 gallon/cu.yard of corrosion inhibiting additives for all below grade concrete. Use approximately 2 gallon/cu.yard of corrosion inhibiting additives for all above grade concrete work. Quantity of corrosion inhibiting additives shown are approximate and subject to manuf. recommendation.

B. Use

C. Use

1. Provide concrete by class for the uses listed below.

Concrete class	Type of use
A	Concrete greater than 36 inches thick See Section 03 70 00 for additional requirements
B	Non-structural concrete (sidewalks, curbs, pavers, etc.)
C-1	Typical cast-in-place structural concrete
C-2	Precast concrete
D-1	Topping concrete (Precast Concrete Topping), flume interstitial "grout", and 2" concrete topping at clarifiers
C-3	Auger Cast Pile concrete, All below grade concrete
E ^a	Pipe bedding and encasement, electrical conduit encasement (duct banks) and concrete fill
F	Flowable Fill
[G	Tremie slab concrete]

^a Contractor's option to use the same concrete mix for pipe encasement as the concrete slab above.

D. Control Tests

1. General

- a. Select and adjust proportions of ingredients in accordance with ACI 211.1. Verification of mix characteristics for submittal may be achieved using either the Trial Mix Design method or Field Experience Data method. Do not place concrete prior to submittal and acceptance of proposed mix.

2. Trial Mix Design

- a. Mixes verified by this method shall have the samples produced for testing, manufactured at the batch plant which will supply concrete to the project, using materials proposed for the Work and material combinations listed above. Testing, data, and reporting shall conform to ACI 318 and the following:

- 1) Required compressive strength used as the basis for selecting concrete proportions (f'_{cr}) shall be the specified concrete strength (f'_c) + 1000 psi for specified concrete strengths less than 3,000 psi and f'_c + 1200 psi for specified concrete strengths between 3000 psi and 5000 psi.
 - 2) Make at least three different trial mixtures for each class of concrete qualified by the Trial Mix Design. Each trial mixture shall have a different w/cm ratio or different cementitious materials content that will produce a range of compressive strengths encompassing f'_{cr} .
 - 3) Design trial mixtures to produce a slump within $\frac{3}{4}$ inch of the maximum specified and an air content within 0.5 percent of the maximum specified.
 - 4) For each w/cm ratio or cementitious materials content, cast and cure at least twelve standard test cylinders in accordance with ASTM C192. Four cylinders from each batch tested at age 7-days, 14-days, and 28-days or as required to comply with ACI 318.
 - 5) From results of the cylinder tests, plot a curve showing the relationship between w/cm ratio and compressive strength.
 - 6) From the curve of w/cm ratio versus compressive strength, select the w/cm ratio that will produce f'_{cr} . This is the maximum w/cm ratio to be used unless a lower w/cm ratio is specified above.
3. Field Experience Data:
- a. When sufficient test data for a particular mix design is available which is identical or substantially similar to that proposed for use, Contractor may substitute use of this data in lieu of a trial mix design. Field data, reports, and analysis shall conform to ACI 318, except as modified herein.
 - 1) Historical mix design proportions for which data are submitted may vary from the specified mix within the following limits:
 - a) f'_c as specified or up to 500 psi above
 - b) w/cm ratio as specified or lower
 - c) pozzolan content within 5 percent of that specified
 - d) maximum coarse aggregate size may not vary smaller, but gradation of coarse aggregate may vary
 - e) slump after introduction of admixtures +0/-1 inch.
 - b. Use of historical Field Experience Data does not allow modification of the project mix specifications herein without review and acceptance by the Engineer.
4. Shrinkage:
- a. Liquid containing structures using Class C-1 concrete mix are intended to be watertight. Provide test results for Class C-1 concrete mix meeting the following requirement: drying shrinkage limit of 0.038 percent in the laboratory at 35-days (7-days moist cure and 28-days drying) as tested in accordance with ASTM C157 and the following modifications:
 - 1) Wet cure specimens for a period of 7-days (including the period of time the specimens are in the mold). Wet cure may be achieved either through storage in a moist cabinet or room in accordance with ASTM C 511, or through storage in lime saturated water.
 - 2) Slump of concrete for testing shall match job requirements and need not be limited to restrictions as stated in ASTM C 157 section 8.4.

- 3) Report results in accordance with ASTM C 157 at 0, 7, 14 & 28-days of drying.
- b. Concrete shall not be placed in the field prior to acceptance of the concrete mix. To meet the drying shrinkage limit, it is recommended that a shrinkage reducing admixture be considered for use in concrete for liquid containing structures.

2.03 WATERSTOPS

- A. Polyvinyl Chloride (PVC):
 1. Manufacture PVC waterstops from virgin polyvinyl chloride conforming to the Corps of Engineers Specification No. CRD-C572.
 2. Use 6-inch by 3/8-inch ribbed flat ribbed with center bulb waterstop in construction joints. Acceptable products include: Greenstreak Group, Inc. "Model 705"; Vinylex Waterstops and Accessories "Model RB6-38; or approved equal.
 3. Use molded crosses, tees, and other shapes for changes of direction, intersections, and transitions or cut and splice as recommended by manufacturer.
- B. Thermoplastic:
 1. Acceptable products include: Greenstreak Group, Inc. "Westec Envirostop TPE-R"; Vinylex Waterstops and Accessories "Petro Stop"; or approved equal of similar profiles to above specified PVC waterstops in chemical containment areas.
- C. Retro-Fit
 1. Use "Tee" or "L" shape as indicated with epoxy adhesive, stainless steel batten strips, and stainless steel adhesive anchors. Acceptable products include: Greenstreak Group, Inc Model "667" or approved equal.
- D. Expanding (Hydrophilic) Waterstops
 1. Bentonite-free, made from unvulcanized rubber. Acceptable products include: Adeka Corporation "Ultra Seal MC-2010MN with P-201 adhesive/sealant"; Greenstreak Group, Inc. "Hydrotite CJ-1020-2K with Leakmaster LV-1 adhesive/sealant"; or approved equal. These are allowable for use only where indicated on the drawings or accepted in writing by Engineer. Provide adhesive/sealant approved by manufacturer plus concrete nails and fender washers to secure waterstop material in-place during concrete placement. The waterstop MUST be placed [between two mats or curtains of steel reinforcement][with minimum 3-inches concrete cover.
 2. For limited cover applications or where only one mat or curtain of reinforcement is present, use Adeka Corporation "Ultra Seal KBA-1510FP" or approved equal.
- E. Non-expanding Waterstops
 1. Acceptable products include: Henry Company "SF302 Synko-Flex Waterstop with primer" or approved equal.

2.04 SEALANTS AND JOINT FILLERS

- A. Sealants and preformed joint fillers are specified in Sections 07 92 00 and 07 91 26.

2.05 BONDING COMPOUNDS

- A. Epoxy resin bonding compounds for use in wet areas shall conform to ASTM C881 Types IV or V, Class A, B, or C depending on temperature at use. Acceptable products include: BASF Corporation "MasterEmaco ADH 327RS"; Sika Chemical Corporation "Sikadur 32"; or approved equal.
- B. Non-epoxy bonding compounds for use in dry areas for non-structural bonding or as noted on the drawings shall conform to ASTM C1059 Type II. Acceptable products include: Penetron Specialty Products "Acrylic Bondcrete"; ChemMasters "Cretelox"; or approved equal.
- C. Apply bonding compounds in accordance with the manufacturer's instructions.

2.06 EPOXY FOR CRACK INJECTION

- A. Use a two-component, moisture insensitive, high modulus, injection grade, 100 percent solids, epoxy-resin blend. Consistency as required to achieve complete penetration into cracks. Material shall conform to ASTM C881 Type 1 Grade 1. Acceptable products include: Sika Corporation "Sikadur 52"; Adhesives Technology Corporation "Crackbond SLV302"; or approved equal.
- B. Use epoxy injection for structural crack repairs except as noted below for non-structural cracks in liquid-containing concrete structures. The Engineer shall determine whether a crack is classified as structural or non-structural.

2.07 CHEMICAL GROUT FOR CRACK INJECTION

- A. Use hydrophobic polyurethane grout at the Engineer's discretion as an alternative for sealing non-structural cracks in concrete structures intended to be watertight. Acceptable products for sealing hairline cracks include: GCP Applied Technologies "DE NEEF Flex SLV PURE" (must be used with DE NEEF Flex Cat PURE); or Sika Corporation "SikaFix HH LV" as appropriate for crack width; or approved equal. Coordinate with product supplier to verify and select appropriate product for crack widths to be injected.

2.08 SURFACE RETARDANT

- A. Retardant for exposing aggregate for unformed surfaces in construction joints shall be Sika Corporation "Rugasol-S"; GCP Applied Technologies "Top-Cast"; or approved equal.
- B. Apply retardant in accordance with manufacturer's instructions sufficient to assure a minimum penetration of 1/4 inch.

2.09 POST APPLIED CONCRETE HARDENER AS SPECIFIED ON ARCHITECTURAL DRAWINGS AND SPECIFICATION. CURING AND SEALING COMPOUNDS

- A. Acceptable products include: BASF Corporation "MasterKure CC 250SB"; Dayton Superior "Cure & Seal 25% J22UV"; or approved equal, conforming to ASTM C1315.
- B. Compound shall be clear and applied in accordance with the manufacturer's instructions.

- C. Curing and sealing compound shall be certified compliant with final finish system if applicable, including compatibility with floor hardeners in areas where floor hardeners are specified to be used.
- D. Compound shall be clear and applied in accordance with the manufacturer's instructions.
- E. Curing compounds shall be certified compliant with final finish system if applicable, including compatibility with floor hardeners in areas where floor hardeners are specified to be used.

2.10 TRENCH DRAINS

- A. Use either field formed and cast with grate and frame, or utilize a pre-engineered manufactured trench drain system that conforms to the design load requirements of AASHTO H-20 in traffic areas or 300 pounds per square foot elsewhere. Include the following minimum requirements:
 - 1. A round or V-bottom channel, sloped to a minimum of 1/16-inch per foot. See drawings for channel cross section or size. If not shown, use 12 inches wide and deep (nominal) and confirm with Owner's Representative.
 - 2. Aluminum grating frame with anchors at 45 degrees into the surrounding concrete. Coat aluminum to prevent direct concrete contact.
 - 3. Aluminum grate conforming to Federal Specification RR-F-621C.
 - 4. A locking device which directly connects the grate to the frame.
- B. Candidate manufacturers include: MultiDrain Systems, Atlanta, Georgia; ABT, Inc., Troutman, North Carolina; or approved equal.

2.11 NEOPRENE BEARING, SEAL PADS, AND RODS

- A. Use 100 percent chloroprene (neoprene), 50 Durometer A, conforming to AASHTO Standard Specifications for Highway Bridges. Pads and rods shall conform to geometry as shown on the drawings. Products shall be one-piece as manufactured, or factory spliced; using a process proven gas-tight in repeated similar applications. Do not use glues and adhesives to bond pieces together.
- B. Deliver to job site in protective containers or packaging and maintain the integrity of the pad/rod through construction.

PART 3 EXECUTION

3.01 GENERAL

- A. Use only truck-mixed, ready-mixed concrete conforming to ASTM C94. Proportion materials by weighing.
- B. Introduce pozzolan into the mixer with cement and other components of the concrete mix; do not introduce pozzolan into a wet mixer ahead of other materials or with mixing water.
- C. Introduce water at the time of charging the mixer; additional water may be introduced within 45 minutes from charging the mixer, provided the specified w/c ration and slump is not exceeded and the maximum total water per the approved mix design is not exceeded.

- D. Arrange with the testing laboratory for inspection as required to comply with these specifications.
- E. Deliver concrete to the site and complete discharge within 90 minutes after introduction of water to the mixture. Extension of allowable time beyond this limit requires a Contractor proposed remedial action plan to be reviewed and accepted by the Owner's Representative.

3.02 CONVEYING AND PLACING CONCRETE

- A. Convey concrete from the mixer to the forms in accordance with ACI 301. Remove concrete that has segregated in conveying from the site of the work.
- B. Placing Concrete:
 - 1. General:
 - a. Place concrete in accordance with ACI 301. Do not permit concrete to drop freely more than 4-ft (6-ft when superplasticizer is used).
 - 2. Placing Concrete By Pumping:
 - a. Concrete placed by pumping is at Contractor's discretion and shall not be the cause to change or relax specified mix design characteristics. Concrete shall possess the specified characteristics at the point of placement.
 - b. Measure slump at the hose discharge, except as follows: Initial slump testing in each placement shall occur at both the pumping unit inlet hopper and hose discharge. Slump loss in pumping, measured between the inlet hopper and the hose discharge, shall not exceed 1 inch. After these criteria have been satisfied, slump may be measured at the inlet hopper with allowable slump increased by the earlier measured difference, not to exceed 1 inch.
 - c. Measure air content at the hose discharge, except as follows: Initial air content testing shall occur at both the pumping unit inlet hopper and the hose discharge. Loss of air content shall be measured between the inlet hopper and the hose discharge. Increase the air content of the delivered concrete at the inlet hopper to provide the specified air content at the hose discharge. After these criteria have been satisfied, air content may be measured at the inlet hopper.
 - d. Before starting each pumping operation, prime the pump and line with a cement slurry to lubricate the system. Waste cement slurry outside the forms. Equip hose tip with a safety chain for recovery in case of hose blowout during pumping. Hose or accessories shall not remain in the freshly placed concrete.
 - e. Use tremie placing techniques and equipment for pump placed concrete. Pump discharge system shall remain full of concrete from pump to discharge point at all times. Concrete pumping shall not occur until Owner's Representative has verified equipment including the tremie plug. Should the discharge line become open, with zones empty of concrete, cease pumping and re-primed with tremie plug installed before continuing.
 - 3. Placing Concrete In Hot Weather
 - a. In temperatures above 80 degrees F, place concrete in accordance with ACI 305.1.
 - 4. Placing Concrete In Cold Weather

- a. In temperatures below 40 degrees F, place concrete in accordance with ACI 306.1.

3.03 CONSOLIDATING CONCRETE

- A. Consolidate concrete in accordance with ACI 301. If evidence of inadequate consolidation is observed, concrete placement will be suspended until Contractor provides a revised plan to achieve proper consolidation.

3.04 CURING AND SEALING

A. General

1. Cure concrete using water (including form curing and use of moisture retaining covers), a clear membrane curing compound, or by a combination of both methods. Coordinate repairs or treatment of concrete surfaces so that interruption of curing will not be necessary.
2. Maintain concrete surface temperature between 50 degrees F and 80 degrees F for at least 5 days. Cure concrete in hot weather (above 80 degrees F) in accordance with ACI 305.1. Cure concrete in cold weather (below 45 degrees F) in accordance with ACI 306.1.

B. Water Curing

1. Keep concrete continuously wet for a minimum of 10-days after placement (14 days after placement for sections over 3-feet thick). Absorptive mats or fabric may be used to retain moisture during the curing period. Absorptive covers shall comply with AASHTO M182, Class 3, and moisture retaining covers shall comply with ASTM C171.
2. Use water curing in hot weather for liquid containment structures. Cover forms and keep moist. Loosen forms as soon as possible without damage to the concrete, and make provisions for curing water to run down inside them. During form removal, take care to provide continuously wet cover to newly exposed surfaces.

C. Curing Compound

1. When curing compound is allowed, apply it as soon as the concrete has set sufficiently so as not to be marred by the application or apply it immediately following form removal for vertical and other formed surfaces. Preparation of surfaces, application procedures, and installation precautions shall follow manufacturer's instructions. For liquid containing structures, apply curing compound at twice the manufacturer's recommended dosage rate, applied in two coats perpendicular to each other.
2. Do not use curing compound on concrete surfaces to be coated, waterproofed, moisture-proofed, tiled, roofed, or where other coverings are to be bonded. In these cases, use water curing unless the curing compound is first removed or is compatible with the final finish covering.

3.05 PROTECTION

- A. Protect concrete from injurious action by sun, rain, wind, flowing water, frost, excessive vibration and mechanical means.

- B. Loading green concrete is not permitted. Green concrete is defined as concrete with less than 100 percent of the specified strength.
- C. Backfill shall not be placed against concrete walls until the concrete has reached the specified strength, connecting slabs and beams have been cast and have also reached the specified strength, and watertightness testing and repairs have been completed for liquid containing structures to the satisfaction of the Owner's Representative.
- D. Arrangements for covering, insulating, heating, and protecting concrete in cold weather shall be in accordance with ACI 306.1.

3.06 CONSTRUCTION JOINTS

A. General

- 1. Place concrete in each unit of construction continuously. Before new concrete is placed on or against concrete which has set, retighten forms and clean foreign matter from the surface of the set concrete. Provide waterstops as specified.

B. Construction

- 1. Form construction joints by producing a rough surface of exposed aggregates using a surface retardant; include joints between the slab and topping concrete. The limit of the treated surfaces shall be 1 inch away from the joint edges. Within 24 hours after placing, remove retarded surface mortar either by high pressure water jetting or stiff brushing or combination of both so as to expose coarse aggregate. A rough surface of exposed aggregate may also be produced by sandblasting followed by high pressure water jetting. Sandblasting, if used, shall remove 1/4 inch of laitance film and expose coarse aggregate to ensure adequate bond and watertightness at the construction joints.

C. Locations

- 1. Provide construction joint locations as follows:
 - a. Cast walls exceeding 50 feet in length in panels not to exceed 30 feet in length. Cast adjoining panels only after 5-days have elapsed. Joints are not allowed within the lesser of 10 feet or 25 percent of the wall length from a corner unless specifically detailed thus on the drawings.
 - b. Locate joints in beams or girders at or near the quarter point between supports.
 - c. Make joints in the members of a floor system at or near the quarterpoint of the span.
 - d. Make joints in walls and columns at the underside of floors, slabs, beams or girders and at the tops of footings or floor slabs.
 - e. Cast slab panels in checkerboard patterns not to exceed 40 feet in length and not to exceed 900 square feet in area, with maximum 1 1/2 to 1 ratio of side lengths. Minimum lapsed time between placing adjacent panels shall be 3-days. The requirements for size of slab panel is waived if joints are located on the Drawings.
- 2. Vertical construction joints shall have edges grooved or beveled at faces exposed to view including interior faces of basins and tanks. Seal grooves subjected to wetting or weather with joint sealant.

3. Continue reinforcing steel and welded wire reinforcement through construction joints. Beams, girders, and floor slabs shall not be constructed over columns or walls until at least one day has elapsed to allow for initial shrinkage in the column or wall. No joint will be allowed between a slab and a beam or girder unless otherwise shown. Joints shall be perpendicular to the main reinforcement. Provide waterstops in construction joints as specified.

3.07 INSERTS AND EMBEDMENTS

A. Inserts

1. Where pipes, castings, or conduits are to pass through structures, position in forms before placing concrete; or where shown on Drawings or approved by the Owner's Representative, provide openings in the concrete for subsequent insertion of such pipes, castings, or conduits. Provide waterstops and a slight flare in the form to facilitate grouting and permit the escape of entrained air during grouting.
2. Provide additional reinforcement around openings. Use non-shrink grout to infill around inserts.
3. Place horizontal conduits and pipes, in slabs and beams, between the top and bottom layers of reinforcement. Spacing and size limitations shall conform to ACI 318.
4. Conduits and pipes shall not run directly beneath a column or base plate.
5. Position conduit, pipe, and other ferrous items such that there will be a minimum of 2-inches clearance between said item and concrete reinforcement. Welding inserts to reinforcement is not permitted.
6. The outside diameter of conduit or pipe shall not exceed one-fourth the slab or beam thickness.

B. Embedments

1. Gate frames, gate thimbles, special castings, channels, grating frames, or other miscellaneous metal parts to be embedded in concrete shall be secured in the forms prior to concrete placement.
2. Embed anchor bolts and inserts in concrete as shown. Provide inserts, anchors, or other bolts necessary for the attachment of piping, valves, metal parts, and equipment.
3. Provide nailing blocks, plugs, strips, and the like necessary for the attachment of trim, finish, and similar work. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable material to prevent entry of concrete. Do not use continuous anchor slots or strips in concrete intended to be watertight.
4. Position operators or sleeves for gate or valve stems to clear reinforcing steel, conduit, and other embedments, and to align accurately with equipment.

3.08 EXPANSION JOINTS

- A. Expansion joints shall be as shown. Do not extend reinforcement or other embedded metal items through expansion joints. Provide waterstops where indicated.

3.09 WATERSTOPS

- A. Waterstops shall conform to ACI 301. Tie waterstops in position prior to placement of concrete to prevent movement and deformation.
- B. Provide waterstops in construction and expansion joints as follows:
 - 1. Joints in parts of structures exposed to ground or water on one side and occupied by non-submerged equipment or by personnel on the other.
 - 2. Wall and slab joints of tanks and channels subject to water pressure.
 - 3. Waterstops shall be provided for the full height of the walls.
 - 4. Provide at other locations shown on the Drawings.
- C. Field splices shall be at straight sections using heat fused welded, butt splices only. Lapping of splices or joining by means other than heat fused welding is not allowed.
- D. Install hydrophilic waterstops according to manufacturer's recommendations. Surfaces of concrete shall be prepared level/plumb and to the smoothness required by manufacturer. Grind surface as necessary. Provide bonding adhesive and concrete nails with fender washers to hold waterstop in position during concrete placement.

3.10 MODIFICATION OF EXISTING CONCRETE

- A. General
 - 1. Verify structural dimensions related to or controlled by previously constructed or existing structures prior to concrete work.
- B. Cutting or Coring Concrete
 - 1. Saw cut concrete to a depth of 1 inch to form straight outlines of concrete areas to be removed. Where reinforcement is exposed due to saw cutting or core drilling and no new material is to be placed on the cut surface, provide a protective epoxy coating to the entire cut surface.
 - 2. Coat surfaces of oversized openings with an epoxy bonding compound prior to re-finishing with profiling mortar to the required opening size.
 - 3. Grind existing joint edges to create a chamfer matching those used on adjacent construction.
 - 4. Investigate concrete to be drilled, cored, or sawcut to determine location of reinforcing steel. Locate penetrations to clear existing reinforcing steel. Where not possible to avoid reinforcing steel, consult the Engineer as to acceptability of cutting reinforcing steel and provide new reinforcing systems as directed.
 - 5. Locating methods include chipping to expose reinforcing steel, ground penetrating radar, X-ray, or magnetic flux devices. Locates of existing reinforcing shall be by the Contractor.
- C. Joining New Concrete To Existing
 - 1. Existing concrete surfaces to be joined with new concrete shall be cleaned and roughened by abrasive blasting, bush hammering, or other method to achieve ¼-inch amplitude surface. Remove existing metalwork, embeds, or other interfering items. Coat existing surface with epoxy bonding compound prior to placement of new concrete.

D. Post-Installed Anchors and Dowels

1. Use non-destructive methods for locating reinforcement prior to drilling operations. For anchor and dowel locations that interfere with reinforcement, attempt to relocate to avoid drilling through the reinforcement if possible.
2. For situations that do not allow relocation, cutting of reinforcement for installation is subject to the following:
 - a. Prior to drilling through reinforcement, the Contractor shall consult the Owner's Representative or Engineer.
 - b. Drill holes with a hammer drill and carbide bit (core drilled holes are not allowed), followed by brushing and air-cleaning with oil-free compressed air.
 - c. Holes drilled through reinforcement must be in compliance with adhesive anchor assumptions for roughened hole surface typical of a hammer drill and carbide bit. No smooth hole surfaces are allowed.
 - d. Do not cut slab rebar within 24 inches of a supporting wall, column, or an opening in the slab.
 - e. No cutting of rebar is allowed in the middle third of slab spans for anchors with diameters equal to or greater than 3/4 inch.
 - f. Maximum of two rebar may be cut in any 10 foot width of slab.
 - g. Maximum of two rebar may be cut within any 10 foot width of concrete wall.
 - h. Maximum of one rebar may be cut within any 8 foot width of CMU wall.
3. For anchors that cannot be moved and that conflict with the above requirements, consult Engineer for direction. It is not acceptable to cut reinforcement in beams, columns, precast members, or stairs.
4. Use a pre-manufactured, self-mixing, injectable, two-component, epoxy adhesive, as per Section 03 60 00. Follow manufacturer's recommendations and ICC Evaluation Report for installation.

E. Waterstops

1. Where a waterstop between new and existing concrete is required, install a hydrophilic waterstop, or a retrofit waterstop where indicated on the design drawings for the specific location.

3.11 FORMED SURFACE FINISHES

A. Repair Of Surface Defects

1. Repair surface defects, including tie holes, minor honeycombing, or otherwise defective concrete in accordance with ACI 301. Clean areas to be repaired. Cut and chip out honeycombed or otherwise defective areas to solid concrete, to a depth of at least 1-inch. If defective area includes exposed reinforcing steel, correct by removing concrete a minimum of 1-inch beyond the reinforcing. Make edges of the cut perpendicular to the surface of the concrete in a neat rectangular pattern.
2. Joints shall be grooved to a radius or bevel of 3/4-inch depth.
3. Finish patches on exposed surfaces to match and blend with adjoining work. Cure patches as specified for the concrete. Protect finished surfaces from stains and abrasions.

B. Formed Surface Finishes

1. Finish A - Grout Rubbed Finish

- a. After repair of surface defects, apply a grout rubbed finish in accordance with ACI 301 except that all form fins and other protrusions shall be completely removed. Lightly sandblast surfaces prior to sacking. Sandblasting shall occur after the specified curing period.
 - b. Add a PVA bonding compound to the mix water used in sacking mortar; as recommended by the manufacturer.
 - c. Provide Finish A at uncoated surfaces of stair wells, at interior surfaces of equipment rooms, galleries, tunnels, operations areas, exposed channels and tanks from 1 foot below minimum water surfaces and up, at exposed exterior surfaces to 1 foot below grade, and at permanently exposed vertical and sloped surfaces such as pipe chases.
 - d. Do not provide Finish A at concrete surfaces receiving a coating.
2. Finish B - Smooth Surface Finish
- a. Initial surface preparation is the same as Finish A; repair surface defects and remove all form fins.
 - b. Provide Finish B at surfaces to be coated, at interior surfaces of exposed channels and tanks from 1 foot below minimum water surfaces and down (Finish A applied above this level), and full height at surfaces of wet wells, tanks, and channels not exposed to view. See Section 09 90 00 for additional concrete surface preparation, including filling of bug holes, and coating requirements.
3. Finish C - Rough Form Finish
- a. Repair surface defects and imperfections greater than 3/8 inch in any dimension. Remove form fins and protrusions down to less than 3/8 inch projection.
 - b. Provide Finish C or smoother at exterior surfaces from 1 foot below grade and down, at other vertical surfaces not exposed to view and not specified above to receive Finish A or B.
 - c. Also apply Finish C to unoccupied interior areas not otherwise specified.
4. Finish D - Unfinished Surface
- a. Repair surface defects and otherwise leave the surfaces as they come from the forms, except plug tie holes and repair or remove defects greater than 1/2 inch in any dimension.

C. Sample Of Formed Surface Finish A

- 1. Provide a sample concrete panel, minimum 4 feet by 4 feet; representative of formed surface Finish A. The panel shall be representative of the workmanship and finish required, including repair of defects, filling of tie holes, sandblasting, and rubbing.
- 2. The sample shall be approved by the Owner's Representative prior to the start of production work. The sample shall be on display at the job site, and finished surfaces shall match sample.

3.12 SLAB FINISHES

A. General

- 1. The finishes specified herein include surface finishes, treatments and toppings for floors and slabs. Do not use dry cement on new concrete surfaces to absorb excess moisture. Round edges to a radius of 1/2 inch.

2. Slope floors to drain uniformly within a room or space. Unless otherwise specified, slope shall be a minimum of 1/8 inch per foot toward nearest drain. Restrict use of floor drains with only locally depressed slabs to locations specifically noted.
3. Immediately after final finish is applied, the surface shall be cured and protected as specified in Curing, Sealing, and Protection paragraphs above.
4. Where finish is not specified, floor slabs shall receive a Steel Trowel Finish.

B. Float Finish

1. Perform floating with a hand or power-driven float in accordance with ACI 301. Begin floating when the bleed water sheen has disappeared and the surface has stiffened sufficiently. Float as required to meet tolerance requirements of ACI 117 for a conventional surface.
2. Floating shall close cracks and checks plus compact and smooth the surface. Refloat the slab to a uniform texture.
3. Apply float finish to surfaces of channels, tank bottom slabs, exterior below grade horizontal surfaces, including tops of footings, and surfaces to receive insulation or roofing.

C. Steel Trowel Finish

1. Float the concrete surface as indicated above and then trowel in accordance with ACI 301.
2. Provide Steel Trowel Finish on interior exposed floors and slabs that will receive resilient flooring, carpet or ceramic tile, unless specified otherwise.
3. Surface Hardener (see Part 2) shall be troweled into the finished surface at the locations shown on Architectural drawings.

D. Broom Finish

1. Float the concrete surface as indicated above, then immediately give the concrete a coarse transverse scored texture by drawing a broom or burlap belt across the surface in accordance with ACI 301.
2. Provide a Broom Finish for steps and ramps, exterior exposed horizontal surfaces, and where otherwise indicated.

E. Samples Of Concrete Slab Finishes

1. Provide a sample concrete slab, minimum 4 feet by 4 feet, representative of workmanship and each specified finish.
2. Samples shall be approved by the Owner's Representative prior to the start of production work. The samples shall be on display at the job site, and finished surfaces shall match samples.

3.13 TOPPING CONCRETE

A. Subfloor Finish

1. Slabs to receive a topping concrete, topping grout, or tile; shall be float finished to required elevations. Immediately following the final finishing, either:
 - a. treat slab with a retardant and abrasive blast to create expose aggregate with 1/4 inch amplitude, or

- b. create the $\frac{1}{4}$ inch amplitude roughened surface by raking the freshly floated surface using a standard garden rake.
 2. Immediately after finishing, proceed with required curing and protection of the slab as stated above.
- B. Topping Concrete or Grout
 1. Remove dirt, laitance, and loose aggregate. Keep cleaned base slab saturated surface dry for a period of 24 hours prior to the application of topping. Remove excess water.
 2. Apply and scrub a neat cement grout into the surface of the base slab using a stiff broom. The cement grout shall not be allowed to dry and shall be spread within 15 minutes ahead of the topping placement.
 3. The topping shall then be placed, compacted, and floated. Test surface with a straight edge to detect and correct high and low spots to a tolerance of $\frac{1}{8}$ inch in 10 feet.
 4. Incorporate float finish, surface hardener, steel trowel finish, etc. as specified.

3.14 RELATED SURFACES

- A. Stair Tread:
 1. Construct stair treads with a nonskid nosing as specified in Section 05 50 00.
 2. Treads shall have a Float Finish followed by a Steel Trowel Finish with a slope of $\frac{1}{8}$ inch toward the front.
 3. Ends of treads shall have a $\frac{1}{16}$ to $\frac{1}{8}$ inch cut between concrete and metal tread to allow for expansion.
- B. Finishing of Unformed Surfaces
 1. Adjacent Unformed Surfaces
 - a. Tops of walls, buttresses, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces shall be struck smooth after concrete is placed and shall be Float Finished to a texture reasonably consistent with that of the adjacent formed surface.
 - b. Continue final treatment of formed surface uniformly across the top of the unformed surface.
 2. Pavements and Sidewalks
 - a. The surface of the concrete shall be screeded to grade and sloped to drain. After screeding, the surface shall be Float Finished followed by a Broom Finish.
 - b. Round edges and expansion joints to a radius of $\frac{1}{2}$ inch. Control joints shall be grooved or sawcut to a minimum depth of $\frac{1}{4}$ the slab thickness.

3.15 FIELD SAMPLING AND TESTS

- A. General
 1. Field sampling and tests shall be performed by an independent testing laboratory. Samples of aggregates and concrete will be obtained at such times to represent the quality of the materials and work throughout the project.

2. The laboratory shall provide necessary labor, materials and facilities for sampling aggregate and for casting, handling, and initially storing the concrete samples at the work site.
3. The minimum number of samples and tests are specified in Testing paragraph below.

B. Sampling

1. Aggregates

a. General

- 1) Sample fine and coarse aggregates in accordance with ASTM D75 not less than 30 days prior to the use of such aggregates in the work.
- 2) Take samples at the discharge gates of the bins feeding the weigh hopper. Repeat sampling when the source of material is changed or when unacceptable deficiencies or variations from the specified requirements of materials are found.
- 3) Aggregate samples shall be tagged and their sources identified.

b. Coarse Aggregate

- 1) Take a sample weighing between 50 and 60 pounds after the batch plant is brought up to full operation.
- 2) Take samples to obtain a uniform cross section, accurately representing the materials on the belt or in the bins for sieve analysis.

c. Fine Aggregate

- 1) Take samples as specified for coarse aggregate.
- 2) Take samples of sand when the sand is moist for sieve analysis and specific gravity tests.

2. Concrete

- a. Take samples of plastic concrete in accordance with ASTM C172.
- b. Take samples at the hopper of mixing equipment or transit mix truck, except as noted in the Placing Concrete by Pumping subparagraph of the Conveying and Placing article above.

C. Testing

1. Aggregate

- a. A minimum of one test of coarse aggregate per 400 cubic yards of concrete used and a minimum of one test of fine aggregate per 200 cubic yards of concrete used shall be made to confirm continuing conformance with specifications for gradation, cleanliness and sand equivalent.
- b. A maximum of one test per day of each aggregate is required.
- c. Repeat of the entire concrete mix design test program is required before source changes will be accepted.

2. Concrete

a. Strength Tests

- 1) The strengths specified for the design mix shall be verified by the independent testing laboratory during placement of the concrete. Verification shall be accomplished by testing standard cylinders of concrete samples taken at the job site. Cylinders shall be 4 by 8 inch or 6 x 12 inch.

- 2) Concrete samples shall represent the concrete placed in the forms. One set of six standard 6 x 12 inch (or nine 4 x 8 inch) cylinders shall be cast of each class of concrete for each 100 cubic yards or less, or for each 5,000 square feet of slab or wall surface area placed per day. Provide additional cylinders when an error in batching is suspected. Each set of cylinders are cast from material taken from a single load of concrete.
- 3) Casting, handling and curing of cylinders shall be in accordance with ASTM C31. For the first 24 hours after casting, keep cylinders moist in a storage box constructed and located so that its interior air temperature will be between 60 and 80 degrees F. At the end of 24 hours, the testing laboratory will transport the cylinders to their laboratory.
- 4) Testing of specimens for compressive strength shall be in accordance with ASTM C39. Each test shall consist of two 6 x 12 inch (or three 4 x 8 inch) test cylinders from each group of six (or nine) specimens. Test at the end of 7 days and at the end of 28 days. The remaining cylinders shall be tested at the end of 56 days if the 28-day strength reports below specification.
- 5) A strength test shall consist of the average strength of two 6 x 12 inch (or three 4 x 8). If one cylinder shows evidence of low strength due to improper sampling, casting, handling, or curing, the result of the remaining cylinders may be used if approved by the Owner's Representative.
- 6) The average of any three consecutive 28-day strength test results of the cylinders representing each class of concrete for each structure shall be equal to or greater than the specified strength. Not more than 10 percent of the individual strength test results shall have values less than the specified 28-day strength for the total job concrete. No individual strength test result shall be less than the specified strength by more than 500 pounds per square inch.
- 7) Provide certified reports of the test results directly to the Owner's Representative and the Engineer. Test reports shall include sufficient information to identify the mix used, the stationing or location of the concrete placement, and the quantity placed. Slump, water/cement ratio, air content, temperature of concrete, and ambient temperature shall be noted.
- 8) The 28-day strength test results shall be evaluated in accordance with ACI 214R. Quality control charts showing field test results shall be included with the test results for each class of concrete in each major structure. Charts shall be prepared in accordance with ACI 214R. Quality control charts shall be maintained throughout the entire project and shall be available for the Owner's Representative's inspection at any time.
- 9) If the 28-day test results fall below the specified compressive strength for the class of concrete required for any portion of the work, adjustment in the proportions, water content, or both, shall be made as necessary at the Contractor's expense. Report changes and adjustments in writing to the Owner's Representative.
- 10) If compressive test results indicate concrete in place may not meet structural requirements, tests shall be made to determine if the structure or portion thereof is structurally sound. Tests may include, but not be limited to, cores in accordance with ASTM C42 and any other analyses or

load tests acceptable to the Engineer. Costs of such tests and/or analysis shall be borne by the Contractor.

b. Tests for Consistency of Concrete

- 1) Measure slump in accordance with ASTM C143. Take samples for slump determination from concrete during placement. Tests shall be made at the beginning of concrete placement operation, whenever test cylinders are cast, and at subsequent intervals to ensure that the specification requirements are met.
- 2) For pumped concrete, measure slump in accordance with the Placing Concrete by Pumping subparagraph of the Conveying and Placing article above.
- 3) When high range water reducer is added at the site, slump tests shall be taken before and after addition of the admixture.

c. Tests for Temperature and Air Content

- 1) Temperature tests shall be made at frequent intervals during hot or cold weather conditions until satisfactory temperature control is established. Perform temperature tests whenever test cylinders are cast.
- 2) Measure air content in accordance with ASTM C231 whenever test cylinders are cast. For pumped concrete, measure air content in accordance with the Placing Concrete by Pumping subparagraph of the Conveying and Placing article above.

D. Final Laboratory Report

1. The testing laboratory shall provide a final report at the completion of all concreting. This report shall summarize the findings concerning concrete used in the project and provide totals of concrete used by class and structure.
2. Include final quality control charts for compressive strength tests for classes of concrete specified in each major structure. Also include the concrete batch plant's coefficient of variation and standard deviation results for each class of concrete.

3.16 REPAIR OF DAMAGED AND CRACKED CONCRETE

A. Acceptance Of Concrete

1. Completed cast-in-place concrete work shall conform to the applicable requirements of ACI 301 and the Contract Documents. Concrete work that fails to meet these requirements shall be repaired, as approved by the Engineer, to bring the concrete into compliance. Repair methods shall be in accordance with ACI standards, including ACI 503.7, and are subject to the approval of the Engineer.
2. Concrete that cannot be brought into compliance by approved repair methods will be rejected. Remove and replace rejected concrete work.
3. The cost of repairs and replacement of defective concrete shall be borne by the Contractor.

B. Repair Methods

1. Damaged/defective concrete or concrete with crack widths exceeding 0.004 inches at liquid-containing and conveying structures or crack widths exceeding 0.006 inches for other structures shall be repaired by one of the following methods (only the Engineer may determine that a defect or crack does not require repair):

- a. Perform watertightness testing and repair as needed to meet leakage criteria in this specification even when liquid-containing and conveying structures meet the crack width criteria defined above.
 - b. Damaged or defective concrete includes surface defects, honeycomb, rock pockets, indentations greater than 3/16 inch, spalls, chips, air bubbles greater than 1/2 inch diameter, pinholes, bugholes, embedded debris, lift lines, sand lines, bleed lines, leakage from form joints, fins, projections, form popouts, texture irregularities, and stains or other color variation that cannot be removed by cleaning.
 - 1) Damaged or defective concrete is repaired according to procedures outlined above under finish requirements, Repair of Surface Defects.
2. Crack Repair Method 1
 - a. Fill the joint or crack by drilling holes to the affected area (following the product manufacturer's details), install injection ports, and force epoxy or chemical grout (expanding urethane) into the joint under pressure.
 - b. Material type and repair procedures shall be approved by Engineer.
 - c. After injection and curing; ports, sealing mix, and surface shall be cleaned and worked to match the adjacent specified finish.
 3. Crack Repair Method 2
 - a. Fill cracks with low viscosity epoxy, applied by pouring/flooding crack zone until cracks are filled. Prepare surface, install, and cure according to manufacturer's recommendations.
 - b. At a minimum, prepare surface to be clean and dry with no visible detrimental material in cracks to be filled. Conform to temperature limitations of epoxy. Clean and refinish to match adjacent surfaces.
 4. Crack Repair Method 3
 - a. Cut a bevel groove 3/8 to 1/2 inch in width and depth, use backer rod or tape, and fill with sealant in accordance with manufacturer's instructions.
 - b. This repair method is only used where approved by Engineer.
 - c. Groove and sealant shall be applied on wet or hydrostatic pressure side of surface.
- C. Repair Method Use
1. Repair Method 1: For cracks in walls, surfaces sloped 1:1 or greater, beams, columns, structural slabs, overhead surfaces, and liquid retaining surfaces. Need for repair depends upon crack width, location, and leakage.
 2. Epoxy grout is used for repair of structural cracks and chemical grout (expanding urethane) for repair of non-structural cracks at liquid-containing structures. The Engineer shall determine whether a crack is classified as structural or non-structural.
 3. Repair Method 2: Utilized in lieu of Method 1 for slabs when approved by Owner's Representative. Final finish shall match adjacent surfaces.
 4. Repair Method 3: Limited to dry-surface slabs, walls subject to less than three feet of liquid pressure, or as approved by Engineer. Repair Method 3 is not an equivalent repair method to Repair Methods 1 or 2, which shall be considered the standards.

3.17 BEARING AND SEAL PADS

A. General

1. Seal pads are intended to result in a gas-tight and liquid tight seal between surfaces and may also serve as bearing pads. Bearing pads are intended primarily to transmit structural loads between two structural elements.
2. A seal pad is intended to seal by dead load compressive force or mechanical clamping force as detailed. The seal pad may be bonded to one or both surfaces to maintain uniformly tight contact with the pieces contacting it. Neoprene materials may not be compatible with coatings applied later, and the Contractor shall verify that the particular coating(s) proposed for use are:
 - a. contact compatible without neoprene breakdown; or
 - b. mask off neoprene which may be exposed to the coating to prevent contact.

B. Concrete Contact

1. Neoprene pads shall bear against clean, smooth concrete. Clean concrete with high-pressure hydro-blast (3,500 psi) equipment. Epoxy grout cracks as specified above. Repair surfaces with irregularities greater than 1/16 inch. Create a 1/4-inch amplitude surface roughness and patch using an epoxy bonding agent followed by either polymer modified repair concrete or profiling mortar. Cure patch material before installing pad.
2. Bond seal pad, as indicated, to concrete prepared as above. Bonding agent shall be as recommended by the pad manufacturer to not allow shear sliding of the pad either with or without load normal to its surface.

C. Metal Surface Contact

1. Neoprene pads with metal-to-metal or metal-to-concrete contact shall be 1/4 inch minimum thickness or as shown on the drawings.
2. Contact surfaces shall be clean, smooth, and without evidence of harmful sharp edges or chemicals.
3. Compression is achieved by tightening connection bolts to specified torque, determined by:
 - a. the equipment manufacturer; or
 - b. structural specifications on the drawings; or
 - c. minimum 1/16 turn past "snug tight" as defined by AISC Steel Construction Manual.
4. Tighten bolts in multiple steps, proceeding around the joint to result in a uniform compression of the pad.
5. Certain pieces of equipment may have gasket specifications particular to that piece of equipment. Refer to those Sections of the specifications for requirements.

3.18 WATERTIGHTNESS TESTING AND REPAIR

A. Liquid Containing Concrete Tanks And Channels (Injection Well Pump Station Below Ground Wet Well)

1. Watertightness testing shall comply with ACI 350.1 and the following requirements.
2. Concrete tanks, basins, reservoirs and channels which have walls or slabs subjected to hydrostatic pressure shall be tested for watertightness. The tests shall be made

after the structure is complete and the concrete has achieved its specified 28-day strength, but prior to application of waterproof coating or backfill.

3. Filling of the tank for watertightness testing shall not exceed a rate of 4 feet/hour. Fill with water to the maximum operating water surface. Keep water at this level for at least 72 hours prior to start of test.
4. Testing includes visual inspection of the dry sides of all walls, wall base construction joint at top of the slab, and the soffit of elevated slabs for evidence of leakage. Damp spots, leakage, or seepage revealed by the test, including those caused by shrinkage of concrete, honeycombed areas, construction joints, or other sources shall be repaired by Repair Method 1 (see Repair Methods paragraph in the Repair of Damaged Concrete and Cracking article above).
5. Damp spots are defined as areas from which water that can be picked up on dry hand and smeared across the dry concrete surface.
6. Re-test tanks or channels which have been repaired to check the suitability of repairs.
7. Provide water required for testing and re-testing and dispose of in an approved manner.
8. After repair of visual leakage, liquid containing or conveying concrete structures supported on soil must also meet maximum leakage criteria into the soil through their base slab or mat foundation as follows:

Structure Type	Tightness Criterion
Containment structures fully lined prior to hydrostatic test	No measurable loss
Cylindrical water and wastewater storage tanks and reservoirs other than digesters	0.050 percent per day
Digesters	0.050 percent per day (surcharged hydrostatic test)
Rectangular basins and tanks	0.050 percent per day
Concrete paved reservoirs and channels	0.10 percent per day

Note: All damp spots and/or leakage through walls, wall-to-slab joints, and elevated slabs shall first be repaired as described above.

9. Record volume loss by measuring the vertical distance from the water surface to a fixed point on the tank above the water surface. Account for evaporation from open surfaces.
10. If the drop in water surface during the test period exceeds the values given in the table above, exclusive of evaporation, the leakage is considered excessive and shall be remedied. The test period shall be per ACI 350.1.

3.19 CLEANUP

- A. Upon completion of the work and prior to final inspection, clean all concrete surfaces as follows: Sweep with a broom to remove loose dirt, then mop and/or flush with clean water. Scrub by hand or machine as required to remove and blend stains or discolored areas .
- B. Clean floors that have curing and sealing compound as stated above, followed by the final application of curing and sealing compound.

SECTION 03 41 33

PRECAST STRUCTURAL PRETENSIONED CONCRETE

PART 1 GENERAL

1.01 SUMMARY

A. Scope

1. This Section specifies the design, fabrication, and erection of precast, prestressed concrete members of hollow core and double tee construction. The work shall include product design, manufacture, transportation, erection, and connections.

1.02 REFERENCES

A. Reference Codes and Standards

1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
ACI 318	Building Code Requirements for Reinforced Concrete
AWS D1.1	Structural Welding Code Steel
ASTM 416	Uncoated Seven-Wire Stress-Relieved Strand for Precast Concrete.
ASTM D2240	Test for Rubber Property Durometer Hardness
ASTM A36	Standard Specification for Carbon Structural Steel
ASTM A706	Low-Alloy Steel Deformed and Plain Bar for Concrete Reinforcement
PCI MNL-116	Manual for Quality Control for Plants and Production of Precast Prestressed Concrete Products.
PCI MNL-120	Design Handbook Precast and Prestressed Concrete
PCI MNL-123	Manual on Design and Typical Details of Connections for Precast and Prestressed Concrete

Reference	Title
FBC	Florida Building Code with local Amendments

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications

1. The precast concrete manufacturing plant shall be certified by the Precast/Prestressed Concrete Institute Plant Certification Program. Manufacturer shall be certified at the time of bidding. Certification shall be in the following product group and categories: C3, C4. The manufacturer shall have a minimum of 5 years experience in the production of precast, prestressed double tees and hollow core slabs, and shall submit a record of work covering the last 5 years to substantiate experience in the manufacture of precast and prestressed double tees and hollow core slabs.

B. Installer Qualifications

1. The Installer shall have been regularly engaged for at least three years in the installation of precast structural concrete similar to the requirements of the project.

C. Welder Qualifications

1. Welders shall be qualified within the last year in accordance with AWS D1.1.

D. Testing

1. Testing shall be in general compliance with testing provisions in Section 03 30 00 - Cast-In-Place Concrete and PCI MNL-116.

1.04 SUBMITTALS

- A. Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.

1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.

2. Complete Drawings and data covering design, fabrication, layout, and installation. All Drawings and calculations shall bear the seal of a professional structural Engineer registered in the State of Florida.
3. Letter or certification from a structural Engineer licensed by the State of Florida certifying that the product has been designed in accordance with the Contract Documents.
4. Certification of the Supplier by Prestressed Concrete Institute including statement of Manufacturer's experience.
5. Statement from the Manufacturer attesting to Installers experience.
6. Test reports
 - a. Test reports for required testing during production. Information on plant capability, productivity, quality assurance program, and manufacturing equipment and procedures.
 - b. Reports covering source and quality of concrete materials in accordance with Section 03 30 00 - Cast-In-Place Concrete.
 - c. Test reports showing compressive strength of each design mix in accordance with Section 03 30 00 - Cast-In-Place Concrete.
7. Product Design Criteria
 - a. Loadings for design including initial handling and erection stress limits; all dead and live loads as specified on the Plans; all other loads specified for member, where applicable.
 - b. Record copy of design calculations for products, connections, and anchorage, performed by a registered Engineer experienced in precast, prestressed concrete design. Calculations will not be reviewed and will not be returned to Contractor.
 - c. Design shall be in accordance with applicable codes.
8. Shop Drawings
 - a. Submit Shop Drawing showing complete information for fabrication and installation of precast concrete units. Indicate member dimensions and cross-Section; location; and size and type of reinforcement, including special reinforcement and lifting devices necessary for handling and erection.
 - b. Submit signed and sealed layout showing all precast/pretensioned units including connection details by a registered Engineer experienced in precast, prestressed concrete design.
 - c. Include erection procedure for precast units, sequence of erection, and required handling equipment.
 - d. Show layout, dimensions, and identification of each precast unit corresponding to sequence and procedure of installation.
 - e. Indicate welded connections by AWS standard symbols. Detail inserts, connections, and joints including accessories and construction at openings in precast units.
 - f. Show locations and details of anchorage device that are to be embedded in other construction.
 - g. State limitations for field cutting or modifications.
9. Special shipping, storage and protection, and handling instructions.

PART 2 PRODUCTS

2.01 PERFORMANCE AND DESIGN REQUIREMENTS

- A. Structural precast concrete shall be suitable for the service conditions as specified and as indicated on the drawings. Members, including embedments and accessories, shall be designed in accordance with the following performance and design requirements.
 - 1. For all members, under dead load conditions (the dead load of the member plus the required superimposed uniform dead load), there shall be no flexural tension in the precompressed tensile zone.
 - 2. For members exposed to corrosive or high humidity environments, flexural tension in the precompressed tensile zone shall not exceed 3 x square root of $f'c$, psi. For members in dry environments, the maximum flexural tension in the precompressed tensile zone under applied dead load plus live load shall be: 6 x square root of $f'c$, psi.
 - 3. Members shall be designed for the loadings, penetrations, and configurations indicated on the drawings.
 - 4. Adjacent members shall have approximately the same camber.
 - 5. Immediate deflection of members due to live load shall not exceed span/480.
 - 6. Members shall have embedments and additional reinforcing to satisfy support and anchorage details.
 - 7. Manufacturer shall design and detail connections in general accordance with the configurations indicated on the drawings. Connection design shall satisfy all applicable requirements of the building code.

2.02 MATERIALS

- A. Concrete Mix Components
 - 1. Concrete mix components shall be in accordance with Section 03 30 00 - Cast-In-Place Concrete.
- B. Reinforcing Steel
 - 1. Reinforcing steel shall be in accordance with Section 03 20 00 - Concrete Reinforcing.
- C. Prestressing Strand
 - 1. Prestressing strand shall be uncoated, 7-wires strand conforming to ASTM A416, Grade 250 or 270.
- D. Embedded Items and Anchorage Devices
 - 1. All embedded items, inserts, and anchorage devices exposed to view, moisture or weather shall be hot-dipped galvanized or stainless steel. Unistrut inserts shall be stainless steel. Anchorage devices shall be fabricated from ASTM A36 steel.
- E. Penetrations
 - 1. All required penetrations and openings larger than 6-inches in diameter or 6-inches square shall be formed in place at the time of casting. Additional reinforcing shall be added where required to meet loading requirements. Openings and penetrations smaller than 6-inches may be core drilled.

F. Molds

1. Material from which molds are to be fabricated shall be steel, concrete, fiberglass, reinforced plastic, or wood. The selection of materials for molds shall be at the Supplier option, except that wood shall not be used without the express approval of the Engineer. All elements shall be cast in molds of rigid construction, accurate in detail with precise corners and arises, and designed to provide a close control of dimensions and details as indicated on the Plans.
2. Prior to casting of precast elements, molds shall have all surface joints, radii, corners, etc., filled, ground, filed, straightened or otherwise removed to provide a finished concrete surface that is smooth and dense, free of honeycombing, large air pockets, offsets, sinkages, or other irregularities.

G. Parting Compound

1. All molds shall be coated with parting compound to facilitate removal of elements from molds. Parting compound shall be non-petroleum, nonstaining and shall be of a nature and composition not deleterious to concrete.

H. Concrete Mix

1. Pre-cast concrete shall attain a minimum compressive strength of 5,000 psi at the end of 28 days. Provide Class C-2 concrete as specified in Section 03 30 00 - Cast-In-Place Concrete.

I. Bearing Pads

1. Bearing pads shall be Elastomeric Isotropic Random Oriented Fiber Reinforced Pad; JVI Inc. "Masticord"; Voss Engineering "Fiberlast" or approved equal. Refer to ASTM D2240 and D412, Grade Shore A, Durometer 50, or as required by specific design requirements by precast designer.

J. Topping Slabs

1. Topping slabs as indicated on the Plans and as specified in the Section 03 30 00 - Cast-In-Place Concrete for Class D-1 concrete.

2.03 MANUFACTURE

A. Manufacturing Procedures

1. Manufacturing procedures shall be in compliance with PCI MNL-116.

B. Configuration

1. Members shall be rigid, adequately braced, and free from dents, gouges, or other irregularities which would impair the quality, appearance, or performance of the members.

C. Release of Tension

1. The concrete shall attain a compressive strength of at least 3,500 psi before the pretensioning stress in the prestressing strands is released.

D. Embedded Accessories

1. All plates, inserts, and other accessories which are required to be embedded in the members shall be installed at the time of manufacture. All embedded items shall be

accurately positioned and shall be rigidly held in position during concrete placement. It is essential that bearing plates be installed in exact and true position.

2. Prestressed members shall be provided with lifting loops or similar devices to facilitate handling as needed.
- E. Openings and Inserts
1. Openings for roof ventilators, roof hatch, and other items as indicated on the Plans shall be incorporated into the design and fabrication. The Plans shall be carefully reviewed for the openings and inserts required by the work of all trades, and all openings and inserts which are beyond the limitations of field modification shall be provided by the manufacturer. Side edges of openings shall be formed or cut neatly and shall have vertical surfaces. Saddles, headers, or other suitable supports shall be provided by the Supplier as necessary for the size and location of openings.
- F. Ends of Strands
1. Protruding ends of prestressing strands shall be cut off flush with the concrete and coated or finished to prevent rusting.
- G. Surface Finish
1. Formed surfaces shall have a smooth uniform texture and color. All fins and other projections shall be removed from formed surfaces, and all holes and other surface defects shall be repaired to the satisfaction of Engineer.
 2. Unformed surfaces shall be screeded to proper levels and finished according to use as follows
 - a. Slab surfaces to receive poured in place concrete topping shall be given a coarse texture by brooming with a stiff bristled broom or by other suitable devices that will result in uniform transverse scoring in advance of curing operations.
 - b. Slab surfaces that do not receive poured in place concrete topping shall be given a steel trowel finish to provide a dense surface, uniform in texture and appearance.
- H. Shop Markings
1. Each member shall have shop markings, painted or labeled at a place not exposed to view after installation, to indicate location and position in the structure in accordance with the Supplier layout drawings.
- I. Bearing Pads
1. Bearing pads shall be used where indicated on the Plans or in accordance with the Supplier typical connections details as accepted by Engineer.
- J. Topping Slab Concrete
1. Topping slab concrete shall be designed, batched, and delivered as indicated on the Plans and in accordance with Section 03 30 00 - Cast-In-Place Concrete.

2.04 CURING

- A. Concrete shall be cured by continuous surface saturation or inundation, exposure to steam or saturated air in a tightly closed room or chamber, or other method acceptable to Engineer. Moist curing shall be maintained for at least 7 days when Type I cement is

used, or 48 hours when Type III cement is used. The steam curing period shall be as needed to reach minimum compressive strength. Members shall be air cured in the fabricator's yard until they attain an age of at least 30 days.

2.05 TOLERANCES

- A. Tolerances for prestressed concrete members shall be as recommended by PCI MNL-116.

PART 3 EXECUTION

3.01 SHIPMENT AND STORAGE

- A. Product shall be shipped and stored in accordance with manufacturer's requirements.
- B. Supplier shall provide Contractor with detailed recommendations and instructions for product storage.
- C. Precast concrete members shall not be damaged during handling and shall be kept from contact with adjacent concrete members. Members shall be stored on timber skids and leveled to avoid twisting or other undesirable stresses. Members shall not be moved from the Supplier's yard until completion of the specified curing period. The open ends of cores shall be protected from the elements to prevent trapping of moisture in the cores. Supplier will be responsible for the condition of prestressed members until they are removed from the delivery vehicle at the site.

3.02 SUPPLIER'S FIELD SERVICES

- A. Supplier shall provide assistance during product installation as required by the Contractor.

3.03 INSTALLATION

- A. The Supplier shall provide the Contractor with detailed recommendations and instructions for installation of the products specified in this Section.
- B. Prestressed concrete members shall be set in position in accordance with the Supplier layout and the Plans. Bearing pads shall be installed as indicated on the design and fabrication Drawings. Members shall rest solidly upon the supports, without rocking.
- C. Hollow Core and Double Tee Members
 1. Members in final position shall be loaded as necessary so that adjacent top edges are even, and the joints shall be welded as indicated on the Plans. Loading shall be acceptable to Engineer.
 2. After all joints have been grouted for hollow core slabs and welded for double tees and leveling loads removed, the member shall be anchored to the supports as indicated on the Plans.
- D. Welding
 1. Welding shall be done by qualified welders possessing valid certificates under the qualification procedures of AWS D1.1. Care shall be exercised to avoid overheating

and cracking the concrete adjacent to the anchorage plates. All members damaged during welding shall be removed and replaced by the Installer with new, undamaged members at no additional cost to the Owner.

E. Field Cutting

1. Openings, within the Supplier limitations and not requiring cutting of prestressing strands, shall be cut in the field by the erector in accordance with the Supplier standard recommendations. Openings requiring cutting of prestressing strands shall be made during manufacture; prestressing strands shall not be cut in the field.
2. All cutting of concrete Sections shall be done with suitable concrete saws or core drilling equipment in a manner that will provide smooth, even cut surfaces. Side edges of openings shall have vertical surfaces.
3. All lifting loops shall be cut off flush with the top surface of the member before any covering materials are placed.

F. Joints

1. The soffit of all members shall present a neat and uniform appearance.

G. Topping Slabs

1. All joints and other locations which could leak liquid topping shall be sealed or dammed prior to placement. Topping slab concrete shall be placed finished and cured in accordance with Section 03 30 00 - Cast-In-Place Concrete.

3.04 CLEANING AND REPAIRING

- A. After installation, precast elements shall be protected from all damage until final acceptance by the Engineer. Precast units with cracks, spalls, and other defects shall be subject to rejection. Units reviewed for repair shall be repaired to the satisfaction of the Engineer.

END OF SECTION

SECTION 03 48 11
PRECAST CONCRETE VAULTS

PART 1 GENERAL

1.01 SUMMARY

A. Scope

1. This Section specifies factory design and manufacture of precast concrete vault sections, accessories and the following.
 - a. Quality assurance and control.
 - b. Field installation of vaults.
 - c. Waterproofing and epoxy coating of vaults.
 - d. Installation of frames, hatches, and fall protection.
 - e. Ladders and safety devices.
 - f. Vault schedule.

B. Performance Requirements

1. All vaults shall be designed by a licensed professional engineer registered in the State of Florida, and engaged by the Supplier. All dead loads, live loads, flotation, erection, temperature and anchorage stresses shall be considered.
2. The calculations and drawings shall be prepared in a neat and legible manner, sealed by the licensed Professional Engineer performing the calculations.
3. The sealed calculations shall include a summary page to list all design loads, material specifications, and design criterion used in the calculations.
4. For design, groundwater shall be assumed at grade the top of the vault and the design shall provide for a percent factor of safety against floatation.
5. Vaults A, B, C, D listed in the Schedule of Vaults shall be designed for H-20 wheel load on top slab, hatches, and surcharge loading at grade around all sides of the vault.

1.02 QUALITY ASSURANCE

A. Reference Codes and Standards

1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that

date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
ASTM C150	Portland Cement
ASTM C207	Hydrated Lime for Masonry Purposes
ASTM C478	Precast Reinforced Manhole Sections
ASTM C858	Underground Precast Concrete Utility Structures
ASTM C913	Precast Concrete, Water, and Wastewater Structures
ACI 301	Specifications for Structural Concrete Buildings
ACI 315	Details and Detailing of Concrete Reinforcement
ACI 315R	Manual of Engineering and Placing Drawings for Reinforced Concrete Structures
ACI 318	Building Code Requirements for Structural Concrete
ACI 350	Environmental Engineering Concrete Structures
CRSI 63	Recommended Practice for Placing Reinforcing Bars

- A. Supplier shall be a PCI, NPCA, and/or FDOT-certified plant for production of precast vaults as specified herein.
- B. Aggregate used in producing concrete shall be from FDOT approved sources.
- C. Quality Control Inspection
 - 1. The quality of all materials, the process of manufacture and the finished sections shall be subject to inspection by Engineer. Such inspection may be made at the place of manufacture and/or at the Site after delivery.
 - 2. All sections shall be inspected for general appearance, dimensions, soundness, etc. The surface shall be dense, close-textured and free of honeycomb, cracks, roughness, exposure of reinforcement, damaged joints, or other irregularities.
 - 3. All sections which have been damaged after delivery will be rejected, or if already installed, shall be repaired or removed and replaced entirely at Contractor's expense.
 - 4. Rejected sections shall be tagged as such, segregated from other sections, and removed from the Site.

1.03 ENVIRONMENTAL CONDITIONS

- A. Product in this Section shall be subjected to environmental conditions in accordance with Section 01 11 80 – Environmental Conditions.

1.04 SUBMITTALS

- A. Preconstruction/Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.
1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.
 2. Submit evidence that shows current PCI, NPCA, and/or FDOT certification.
 3. Submit shop drawings of wall sections and bases proposed for this project, include joint design and related details for field assembly as applicable.
 4. Submit certification of conformance with Contract Documents and ASTM C478, C858, C913.
 5. Submit catalog cut and installation details for cast iron manhole covers, aluminum hatches with fall protection grates, and ladders with safety devices
 6. Submit catalog cut for epoxy coating system used at interior surfaces and waterproofing system used on exterior surfaces.
 7. Under a separate submittal, provide two file copies of signed and sealed calculations by a licensed professional engineer registered in the state of FLORIDA for each vault indicating all loads and load combinations. Other than the summary page, calculations will not be reviewed; calculations will not be returned to Contractor. For design, groundwater shall be assumed at grade and the design shall provide a 1.3 factor of safety against flotation.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

- A. Suppliers
3. The Engineer and the Department believe that the Suppliers indicated in this Section are capable of producing equipment and products, which will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular Supplier or product, nor shall it be construed that a named Supplier's standard product will comply with the requirements of this Section.
- B. Supplier Qualifications

1. The Supplier shall have X (X) years of experience manufacturing and installing precast concrete vaults in similar-sized projects.

2.02 MATERIALS

- A. Materials specified are considered the minimum acceptable for the purposes of durability, strength, and resistance to erosion and corrosion. The Contractor may propose alternative materials for the purpose of providing greater strength or to meet required stress limitations. However, alternative materials must provide at least the same qualities as those specified for the purpose. If alternatives are proposed, the proposals shall be accompanied with documentation supporting the claimed superiority of the proposed substitutions. The Engineer shall be the sole decider in the equivalency of alternative materials of construction.

2.03 CONCRETE

- A. Minimum 28-Day Compressive Strength - 4500 psi.

2.04 REINFORCEMENT

- A. Reference Section 03 20 00 – Concrete Reinforcing.

2.05 PRECAST OR CAST-IN-PLACE CONCRETE BASES

- A. Design and manufacture of precast concrete bases shall conform to the requirements of this section and ASTM C478, C858, C913 if proposed and designed by Contractor. Cast-in-place concrete bases shall conform to Section 03 11 00 – Concrete Forming and Section 03 30 00 – Cast-In-Place Concrete.
- B. Bases shall conform to the dimensions indicated on the Plans or as required by design. The horizontal joint at the top of the base shall be compatible with that of the precast wall section.
- C. Sumps shall be field constructed where shown on the Plans. Walking surfaces shall be sloped to the sump, have a non-slip broom finish, and be sealed with a penetrating concrete sealer. Minimum concrete fill thickness at sumps shall be two inches.

2.06 PRECAST CONCRETE WALLS

- A. Design and manufacture of precast concrete walls shall conform to the requirements of this section and ASTM C478, C858, C913.
- B. All tongue-and-groove joints in the precast wall, including the joint at the top of the base, shall be made up using gaskets.
- C. The precast sections shall be provided with a special groove to receive and hold the gasket in position during joint assembly.
- D. After joint assembly, the gap between sections shall be packed on the inside and outside with “Masterflow 713” by Master Builder; “Five Star Grout” by U.S. Grout Corp.; or Approved Equal, and shall be troweled smooth so that no projections remain on the

inside. There shall be concrete to concrete bearing between the various sections. The gasket shall not support the weight of the section.

2.07 PRECAST CONCRETE SLAB TOPS

- A. Precast reinforced concrete slab tops shall be manufactured in accordance with ASTM C478 & C858. Openings and frames shall be provided for hatches where shown on the Plans. Slab tops shall be set in a full bed of mortar.
- B. Slab tops shall be crowned or sloped to drain, minimum 1/4 inch per foot.
- C. Concrete slab tops shall receive a non-slip broom finish and a penetrating concrete sealer "in accordance with" Section 03 30 00 - Cast-in-Place Concrete.

2.08 GRATING TOPS

- A. Where grating tops are shown on the Plans, the Contractor shall supply fabricated grating frames to the precast supplier and coordinate the grating installation for a complete Project.

2.09 PIPE SEALS

- A. Where polyethylene, plastic or PVC pipe is utilized, connections between vault and pipes shall be made with flexible rubber sleeves with stainless steel straps and bolts. Provide an elastomeric waterstop gasket where sleeve sizes are not commercially available.
- B. The annular space around the pipe wall or sleeve shall be packed with "Masterflow 713" by Master Builders, "Five Star Grout" by U.S. Grout Corp.; or Approved Equal. Before the grout has set, Contractor shall recheck invert elevations of the pipe.
- C. For steel or ductile iron pipe, provide a pipe sleeve sized to accept the pipe plus a modular mechanical seal such as Link Seal or Approved Equal.

2.10 HATCHES

- A. Hatches shall be of the size and type shown on the Plans and as described below .
 - 1. Aluminum single leaf, watertight gasketed floor hatch. Floor hatch shall be furnished with flush stainless steel hinges, aluminum stiffeners, and lockable slam latch. Hatches shall have extended aluminum frame to match concrete thickness with continuous anchor and shall be constructed of 1/4 inch minimum aluminum diamond pattern plate design.
 - 2. Hatches shall be provided with an auto-lock, hold-open device and torsion spring assembly. All hardware, including all parts of the latch and lifting mechanism assemblies, hold-open arms and guides, and all brackets, hinges, pins and fasteners shall be stainless steel or bronze.
 - 3. The hatches shall be designed for an H-20 wheel load. A 1-inch drain coupling shall be provided in hatch frame. Contractor to extend drain to exterior of structure or to sump pit at vaults intended to remain dry.
 - 4. At all hatches, provide a hinged aluminum grate fall-through protection system.
 - 5. Aluminum hatches shall be Bilco "PCM" or as manufactured by Washington Aluminum Company or Approved Equal.

2.11 LADDER

- A. Where shown on the Plans, provide ladders as specified in Section 05 53 10 – Metal Gratings and Stair Threads.
- B. Where shown on drawings, provide ladder rungs made of cast iron or polypropylene with steel reinforcement. Rungs shall be either cast in place or drilled and adhesive grouted in the shop. Rungs are equally spaced at a maximum 12-inch spacing from the top of the base slab to the top of the top slab.
- C. Install ladder rungs so that the distance from the rungs to the finished wall is 7 inches.
- D. Provide aluminum stainless steel ladder access safety post as specified in Section 05 50 00 by Bilco, U.S.F. Fabrications, or Approved Equal.

2.12 OPENINGS AND INSERTS

- A. All openings required in the concrete shall be reinforced with additional diagonal bars tied to each layer of wall or slab reinforcement.
- B. Any required pipe sleeves, inserts, and wall openings shall be coordinated with mechanical requirements prior to casting the units.

2.13 WATERPROOFING

- A. Around the exterior of all wall joints, apply the “Bituthene” primer and membrane waterproofing system by W.R. Grace Company, or Approved Equal.
- B. Exterior wall surfaces shall be waterproofed using Supplier standard two-coat system, specifically designed to waterproof the exterior of concrete surfaces in a below-grade submerged condition.
- C. For the top slab and above-grade exposed side walls, the concrete shall be sealed with two coats of a Type finish in accordance with Section 03 30 00 – Cast-In-Place Concrete penetrating concrete slab sealer.

2.14 COATINGS

- A. Coatings shall be provided in accordance to Section 09 90 00 – Painting and Coating.
- B. Epoxy Coating
 - 1. The interior surface of the wet well shall receive a factory applied epoxy coating. Apply at wall surfaces (full height) and ceiling.
 - 2. Surfaces shall be abrasive blasted and allowed to cure a minimum of 28 days prior to application of epoxy coating system. Follow manufacturer’s instructions for primer, application temperatures, etc. Use Sika Corporation “Sikagard 62”, Euclid Chemical Company “Duraltex 1707”, or Approved Equal.

PART 3 EXECUTION

3.01 SHIPMENT AND STORAGE

- A. Products shall be shipped and stored in accordance with Section 01 60 00 - Common Product Requirements.
- B. Supplier shall provide Contractor with detailed recommendations and instructions for product storage.

3.02 SUPPLIER'S FIELD SERVICES

- A. Supplier shall provide field services in accordance with Section 01 60 00 – Common Product Requirements and as further required within this Section.
- B. Supplier shall provide assistance during product installation as required by the Contractor.

3.03 INSTALLATION

- A. Supplier's services shall be provided as specified in Section 01 60 00 – Common Product Requirements.
- B. The Supplier shall provide the Contractor with detailed recommendations and instructions for installation of the products specified in this Section.
- C. Supplier shall provide assistance during product installation as required by the Contractor.
- D. The equipment shall be installed at the locations shown and in accordance with the recommendations of the Supplier.
- E. Examination
 - 1. Verify that subgrade elevations for vault base is correct, excavation is dewatered, and subgrade is pre-compacted.
 - 2. Verify that rejected units have been removed from Site.
- F. Preparation
 - 1. Provide foundation mat of run-of-crusher stone to support base. Mat shall be 6 inches minimum depth and shall bear on sound undisturbed earth; excavate and remove subgrade material as necessary to reach sound subgrade.
 - 2. Stone foundation mat shall be a minimum of 1 foot greater than the footprint of the vault base, and shall be compacted to a uniform, level surface.
- G. Base Vault shall be accurately located and uniformly supported on the foundation mat in a level position.
- H. Install wall sections in properly oriented position; follow Supplier instructions for joining together each section using the gaskets. Pack joints with grout.
- I. Units shall be laid-up plumb and level.

- J. Contractor is responsible for the integrity of all materials and protection against flotation during the installation and backfilling process.
- K. Coatings
1. All exterior below-grade wall joints shall be sealed using a membrane waterproofing system. Next, all below-grade wall surfaces shall be waterproofed, applied per Supplier instructions.
 2. After installation is complete, the cover slab and interior walking surfaces shall be sealed as specified above.
 3. After installation of mechanical equipment, provide touch-up painting of damaged epoxy wall finish.
- L. Backfilling
1. Backfill using well compacted structural fill material, being careful to not damage exterior waterproof coating while providing full support under connecting pipes using compacted bedding material.
 2. During the one year warranty period, all visible leaks shall be sealed in an approved manner.

3.04 SCHEDULE OF VAULTS

Vault Identification	Reference Drawing
Concentrate Isolation Plug Valve Vault	S-10-1102, D-10-1103
Concentrate Isolation Check Valve Vault	S-10-1102, D-10-1103
IWPS No. 1 Isolation Plug Valve Vault	S-10-1103, D-10-1104
Plant Drain Pump Station	S-40-2101/2301, D-40-2101/2301
NPW Valve Vault Replacement	Same size as existing vault, refer to C-10-2309

END OF SECTION

SECTION 03 60 00

GROUTING

PART 1 GENERAL

1.01 DESCRIPTION

- A. Section includes: Grout for column base plates, other structural supports, equipment bases, reinforcing bar dowels, surface repair, grout toppings, patching of fresh concrete, and uses other than masonry. Grout for masonry is specified in Section 04 20 00. Adhesive anchor bolt grouting is specified in Section 05 05 20. Topping concrete over precast elements and clarifier topping concrete is specified in Section 03 30 00.

1.02 RELATED SECTIONS

- A. This section contains specific references to the following related sections. Additional related sections may apply that are not specifically listed below.
1. Section 03 30 00 Cast-In-Place Concrete
 2. Section 04 22 00 Unit Masonry
 3. Section 05 05 20 Anchor Bolts
 4. Section 43 05 13 Rigid Equipment Mounts

1.03 REFERENCES:

- A. The references listed below are a part of this section. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
ASTM C109	Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 inch or 50 mm Cube Specimens)
ASTM C230	Flow Table for Use in Tests of Hydraulic Cement
ASTM C307	Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing
ASTM C939	Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)
ASTM C531	Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes
ASTM C579	Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing and Polymer Concretes
ASTM C882	Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear
ASTM C942	Standard Test Method for Compressive Strength of Grouts for Preplaced-Aggregate Concrete in the Laboratory

Reference	Title
ASTM C1107	Packaged Dry, Hydraulic-Cement Grout (Non-shrink)
ASTM C1181	Standard Test Methods for Compressive Creep of Chemical-Resistant Polymer Machinery Grouts
ASTM E329	Agencies Engaged in Construction Inspection, Testing, or Special Inspection
COE CRD-C611	Flow of Grout for Preplaced Aggregate Concrete
COE CRD-C621	Non-shrink Grout
FBC	Florida Building Code with local code amendments

1.04 SUBMITTALS

A. Action Submittals

1. Procedure: Section 01 33 00:
2. A copy of this specification section with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.
3. Check-marks (✓) shall denote full compliance with a paragraph as a whole. Deviations shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Include a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
4. Complete product literature, including mixing, handling and placement instructions for the following: Cementitious non-shrink grout, epoxy grout, adhesive for reinforcing bar dowel grouting, concrete repair mortar, and prepackaged cement grout products to be used on the project.
5. Mix design for cement grout that is not prepackaged, including product data for aggregates and cement in accordance with Section 03 30 00.
6. Current ICC Evaluation Service reports for adhesives used for reinforcing dowels.
7. Installer certification in accordance with ACI/CRSI Adhesive Anchor Installer Certification Program for installers of horizontal or upwardly inclined reinforcing bar dowels grouted using adhesive.
8. Certified test results verifying the compressive strength, shrinkage and expansion requirements specified herein.

1.05 QUALITY ASSURANCE

A. Quality Control by Owner

1. Special inspection services shall be performed by the Special Inspector under contract with the Owner and in accordance with FBC and local amendments.
2. Adhesive anchors installed in horizontal or upwardly inclined orientations to resist sustained tension loads shall be continuously inspected during installation by a Special Inspector.

- a. The Special Inspector shall furnish a report to the Engineer, Owner's Representative and Building Official that the work covered by the report has been performed and that the materials used and the installation procedures used conform with the approved Project Manual and the Manufacturer's Printed Installation Instructions (MPII).
- B. Quality Control by Contractor
1. Provide the services of an independent testing laboratory which complies with the requirements of ASTM E329 if a product other than those listed below is proposed and test data is not available from the supplier to demonstrate equivalence to the specified grout. The testing laboratory shall sample and test the proposed grout materials. Costs of testing laboratory services shall be borne by the Contractor.
- C. Certifications
1. Installer certification shall be in accordance with ACI/CRSI Adhesive Anchor Installer Certification Program for installers of horizontal or upwardly inclined reinforcing bar dowels grouted using adhesive.
- D. Compression test specimens will be taken during construction from the first placement of each type of grout and at intervals thereafter as selected by the Engineer to insure continued compliance with these Specifications.
1. Compression tests and fabrication of specimens for epoxy grout will be performed as specified in ASTM C579, Method B, at intervals during construction as selected by the Engineer. A set of three specimens will be made for testing at seven days and any other time period as appropriate.
 2. Compression tests and fabrication of specimens for cement grout and non-shrink grout will be performed as specified in ASTM C109 at intervals during construction as selected by the Engineer. A set of three specimens will be made for testing at seven days, 28 days and any additional time period as appropriate.
- E. Manufacturer Qualifications
1. Manufacturer shall have a minimum of five years experience of producing products substantially similar to that required and shall be able to submit documentation of at least five satisfactory installations that have been in successful operation for at least five years each.
 2. When required, provide services of manufacturer's full-time employee, factory-trained in handling, use, and installing the products required, with at least five years of experience in field applications of the products required.

PART 2 PRODUCTS

2.01 CEMENTITIOUS NON-SHRINK GROUT

- A. The grout material shall be an approved ready to use mixture requiring only water for use at the job site. The 2-inch cubes shall have a minimum compressive strength of 3,000 psi at 7 days and 7,000 psi at 28 days.
- B. Cementitious non-shrink non-metallic aggregate grout shall be:
 1. BASF, Masterflow 928

2. Euclid Chemical Company, Hi-Flow Grout
 3. Five Star Products, Inc., Five Star Grout
 4. Sika Corporation, SikaGrout 212
 5. Approved Equal
- C. Non-shrink grout shall conform to CRD-C 621 and ASTM C1107, Grade B or C when tested at a maximum fluid consistency of 30 seconds per ASTM C939 at temperature extremes of 45 degrees Fahrenheit and 90 degrees Fahrenheit and an extended working time of 15 minutes.
- D. Fluid grout shall pass through the flow cone, with continuous flow, one hour after mixing.

2.02 EPOXY GROUT FOR EQUIPMENT MOUNTING:

- A. Epoxy grout shall be a pourable, non-shrink, 100-percent solids system.
- B. Epoxy grout for equipment mounting shall be a non-cementitious, resin based, multi-component formulation. Epoxy grout shall be flowable, with shrinkage minimized to achieve minimum 98% effective bearing area. Epoxy grout shall be:
1. BASF, Masterflow 648
 2. Euclid Chemical Company, E3-G
 3. Sika Corporation, Sikadur 42
 4. Approved Equal.
- C. The following properties shall be attained with the minimum quantity of aggregate allowed by epoxy grout manufacturer.
1. Length change after hardening shall be less than 0.0006-inch per inch and coefficient of thermal expansion shall be less than 0.00003-inch per inch per degree F when tested in accordance with ASTM C531.
 2. Compressive creep at one year shall be less than 0.001-inch per inch when tested under a 400-psi constant load at 140 degrees F in accordance with ASTM C1181.
 3. Minimum seven-day compressive strength shall be 14,000 psi when tested in accordance with ASTM C579
 4. Grout shall be capable of maintaining at least a flowable consistency for minimum of 30 minutes at 70 degrees F.
 5. Shear bond strength to portland cement concrete shall be greater than shear strength of concrete when tested in accordance with ASTM C882/C882M.

2.03 ADHESIVE FOR GROUTING REINFORCING BAR DOWELS

- A. Adhesive for setting dowels in concrete shall be an injectable two-component epoxy adhesive. Adhesive shall be approved for the intended use per the product ICC Report. Adhesive shall be:
1. Hilti, HIT-RE 500v3
 2. Simpson Strong Tie, SET XP
 3. Approved Equal (equivalent product must have ICC approval for use in cracked concrete in areas with high seismic risk).

- B. Adhesive for setting dowels in concrete masonry shall be an injectable two-component epoxy adhesive. Adhesive shall be approved for the intended use per the product ICC Report or IAPMO Report. Adhesive shall be:
 - 1. Hilti, HIT-HY 70
 - 2. Simpson Strong Tie, SET XP
 - 3. Approved Equal [acceptable per ICC Report or IAPMO Report for resisting earthquake loads]

2.04 CONCRETE REPAIR MORTAR

- A. Horizontal Applications: Repair mortars shall be:
 - 1. BASF, MasterEmaco S 466CI
 - 2. Sika Corporation, SikaTop 111 Plus
 - 3. Approved Equal
- B. Vertical and Overhead Applications: Repair mortars shall be:
 - 1. BASF, MasterEmaco 1500HCR Vertical Overhead
 - 2. Sika Corporation, SikaTop 123 Plus
 - 3. Approved Equal

2.05 CEMENT GROUT

- A. Cement grout shall be comprised of cement, fine aggregate, coarse aggregate, water, and admixtures proportioned and mixed in accordance with this Section.
 - 1. Minimum Compressive Strength: 4,500 psi at 28 days.
 - 2. Maximum Water Cement Ratio: 0.42 by weight.
 - 3. Coarse Aggregate: ASTM C33/C33M, No. 8 size.
 - 4. Fine Aggregate: ASTM C33/C33M, approximately 60 percent by weight of total aggregate.
 - 5. Air Content: Five percent (plus or minus one percent).
 - 6. Minimum Cement Content: 564 pounds per cubic yard.
 - 7. Slump for grout fill shall be adjusted to match placing and finishing conditions, and shall not exceed four inches.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine and accept existing conditions before beginning work.

3.02 CEMENTITIOUS NONSHRINK GROUT

- A. Non-shrink, cementitious, nonmetallic aggregate grout shall be used for column base plates, structural bearing plates, and all locations where the general term “non-shrink grout” is indicated on the Drawings. Use of this grout to support the bearing surfaces of machinery shall be as specified in Section 43 05 13 or as detailed on the Drawings for specific locations or pieces of equipment. If guidance is not provided in locations noted

above, use of non-shrink grout for equipment mounting shall be limited to equipment less than 25 horsepower or 750 pounds. Grout shall be placed and cured in accordance with the manufacturer's instructions.

- B. Non-shrink cementitious grout shall not be used as a surface patch or topping. Non-shrink cementitious grout must be used in confined applications only.

3.03 EPOXY GROUT FOR EQUIPMENT MOUNTING

- A. Prepare concrete surfaces of equipment pads as indicated in details on the Drawings and as required by the epoxy grout manufacturer. Epoxy grout for equipment mounting shall be placed and cured in accordance with the requirements of Section 43 05 13, details on the Drawings, and in conformance with manufacturer's recommendations.

3.04 ADHESIVE FOR GROUTING REINFORCING BAR DOWELS

- A. Follow manufacturer's instructions.

3.05 CONCRETE REPAIR MORTAR

- A. Concrete repair materials and procedures shall be submitted for review to the Owner's Representative and shall be accepted prior to commencement of the repair work.
- B. Follow all manufacturer's instructions, including those for minimum and maximum application thickness, surface preparation and curing. Add aggregate as required per manufacturer's recommendations. Any deviations from the manufacturer's instructions shall be submitted for review to the Owner's Representative and shall be accepted prior to commencement of the work.

3.06 CEMENT GROUT

- A. Cement grout shall be used for grout toppings less than four inches thick and for patching of fresh concrete.
- B. Grouting shall comply with temperature and weather limitations in Section 03 30 00, Cast-In-Place Concrete.
- C. Cure grout in accordance with grout manufacturer's instructions for prepackaged grout and Section 03 30 00, Cast-In-Place Concrete, for non-prepackaged cement grout.

END OF SECTION

SECTION 03 70 00

MASS CONCRETE

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Requirements for cast-in-place mass concrete as defined in Section 03 30 00 for Class A concrete.

1.02 RELATED SECTIONS

- A. This section contains specific references to the following related sections. Additional related sections may apply that are not specifically listed below.
1. Section 03 30 00 Cast-In-Place Concrete

1.03 REFERENCES

- A. The references listed below are a part of this section. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
ACI 207.1R	Guide to Mass Concrete
ACI 207.2R	Report on Thermal and Volume Change Effects on Cracking Of Mass Concrete
ACI 207.4R	Cooling and Insulating Systems for Mass Concrete
ACI 301	Specifications for Structural Concrete
ASTM C494	Chemical Admixtures for Concrete

1.04 SUBMITTALS

- A. Action Submittals
1. Procedures: Section 01 33 00.
 2. A copy of this specification section with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.
 3. Check-marks (✓) shall denote full compliance with a paragraph as a whole. Deviations shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Include a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

4. Temperature control plan, including system for monitoring the temperature of concrete and reducing excessive temperature and temperature differentials. Temperature control plan shall include the following items:
 - a. Calculated or measured temperature rise of concrete.
 - b. Upper limit for concrete temperature at time of placement.
 - c. Description of specific measures and equipment that will be used to ensure maximum temperature in placement will not exceed specified maximum temperature limit.
 - d. Calculated maximum temperature in placement based on expected conditions at time of placement and use of proposed measures to control temperatures.
 - e. Description of specific measures and equipment that will be used to ensure temperature difference will not exceed specified temperature difference limit.
 - f. Calculated maximum temperature difference in placement based on expected conditions at time of placement and use of proposed measures to control temperature differences.
 - g. Description of equipment and procedures that will be used to monitor and log temperatures and temperature differences.
 - h. Drawing showing locations for temperature sensors.
 - i. Description of format and frequency of providing temperature data.
 - j. Description of measures to address and reduce excessive temperatures and temperature differences, if they occur.
 - k. Description of curing procedures, including materials and methods, and curing duration.
 - l. Description of formwork removal procedures to ensure temperature difference at temporarily exposed surface will not exceed temperature difference limit, and how curing will be maintained.
 - m. If concrete design mixture is changed, temperature control plan must be updated.
 - n. Temperature control plan shall take into account and be coordinated with the lift heights that the Contractor plans for mass concrete pours. Locations of horizontal joints in the mass concrete pours due to planned lift heights shall be submitted for approval to the Engineer.
5. Performance-Based Temperature Difference Limit Approach:
 - a. If the performance based approach to differential temperatures is utilized (see Temperature Control article below in Part 3), submit report with substantiating test data and graphs showing relation between differential temperature and strength of concrete.
6. Layout of cooling pipe system, if used, showing pipe sizes and material type, connections, location, spacing, method of support, and system for monitoring the temperature of the water in the cooling pipes.

1.05 QUALITY ASSURANCE

A. General

1. Quality control shall be in accordance with Section 03 30 00, plus the additional provisions specified in this section for mass concrete.

PART 2 PRODUCTS

2.01 GENERAL

- A. Mass concrete materials and concrete characteristics, including mix design, shall be in accordance with the requirements for Concrete Class "A" in Section 03 30 00 and shall further comply with the additional requirements specified in this section.
1. Compressive Strength: Minimum 56-day compressive strength = 4,000 psi.
 2. Cement:
 - a. Cement shall be Portland Cement Type II (moderate heat of hydration), except as modified herein.
 - b. Cement shall contain no more than 8 percent tricalcium aluminate.
 - c. The sum of tricalcium aluminate and tricalcium silicate shall be less than 58 percent.
 - d. Cement shall be stored in a covered, shaded silo to prevent heating by direct sunlight.
 3. Coarse Aggregate:
 - a. Aggregates shall be stored in a covered area and the aggregates shaded to prevent heating by direct sunlight.
 - b. Aggregates shall be continuously sprayed with water to cool the aggregates. The water content of the concrete mix shall be adjusted to account for the cooling water.
 4. Fine Aggregate:
 - a. Aggregates shall be stored in a covered area and the aggregates shaded to prevent heating by direct sunlight.
 - b. Aggregates shall be continuously sprayed with water to cool the aggregates. The water content of the concrete mix shall be adjusted to account for the cooling water.
 5. Concrete Admixtures:
 - a. Provide water reducing admixture, as specified in Section 03 30 00, in all mass concrete.
 - b. Provide pozzolan (fly ash) as specified in Section 03 30 00 in all mass concrete. Note that only Class F fly ash is allowed.
 - c. Set Retarding Admixture:
 - 1) At the Contractor's option, a set retarding admixture can be used to control set time and minimize premature setting of concrete and formation of cold joints.
 - 2) Set retarding admixture shall conform to ASTM C494, Type B.
 - 3) Admixture dosage shall be per the manufacturer's written requirements.
 6. Water and Ice:
 - a. Mixing water shall be as specified in Section 03 30 00.
 - b. Ice used in lieu of, or in addition to, mixing water shall be made from water conforming to Section 03 30 00.

PART 3 EXECUTION

3.01 PLACING CONCRETE

- A. Concrete placement shall conform to Section 03 30 00 except as modified herein.

3.02 TEMPERATURE CONTROL

A. General:

1. Maximum as-delivered concrete temperature shall be 70 degrees F.
2. During placement of concrete, temperature control measures shall be in place to limit the maximum initial concrete temperature rise to 20 degrees F during placement.
3. The maximum allowable temperature of the concrete shall be 158 degrees F.
4. Difference in temperature between concrete interior and surface temperatures shall not exceed 35 degrees F. As an alternative to meeting the 35 degree F maximum differential temperature limit, submit for approval a "Performance-Based Temperature Difference Limit" approach where the allowable differential temperature limit varies with the in-place compressive strength of the concrete (reference ACI 207.2R for more information on this approach). The performance based approach shall be based on measurements of key thermal and physical properties of the project mass concrete mix, such as compressive strength, elastic modulus, and tensile strength, to determine relations between these parameters.
5. Install a temperature monitoring system to measure temperatures within the interior and at the surface of the concrete.
6. Provide a means to control the concrete temperature differential based on the temperature monitoring data.
7. The interior of the concrete shall be allowed to cool down and stabilize for a minimum of 21 days from the time of placement.
8. No mass concrete placement shall occur until written approval of the temperature control plan.

B. Pre-Cooling of the Concrete Mix:

1. Pre-cooling of the concrete mix prior to placement may also be attained by the following means:
 - a. Batch water shall be cooled and ice may be substituted for a portion of the batch water.
 - b. Alternative means proposed and approved by the Construction Manager.

C. Cooling During Concrete Placement:

1. Use fog sprayers to reduce the ambient air temperature. Adjust the water content of the concrete to account for added water.

D. Post-Cooling of the Concrete:

1. Concrete shall be water cured as soon as possible following placement per the requirements of Section 03 30 00. Cold water shall not be used for curing because it will increase the differential temperature between the surface and interior.

2. The temperature of the interior and surfaces of the concrete shall be continuously monitored during the cooling period.
3. The cooling period is defined as the time required for the interior of the concrete placement to stabilize and shall be a minimum of 21 days from the time of placement.
4. Insulating blankets may be used over the pumped curing water to prevent rapid surface cooling.
5. Embedded thin walled piping and circulating water may be used to control heat gain in the previously cast concrete. Clearly indicate in the temperature control plan if cooling piping will be embedded in the concrete. The embedded piping shall not be installed within the top 20 inches of the slab or wall. The cooling pipe system shall be operated for the duration of the cooling period.

END OF SECTION

SECTION 04 20 00

UNIT MASONRY

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope

1. This section specifies masonry work consisting of concrete masonry units, general unreinforced and reinforced masonry construction.

B. Type

1. Masonry work shall be constructed from units of concrete in combination with reinforcing, mortar, and grout as specified.

1.02 QUALITY ASSURANCE

A. References

1. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ASTM A90	Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles
ASTM A153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A1064	Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed for Concrete
ASTM C90	Loadbearing Concrete Masonry Units
ASTM C91	Masonry Cement
ASTM C129	Non-Load-Bearing Concrete Masonry Units
ASTM C144	Aggregate for Masonry Mortar
ASTM C150	Portland Cement
ASTM C207	Hydrated Lime for Masonry Purposes
ASTM C270	Mortar for Unit Masonry
ASTM C404	Aggregates for Masonry Grout
ASTM C476	Grout for Masonry

Reference	Title
ASTM C666	Resistance of Concrete to Rapid Freezing and Thawing
ASTM E514	Water Penetration and Leakage Through Masonry

B. Sample Panel

1. A sample masonry panel for each type of masonry, approximately 6 feet long by 4 feet high shall be constructed on site for approval by the Construction Manager. Each panel shall show the workmanship, coursing, bond, anchors, joint reinforcing wall ties, tooling of joints, range of color, texture of masonry, and mortar color. Finished work shall match the approved sample panel.

C. Appearance

1. Source or supply of materials shall not be changed after the work has started if the appearance of the finished work would be affected.

D. Efflorescence Testing

1. Certified efflorescence test reports shall be provided on masonry units that are to be exposed to weathering. Schedule tests far enough in advance of starting masonry work to permit retesting if necessary. Test three pairs of specimens of each type of masonry unit for efflorescence in accordance with ASTM C67. If any pair is rated "effloresced," the units represented by the samples will be rejected.

1.03 SUBMITTALS

A. The following information shall be provided in accordance with Section 01 33 00:

1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Construction Manager shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
2. Shop drawings showing details of bond beams and lintels.
3. Three representative full-size sample masonry units showing full range of color, texture, finish, and dimensions.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Cementitious materials shall be delivered to the site in unbroken containers, plainly marked and labeled with manufacturers' names and brands, stored in dry, weathertight enclosures to prevent entry of foreign materials and damage by water or dampness. Masonry units shall be stored off the ground and handled with care to avoid chipping and**

breakage. Materials shall be protected from damage and, except for sand, kept dry until used. Sand shall be covered to prevent intrusion of water and foreign materials and to prevent drying. Materials containing frost or ice shall not be used.

PART 2 PRODUCTS

2.01 MASONRY UNITS

A. Concrete Masonry Units:

1. General:

- a. Concrete masonry units shall be of modular dimensions and air, water, or steam cured. Unless otherwise specified, exposed surfaces of units shall be comparatively smooth and of uniform texture. Special surface texture or, architectural faces shall be provided where specified. Surfaces of units which are to be plastered or stuccoed shall be sufficiently rough to provide a suitable bond.

2. Hollow Load-Bearing Units:

- a. Hollow load-bearing units shall conform to ASTM C90 made with lightweight or medium weight aggregate. Load-bearing units shall be provided, unless otherwise specified.

3. Hollow Non-Load-Bearing Units:

- a. Hollow non-load-bearing units, where specified, shall conform to ASTM C129, Type I, made with lightweight or medium weight aggregate. Load-bearing units may be provided in lieu of non-load-bearing units.

4. Special Shapes

- a. Special shapes such as closures, header units, and jamb units shall be provided as necessary to complete the work. Special shapes shall conform to the requirements for the units with which they are used.

B. Filled Ground Face Concrete Masonry Units:

1. In addition to requirements applicable to all concrete masonry units, comply with this Article for filled ground-face concrete masonry units.

2. Products and Manufacturers: Provide one of the following:

- a. Trendstone Plus, by Trenwyth Industries, an Oldcastle Company
- b. Or Approved Equal.

3. Filled Ground-Face Concrete Masonry Units: Provide face of units filled with cementitious grout with minimum cured strength and durability equal to concrete masonry units. After polishing, filled surface shall have factory-applied heat treated acrylic coating conforming with ASTM C744 relative to adhesion, abrasion, color change, and resistance to fading. Provide the following:

- a. ASTM C90 compliant.
- b. Facing Components, ASTM C744.
- c. Freeze/Thaw Durability, ASTM C1262: No separation, spalling, cracking, or disintegration of facing.

4. Color and Score Pattern: Provide the following"

- a. ENGINEER will select maximum of four colors.
- b. Color, surface texture, and aggregate uniform within normal range established by Sample approved by ENGINEER.

C. Precast Concrete Lintels

1. Precast concrete lintels shall be of the same materials and surface texture as adjacent masonry units, with a 28-day compressive strength of not less than 2000 psi. Reinforcing shall be provided as specified. Lintels shall be of sizes specified, straight and true, with at least 8 inches of bearing at each end.

2.02 MORTAR

A. Cement

1. Cement shall be Portland cement conforming to ASTM C150, Type II, low alkali containing less than 0.60 percent alkalis.

B. Hydrated Lime

1. Hydrated lime shall conform to ASTM C207, Type S.

C. Masonry Cement

1. Masonry cement shall conform to ASTM C91, except that for masonry cement used in mortar for exterior walls, the air content of the mortar specimen shall be not more than 16 percent by volume in lieu of 22 percent. Containers shall bear complete instructions for proportioning and mixing to obtain the required types of mortar.

D. Sand

1. Aggregate for mortar shall be sand conforming to ASTM C144.

E. Water

1. Water shall be clean, potable, and free from substances which could adversely affect the mortar.

F. Waterproofing Compound

1. Mortar shall contain an admixture of Master Builders Rheomix 235, Sonneborn Hydrocide Powder, or equal.

G. Mortar Types

1. Unless otherwise specified, mortar shall be ASTM C270, Type M for foundation and exterior walls and other load-bearing or shear-wall masonry, and Type S for non-load-bearing, non-shear-wall interior masonry. Waterproofing compound shall be added in accordance with manufacturer's recommendations. Air content shall not be less than 11 percent. Where colored mortar is specified to match the masonry units, add colorant to obtain the color indicated. Colorant shall be alkali-resistant iron oxide based and shall be Sonneborn "Sonobrite," Solomon Grind-Chem Service, Inc., "Concentrated Cement Color," or equal.

H. Premixed Mortar

1. Premixed mortar shall be ASTM C270, Type M or S for use as specified in paragraph 2.02 Mortar Types. Water proofing compound shall be added in accordance with manufacturer's recommendation. Air content shall not be less than 11 percent.

I. Admixtures

1. Admixtures may be used in mortar to retard curing and provide up to 36 hours of workability, provided that the admixture does not adversely affect bonding or compressive strength.

2.03 ACCESSORIES

A. Horizontal Joint Reinforcement:

1. Horizontal joint reinforcement shall be fabricated from cold drawn steel wire, ASTM A82. Wire shall be hot-dipped galvanized after fabrication in accordance with ASTM A153. Reinforcement shall be truss type with two or more longitudinal wires welded to a continuous diagonal cross wire, or ladder type with perpendicular cross wires not more than 16 inches o.c. Reinforcement shall be provided in flat sections 10 feet long, and preformed corners and tees approximately 30 inches long. Overall width shall be approximately 2-inches less than nominal thickness of wall.
2. For single-wythe walls and partitions, two 9-gage longitudinal wires and 9-gage cross wires shall be provided.

B. Reinforcing Bars

1. Reinforcing steel shall be as specified in Section 03 20 00. Unless specifically indicated otherwise, Minimum Lap Splice and development length for both vertical and horizontal reinforcing shall be 48 x diameter of rebar.

C. Anchors And Ties

1. General
 - a. Anchors and ties shall be approved designs of stainless steel, zinc-coated steel, or noncorrosive metal having the equivalent total strength of steel types. Zinc-coated steel shall be coated by the hot-dip process after fabrication to a minimum of 1.25 ounces of zinc per square foot of surface when tested in accordance with ASTM A90.
2. Corrugated Metal Ties
 - a. Metal ties shall be not less than 7/8-inch wide by approximately 7 inches long and not lighter than 22 gage.
3. Rigid Steel Anchors
 - a. Rigid steel anchors shall be not less than 1 inch wide, 1/4 inch thick, and 24 inches long with each end bent not less than 2 inches.
4. Dovetail Flat Bar Or Wire Anchors
 - a. Flat bar anchors shall be sheet steel, not lighter than 16 gage, and 7/8-inch wide, with end turned up 1/4 inch. Wire anchors shall be not lighter than 6 gage, 7/8-inch wide with wire looped and closed.
5. Dovetail Anchor Slots
 - a. Unless otherwise specified, Dovetail slots shall be made of galvanized steel with minimum dimensions of 1 inch wide back by 1 inch deep by 5/8-inch throat.

D. Through-Wall Flashing

1. Flashing, where specified, shall be 5-ounce, electrolytic copper sheet, uniformly coated on both sides with acidproof, alkaliproof, elastic bituminous compound. Factory applied coating shall weigh not less than 6 ounces per square foot (approximately 3 ounces per square foot on each side).

2.04 GROUT

A. General

1. Grout shall comply with ASTM C476, shall use Type II cement, and shall be proportioned by volume to achieve a minimum 28-day compressive strength of 2,000 psi. Grout shall have sufficient water added to produce a consistency for pouring without segregation.

B. Aggregate

1. Aggregate shall comply with ASTM C404.

C. Fine Grout

1. Fine grout shall be composed of one part cement, not more than 1/10 part lime, and 2 1/4 to 3 parts fine aggregate.

D. Coarse Grout

1. Coarse grout shall be composed of one part cement, not more than 1/10 part lime, 2 to 3 parts fine aggregate, and not more than 2 parts coarse aggregate.

2.05 PRODUCT DATA

A. The following information shall be provided in accordance with Section 01 33 00.

Information shall be received by the Construction Manager at least 14 days prior to the beginning of masonry work.

1. Masonry unit certificates showing compliance to the specifications shall be submitted for each type of masonry unit.
2. Reinforcing certificates showing compliance to the specifications shall be submitted for reinforcing steel, including reinforcing steel wire and joint reinforcing, as specified herein and in Section 03 20 00.
3. Certified efflorescence test reports specified in paragraph 1.02 Efflorescence Testing.
4. Shop drawings showing details of anchors, adjustable wall ties, positioning devices, and other accessories.
5. Manufacturer's data and descriptive literature for each type of masonry accessory, premixed mortar, masonry cement, grout admixtures, and flashing. Clearly mark the data to indicate which type, size, or item the Contractor intends to provide. Data shall show conformance to specified requirements and Contractor's proposed usage details.

PART 3 EXECUTION

3.01 PREPARATION

A. General

1. Foundations for masonry work shall be straight, on-line, and level. All surfaces to be bonded with masonry shall be clean and free from laitance or foreign materials. Reinforcing dowels shall be in the correct location as specified. The placement and location of anchor ties, inserts, and other embedded items in concrete or other adjoining work shall be coordinated by the Contractor to suit the masonry work.

B. Protection

1. Exposed surfaces shall be protected from mortar and other stains. When mortar joints are tooled, remove mortar from exposed surfaces with fiber brushes and wooden paddles. Base of walls shall be protected from splash stains by covering adjacent ground with sand, sawdust, or polyethylene.
2. Uniform loads shall not be applied for at least 12 hours or concentrated loads for at least 72 hours after masonry is constructed.
3. Temporary bracing shall be provided as required to prevent damage during construction.
4. Protective boards for polyester film shall be provided during job installation to ensure no damage from building debris.

3.02 WORKMANSHIP

- A. Masonry shall be level and plumb. Story poles or gage rods shall be used throughout the work. Changes in coursing or bonding after the work is started will not be permitted; neither will carrying one section of the walls up in advance of the others be permitted. Unfinished work shall be stepped back for joining with new work; toothing will not be permitted. Heights of masonry at each floor and at sills and heads of openings shall be checked with an instrument to maintain the level of the walls. Door and window frames, louvered openings, anchors, pipes, ducts, and conduits shall be built in as the masonry work progresses. Spaces around metal door frames shall be filled solidly with mortar. Drilling, cutting, fitting, and patching to accommodate the work of others shall be performed by masonry mechanics. Masonry shall be cut with masonry saws for exposed work. Structural steelwork, bolts, anchors, inserts, plugs, ties, lintels, and miscellaneous metalwork shall be placed in position as the work progresses. Chases of approved dimensions for pipes and other purposes shall be provided where specified and necessary. Tops of exposed walls and partitions not being worked on shall be covered with a waterproof membrane secured in place and extended down at least 2 feet on both sides.

3.03 MORTAR MIXING

- A. Mortar materials shall be measured in 1 cubic foot containers to maintain control and accuracy of proportions; measuring materials with shovels is not permitted. Mortar shall be mixed in a mechanical batch mixer for not less than 3 nor more than 5 minutes after all ingredients are in so as to produce a uniform mixture. Water shall be added gradually as required to produce a workable consistency. Mortar not formulated to include retarding admixtures, which has not been placed in final position within 2-1/2 hours after the initial mixing, shall not be retempered and used. Use of antifreeze compounds, salts, or other substances to lower the freezing point of mortar is prohibited.
- B. Mortar shall be mixed in accordance with ASTM C270 to obtain type mortar required. Where colored mortars are required, pigments may be added at the site or provided as part of prepackaged mortar mix. When masonry cement is used, mixing shall conform to printed instructions of the masonry cement manufacturer.

3.04 MORTAR JOINTS

- A. Mortar joints shall be a uniform thickness of 3/8-inch unless otherwise specified. Exposed joints shall be tooled slightly concave with a round or other suitable jointer when

the mortar is thumbprint hard except where otherwise required to match existing construction. For horizontal joints, jointers shall be at least 16 inches long for concrete masonry. Jointers shall be slightly larger than the width of the joint so that complete contact is made along the edges of the units, compressing and sealing the surface of the joint. Joints that will not be exposed shall be struck flush. Vertical joints shall be tooled first. Horizontal joints shall be level; vertical joints shall be plumb and in alignment from top to bottom of wall within a tolerance of plus or minus 1/2 inch in 40 feet.

- B. Weep holes shall be placed at a maximum spacing of 48 inches at the base of cavity walls or veneer walls and in the course bearing on through-wall flashing.

3.05 TOLERANCES

- A. Masonry work shall be within the following limits:
 1. Pilasters and Columns: 1/4 inch from true line..
 2. Face of Concrete Masonry Unit: 1/16 inch from face of adjacent unit.
 3. Variation from True Plane: 1/4 inch in 10 feet and 1/2 inch maximum in 20 feet or more.
 4. Variation from Plumb: 1/4 inch in each story, noncumulative and 1/2 inch maximum in two stories or more.
 5. Variation from Level: 1/8 inch in 3 feet, 1/4 inch in 10 feet, and 1/2 inch maximum.
 6. Variation in Wall Thickness: Plus or minus 1/4 inch.

3.06 CONCRETE MASONRY UNIT WORK

- A. General
 1. The first course shall be laid in a full bed of mortar for the full width of the unit. Succeeding courses shall be laid in running bond unless otherwise specified. Bed-joints shall be formed by applying the mortar to the entire top surfaces of the inner and outer face shells and to head joints by applying the mortar for a width of about 1 inch to the ends of the adjoining units. The mortar shall be of such thickness that it will be forced out of the joints as the units are placed in position. Where anchors, bolts, and ties occur within the cells of the units, metal lath shall be placed in the joint at the bottom of such cells and the cells filled with mortar or grout as the work progresses. Except at grouted or reinforced masonry, concrete brick shall be used for bonding walls, working out the coursing, topping out walls under sloping slabs, distributing concentrated loads, backing brick headers, and elsewhere as required. Concrete masonry units shall not be dampened before or during laying.
- B. Special Concrete Masonry Unit Work
 1. Where exposed concrete masonry unit walls and partitions are specified, special concrete masonry unit work shall be provided. Units shall be selected for uniformity of size, texture, true plane, and undamaged edges and ends of exposed surfaces. Units shall be placed plumb, parallel, and with properly tooled joints of maximum 3/8-inch thickness, and exposed surfaces kept clean and free from blemishes or defects.
- C. Reinforced Concrete Masonry Unit Walls
 1. Where vertical reinforcement occurs, cores shall be filled solid with grout, and units laid in such a manner as to preserve the unobstructed vertical continuity of cores to

be filled. Adjacent webs shall be embedded in mortar to prevent leakage of grout, and mortar fins protruding from joints removed before grout is placed. Minimum clear dimensions of vertical cores shall be 2 by 3 inches. Reinforcing shall be positioned and held accurately before placing grout by tying or by using bar positioners at maximum 8-foot intervals. Vibrator shall be used to consolidate the grout. Minimum clear distance between masonry and vertical reinforcement shall be 1/2 inch. Unless otherwise specified, splices shall be formed by lapping bars not less than 40 bar diameters.

3.07 BONDING AND ANCHORING

- A. Unless otherwise specified, partitions shall extend from the floor to the bottom of the construction above. Walls and partitions shall be structurally bonded and anchored to each other and to concrete walls and beams. Unless otherwise specified, non-load-bearing partitions and interior walls shall be securely anchored to the construction above in a manner that provides lateral stability while permitting unrestricted deflection of construction above. Anchors shall be completely embedded in mortar joints.
- B. In addition, bonding and anchoring shall comply with the following procedures unless otherwise specified.
 - 1. At corners of load-bearing walls, provide a true masonry bond in each course.
 - 2. At intersections of load-bearing walls, provide a true masonry bond in each course, or anchor with rigid steel anchors not more than 2 feet apart vertically.
 - 3. At intersections of non-load-bearing partitions with other walls or partitions, tie with wire mesh ties at vertical intervals of not more than 2 feet or with masonry bonding in alternate courses.
 - 4. At masonry walls facing or abutting new concrete members, anchor masonry to the concrete with dovetail or wire-type anchors inserted in slots or inserts built into the concrete. To anchor masonry walls to existing concrete members, use corrugated metal ties anchored by drive pins to the concrete. Locate anchors not more than 18 inches o.c. vertically and not more than 24 inches o.c. horizontally.

3.08 HORIZONTAL JOINT REINFORCEMENT

- A. Unless otherwise specified, reinforcement shall be provided at 16-inch spacing in all masonry walls. Reinforcement shall be continuous except at control joints and expansion joints. Reinforcement above and below openings shall extend not less than 24 inches beyond each side of openings. Reinforcement shall be provided in the longest available lengths, utilizing the minimum number of splices. Welded L-shaped assemblies and welded T-shaped assemblies to match the straight reinforcement shall be provided at corners and intersections of walls and partitions.

3.09 CONCRETE MASONRY UNIT LINTELS AND BOND BEAMS

- A. Special units, lintels, and bond beams shall have cells filled solidly with grout or concrete, and provided with not less than two No. 5 reinforcing bars, unless otherwise specified. Reinforcing shall overlap a minimum of 40 bar diameters at splices. Bond beams and reinforcing shall terminate on each side of expansion joints. Concrete masonry units used for lintels and bond beams shall have exposed surfaces of the same material and texture as the adjoining masonry units. Bond beam units shall be produced from

standard vertically-voided units with precut knock-out cross walls. Lintels shall be straight and true and shall have at least 8 inches of bearing at each end. Lintels shall set at least 6 days before shoring is removed.

3.10 GROUT

A. General

1. Fine grout shall be provided in grout spaces which are less than 2 inches in any horizontal dimension after deducting the thickness of horizontal reinforcing or in which clearance between reinforcing and masonry is less than 3/4 inch. Coarse grout shall be provided in grout spaces which are 2 inches or greater in all horizontal dimensions after deducting the thickness of horizontal reinforcing provided the clearance between reinforcing and masonry is not less than 3/4 inch. For a coarse grout pour over 6 feet high, increase grout space minimum horizontal dimension to 3 inches.

B. Placement

1. Grout shall be placed from the interior side of walls, except as approved otherwise. Sills, ledges, offsets, and other surfaces shall be protected from grout droppings. Prior to grouting, the grout space shall be clean so that all spaces to be filled with grout do not contain mortar projections greater than 1/2 inch, mortar droppings, or other foreign material. Grout shall be well mixed to prevent segregation, shall be sufficiently fluid to flow into joints and around reinforcing without leaving voids, and shall be placed by pumping or pouring from buckets equipped with spouts. Grout shall be placed in a continuous pour in grout lifts not exceeding 6 feet. At grout pours exceeding 6 feet, cleanouts shall be provided in the bottom course at every vertical bar but shall not be spaced more than 32 inches on center for solidly grouted masonry. Pours shall be 1-1/2 inches below the top of masonry units in top course, except at the finish course. Grout shall be agitated thoroughly to eliminate voids. Masonry displaced by grouting operation shall be removed and relaid in alignment with fresh mortar.

3.11 FORMS AND SHORING

- A. Contractor shall construct forms to the shape, lines, and dimensions of members indicated and make sufficiently rigid to prevent deflections which may result in cracking or other damage to supported masonry. Forms shall not be removed until members have cured.

3.12 CLEANING

- A. Contractor shall protect work which may be damaged, stained, or discolored during cleaning operations.
- B. Exposed masonry surfaces shall be cleaned with clear water and stiff fiber brushes and rinsed with clear water. Where stains, mortar, or other soil remain, scrubbing shall continue with warm water and detergent. Immediately after cleaning, each area shall be rinsed thoroughly with clear water. Damaged, stained, and discolored work shall be restored to original condition or replaced with new work.

3.13 COLD WEATHER CONDITIONS

A. Construction

1. During cold weather, that is, when the air temperature is below 40 degrees F and falling, or when it appears that the air temperature will drop to 40 degrees F or below within 24 hours, Contractor shall not lay masonry unless the work is protected from freezing as specified below. Surfaces receiving mortar shall be free of ice and frost. The following requirements shall be adhered to:
 - a. Air Temperature 40 to 32 Degrees F:
 - 1) Heat sand or mixing water to produce mortar temperature between 40 and 120 degrees F.
 - b. Air Temperature 32 to 25 Degrees F:
 - 1) Heat sand and mixing water to produce mortar temperature between 40 and 120 degrees F.
 - c. Air Temperature 25 to 20 Degrees F:
 - 1) Heat sand and mixing water to produce mortar temperature between 40 and 120 degrees F. Use other heat sources on both sides of walls under construction. Use windbreaks when wind is in excess of 15 mph.
 - d. Air Temperature 20 Degrees F and Below:
 - 1) Heat sand and mixing water to produce mortar temperature between 40 and 120 degrees F. Provide enclosures and auxiliary heat to maintain air temperature above 32 degrees F on both sides of walls under construction. Ascertain that temperatures of masonry units are not less than 20 degrees F when units are laid.

B. Protection

1. Newly laid masonry shall be protected as specified below for the respective mean daily air temperature (MDAT), that is, the average of the daytime high temperature and the forecasted nighttime low temperature.
 - a. MDAT 40 to 32 degrees F:
 - 1) Protect masonry from rain and snow by covering the top 4 feet with weather-resistive membrane for 24 hours after laying.
 - b. MDAT 32 to 25 degrees F:
 - 1) Completely cover newly-laid masonry with weather-resistive membrane for 24 hours.
 - c. MDAT 25 to 20 degrees F:
 - 1) Completely cover newly-laid masonry with insulating blankets and weather-resistive membrane for 24 hours.
 - d. MDAT 20 degrees F and Below:
 - 1) Maintain temperature of masonry above 32 degrees F for 24 hours by providing enclosures and supplementary heat or other approved means.

3.14 SPECIAL INSPECTION

- A. Special masonry inspection as defined by the Local Amendments to Florida Building Code will be provided by the Construction Manager where specified. The Contractor shall

notify the Construction Manager of any masonry work requiring special inspection at least 48 hours before the work begins."

END OF SECTION

SECTION 05 05 14
HOT DIP GALVANIZING

PART 1 GENERAL

1.01 SUMMARY

A. Scope

1. This Section specifies hot-dip galvanizing of steel materials.

1.02 REFERENCES

A. Reference Codes and Standards

1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
ASTM A123	Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products
ASTM A143	Safeguarding Against Embrittlement of Hot Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement
ASTM A153	Zinc Coating (Hot Dip) on Iron and Steel Hardware
ASTM A384	Safeguarding Against Warpage and Distortion During Hot Dip Galvanizing of Steel Assemblies
ASTM A385	Providing High Quality Zinc Coatings (Hot Dip)
ASTM A780	Repair of Damaged and Uncoated Areas of Hot Dip Galvanized Coatings
ASTM B6	Zinc
ASTM D6386	Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting
ASTM E536	Test Methods for Chemical Analysis of Zinc and Zinc Alloys
DOD-P-21035A	Paint, High Zinc Dust Content, Galvanizing Repair

1.03 QUALITY ASSURANCE

- A. Hot-dip galvanized coating applicator shall be a member of the American Galvanizing Association.

1.04 SUBMITTALS

- A. Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.

- 1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.

- 2. Coating applicator's Certificate of Compliance that the hot-dip galvanized coating meets or exceeds the specified requirements of ASTM A123 or A153, as applicable.
- 3. Evidence that the galvanized coating applicator is a member of the American Galvanizing Association.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

2.02 MATERIALS

- A. Zinc used for galvanizing shall conform to ASTM B6, and shall be at least equal to the grade designated as Prime Western.
- B. Maximum amount of aluminum added to a galvanizing bath shall not exceed 0.01 percent.
- C. Hot-Dip Galvanized Coating: Conform to ASTM A123 and A153, as applicable.
- D. Repair: Zinc dust-zinc oxide coating conforming to DOD-P-21035A and containing 95 percent zinc in the dry film. Acceptable product is ZRC Cold Galvanizing Compound by ZRC Worldwide, or Approved Equal.

2.03 FABRICATION REQUIREMENTS

- A. Fabrication practices for products to be galvanized: In accordance with applicable portions of ASTM A143, A384 and A385. Avoid fabrication techniques that could cause steel distortion or embrittlement.
- B. Coordinate with steel detailer to provide vent and drain holes of sufficient size and quantity to achieve specified galvanized coating.

PART 3 EXECUTION

3.01 PREPARATION

- A. Casting surfaces to be galvanized shall be sand blasted or ground smooth. When a smooth cast is required, castings shall be tumbled and all high spots ground flush. Castings shall be normalized to prevent cracking. Malleable iron shall be safeguarded against embrittlement by pre-annealing.
- B. Steel work shall be precleaned utilizing a caustic bath, acid pickle and flux or shall be blast cleaned and fluxed to obtain an acceptable surface for quality hot dip galvanizing.

3.02 APPLICATION

- A. Steel Members, Fabrications, and Assemblies: Hot-dip galvanize after fabrication in accordance with ASTM A123.
- B. Steel Bolts, Screws, Nuts, Washers and Hardware Components: Hot-dip galvanize in accordance with ASTM A153.

3.03 COATING REQUIREMENTS

- A. Hot-dip Coating Thickness: Conform to ASTM A123 or ASTM A153, as applicable.

3.04 TESTING

- A. Chemical analysis for impurities in the bath shall be made in conformity with ASTM E536.
- B. Test Requirements and Methods: In accordance with ASTM A123 or ASTM A153, as applicable.

3.05 GALVANIZED SURFACES TO BE PAINTED

- A. Where galvanized surfaces are specified to be painted in Section 09 90 00 – Painting and Coating or elsewhere in the Contract Documents, conform to ASTM D6386.

3.06 REPAIR OF DEFECTIVE GALVANIZED COATING

- A. Where zinc coating has been damaged after installation, clean substrate surface and repair with zinc dust-zinc oxide coating in accordance with ASTM A780. Apply zinc dust-zinc oxide coating in accordance with Supplier's recommendation. Apply multiple coats to achieve a minimum film thickness of 8 mils.

- B. Remove items not physically damaged, but which have insufficient or deteriorating zinc coatings, and items damaged in shipment or prior to installation, from the Project Site for repair by the hot-dip zinc coating method.

END OF SECTION

SECTION 05 05 20
ANCHOR BOLTS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Bolts and all-thread rods used to attach structural elements and equipment to concrete and concrete masonry. Included are cast-in-place and post-installed anchors (adhesive systems and wedge type expansion anchors), nuts and washers.
- B. Cast-in-place and post-installed anchors shall be Type 316 stainless steel unless noted otherwise.

1.01 RELATED SECTIONS

- A. This section contains specific references to the following related sections. Additional related sections may apply that are not specifically listed below.
 - 1. Section 01 73 24 Design Requirements for Nonstructural Components and Nonbuilding Structures
 - 2. Section 03 30 00 Cast-In-Place Concrete
 - 3. Section 03 60 00 Grouting
 - 4. Section 43 05 13 Rigid Equipment Mounts
 - 5. Section 43 05 18 Vibration Isolation Systems

1.02 REFERENCES

- A. The references listed below are a part of this section. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
ACI 318	Building Code Requirements for Structural Concrete
ASTM A193	Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
ASTM A194	Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
ASTM A320	Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service
ASTM A563	Carbon and Alloy Steel Nuts
ASTM F593	Stainless Steel Bolts, Hex Cap Screws, and Studs
ASTM F594	Stainless Steel Nuts
ASTM F844	Washers, Steel, Plain (Flat), Unhardened for General Use
ASTM F1554	Anchor Bolts, Steel, 36, 55, 105-ksi Yield Strength
FBC	FBC Building Code with local amendments

1.03 SUBMITTALS

A. Action Submittals

1. Procedures: Section 01 33 00.
2. A copy of this specification section with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.
3. Check-marks (✓) shall denote full compliance with a paragraph as a whole. Deviations shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Include a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
4. Anchor bolt placement plans.
5. Anchor bolt, nut, and washer material information, including material certifications.
6. Record copy of design calculations and details showing the required diameter, length, embedment, edge distance, confinement, anchor reinforcement, anchor bolt sleeves, connection redesign, and other conditions, stamped and signed by a Professional Engineer currently registered in the state of Florida. Calculations shall comply with the provisions of ACI 318-14, Chapter 17. Base anchor capacity determination on cracked concrete condition and compressive strength of new concrete per Section 03 30 00. Assume compressive strength of existing concrete is 3,000 psi unless otherwise noted.
7. Submit record copy of proof loading test results within five days after test.
8. Product Data:
 - a. ICC Evaluation Service Reports for post-installed adhesive type anchors and expansion (wedge type) anchors when allowed.
 - b. Product data indicating load capacity charts/calculations.
 - c. Chemical resistance.
 - d. Temperature limitations.
 - e. Manufacturers written installation instructions.
9. Installer certification for horizontal or upwardly inclined adhesive anchors in accordance with ACI/CRSI Adhesive Anchor Installer Certification Program.

1.04 QUALITY ASSURANCE

A. Quality Assurance By Owner

1. Special inspection of anchor bolts shall be performed by the Special Inspector under contract with the Owner and in accordance with FBC and local amendments.
2. A five percent sample of installed post-installed anchors shall be proof-loaded by an independent laboratory contracted by the Contractor. The quantity of samples and locations shall be coordinated with the Owner's Representative.
3. Adhesive anchors installed in horizontal or upwardly inclined orientations to resist sustained tension loads shall be continuously inspected during installation by a Special Inspector.

4. The Special Inspector shall furnish a report to the Engineer, Owner's Representative, and Building Official that the work covered by the report has been performed and that the materials used and the installation procedures used conform with the approved Project Manual and the Manufacturer's Printed Installation Instructions (MPII).

B. Certifications

1. Installer certification shall be in accordance with ACI/CRSI Adhesive Anchor Installer Certification Program for installers of horizontal or upwardly inclined adhesive anchors.

PART 2 PRODUCTS

2.01 GENERAL

- A. Anchor bolt holes in equipment support frames shall not exceed the bolt diameters by more than 1/4 inch. Minimum anchor bolt diameter shall be 1/2 inch. Anchor bolts for equipment mounting and vibration isolation systems shall be provided as specified in Sections 43 05 13 and 43 05 18, respectively.
- B. Tapered washers shall be provided where mating surface is not square with the nut.
- C. Anchor bolts shall be cast-in-place anchors unless post-installed anchors are specified or shown on the Drawings. Substitution of post-installed anchors will not be permitted unless specifically requested by the Contractor and approved by the Engineer.

2.02 PERFORMANCE/DESIGN CRITERIA

- A. Anchor bolts for equipment shall be designed by the equipment manufacturer to include equipment operational loads combined with seismic and wind forces when applicable. Design criteria provided in Section 01 73 24.
- B. Design anchor bolts for support and bracing of non-structural components and non-building structures for loading specified in Section 01 73 24.

2.03 MATERIALS

- A. Anchor bolt materials shall be as specified in the following table:

Material	Specification
Stainless Steel Anchor Bolts	ASTM A193 or A320, Type 316
Stainless Steel Threaded Rods	ASTM F593, Type 316
Stainless Steel Nuts	ASTM A194 Heavy Hex Nuts, Type 316 ASTM F594 Heavy Hex Nuts at Adhesive Anchors, Type 316
Stainless Steel Washers	Type 316 to match bolt material
Carbon Steel Anchor Bolts	ASTM F1554, Grade 36, Hot Dip Galvanized
High-Strength Carbon Steel Anchor Bolts	ASTM F1554, Grade 55, Weldable per Supplementary Requirement S1, Hot Dip Galvanized
Carbon Steel Nuts and Washers	ASTM A563 and F844, Heavy Hex, Hot-Dip Galvanized

Material	Specification
Concrete Adhesive Anchors	Hilti "HIT-RE 500v3", Simpson Strong-Tie "SET-XP", or approved equal, with Type 316 Stainless Steel threaded rods
Concrete Masonry Adhesive Anchors	Hilti "HIT-HY 70", Simpson Strong-Tie "SET-XP", or approved equal, with Type 316 Stainless Steel threaded rods
Concrete Masonry Expansion (wedge) Anchors*	Hilti "KWIK BOLT 3", or approved equal, Type 316 Stainless Steel
Concrete Expansion (wedge) Anchors *	Hilti "KWIK BOLT TZ", or approved equal, Type 316 Stainless Steel

**Post installed anchors shall always be an adhesive type anchor system except where noted otherwise or when Contractor makes a request for a specific application and Engineer approves.*

2.04 STAINLESS STEEL FASTENER LUBRICANT (ANTI-SEIZING)

A. Anti-seizing Lubricant for Stainless Steel Threaded Connections:

1. Formulated to resist washout.
2. Acceptable manufacturers are Bostik, Saf-T-Eze, or equal.

2.05 ANCHOR BOLT SLEEVES

A. Provide anchor bolt sleeves as shown on design drawings and as required by equipment manufacturer's design.

1. Provide high density polyethylene plastic sleeves of single unit construction with deformed sidewalls such that the concrete and grout lock in place.
2. The top of the sleeve shall be self-threading to provide adjustment of the threaded anchor bolt projection.
3. Acceptable manufacturers are Contec, Wilson, or equal.

PART 3 EXECUTION

3.01 GENERAL

- A. Anchor bolts shall be cast-in-place anchors unless post-installed anchors are specified or shown on the Drawings.
- B. Grouting of anchor bolts using plastic sleeves with non-shrink or epoxy grout, where specified, shall be in accordance with Section 03 60 00.
- C. The threaded end of anchor bolts and all-thread rods shall be long enough to project through the entire depth of the nut and if too long, shall be cut off at ½-inch beyond top of nut and ground smooth.

3.02 CAST-IN-PLACE ANCHOR BOLTS

- A. Anchor bolts to be embedded in concrete shall be placed accurately and held in correct position using templates while the concrete is placed.

- B. After anchor bolts have been embedded, their threads shall be protected by grease and the nuts run on.

3.03 ADHESIVE ANCHOR BOLTS

- A. Note that adhesive anchors shall not be substituted for cast-in-place anchor bolts unless the adhesive anchors have been specified or shown on the Drawings, or approval has been obtained from the Engineer that substitution of adhesive anchors is acceptable for the specific use and location. Use of adhesive anchors shall be subject to the following conditions:
 - 1. Limit to locations where intermittent or continuous exposure to the following is extremely unlikely:
 - a. Acid concentrations higher than 10 percent
 - b. Chlorine gas
 - c. Machine or diesel oils
 - 2. Limit to applications where exposure to the following is extremely unlikely:
 - a. Fire
 - b. Concrete or rod temperature above 120 degrees F
 - 3. Overhead applications (such as pipe supports) shall not be allowed unless approved by the Engineer and installation is by an Installer specially certified for overhead applications.
 - 4. Approval from Engineer for specific application and from supplier of equipment to be anchored, if applicable.
 - 5. Anchor diameter and material shall be per Contract Documents or equipment manufacturer's specifications. Anchor shall be threaded or deformed the full length of embedment and shall be free of rust, scale, grease, and oils.
 - 6. Embedment depth shall be as specified or as required by the equipment manufacturer.
 - 7. Follow the anchor system manufacturer's installation instructions.
 - 8. Holes shall have rough surfaces created by using a hammer drill with carbide bit. Core drilled holes are not allowed.
 - 9. Holes shall be blown clean with oil-free compressed air and be free of dust or standing water prior to installation. Follow additional requirements of the adhesive manufacturer.
 - 10. Concrete and air temperature shall be compatible with curing requirements of adhesives per adhesive manufacturer's instructions. Anchors shall not be placed in concrete when the temperature is below 25 degrees F.
 - 11. Anchors shall be left undisturbed and unloaded for full adhesive curing period, which is based on temperature of the concrete.

3.04 EXPANSION ANCHORS

- A. Expansion (wedge type) anchors shall not be substituted for cast-in-place anchor bolts or adhesive anchors unless approved by the Engineer for a specific application. Use of expansion anchors shall be subject to conditions 4 through 9 as specified above for adhesive anchors. Expansion anchors shall not be used in a submerged condition or in mounting of equipment subject to vibration or cyclic motion.

3.05 REINFORCING STEEL CONFLICTS WITH POST-INSTALLED ANCHOR INSTALLATION

- A. When reinforcing steel is encountered in the drill path, slant drill to clear obstruction and provide beveled washer to match angle of anchor. Drill shall not be slanted more than 10 degrees.
- B. Where slanting the drill does not resolve the conflict, notify the Owner's Representative and resolve the conflict to the satisfaction of the Owner's Representative in consultation with the Engineer.
- C. Abandoned post-installed anchor holes shall be cleaned and filled with non-shrink grout and struck off flush with adjacent surface.
- D. The costs of determining and executing the resolution shall be borne by the Contractor. The determination and execution of the resolution shall not result in additional cost to the Owner.
- E. Reinforcing steel in masonry shall not be damaged.
- F. In order to avoid or resolve a conflict, locate embedded reinforcing steel using non-destructive methods and/or redesign the attachment.
 - 1. Redesign shall be done by the Contractor's Professional Engineer currently registered in the state of Florida.
 - 2. Calculations and details for redesign shall be submitted.

END OF SECTION

SECTION 05 10 00
STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.01 SUMMARY

A. Scope

1. This Section specifies structural metal framing
2. Section includes Structural metals consisting of standard shapes, hollow Sections, fasteners, rods and plates that are used in structural supports and connections.

1.02 REFERENCES

A. Reference Codes and Standards

1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
Aluminum Design Manual, The Aluminum Association	Aluminum Design Manual with Specifications and Guidelines for Aluminum Structures
AISC 201	AISC Certification Program for Structural Steel Suppliers
AISC 303	Code of Standard Practice for Steel Buildings and Bridges
AISC 341	Seismic Provisions for Structural Steel Buildings
AISC 360	Specification for Structural Steel Buildings
AISC 810	Erection Bracing of Low-Rise Structural Steel Frames
ASTM A6	General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
ASTM A36	Carbon Structural Steel
ASTM A53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

Reference	Title
ASTM A193	Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications
ASTM A194	Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
ASTM A320	Alloy-Steel and Stainless Steel Bolting for Low Temperature Service
ASTM A325	Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A384	Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies
ASTM A500	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A563	Carbon and Alloy Steel Nuts
ASTM A992	Structural Steel Shapes
ASTM B209	Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B241	Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
ASTM B308	Aluminum-Alloy 6061-T6 Standard Structural Profiles
ASTM F436	Hardened Steel Washers
ASTM F593	Stainless Steel Bolts, Hex Cap Screws, and Studs
ASTM F594	Stainless Steel Nuts
AWS-B3.0	Welding Procedures and Performance Qualifications
AWS-D1.1	Structural Welding Code—Steel
AWS D1.2	Structural Welding Code - Aluminum
AWS D1.6	Structural Welding Code - Stainless Steel
ASW D1.8	Structural Welding Code - Seismic Supplement
FBC	Florida Building Code with local amendments
AISC Steel Construction Manual	American Institute of Steel Construction, Manual of Steel Construction

1.03 QUALITY ASSURANCE

A. Quality Control by Owner

1. Special Inspection of structural metals Work shall be performed by the Special Inspector under contract with the Owner and in conformance with the IBC Chapter 17. Special Inspector(s) and laboratory shall be acceptable to the Owner in their sole discretion. Special Inspection of structural metals is in addition to, but not replacing, other inspections and quality control requirements herein. Where sampling and testing required herein conforms to Special Inspection standards, such sampling and testing need not be duplicated.
2. All structural steel Work shall receive Special Inspection in accordance with FBC, Chapter 17. Structural steel includes all steel elements that resist code-defined loads and whose failure would affect life safety. Items to be inspected include, but are not

limited to, mechanical/electrical supports, beams, stringers, columns, access walkways and stairways.

B. Fabricator Qualifications

1. A qualified fabricator must participate in the AISC 201 Certification program and be designated an AISC Certified Plant, Category STD (Standard for Steel Building Structures).

1.04 SUBMITTALS

A. Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.

1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.

2. Shop Drawings for approval prior to fabrication. Shop Drawings shall not be reproductions of the Plans. Include complete information for the fabrication and erection of the structure's components, including the location, type, and size of bolts, welds, member sizes and lengths, coatings, connection details, blocks, copes, and cuts. Substitutions of details shown on the Plans shall be clearly highlighted on the fabrication Drawings. Explain the reasons for any deviations from the Plans.
3. Certification that steel Supplier is approved to perform steel fabrication without special inspection.
4. AISC quality certification Evidence that steel Supplier has AISC 201 Certification as a "Standard Steel Building Structures" Supplier. Certificate to show name and address of certified firm, effective date, and category of certification.
5. Welding procedures, qualifications, and inspection report.
6. Certified mill test reports for structural steel and high-strength bolts and nuts.
7. In accordance with FBC Chapter 17, manufacturer at the completion of fabrication to submit Certification of Compliance stating that the fabrication was performed in accordance with the design documents.
8. Certified copies of all surveys conducted by a registered Professional Engineer or surveyor showing elevations and locations of base plates and anchor bolts to receive structural steel or aluminum, and final elevations and locations for major members. Indicate discrepancies between actual installation and contract documents.

PART 2 PRODUCTS

2.01 MATERIALS

A. Steel

1. Materials for structural metals shall be as specified in Table A.

Table A - Steel Materials

Material	Specification
Standard steel S-shapes, channels, angles and plates	ASTM A36
Standard rolled steel wide-flange Sections and WTs	ASTM A992
Pipe Sections for posts	ASTM A53, Type E or S, Grade B
Round Hollow Structural Sections (HSS)	ASTM A500, Grade B (Fy=42 ksi)
Square and Rectangular Hollow Structural Sections (HSS)	ASTM A500, Grade B (Fy = 46 ksi)
Stainless steel bolts (used at stainless steel and aluminum framing unless noted otherwise)	ASTM F593, Type 316
Stainless steel nuts and washers (used at stainless steel and aluminum framing unless noted otherwise)	ASTM F594, Type 316
Steel bolts (used at galvanized and painted steel framing)	Galvanized ASTM A325 (Type 1), bearing type bolts fully tensioned
Carbon steel nuts and washers	Galvanized ASTM A563 nuts and galvanized ASTM F436 washers

B. Aluminum

Table B - Aluminum Materials

Material	Specification
Aluminum structural shapes	Alloy 6061-T6 per ASTM B308
Bolts	Use stainless steel bolts for aluminum framing (see Table A above)
Aluminum guardrail and handrail pipe	Alloy 6061-T6 or 6063-T6 per ASTM B241
Aluminum plates	Alloy 6061-T6 per ASTM B209

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine and accept conditions before beginning Work.

3.02 SUPPLIER'S FIELD SERVICES

- A. Supplier shall provide assistance during product installation as required by the Contractor.

3.03 FABRICATION

- A. Fabrication of steel shall be in accordance with the applicable provisions of the AISC Steel Construction Manual – Latest Edition. Fabrication of aluminum shall be in accordance with Aluminum Design Manual – Latest Edition. Fabrication and assembly shall be done in the

shop to the greatest extent possible. The fabricating plant shall be certified under AISC 201 for Category STD (Standard for Steel Building Structures).

- B. Compression joints depending on contact bearing shall have a surface roughness not in excess of 500 micro-inch and ends shall be square within the tolerances for milled ends specified in ASTM A6.
- C. Shop splices of members will be permitted only where indicated on the Plans. Splices not indicated require the approval of the Engineer
- D. Verify measurements at the job site prior to fabrication. Fabricate to match job site measurements.
- E. Provide holes as necessary or as indicated for securing other Work to structural steel framing, and for passage of other Work through steel framing members.

3.04 INSTALLATION

- A. The Supplier shall provide the Contractor with detailed recommendations and instructions for installation of the equipment specified in this Section.
- B. The equipment shall be aligned, connected, and installed at the locations shown and in accordance with the recommendations of the Supplier.
- C. General
 - 1. Erection of structural steel shall be in accordance with the applicable provisions of AISC Steel Construction Manual. Erection plan shall conform to AISC 303. For low-rise structural steel buildings, 60 feet tall or less and a maximum of 2 stories, the structure shall be erected in accordance with AISC 810.
 - 2. Coordinate installation of anchor bolts and other connectors required for securing structural steel to in place Work.
 - 3. Employ a registered professional engineer or surveyor for accurate erection of the structural steel. Check elevations of concrete and locations of anchor bolts before erection proceeds and report discrepancies to the Engineer.
 - 4. Placement tolerances shall be in accordance with AISC 303.
 - 5. After final positioning of steel members, provide full bearing under base plates and bearing plates using non-shrink grout. Place non-shrink grout in accordance with the Supplier's instructions.
 - 6. Protect dissimilar metals from galvanic corrosion by means of pressure tapes, coatings or isolators. Protect aluminum in contact with concrete or grout with a heavy coat of bituminous paint.
 - 7. Metalwork to be embedded in concrete shall be placed accurately and held in correct position while the concrete is placed. The surfaces of metalwork in contact with or embedded in concrete shall be thoroughly cleaned.
 - 8. Structural steel completely encased in concrete shall not be galvanized or painted and shall have a clean surface for bonding to concrete.
 - 9. Metalwork which is bent, broken or otherwise damaged shall be repaired or replaced.

D. Welding

1. Welding shall be done by welders, welding operators, and tackers who have been qualified by tests as prescribed by AWS to perform the type of Work required. The quality of welding shall conform to AWS Codes.
2. Develop and submit the Welding Procedure Specifications (WPS) for all welding, including welding done using prequalified procedures.
3. Provide continuous seal welds for plates or structural shapes that are exposed to or submerged in water or wastewater.

E. Bolted Connections

1. Bolted connections, unless noted otherwise, shall conform to AISC 360 and shall be bearing type connections with bolts fully tensioned unless connecting HSS shapes. Punch, subpunch and ream, or drill bolt holes perpendicular to the surface of the member. Holes shall be punched 1/16 inch larger than the nominal size of the bolts, unless otherwise specified. Bolts, nuts, and washers shall be clean of dirt and rust and lubricated immediately prior to installation. No drifting of bolts or enlargement of holes will be allowed to correct misalignment. Holes shall not be cut or enlarged by burning. Mismatched holes shall be corrected with new material.

3.05 CORROSION PROTECTION

- A. Unless otherwise specified, carbon steel shall be galvanized. If coatings are indicated on the Plans or elsewhere in the Specifications, coat in accordance with Section 09 90 00 – Painting and Coating surface preparation shall be as specified in Section 09 90 00 – Painting and Coating and shall include the following operations
1. Grind the exterior and interior edges of all flame-cut plates or members to a smooth surface.
 2. Grind all sharp edges off of the sheared plates and punched holes.
 3. Grind uneven or rough welds with high beads to a smooth finish.

3.06 CLEANING

- A. After installation, damaged surfaces of shop primed metals shall be cleaned and touched up with the same material used for the shop coat. Damaged surfaces of galvanized metals shall be repaired as specified in Section 05 05 14 – Hot Dip Galvanizing.

END OF SECTION

SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.01 SUMMARY

- A. Scope
1. Custom fabricated metal items and certain manufactured units not otherwise indicated to be provided under work of other Specification Sections.
 2. Seat angle frames
 3. Fall arrest anchors
 4. Iron castings
 5. Ladders, and safety posts
 6. Ladder Rail Fall Protection System
 7. U-channel concrete inserts
 8. Cover plates and frames
 9. Pipe sleeves
 10. Bollards
 11. Safety nosings at concrete stairs
 12. Miscellaneous metal fabrications not covered elsewhere

1.02 REFERENCES

- A. Reference Codes and Standards
1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
 2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
Aluminum Design Manual	The Aluminum Association, Aluminum Design Manual with Specifications and Guidelines for Aluminum Structures
AISC 303	Code of Standard Practice for Steel Buildings and Bridges
AISC 360	Specification for Structural Steel Buildings
AISC Steel Construction Manual	American Institute of Steel Construction, Manual of Steel Construction
ANSI A14.3	Standard for Ladders - Fixed - Safety Requirements
ASTM A36	Carbon Structural Steel
ASTM A48	Gray-Iron Castings
ASTM A53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A108	Steel Bar, Carbon and Alloy, Cold-Finished
ASTM A123	Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A193	Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
ASTM A194	Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
ASTM A240	Chromium and Chromium Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM A276	Stainless Steel Bars and Shapes
ASTM A283	Low and Intermediate Tensile Strength Carbon Steel Plates
ASTM A307	Carbon Steel Bolts, Studs, and Threaded Rod 60000 psi Tensile Strength
ASTM A312	Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
ASTM A320	Alloy-Steel Bolting Materials for Low Temperature Service
ASTM A325	Structural Bolts, Steel, Heat Treated 120/105 ksi Minimum Tensile Strength
ASTM A380	Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems
ASTM A384	Standard Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies
ASTM A489	Carbon Steel Lifting Eyes
ASTM A500	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A554	Welded Stainless Steel Mechanical Tubing
ASTM A563	Carbon and Alloy Steel Nuts
ASTM A572	High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A653	Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by the Hot Dip Process
ASTM A780	Repair of Damaged and Uncoated Areas of Hot Dip Galvanized Coatings
ASTM A786	Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates

Reference	Title
ASTM A793	Rolled Floor Plate, Stainless Steel
ASTM A924	Steel Sheet, Metallic-Coated by Hot-Dip Process
ASTM A992	Structural Steel Shapes
ASTM A1011	Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
ASTM B209	Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B210	Aluminum and Aluminum-Alloy Drawn Seamless Tubes
ASTM B211	Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire
ASTM B221	Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B241	Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
ASTM B308	Aluminum-Alloy 6061-T6 Standard Structural Profiles
ASTM B429	Aluminum-Alloy Extruded Structural Pipe and Tube
ASTM B632	Aluminum-Alloy Rolled Tread Plate
ASTM D1056	Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM F436	Hardened Steel Washers
ASTM F468	Nonferrous Bolts, Hex Cap Screws, SocketHead Cap Screws and Studs for General Use
ASTM F593	Stainless Steel Bolts, Hex Cap Screws, and Studs
ASTM F594	Stainless Steel Nuts
AWS D1.1	Structural Welding Code - Steel
AWS D1.2	Structural Welding Code - Aluminum
AWS D1.6	Structural Welding Code - Stainless Steel
OSHA 29 CFR 1910.27	Fixed Ladders
OSHA 29 CFR 1926.502	Fall Protection Systems Criteria and Practices
SSPC SP5	White Metal Blast Cleaning
FBC	Florida Building Code with local amendments (Latest Edition)

1.03 QUALITY ASSURANCE

A. Qualifications

1. Fabricator shall have a minimum of five years' experience in fabrication of metal specified.

B. Certificates

1. Certified welding procedures and welding operators in accordance with AWS. Welding operator certificates shall be no more than one-year old and the welder shall have used the welding process to be performed within the last six months.

- C. The use of salvaged, reprocessed or scrap materials will not be permitted.
- D. Shop Assembly Items in the shop shall be preassembled to the greatest extent possible, so as to minimize field splicing and assembly of units. Units shall be disassembled only to the extent necessary for shipping and handling limitations. Units shall be clearly marked for reassembly and coordinated installation.

1.04 SUBMITTALS

- A. Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.
 - 1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.
 - 2. Manufacturer's Product Data.
 - 3. Detailed Shop Drawings
 - a. Fabrication drawings showing layouts, connections to structural system, and anchoring details.
 - b. Erection and installation drawings indicating thickness, type, grade, class of metal, coating system and dimensions.
 - c. Construction details, reinforcement, anchorage, and installation with relation to the building construction.
 - 4. Welding procedures and welder certificates and qualifications.
 - 5. U-Channel concrete inserts: Manufacturer's product description and allowable load tables.
 - 6. Passivation method for stainless steel fabrications.
 - 7. Fall Arrest Anchor Certificate
 - a. Certify fall arrest system is designed to meet OSHA 29 CFR 1926.502 specified performance requirements.
 - b. Signed and sealed by a Professional Engineer licensed in the state in which the project is located.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

A. Supplier Qualifications

1. The Supplier shall have five (5) years of experience manufacturing and installing metal fabrications in similar-sized projects.

2.02 MATERIALS

- #### A. Materials used for the construction of the equipment provided under this specification shall be as follows

Material	Specification
Steel	
Sheets, plates and shapes (except W shapes)	ASTM A36
W shapes	ASTM A992
Pipe	ASTM A53, Grade B
Square/rectangular tubing	ASTM A500, Grade B
Headed Anchor Studs	ASTM A108
Carbon steel bolts	ASTM A307, Grade A
High strength bolts	ASTM A325 (Type 1)
Nuts	ASTM A563
Washers	ASTM F436
Stainless Steel	
Sheet and Plates	ASTM A240, Type 316 or 316L
Shapes, bars, and similar items	ASTM A276, Type 316 or 316L
Pipe	ASTM A312, Type 316 or 316L
Headed Anchor Studs	ASTM A276, Type 316L
Bolts	ASTM F593, Type 316
Nuts	ASTM F594, Type 316
Aluminum	
Sheets and plates	ASTM B209, Type 6061-T6
Bars, flats and similar items	ASTM B211 or B221, Type 6061-T6
Shapes	ASTM B308, Type 6061-T6
Round tubing and pipe	ASTM B241, Type 6061-T6
Square and rectangular tubing	ASTM B221, Type 6063-T52
Pipe	ASTM B211 or B241, Type 6061-T6
Bolts, Stainless Steel	ASTM F593, Type 316
Nuts, Stainless Steel	ASTM F594, Type 316
Checker Plate	
Steel	ASTM A786
Stainless steel	ASTM A793, Type 304
Aluminum	ASTM B632, Type 6061-T6
Other steel items	

Material	Specification
Iron castings	ASTM A48
Eyebolts	ASTM A489
Threaded rods	ASTM A36

2.03 FABRICATION

A. General

1. Conform to AISC or Aluminum Association standards as applicable. Where Code defined loads apply, also conform to IBC requirements.
2. Shop and field welding shall conform to the requirements of AISC, the Aluminum Design Manual, and applicable AWS procedures and Specifications as required by the material being welded.
3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt, tight, flush, and hairline. Remove burrs and weld splatter. Ease exposed edges to small uniform radius.
4. Holes shall be punched 1/16 inch larger than the nominal size of the bolts, unless otherwise specified. Whenever needed, because of the thickness of the metal, holes shall be sub punched and reamed or shall be drilled.
5. Fabrication, including cutting, drilling, punching, threading and tapping required for fabrications or adjacent work, shall be performed prior to galvanizing.

B. Seat Angle Frames

1. Provide recessed seat angle frames for grating and floor plates. Miter corners to ensure accurate fit. Match depth of recess with grating or floor plate thickness. Anchor frames in concrete with headed studs. Steel angle support frames shall be stainless steel, ASTM A276, Type 316, unless indicated otherwise.

C. Fall Arrest Anchors

1. Fall arrest anchors shall meet requirements of OSHA 29 CFR 1926.502. Anchorages attached to personal fall arrest equipment shall be capable of supporting at least 5,000 pounds per employee attached, or shall be designed, installed, and used as part of a complete personal fall arrest system which maintains a safety factor of at least two. Type of anchor shall fit the application and substrate material.
2. Fall arrest anchors shall be manufactured by
 - a. Thaler Metal Industries
 - b. DBI-SALA
 - c. Or Approved Equal

D. Iron Castings

1. Castings shall be as specified on the Plans. Castings weighing less than 100 pounds shall be galvanized after machining. Castings weighing greater than 100 pounds shall be galvanized where specified.

E. Ladders

1. Aluminum Ladders: Ladders shall be vendor supplied pre-engineered aluminum ladders. Ladders shall be fabricated of alloy 6063-T6. Rungs shall have non-slip grip surface. Finish shall be anodized. Fabricate ladders with rails, rungs, landings and

cages to meet applicable requirements of OSHA 29 CFR 1910.27. Rungs shall be a minimum clear length of 16 inches, uniformly spaced at a maximum of 12 inches and plug welded into side rails. Install ladders so that the distance from the centerline of rungs to the finished wall surface is not less than 7 inches nor more than 12 inches. Provide clip angle supports bolted to the side rail at the top. Provide intermediate clip angle lateral supports at a maximum of 10 feet on center.

2. Ladder Safety Post
 - a. Provide a telescoping ladder safety post at ladders below all floor and roof hatches, and other coverings.
 - b. The ladder safety post shall be pre-assembled from the Supplier.
 - c. Performance characteristics
 - 1) Post shall lock automatically when fully extended.
 - 2) Post shall have controlled upward and downward movement.
 - 3) Release lever shall disengage the post to allow it to be returned to its lowered position.
 - 4) Post shall have adjustable mounting brackets to fit ladder rung spacing up to 14" on center and clamp brackets to accommodate ladder rungs up to 1-3/4" in diameter.
 - 5) Post Manufactured of high strength square tubing with a pull up loop provided at the upper end of the post to facilitate raising the post.
 - 6) Material of construction: Aluminum
 - 7) Balancing spring Stainless steel spring balancing mechanism to provide smooth, easy, controlled operation when raising and lowering the safety post.
 - d. Acceptable products include
 - 1) LadderUp Safety Post by Bilco
 - 2) Ladder Safety Post Model SP by Nystrom Inc.
 - 3) Or Approved equal
3. Ladder Rail Fall Protection System
 - a. System shall consist of a vertical rigid track carrier rail securely and permanently attached to ladder, over which travels a sleeve to harness belt can be attached.
 - b. Rail
 - 1) Notched at six-inch intervals and constructed of stainless steel Type 316.
 - 2) Provide ladder attachments/rail mounting brackets of same material as rail, and as required by Supplier.
 - 3) For all ladders, include provisions to secure safety sleeve to carrier rail at top of vertical ladder so that sleeve will not slide down rail when safety belt is unsnapped.
 - 4) Ladders Below Hatches Rail for ladder shall extend from bottom of ladder to top of ladder. Provide telescopic safety post.
 - 5) Ladders Not Below Hatches Rail for ladder shall extend from bottom of ladder to above horizontal landing or roof at top of ladder. Provide removable extension section at top of ladder. Arrange rail to allow climber to land on landing or roof without unsnapping climber's safety harness.
 - c. Accessories Provide with each ladder the following, all furnished by the fall prevention system Supplier

- 1) One safety sleeve compatible for use with the rail. Sleeve shall be cast bronze with five zinc plated steel roller bearings. Sleeve shall travel smoothly on straight or curved rail.
 - 2) One safety harness that attaches to sleeve. Harness shall be of woven high-strength nylon, with padded straps and forged steel buckles and rings. Harness shall distribute impact forces of a fall over climber's thighs, buttocks, chest, and shoulders.
 - 3) One shock adsorbing lanyard no longer than six-feet, complying with ANSI Z359.1. Lanyard shall be 5/8-inch diameter nylon rope with double locking hooks at each end.
- d. Acceptable ladder rail fall protection systems include
- 1) Miller Saf-T-Climb as manufactured by Honeywell
 - 2) Vertical Rigid Track Fall Arrest System as manufactured by Diversified Fall Protection
 - 3) Or Approved equal
- F. U-Channel Concrete Inserts
1. U-Channel Concrete Inserts shall be galvanized or stainless steel conforming to attachment hardware and materials attached. Channels shall be 1 5/8 inch wide by 1 3/8 inch deep with a minimum thickness of 0.105 inches. Channels shall be open-bottom with curved or lipped flange edges to engage standard nuts and connection hardware. Load rating shall meet or exceed a 2,000 pound point load at 12 inch minimum spacing. Provide standard accessories and hardware in accordance with Suppliers recommendations.
- G. Cover Plates and Frames
- Fabricate aluminum cover plates weighing not more than 80 pounds per cover with a raised pattern nonslip top surface conforming to ASTM B632. Reinforce to sustain a live load of 100 pounds per square foot (foot traffic only) or as indicated on the Plans. Frames shall be stainless steel angles and plates, with stainless steel headed anchors welded to frame for anchoring to concrete. Miter and weld corners and butt joint straight runs. Provide flush drop handles for removal. Remove sharp edges and burrs from cover plates and exposed edges of frames. Weld connections and grind top surface smooth. Provide 1/8 inch clearance at edges.
- H. Pipe Sleeves
1. Unless otherwise indicated on the Plans, fabricate pipe sleeves from schedule 40 steel pipe with 3/16 inch thick by 3 feet wide seep ring continuously seal welded to the outside of the pipe. Galvanize after fabrication in accordance with ASTM A123.
- I. Bollards
1. Provide minimum 6 inch galvanized standard weight steel pipe or as indicated on the Plans. Pipe to be in accordance with ASTM A53. Anchor posts in concrete and fill solidly with concrete of a minimum compressive strength of 2500 psi. Coat galvanized pipe above grade in accordance with Section 09 90 00 - Painting and Coating – Painting and Coating. Top coat cover color shall be safety yellow.
- J. Safety Nosings at Concrete Stairs
1. Safety stair treads shall be 4 inches wide and manufactured by

- a. Safe T Metal Company Incorporated, Style AX;
- b. Wooster Products Incorporated, Alumogrit, Type 101;
- c. Or Approved Equal.

K. Other Miscellaneous Steel Metalwork

1. Other miscellaneous steel metalwork including embedded and non-embedded steel metalwork, hangers and inserts shall be as specified or shown on the Plans, and shall be galvanized after fabrication unless otherwise noted.

2.04 FINISHES

A. Galvanizing

1. Galvanize items specified to be zinc-coated, after fabrication where practicable. Galvanizing in accordance with ASTM A123, ASTM A153, ASTM A653 or ASTM A924, Z275 G90, as applicable. Galvanize anchor bolts, grating fasteners, washers, and parts or devices necessary for proper installation, unless indicated otherwise.
2. Repair damaged Zinc-Coated surfaces with galvanizing repair method and paint conforming to ASTM A780 or by application of stick or thick paste material specifically designed for repair of galvanizing, as approved by the Department.
3. Safeguard against warpage and distortion during galvanizing of steel in accordance with ASTM A384. Straighten items after galvanizing so that they are straight, free of racking and distortion.

B. Shop Painting

1. Prepare and coat surfaces in accordance with Section 09 90 00 - Painting and Coating.
2. Steel to be embedded in concrete shall be free of dirt and grease.

C. Aluminum Surfaces

1. Surface condition aluminum before finishes are applied. Remove roll marks, scratches, rolled-in scratches, kinks, stains, pits, orange peel, die marks, structural streaks, and other defects which will affect uniform appearance of finished surfaces.
2. Aluminum finishes for unexposed sheet, plate and extrusions may have mill finish as fabricated.
3. Provide other aluminum items with a standard mill finish.
4. Provide a coating thickness not less than that specified for protection.
5. Provide decorative type finishes for items used in interior occupied locations or architectural type finish for items used in exterior locations.
6. Provide a polished satin finish on items to be anodized.

D. Stainless Steel Passivation

1. Stainless steel to be cleaned, descaled, and passivated after fabrication in accordance with ASTM A380. Passivate to remove iron compounds from the surface of the stainless steel.

PART 3 EXECUTION

3.01 SHIPMENT AND STORAGE

- A. Supplier shall provide Contractor with detailed recommendations and instructions for product storage.
- B. Avoid damage during delivery and handling of fabrications.
- C. Store off the ground on skids or other supports to keep items free of dirt and other foreign debris and to protect against corrosion.

3.02 EXAMINATION

- A. Verify measurements at the site. Include field dimensions in Shop Drawings.
- B. Examine and accept existing conditions before beginning work.

3.03 PREPARATION

- A. Make provisions for erection loads with temporary bracing. Keep work in alignment.
- B. Supply items required to be cast into concrete or embedded in masonry with setting templates.

3.04 INSTALLATION

- A. The Supplier shall provide the Contractor with detailed recommendations and instructions for installation of the product specified in this Section.
- B. The product shall be aligned and installed at the locations shown and in accordance with the recommendations of the Supplier.
- C. Install items plumb, level and square, accurately fitted, and free from distortion or defects. Install rigid, substantial, and neat in appearance.
- D. Allow for erection loads and provide temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- E. Fieldwork shall not be permitted on galvanized items. Drilling of bolts or enlargement of holes to correct misalignment will not be allowed.
- F. Protect encased or embedded dissimilar metals (both metals must be encased or embedded) from galvanic corrosion by means of pressure tapes, coatings or isolators.
- G. Place metalwork to be embedded in concrete accurately and hold in correct position while the concrete is placed or, if indicated, form recesses or blockouts in the concrete. Thoroughly clean the surfaces of metalwork in contact with or embedded in concrete.
- H. Seat angles, supports and guides: Set seat angles for grating and supports for floor plates so that they maintain the grating and floor plates flush with the floor.

- I. Ladder Safety Post: Comply with manufacturer's installation instructions.
- J. Pipe Sleeves: Provide where pipes pass through concrete or masonry. Holes drilled with a rotary drill may be provided in lieu of sleeves in existing walls. Provide a center flange for water stoppage on sleeves in exterior or water bearing walls. Provide a rubber caulking sealant or a modular mechanical unit to form a watertight seal in the annular space between pipes and sleeves.
- K. U-Channel Concrete Inserts Provide as indicated for pipe supports and where otherwise specified or shown on the Plans.
- L. Safety Nosings: Unless otherwise specified, safety stair nosing shall be installed on concrete stairs. Nosing shall be secured to concrete with suitable anchors at 15 inches on center and not more than 4 inches from the ends. 1/8 inch thick rubber tape shall be provided at both ends and cut to fit shape of nosing prior to concrete placement.
- M. Fastening to Construction-In-Place: Provide anchorage devices and fasteners where necessary for fastening fabricated items to construction-in-place. Design anchorage devices in accordance with Section 01 73 24 - Design Requirements for Non-Structural Components and Non-Building Structures. Anchor bolts to be in accordance with Section 05 05 20 – Anchor Bolts.
- N. Railing: Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing required by design loads and as limited on the Plans. Plumb posts in each direction.
- O. Repair/Restoration
 - 1. Galvanized
 - a. Maximum area to be repaired shall not be more than 1/2 of 1 percent of the surface area or 36 sq. in. per ton of piece weight, whichever is less. Damage in excess of this requirement shall be repaired by stripping and recoating entire piece.
 - b. Clean damaged areas to SSPC-SP5. Repair with zinc-rich paint in accordance with the Supplier's instructions and with ASTM A780, Annex A2. Minimum thickness requirements shall be in accordance with ASTM A123.
 - c. Use zinc-rich repair paint. Acceptable Suppliers
 - 1) LPS, Cold Galvanize
 - 2) ZRC Worldwide, ZRC Galvilite
 - 3) Or Approved Equal
 - 2. Painted
 - a. After installation, clean and touch up damaged areas with the same materials used for the shop coat.

3.05 FIELD QUALITY CONTROL

- A. Electrolytic Protection
 - 1. Protect dissimilar metals from galvanic corrosion by means of pressure tapes, coatings, or isolators. Aluminum in contact with concrete or grout shall be protected with a heavy coat of bituminous paint.

B. Stainless Steel

1. During handling and installation, take necessary precautions to prevent carbon impregnation of stainless steel members.
2. After installation, visually inspect stainless steel surfaces for evidence of iron rust, oil, paint, and other forms of contamination.
3. Remove contamination in accordance with requirements of ASTM A380.
4. Brushes used to remove foreign substances shall utilize only stainless steel or nonmetallic bristles.

END OF SECTION

SECTION 05 51 00

METAL STAIRS

PART 1 GENERAL

1.01 SUMMARY

A. Scope

1. This Section specifies requirements for Contractor designed aluminum stair systems, including but not limited to landings, stairs stringers, stair treads, abrasive nosings, and railing.

1.02 REFERENCES

A. Reference Codes and Standards

1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
Aluminum Design Manual	The Aluminum Association, Aluminum Design Manual with Specifications and Guidelines for Aluminum Structures
ACI 301	Standard Specification for Structural Concrete
ASCE 7	Minimum Design Loads for Buildings and Other Structures
ASTM A193	Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
ASTM B209	Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B210	Aluminum and Aluminum-Alloy Drawn Seamless Tubes
ASTM B211	Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire
ASTM B221	Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B241	Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube

Reference	Title
ASTM B308	Aluminum-Alloy 6061-T6 Standard Structural Profiles
ASTM F594	Stainless Steel Nuts
AWS D1.2	Structural Welding Code - Aluminum
NAAMM AMP 510	Metal Stairs Manual
OSHA 29 CFR 1910.24	Fixed Industrial Stairs
FBC	Florida Building Code with Local amendments (Latest Edition)

1.03 QUALITY ASSURANCE

- A. Qualifications
 - 1. Fabricator shall be specialized in stair assemblies with a minimum of three years' experience.
- B. Certificates
 - 1. Certified welding procedures and welding operators in accordance with AWS.
- C. Regulatory Requirements
 - 1. Comply with Florida Building Code (FBC) and OSHA 29 CR 1910.24.

1.04 SUBMITTALS

- A. Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.
 - 1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.
 If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.
 The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed. Supplier's product data.
 - 2. Manufacturer's product data.
 - 3. Stair Design: Stair assemblies to be designed by the Contractor incorporating specified criteria, and employing a Professional Engineer currently registered in the State of Florida to perform the design engineering. Drawings and design calculations to be stamped and signed by the Professional Engineer.

4. Shop Drawings: Stair fabrication Drawings showing layouts, connections to structural system, and anchoring details. Erection and installation Drawings indicating thickness, type, grade, class of metal, coating system and dimensions. Show construction details, reinforcement, anchorage, and installation with relation to the building construction.
5. Welding procedures and welder certificates and qualifications.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Comply with FBC requirements, including but not limited to means of egress requirements, stair treads and riser configuration, handrail and guard layout and design, headroom, and stairway landing configuration.
- B. Structural Requirements
 1. Dead Loads
 - a. Designed for full dead-load plus the following live-load conditions applied individually or in combination in accordance with FBC.
 2. Live Loads
 - a. Metal stair assembly to carry a minimum uniform live load of 100 psf of projected plan area.
 - b. Stair treads to be designed for a minimum concentrated load of 300 pounds on an area of 4 square inches.
 - c. An isolated concentrated load of 1000 pounds applied to framing members where it is most critical.
 - d. Wind Loads See Section 01 73 24 - Design Requirements for Non-Structural Components and Non-Building Structures.
- C. Deflections
 1. Limit live load deflection of treads, platforms, and framing members to L/360 or 1/4 inch, whichever is less.

2.02 MATERIALS

- A. Materials for stair systems are specified in Table A.

Table A, Materials for Metal Stairs

Material	Specification
Aluminum	
Sheets and plates	ASTM B209, Type 6061-T6
Bars, flats and similar items	ASTM B211 or B221, Type 6061-T6
Shapes	ASTM B308, Type 6061-T6
Round tubing and pipe	ASTM B241, Type 6061-T6
Square and rectangular tubing	ASTM B221, Type 6063-T52
Pipe	ASTM B211 or B241, Type 6061-T6

Table A, Materials for Metal Stairs

Bolts, Stainless Steel	ASTM F593, Type 316
Nuts, Stainless Steel	ASTM F594, Type 316

2.03 FABRICATION

A. General

1. Provide complete stair assemblies, including metal framing, stair treads, hangers, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and landings on supporting structure.
2. Conform to Aluminum Association standards as applicable.
3. Structural metal framing to be in accordance with Section 05 10 00 – Structural Metal Framing.
4. Provide stairs of welded construction. Bolts may be used where welding is not practical.
5. Shop and field welding shall conform to the requirements of the Aluminum Design Manual and applicable AWS procedures and Specifications as required by the material being welded.
6. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt, tight, flush, and hairline. Remove burrs and weld splatter. Ease exposed edges to small uniform radius.
7. Holes shall be punched 1/16 inch larger than the nominal size of the bolts, unless otherwise specified. Whenever needed, because of the thickness of the metal, holes shall be subpunched and reamed or shall be drilled.
8. Fabrication including cutting, drilling, punching, threading and tapping required for fabrications or adjacent Work shall be performed prior to hot-dip galvanizing.
9. Pre-assemble stair components in the shop to the greatest extent possible.
10. Furnish setting Drawings, templates, and directions for installing anchorages, including sleeves, concrete anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry.

B. Stairs – Aluminum

1. Provide aluminum stairs complete with stringers, grating treads, landings, columns, guardrails, handrails, and necessary bolts and other fastenings.
2. Fabricate stringers of structural aluminum channels. Provide closures for exposed ends of stringers. Construct landings of structural channel headers and miscellaneous framing members.
3. Grating Treads and Landings Provide aluminum grating for treads and platforms conforming to Section 05 53 10 - Metal Gratings and Stair Threads. Fabricate grating treads with abrasive nosing and with angle or plate carrier at each end for stringer connections. Secure treads to stringers with bolts. Fabricate grating landings with nosing that matches grating treads. Provide toe-plates at open-sided edges of landing.
4. Provide railings for stairs and platforms in accordance with Section 05 52 10 – Aluminum Railings.

2.04 FINISHES

- A. Aluminum Surfaces
 - 1. Surface condition aluminum before finishes are applied. Remove roll marks, scratches, rolled-in scratches, kinks, stains, pits, orange peel, die marks, structural streaks, and other defects which will affect uniform appearance of finished surfaces.
 - 2. Aluminum finishes for unexposed sheet, plate and extrusions may have mill finish as fabricated.
 - 3. Provide all other aluminum items with a standard mill finish.

PART 3 EXECUTION

3.01 SHIPMENT AND STORAGE

- A. Supplier shall provide Contractor with detailed recommendations and instructions for product storage.
- B. Deliver all materials to job site properly marked to identify the structure for which they are intended and at such intervals to insure uninterrupted progress of the Work. Marking shall correspond to markings indicated on the Shop Drawings. Avoid damage during delivery and handling of fabrications.
- C. Store all members off the ground using pallets, platforms, or other supports.
- D. Do not store materials on the structure in a manner that might cause distortion or damage to the members or the supporting structure.

3.02 EXAMINATION

- A. Verify measurements at the Site. Include field dimensions in Shop Drawings.
- B. Examine and accept existing conditions before beginning Work.

3.03 INSTALLATION

- A. Install items plumb, level and square, accurately fitted, and free from distortion or defects. Install rigid, substantial, and neat in appearance.
- B. Allow for erection loads and provide temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Fieldwork shall not be permitted on galvanized items. Drilling of bolts or enlargement of holes to correct misalignment will not be allowed.
- D. Set steel stair baseplates on wedges, or shims. After stairs have been positioned and aligned, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
- E. Railing: Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing required by design loads. Plumb posts in each direction.

- F. Safety Nosings: Unless otherwise specified, safety stair nosing shall be installed on all concrete stairs. Nosing shall be secured to concrete with suitable anchors at 15 inches on centers and not more than 4 inches from the ends. 1/8 inch rubber tape, 1/8 inch thick, shall be provided at both ends and cut to fit shape of nosing prior to concrete placement.
- G. Fastening To Construction-In-Place Provide anchorage devices and fasteners where necessary for fastening fabricated items to construction-in-place. Design anchorage devices in accordance with Section 01 73 24 - Design Requirements for Non-Structural Components and Non-Building Structures. Anchor bolts to be in accordance with Section 05 05 20 - Anchor Bolts.

3.04 FIELD QUALITY CONTROL

- A. Electrolytic Protection Dissimilar metals shall be protected from galvanic corrosion by means of pressure tapes, or coatings. Aluminum in contact with concrete, grout, masonry, or dissimilar metals, shall be protected with a heavy coat of bituminous paint.

END OF SECTION

SECTION 05 52 10
ALUMINUM RAILINGS

PART 1 GENERAL

1.01 SUMMARY

A. Scope

1. This Section specifies prefabricated anodized aluminum component type guardrail and handrail systems; herein referred to as railing.

1.02 REFERENCES

A. Reference Codes and Standards

1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
Aluminum Design Manual	The Aluminum Association, Aluminum Design Manual with Specifications and Guidelines for Aluminum Structures
ASTM B209	Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B210	Aluminum and Aluminum-Alloy Drawn Seamless Tubes
ASTM B221	Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B429	Aluminum-Alloy Extruded Structural Pipe and Tube
ASTM B483	Aluminum and Aluminum-Alloy Drawn Tube and Drawn Pipe for General Purpose Applications
ASTM F593	Stainless Steel Bolts, Hex Cap Screws, and Studs
ASTM F594	Stainless Steel Nuts
AWS D1.2	Structural Welding Code, Aluminum
OSHA	U.S. Dept. of Labor, Occupational Safety and Health Administration

Reference	Title
FBC	Florida Building Code with local amendments (Latest Edition)

1.03 QUALITY ASSURANCE

- A. Railing shall conform to the standards of the Occupational Safety and Health Administration (OSHA) and the Florida Building Code.

1.04 SUBMITTALS

- A. Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.

1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.

2. Layout, installation, and detail Shop Drawings for railing.
3. Design calculations stamped and signed by a Licensed Professional Engineer in the State of Florida. Railing and base support connections to be designed by the Contractor incorporating specified criteria and provisions in the current building code with local governing amendments.

- B. Informational Submittals

1. Material certification for compliance with this Specification for aluminum and stainless steel materials.

PART 2 PRODUCTS

2.01 PERFORMANCE/DESIGN CRITERIA

- A. Railing assembly and attachments shall resist a minimum uniform load of 50 pounds per linear foot on the top rail and a concentrated load of 200 pounds (not acting concurrently with the uniform load) applied in any direction. Contractor's supplier and engineer are responsible for designing the guardrail/handrail system along with its base support and anchor bolt size and embedment depth into concrete, or connection to metal framing, to

resist the above loading condition taking into account anchor edge distances and concrete strengths at the point of attachment. Contractor shall submit calculations signed and sealed by a Professional Engineer in the State of Florida.

- B. Thermal Movements Provide railing that allow for thermal movements resulting from the project site maximum range in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime sky heat loss.

2.02 ACCEPTABLE PRODUCTS

- A. Suppliers
 - 1. Candidate Suppliers include Julius Blum & Co., Inc., Golden Railing Inc., Moultrie Manufacturing, American Railing Systems, Inc., Or Approved Equal.
- B. Supplier Qualifications
 - 1. The Supplier shall have three (3) years of experience manufacturing and installing aluminum railings in similar-sized projects.

2.03 MATERIALS

- A. Materials used for the construction of the equipment provided under this specification shall be as follows

Component	Material
Aluminum pipe	ASTM B210 Alloy 65060-T832; ASTM B 221 Alloy 6063-T5/T52; ASTM B 429, Alloy 6063-T832; ASTM B483, Alloy T832
Aluminum plate	ASTM B209, Alloy 6061-T6
Stainless steel bolts	ASTM A593, Type 316
Stainless steel nuts and washers	ASTM A594, Type316

2.04 CONFIGURATION/COMPONENTS

- A. Guard Top Rails Minimum 1 1/2 inch nominal diameter pipe, Schedule 40.
- B. Intermediate Rails Minimum 1 1/2 inch nominal diameter pipe, Schedule 40.
- C. Handrails 1 1/2 inch nominal diameter pipe, Schedule 40.
- D. Posts Minimum 1 1/2 inch nominal diameter pipe, Schedule 80.
- E. Provide Supplier’s heavy-duty base fitting with stainless steel set screws.
- F. Provide extruded Alloy 6063-T5 or T52 aluminum alloy toeboards, unless railing is mounted on curbs or other construction of sufficient height and type to comply with OSHA 1910.23. Bars or plates are not acceptable.
- G. Bolts, including anchor bolts, shall be Type 316 stainless steel.

H. Fittings

1. Fittings shall be cast aluminum elbows, T-shapes, post brackets and escutcheons. Provide adapter and anchor plugs as required for a complete installation.
2. Floor sleeves for removable railing shall be stainless steel, embedded in concrete.

2.05 ASSEMBLY/FABRICATION

- A. Pipe cuts shall be clean, straight, square and accurate for minimum joint gap. Work shall be done in conformance with the guardrail and handrail Supplier's instructions. Work shall be free from blemishes, defects, and misfits of any type which can affect durability, strength, or appearance.
- B. Guardrailing and handrailing shall be connected by screws or bolts. Holes shall be punched 1/16 inch larger than the nominal size of the bolts, unless otherwise specified. Wherever needed because of the thickness of the metal, holes shall be subpunched and reamed or drilled. Components with mismatched holes shall be replaced. No drifting of bolts or enlargement of holes will be allowed to correct misalignment.
- C. Do not use blind rivets, pop rivets, or other exposed fastening devices in the Work under this Section. Fasteners used for side-mounting fascia flanges where shown or specified may be exposed in the Work. Provide internal threaded aluminum rivets, stainless steel through-bolts with lock nuts, stainless steel sheet metal screws with lock washers, and epoxy adhesive for fastening components of the Work
- D. Supply components required for anchorage of fabrications.

2.06 ISOLATION COATING

- A. Isolation coating shall be applied to all aluminum surfaces in contact with concrete, masonry, or dissimilar metals. Use a heavy coat of bituminous paint.

2.07 FINISHES

- A. Clear anodized in accordance with the Aluminum Association AA-M12-C22-A41. Anodize exposed prefabricated components, except stainless steel fasteners, after fabrication.

PART 3 EXECUTION

3.01 SHIPMENT AND STORAGE

- A. Supplier shall provide Contractor with detailed recommendations and instructions for product storage.
- B. Cushion wrap complete rails, modules and components to prevent scratching and denting during shipment, storage, and installation.
- C. Leave wrap intact, insofar as possible, until railing is completely installed.

3.02 EXAMINATION

- A. Examine and accept existing conditions before beginning Work.

- B. Field verify measurements for railings before fabrication.

3.03 INSTALLATION

- A. Supplier shall provide assistance during equipment installation as required by the Contractor.
- B. The product shall be installed at the locations shown and in accordance with the recommendations of the Supplier.
- C. Protect dissimilar metals from galvanic corrosion by means of pressure tapes, coatings, or isolators. Aluminum in contact with concrete or grout shall be protected with a heavy coat of bituminous paint.
- D. Accurately place metal to be embedded in concrete and hold in correct position while the concrete is placed. Where recesses or blockouts are formed in the concrete, grout metalwork in place after concrete has attained its design strength in accordance with Section 03 30 00 - Cast-In-Place Concrete.
- E. Unless otherwise indicated, field welding of railing is not permitted.

1.02 TOLERANCES

- A. Maximum variance from plumb 1/4 inch.
- B. Maximum offset from true alignment 1/4 inch.

END OF SECTION

SECTION 05 53 10
METAL GRATINGS AND STAIR TREADS

PART 1 GENERAL

1.01 SUMMARY

A. Scope

1. This Section specifies aluminum, and galvanized steel bar grating and stair treads.

B. Definitions

1. Galvanize Hot-dip galvanize per ASTM A123 or ASTM A153, per Section 05 05 14 – Hot Dip Galvanizing.

1.02 REFERENCES

A. Reference Codes and Standards

1. This Section contains references to the following documents. Those documents are a part of this Section as specified and modified. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued, or replaced. In all cases, the Florida Building Code (FBC) shall be considered as the Building Code in effect.

Reference	Title
ASTM A123	Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A167	Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A380	Cleaning, Descaling, and Passivation of Stainless Steel
ASTM A666	Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
ASTM A1011	Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, and High-Strength Low-Alloy
ASTM B221	Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ANSI/NAAMM	Metal Bar Grating Design Manual

1.03 SUBMITTALS

- A. Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.
1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.

2. Shop Drawings showing placing Plans for grating.
 - a. Provide layout and fabrication details of support frames.
 - b. Provide panel layout with individual panel dimensions.
3. Manufacturer's product data with load tables.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Materials used for the construction of the equipment provided under this specification shall be as follows

Component	Material
Aluminum grating bearing and cross bars	ASTM B221, alloy 6061
Steel grating bearing and cross bars	ASTM A1011, mild carbon steel

2.02 ASSEMBLY/FABRICATION

- A. Welds
1. Grind smooth rough welds and sharp metal edges. Make welds exposed to view uniform and neat.
 2. Prior to galvanizing, sandblast welds.
- B. Clearance provide 1/4" separation between panels and at bearing ends of panel to support frame.
- C. Grating
1. General

- a. Provide serrated grating for slip resistance.
 - b. Bearing bars and cross bars are continuous.
 - c. Openings shall be banded with bars having the same dimensions as the bearing bars. Band perimeter edges with bars flush at the top surface of the grating and 1/4 inch clear of the bottom surface.
 - d. Bars terminating against edge bars shall be welded to the edge bars when welded construction is used.
 - e. When crimped or swaged construction is used, bars at edges shall protrude a maximum of 1/16 inch and be peened or ground to a smooth surface.
 - f. Fabrication methods employing bending or notching of bearing or cross bars is not permitted.
 - g. Maximum grating panel weight shall not exceed 80 pounds.
2. Aluminum Grating
- a. Fabricate grating with a mill class 1 clear anodize finish. Punch bearing bars to receive cross bars. After insertion in the bearing bars, cross bars are deformed by a hydraulic press or similar means to permanently lock the bars into the bearing bar openings.
3. Steel Grating
- a. Use only where specified. Hot-dip galvanized finish after fabrication.
- D. Stair Treads
- 1. Treads shall match the grating material and type furnished for landings. Use serrated surface for slip resistance. Provide abrasive nosings on each tread. Provide carrier angle at each end for attachment to stair stringers. Attach components to support members with Type 316 stainless steel fasteners.

PART 3 EXECUTION

3.01 SHIPMENT AND STORAGE

- A. Product shall be shipped and stored in accordance with Section 01 66 00 – Product Storage and Handling Requirements.
- B. Supplier shall provide Contractor with detailed recommendations and instructions for product storage.

3.02 EXAMINATION

- A. Examine and accept existing conditions before beginning Work.
- B. Field measure grating for proper cutouts and sizes prior to fabrication.

3.03 INSTALLATION

- A. The Supplier shall provide the Contractor with detailed recommendations and instructions for installation of the product specified in this Section.
- B. The equipment shall be aligned and installed at the locations shown and in accordance with the recommendations of the Supplier.

- C. Fieldwork is not permitted on galvanized items.
- D. Drilling of bolts or enlargement of holes to correct misalignment is not permitted.
- E. Protect dissimilar metals from galvanic corrosion by means of pressure tapes, coatings, or isolators. Protect aluminum in contact with concrete with a heavy coat of bituminous paint.
- F. Use stainless steel metalwork to be embedded in concrete. Clean surfaces in contact with or embedded in concrete and hold in correct position while concrete is placed. Or, provide formed recesses or blockouts in concrete and then, after concrete has attained design strength, grout metalwork in-place using non-shrink grout.

3.04 REPAIR

- A. Repair damaged surfaces of galvanized metals per Section 05 05 14 – Hot Dip Galvanizing.

END OF SECTION

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SUMMARY

- A. Scope
1. This Section specifies all rough carpentry.
 2. Inspection report specified in this Section.

1.02 QUALITY ASSURANCE

- A. Reference Codes and Standards
1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
 2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
ANSI B18.2.1	Square and Hex Bolts and Screws, Inch Series Including Hex Cap Screws and Lag Screws
ANSI B18.2.2	Square and Hex Nuts (Inch Series)
ANSI B18.5	Round Head Bolts (Inch Series)
ANSI B18.6.1	Wood Screws (Inch Series)
ASTM A687	High-Strength Nonheaded Steel Bolts and Studs
AWPA C1	All Timber Products--Preservative Treatment by Pressure Process
AWPA C2	Standard for the Preservative Treatment of Lumber, Timber, Bridge Ties, and Mine Ties by Pressure Treatment
AWPA C9	Plywood--Preservative Treatment by Pressure Process
AWPA M6	Brands Used on Forest Products
AWPB LP-22	Standard for Softwood Lumber, Timber, and Plywood Pressure Treated with Waterborne Preservatives for Ground Contact Use

Reference	Title
FEDSPEC FF-B-588C	Bolt, Toggle, and Expansion Sleeve, Screw
FEDSPEC FF-N-105B	Nails, Brads, Staples and Spikes Wire, Cut and Wrought
FEDSPEC FF-S-325	Shield, Expansion, Nail Expansion, and Nail, Drive Screw (Devices, Anchoring, Masonry)
FEDSPEC FF-T-1813	Tack
FEDSPEC MM-T-371E	Ties, Railroad, Wood (Cross and Switch)
FEDSPEC UU-B-790A	Building Paper, Vegetable Fiber (Kraft, Waterproofed, Water Repellent and Fire Resistant)
MIL-L-19140E	Lumber and Plywood, Fire-Retardant Treated
NFP-NDS	National Design Specification for Wood Construction and Supplement 1986, Design Values for Wood Construction
PS 1	U.S. Department of Commerce, Product Standard, Construction/Industrial Ply-wood
PS 20	U.S. Department of Commerce, Product Standard, American Softwood Lumber Standards
TPI 78	Design Specification for Metal Plate Connected Wood Trusses
TPI BWT	Bracing Wood Trusses—Commentary and Recommendations
TPI HET	Handling and Erecting Wood Trusses—Commentary and Recommendations
TPI QST	Quality Standard for Metal Plate Connected Wood Trusses

B. Grading and Marking

1. Lumber

- a. Each piece of framing and board lumber and each bundle of small pieces of lumber shall be marked with the grade mark of a recognized association or independent inspection agency. Such association or agency shall be certified by the Board of Review, American Lumber Standards Committee, to grade the species used.

2. Plywood

- a. Each sheet shall be marked with the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the plywood. The mark shall identify the plywood by species group or span rating, exposure durability classification, grade, and compliance with PS 1.

3. Preservative-Treated Lumber and Plywood

- a. The Contractor shall be responsible for the quality of treated wood products. Each treated piece shall be permanently marked or branded by the producer in accordance with AWPB M6. The Contractor shall provide the Engineer with the inspection report of an independent inspection agency showing that offered products comply with applicable AWPB treatment standards. The AWPB Quality Mark "LP-22" on each piece will be accepted, in lieu of inspection reports, as evidence of compliance with applicable AWPB treatment standards.

4. Fire-Retardant Treated Lumber and Plywood
 - a. Each piece shall be marked in accordance with MIL-L-19140, except pieces that are to be natural or transparent finished. In addition, exterior fire-retardant lumber and plywood shall be distinguished by a permanent penetrating blue stain. Labels of a nationally recognized independent testing agency will be accepted as evidence of conformance to the fire-retardant requirements of MIL-L-19140.
- C. Sizes and Surfacing
 1. Dressed sizes of yard and structural lumber shall comply with PS 20. Unless otherwise specified, lumber shall be surfaced four sides. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced.
- D. Moisture Content
 1. Lumber shall be air-dried or kiln-dried. Treated lumber shall be kiln-dried after treatment. Maximum moisture content of wood products shall be as follows.
 - a. Framing lumber and boards--19 percent maximum.

1.03 ENVIRONMENTAL CONDITIONS

- A. Product in this Section shall be subjected to environmental conditions in accordance with Section 01 11 80 - Environmental Conditions.

1.04 SUBMITTALS

- A. Preconstruction/Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.
 1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.
 2. Detailed list of equipment, and type of fasteners to be used.
 3. Shop Drawings for fabricated wood trusses and other fabricated structural members indicating materials, details of construction, methods of fastening, and erection details.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Materials specified are considered the minimum acceptable for the purposes of durability, strength, and resistance to erosion and corrosion. The Contractor may propose alternative materials for the purpose of providing greater strength or to meet required stress limitations. However, alternative materials must provide at least the same qualities as those specified for the purpose. If alternatives are proposed, the proposals shall be accompanied with documentation supporting the claimed superiority of the proposed substitutions. The Engineer shall be the sole decider in the equivalency of alternative materials of construction.

2.02 LUMBER

- A. Framing Lumber
 - 1. For framing lumber such as studs, plates, caps, cant strips, sleepers, nailing strips, and nailers and board lumber provide the following grade and species:
 - a. Construction Grade, for material up to and including four-inch wide.
 - b. No. 2 or better for material greater than four-inch wide up to and including 12-inch wide.
 - c. Spruce-Pine-Fir, NLGA.
 - d. Lumber for Protection and Temporary Support: Size and grades to conform to Laws and Regulations, including OSHA.

2.03 ROUGH HARDWARE

- A. Unless otherwise specified, rough hardware shall be of the type and size necessary for the project requirements. Sizes, types, and spacing of fastenings of manufactured building materials shall be as recommended by the Manufacturer unless otherwise specified. Rough hardware exposed to the weather or embedded in or in contact with preservative treated wood, exterior masonry, or concrete walls or slabs shall be hot-dip galvanized. Nails and fastenings for fire-retardant treated lumber and woodwork exposed to the weather shall be copper alloy.
- B. Bolts, nuts, studs, and rivets shall conform to ANSI B18.2.1, ANSI B18.5, ANSI B18.2.2, and ASTM A687.
- C. Expansion shields shall conform to FEDSPEC FF-S-325. Unless otherwise specified, maximum size of devices in Groups IV, V, VI, and VII shall be 3/8 inch.
- D. Lag screws and lag bolts shall conform to ANSI B18.2.1.
- E. Toggle bolts shall conform to FEDSPEC FF-B-588.
- F. Wood screws shall conform to ANSI B18.6.1.
- G. Wire nails shall conform to FEDSPEC FF-N-105.

2.04 PRESERVATIVE TREATMENT

- A. Lumber and timber, where specified, shall be treated in accordance with AWPA C1 and C2 and plywood in accordance with AWPA C1 and C9. All wood shall be air- or kiln-dried after treatment. Specific treatments shall be verified by the report of an approved independent inspection agency or the AWPB Quality Mark on each piece. Surfaces of lumber that will be exposed shall not be incised. Areas that are cut or drilled after treatment shall be brush coated with either the same preservative used in the treatment or with a 2 percent copper naphthenate solution. Preservatives used shall be acceptable for specific treatment under local codes and regulations pertaining to toxic and hazardous materials.

PART 3 EXECUTION

3.01 SHIPMENT AND STORAGE

- A. Product shall be shipped and stored in accordance with Section 01 66 00 - Product Storage and Handling Requirements.
- B. Supplier shall provide Contractor with detailed recommendations and instructions for product storage.
- C. Materials shall be stored in an area protected from weather, elevated a minimum of 6 inches above the ground on framework and covered with waterproof covering. Materials shall not be stored in wet or damp areas.

3.02 INSTALLATION

- A. The Supplier shall provide the Contractor with detailed recommendations and instructions for installation of the product specified in this Section.
- B. Framing lumber and other rough carpentry shall be fit and set accurately to the required lines and levels and secured in place in a rigid manner. Framing members between bearing points shall not be spliced. Joists, rafters, and purlins shall be set with their crown edge up. Members shall be framed for the passage of pipes, conduits, and ducts; however, cutting or boring of structural members for the passage of ducts or pipes is not permitted. Unless otherwise specified, all members damaged by such cutting or boring shall be reinforced by means of specially formed and approved sheet metal or bar steel shapes, and spiking and nailing shall be in accordance with the Nailing Schedule contained in UBC. Spikes, nails, and bolts shall be drawn up tight. Timber connections and fastenings shall conform to NFPA-NDS. Slate or steel shims shall be used when leveling joists, beams, and girders on masonry or concrete.
- C. Sills
 - 1. Sills shall be set level and square, wedged with steel or slate shims, and grouted with nonshrinking cement mortar to provide continuous and solid bearing. Sills shall be anchored to the foundations as specified. Unless otherwise specified, minimum 5/8-inch diameter bolts shall be provided at all corners and splices and spaced at a maximum of 6 feet o.c. between corner bolts. At least two bolts shall be provided for each sill member. Bolts shall be provided with plate washers and nuts. Bolts in exterior walls shall be zinc-coated.

2. Anchors in Masonry
 - a. Unless otherwise specified, anchor bolts shall be embedded not less than 15 inches in masonry unit walls and each provided with a nut and a 2-inch diameter washer at bottom end. Bolts shall be fully grouted with mortar.
 3. Anchors in Concrete
 - a. Unless otherwise specified, anchor bolts shall be embedded not less than 8 inches in poured concrete walls and each provided with a nut and a 2-inch diameter washer at bottom end. A bent end may be substituted for the nut and washer; bend shall be not less than 90 degrees.
- D. Columns and Posts
1. Columns and posts shall be set plumb, in alignment, and with full and uniform bearing. The bottom and bearing surfaces shall not be embedded in concrete or set in direct contact with concrete slabs on grade. For post and beam construction, Steel post caps shall be utilized in such a manner that the post above will tier directly over the one below.

END OF SECTION

SECTION 07 21 05
BUILDING INSULATION

PART 1 GENERAL

1.01 SUMMARY

- A. Scope
 - 1. This Section specifies building insulation.
 - 2. Contractor shall provide all labor, materials, tools, equipment, and incidentals as shown, specified, and required to furnish and install building insulation.
 - 3. Extent of each type of building insulation is shown and indicated in the Contract Documents.
- B. Coordination
 - 1. Review installation procedures under this and other specification sections and coordinate installation of items that must be installed with or before building insulation work.
- C. Performance Requirements
 - 1. Thermal conductivity thicknesses shown are for thermal conductivity, k value at 75 degrees F, specified for each material.
 - 2. Provide adjusted thicknesses based on thicknesses shown or specified for building insulations, as required to comply with required thermal resistances for material having different thermal conductivity.
- D. Scheduling
 - 1. Proceed with building insulation work when preceding Work is ready to receive the Work of this Section.
 - 2. Proceed with building insulation and associated work after curbs, blocking, substrate board, nailer strips, vents, drains and other projections through the substrates have been installed, and when substrate construction and framing of openings is complete.
 - 3. Proceed with and complete the Work when materials, equipment and tradesmen required for the installation of building insulation and backfilling operations are at the Site and ready to follow with the Work in manner that does not leave the Work vulnerable to damage or deterioration.
 - 4. Do not advance installation of building insulation beyond that necessary for proper sequencing of the Work. Do not advance the Work when there is no proper and secure protection from damaging weather and construction activities.

1.02 QUALITY ASSURANCE

- A. Reference Codes and Standards
 - 1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the

requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
ASTM C177	Test Methods for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
ASTM C203	Test Method for Breaking Load and Flexural Properties of Block Type Thermal Insulation.
ASTM C236	Test Methods for Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box.,
ASTM C272	Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions.
ASTM C303	Test Method for Dimensions and Density of Preformed Block and Board-Type Thermal Insulation.
ASTM C518	Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
ASTM C520	Test Methods for Density of Granular Loose Fill Insulation
ASTM C531	Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars and Monolithic Surfacing
ASTM C549	Specification for Perlite Loose Fill Insulation
ASTM C553	Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C578	Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C612	Specification for Mineral Fiber Block and Board Thermal Insulation
ASTM C665	Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C764	Specification for Mineral Fiber Loose Fill Thermal Insulation
ASTM D696	Test Method for Coefficient of Linear Thermal Expansion of Plastics between -30 Degrees C and 30 Degrees C with a Vitreous silica dilatometer.
ASTM D1621	Test Method for Compressive Properties of Rigid Cellular Plastics
ASTM D2126	Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
ASTM E84	Test Method for Surface Burning Characteristics of Building Materials
ASTM E96	Test Methods for Water Vapor Transmission of Materials.
ASTM E119	Test Methods for Fire Tests of Building Construction and Materials
UL 1479	Fire Tests of Through-Penetration Firestops

B. Installer Qualifications

1. Engage single installer for each type of building insulation. Each installer shall be skilled, trained, and have record of successful experience in applying and installing each product, and possess successful record of performing work in accordance with recommendations and requirements of Supplier or that can submit written evidence of being acceptable to Supplier for providing the required work. Installers shall employ only tradesmen with specific skill and successful experience in each type of work required. Submit to Engineer name and qualifications of each installer with the following information for at least three successful, completed projects per installer.
 - a. Names and telephone numbers of owner and architect or engineer responsible for each project.
 - b. Approximate contract cost of the building insulation system installed.
 - c. Quantity (area) of building insulation installed.

C. Regulatory Requirements

1. Comply with code interpretations by authorities having jurisdiction at the Site.

1.03 ENVIRONMENTAL CONDITIONS

- A. Product in this Section shall be subjected to environmental conditions in accordance with Section 01 11 80 – Environmental Conditions.
1. Complete the installation and concealment of building insulation materials as rapidly as possible to avoid damage from adjacent construction operations and adverse weather conditions.
 2. Install building insulations when weather and temperature conditions comply with building insulations supplier's written recommendations.
 3. Install building insulations when damaging environmental condition are not forecasted for the time when exposed systems materials components would be exposed to potential damage from the elements.
 4. Protect building insulation work from precipitation, frost, and direct sunlight.
 5. Do not apply pressure-sensitive tape when temperature is below 35 degrees F or above 110 degrees F.
 6. Record decisions, conditions, and agreements to proceed with the Work when weather conditions may be unfavorable. State reasons for proceeding, along with names of persons involved, and changes or revisions (if any), if required, to allow the Work to proceed.

1.04 SUBMITTALS

- A. Preconstruction/Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.
1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided

by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.

2. Shop Drawings
 - a. Drawings showing extent of the building insulation work and all details required for the Work, referencing system components provided as samples.
 3. Product Data
 - a. Material specifications and general recommendations from building insulation supplier for each type of building insulation product. Include supplier's data substantiating that materials comply with Contract Documents.
 - b. Test Reports: Copies of reports of tests on materials being furnished or previously-manufactured, identical materials verifying compliance with physical properties and environmental features specified in the Contract Documents. When requested by Engineer, submit qualifications and summary of experience of testing agencies in performing tests similar to those required.
 4. Samples
 - a. Twelve-inch by twelve-inch samples of each required type of building insulation.
 - b. Samples will be reviewed by Engineer for color and texture only. Compliance with other requirements is responsibility of Contractor.
- B. Informational Submittals: The following minimum informational submittals shall be submitted in accordance with the timing requirements specified in these Contract Documents, prior to Substantial Completion and in accordance with Section 01 33 00 - Submittals.
1. Certificates: Certificate from Supplier stating that supplier of foam-type rigid board insulation has used an environmentally safe blowing agent complying with specified requirements.
 2. Supplier's Instructions: Supplier's installation instructions. Indicate by copy of transmittal form that installer has received copy of Supplier's installation instructions.
 3. Site Quality Control Submittals: Submit results of specified Site quality control tests.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

- A. Suppliers
1. The Engineer and the City believe that the Suppliers indicated in this Section are capable of producing equipment and products, which will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a

particular Supplier or product, nor shall it be construed that a named Supplier's standard product will comply with the requirements of this Section.

B. Supplier Qualifications

1. Obtain building insulations, requiring hydrochlorofluorocarbon blowing agent from Supplier(s) that manufacture product required using blowing agent acceptable for use until the year 2020 and complying in all respects with Copenhagen Amendments to the Montreal Protocol.
2. Supplier shall provide complete technical services including preparation and review of Shop Drawings and submittals, installation methods, and proposed detailing for the Work.

2.02 MATERIALS

A. Materials specified are considered the minimum acceptable for the purposes of durability, strength, and resistance to erosion and corrosion. The Contractor may propose alternative materials for the purpose of providing greater strength or to meet required stress limitations. However, alternative materials must provide at least the same qualities as those specified for the purpose. If alternatives are proposed, the proposals shall be accompanied with documentation supporting the claimed superiority of the proposed substitutions. The Engineer shall be the sole decider in the equivalency of alternative materials of construction.

1. Glass Fiber Insulations: Provide the following types
 - a. Provide insulations formed from glass fibers and resinous binders fabricated into flexible blankets, semi rigid and rigid sheets complying with ASTM C665, ASTM C553, and ASTM C612.
2. Rigid Board Insulation: Provide thermal rigid board insulation complying with ASTM C612, Classes 1A and 1B.
 - a. Physical Properties
 - 1) Thermal Conductivity (k), ASTM C518 0.23 Btu/inch/hour/square foot/degree F.
 - 2) Density, Supplier's Certified Test Six pounds per cubic foot (pcf.)
 - 3) Compressive Strength (psi at 10 percent deformation) 350 psi.
 - 4) Flame Spread, ASTM E84 15.
 - 5) Smoke Developed, ASTM E84 Zero.
 - b. Thickness 1.50 inches.
 - c. Width 4.0 feet.
 - d. Length 6.0 feet.
 - e. Products and Suppliers Provide one of the following:
 - 1) Type 705, 700 Series Board Insulation by Owens Corning Fiberglass Corporation;
 - 2) Insul Shield Thermal Board Insulation by Johns Manville; or
 - 3) Approved Equal.
3. Loose Granular Perlite Insulations: Provide the following:
 - a. Loose Fill Insulation: Provide inert asbestos-free volcanic glass-like perlite aggregates expanded by special heat process and treated with non-flammable silicone complying with ASTM C549.

- 1) Physical Properties:
 - a) Thermal Conductivity (k), ASTM C549: 0.37 Btu/inch/hour/square foot/degree F.
 - b) Density, ASTM C520: Five to eight pounds per cubic foot (pcf).
 - c) Flame Spread, ASTM E84: Zero.
 - d) Fuel Contributed, ASTM E84: Zero.
 - e) Smoke Development, ASTM E84: Zero.
- 2) Products and Manufacturers: Provide one of the following:
 - a) Permalite by Grefco, Inc.
 - b) Or equal.

PART 3 EXECUTION

3.01 SHIPMENT AND STORAGE

- A. Product shall be shipped and stored in accordance with Section 01 66 00 - Product Storage and Handling Requirements.
- B. Supplier shall provide Contractor with detailed recommendations and instructions for product storage.
- C. Do not deliver insulation materials to the Site before the time of installation.
- D. Deliver materials in sufficient quantities to allow uninterrupted continuity of the Work.
- E. Handle materials carefully to avoid damage and breakage or compressing of boards to less than their specified thickness, or other damage.
- F. Handle materials in manner that prevents inclusion of foreign materials.
- G. Storage of Materials
 1. Store materials in dry, enclosed area, off ground and away from possible contact with water, ice, and snow.
 2. Prevent damage to materials during storage, including minimizing the time materials are stored at the Site before being incorporated into the Work. Store only sufficient quantity of building insulation materials at the Site required for continuous advancement of the Work without causing delay.

3.02 SUPPLIER'S FIELD SERVICES

- A. Supplier shall provide assistance during product installation as required by the Contractor.

3.03 INSTALLATION

- A. The Supplier shall provide the Contractor with detailed recommendations and instructions for installation of the product specified in this Section.

- B. Supplier shall provide assistance during product installation as required by the Contractor.
- C. The product shall be installed at the locations shown and in accordance with the recommendations of the Supplier.
- D. Following installation, Supplier shall provide Certificate of Proper Installation.
- E. Inspection
 - 1. Contractor and installer shall examine substrate and conditions under which building insulation work will be performed and notify Engineer in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected.
- F. Preparation
 - 1. Surfaces to receive building insulation shall be clean of all debris, dirt, and other contamination before installation begins.
- G. Comply with Supplier's instructions for particular conditions of installation in each case. If printed instructions are not available or do not apply to Site conditions, before proceeding with the Work obtain from Supplier and submit to Engineer specific installation recommendations from Supplier.
- H. Extend insulations full thickness over entire surface to be insulated. Cut and fit tightly around obstructions. Fill voids with insulation.
- I. Apply number of layers of insulation specified, each of required thickness, or required thickness to provide thermal value shown or indicated in the Contract Documents, to make up the total thickness.
- J. Unit type Building Insulation
 - 1. Apply insulation units of type shown or indicated to substrate by method indicated. If not otherwise indicated and except for units resting on horizontal surfaces, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
 - 2. Exercise extreme care to avoid damaging and soiling of faces on insulation units that will remain exposed-to-view. Align joints accurately, with adjoining surfaces set flush.
- K. Correcting Defective Work
 - 1. System components that are dislodged, damaged, expanded, broken, penetrated, or crushed by subsequent installation operations or damaged by detrimental weather shall be immediately replaced with undamaged material in compliance with the Contract Documents and properly protected as specified.
 - 2. Only original installer shall repair or replace deteriorated or defective work.

3.04 PROTECTION

- A. Protection from Elements
 - 1. Protect all components of the Work from detrimental weather conditions. Do not allow building insulation materials to become wet or soiled, or covered with ice or

snow. Provide continuous protection of materials against damage, wetting and moisture absorption and storing materials as specified

2. Work that cannot, for reasons acceptable to Engineer, be covered with complete construction system before onset of weather detrimental to the Work, shall be completely covered and protected in manner that deflects precipitation from building insulations without damaging adjacent Work.
- B. Protection During Construction
1. Protect all components of the Work from construction operations including, but not limited to, backfilling, framing, and sheathing, aluminum siding, and concrete unit masonry work, until the Work is completed and acceptable to Engineer.
 2. Protect building insulations from damage and abuse by other contractors and installers until readiness for final payment.
 3. Do not allow building insulations to come into contact with welding operations or other fire or ignition sources.
 4. Do not allow construction traffic not associated with installation of building insulation in the area of building insulation work. Protect the area from access by other installers and contractors until the building insulation work has been incorporated into finished construction systems.
- C. Building insulation that becomes wet, damaged, or deteriorated shall be promptly removed from the Site and replaced with materials conforming to this Section.

END OF SECTION

SECTION 07 22 16
ROOF BOARD INSULATION

PART 1 GENERAL

1.01 SUMMARY

A. Scope

1. This Section specifies roof board insulation.
2. Contractor shall provide all labor, materials, tools, equipment and incidentals as shown, specified and required to furnish and install all roof board insulation.
3. The Work also includes
 - a. Providing openings in roof board insulation to accommodate the Work under this Section and others, and building into the roof board insulation all items such as sleeves, inserts and all other items to be embedded in roof board insulation for which placement is not specifically provided under other specification sections.
4. Extent of each type of roof board insulation is shown on the Plans.
5. Types of products required include the following
 - a. Extruded, CFC, HCFC-free blowing agent, polyisocyanurate rigid board-type insulation.
 - b. Miscellaneous materials and accessories.

B. Performance Requirements

1. General Performance: Installed insulation, membrane roofing, and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing, insulation, and base flashings shall remain watertight.
2. Material Compatibility: Provide insulation materials that are compatible with other roofing system materials under conditions of service and application required, as demonstrated by membrane roofing supplier based on testing and field experience.

C. Coordination

1. Review installation procedures under other specification sections and coordinate the installation of items that must be installed with the roof board insulation work.
2. All framing for openings, edge angles, nailers, curbs and other items shall be in place before start of roof board insulation work.
3. Coordinate finish of galvanized steel metal roof deck for acceptance by lightweight insulating concrete supplier.
4. Field-verify location of all roof penetrations, drain locations, and deck deflections.

1.02 QUALITY ASSURANCE

A. Reference Codes and Standards

1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the

requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
ASHRAE/IESNA 90.1	Energy Standard For Buildings Except Low Rise Residential Buildings
ASTM C 177	Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
ASTM C 203	Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation
ASTM C 209	Test Methods for Cellulosic Fiber Insulating Board
ASTM C 272	Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions
ASTM C 303	Test Method for Dimensions and Density of Preformed Block and Board-Type Thermal Insulation
ASTM C 518	Test Method for Steady-State Thermal Transmission Properties by Means of Heat Flow Meter Apparatus
ASTM C 550	Test Method for Measuring Trueness and Squareness of Rigid Block and Board Thermal Insulation
ASTM C578	Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 1289	Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM D 696	Test Method for Coefficient of Linear Thermal Expansion of Plastics between -30 Degrees C and 30 Degrees C with a Vitreous Silica Dilatometer
ASTM D 1621	Method for Compressive Properties of Rigid Cellular Plastics
ASTM D 1623	Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics
ASTM E 84	Test Method for Surface Burning Characteristics of Building Materials
ASTM E 96	Test Methods for Water Vapor Transmission of Materials
ASTM E 108	Test Methods for Fire Tests of Roof Coverings
FM Global Loss Prevention Data for Roofing Contractors, 1 29	Above-Deck Roof Components
NRDCA, LICRDC	Accreditation Program
UL	Building Materials Directory

B. Installer's Qualifications

1. Roof board insulation work shall be performed by the installer of the associated roofing for undivided responsibility.

C. Source Quality Control

1. Obtain extruded polyisocyanurate rigid board-type insulation from suppliers who manufacture specified insulation using a blowing agent containing no chlorine-based compounds.
2. Engage a single supplier for each type of roofing insulation who shall provide the services of a technical representative to assist Contractor and Engineer by providing technical opinions on the adequacy of materials and methods of installation based on Shop Drawings approved by Engineer
3. Provide such services during the time of delivery, storage, handling and installation of all roofing insulation.
4. The thicknesses shown are based on the thermal conductivity, k value at 75° F specified for each material. Thicknesses of roof board insulation materials submitted by Contractor as "or Approved Equal" to specified materials shall have their thicknesses adjusted to provide the same thermal resistance as materials specified.

D. Requirements of Regulatory Agencies: Comply with fire resistance ratings as required by governing authorities and building codes, and complies with the following roof board insulation requirements

1. Underwriters Laboratories requirements for roof deck constructions which are rated "UL Class A".
2. Factory Mutual requirements for "Class 1-90" rated construction, for wind resistance.

1.03 ENVIRONMENTAL CONDITIONS

- A. Product in this Section shall be subjected to environmental conditions in accordance with Section 01 11 80 - Environmental Conditions.

1.04 SUBMITTALS

- A. Preconstruction/Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.

1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections,

along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.

2. Shop Drawings for the products supplied under this Section including
 - a. Field verified locations of all roof penetrations and deck deflections.
 - b. Complete layout of all roof board insulation showing sizes, placement, number of courses and methods of fastening. Include statement that fastening method, location and density of fasteners have been approved by roof membrane supplier and comply with wind uplift requirements specified.
 - c. Weights of all equipment to be used on roof.
 - d. All required roof board insulation details approved by the Supplier and the supplier of the respective roofing systems.
 3. Operation and maintenance information in accordance with Section 01 77 30 - Operating and Maintenance Instructions.
 4. Special shipping, storage and protection, and handling instructions.
 5. Supplier's specifications and installation instructions for each type of roof board insulation required. Include data substantiating that the materials comply with specified requirements.
 6. Qualifications Statements
 - a. Supplier
 - b. Installer
 7. Certificates
 - a. Installer's qualifications.
 - b. Installer's NRDC Accreditation.
 8. Samples
 - a. Each fastener to be used in the Work.
 - b. 12 inch by 12 inch sample of specified extruded and expanded rigid board type insulation and composite insulation system.
- B. Informational Submittals: The following minimum informational submittals shall be submitted in accordance with the timing requirements specified in these Contract Documents, prior to Substantial Completion and in accordance with Section 01 33 00 - Submittals.
1. Operations and Maintenance Manuals (including Warranty) in accordance with Section 01 77 30 - Operating and Maintenance Instructions
 2. Factory Test Reports
 3. Field Test Reports
 4. Warranty Documentation
 - a. Installer's two (2)-year warranty.
 - b. In addition to the above Contractor shall provide the City with Supplier's one (1)-year warranty.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

A. Suppliers

1. The Engineer and the City believe that the Suppliers indicated in this Section are capable of producing equipment and products, which will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular Supplier or product, nor shall it be construed that a named Supplier's standard product will comply with the requirements of this Section.

B. Supplier Qualifications

1. The Supplier shall have five (5) years of experience manufacturing and installing roof board insulation in similar-sized projects.
2. Supplier of the primary roofing membrane systems shall be a supplier who finds the generic types of insulation specified herein as acceptable and bondable if installed according to the roofing supplier's standards for complete product and performance responsibility.

2.02 MATERIALS

- A. Materials specified are considered the minimum acceptable for the purposes of durability, strength, and resistance to erosion and corrosion. The Contractor may propose alternative materials for the purpose of providing greater strength or to meet required stress limitations. However, alternative materials must provide at least the same qualities as those specified for the purpose. If alternatives are proposed, the proposals shall be accompanied with documentation supporting the claimed superiority of the proposed substitutions. The Engineer shall be the sole decider in the equivalency of alternative materials of construction.

1. FM Approvals Listing: Provide insulation and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a membrane roofing system, and that are listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals' markings.
 - a. Fire/Windstorm Classification: Class 1A-90

B. Extruded Polyisocyanurate Rigid Board Roof board insulation

1. Rigid, rectangular boards of extruded closed-cell polyisocyanurate complying with ASTM C 1289, Type II, Grade 3, with low water vapor permeability and laminated to heavy black (non-asphaltic) fiber-reinforced felt facers with one side of board containing perforated facers and the other side containing non-perforated facers.
2. Provide a blowing agent with zero ozone depletion potential, such as pentane.
3. Physical Properties: Provide the following
 - a. Minimum Compressive Strength, (at 10 percent deformation), ASTM D 1621: 25 psi minimum.
 - b. Flame Spread, ASTM E 108: Class A.
 - c. Smoke Development, ASTM E 84: 120 maximum.
 - d. Vapor Transmission, ASTM E 96: <1 perms/inch.
 - e. Thermal Resistance, ASTM C 518: 7/inch.

- f. Maximum Water Absorption, ASTM C 209: 0.10 percent by volume.
- 4. Size: 48-inches by 96 inches by 2-inch thick.
- 5. Number of Layers: As required by thickness of roof board insulation shown.
- 6. Products and Suppliers: Provide one of the following:
 - a. Tapered HP-H Polyiso Insulation by Carlisle SynTec Systems Division of Carlisle Corporation, or
 - b. Approved Equal.
- C. Miscellaneous Materials
 - 1. Adhesive for Bonding Insulation: The type recommended by the Supplier, and complying with fire resistance requirements.
 - 2. Mechanical Anchors: The type recommended by the Supplier for the type of deck used, and complying with fire and insurance rating requirements.

PART 3 EXECUTION

3.01 SHIPMENT AND STORAGE

- A. Product shall be shipped and stored in accordance with Section 01 66 00 - Product Storage and Handling Requirements.
- B. Supplier shall provide Contractor with detailed recommendations and instructions for product storage.
- C. Delivery of Materials
 - 1. Do not deliver insulation materials to the Site before time of installation.
 - 2. Deliver materials in Supplier's original, undamaged packages or acceptable bulk containers.
- D. Storage of Materials
 - 1. Do not allow insulation materials to become wet or soiled, or covered with ice or snow.
 - 2. Protect plastic insulation from exposure to sunlight.
 - 3. Protect plastic insulation against ignition.
 - 4. Store packaged materials to protect them from the weather and physical damage.

3.02 INSTALLATION

- A. The Supplier shall provide the Contractor with detailed recommendations and instructions for installation of the products specified in this Section.
- B. Supplier shall provide assistance during product installation as required by the Contractor.
- C. Products shall be installed at the locations shown and in accordance with the recommendations of the Supplier.
 - 1. Comply with Supplier's instructions for the particular conditions of installation in each case. If printed instructions are not available or do not apply to Site conditions, consult the Supplier for specific recommendations before proceeding. Incorporate

recommendations into the Work only as approved by Engineer. Record all such discussions and the basis for discussions in the Job Conditions Report specified in Part 3 of this Section.

D. Inspection

1. Examine the substrate and the conditions under which the roof board insulation work is to be performed, and notify Engineer, in writing, of any unsatisfactory conditions. Do not proceed with the roof board insulation work until unsatisfactory conditions have been corrected in a manner acceptable to Engineer.
2. Commencement of the Work shall be understood by Engineer to mean that all conditions are acceptable to the Supplier, Contractor and installer to provide acceptable Work under this Contract.

E. Preparation

1. Verify that vapor barrier has been installed on decks, with all joints and penetrations in the vapor barrier sealed using techniques recommended by the vapor barrier supplier to retain full perm rating of the vapor barrier.

F. Coordinate heights of wood blocking and continuous wood sleepers to provide flush transition between roof board insulation and perimeter wood blocking.

G. Extend roof board insulation full thickness as shown over entire surface to be insulated.

H. Cut and fit tightly around obstructions, and fill voids with roof board insulation.

I. Job Conditions

1. Environmental Requirements

- a. Do not install roof board insulation when weather conditions are such that the deck is not completely dry, there is ice or snow on the deck, or where there is no assurance that the roof board insulation can be completely protected from the weather by the end of the day's work.

2. Protection

- a. Do not overload the building structure with the weight of stored materials or use of equipment.
- b. Install temporary water cut offs at the end of each day's work to protect the roof board insulation. Remove the temporary water cut offs upon resumption of the Work.

J. Sequencing

1. Proceed with and complete the Work only when materials, equipment and tradesmen required for the installation of the roofing membrane over the insulation are at the Site; are installing the vapor barrier, and are ready to follow with this Work immediately (same day) behind the roof board insulation work.
2. Do not install any more rigid board-type roof board insulation each day than can be covered with complete roofing system by the end of that working day.

K. Board-Type Roof Board Insulation Units: Install rigid board-type roof board insulation according to FM 1-29 Wind Storm Resistance Classification specified, and the roofing warranty requirements as follows

1. Install wood nailers as required by roofing membrane supplier.
2. Secure roof board insulation to deck using mechanically fasteners specifically designed and sized for fastening specified board-type roof board insulation to deck type shown and in accordance with the requirements of applicable governing authorities having jurisdiction and roofing membrane supplier's warranty recommendations, whichever produces the greatest fastener density.
3. Coat edges of closed cell (non-breathing) units with either adhesive or mastic sealer, and shove into place against installed units so that joints are filled and sealed.
4. Extend roof board insulation full thickness as shown over entire surface of roofs.

L. Performance

1. Roof board insulation work shall withstand the uplift forces of wind, as defined by the roofing warranty.
2. Failures of the roof board insulation work in bond or anchorage to the substrate, or between courses of roof board insulation, or within the roof board insulation, will be considered failures of materials or workmanship under the roofing warranty.

M. Protection

1. Do not permit construction traffic over completed insulation work, except as required for roofing.
2. Protect roof board insulation work from exposure to moisture, damage and deterioration, primarily by prompt installation of roofing work to be placed over the roof board insulation.

N. Inspection and Acceptance

1. Roof board insulation which has become wet, damaged, or deteriorated, as determined by Engineer, shall be promptly removed from the Site, even if already installed.
2. Correct all improperly sloped, chipped, cracked, improperly set, ridged or rough areas in the roof board insulation to provide substrate acceptable to roofing supplier and the Engineer.
3. Final Acceptance will be contingent upon the receipt by Engineer of a Job Conditions Report certifying conformance of the Work with the requirements of this Section and which includes all information requested by the Contract Documents.

END OF SECTION

SECTION 07 24 00
EXTERIOR INSULATION AND FINISH SYSTEM

PART 1 GENERAL

1.01 SUMMARY

- A. Scope.
1. This Section specifies exterior insulation and finish system.
 2. Contractor shall provide all labor, materials, equipment, appurtenances, specialty items and services required to furnish and install the complete exterior insulation and finish system (EIFS) work.
 3. The extent of the exterior insulation and finish system is as shown on the Plans and as specified in this Section.
 4. The types of exterior insulation and finish system work required includes, but is not necessarily limited to, the following
 - a. A ready mixed acrylic based textured wall coating system including double layers of reinforcing mesh and all additives and components as recommended by the Supplier for application over rigid insulation board.
 - b. Key coats, ground coats and finish coats of reinforced plaster materials with mechanical finish specified.
 - c. Double layer reinforcing meshes and applicable matrixes for all surfaces receiving rigid insulation board to full height and width.
 - d. Insulation board.
 - e. All additives and miscellaneous components necessary to complete the Work.
 - f. Custom fabrication of all system components as required to reproduce the architectural features shown on the Plans to the allowable tolerances specified.
- B. Performance Requirement
1. Comply with the recommendations of the Plasterer's Manual, by the Portland Cement Association; the Florida Building Code; and the Guideline Specification for exterior insulation and finish systems Class PB, published by EIFS Industry Members Association (EIMA), except where more stringent requirements are shown on the Plans or specified.
 2. In order to ensure complete product compatibility and bondability of the completed exterior insulation and finish system work, Contractor may, with the approval of the Engineer, submit Supplier sub-components of the exterior insulation and finish system work which the Supplier certifies, in writing, to the Engineer, to be more appropriate to the substrate or job conditions encountered. All such approved substitutions shall be at no additional cost to the City. No reduction in number of layers or types of reinforcing mesh shall be approved by the Engineer.
 3. Final selection of products shall be made from Supplier's complete selection of highest quality products at no additional cost to the Engineer.
 4. A fully adhesive based system is specified herein. Where, on new Work, acceptability of substrate adhesive bond cannot be determined or made acceptable to the exterior insulation and finish system installer, provide exterior insulation and finish system Supplier's standard mechanical fastener system for the Work of this Section.

5. Test Reports: Contractor shall furnish to the Engineer certified laboratory test reports from the Supplier for required performance tests as follows
 - a. Surface Burning Characteristics Test in accordance with ASTM E 84.
 - b. Water Penetration Test in accordance with ASTM E 331, EIMA 101.02.
 - c. Wind Load Test in accordance with ASTM E 330.
 - d. Impact Resistance Test in accordance with EIMA 101.86.
 - e. Abrasion Resistance Test in accordance with ASTM D 968.
 - f. Accelerated Weathering Tests in accordance with ASTM G 152, ASTM G 153, and ASTM G 154.
 - g. Mildew Resistance Test in accordance with ASTM D 3273.
 - h. Water Resistance Test in accordance with ASTM D 2247.
 - i. Absorption - Freeze/Thaw Tests in accordance with ASTM C 67, EIMA 101.01.
6. Certification: Contractor shall furnish to the Engineer certification that all materials are compatible with substrates as specified.

C. Coordination

1. The Supplier of the materials specified herein shall be required to review and satisfy all relevant requirements of other Sections and the requirements of the Plans. Contractor, Supplier, and/or Subcontractor(s) furnishing and/or installing materials, equipment, services and specialties associated with this Section shall fully coordinate their efforts.
2. Review installation procedures under other specification sections and coordinate the Work to produce substrate surfaces free from contaminants incompatible with the exterior insulation and finish system work, and substrates acceptable to the exterior insulation and finish system installer for completely acceptable product performance.
3. Contractor shall provide all labor, equipment, materials, appurtenances, specialty items and services not provided by Contractor's, Suppliers, and/or Subcontractor(s), but required to furnish and install the complete and operable systems.

D. Pre-Installation Meeting

1. Prior to the installation of the exterior insulation and finish system, Contractor shall schedule a Pre-Installation Meeting to review the following.
 - a. Review project requirements, including all Contract Documents.
 - b. Procedure for on-Site inspection and acceptance of EIFS substrate and pertinent details (for example, mock-up installation).
 - c. Contractor's plan for the coordination of Work of the various trades involved in providing EIFS and other components.
2. Pre-Installation Meeting shall be attended by Contractor, EIFS supplier, personnel directly responsible for installation of the EIFS system, personnel responsible for related Work, such as flashing, windows and doors, and the Engineer. Before beginning EIFS work, Contractor shall confirm, in writing, the resolution of conflicts among those attending the Pre-Installation Meeting.

E. Scheduling

1. Proceed with the exterior insulation and finish system work only after all projections through the substrate construction are completed.
2. Proceed with and complete the Work only when materials, equipment and workers required for the installation of the exterior insulation and finish system work are at the Site and have sufficient materials and resources to complete the Work in a manner which shall reveal no inconsistencies of texture, color or allowable tolerance in the finished Work greater than that which has been approved on the sample panel by Engineer.

1.02 QUALITY ASSURANCE

A. Reference Codes and Standards

1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
ASTM A 653	Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
ASTM B 117	Practice for Operating Salt Spray (Fog) Apparatus
ASTM C 67	Test Methods for Sampling and Testing Brick and Structural Clay Tile.
ASTM C 150	Specification for Portland Cement
ASTM C 177	Test Method for Steady State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
ASTM C 203	Test Methods for Breaking Load and Flexural Properties of Block Type Thermal Insulation
ASTM C 272	Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions
ASTM C 303	Test Method for Dimensions and Density of Preformed Block Type Thermal Insulation
ASTM C 518	Test Method for Steady State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
ASTM C 550	Test Method for Measuring Trueness and Squareness of Rigid Block and Board Thermal Insulation

Reference	Title
ASTM C 578	Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 847	Specification for Metal Lath
ASTM C 1186	Specification for Flat Non-Asbestos Fiber-Cement Sheets
ASTM C 1382	Test Method for Determining Tensile Adhesion Properties of Sealants When Used in Exterior Insulation and Finish Systems (EIFS) Joints
ASTM D 696	Test Method for Coefficient of Linear Thermal Expansion of Plastics Between - 30°C and 30°C With a Vitreous Silica Dilatometer
ASTM D 968	Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM D 1621	Test Method for Compressive Properties of Rigid Cellular Plastics
ASTM D 1623	Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics
ASTM D 2247	Practice for Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D 3273	Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
ASTM E 72	Test Methods of Conducting Strength Tests of Panels for Building Construction
ASTM E 84	Test Method for Surface Burning Characteristics of Building Materials
ASTM E 96	Test Methods for Water Vapor Transmission of Materials
ASTM E 330	Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
ASTM E 331	Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E 2486	Standard Test Method for Impact Resistance of Class PB and PI Exterior Insulation and Finish Systems (EIFS)
ASTM E 2568	Standard Specification for PB Exterior Insulation and Finish Systems
ASTM E 2570	Test Method for Water-Resistive (WRB) Coatings used Under Exterior Insulation and Finish Systems (EIFS) or EIFS with Drainage
ASTM G 152	Practice for Operating Open Flame Carbon Arc light Apparatus for Exposure of Nonmetallic Materials
ASTM G 153	Practice for Operating Enclosed Carbon Arc light Apparatus for Exposure of Nonmetallic Materials
ASTM G 154	Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials
FBC	Florida Building Code 2017 with local amendments

B. Warranty

1. A warranty for the equipment specified under this Section shall be provided in accordance with the General Conditions. The Warranty shall be for one (1) year from the date of the Notice of Substantial Completion certificate issued for the Work. If extended warranties are required, a special paragraph calling for an extended warranty will be included in this Section.
2. Special Warranty: Contractor shall furnish an additional written warranty signed by the Supplier, installer and Contractor, agreeing to replace exterior insulation and finish system work which fail in materials or workmanship within five (5) years of the date of Final Acceptance.

C. Installer Qualifications

1. Provide a single installer, approved by the specified EIFS supplier who is regularly engaged in exterior insulation and finish systems work and has a minimum of five (5) years experience in the installation of the types of materials specified.

D. Allowable Tolerances

1. Flat or Curved Surfaces: Do not exceed 1/8 inch in eight feet for bow or warp of surface, and for plumb or level.
2. Color Breaks: Do not exceed 1/8 inch in eight feet out of alignment from color break lines shown on the Plans Source Quality Control: Contractor shall obtain all materials from the same Supplier.
3. Provide the services of a qualified Supplier's technical representative at the project site at the commencement of Work and during the time when the mock up Work is being constructed to advise on materials, installation and finishing techniques.

E. Job Mockups

1. Prior to the installation of the exterior insulation and finish system work, but after Engineer's approval of Shop Drawings, build free standing 4 foot by 6 foot sample panels of each type of complete exterior insulation and finish system on same substrate material that will be used in the Work, to show a representative installation of each complete exterior insulation and finish system work, including final texture and colors. Stage sample panel work to leave exposed a 12 inch wide band of each component required in the Work. Obtain Engineer's acceptance of visual qualities of the mock ups before start of exterior insulation and finish system work. Retain and protect mock up during installation as a standard for judging completed exterior insulation and finish system work. Do not destroy mock-up until given permission by the Engineer.
2. Exterior insulation and finish system work that does not meet the standard approved on the sample areas shall be removed and replaced by Contractor at Contractor's expense.
3. Mockups that do not have an exposed portion of each system component shall be rejected.

1.03 ENVIRONMENTAL CONDITIONS

- A. Equipment in this Section shall be subjected to environmental conditions in accordance with Section 01 11 80 – Environmental Conditions.
- B. Proceed with the exterior insulation and finish system work only when weather conditions will permit unrestricted use of materials and quality control of the Work being installed, complying with the requirements specified in this Section and with the recommendations of the exterior insulation and finish systems materials Supplier.
- C. Do not proceed with the installation of exterior insulation and finish system under adverse weather conditions, or when temperatures are below 40°F or expected to fall below 40°F within 24 hours after installation.
- D. Do not proceed with the installation of exterior insulation and finish system when temperatures are over 90°F without consulting Supplier for specific application recommendations.

- E. Under extremely windy or hot conditions, where too rapid drying occurs, cure finished surface by fog spraying with water. Comply with Supplier's recommendations to prevent color variation.
- F. Proceed only when Contractor and his installer are willing to guarantee the Work as required and without additional reservations and restrictions.
- G. Protection
 - 1. Do not allow finish system work to overflow or spill onto adjoining surfaces or to migrate into the voids of adjoining materials.
 - 2. Draw all color break lines accurately and to the tolerances specified.
 - 3. Protect materials against damage by construction traffic.

1.04 SUBMITTALS

- A. Preconstruction/Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.
 - 1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.
 - 2. Supplier's complete selection of standard and custom colors and textured finish coats.
 - 3. Each component material to be used in the Work.
 - 4. Samples will be reviewed by Engineer for color and texture only. Compliance with other requirements is the exclusive responsibility of Contractor.
 - 5. Shop Drawings: Submit for approval the following
 - a. Supplier's specifications and installation instructions for each component of the exterior insulation and finish systems for each substrate.
 - b. Fully coordinated Shop Drawings showing 1/4 inch scale elevation of all walls to receive the Work of this Section and all termination details at 1 1/2-inch scale between this Work and the Work of other specification sections. Also, include details of system components and control joint locations and details and all custom architectural shapes required for the Work.

- B. Informational Submittals: The following minimum informational submittals shall be submitted in accordance with the timing requirements specified in these Contract Documents, prior to Substantial Completion and in accordance with Section 01 33 00 - Submittals.
1. Certification: In accordance with this Section.
 2. Maintenance Manual: Submit copies of bound maintenance manual for the exterior insulation and finish system work in accordance with Section 01 77 30 - Operating and Maintenance Instructions. Include instructions for cleaning, repair and general maintenance work. Include Supplier's data on all components of the exterior insulation and finish system work and name, address and telephone number of Supplier, installer and local product distributor.
 3. Test Reports: In accordance with this Section.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

- A. Suppliers
1. The Engineer and the City believe that the Suppliers indicated in this Section are capable of producing equipment and products, which will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular Supplier or product, nor shall it be construed that a named Supplier's standard product will comply with the requirements of this Section.
- B. Supplier Qualifications
1. The Supplier shall have five (5) years of experience manufacturing and installing exterior insulation and finish system in similar-sized projects.

2.02 MATERIALS

- A. Materials specified are considered the minimum acceptable for the purposes of durability, strength, and resistance to erosion and corrosion. The Contractor may propose alternative materials for the purpose of providing greater strength or to meet required stress limitations. However, alternative materials must provide at least the same qualities as those specified for the purpose. If alternatives are proposed, the proposals shall be accompanied with documentation supporting the claimed superiority of the proposed substitutions. The Engineer shall be the sole decider in the equivalency of alternative materials of construction.
- B. Air and Moisture Barrier: Water / Weather-Resistive-Barrier Coating.
1. EFIS manufacturer's standard formulation and accessories designed for indicated use, compatible with substrate, and complying with performance requirements indicated.
 2. StoGuard Air and Moisture Barrier by Sto Corp., or
 3. Approved Equal.
- C. Adhesives: Provide adhesives as required for the substrate encountered as recommended by the Supplier of the complete exterior insulation and finish system.
1. Sto BTS Plus by Sto Corp., or

2. Approved Equal.
- D. Insulation Board
1. Rigid: 100 percent virgin expandable polystyrene modified resin bead board in compliance with ASTM C 578, Type I, with bead fusion of 80 percent minimum with no visible voids.
 - a. Molded blocks air dried for minimum of six weeks with less than 0.5 percent residual pentane prior to fabrication.
 - b. Dimension Tolerances, ASTM C 550
 - 1) Length: $\pm 1/16$ -inch.
 - 2) Width: $\pm 1/16$ -inch.
 - 3) Thickness: $\pm 1/16$ -inch.
 - 4) Squareness: $\pm 1/16$ -inch.
 - 5) Flatness: $\pm 1/32$ -inch.
 2. Physical Properties
 - a. Density, ASTM C 303: 0.91 to 1.10 lbs/cu.ft.
 - b. Thermal Resistance, (R at 75 °F), ASTM C 177 and ASTM C 518: R=3.6 s.f./°F/hr/BTU.
 - c. Thermal Conductivity (k at 40°F), ASTM C 177 and ASTM C 518: U=0.25 BTU/in.hr/s.f./°F.
 - d. Coefficient of Thermal Expansion, ASTM D 696: 3.5×10^{-5} in./ in./°F.
 - e. Compressive Strength (ten percent deflection), ASTM D 1621: 10 to 14 psi.
 - f. Flexural Strength, ASTM C 203: 25 to 30 psi.
 - g. Tensile Strength, ASTM C 1623: 16 to 20 psi.
 - h. Water Vapor Transmission, ASTM E 96: 2.0 to 5.0 perms.
 - i. Water Vapor Absorption, ASTM C 272: Less than four percent.
 - j. Flame Spread, ASTM E 84: Less than 25.
 - k. Smoke Developed, ASTM E 84: Less than 450.
 3. Thicknesses: 2-inch and as required to provide architectural features shown on the Plans.
 4. Rigid insulation shall be as approved by the exterior insulation and finish system Supplier for complete product system responsibility.
 5. Where insulation board is shown on the Plans with non-standard profiles provide custom fabricated rigid polystyrene resin boards fabricated to the profiles shown on the Plans, complying with the tolerances specified. Provide continuous pre-molded inside and outside corner shapes.
 6. Provide insulation boards approved by the exterior insulation and finish system supplier for the system specified herein.
- E. Base Coat: Provide lightweight factory blended one component polymer modified portland cement based high build base coat.
1. Sto BTS Xtra by Sto Corp., or
 2. Approved Equal.

- F. Reinforcing Meshes: Provide the following two types
 - 1. Ultra High Impact Reinforcing Mesh
 - a. Nominal 15 oz./sq.yd., ultra-high impact, double strand, interwoven, open-weave glass fiber fabric with alkaline resistant coating.
 - b. Product and Supplier
 - 1) Armor Mat by Sto Corp., or
 - 2) Approved Equal.
 - 2. Standard Reinforcing Mesh
 - a. Nominal 4.5 oz./sq. yd., symmetrical, interlaced open-weave glass fiber fabric made with alkaline resistant coating.
 - b. Product and Supplier
 - 1) Sto Mesh by STO Corp., or
 - 2) Approved Equal.

- G. Primers: Acrylic based tintable primer for spray application.
 - 1. StoPrime by STO Corp., or
 - 2. Approved Equal.

- H. Textured Wall Finish: Provide an acrylic based textured wall finish with graded marble aggregate and self-cleaning properties. Comply with the following
 - 1. Particle Size: 2.0 millimeter.
 - 2. Color: The City approved color palette for buildings and structures shall be selected from standard or custom color charts, and shall be submitted to Engineer for final selection and approval.
 - 3. Texture: Textured stucco effect. Final exact texture to be selected by Engineer from Supplier's complete selection of standard and custom textured finishes.
 - 4. Resistant to the effect of weather.
 - 5. Hardness: Resistant to mechanical stress. Scratch and impact resistant.
 - 6. Flexibility: Capable of bridging normal shrinkage cracks.
 - 7. Supplier's "Or Approved Equal" products and systems shall provide a complete selection of standard and custom colors and textures.
 - 8. Product and Supplier
 - a. STOLIT by Sto Corp., or
 - b. Approved Equal.

- I. Miscellaneous Materials
 - 1. Water: Free from injurious amounts of impurities and potable.
 - 2. Portland Cement: ASTM C 150, Type I.
 - 3. Deep V Expansion Joints and Surface Mounted Control Joints: Galvanized metal, ASTM A 653, with temporary fasteners.
 - 4. Starter Track: Rigid PVC (polyvinyl chloride) plastic track.
 - 5. Mesh Corner Bead Standard: Provide one component PVC (polyvinyl chloride) accessory with integral reinforcing mesh for outside corner reinforcement.
 - 6. Drip Edge Profile: Provide one component PVC (polyvinyl chloride) accessory with integral reinforcing mesh that creates a drip edge and plaster return.

2.03 MIXES

- A. Sto BTS Xtra – mix ratio with water: 4.75- 5 quarts (4.5-4.7 L) of clean potable water per 38 pound (17.2 kg) bag of Sto BTS Xtra. Pour water into a clean mixing pail. Add Sto BTS Xtra, mix to a uniform consistency and allow to set for approximately 5 minutes. Adjust mix if necessary with additional Sto BTS Xtra or water and remix to a uniform trowel consistency. Avoid retempering. Keep mix ratio consistent. Do not exceed maximum amount of water in mix ratio.
- B. Sto primer – mix with a clean, rust-free high speed mixer to a uniform consistency.
- C. Stolit Lotusan – mix with a clean, rust-free high speed mixer to a uniform consistency. A small amount of water may be added to adjust workability. Limit addition of water to amount needed to achieve the finish texture.
- D. Anti-freeze, accelerators and rapid binders are not allowed.
- E. Air entraining agents, air entrained lime, and air entrained Portland cement are not allowed.
- F. Mix only as much material as can readily be used.

2.04 FABRICATION

- A. Custom fabricate exterior insulation and finish system to provide all arises, returns, reveals and architectural features shown on the Plans.
- B. Product and Supplier
 - 1. Exterior Insulation and Finish System
 - a. StoTherm ci Lotusan by Sto Corp., or
 - b. Approved Equal
 - 2. Exterior Finish System
 - a. StoPowerwall ExtraSeal by Sto Corp., or
 - b. Approved Equal

PART 3 EXECUTION

3.01 SHIPMENT AND STORAGE

- A. Product shall be shipped and stored in accordance with Section 01 66 00 - Product Storage and Handling Requirements.
- B. Supplier shall provide Contractor with detailed recommendations and instructions for product storage.
- C. Delivery of Materials
 - 1. Deliver materials in exterior insulation and finish system Supplier's original unopened packages.
 - 2. Include the following information on the label
 - a. Name of material and supplier.

- b. Formula or specification number, lot number, color and date of manufacture.
 - c. Mixing instructions, shelf life and curing time, when applicable.
 - 3. Failure to comply with these requirements shall be sufficient cause for rejection of the material in question, by Engineer, and require its removal from the Site. Supply new material conforming to the specified requirements at no additional cost to the City.
- D. Storage of Materials
- 1. Store materials so as to preclude the inclusion of foreign materials.
 - 2. Store in accordance with Supplier's recommendations in a clean, dry, well ventilated area.
 - 3. Store materials out of direct sunlight and at a temperature of not less than 40°F, or more than 90°F.
- E. Handling
- 1. Handle materials carefully to prevent inclusion of foreign materials.
 - 2. Do not open containers or mix components until necessary preparatory work has been completed and installation will start immediately.
 - 3. Do not expose combustible or sensitive material to excessive heat or open flame.
 - 4. Materials shall be used in the Work only when the material being incorporated into the Work bears the same name and formulation as the container or package in which it is contained.
 - 5. Contractor shall not change containers or use material from unmarked or incorrectly labeled containers.
 - 6. Failure to comply with this requirement will be cause for the Engineer to require the product to be removed from the site and the area wherein the product has been incorporated to be removed and rebuilt with material complying with the specified requirements. This requirement shall govern even if Contractor certifies or proves that the material was appropriate for incorporating into the Work.

3.02 SUPPLIER'S FIELD SERVICES

- A. Supplier shall provide assistance during equipment installation as required by the Contractor.

3.03 INSTALLATION

- A. The Supplier shall provide the Contractor with detailed recommendations and instructions for installation of the product specified in this Section.
- B. Supplier shall provide assistance during product installation as required by the Contractor.
- C. The product shall be installed at the locations shown and in accordance with the recommendations of the Supplier.
- D. Following installation, Supplier shall provide Certificate of Proper Installation.
- E. General rules for application of finishes shall be as follows

1. Using a clean rust free high speed mixer, thoroughly stir finish to a uniform consistency (small amounts of clean water may be added to aid workability).
 2. Avoid application in direct sunlight.
 3. Apply finish in a continuous application always working to a wet edge.
 4. Finish may be applied over caulk joints, but not over expansion joints.
 5. Apply aggregate and textured finish coats following the specified EIFS supplier's printed instructions.
- F. Exterior Insulation and Finish System over Concrete and Concrete Masonry Wall Construction
1. Air/Moisture Barrier
 - a. Transition Detailing: Provide air barrier continuity.
 - b. Provide rough opening protection.
 - c. Air/Moisture Barrier Coating:
 - 1) Repair static cracks up to 1/2 inch wide. Rake the crack with a sharp tool to remove loose or friable material and blow clean with oil-free compressed air. Apply the crack filler with a trowel or putty knife over the crack and tool the surface smooth. Protect repair from weather until dry.
 - 2) Liberally apply coating to the surface with a 3/4 inch nap roller or spray equipment to a minimum wet thickness of 20 – 40 wet mils, depending on surface condition. Apply to a uniform thickness. Additional coats may be necessary to provide a void and pinhole free surface. Protect from weather until dry.
 2. EIFS Installation
 - a. Starter Track
 - 1) Strike a level line at the base of the wall to mark where the top of the starter track terminates.
 - 2) Attach the starter track even with the line into structural supports with the proper fastener: Corrosion resistant concrete or masonry screws with minimum 1 inch penetration for concrete or CMU. Attach between studs into blocking as needed to secure the track flat against the wall surface. For concrete/masonry surfaces, attach directly at 12 inches on center maximum
 - 3) Butt sections of starter track together. Miter cut outside corners and abut. Snip front flange of one inside corner piece (to allow EPS insulation board to be seated inside of track) and abut.
 - 4) Install Starter Track at other EIFS terminations beneath window sills with concealed flashing (refer to Supplier Standard Details)
 - b. Backwrapping
 - 1) Apply a strip of detail mesh to the dry air/moisture barrier at all system terminations (windows, doors, expansion joints, etc.) except where the Starter Track is installed. The mesh must be wide enough to adhere approximately 4 inches of mesh onto the wall, be able to wrap around the insulation board edge and cover a minimum of 2 1/2 inches on the outside surface of the insulation board. Attach mesh strips to the air/moisture barrier and allow them to dangle until the backwrap procedure is completed. Alternatively, pre-wrap terminating edges of insulation board
 - c. Adhesive Application and Installation of Insulation Board

- 1) Ensure the air/moisture barrier surface is free of surface contamination. Install the insulation board within 30 days of the application of the air/moisture barrier coating, or clean the surface and recoat.
 - 2) Rasp the interior lower face of insulation boards to provide a snug friction fit into the Starter Track.
 - 3) Use either polyurethane spray foam adhesive or cementitious adhesive.
 - a) Polyurethane Spray Foam Adhesive: apply adhesive to the back of the insulation board with the dispensing pistol approximately $\frac{3}{4}$ inch from ends. Apply 5 additional ribbons spaced equally at no greater than 7 inches apart between the end ribbons. Apply uniform ribbons of adhesive parallel with the SHORT dimension of the board so that when boards are placed on the wall the ribbons will be VERTICAL. Apply adhesive ribbons approximately $\frac{1}{2}$ inch in diameter which will expand to $\frac{3}{4}$ - 1 inch. Keep adhesive $\frac{1}{2}$ inch short of board edges. Apply adhesive uniformly so ribbons of adhesive do not converge. Allow adhesive to "dwell" and become "tacky" before placing boards on wall. Adhesive will look smooth, not jagged, when ready to apply to wall surface. Place boards while adhesive is "tacky" and before adhesive "skins". Place insulation boards in a running bond pattern on the wall with the long dimension horizontal. Start by inserting the lower edge of the boards inside the starter track at the base of the wall until they contact the bottom of the track. Apply light pressure when placing the boards. After boards have been in place for 5-10 minutes use a straight edge to lightly press the boards inward and to keep board joints flush, as post expansion of the adhesive may force boards slightly outward.
 - b) Cementitious Adhesive: apply adhesive to the back of the insulation board with the proper size ($1/2 \times 1/2 \times 2$ inch) stainless steel notched trowel. Apply uniform ribbons of adhesive parallel with the SHORT dimension of the board so that when boards are placed on the wall the ribbons will be VERTICAL. Apply adhesive uniformly so ribbons of adhesive do not converge. Immediately place insulation boards in a running bond pattern on the wall with the long dimension horizontal. Start by inserting the lower edge of the boards inside the starter track at the base of the wall until they contact the bottom of the track. Apply firm pressure over the entire surface of the boards to ensure uniform contact of adhesive. Do not delay installation once adhesive is applied. If adhesive "skins" remove it and apply fresh adhesive
 - 4) Butt all board joints tightly together to eliminate any thermal breaks. Care must be taken to prevent any adhesive from getting between the joints of the boards.
 - 5) Cut insulation board in an L-shaped pattern to fit around openings. Do not align board joints with corners of openings.
 - 6) Check for satisfactory contact of the insulation board with the substrate. If any boards have loose areas use the spray foam adhesive dispensing pistol to create a hole through the board and inject adhesive to attach the loose area. Allow the adhesive to expand to the outer face of the board while withdrawing the pistol. Cut excess adhesive flush with the surface of the insulation. Do not use nails, screws, or any other type of non-thermal mechanical fastener.
- d. Slivering and Rasing of Insulation Board Surface

- 1) Make sure insulation boards are fully adhered to the substrate.
 - 2) Fill any open joints in the insulation board layer with slivers of insulation or the spray foam adhesive.
 - 3) Rasp the insulation board surface to achieve a smooth, even surface and to remove any ultraviolet ray damage.
- e. Trim, Reveals and Projecting Aesthetic Features
- 1) Attach features and trim where designated on drawings with adhesive to a base layer of insulation board or to the coated sheathing surface. Fill any gaps between the trim and base layer of insulation with spray foam adhesive and rasp flush with the trim surface. Slope the top surface of all trim/features minimum 1:2 (27°) and the bottom of all horizontal reveals minimum 1:2 (27°).
 - 2) Cut reveals/aesthetic grooves with a hot-knife, router or groove-tool in locations indicated on drawings.
 - 3) Offset reveals/aesthetic grooves minimum 3 inches from insulation board joints.
 - 4) Do not locate reveals/aesthetic grooves at high stress areas.
 - 5) Ensure minimum $\frac{3}{4}$ inch thickness of insulation board at the bottom of the reveals/aesthetic grooves.
- f. Completion of Backwrapping
- 1) Complete the backwrapping procedure by applying base coat to exposed edges of insulation board and approximately 4 inches onto the face of the insulation board. Pull mesh tight around the board and embed it in the base coat with a stainless steel trowel. Use a corner trowel for clean, straight lines. Smooth any wrinkles or gaps in the mesh.
- g. Accessory Installation
- 1) Corner Bead: cut the corner bead accessory to proper length as needed. Use full pieces wherever possible and avoid using short filler pieces. Offset accessory butt joints from substrate joints. Apply base coat with a stainless steel trowel to an approximate thickness of $\frac{1}{8}$ inch to the outside corner area that will receive the accessory. Immediately place the accessory directly into the wet base coat material. Do not slide into place. Press the accessory into place. A corner trowel is best for this purpose. Embed and completely cover the mesh and PVC by troweling from the corner to the edge of the mesh so that no mesh or PVC color is visible. Avoid excess build-up of base coat and feather along mesh edges. Adjoin separate pieces by abutting PVC to PVC and overlapping the mesh "tail" from one piece onto the next piece. Fully embed the accessory and mesh "tail" in base coat material. When installing field mesh reinforcement overlap accessory mesh and PVC. Remove any excess base coat from the outside corner.
 - 2) Drip Edge: install the drip edge accessory prior to application of field mesh. Install with arrow on mesh pointing UP. Cut the accessory to proper length as needed. Use full pieces wherever possible and avoid using short filler pieces. Offset accessory butt joints from substrate joints. Apply base coat with a stainless steel trowel to an approximate thickness of $\frac{1}{8}$ inch to the area that will receive the accessory. Immediately place the accessory directly into the wet base coat material and press into place. Do not slide into place. Embed and completely cover the mesh and PVC by troweling from the drip

edge screed rail to the edge of the mesh. Avoid excess build-up of base coat, feather along mesh edges, and remove any excess base coat from the drip edge nosing. Abut adjoining pieces and install as described above. When installing field mesh reinforcement overlap accessory mesh 4 inches on both vertical and horizontal faces so the PVC is overlapped, and remove any excess base coat from the drip edge nosing. On vertical and horizontal faces of the accessory install finish to the drip edge lines and remove any protruding finish from the drip edge nosing

h. Base Coat and Reinforcing Mesh Application

- 1) Ensure the insulation board is firmly adhered and free of surface contamination or UV degradation, and is thoroughly rasped before commencing the base coat application.
- 2) Apply minimum 9 X 12 inch diagonal strips of detail mesh at corners of windows, doors, and all penetrations through the system. Embed the strips in wet base coat and trowel from the center to the edges of the mesh to avoid wrinkles.
- 3) Apply detail mesh at trim, reveals and projecting architectural features. Embed the mesh in the wet base coat. Trowel from the base of reveals to the edges of the mesh.
- 4) Ultra-High impact mesh application, install at a minimum height of 6'-0" above finished grade or finish floor at all areas: apply base coat over the insulation board with a stainless steel trowel to a uniform thickness of approximately 1/8 inch. Work horizontally or vertically in strips of 40 inches, and immediately embed the mesh into the wet base coat by troweling from the center to the edge of the mesh. Butt ultra-high impact mesh at seams. Allow the base coat to dry.
- 5) Standard mesh application: Apply base coat over the insulation board, including areas with Ultra-High impact mesh, with a stainless steel trowel to a uniform thickness of approximately 1/8 inch. Work horizontally or vertically in strips of 40 inches, and immediately embed the mesh into the wet base coat by troweling from the center to the edge of the mesh. Overlap mesh not less than 2-1/2 inches at mesh seams and at overlaps of detail mesh. Feather seams and edges. Double wrap all inside and outside corners with minimum 6 inch overlap in each direction. Avoid wrinkles in the mesh. The mesh must be fully embedded so that no mesh color shows through the base coat when it is dry. Re-skim with additional base coat if mesh color is visible.
- 6) Sloped Surfaces: for trim, reveals, aesthetic bands, cornice profiles, sills or other architectural features that project beyond the vertical wall plane more than 2 inches apply waterproof base coat with a stainless steel trowel to the sloped surface and minimum four inches above and below it. Embed standard mesh or detail mesh in the waterproof base coat and overlap mesh seams a minimum of 2-1/2 inches.
- 7) Allow base coat to thoroughly dry before applying primer or finish.

i. Primer Application

- 1) Ensure the base coat surface is free of surface contamination before commencing the primer application.
- 2) Apply primer evenly with brush, roller or proper spray equipment over the clean, dry base coat and allow to dry thoroughly before applying finish.

j. Finish Coat Application

- 1) Ensure the base coat surface or primed base coat is free of surface contamination before commencing the finish application.
 - 2) Apply finish directly over the base coat or primed base coat when dry. Apply finish by spray or stainless steel trowel, depending on the finish specified. Follow these general rules for application of finish:
 - a) Avoid application in direct sunlight.
 - b) Apply finish in a continuous application, and work to an architectural break in the wall.
 - c) Weather conditions affect application and drying time. Hot or dry conditions limit working time and accelerate drying. Adjustments in the scheduling of work may be required to achieve desired results. Cool or damp conditions extend working time and retard drying and may require added measures of protection against wind, dust, dirt, and rain. Adjust work schedule and provide protection.
 - d) Do not install separate batches of finish side-by-side.
 - e) Do not apply finish into or over sealant joints. Apply finish to outside face of wall only.
 - f) Do not apply finish over irregular or unprepared surfaces, or surfaces not in compliance with the requirements of the project specifications.
- G. Install backer rod (25 percent compression) in calk joint openings to provide a depth equal to the width of the joint. Install a Supplier's approved sealant and tool flush with the ground coat surface. Allow sealant to set in accordance with the specified EIFS supplier 's specifications prior to applying finish coat.
- H. Vertical Building Expansion Joints: Vertical building expansion joints shall be installed when the substrate has an existing control joint, expansion joint, or live building crack, or where the system is applied to dissimilar substrates. These joints shall extend through the full thermal system and shall be calked with an approved expansion joint sealant against a backer rod. On expansion joints, the reinforcing fiberglass mesh and ground coat shall completely wrap the edges of the insulation board so that the expansion joint calk is not in direct contact with the insulation board.

3.04 INSPECTION

- A. Contractor shall examine the substrates to receive exterior insulation and finish system work, and the conditions under which the Work is to be performed, and notify Engineer, in writing, of any conditions detrimental to the proper and timely completion of the Work and performance of the exterior insulation and finish systems. Do not proceed with the exterior insulation and finish systems Work until unsatisfactory conditions have been corrected by Contractor.

3.05 PREPARATION

- A. Prime and seal all sheathing board and substrates with primer specified and coordinate fastener selection, adhesives and finishes as required by exterior insulation and finish system supplier.
- B. Cast-In-Place Concrete

1. Provide a surface that is water absorbent, free of surface contamination such as algae, curing compounds, dirt, dust, efflorescence, form oil, fungus, grease, laitance, mildew or other foreign substances, straight and true to line and plane. Remove form ties and trim projecting concrete so it is even with the plane of the wall. Remove form release agents by washing with a trisodium phosphate detergent and thoroughly rinsing with clean water. Remove efflorescence by mechanically scraping or abrading the surface with a wire brush. Refer to ASTM D 4258 for cleaning practice and other cleaning methods that may apply.
- C. Concrete Masonry Units
1. Provide a surface that is free of surface contamination such as algae, dirt, dust, efflorescence, oil, fungus, grease, mildew or other foreign substances, straight and true to line and plane. Remove projecting joint mortar so it is even with the plane of the wall. Remove grease, oil and dirt by washing with a trisodium phosphate detergent and thoroughly rinsing with clean water. Remove efflorescence by mechanically scraping or abrading the surface with a wire brush. Refer to ASTM D 4261 for cleaning practice and other cleaning methods that may apply.

3.06 FIELD TESTING AND COMMISSIONING

- A. Contractor shall provide the services of a field technical representative authorized by the Supplier of the EIFS to perform on-Site, in-progress inspections at no additional cost to the City.
- B. Certify that the completed Work is in accordance with the Specifications and without damage or deterioration at the time of Final Acceptance.

3.07 ADJUSTMENT, CUTTING AND PATCHING

- A. Cut, patch, and repair exterior insulation system and finish coat work as required and as necessary to accommodate and provide acceptable substrate for other work. Repair cracks and indented surfaces. Point up finish surfaces around items which are built into or penetrate exterior insulation system and finish coat work.
- B. Repair or replace the Work to eliminate blisters, buckles, check cracking, dry outs, excessive pinholes, and similar imperfections. Repair or replace the Work as necessary to comply with specified tolerances and required visual effects.
- C. Protect exterior insulation and finish system work so as to be clean and undamaged at the time of Final Acceptance.
- D. Engineer may require additional finish coats if, in the opinion of Engineer, the finish is inconsistent in color, texture, or has holidays, areas of unusual porosity or exhibits other imperfections.
- E. Only the installer shall repair or replace deteriorated or defective Work.
- F. Clean the exterior insulation and finish system work as recommended by the Supplier.

3.08 CLEANING AND PROTECTION

- A. Remove temporary covering and whatever other provisions were made to minimize spattering of ground, primer and finish coats on other work. Promptly remove ground primer and finish coats from surfaces which are not to be finished as part of the Work of this Section. Repair surfaces which have been stained, marred or otherwise damaged during the exterior insulation and finish system work. When exterior insulation and finish system work is completed, remove unused materials, containers, and equipment and other debris caused by the Work of this Section.
- B. Protect exterior insulation and finish system work from deterioration and damage during remainder of construction period.

END OF SECTION

SECTION 07 53 23

ETHYLENE-PROPYLENE-DIENE-MONOMER ROOFING

PART 1 GENERAL

1.01 SUMMARY

A. Scope

1. This Section specifies Ethylene-Propylene-Diene-Monomer Roofing (EPDM) with associated sheet flashing.

B. Preroofing Conference

1. Prior to the installation of the EPDM roofing and associated work, Contractor shall schedule and meet at the Site with the roofing installer, the installer of each component of associated work, the installers of deck and insulation to receive roofing work, the installers of other work in and around roofing which must follow the roofing work, including mechanical work, Engineer and other representatives directly concerned with performance of the Work. Review foreseeable methods and procedures related to the EPDM roofing work, including but not necessarily limited to, the following:
 - a. Review project requirements, including Contract Documents.
 - b. Review required submittals, both completed and yet to be completed.
 - c. Review status of substrate including drying, structural loading limitations and similar considerations.
 - d. Review availability of materials, tradesmen, equipment and facilities required to make progress and avoid delays.
 - e. Review required inspection, testing, certifying and accounting procedures.
 - f. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions.
 - g. Review regulations concerning code compliance, FM compliance, environmental protection, health, safety, fire and similar considerations.
 - h. Review procedures required for protection of roofing during the remainder of the Work.

1.02 QUALITY ASSURANCE

A. Reference Codes and Standards

1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if

there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
ASTM C 208	Specification for Cellulosic Fiber Insulating Board
ASTM C 728	Specification for Perlite Thermal Insulation Board
ASTM C 1177	Specification for Glass Mat Gypsum Substrate for Use as Sheathing
ASTM C 1278	Specification for Fiber-Reinforced Gypsum Panel
ASTMC 1396	Specification for Gypsum Board
ASTM D 4263	Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
ASTM D 4637	Specification for EPDM Sheet Used In Single-Ply Roof Membrane
ASTM E 329	Specification for Agencies Engaged in Construction Inspection and/or Testing
ASTM E 1980	Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces
FM Global Loss Prevention Data Sheets	1-28, Wind Loads to Roof Systems and Roof Deck Securement
FM Global Loss Prevention Data Sheets	1-29, Above-Deck Roof Components
FM Global Loss Prevention Data Sheets	1-28R and 1-29R, Roof Systems
FM Global Loss Prevention Data Sheets	1-49, Perimeter Flashing
FM Approvals 4470	Class 1 Roof Covers
FM Global	Research Technical Reports
UL 790	Tests for Fire Resistance of Roof Covering Materials
UL BMD	Building Materials Directory

B. Warranty

1. Provide a roofing guarantee in the form and content specified, covering the EPDM roofing and associated work specified therein, signed by Contractor and their installer, in accordance with the General Conditions. Provide a two (2)-year roofing guarantee period, starting from the date of the Final Completion certificate issued for the Work, stating that for the duration of the guarantee, Contractor and installer shall be responsible to fix leaks, replace EPDM roofing and roof insulation components damaged by moisture penetration, and other defects caused by improper workmanship or the improper arrangement of the various system components.
2. Special Warranty: A Manufacturer's standard warranty shall be provided for the elastomeric sheet roofing system in accordance with the General Conditions. The

warranty shall be issued directly to the City. In no event shall the warranty period be less than twenty (20) years from the date of acceptance of the Work.

C. Qualification of Installer

1. Engage a single installer skilled, trained and with successful experience in the installation of the type of EPDM system specified, who is a recognized roofing installer with specific skill and successful experience in the type of roofing specified in this Section, and equipped to perform workmanship in accordance with the Contract Documents, manufacturer's written instructions for guaranteed construction and the approved Shop Drawings and who agrees to employ only tradesmen with specific skill and successful experience in this type of work. Submit names and qualifications to the Engineer along with the following information on a minimum of three successful projects:
 - a. Names and telephone numbers of owners, architects or engineers responsible for projects.
 - b. Approximate contract cost of the EPDM roofing.
 - c. Amount of area installed.
2. The roofing installer shall be an approved roofing applicator who has qualified for appointment and has been trained by the Manufacturer.
3. Submit proof of acceptability of installer by the Manufacturer to Engineer.

1.03 ENVIRONMENTAL CONDITIONS

- A. Product in this Section shall be subjected to environmental conditions in accordance with Section 01 11 80 - Environmental Conditions.

1.04 SUBMITTALS

- A. Preconstruction/Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.
1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.
 2. Shop Drawings: Submit the following:

- a. Copies of drawings completely dimensioned using field-verified dimensions on plans of each roof area and the accurate location of all roof penetrations roof mounted equipment, curbs, skylights and other features present on the roof areas specified by Engineer to be included under the Work of this Section and all details of construction and erection, including all flashing details coordinated with Section 07 62 00 - Sheet Metal Flashing and Trim, Section 07 22 16 - Roof Board Insulation, and FM Publications specified, and the location of all walkway pad patterns required by the Manufacturer for warranted construction and as shown. Contractor shall submit all details requiring consideration and the performance of the details shall be approved by the EPDM roofing manufacturer for guaranteed construction as specified.
3. Product Data
 - a. Manufacturer's specifications and product manuals indicating product information correlated to specified requirements, Manufacturer's installation instructions, maintenance instructions and other data as may be required by Engineer.
 - b. Copies of the FM Global Loss Prevention Data Sheets and appropriate FM Global Research Technical Reports, indicating compliance with wind uplift pressure-resistant performance criteria, and the requirements for FM Approved 1-90 system construction and perimeter securement conditions.
 - c. Warranty specified in this Section.
4. Certificates
 - a. Contractor's Review: Accompanying approval request, submit to Engineer a written statement signed by Contractor, stating that the Contract Documents for roofing, insulation, and flashing have been reviewed with an agent of the roofing material manufacturer and that they are in agreement that the selected systems are proper, compatible and that the details shown are not in conflict with the roofing manufacturer's roofing, insulation, and flashing details. Show by copy of transmittal form that a copy of the statement has been transmitted to the Manufacturer.
 - b. Statement of Application: Upon completion of the Work, submit a statement to Engineer signed by Contractor stating that the Work complies with the requirements of these Specifications and the installation methods comply with the Manufacturer's printed instructions and were proper and adequate for the condition of installation and use.
5. Samples
 - a. 12-inch by 12-inch sheet of each item specified and 6-inch long pieces of each required system component to be used in the Work.
 - b. Each fastener type required marked as to type of material and with their intended purpose in the Work.
 - c. All components of the EPDM roofing and flashing labeled with their intended use in the Work. Compliance with all other requirements is exclusive responsibility of Contractor.
6. Evidence of applicator qualifications as specified this Section, Qualification of Applicator.
7. Operations and Maintenance Data: For membrane roofing system to include in maintenance manuals.
8. Warranty documentation as specified in this Section.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

A. Manufacturers

1. The Engineer and the City believe that the Manufacturers indicated in this Section are capable of producing equipment and products, which will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular Manufacturer or product, nor shall it be construed that a named Manufacturer's standard product will comply with the requirements of this Section.

B. Manufacturer Qualifications

1. The Manufacturer shall have ten (10) years of experience manufacturing EPDM roofing in similar-sized projects.

2.02 MATERIALS

- #### **A. Materials specified are considered the minimum acceptable for the purposes of durability, strength, and resistance to erosion and corrosion. The Contractor may propose alternative materials for the purpose of providing greater strength or to meet required stress limitations. However, alternative materials must provide at least the same qualities as those specified for the purpose. If alternatives are proposed, the proposals shall be accompanied with documentation supporting the claimed superiority of the proposed substitutions. The Engineer shall be the sole decider in the equivalency of alternative materials of construction.**

1. EPDM: ASTM D 4637, uniform, flexible, white, EPDM sheet.
 - a. Type I, non-reinforced.
 - b. Thickness: 60 mils, nominal.
2. Acceptable Products and Manufacturers: Provide one of the following:
 - a. Sure-White Fully-Adhered Roofing System and 20 Year Total System Warranty by Carlisle SynTec Systems Division of Carlisle Corporation.,
 - b. RubberGard EcoWhite Fully-Adhered Roofing System and 20 Year Total System Warranty by Firestone Building Products., or
 - c. Approved Equal.

- #### **B. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.**

1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Gypsum Board and Panel Adhesives: 50 g/L.
 - c. Multipurpose Construction Adhesives: 70 g/L.
 - d. Fiberglass Adhesives: 80 g/L.
 - e. Single-Ply Roof Membrane Adhesives: 250 g/L.

- f. Single-Ply Roof Membrane Sealants: 450 g/L.
 - g. Nonmembrane Roof Sealants: 300 g/L.
 - h. Sealant Primers for Nonporous Substrates: 250 g/L.
 - i. Sealant Primers for Porous Substrates: 775 g/L.
 - j. Other Adhesives and Sealants: 250 g/L.
- C. Sheet Flashing: White, 60-mil-thick EPDM, partially cured or cured, according to application.
 - D. Bonding Adhesive: Manufacturer's standard, water based.
 - E. Splice Tape and Primer: Manufacturer's standard, synthetic-rubber polymer primer and 3-inch wide minimum, white EPDM splice tape with release film.
 - F. Lap Sealant: Manufacturer's standard, single-component sealant, colored to match membrane roofing.
 - G. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.
 - H. Metal Termination Bars: Manufacturer's standard, predrilled 6063-T6 extruded aluminum, approximately 1-inch by 1/8-inch thick; with anchors.
 - I. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to roofing system manufacturer.
 - J. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.
 - K. Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2 - inch thick.
 - 1. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate panel to roof deck.
 - L. Vapor Retarder: Polyethylene Film: ASTM D 4397, 6 mils thick, minimum, with maximum permeance rating of 0.13 perm.
 - 1. Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
 - M. Roof Insulation: Refer to Section 07 22 16 - Roof Board Insulation.
 - N. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch thick, factory primed.
 - O. Flexible Walkways: Factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured, white walkway pads, approximately 3/16 inch thick, and acceptable to EPDM roofing system manufacturer

PART 3 EXECUTION

3.01 SHIPMENT AND STORAGE

- A. Product shall be shipped and stored in accordance with Section 01 66 00 - Product Storage and Handling Requirements.
- B. Manufacturer shall provide Contractor with detailed recommendations and instructions for product storage.
- C. Manufactured roofing materials shall be delivered in Manufacturers' original unopened containers or wrappings with labels intact and legible. Where materials are covered by a referenced Section, the containers shall bear the Section number, type, and class as applicable. Materials shall be stored on pallets and covered with canvas tarpaulins to keep them clean and dry. Polyethylene covering is not an acceptable method of protecting materials. Materials temporarily stored on the roof shall be located in approved areas and shall be distributed to stay within the indicated live load limits of the roof construction.

3.02 SUPPLIER'S FIELD SERVICES

- A. Manufacturer shall provide assistance during product installation as required by the Contractor.

3.03 WORK SEQUENCE

- A. Work shall be arranged to prevent use of newly constructed roofing for storage, walking surface, or equipment movement. If access is necessary, temporary walkways, platforms, or runways shall be provided to protect new roofing surfaces and flashings from mechanical damage.

3.04 INSPECTION

- A. Contractor and installer shall examine the substrate and the conditions under which the EPDM roofing and base flashing Work is to be performed, and notify Engineer, in writing, of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to Engineer.
- B. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
 - 1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
 - 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation. Fasteners shall be the size and material recommended by the membrane roofing manufacturer.
 - 3. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
 - 4. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

5. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.

3.05 PREPARATION

- A. Clean the substrate of dust, debris, substances and interferences detrimental to the Work.
- B. Fill voids, joints and rough areas in the substrate with elastomeric sealant or other underlayment compound recommended by the EPDM roofing manufacturer.
- C. Test the substrate for excessive moisture as recommended by the EPDM roofing manufacturer.
- D. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- E. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.06 INSTALLATION

- A. General
 1. Follow all applicable installation instructions and recommendations contained in the EPDM roofing manufacturer's written installation and product manuals and the information contained on approved Shop Drawings. Where Contractor requests to deviate from written installation and product manuals and approved Shop Drawings, all such deviations shall be submitted to Engineer for approval along with EPDM roofing manufacturer's written agreement and a statement of acceptability for compliance with guaranteed construction.
 2. Begin installation only in the presence of the EPDM roofing manufacturer's technical representative.
 3. Cut sheets to the maximum size possible, in order to minimize seams and to accommodate contours of the deck. Do not seam within four feet of roof drains.
 4. Clean all splices and lap areas using Manufacturer's recommended splice cleaner.
 5. Lap sheets and bond joints using the seaming system recommended by the Manufacturer.
 6. Cover top edges of each sheet at seams with uniform fillet of special sealant.
- B. Vapor-Retarder Installation
 1. Polyethylene Film: Loosely lay polyethylene-film vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches and 6 inches, respectively.
 - a. Continuously seal side and end laps with tape.
 2. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into membrane roofing system.

C. Insulation Installation

1. Refer to Section 07 22 16 - Roof Board Insulation.
2. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
3. Comply with membrane roofing system and insulation manufacturer's written instructions for installing roof insulation.

D. Adhered Membrane Roofing Installation

1. Adhere membrane roofing over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll membrane roofing and allow to relax before installing.
2. Start installation of membrane roofing in presence of membrane roofing system manufacturer's technical personnel.
3. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by Manufacturer. Stagger end laps.
4. Bonding Adhesive: Apply to substrate and underside of membrane roofing at rate required by the Manufacturer and allow to partially dry before installing membrane roofing. Do not apply to splice area of membrane roofing.
5. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations, and perimeters.
6. Apply membrane roofing with side laps shingled with slope of roof deck where possible.
7. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping membrane roofing according to Manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of membrane roofing terminations.
8. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.

E. Base Flashing Installation

1. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
2. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.
3. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
4. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.
5. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

F. Flexible Walkways: Install walkway products in locations indicated. Adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.07 FIELD TESTING AND COMMISSIONING

- A. Testing Agency: Engage a qualified independent testing agency to perform inspections.
- B. After installing the EPDM roofing membrane, and all elastic sheet and flashing seams have been sealed, conduct in-place water retention tests.
 - 1. Plug drains and flood roof with 2-inches of water above roof high points. Let water remain in-place for 24 hours. Do not add additional water during the time of the test and schedule testing during a period when precipitation is not predicted. If precipitation occurs during the time of the test, reconduct test when precipitation is not predicted during the time of the test. Calculate expected evaporation at temperatures, humidity and wind conditions occurring during the time of the tests.
 - 2. Measure water remaining in place at the high point of roofs. Roof areas which demonstrate loss of water, that cannot be explained by loss due to evaporation, shall be inspected by a technical representative of the EPDM roofing manufacturer and the source of leaks determined and presented to the City and Engineer as part of a field report which shall also make recommendations for remedial work. Where the source of leaks cannot be determined, the EPDM roofing shall be removed and replaced with new EPDM roofing at no additional cost to the City. All material and construction systems damaged by the results of this test shall be replaced with new, at no additional cost to the City.
 - 3. After remedial repairs have been made and inspected by a technical representative of the EPDM roofing manufacturer and judged to be watertight, repeat the water retention test. If, this test shows that the EPDM roofing is still not retaining water according to expected results, remove the entire EPDM roofing and replace with new, at no additional cost to City.
- C. Final Roof Inspection: Arrange for roofing system manufacturer's technical representative to inspect roofing installation on completion.
- D. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.
- E. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements

3.08 PROTECTION AND CLEANING

- A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Engineer and the City.
- B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of the Notice of Substantial Completion certificate issued for the Work and according to warranty requirements.

- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SUMMARY

- A. Scope
 - 1. This Section specifies
 - a. Formed low-slope roof flashing and trim.
 - b. Formed equipment support flashings.
 - c. Manufactured reglets.

- B. Performance Requirements
 - 1. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
 - 2. Recycled Content of Steel-Sheet Flashing and Trim: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 10 percent.
 - 3. Recycled Content of Zinc-Sheet Flashing and Trim: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 10 percent.
 - 4. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
 - 5. SPRI Wind Design Standard: Manufacture and install copings and roof edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressure.
 - a. Design Pressure As indicated on the Plans.
 - 6. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent 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.
 - a. Temperature Change 120 degrees F, ambient; 180 degrees F, material surfaces.
 - 7. Water Infiltration: Provide sheet metal flashing and trim that prevent water infiltration to building interior.

- C. Coordination
 - 1. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
 - 2. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leak-proof, secure, and noncorrosive installation.

- D. Preinstallation Conference Conduct conference at Work Site.
 - 1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
 - 3. Review sheet metal flashing and repair procedures after flashing installation.

1.02 QUALITY ASSURANCE

A. Reference Codes and Standards

- 1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
- 2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
ASTM B69-13	Types 1 and 2 Standard Specification for Architectural Rolled Zinc Sheet and Coil DIN EN 988
ASTM A167-99	Stainless Steel Alloy Material Standards
ASTM A240	Type 304 Stainless Steel Alloy Material Standards
RHEINZINK	Architectural Zinc Design Guidelines
SMACNA	Architectural Sheet Metal Manual
ISO 9001	Quality Management
ISO 14001	Environmental Management

B. Warranty

- 1. A warranty for the equipment specified under this Section shall be provided in accordance with the General Conditions and Section 01 80 00 – Warranties. The Warranty shall be for one (1) year from the date of the Notice of Substantial Completion certificate issued for the Work. If extended warranties are required, a special paragraph calling for an extended warranty will be included in this Section.

- C. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Work and whose products have a record of successful in-service performance.
 - 1. For copings and roof edge flashings that are SPRI ES-1 tested, shop shall be listed as able to fabricate required details as tested and approved.
- D. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
- E. Coordinate work of this Section with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of work and protection of materials and finishes.

1.03 ENVIRONMENTAL CONDITIONS

- A. Product in this Section shall be subjected to environmental conditions in accordance with Section 01 11 80 - Environmental Conditions.

1.04 SUBMITTALS

- A. Preconstruction/Action Submittals The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittal.
 - 1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up Specification Sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.
 - 2. Product Data For each type of product
 - a. Provide product data sheet for Architectural Zinc material including Zinc Rolling Mill name, Quality control (including ASTM and ISO standards), Physical Properties, intended uses, and storage and handling requirements.
 - b. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
 - 3. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following

- a. Identify material, thickness, weight, and finish for each item and location in Project.
 - b. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
 - c. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
 - d. Details of expansion-joint covers, including showing direction of expansion and contraction.
4. Samples for Initial Selection: For each type of sheet metal flashing and trim indicated with factory-applied color finishes.
- a. Include similar samples of trim and accessories involving color selection.
5. Samples for Verification: For each type of exposed finish.
- a. Sheet Metal Flashings: 12 inches long by actual width of unit, including finished seam, and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
 - b. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.
 - c. Unit-Type Accessories and Miscellaneous Materials: Full-size Sample.
 - d. Warranty Information: Prior to starting the Work, submit sample copy of warranty to be provided.
6. Qualification Data For Supplier.
- B. Informational Submittals: The following minimum informational submittals shall be submitted in accordance with the timing requirements specified in these Contract Documents, prior to Substantial Completion and in accordance with Section 01 33 00 - Submittal.
- 1. Product Certificates: For each type of coping and roof edge flashing that is SPRI ES-1 tested.
 - 2. Product Test Reports: For each product, for tests performed by a qualified testing agency.
 - a. Submit ANSI/SPRI test data for all edge metal and coping systems.
 - 3. Maintenance Data: For zinc flashing and trim, and its accessories, to include in maintenance manuals, in accordance with Section 01 77 30 - Operating and Maintenance Instructions.
 - 4. Warranty: Submit Supplier's warranty showing conformance to provisions of this Section.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

A. Suppliers

- 1. The Engineer and the City believe that the Suppliers indicated in this Section are capable of producing equipment and products, which will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a

particular Supplier or product, nor shall it be construed that a named Supplier's standard product will comply with the requirements of this Section.

B. Supplier Qualifications

1. The Supplier shall have five (5) years of experience manufacturing and installing sheet metal flashing and trim in similar-sized projects.

2.02 MATERIALS

- A. Materials specified are considered the minimum acceptable for the purposes of durability, strength, and resistance to erosion and corrosion. The Contractor may propose alternative materials for the purpose of providing greater strength or to meet required stress limitations. However, alternative materials must provide at least the same qualities as those specified for the purpose. If alternatives are proposed, the proposals shall be accompanied with documentation supporting the claimed superiority of the proposed substitutions. The Engineer shall be the sole decider in the equivalency of alternative materials of construction.

2.03 SHEET METALS

- A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Stainless-Steel Sheet: ASTM A 240, Type 316L, dead soft, fully annealed; with smooth, flat surface.
1. Finish 2D (dull, cold rolled).
- C. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, G90 coating designation or aluminum-zinc alloy-coated steel sheet according to ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40; pre-painted by coil-coating process to comply with ASTM A 755/A 755M.
1. Surface: Smooth, flat and with Supplier's standard clear acrylic coating on both sides
 - a. Three-Coat Fluoropolymer AAMA 621. 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 Suppliers' written instructions.
 2. Color: As selected by the City from Supplier's full range.
 3. Concealed Finish: Pretreat with Supplier's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.
- D. Solid Zinc Sheet: Rolled zinc alloyed with copper and titanium per ASTM B 69, and as per EN 988 requirements.
1. Zinc material shall contain a minimum of 30% post-consumer recycled content.
 2. Alloy shall be Type 710 with 0.08% - 1.00% copper and 0.06% - 0.20% titanium by weight. Zinc used in the Type 710 alloy shall be 99.995% pure SHG (special high grade) zinc.
 3. Material thickness 1.0 mm.

4. Zinc materials shall be domestically mined and milled in the United States of America.
 5. Color: As selected by Engineer from Supplier's full range.
 - a. Finish shall be a mechanical texture.
 - b. Color shall be uniform.
- E. Aluminum Sheet: ASTM B 209, Alloy 3003, 3004, 3105, or 5005, Temper suitable for forming and structural performance required, but not less than H14, finished as follows

2.04 UNDERLAYMENT MATERIALS

- A. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt; non-perforated.
- B. Self-Adhering, High-Temperature Sheet: Minimum 30 mils thick, consisting of a slip-resistant polyethylene or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment Supplier.
1. Basis-of-Design Product: Subject to compliance with requirements, provide self-adhering underlayment manufactured by IMETCO; Intelliwrap or comparable product by one of the following:
 - a. Carlisle Coatings & Waterproofing Inc.,
 - b. Grace Construction Products; W.R. Grace & Co. -- Conn.,
 - c. Kirsch Building Products, LLC.,
 - d. Owens Corning.,
 - e. Polyguard Products, Inc.,
 - f. Protecto Wrap Company., or
 - g. Approved Equal.
 2. Thermal Stability: ASTM D 1970; stable after testing at 240 degrees F or higher.
 3. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 degrees F or lower.
- C. Slip Sheet: Rosin-sized building paper, 3 lb/100 square foot minimum

2.05 MISCELLANEOUS MATERIALS

- A. Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by Supplier of primary sheet metal unless otherwise indicated.
- B. Fasteners: Self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by fabricator of primary sheet metal.
1. Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.

- b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - 2. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
 - 3. Fasteners for Zinc-Coated (Galvanized) and Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.
- C. Solder
- 1. For Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet Supplier.
 - 2. For Zinc: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
- D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, non-sag, non-toxic, non-staining tape.
- E. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum Supplier for exterior nonmoving joints, including riveted joints.
- H. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.
- I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.
- J. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.
- K. Metal Accessories: Provide sheet metal clips, straps, anchoring devices and similar devices and similar accessory units as required for installation of the Work, matching or compatible with material being installed, non-corrosive, size and gauge required for performance.

2.06 MANUFACTURED SHEET METAL FLASHING AND TRIM

- A. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with shop-mitered and -welded corners and junctions and with interlocking counterflashing on exterior face, of same metal as reglet.
 - 1. Suppliers Subject to compliance with requirements, available Suppliers offering products that may be incorporated into the Work include, but are not limited to the following:

- a. Cheney Flashing Company,
 - b. Fry Reglet Corporation,
 - c. Heckmann Building Products, Inc.,
 - d. Hickman Company, W. P,
 - e. Keystone Flashing Company, Inc.,
 - f. National Sheet Metal Systems, Inc., or
 - g. Approved Equal.
- 2. Material: Stainless steel, 0.018 inch thick.
 - 3. Type (at locations as indicated on the Plans).
 - a. Cast-in-Place Type: Provide, cast-in-place reglets for concrete, with manufacturer's standard foam backer rod to prevent cement from entering reglet.

2.07 FABRICATION, GENERAL

- A. Custom-fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 - 1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 - 2. Obtain field measurements for accurate fit before shop fabrication.
 - 3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 - 4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on the Plans and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
 - 2. Use lapped expansion joints only where indicated on the Plans.
- D. Sealant Joints: Where movable, non-expansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
 - 1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" and FMG Loss Prevention Data Sheet 1-49 for application but not less than thickness of metal being secured.

- F. Seams Fabricate: nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

2.08 MISCELLANEOUS SHEET METAL FABRICATIONS

- A. Equipment Support Flashing
 - 1. Fabricate from 0.050-inch thick prefinished aluminum sheet.

2.09 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: 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

3.01 SHIPMENT AND STORAGE

- A. Product shall be shipped and stored in accordance with Section 01 66 00 - Product Storage and Handling Requirements.
- B. Supplier shall provide Contractor with detailed recommendations and instructions for product storage
- C. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.
- D. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.
- E. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.
- F. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- G. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

3.02 SUPPLIER'S FIELD SERVICES

- A. Supplier shall provide assistance during product installation as required by the Contractor.

3.03 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
 - 1. Verify compliance with requirements for installation tolerances of substrates.
 - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 - 3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.04 INSTALLATION

- A. The Supplier shall provide the Contractor with detailed recommendations and instructions for installation of the products specified in this Section.
- B. Supplier shall provide assistance during product installation as required by the Contractor.
- C. Products shall be installed at the locations shown and in accordance with the recommendations of the Supplier.
- D. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required for a complete sheet metal flashing and trim system.
 - 1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 - 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - 3. Space cleats not more than 12 inches apart. Attach each cleat with at least two (2) fasteners. Bend tabs over fasteners.
 - 4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
 - 5. Torch cutting of sheet metal flashing and trim is not permitted.
- E. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal supplier or cited sheet metal standard.

1. Coat concealed side of stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install self-adhering sheet underlayment and cover with slip sheet.
 3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.
- F. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
1. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
 2. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
 3. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.
- G. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on the Plans.
- H. Fasteners Use fastener sizes that penetrate substrate not less than recommended by fastener supplier to achieve maximum pull-out resistance.
1. Zinc: Use stainless-steel fasteners.
 2. Aluminum: Use aluminum or stainless-steel fasteners.
 3. Stainless Steel: Use stainless-steel fasteners.
- I. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- J. Seal joints as required for watertight construction.
1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 degrees F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 degrees F.
 2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 - Joint Sealants.

- K. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets with solder to width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed work.
1. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.
 2. Do not solder pre-painted, aluminum sheet.
 3. Heat surfaces to receive solder, and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
 4. Stainless-Steel Soldering: Pre-tin edges of uncoated sheets, using solder for stainless steel and phosphoric acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder Supplier's recommended methods for cleaning and neutralization.
- L. Aluminum Flashing: Rivet or weld joints in uncoated aluminum where necessary for strength.
- M. Underlayment Installation
1. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.
 2. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment Supplier. Comply with temperature restrictions of underlayment Supplier for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller. Cover underlayment within fourteen (14) days.
 3. Apply slip sheet, wrinkle free, over underlayment before installing sheet metal flashing and trim.
- N. Roof Flashing Installation
1. Install sheet metal flashing and trim to comply with performance requirements, sheet metal Supplier's written installation instructions, and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
 2. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.
 3. Copings: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated.
 - a. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 16-inch centers.
 - b. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch centers.

4. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.
 5. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints minimum of 4 inches. Secure in waterproof manner by means of snap-in installation and sealant or lead wedges and sealant unless otherwise indicated.
 6. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.
- O. Miscellaneous Flashing Installation
1. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.
- P. Erection Tolerances
1. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on the Plans and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.05 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.
- C. Clean off excess sealants.
- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in the Supplier's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim Supplier. Maintain sheet metal flashing and trim in clean condition during construction.
- E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 71 00
ROOF SPECIALTIES

PART 1 GENERAL

1.01 SUMMARY

A. Scope

1. This Section specifies roof specialties.
2. Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all roof specialties work.
3. The extent of the roof specialties is shown on the Plans.
4. The types of roof specialties work required include, but are not necessarily limited to, the following
 - a. Shop-fabricated, snap-lock metal coping flashing and shop-formed cap flashing requiring no exposed fasteners or splice-plates.
 - b. Complete selection of full-strength, polyvinylidene fluoride finishes and colors with extended life topcoat.
 - c. Protective strippable film on all surfaces of snap-lock metal coping, extruded aluminum gravel stops, fascia extensions and metal coping corner and transition flashings.
 - d. Shop-fabricated exposed surface-mounted polyvinylidene fluoride finished aluminum scuppers, conductor heads, and downspouts.
 - e. Miscellaneous accessories, fasteners, cleats and incidental sheet metal flashing and trim system components necessary for a complete installation.

B. Coordination

1. Review installation procedures under other sections and coordinate the installation of items that shall be installed with the roof specialties work.

1.02 QUALITY ASSURANCE

A. Reference Codes and Standards

1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a

later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
AAMA 621	Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) & Zinc-Aluminum Coated Steel Substrates
FM Global	Loss Prevention Data for Roofing Contractors, 1-49 - Perimeter Flashing.
FS H C 494	Coating Compound, Bituminous, Solvent Type, Acid Resistant
FS TT C 494	Federal Specifications, Coating Compound, Bituminous, Solvent Type, Acid Resistant
NRCA	The Roofing Manual
SMACNA	Architectural Sheet Metal Manual

B. Performance Requirements

1. Roof specialties shall be permanently watertight, and not deteriorate in excess of Supplier’s published limitations.
2. Snap-lock coping shall be detailed, fabricated and installed to provide a minimum of FM 1-90 wind up-lift resistance and require no exposed fasteners of any kind.
3. Comply with fabrication details recommended by FM Global, Loss Prevention Data for Roofing Contractors; SMACNA, Architectural Sheet Metal Manual; The NRCA Roofing Manual, and the requirements of the roof specialties Supplier, and as shown on approved Shop Drawings.
4. Standards: Comply with applicable standards and recommendations of SMACNA, Architectural Sheet Metal Manual, for the fabrication and installation of roof specialties work, except to the extent more stringent requirements are specified.

C. Warranty

1. A warranty for the equipment specified under this Section shall be provided in accordance with the General Conditions. The Warranty shall be for one (1) year from the date of the Notice of Substantial Completion certificate issued for the Work. If extended warranties are required, a special paragraph calling for an extended warranty will be included in this Section.
2. Provide coping and cap flashing supplier’s fifteen (15)-year warranty against blow-off, leak, or premature membrane failure in winds of up to 90 miles per hour.
3. Provide Supplier’s twenty (20)-year warranty on the specified polyvinylidene fluoride based coating.
4. Guarantee that the polyvinylidene fluoride based coating meets all criteria specified and will not spall, check, craze, peel or otherwise lose adhesion for a period of twenty (20) years from the date of installation, to the extent that such shall create unsightly conditions or otherwise impair the intended architectural qualities of the building.
5. In the event that the polyvinylidene fluoride based coating fails to meet the specified standards the Supplier shall, at their own expense, replace or field paint, at the discretion of Engineer, all areas affected by the failure. In the event that repainting is selected, it shall be done at mutually agreeable intervals throughout the term of the warranty.

6. The warranty specified shall not deprive the City of other rights the City may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
7. The warranty does not apply where failure is caused by accidents, or external conditions or forces beyond the control of the Supplier.

D. Installer Qualifications

1. Engage a single installer who is a recognized roof specialties installer, skilled and experienced in the type of roof specialties work required, and equipped to perform workmanship in accordance with recognized standards so that there will be undivided responsibility for the performance of the Work. Submit name and qualifications to Engineer along with at least three (3) successfully completed projects including names and telephone numbers of owners, architects and engineers, responsible for the project and the approximate contract price for roof specialties work.
2. The installer of the roof specialties work shall be franchised or otherwise accepted in writing by the roofing materials supplier for installation of fully guaranteed roofing work in accordance with these Specifications.

E. Component Supply and Compatibility: Provide roof specialties as a complete unit produced by a single Supplier specializing in the production of this type of work, including hardware, accessories, mounting and installation components.

F. Scheduling

1. Coordinate roof specialties work with roofing, flashing, trim, and the construction of decks, parapets and other adjoining portions of the Work, to provide a permanently watertight, leak proof, secure and non-corrosive installation.
2. Deliver materials to the Site in sufficient quantities to ensure uninterrupted progress of the Work.
3. Schedule the installation of roof specialties to coincide with the installation of roofing, waterproofing, drains, piping, blocking, nailers, reglets, framing at openings, curbs, parapets and other adjoining and substrate portions of the Work.
4. Proceed with and complete the Work only when materials, equipment and knowledgeable tradesmen, required for the installation of roof specialties, are at the Site and are ready to follow, and integrate roof specialties work with roofing work, in order to maintain watertight conditions.

1.03 ENVIRONMENTAL CONDITIONS

- A. Product in this Section shall be subjected to environmental conditions in accordance with Section 01 11 80 – Environmental Conditions.

1.04 SUBMITTALS

- A. Preconstruction/Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.
1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-

marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.

2. Shop Drawings
 - a. Shop Drawings showing the manner of forming, jointing and securing the metal to form roof specialties work. Show expansion joint details and water-proof connections to adjoining portions of the Work and at obstructions and penetrations.
 - b. Drawings showing the coordination. Provide detailed Shop Drawings showing large scale details of Sections and profiles of all roof specialties to be used in the Work, with all items, including fastener locations, cleats and other miscellaneous accessories necessary to complete the Work, fully dimensioned, properly located, quantified and presented such that sequence of installation is acceptable to each roofing system and adjacent construction material installer.
 3. Product Data
 - a. Copies of Supplier's specifications, recommendations and installation instructions for roof specialties applications. Include Supplier's certification or other data substantiating that the materials comply with the requirements.
 4. Samples
 - a. Each item of roof specialty, demonstrating assembly of system joint components and fasteners, securely mounted to substrate simulating actual installation in the Work.
 - b. Polyvinylidene fluoride supplier's color samples for final selection by Engineer. After initial selection of colors by Engineer from Supplier's color charts, submit Engineer's preliminary color choices on actual samples of metal substrate for final color selections by Engineer.
 - c. Samples will be reviewed by Engineer for color and texture only. Compliance with other requirements is the responsibility of the Contractor.
- B. Informational Submittals: The following minimum informational submittals shall be submitted in accordance with the timing requirements specified in these Contract Documents, prior to Substantial Completion and in accordance with Section 01 33 00 - Submittals.
1. Warranty, as specified in this Section.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

A. Suppliers

1. The Engineer and the City believe that the following Suppliers indicated in this Section are capable of producing equipment and products, which will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular Supplier or product, nor shall it be construed that a named Supplier's standard product will comply with the requirements of this Section.

B. Supplier Qualifications

1. The Supplier shall have five (5) years of experience manufacturing and installing roof specialties in similar-sized projects.

2.02 MATERIALS

A. Materials specified are considered the minimum acceptable for the purposes of durability, strength, and resistance to erosion and corrosion. The Contractor may propose alternative materials for the purpose of providing greater strength or to meet required stress limitations. However, alternative materials must provide at least the same qualities as those specified for the purpose. If alternatives are proposed, the proposals shall be accompanied with documentation supporting the claimed superiority of the proposed substitutions. The Engineer shall be the sole decider in the equivalency of alternative materials of construction.

1. Formed Metal Coping, Caps and Trim: Provide smooth sheet of 0.063- inch, 5005-H134 aluminum alloy, complying with the following
 - a. Provide coping and cap flashings, sized as shown, that provides for independent mounting and full expansion and contraction over prefabricated 6-inch wide aluminum retainers, compression clips mounted 12 feet - 0 inches on centers, and 2-inch wide aluminum retainer plates with single compression pad mounted between dual compression clips.
 - b. Provide system that incorporates a gutter bar with dual compression gaskets at each joint to drain water.
 - c. System shall not incorporate exposed sealants.
 - d. Provide internal face line-up splices at all joints.
 - e. All coping and cap flashings shall have all corners mitered and continuously heliarc welded watertight prior to shop-painting. Exposed mechanical fasteners, blind rivets and similar methods are not approved for the Work. Reinforce metal at welds as may be required to provide welded seams.
 - f. Concealed fasteners splice plates and neoprene compression pads shall be as recommended by the Supplier.
 - g. Products and Suppliers
 - 1) Gutter Splice System TITE-LOC Coping by Peterson Aluminum Corporation,
 - 2) Designer Leak-Tite Coping by Metal-Era Incorporated, or
 - 3) Approved Equal.
2. Custom Thru-Wall Scuppers, Custom Overflow Scuppers, Conductor Heads, and Downspouts:

- a. Provide aluminum sheet 6063-T6 alloy, with smooth finish; in accordance with SMACNA.
- b. Size, Thickness, and Profile
 - 1) Custom Thru-wall Scupper: .050-inch thick; 6-inches x 12-inches.
 - 2) Custom Overflow Scupper: .050-inch thick; 6-inches x 12-inches.
 - 3) Conductor Head: .063-inches thick; Size as required for proper transition between the scupper and the downspout.
 - 4) Downspouts: 1/8-inch thick; 3-inches x 4-inches.
- c. Products and Manufacturers: Provide one of the following
 - 1) Custom Thru-wall Scuppers, Custom Overflow Scuppers, Conductor Heads, and Downspouts by Architectural Products Company,
 - 2) Custom Thru-wall Scuppers, Custom Overflow Scuppers, Conductor Heads, and Downspouts by Metal-Era Incorporated, or
 - 3) Approved Equal.

2.03 FABRICATION

- A. The fabrication requirements for roof specialty work apply to both shop fabricated and on-Site fabricated work.
- B. Supplier's Recommendations: Except as otherwise shown or specified, comply with the recommendations and instructions of the Supplier of the roof specialty being fabricated.
- C. Provide for thermal expansion of exposed items. Maintain a watertight seal at expansion joints. Locate expansion joints at the following maximum spacings:
 - 1. Midpoint of run.
- D. Fabricate work with lines and corners of exposed units true and accurate. Form exposed faces flat and free of buckles, excessive waves and avoidable tool marks, considering the temper and reflectivity of the metal. Provide uniform, neat seams with minimum exposure of solder, welds and sealant. Fold back the sheet metal to form a hem on the concealed side of exposed edges.
- E. Fabricate drainage sumps and downspouts and supports as shown.
- F. Support and Anchorage: Fabricate units with adequate provisions for support and anchorage, of the types required for the indicated method of installation.
- G. Conductor Heads and Downspouts: Fabricate aluminum sheet using double flat-lock seams. Rivet joints where necessary for strength. Pop rivets are not acceptable.
- H. Finishes
 - 1. High-Performance Organic Finish (Three-Coat Fluoropolymer): AAMA 2605: Supplier's standard three- coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 621 and the coating and resin suppliers' written instructions.

2. Colors
 - a. Full selection of Supplier's standard colors for final selection by Engineer.
3. Products and Suppliers
 - a. Kynar 500 Fluropon by the Valspar Corporation,
 - b. Kynar 500 Duranar, or
 - c. Approved Equal

PART 3 EXECUTION

3.01 SHIPMENT AND STORAGE

- A. Product shall be shipped and stored in accordance with Section 01 66 00 - Product Storage and Handling Requirements.
- B. Supplier shall provide Contractor with detailed recommendations and instructions for product storage.
- C. Delivery of Materials
 1. Deliver, store and handle materials to preclude denting, scratching or otherwise marring the surface and finish of the roof specialties material.
 2. Items delivered in broken, damaged, rusted, or unlabeled condition shall immediately be removed from Site and not offered again for approval by Engineer.
- D. Storage of Materials
 1. Store materials in an area undercover and protected from construction traffic.
 2. Store materials in same package in which they were shipped, off the ground and on platforms protected from dirt and other contamination.
 3. Store in a manner which does not permit water to remain on roof specialties materials and system components.
- E. Handling of Materials
 1. Protect roof specialties from dents, scratches, warps and bends.
 2. Remove strippable protective film, immediately preceding installation of each system component.

3.02 SUPPLIER'S FIELD SERVICES

- A. Supplier shall provide assistance during equipment installation as required by the Contractor.

3.03 INSPECTION

- A. Examine the supporting structure and other elements of the substrate and conditions under which the roof specialties work is to be performed and notify Engineer, in writing, of any conditions detrimental to the proper and timely completion of the Work and performance of the drainage sumps, roof and overflow drains, and downspouts. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to Engineer.

3.04 PREPARATION

- A. Wherever possible, take field measurements, prior to completion of shop fabrication and finishing of roof specialties work. Do not delay job progress. Allow for erection tolerances corresponding with specified tolerances where final dimensions cannot be established before fabrication.

3.05 INSTALLATION

- A. The Supplier shall provide the Contractor with detailed recommendations and instructions for installation of the product specified in this Section.
- B. Supplier shall provide assistance during product installation as required by the Contractor.
- C. Products shall be installed at the locations shown and in accordance with the recommendations of the Supplier.
- D. Comply with Supplier's recommendations and installation instructions.
- E. Protection of Aluminum from Dissimilar Materials: Coat all aluminum surfaces in contact with dissimilar materials such as concrete, masonry, steel and other metals as specified in Section 09 90 00 - Painting and Coating
- F. Conceal fasteners and expansion provisions, wherever possible, in exposed work, and locate so as to minimize the possibility of leakage. Cover and seal work, as required, for a tight installation.
- G. Provide concealed cleat type anchorages wherever practical and arrange to relieve stresses in the roof specialties work which result from building movement and thermal expansion.
- H. Splice and Expansion Units: Use 0.050-inch thick splice plates.
- I. Bed flashing flanges in a bed of roofing cement or other setting compound which is compatible with adjoining portions of the Work and substrate.
- J. On vertical overlaps, lap sheet metal a minimum of 3 inches.
- K. On sloping overlaps, of slopes of not less than 6 inches in 12 inches, lap unsealed overlaps a minimum of 6 inches.
- L. For embedment of metal flanges in elastic sheet flashing or stripping, extend flanges for a minimum of 4-inches embedment.
- M. Support and anchor each unit of the Work in the manner as shown, but in no case in a manner which would be inadequate for thermal expansion stresses and the normal loading of water, wind and similar loadings.
- N. Install units with lines and corners true and accurate in alignment and location. Install drainage sumps to assure positive drainage to downspouts.

- O. Installation of Metal Copings
 - 1. Install metal copings using concealed fasteners and plates in compliance with Supplier's written recommendations as shown on approved Shop Drawings.
 - 2. Coping and cap flashings shall be installed with 3/8-inch wide butt joints 12 feet-0 inches on center, unless otherwise shown.
 - 3. Use all items supplied by the Supplier for a complete, watertight and blow-off resistant installation.
 - 4. Set all flashings straight, level and plumb.

3.06 FIELD TESTING AND COMMISSIONING

- A. Field Testing and Commissioning shall be in accordance with the requirements of Section 01 75 00 – Equipment Testing and Plant Startup.
- B. The Supplier shall provide detailed procedures for Field Testing and Commissioning procedures for the equipment specified in this Section.
- C. Field Testing and Commissioning shall be performed under the direction of experienced and qualified personnel provided by the Supplier.
- D. Polyvinylidene Fluoride Based Coatings: Determine conformity of sheet metal flashing and trim Work requiring painted finish to these Specifications as follows
 - 1. The Supplier of the roofing specialties work shall set aside and label samples of each component of the sheet metal flashing and trim Work from each production lot for the Project. Protect samples from weather.
 - 2. Make samples of sheet metal flashing and trim Work available at all times, for comparison with installed sheet metal flashing and trim Work as requested by Engineer, for the full time of the warranty.
 - 3. Make color comparison measurements with a Hunter Tristimulus Color Difference Meter employing methods of computation in use at the National Bureau of Standards.

3.07 CLEANING AND PROTECTION

- A. Protect the roof specialties from all damage until Final Completion.
- B. Roof specialties damaged before Final Completion shall be replaced with new material as specified herein, at no additional cost to the City.
- C. Clean exposed surfaces of every substance which is visible or might cause corrosion of the metal or deterioration of the finish.

END OF SECTION

SECTION 07 84 00
FIRE SAFING AND FIRE STOPPING SEALANTS

PART 1 GENERAL

1.01 SUMMARY

- A. Scope
 - 1. This Section specifies fire safing and fire stopping sealants
 - 2. The Contractor shall provide fire safing and fire stopping sealants and appurtenant work, complete and in place in accordance with the Plans.

1.02 QUALITY ASSURANCE

- A. Reference Codes and Standards
 - 1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
 - 2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
ASTM E 814	Standard Test Method for Fire Tests of Through Penetrations Fire Stop

- B. Building Code: Refer to the Plans to determine which building code applies. The applicable Florida Building Code 2014, defined by the Plans, is referenced herein as “the Code”.
- C. Underwriter’s Laboratories (UL): UL 1479 Standard Test for Fire Tests of Through Penetration Fire Stops
- D. Single Source Responsibility: Fire safing and fire stopping sealants shall be provided by a single Supplier, each.
- E. Installer Qualifications

1. Installer shall have a minimum of five (5) years experience in the successful completion of at least five (5) projects of similar size and scope, employing similar products, materials, applications, and performance requirements.
 2. The fire stop sealant shall be installed by a single specialty contractor who specializes in fireproofing installations.
 3. Installers without these qualifications will not be accepted.
- F. Supplier's Technical Field Representative: Supplier's technical field representative shall be on Site for at least one (1) day, beginning at the start of surface preparation and continuing through application, to train the installers and to supervise the Work. The Supplier's technical field representative shall observe as necessary to certify in writing that the completed Work has been performed according to the Supplier's instructions.
- G. Fire safing and fire-stopping sealants work shall comply with the following references
1. ASTM E 814.
 2. UL 1479.
 3. The applicable Florida Building Code 2020.
 4. As otherwise indicated on the Plans. special warranty provisions

1.03 ENVIRONMENTAL CONDITIONS

- A. Product in this Section shall be subjected to environmental conditions in accordance with Section 01 11 80 - Environmental Conditions.
- B. Comply with Supplier's written instructions for environmental conditions before, during, and after installation.
- C. Protect surrounding work from damage that may result from operations under this Section.

1.04 SUBMITTALS

- A. Preconstruction/Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.
 1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the requirements of the

Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.

2. Literature: Supplier's specifications, technical data, installation methods, and maintenance instructions, and the following
 - a. Joint width and depth tables.
 3. Certifications
 - a. Certification by the fire safing and fire stopping sealant supplier that the fire safing and fire stopping sealant is suitable for, and compatible with, the required installation.
 - b. Certification by the Supplier that the fire safing and fire stopping sealant is suitable for, and compatible with, the substrates and surfaces indicated.
 - c. Certification of Supplier qualifications demonstrating compliance with the qualifications requirements, and are suitable for the intended application as indicated.
 - d. Certification of installer qualifications demonstrating compliance with the qualifications requirements indicated. Include a list of five (5) similar completed projects with addresses of the project location, date of project completion, and contact information of the engineer, contractor and the owner.
 4. Application Schedule Furnish a detailed and complete application schedule indicating location and detail of installation.
 5. When requested by Engineer, submit samples of the materials proposed. Samples shall be clearly marked to show the Supplier's name, product identification, finish and color. New samples shall be resubmitted of each, as required, until approved by Engineer. Upon approval, the samples shall become the standard for acceptance for the project with regard to color, finish, and quality of each item. Approval of samples shall not relieve Contractor from compliance with the Plans.
- B. Informational Submittals: The following minimum informational submittals shall be submitted in accordance with the timing requirements specified in these Contract Documents, prior to Substantial Completion and in accordance with Section 01 33 00 - Submittals.
1. Certification by the Supplier's field representative that surfaces have been prepared and the products have been applied in accordance with the Supplier's recommendations.
 2. Certification from an independent testing laboratory that the submitted materials meet the requirements of the references indicated.
 3. Certification of UL approvals indicated.
 4. When requested by Engineer, furnish other certifications as may be required to demonstrate compliance with the Contract Documents.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

A. Suppliers

1. The Engineer and the City believe that the following Suppliers indicated in this Section are capable of producing equipment and products, which will satisfy the requirements of this Section. This statement, however, shall not be construed as an

endorsement of a particular Supplier or product, nor shall it be construed that a named Supplier's standard product will comply with the requirements of this Section.

B. Supplier Qualifications

1. The Supplier shall have ten (10) years of experience manufacturing and installing fire safing and fire stopping sealants in similar-sized projects.
2. Fire safing and fire-stopping Supplier shall have a minimum of ten (10) years of fire safing and fire-stopping manufacturing experience.
3. Suppliers without these qualifications will not be accepted.

2.02 MATERIALS

- A. Materials specified are considered the minimum acceptable for the purposes of durability, strength, and resistance to erosion and corrosion. The Contractor may propose alternative materials for the purpose of providing greater strength or to meet required stress limitations. However, alternative materials must provide at least the same qualities as those specified for the purpose. If alternatives are proposed, the proposals shall be accompanied with documentation supporting the claimed superiority of the proposed substitutions. The Engineer shall be the sole decider in the equivalency of alternative materials of construction.

2.03 GENERAL

- A. Fire safing and fire-stopping sealants shall be recommended by the Supplier for the installation indicated.
- B. Fire safing and fire-stopping sealants shall be suitable for, and compatible with, the required installation.
- C. Fire safing and fire-stopping sealants shall be suitable for, and compatible with, the substrates and surfaces indicated.
- D. Refer to Section 07 92 00 – Joint Sealants for non-fire rated applications.

2.04 FIRE SAFING

- A. Description: Provide UL-approved mineral fiber fire safing material for filling void areas and for joint backing where indicated and required.

2.05 FIRE SEALANT

- A. Description: Unless otherwise indicated, provide UL-approved two-part, silicone foam fire stopping sealant, including primer as recommended by the Supplier.
1. Two-hour fire rated sealant conforming to ASTM E 814 and UL 1479. Fire-resistant penetration sealant shall be fire-resistant foam that, when cured, retains form and stability at high temperature.
- B. Provide specific UL-approved products as required by UL assemblies indicated on the Plans.

PART 3 EXECUTION

3.01 SHIPMENT AND STORAGE

- A. Product shall be shipped and stored in accordance with Section 01 66 00 - Product Storage and Handling Requirements.
- B. Supplier shall provide Contractor with detailed recommendations and instructions for product storage.
- C. Deliver materials to Site in Supplier's original, unopened packages, containers, or bundles with labels intact, which clearly identify contents.
- D. Store materials carefully in accordance with the Supplier's written instructions, in an area that is protected from deleterious elements, and in a manner that will prevent damage to the products.
- E. Handle materials in strict accordance with Supplier's written instructions.

3.02 APPLICATIONS

- A. Provide fire safing between structural deck, walls, partitions and elsewhere as required, to seal fire rated decks, walls, partitions, assemblies, components, connections, and spaces.
- B. Provide fire stopping sealant at joints and penetrations in structural deck, walls, and partitions, and elsewhere as required to seal fire rated walls, partitions, floors, ceilings, decks, assemblies, components, connections, and spaces, where not otherwise fire stop-sealed under other Sections.
- C. Fire safing and fire-stopping sealants shall also be installed elsewhere, where indicated on the Plans.

3.03 INSPECTION

- A. The Contractor shall be totally responsible for the proper performance and completion of the Work under this Section.
- B. Systems and components shall be inspected before installation.
 - 1. Damaged or defective items shall be rejected and marked as such and shall be removed from the Site.
- C. The Contractor shall verify dimensions, tolerances, and method of attachment with adjacent portions of the Work.
 - 1. Examine substrates, areas, and conditions where fire safing and fire stopping sealants will be installed for compliance with the requirements for installation, taking into account tolerances, and other conditions affecting performance of installed fire safing and fire stopping sealants.
 - a. Surfaces to receive fire safing and fire-stopping sealants shall be dry, free of oil, dirt, dust and other contaminants and loose materials, and shall be in the proper

condition as indicated by the Supplier prior to the application of the fire safing and fire-stopping sealants materials.

2. Notify the Engineer in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in an acceptable manner.
3. Commencement of the installation by the Contractor shall indicate Contractor's acceptance of the substrate, areas, and conditions.

3.04 SURFACE PREPARATION

- A. Surface preparation shall be in compliance with the applicable references and with the Supplier's written instructions.
- B. Coatings, including curing compounds, form release agents, and other substances shall be removed as recommended by the fire safing and fire-stopping sealants Supplier.
- C. Protrusions, bumps, ridges, and loose substrate surface materials shall be removed by sanding or grinding.
- D. Laitance, efflorescence, and loose mortar shall be removed from the joint cavity.
- E. Ferrous metal surfaces shall be cleaned of rust, mill scale, and other coatings by wire brush, grinding, or sandblasting.
- F. Protective coatings shall be removed from surfaces to receive fire safing and fire-stopping sealants.
 1. Solvents used to remove protective coating shall be as recommended by the fire safing and fire-stopping sealants Supplier, shall be compatible with the adjacent materials and surfaces, shall not damage adjacent finishes, and shall be non-staining.
- G. Bituminous or resinous materials shall be removed from surfaces to receive fire safing and fire-stopping sealants.
- H. Immediately before application of fire safing and fire-stopping sealants materials, scrape surfaces to be covered free from foreign materials and brush clean.
- I. Substrate shall be swept to remove all loose materials prior to beginning fire safing and fire-stopping sealants installation.

3.05 PREPARATION

- A. Sequence installation properly with the installation and protection of other portions of the Work, so that neither will be damaged by the installation of the other.

3.06 INSTALLATION

- A. The Supplier shall provide the Contractor with detailed recommendations and instructions for installation of the product specified in this Section.

- B. Supplier shall provide assistance during product installation as required by the Contractor.
- C. Products shall be installed at the locations shown and in accordance with the recommendations of the Supplier.
- D. Installation shall comply with the requirements of the Contract Documents, with applicable references, and with Supplier's written instructions. Where a conflict occurs among these requirements, the more stringent shall apply, as determined by the Engineer.
- E. Primer, if recommended by the Supplier for the application, shall be applied per the Supplier's recommended procedures.
- F. Install fire safing and fire stopping sealant on properly prepared surfaces.
 - 1. Fire stopping sealant shall completely fill joints.
 - 2. Tool smooth as approved.

3.07 CLEANING FINISHING AND PROTECTION

- A. Adhesive papers used for masking which become firmly bonded when exposed to heat and/or light shall not be used.
 - 1. Remove masking film and temporary labels as soon as possible after installation. Films and labels left in place after installation shall be the responsibility of the Contractor
 - 2. Residue shall not be left on any surfaces.
 - 3. The surfaces of materials adjoining fire safing and fire-stopping sealant joints shall be cleaned free of smears of sealant or other soiling due to fire safing and fire-stopping sealant operations.
- B. Fire safing and fire-stopping sealants shall be protected from damage from subsequent construction operations.
- C. Contractor shall make adjustments required until accepted.
- D. Damaged items shall be removed and replaced at the direction of the Engineer.
- E. When fire safing and fire stopping sealants work is completed, remove unused materials, containers, and equipment, and clean the Site of fire safing and fire stopping sealant debris.

END OF SECTION

SECTION 07 91 26

JOINT FILLERS

PART 1 GENERAL

1.01 DESCRIPTION

- A. This section specifies preformed joint fillers.

1.02 QUALITY ASSURANCE

- A. References:

1. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ASTM D994	Preformed Expansion Joint Filler for Concrete (Bituminous Type)
ASTM D1752	Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

PART 2 PRODUCTS

2.01 PREFORMED ASPHALT FIBERBOARD

- A. Preformed asphalt fiberboard joint filler shall be in accordance with ASTM D994 and shall be 1/2 inch thick unless otherwise specified.

2.02 PREFORMED RESIN-BONDED CORK

- A. Preformed resin-bonded cork joint filler shall be in accordance with ASTM D1752, Type II. Cork joint filler thickness shall match the specified joint width.

2.03 PRODUCT DATA

- A. The following information shall be provided in accordance with Section 01 33 00:
1. Manufacturer's recommendations for handling and installation of the material.

PART 3 EXECUTION

3.01 GENERAL

- A. Preformed joint fillers shall be placed into position before the concrete is poured. Where it is necessary for the filler to be fixed to existing concrete or other building materials, a suitable adhesive recommended by the filler manufacturer shall be used. Filler surfaces shall be clean and dry prior to the placement of the concrete.

3.02 PREFORMED ASPHALT FIBERBOARD

- A. Preformed asphalt fiberboard joint fillers shall be used for expansion joints in concrete sidewalks, curbs, and roadways.

3.03 PREFORMED RESIN-BONDED CORK

- A. Preformed resin-bonded cork joint filler shall be used for expansion joints in concrete structures. The expansion joint shall be sealed with backer rod and sealant as specified in Section 07 92 00.

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

PART 1 GENERAL

1.01 SUMMARY

- A. This Section specifies joint sealants.

1.02 QUALITY ASSURANCE

- A. Reference Codes and Standards

1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
FEDSPEC TT-S-00230C	Sealing CompoundElastomeric Type, Single Component
FEDSPEC TT-S-00227E	Sealing CompoundElastomeric Type, Multi-Component

1.03 SUBMITTALS

- A. Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.
1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.
If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons

for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.

2. Manufacturer's product data showing conformance to the specified products.
3. Manufacturer's recommendations for storage, handling and application of sealants and primers.

PART 2 PRODUCTS

2.01 MANUFACTURER QUALIFICATIONS

1. The Manufacturer shall have five (5) years of experience manufacturing and installing joint sealants in similar-sized projects.

2.02 MATERIALS

A. POLYURETHANE SEALANT

B. Acceptable products shall be:

1. Sikaflex by Sika Chemical Corporation,
2. Vulkem by Mameco International,
3. U-Seal Joint Sealant by Burke Company,
4. Rubber Calk by Products Research and Chemical Corporation, or
5. Approved Equal.

C. Polyurethane sealants shall conform to FEDSPEC TT-S-0230C for one-component systems and FEDSPEC TT-S-00227E for two-component systems. Polyurethane sealant shall be one of the following two types.

1. Self-Leveling
 - a. Self-leveling polyurethane sealant shall be Type I, Class A as specified by the FEDSPECS referenced above.
2. Nonsag
 - a. Nonsag polyurethane sealant shall be Type II, Class A as specified by the FEDSPECS referenced above.

D. Primer

1. Primer shall be as recommended by the sealant supplier.

E. Backer Rod or Backer Tape

1. Backer rod shall be open cell polyethylene or polyurethane foam. Rod shall be cylindrical unless otherwise specified. Backer tape shall be polyethylene or polyurethane with adhesive on one side.

2.03 MASTIC SEALANT

- A. Mastic joint sealant shall consist of a blend of refined asphalts, resins and plasticizing compounds, reinforced with fiber. Sealant shall be compatible with joint fillers and shall be pressure grade.
- B. Primer
 - 1. Primer shall be as recommended by the mastic sealant supplier.

PART 3 EXECUTION

3.01 GENERAL

- A. Sealants and primers shall be applied according to the sealant supplier's recommendations. Polyurethane sealants shall be used on all expansion joints and specified construction joints.
- B. Joints and spaces to be sealed shall be clean, dry and free of dust, loose mortar, concrete and plaster. Additional preparation of joints and spaces shall be provided in accordance with Supplier's recommendations. Primer shall be applied only to the surfaces that will be covered by the sealant.

3.02 POLYURETHANE SEALANTS

- A. Nonsag polyurethane sealants shall be used on vertical joints. Self-leveling polyurethane sealants shall be used on horizontal joints.
- B. Joint Dimensions
 - 1. Unless otherwise specified, joints and spaces to be filled shall be constructed to the following criteria. Joints and spaces shall have a minimum width of 1/4 inch and a maximum width of 1 inch. The depth of the sealant shall be one-half the width of the joint, but in no case less than 1/4 inch deep. Sealant depth shall be measured at the point of smallest cross Section. When joints exceed the depth requirements, backing rod shall be inserted to provide the joint depth specified. If the joint sealant depth is within the specified tolerances, backer tape shall be placed in the bottom of the joint.

3.03 MASTIC SEALANT

- A. Joint Dimensions
 - 1. Joints to be sealed shall be 2 inches deep, 1 inch wide at the top, and 3/4 inch wide at the base.

END OF SECTION

SECTION 08 11 16
ALUMINUM DOORS AND FRAMES

PART 1 GENERAL

1.01 DESCRIPTION

- A. Scope
 - 1. This section specifies aluminum doors and frames.
- B. Type
 - 1. Unless otherwise specified, the doors shall be flush slab type. Frames shall be square-cut and mechanically locked at header ends and shall have integral stops.
- C. Performance Requirements
 - 1. Structural:
 - a. Shapes and thicknesses of framing members shall be sufficient to withstand a design wind load of not less than 30 pounds per square foot of supported area with a deflection of not more than 1/175 times the length of the member and a safety factor of not less than 1.65.
 - 2. Air Infiltration
 - a. When tested in accordance with ASTM E 283, air infiltration shall not exceed 0.06 cubic feet per minute per square foot of fixed area at a test pressure of 6.24 pounds per square foot (50 mile per hour wind).
 - 3. Water Penetration:
 - a. When tested in accordance with ASTM E 331, there shall be no water penetration at a pressure of 8 pounds per square foot of fixed area.

1.02 QUALITY ASSURANCE

- A. References
 - 1. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.
 - 2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
AA DAF45	Designation System for Aluminum Finishes
ASTM A36/36M	Structural Steel
ASTM B209	Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B221	Aluminum and Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube
ASTM E283	Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors
ASTM E331	Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
SSPC-PS 9.01	Cold-Applied Asphalt Mastic Painting System with Extra-Thick Film

B. Certificates of Compliance

1. Manufacturer's certificates shall be submitted to the Construction Manager attesting that doors, frames, and accessories meet the specified requirements.

1.03 SUBMITTALS

A. The following information shall be provided in accordance with Section 01 33 00:

1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Construction Manager shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
2. Shop drawings containing the following information:
 - a. Elevations of each door type
 - b. Size of doors and frames
 - c. Metal gauges
 - d. Details of door and frame construction
 - e. Methods of anchorage
 - f. Glazing details
 - g. Weatherstripping
 - h. Provisions for and location of hardware
 - i. Details of installation
 - j. Schedule showing location of each door, frame, and swing of door

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Materials delivered to the site shall be unloaded and stored with minimum handling. Storage space shall be in a dry location with adequate ventilation, free from dust or water, and easily accessible for inspection and handling. Materials shall be stacked on nonabsorptive strips or wood platforms. Doors and frames shall not be covered with tarps, polyethylene film, or similar coverings. Finished surfaces shall be protected during shipping and handling using manufacturer's standard method, except that no coatings or lacquers shall be applied to surfaces to which caulking and glazing compounds must adhere.

PART 2 PRODUCTS

2.01 DOORS AND FRAMES

- A. Swing-type aluminum doors and frames shall be of size, design, and location indicated. Doors shall be provided complete with frames, framing members trim, and accessories.

2.02 MATERIALS

- A. Anchors
 - 1. Unless otherwise specified, anchors shall be steel with hot-dipped galvanized finish.
- B. Weatherstripping
 - 1. Unless otherwise specified, weatherstripping shall be continuous wool pile.
- C. Aluminum Alloy for Doors and Frames
 - 1. Aluminum alloy for doors and frames shall be ASTM B 221, Alloy 6063-T5 for extrusions and ASTM B 209, alloy and temper best suited for aluminum sheets and strips.
- D. Fasteners
 - 1. Unless otherwise specified, fasteners shall be nonmagnetic stainless steel or aluminum.
- E. Structural Steel
 - 1. Structural steel shall conform to ASTM A 36.
- F. Aluminum Paint
 - 1. Unless otherwise specified, aluminum paint shall be as recommended by aluminum door manufacturer.
- G. Bituminous Coating
 - 1. Coating shall be cold applied asphalt mastic complying with SSPC-PS 9.01 compounded for 30 mil thickness per coat.

2.03 FABRICATION

- A. Aluminum Frame

1. Frames shall be fabricated from extruded aluminum shapes with contours approximately as indicated. Removable glass stops and glazing beads shall be provided for frames accommodating fixed glass. Countersunk stainless steel Phillips screws spaced not more than 12 inches o.c. shall be used for exposed fastenings. Joints in frame members shall be milled to a hairline fit, reinforced, and secured mechanically.

B. Aluminum Doors

1. Doors shall be of type, size, and design indicated and not less than 1 3/4 inches thick. Minimum wall thickness shall be 0.125 inch, except beads and trim shall be 0.050 inch. Door sizes shown are nominal and shall include standard clearances as follows: 0.093 inch at hinge and lock stiles, 0.125 inch between meeting stiles, 0.125 inch at top rails, 0.187 inch between bottom and threshold, and 0.687 inch between bottom and floor. Single-acting doors shall be beveled 0.125 inch at lock, hinge, and meeting stile edges. Double-acting doors shall have rounded edges at hinge stile, lock stile, and meeting stile edges.
2. Unless otherwise specified, doors shall be flush doors using facing sheets with a plain smooth surface. Construction shall consist of a phenolic resin-impregnated kraft paper honeycomb core, surrounded at edges and around glass and louvered areas with extruded aluminum shapes. The impregnation of core shall have a minimum of 20 percent resin content. Sheet aluminum door facings shall be not less than 0.04-inch thick laminated to a 0.10-inch thick tempered hardboard backing. The backing shall be bonded to the honeycomb core. Facing sheets shall be bonded to core under heat and pressure with a thermosetting adhesive, and mechanically locked to the extruded edge members.

C. Welding and Fastening

1. Where possible, welds shall be located on unexposed surfaces; on exposed surfaces welds shall be dressed smoothly. Welding rods, filler wire, and flux shall be selected to produce a uniform texture and color in finished work. Flux and spatter shall be removed from surfaces immediately after welding. Exposed screws or bolts will be permitted only in inconspicuous locations, and shall have countersunk heads. Concealed reinforcements for hardware shall be welded in place.

D. Weatherstripping

1. Weatherstripping shall be provided on edges of exterior doors and fit into slots which are integral with doors or frames.
2. Weatherstripping shall be replaceable without special tools. Installation shall allow doors to swing freely and close positively.

E. Anchors

1. Anchors, of the sizes and shapes indicated, shall be provided on the backs of subframes for securing subframes to adjacent construction. Transom bars shall be anchored at ends and mullions at head and sill. Freestanding door frames shall be reinforced and anchored to floor construction in accordance with manufacturer's recommendation. Anchors shall be placed near top and bottom of each jamb and at intermediate points not more than 25 inches apart.
2. Hardware is specified in Section 08 71 00. Hardware templates and hardware (except field-applied hardware) shall be delivered to the door manufacturer for use in fabrication of aluminum doors and frames. Doors and frames shall be cut, reinforced,

drilled, and tapped at the factory to receive template hardware. Doors to receive surface-applied hardware, except push plates, kick plates, and mop plates, shall be provided with reinforcing only and drilled and tapped in the field. Hardware reinforcements shall be stainless steel or steel with hot-dipped galvanized finish, and secured with stainless steel screws. Reinforcement in core of flush doors shall be provided as required to receive locks, door closers, and other hardware.

F. Provisions for Glazing:

1. Extruded aluminum snap-in glazing beads shall be provided on interior side of doors and extruded aluminum, theft-proof, snap-in glazing beads or fixed glazing beads on exterior or security side of doors. Glazing beads shall have vinyl insert glazing gaskets and be designed to receive glass of thickness specified. Glazing is specified in Section 08 81 00.
2. Anodized Finishes: NAAMM AA-M10-C22-A41, (minimum thickness of 0.7- mils), Architectural Class I Clear Anodized Finish.

2.04 PRODUCT DATA

- A. The following information shall be provided in accordance with Section 01 33 00:
1. Detail specifications and instructions for installation, adjustments, cleaning and maintenance.
 2. Certificates of compliance specified in paragraph 1.02 Certificates of Compliance.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Frames shall be plumb, square, and level and anchored to adjacent construction as specified and in accordance with manufacturer's printed instructions. Bottom of each frame shall be anchored to rough floor construction with 3/32-inch thick stainless steel angle clips secured to back of each jamb and to floor construction; stainless steel bolts and expansion rivets shall be used for fastening clip anchors. Doors shall be hung to produce clearances specified. After erection and glazing, doors and hardware shall be adjusted to operate properly.

3.02 PROTECTION FROM DISSIMILAR MATERIALS

A. Dissimilar Metals

1. Where aluminum surfaces come in contact with metals other than stainless steel, zinc, or small areas of white bronze, aluminum shall be protected from direct contact by one or a combination of the following methods:
2. Paint the dissimilar metal with one coat of heavy-bodied bituminous paint.
3. Apply a good quality elastomeric sealant between the aluminum and the dissimilar metal.
4. Paint the dissimilar metal with one coat of primer and one coat of aluminum paint.
5. Use a nonabsorptive tape or gasket in permanently dry locations.

B. Drainage from Dissimilar Metals:

1. In locations where drainage from dissimilar metals has direct contact with aluminum, provide protective paint, to prevent aluminum discoloration.
- C. Masonry and Concrete:
1. Aluminum surfaces in contact with mortar, concrete, or other masonry materials shall be protected with one coat of heavy-bodied bituminous paint.
- D. Wood or Other Absorptive Materials:
1. Aluminum surfaces in contact with absorptive materials subject to frequent moisture, and aluminum surfaces in contact with treated wood, shall be protected with two coats of aluminum paint or one coat of heavy-bodied bituminous paint. In lieu of painting the aluminum, the Contractor shall have the option of painting the wood or other absorptive surface with two coats of aluminum paint and sealing the joints with elastomeric sealant.

3.03 CLEANING

- A. Upon completion of installation, door and frame surfaces shall be cleaned in accordance with door manufacturer's recommended procedure, including removal of excess glazing and sealant compounds. Protective coating shall be removed when completion of construction activities no longer requires its retention. Use of abrasive, caustic, or acid cleaning agents is not allowed.

3.04 PROTECTION

- A. Doors and frames shall be protected from damage and from contamination by other materials such as cement mortar. Prior to completion and acceptance of the work, damaged doors and frames shall be restored to original condition or replaced with new ones.

END OF SECTION

SECTION 08 31 00
ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SUMMARY

- A. Scope
 - 1. This Section specifies access doors and panels.
 - 2. Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified and required to furnish and install all access doors and panels work.
 - 3. Extent of access doors and panels is shown.
 - 4. Types of products required include the following
 - a. Fire rated wall access doors.
 - b. Miscellaneous hardware, accessories and fasteners.
- B. Coordination
 - 1. Review installation procedures under this and other sections and coordinate the installation of items that must be installed with, or before the access doors and panels work.
 - 2. Notify other contractors in advance of the installation of the access doors and panels to provide them with sufficient time for the installation of items included in their contracts that must be installed with, or before, the access doors and panels work.

1.02 ENVIRONMENTAL CONDITIONS

- A. Product in this Section shall be subjected to environmental conditions in accordance with Section 01 11 80 - Environmental Conditions.

1.03 SUBMITTALS

- A. Preconstruction/Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.
 - 1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the requirements of the

Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.

2. Shop Drawings
 - a. Copies of Supplier's technical data and installation instructions for each type of access door and panel assembly. Transmit copy of the instructions for each type to the installer. Provide setting drawings, templates, instructions and directions for installation of anchorage devices.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

- A. Suppliers
 1. The Engineer and the City believe that the following Suppliers are capable of producing equipment and products, which will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular Supplier or product, nor shall it be construed that a named Supplier's standard product will comply with the requirements of this Section.
 2. Candidate Suppliers include the following:
 - a. Karp Associates, Inc., or
 - b. Approved Equal.
- B. Supplier Qualifications
 1. The Supplier shall have five (5) years of experience manufacturing and installing access doors and panels in similar-sized projects.

2.02 MATERIALS

- A. Materials specified are considered the minimum acceptable for the purposes of durability, strength, and resistance to erosion and corrosion. The Contractor may propose alternative materials for the purpose of providing greater strength or to meet required stress limitations. However, alternative materials must provide at least the same qualities as those specified for the purpose. If alternatives are proposed, the proposals shall be accompanied with documentation supporting the claimed superiority of the proposed substitutions. The Engineer shall be the sole decider in the equivalency of alternative materials of construction.

2.03 DETAILS OF CONSTRUCTION

- A. Description
 1. Provide access door and panel assemblies manufactured as integral units and complete with all components and accessories ready for installation.
- B. Fire-Rated Wall Access Doors: Provide the following for masonry and wallboard
 1. Sandwich-Type Flush Door Panels: 20-gauge stainless steel with No. 4 finish with 2-inches of mineral wool insulation within welded pan-type construction.
 2. Frames: 16-gauge stainless steel with No. 4 finish with 1-inch wide flange continuously welded and ground smooth at corners.
 3. Finish Hardware

- a. Hinge: Continuous stainless steel piano hinge.
- b. Closer: Automatic, self-latching with interior latch release.
- c. Lock: Prepare access door for mortise locks and coordinate dead bolt and cylinder requirements with Section 08 71 00 - Door Hardware.
4. Provide fire-rated wall access doors tested and approved by Underwriters' Laboratories, Inc., for 60-minute fire-resistance.
5. Size: 16-inches by 16-inches.

PART 3 EXECUTION

3.01 SHIPMENT AND STORAGE

- A. Equipment shall be shipped and stored in accordance with Section 01 60 00 - Common Product Requirements.
- B. Supplier shall provide Contractor with detailed recommendations and instructions for equipment storage.

3.02 SUPPLIER'S FIELD SERVICES

- A. Supplier shall provide assistance during product installation as required by the Contractor.

3.03 INSTALLATION

- A. The Supplier shall provide the Contractor with detailed recommendations and instructions for installation of the product specified in this Section.
- B. Products shall be installed at the locations shown and in accordance with the recommendations of the Supplier.
- C. Comply with Supplier's instructions for installation of access doors and panels.
- D. Coordinate installation with work of other trades.
- E. Set frames accurately in position and securely attach to support with face panels plumb or level in relation to adjacent finish surfaces.
- F. Inspection
 1. Contractor must examine the areas and conditions under which access doors are to be installed and notify Engineer, in writing, of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to Engineer.
- G. Adjustment and Cleaning
 1. Adjust hardware and panels after installation for proper operation.
 2. Remove and replace panels or frames, which are warped, bowed or otherwise damaged.

END OF SECTION

**SECTION 08 31 20
FLOOR ACCESS DOORS**

PART 1 GENERAL

1.01 SUMMARY

A. Scope

1. This Section specifies factory-fabricated single or double leaf aluminum floor access doors and frames with water drainage. Include odor resistant gasket, safety chain, telescoping ladder safety post, and fall protection grating system.

B. Performance Requirements

1. Door leafs shall be reinforced to support a minimum live load of 300 psf or AASHTO H-20 wheel load with a maximum deflection of 1/150th of the span. See Floor Access Door Schedule at the end of this Section, which indicates loading criteria required at each location.
2. Nominal opening sizes and hinge opening side shall be as noted on the Plans and in the Floor Access Door Schedule.

1.02 QUALITY ASSURANCE

A. Reference Codes and Standards

1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
ASTM B221	Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B632	Aluminum-Alloy Rolled Tread Plate
ASTM A240	Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM F593	Stainless Steel Bolts, Hex Cap Screws, and Studs
ASTM F594	Stainless Steel Nuts

Reference	Title
AASHTO	American Association of State Highway and Transportation Officials
OSHA	U.S. Dept. of Labor, Occupational Safety and Health Administration

B. Installer

1. Minimum of two (2) years' experience installing products similar to those provided in this Section.

C. Warranty

1. A warranty for the equipment specified under this Section shall be provided in accordance with the General Conditions. The Warranty shall be for one (1) year from the date of the Notice of Substantial Completion certificate issued for the Work. If extended warranties are required, a special paragraph calling for an extended warranty will be included in this Section.
2. Special Warranty: Materials shall be free of defects in material and workmanship for a period of five (5) years from the date of purchase. Should a part fail to function in normal use within this period, Supplier shall furnish a new part at no charge.

1.03 ENVIRONMENTAL CONDITIONS

- A. Product in this Section shall be subjected to environmental conditions in accordance with Section 01 11 80 - Environmental Conditions

1.04 SUBMITTALS

- A. Preconstruction/Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.

1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.

2. Statement of experience for both Supplier and installer.
3. Fabrication drawings showing layouts, connections to structure, and anchoring details.

4. Erection and installation drawings showing construction details, reinforcement, anchorage, and installation with relation to the building construction.
 5. Drain pipe layout from the drain coupling to the discharge point.
- B. Informational Submittals: The following minimum informational submittals shall be submitted in accordance with the timing requirements specified in these Contract Documents, prior to Substantial Completion and in accordance with Section 01 33 00 - Submittals.
1. Supplier's product data showing conformance to this Section.
 2. Structural calculations for the floor access door design provided by the Supplier and sealed by a registered Professional Engineer registered in the State of Florida.
 3. Instructions for the storage, handling, installation, and operation.
 4. Supplier's warranty.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

A. Suppliers

1. The Engineer and the City believe that the following Suppliers are capable of producing equipment and products, which will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular Supplier or product, nor shall it be construed that a named Supplier's standard product will comply with the requirements of this Section.
2. Candidate Suppliers include the following:
 - a. The Bilco Company,
 - b. Babcock Davis,
 - c. Halliday Products,
 - d. East Jordan Iron Works (EJ), or
 - e. Approved Equal.

B. Supplier Qualifications

1. The Supplier shall have five (5) years of experience manufacturing and installing floor access doors in similar-sized projects.

2.02 MATERIALS

- A. Materials specified are considered the minimum acceptable for the purposes of durability, strength, and resistance to erosion and corrosion. The Contractor may propose alternative materials for the purpose of providing greater strength or to meet required stress limitations. However, alternative materials must provide at least the same qualities as those specified for the purpose. If alternatives are proposed, the proposals shall be accompanied with documentation supporting the claimed superiority of the proposed substitutions. The Engineer shall be the sole decider in the equivalency of alternative materials of construction.
1. Access doors, single or double leaf 1/4 inch minimum aluminum with diamond tread pattern; ASTM B632, 6061-T6.

2. Channel frame shall be 1/4 inch minimum extruded aluminum with bent down anchor tabs around the perimeter ASTM B221, 6061-T6.
3. Hardware ASTM A240 Type 316 stainless steel throughout.
4. Fasteners
 - a. Bolts ASTM F593
 - b. Nuts ASTM F594

2.03 COMPONENTS/ FEATURES

- A. Supplier shall provide the required number and size of compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled door leaf operation throughout the entire arc of opening; and to act as a check in retarding downward motion of the cover when closing.
- B. Spring tubes shall be constructed of a reinforced nylon 6/6-based engineered composite material. The upper tube shall prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe fastened to a formed 1/4 inch gusset support plate.
- C. Door leafs shall be equipped with a hold-open arm which automatically locks the door in the open position. A removable exterior turn/lift handle with a spring loaded ball detent shall be provided to open the door and the latch release shall be protected by a flush, gasketed, removable screw plug. A stainless steel snap lock with fixed handle shall be mounted on the underside of the door.
- D. Provide heavy forged aluminum hinges with 1/4 inch minimum diameter stainless steel pins.
 1. Hinges must operate in such a manner to prevent the door leafs from protruding into the channel frame.
 2. Design hinges specifically for horizontal installation.
 3. Hinges shall be through-bolted to the cover with tamperproof stainless steel lock bolts and through-bolted to the frame with stainless steel bolts and locknuts.
- E. A continuous ethylene propylene diene monomer (EPDM) gasket shall be mechanically attached to the aluminum frame to create a barrier around the entire perimeter of the cover and significantly reduce the amount of dirt and debris that may enter the channel frame.
- F. A 1.5 inch drain coupling shall be provided.
- G. Provide a continuous EPDM odor resistant gasket along the inside edge of the frame. This gasket is in addition to the perimeter debris gasket.
- H. Provide safety chain made of non-corrosive material that will span across the corners of double leaf access doors when open.
- I. Provide telescoping ladder safety posts for easy, safe ladder access through the access door openings.
 1. Material Stainless steel.
 2. Telescoping post to be permanently mounted to the top two rungs of fixed ladders.

3. Post must automatically lock in the fully raised position to provide the user with a firm and steady hand-hold.
 4. Post to have release lever that allows the post to be easily lowered to its retracted position.
- J. Provide a fall protection grating system where indicated in the Floor Access Door Schedule. Supplier shall install the grating system when the door is fabricated.
1. Design Criteria
 - a. Meet OSHA 29 CFR 1910.23 requirements for fall protection.
 2. Grating Panel Material
 - a. Aluminum with powder coat paint finish.
 3. Grating Panel Color
 - a. High visibility OSHA safety yellow or orange.
 4. Grating panel shall lock automatically in the full open position.
 5. Grating panel shall lift open in the opposite direction as the door(s).
 6. Hold Open Feature
 - a. Stainless steel hold open device shall be provided to lock the cover in the fully open 90 degree position.
 7. Lift Mechanism and Hardware
 - a. stainless steel lifting mechanisms as specified above for all fall protection panels that weigh over 50 pounds.
 8. Grating Openings
 - a. Reinforced with easy-open aluminum covers for removal of instrumentation below access doors.

2.04 FINISHES

- A. Door and frame Mill finish aluminum with heavy bituminous coating where in contact with concrete.
- B. Telescopic safety post aluminum or stainless steel.
- C. Springs Electro-coated acrylic finish.

PART 3 EXECUTION

3.01 SHIPMENT AND STORAGE

- A. Product shall be shipped and stored in accordance with Section 01 66 00 – Product Storage and Handling Requirements.
- B. Supplier shall provide Contractor with detailed recommendations and instructions for product storage.
- C. Deliver materials in Supplier’s original packaging, stored in a dry, protected, well-vented area. Inspect product upon receipt and report damage to carrier and Supplier.

3.02 SUPPLIER'S FIELD SERVICES

- A. Supplier shall provide assistance during equipment installation as required by the Contractor.

3.03 INSTALLATION

- A. The Supplier shall provide the Contractor with detailed recommendations and instructions for installation of the products specified in this Section.
- B. Products shall be installed at the locations shown and in accordance with the recommendations of the Supplier.
- C. Frame shall be accurately cast in place and securely anchored to concrete. Installation of access doors after concrete is placed is not allowed.
- D. Set frame level, plumb and in proper alignment with adjacent work.
- E. Contractor shall field route a 1.5 inch Schedule 80 PVC drain pipe from the 1.5 inch drain coupling on all access doors to the water or floor level below. Place drain pipe clear of the access area below the door and as approved by the Engineer.
- F. Examination
 - 1. Examine substrates and openings for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.
- G. Repair/Restoration
 - 1. Repair finishes damaged during installation.
 - 2. Remove and replace doors that are warped, bowed, or otherwise damaged.
- H. Adjusting And Cleaning
 - 1. Adjust doors and hardware after installation for proper operation.
- I. Clean exposed surfaces using methods acceptable to the Supplier that will not damage finish.

3.04 FLOOR ACCESS DOOR SCHEDULE

Floor Access Doors						
Quantity	Location/Room Number	Clear Opening Size (north/south x east/west) 1	Leafs	Loading	Fall Protection Grating	Comments
2	Concentrate Isolation Check Valve Vault	3'-0" x 3'-0"	Single	H-20	Yes	
1	Concentrate Isolation Plug Valve Vault	3'-0" x 3'-0"	Single	H-20	Yes	
1	Concentrate Isolation Plug Valve Vault	2'-0" x 2'-0"	Single	H-20	Yes	
2	IWPS No.1 Isolation Plug Valve Vault	3'-0" x 3'-0"	Single	H-20	Yes	
7	IWPS2 Pump Room	4'-0" x 4'-0"	Single	150 psf	Yes	
3	Plant Drain Pump Station	3'-0" x 3'-6"	Double	250 psf	Yes	

Note

1. Clear opening is defined as the dimensions such that objects can pass through the floor access door. Lifting and other hardware shall be outside of the opening dimensions.

END OF SECTION

SECTION 08 33 00

SHUTTERS

PART 1 GENERAL

1.01 SUMMARY

A. Scope

1. This Section shall consist of furnishing all the labor, materials, and equipment necessary for installation of weather protection shutters as shown on the Plans and specified herein.

B. Performance Requirements

1. Wind Loads: Reference Structural Drawings.
2. Shutters shall comply with the Florida Building Code Projectile Requirements.

1.02 QUALITY ASSURANCE

A. Reference Codes and Standards

1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
American Architectural Suppliers Association (AAMA)	
American Society of Testing and Materials (ASTM)	1. A167 Specification for Stainless and Heat Resisting Chromium Nickel Steel Plate, Sheet and Strip 2. A653 Specification for Steel Sheet, Zinc-Coated (galvanized) by the Hot-Dip Process
Florida Building Code	High Velocity Hurricane Zone
National Fire Protection Association (NFPA)	NFPA Standard for Fire Doors, Fire Windows
Underwriters Laboratories Inc, (UL)	Building Materials Directory

- B. Warranty
 - 1. The Supplier shall warrant the equipment, materials and products specified in this Section against defective materials and workmanship with the Supplier's standard warranty, but for no less than one (1) year from the date of Substantial Completion.
 - 2. The Contractor shall warrant the Work against defects for one (1) year from the date of Substantial Completion.
- C. Installer Qualifications
 - 1. Shutter Supplier and installer shall have five (5) years experience in shutter manufacture and successfully completed similar installations.
- D. Design Requirements
 - 1. Shutters shall comply with the Florida Building Code and meet the design pressures shown on Contract Drawings and meet the Impact Standards, in compliance with Florida Building Code (FBC) High Velocity Hurricane Zones (HVHZ) Protocols and required product Notice of Acceptance (NOA) or Florida statewide product approval

1.03 ENVIRONMENTAL CONDITIONS

- A. Product in this Section shall be subjected to environmental conditions in accordance with Section 01 11 80 - Environmental Conditions.

1.04 SUBMITTALS

- A. Preconstruction/Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.
 - 1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.
 - 2. Shop Drawings: Indicate pertinent dimensions, anchorage, methods, locations and installation details.
 - 3. Product Data: Submit general construction, component connections and details.
 - 4. Supplier's Installation Instructions: Indicate installation sequence and procedures, adjustment and alignment procedures.

5. Submit properly identified product data including material specifications, published installation directions, and operation and maintenance instructions.
6. Submit Shop Drawings for review showing locations, elevations, sizes, materials, gauges, construction details, fenestration, hood, fasteners, seals, counterbalance, manual, chain or power operation, locking provisions, finishes, installation details and wiring diagrams.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

A. Suppliers

1. The Suppliers shall be capable of producing equipment and products, which will satisfy the requirements of this Section.

B. Supplier Qualifications

1. The Supplier shall have five (5) years of experience manufacturing and installing shutters in similar-sized projects.

2.02 MATERIALS

- #### **A. Materials specified are considered the minimum acceptable for the purposes of durability, strength, and resistance to erosion and corrosion. The Contractor may propose alternative materials for the purpose of providing greater strength or to meet required stress limitations. However, alternative materials must provide at least the same qualities as those specified for the purpose. If alternatives are proposed, the proposals shall be accompanied with documentation supporting the claimed superiority of the proposed substitutions. The Engineer shall be the sole decider in the equivalency of alternative materials of construction.**

2.03 EXTERIOR ROLL-UP SHUTTERS

- #### **A. Aluminum, sizes as indicated complete with curtain, guides, roller shaft, brackets, hoods, manual push up operating provisions, anchorage and fastening devices, counterbalance mechanism and all other parts and fittings required for a complete installation.**
- #### **B. Curtain: Fabricate curtain of interlocking aluminum slats designed to withstand wind loads in accordance with the Florida Building Code.**
1. Slats: 16 gauge minimum roll formed anodized aluminum, clear 60 minute anodized in accordance with AAMA AA-M12-C22-A41, before fabrication.
 2. End Locks: Supplier's standard galvanized malleable iron alternate end locks riveted to ends of slats.
 3. Bottom Bar: Supplier's standard aluminum designed to reinforce lower edge of curtain against wind pressure. Equip bottom bar with neoprene astragal.
- #### **C. Jamb Guides: Extruded aluminum members in finish to match the slats, built to form a slot of sufficient depth to retain curtain in guides. Equip guides with wind locks, as required to resist specified wind loads and with heavy nap inserts, eliminating metal to metal contact and adding weather and dust tightness.**

- D. Counter balance Mechanism: Steel spring mounted around a steel shaft encased in a spring barrel and connected to curtain with Supplier's standard barrel rings. Use grease-sealed or self-lubricating bronze ball bearings for all rotating members.
 - 1. Spring Barrel: Fabricate of hot-formed carbon steel or welded or seamless pipe of required diameter and wall thickness to support roll-up of curtain without distortion of slats and limit barrel deflection to 0.03 inch/ft. maximum, of span under load. Hot-dip galvanize barrel inside and out in accordance with ASTM A653.
 - 2. Springs: Oil-tempered adjustable torsion spring for counterbalancing and provision of sufficient torque to assure easy operation of door from any position.
 - 3. Tension Rod: Case-hardened steel of adequate size to hold fixed end of springs and carry torsional loads.
 - 4. Brackets: Supplier's standard cast iron or cold-rolled steel plate with groove for curtain and designed to house end of coils.
- E. Hoods: Fabricate from 16-gauge minimum anodized aluminum sheet to form fascia and enclose curtain coil. Reinforce with beads or flanges to prevent deflection.
- F. Gears: Supplier's standard with safety and reduction factor designed for shutter.
- G. Fenestration: 1/16 inch minimum, clear plastic lights across entire width of curtain where indicated. Seal lights outside with rubber gaskets and hold in place inside with 16 gauge minimum anodized aluminum cover plate.
- H. Locking Provisions: Equip doors with slide bolts on both sides of bottom rail with padlock eyes located on interior side. Provide additional cut outs in jamb guides to facilitate an intermediate locking point two inches clear from bottom of rail to top of precast counter.
- I. Miscellaneous Parts: Provide all miscellaneous parts and fittings as required for a complete installation.
- J. Finish: Remove all oil and grease by shop phosphate treating all galvanizing. Provide one shop coat of metallic primer to all parts, other than stainless steel or aluminum, not protected by galvanizing.

2.04 FASTENERS

- A. All exposed fasteners shall be security type.

PART 3 EXECUTION

3.01 SHIPMENT AND STORAGE

- A. Products shall be shipped and stored in accordance with Section 01 66 00 - Product Storage and Handling Requirements.
- B. Supplier shall provide Contractor with detailed recommendations and instructions for product storage.

3.02 SUPPLIER'S FIELD SERVICES

- A. Supplier shall provide assistance during product installation as required by the Contractor.

3.03 INSTALLATION

- A. The Supplier shall provide the Contractor with detailed recommendations and instructions for installation of the product specified in this Section.
- B. Supplier shall provide assistance during product installation as required by the Contractor.
- C. Products shall be installed at the locations shown and in accordance with the recommendations of the Supplier.
- D. Mount curtains in accordance with Supplier's published installation directions and reviewed Shop Drawings under direct supervision of door supplier or his authorized representative. Adjust to operate smoothly without forcing or binding.
- E. Operator and Controls
 - 1. Install operator and controls where indicated and adjust and lubricate for proper operation.

END OF SECTION

SECTION 08 33 23
OVERHEAD COILING DOORS

PART 1 GENERAL

1.01 SUMMARY

- A. Scope
 - 1. This Section specifies overhead coiling service door.
- B. Performance Requirements
 - 1. Structural Performance, Exterior Doors Capable of withstanding the design wind loads.
 - a. Design Wind Load As indicated on Plans.
 - b. Deflection Limits Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.
 - c. Operability under Wind Load Design overhead coiling doors to remain operable under design wind load, acting inward and outward.
 - d. Component Importance Factor 1.5.
 - 2. Environmental Conditions: Door components and assembly to be constructed and warranted for salt spray exposure.

1.02 QUALITY ASSURANCE

- A. Reference Codes and Standards
 - 1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
 - 2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
Florida Building Code	High Velocity Hurricane Zone
National Fire Protection Association (NFPA)	Specification for Carbon Structural Steel
Underwriters Laboratories Inc, (UL)	Building Materials Directory

B. Warranty

1. A warranty for the products and materials specified under this Section shall be provided in accordance with the General Conditions and Section 01 80 00 – Warranties. The Warranty shall be for two (2) years from the date of the Notice of Substantial Completion certificate issued for the Work.

C. Installer Qualifications

1. An entity that employs installers and supervisors who are trained and approved by Supplier for both installation and maintenance of units required for this Work.

D. Regulatory Requirements

1. Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC A117.1.

1.03 ENVIRONMENTAL CONDITIONS

- A. Product in this Section shall be subjected to environmental conditions in accordance with Section 01 11 80 – Environmental Conditions.

1.04 SUBMITTALS

- A. Preconstruction/Action Submittals The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.

1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up Specification Sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.

2. Product Data For each type and size of overhead coiling door and accessory.

- a. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
 - b. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
3. Shop Drawings for each installation and for special components not dimensioned or detailed in Supplier's product data.
 - a. Include plans, elevations, sections, and mounting details.
 - b. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
 - c. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
 - d. For exterior components, include details of provisions for assembly expansion and contraction and for excluding and draining moisture to the exterior.
 - e. Include diagrams for power, signal, and control wiring.
 4. Samples for Verification For each type of exposed finish on the following components, in Supplier's standard sizes
 - a. Curtain slats.
 - b. Include similar Samples of accessories involving color selection.
 5. Qualification Data
 - a. Installer
 - b. Factory-authorized service representative
 - c. Supplier
 6. Warranty Information
 - a. Prior to starting Work, submit sample copy of warranty to be provided.
- B. Informational Submittals: The following minimum informational submittals shall be submitted in accordance with the timing requirements specified in these Contract Documents, prior to Substantial Completion and in accordance with Section 01 33 00 - Submittal.
1. Operating and Maintenance Information in accordance with Section 01 78 23 - Operations and Maintenance Data.
 2. Installer Certificates Signed by Supplier certifying that installers comply with specified requirements.
 3. Warranty Submit Supplier's warranty showing conformance to provisions of this Section.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

- A. Suppliers
1. The Engineer and the City believe that the following Suppliers are capable of producing equipment and products, which will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular Supplier or product, nor shall it be construed that a named Supplier's standard product will comply with the requirements of this Section.

2. Candidate Suppliers, reference 2.03, A.1.
- B. Source Limitations
1. Obtain overhead coiling doors from single source from single Supplier.
 2. Obtain operators and controls from overhead coiling door Supplier.
- C. Supplier Qualifications
1. The Supplier shall have five (5) years of experience manufacturing and installing overhead coiling doors in similar-sized projects.

2.02 MATERIALS

- A. Materials specified are considered the minimum acceptable for the purposes of durability, strength, and resistance to erosion and corrosion. The Contractor may propose alternative materials for the purpose of providing greater strength or to meet required stress limitations. However, alternative materials must provide at least the same qualities as those specified for the purpose. If alternatives are proposed, the proposals shall be accompanied with documentation supporting the claimed superiority of the proposed substitutions. The Engineer shall be the sole decider in the equivalency of alternative materials of construction.
- B. Electrical Components, Devices, and Accessories Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.03 DOOR ASSEMBLY

- A. Service Door Overhead coiling door formed with curtain of interlocking metal slats.
1. Suppliers Subject to compliance with requirements, available Suppliers offering products that may be incorporated into the Work include, but are not limited to the following
 - a. Cookson Company,
 - b. Cornell Iron Works, Inc.,
 - c. Metro Door,
 - d. Overhead Door Corporation. or
 - e. Approved Equal.
- B. Operation Cycles Door components and operators capable of operating for not less than one hundred thousand (100,000) cycles. One (1) operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
1. Include tamperproof cycle counter.
- C. Door Curtain Material Galvanized steel.
- D. Door Curtain Slats Flat profile slats of 3-1/4-inch center-to-center height.
1. Gasket Seal. Supplier's standard continuous gaskets between slats.

- E. Bottom Bar Two (2) angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; fabricated from stainless steel and finished to match door.
- F. Curtain Jamb Guides Galvanized steel with exposed finish matching curtain slats.
- G. Hood Match curtain material and finish.
 - 1. Shape Square.
 - 2. Mounting Face of wall.
- H. Locking Devices Equip door with slide bolt for padlock.
 - 1. Locking Device Assembly Cremone-type, both jamb sides locking bars, operable from inside with thumb turn.
- I. Electric Door Operator
 - 1. Usage Classification Medium duty, up to twelve (12) cycles per hour and up to fifty (50) cycles per day.
 - 2. Operator Location Top of hood.
 - 3. Motor Exposure Interior.
 - 4. Emergency Manual Operation Chain type.
 - 5. Obstruction-Detection Device Automatic photoelectric sensor and electric sensor edge on bottom bar.
 - a. Sensor Edge Bulb Color As selected by the Engineer from Supplier's full range.
 - 6. Control Station(s) Interior-mounted.
 - 7. Other Equipment Audible and visual signals.
- J. Curtain Accessories Equip door with weatherseals pull-down strap and automatic closing device.
- K. Door Finish
 - 1. Provide factory applied Powder-Coated Finish, Color as selected by Engineer from Supplier's full range color chart.

2.04 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door Supplier for performance, size, and type of door indicated, and as follows
 - 1. Steel Door Curtain Slats Zinc-coated (galvanized), cold-rolled structural-steel sheet; complying with ASTM A 653, with G90 zinc coating; nominal sheet thickness (coated) of 0.028 inch; and as required.
- B. Curtain Jamb Guides Supplier's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent over-travel of curtain, and a continuous bar for holding windlocks.

2.05 HOODS

- A. General Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
 - 1. Galvanized Steel Nominal 0.028-inch- thick, hot-dip galvanized-steel sheet with G90 zinc coating, complying with ASTM A 653.

2.06 LOCKING DEVICES

- A. Slide Bolt Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.
- B. Safety Interlock Switch Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.07 CURTAIN ACCESSORIES

- A. Weather seals for Exterior Doors Equip each exterior door with weather-stripping gaskets fitted to entire exterior perimeter of door for a weather-resistant installation unless otherwise indicated.
 - 1. At door head, use 1/8-inch-thick, replaceable, continuous-sheet baffle secured to inside of hood or field- installed on the header.
 - 2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch-thick seals of flexible vinyl, rubber, or neoprene.
- B. Pull-Down Strap Provide pull-down straps for doors more than 84 inches high.

2.08 COUNTERBALANCING MECHANISM

- A. General Counterbalance doors by means of Supplier's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel Fabricate spring barrel of Supplier's standard hot-formed, structural-quality, seamless or welded carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 inches/foot of span under full load.
- C. Counterbalance Spring One (1) or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
- D. Torsion Rod for Counterbalance Shaft Fabricate of Supplier's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

- E. Brackets Supplier's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.09 ELECTRIC DOOR OPERATORS

- A. General Electric door operator assembly of size and capacity recommended and provided by door Supplier for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
 - 1. Comply with NFPA 70.
 - 2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24 VAC or DC.
- B. Usage Classification Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.
- C. Door Operator Location(s) Operator location indicated for each door.
 - 1. Top-of-Hood Mounted Operator is mounted to the right or left door head plate with the operator on top of the door-hood assembly and connected to the door drive shaft with drive chain and sprockets. Headroom is required for this type of mounting.
- D. Motors Reversible-type motor with controller (disconnect switch) for motor exposure indicated.
 - 1. Electrical Characteristics
 - a. Phase Polyphase.
 - b. Volts 208 V.
 - c. Hertz 60.
 - 2. Motor Size Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 inches/sec. and not more than 12 inches/second, without exceeding nameplate ratings or service factor.
 - 3. Operating Controls, Controllers, Disconnect Switches, Wiring Devices, and Wiring Supplier's standard unless otherwise indicated.
 - 4. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
- E. Limit Switches Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
- F. Obstruction Detection Devices External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel.
 - 1. Photoelectric Sensor Supplier's standard system designed to detect an obstruction in door opening without contact between door and obstruction.
 - a. Self-Monitoring Type Designed to interface with door operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring

- feature is activated, door closes only with sustained or constant pressure on close button.
2. Electric Sensor Edge Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using Supplier's standard take-up reel or self-coiling cable.
 - a. Self-Monitoring Type Four-wire configured device designed to interface with door operator control circuit to detect damage to or disconnection of sensor edge.
- G. Control Station Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure push-button control labeled "Close."
1. Interior-Mounted Units Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
- H. Emergency Manual Operation Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.
- I. Emergency Operation Disconnect Device Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- J. Motor Removal Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.
- K. Audible and Visual Signals Audible alarm and visual indicator lights in compliance with regulatory requirements for accessibility.

2.10 COATINGS

- A. Overhead Coiling Doors shall be shall Powder-Coat Finish with Supplier's standard baked-on finish consisting of prime coat and thermosetting topcoat.
- B. General Finish Requirements
1. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.
 2. Appearance of Finished Work Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Steel And Galvanized Steel Finishes
1. Powder-Coat Finish Supplier's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating Supplier's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 EXECUTION

3.01 SHIPMENT AND STORAGE

- A. Equipment shall be shipped and stored in accordance with Section 01 66 00 - Product Storage and Handling Requirements.
- B. Supplier shall provide Contractor with detailed recommendations and instructions for product storage.

3.02 SUPPLIER'S FIELD SERVICES

- A. Supplier shall provide assistance during product installation as required by the Contractor.

3.03 INSTALLATION

- A. The Supplier shall provide the Contractor with detailed recommendations and instructions for installation of the product specified in this Section.
- B. Supplier shall provide assistance during product installation as required by the Contractor.
- C. Products shall be installed at the locations shown and in accordance with the recommendations of the Supplier.
- D. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to Supplier's written instructions and as specified.
- E. Install overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.
- F. Accessibility Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.
- G. Power-Operated Doors Install according to UL 325.
- H. Examination
 - 1. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
 - 2. Examine locations of electrical connections.
- I. Proceed with installation only after unsatisfactory conditions have been corrected.
- J. Adjusting
 - 1. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
 - a. Adjust exterior doors and components to be weather-resistant.
 - 2. Lubricate bearings and sliding parts as recommended by Supplier.

K. Adjust seals to provide tight fit around entire perimeter.

3.04 FIELD TESTING AND COMMISSIONING

- A. Field Testing and Commissioning shall be in accordance with the requirements of Section 01 45 20 – Equipment and System Performance and Operational Testing.
- B. The Supplier shall provide detailed procedures for Field Testing and Commissioning procedures for the equipment specified in this Section.
- C. Field Testing and Commissioning shall be performed under the direction of personnel provided by the Supplier.

3.05 TRAINING

- A. Training shall be provided as specified in Section 01 79 00 – Demonstration and Training.
- B. A minimum of eight (8) hours of total training shall be provided.
 - 1. The eight (8) hours of training shall be comprised of the following:
 - 2. Operations Training: Four (4) sessions, one (1) hour per session.
 - 3. Maintenance Training: Four (4) sessions, one (1) hour per session.
- C. Upon completion of the training activities, the Supplier shall provide a Certification of Training Completion.

END OF SECTION

SECTION 08 51 13
ALUMINUM WINDOWS

PART 1 GENERAL

1.01 SUMMARY

- A. Scope
1. This Section specifies fixed aluminum windows.

1.02 QUALITY ASSURANCE

- A. Reference Codes and Standards
1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
 2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
AA DAF45	Designation System for Aluminum Finishes
ANSI/AAMA 101	Voluntary Specifications for Aluminum Prime Windows and Sliding Glass Doors
AAMA 1503.1	Voluntary Test Method for Thermal/ Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections
Fed. Spec. L-S-125B	Screening, Insect, Nonmetallic
Fed. Spec. RR-W-365A	Wire Fabric (Insect Screening) and Int Am 1
SSPC-PS 9.01	Applied Asphalt Mastic Painting System with Extra-Thick Film

- B. Certification
1. Product Labeling
 - a. Each prime window unit shall bear the AAMA Label warranting that the product complies with ANSI/AAMA 101. Certified test reports attesting that the prime window units meet the requirements of ANSI/AAMA 101 will be acceptable in lieu of product labeling.

2. Certified Test Reports
 - a. In lieu of product labeling, test reports shall be provided for each type of window attesting that identical windows have been tested and meet the requirements specified herein for conformance to ANSI/AAMA 101, and minimum Condensation Resistance Factor (CRF).

1.03 ENVIRONMENTAL CONDITIONS

- A. Product in this Section shall be subjected to environmental conditions in accordance with Section 01 11 80 – Environmental Conditions.

1.04 SUBMITTALS

- A. Preconstruction/Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.

1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.

2. Supplier's data describing each window type and finish, hardware, fasteners, operators, screens, weatherstripping, and accessories.
3. Shop Drawings which indicate elevations of windows, full-size Sections, thicknesses and gauges of metal, fastenings, proposed method of anchoring, size and spacing of anchors, details of construction, method of glazing, mullion details, installation details, and other related items.
4. Color chart of standard factory color coatings when factory-finished color coating is to be provided.
5. Samples consisting of one full-size corner of each window type proposed for use. Where screens or weatherstripping is required, fit sample with such items that are to be used.

- B. Product Data

- a. Window schedule indicating location of each window unit.
- b. Certified Test Reports specified in Paragraph 1.02 of this Section.

- C. Protection

1. Finished surfaces shall be protected during shipping and handling using the Supplier's standard method, except that no coatings or lacquers shall be applied to surfaces to which calking and glazing compounds must adhere.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

A. Suppliers

1. The Engineer and the City believe that the following Suppliers are capable of producing equipment and products, which will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular Supplier or product, nor shall it be construed that a named Supplier's standard product will comply with the requirements of this Section.
2. Candidate Suppliers include the following:
 - a. Traco Architectural Systems, Inc., or
 - b. Approved Equal.

B. Supplier Qualifications

1. The Supplier shall have five (5) years of experience manufacturing and installing aluminum windows in similar-sized projects.

2.02 REQUIREMENTS

- A. Prime windows shall conform to ANSI/AAMA 101 and the requirements specified herein. Unless otherwise specified, frame and sash members shall be 6063-T5 aluminum extrusions. Windows shall be provided of types, grades, performance classes, combinations and sizes specified. Windows shall be designed to accommodate glass, weatherstripping, and accessories to be furnished. Each window shall be a complete factory assembled unit with or without glass installed. Dimensions shown are minimum. Windows shall be provided with insulating glass and thermal break necessary to achieve a minimum Condensation Resistance Factor (CRF) of 45 when tested in accordance with AAMA 1503.1.
- B. Fixed Windows
 1. Fixed windows shall be Type F.
- C. Glass and Glazing
 1. Materials are specified in Section 08 81 00 - Glass Glazing.
- D. Calking and Sealing
 1. Materials are specified in Section 07 92 00 - Joint Sealants.

- E. Weatherstripping
 - 1. Weatherstripping shall conform to ANSI/AAMA 101.

2.03 FABRICATION

- A. Provisions for Glazing
 - 1. Windows and rabbets shall be designed for glass thickness specified. Sash shall be designed for one (1)-inch glazing and for securing glass with and glazing compound.
- B. Fasteners
 - 1. Fasteners shall be standard with the window Supplier for windows, trim, and accessories. Self-tapping sheet-metal screws are not acceptable for material more than 1/16-inch thick.
- C. Drips and Weep Holes
 - 1. Drips and weep holes shall be provided as required to return water to the outside.
- D. Accessories
 - 1. Contractor shall provide windows complete with necessary fastenings, clips, fins, anchors, glazing beads, and other appurtenances necessary for complete installation and proper operation.
 - 2. Anchors
 - a. Anchors shall be of the concealed type recommended by the window Supplier for the specific type of construction. Anchors and fasteners shall be compatible with the window and the adjoining construction. A minimum of three anchors shall be provided for each jamb located approximately 6 inches from each end and at midpoint.
- E. Finishes
 - 1. Unless otherwise specified, all windows shall receive a 215-R1, Aluminum Association Code AA-M12C22A41, clear anodized finish after assembly. Minimum coating thickness shall be 0.7 mil.

2.04 ISOLATION COATING

- A. Bituminous Coating
 - 1. Isolation coating shall be applied to all aluminum surfaces in contact with concrete, masonry, or dissimilar metals. Coating shall be cold-applied asphalt mastic complying with SSPC-PS 9.01 compounded for 30 mil thickness per coat.

PART 3 EXECUTION

3.01 SHIPMENT AND STORAGE

- A. Equipment shall be shipped and stored in accordance with Section 01 66 00 - Product Storage and Handling Requirements.
- B. Supplier shall provide Contractor with detailed recommendations and instructions for equipment storage.

- C. Windows shall be delivered to project site in an undamaged condition. Windows and components shall be stored on nonabsorptive strips or wood platforms out of contact with the ground, under a weathertight covering, so as to prevent bending, warping, or otherwise damaging the windows. Damaged windows shall be repaired to an "as new" condition as approved. If windows cannot be repaired, Contractor shall provide a new unit.

3.02 INSTALLATION

A. Method of Installation

- 1. Windows shall be installed in accordance with the window Supplier's printed instructions and details and built in as the Work progresses or installed without forcing into prepared window openings. Contractor shall set windows at proper elevation, location, and reveal; plumb, square, level, and in alignment; and brace, strut, and stay properly to prevent distortion and misalignment. Screws or bolts in sill members, joints at mullions, contacts of windows with sills, built-in fins, and subframes shall be bedded in mastic sealant of a type recommended by the window Supplier. Windows shall be installed in a manner that will prevent entrance of water and wind.

B. Dissimilar Materials

- 1. Aluminum surfaces are in contact with, or fastened to masonry, concrete, wood, or dissimilar metals, except stainless steel or zinc, the aluminum surface shall be protected from direct contact by one or a combination of the following methods
- 2. Paint the dissimilar metal with one coat of heavy-bodied bituminous paint.
- 3. Apply a good quality elastomeric sealant between the aluminum and the dissimilar metal.
- 4. Paint the dissimilar metal with one coat of primer and one coat of aluminum paint.
- 5. Use a nonabsorptive tape or gasket in permanently dry locations.

C. Anchors and Fastenings

- 1. Contractor shall make provision for securing units to each other, to masonry, and to other adjoining construction. Windows installed in masonry walls shall have head and jamb members designed to recess into masonry wall not less than 7/16 inch.

D. Cleaning

- 1. Contractor shall clean interior and exterior surfaces of window units of mortar, plaster, paint spattering spots, and other foreign matter to present a neat appearance. Use of abrasive, caustic, or acid cleaning agents is not allowed. Protective coating shall be removed when completion of construction activities no longer requires its retention. All stained, discolored, or abraded windows that cannot be restored to their original condition shall be replaced with new windows.

END OF SECTION

**SECTION 08 71 00
DOOR HARDWARE**

PART 1 GENERAL

1.01 SUMMARY

- A. Scope
1. This Section specifies door hardware.
 2. Provide all fabrication and mounting templates as needed for fabricators and for control of application of metal items.
 3. Provide all trim, attachments, and fastenings specified or required for proper and complete installation.

1.02 QUALITY ASSURANCE

- A. Reference Codes and Standards
1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
 2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
BHMA	Builders' Hardware Manufacturers' Association
Hardware Institute (DHI)	"Recommended Procedure for Processing Hardware Schedules and Templates" and "Architectural Hardware Scheduling and Format"
International Organization for Standardization (ISO)	14021 - 1999; Environmental.
National Association of Architectural Metal Manufacturers (NAAMM)	
National Fenestration Rating Council (NFRC)	
Underwriters' Laboratories, Inc.	Requirements and approvals

B. Warranty

1. A warranty for the equipment specified under this Section shall be provided in accordance with the General Conditions. The Warranty shall be for one (1) year from the date of the Notice of Substantial Completion certificate issued for the Work. If extended warranties are required, a special paragraph calling for an extended warranty will be included in this Section.
2. Special Warranty 1: Submit written warranty, signed jointly by Manufacturer, installer and Contractor, agreeing to replace hardware, which fail in materials or installations within 3 years of date of acceptance. The 3 parties jointly and separately are responsible for the installation for the period stated herein.
3. Special Warranty 2: Failure of materials or installation include, faulty operation, deterioration of finish or metal in excess or normal weathering and defects in hardware and weather-stripping.

C. Labels and Declarations.

1. National Association of Architectural Metal Manufacturers (NAAMM).
2. National Fenestration Rating Council (NFRC) .

D. Design Requirements

1. Design hardware systems to comply with the Florida Building Code and meet the design pressures shown on Contract Drawings and meet the Impact Standards, in compliance with Florida Building Code (FBC) High Velocity Hurricane Zones (HVHZ) Protocols and required product Notice of Acceptance (NOA) or Florida statewide product approval.

E. Labeling

1. Each unit shall bear a permanent label with Manufacturer's name or logo, city, and state.

F. All Work shall be performed in accordance with referenced standards.

1.03 ENVIRONMENTAL CONDITIONS

- A. Product in this Section shall be subjected to environmental conditions in accordance with Section 01 11 80 - Environmental Conditions.

1.04 SUBMITTALS

- A. Preconstruction/Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.

1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons

for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification Sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.

2. Shop Drawings

- a. Samples: The samples of all items requested by the Engineer shall be furnished by the hardware manufacturer no later than ten (10) days after said request is received.
- b. Manufacturer's Information: The Contractor shall submit a complete detailed hardware list and a schedule along with Manufacturer's literature on each item for approval. No hardware shall be delivered until the hardware schedule has been approved by the Engineer.
- c. The hardware schedule submitted by the Contractor shall list the actual product series numbers. Manufacturer's catalog requirements for actual size of door closers, brackets, and holders shall be observed. All door sizes shall be noted on the hardware schedule and all hardware shall be in strict accordance with height, width, and thickness requirements.
- d. The schedule shall indicate groups, type, manufacturer's name, catalog number, location, and finish of each item to be provided, all in accordance with the DHI "Architectural Hardware Scheduling Sequence and Format."
- e. The schedule shall also include a complete template list showing template references and data for each item requiring preparation of metal doors and frames.

3. Warranty

- a. To be provided by the Manufacturer and installer, in accordance with this Section.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

A. Manufacturers

1. The Engineer and the City believe that the Manufacturers indicated in this Section are capable of producing equipment and products, which will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular Manufacturer or product, nor shall it be construed that a named Manufacturer's standard product will comply with the requirements of this Section.
2. Candidate Manufacturers: Reference Paragraph 2.02, G, or Approved Equal.

B. Manufacturer Qualifications

1. The Manufacturer shall have five (5) years of experience manufacturing and installing door hardware in similar-sized projects.

2.02 GENERAL

- A. Finish hardware shall be coordinated with all other portions of the Work requiring builder's hardware or attaching to it. Copies of schedules, templates, etc., shall be furnished in ample time to avoid fabrication and construction delays. Each item of hardware shall be identified according to the approved list and schedule. All hardware shall be made to template.
- B. All hardware furnished in connection with doors bearing Underwriters' Labels or where necessary to meet special requirements shall be in strict accordance with conditions established by the authority having jurisdiction and shall be subject to approval of that authority.
- C. Hand of lock shall be as shown. If door hand is changed during construction, the Contractor shall make necessary changes at no extra cost to the City.
- D. Exit doors shall be openable at all times from the inside without the use of key or any special knowledge or effort.
- E. The Contractor shall provide the hardware manufacturer with approved Shop Drawings from those trades with which hardware must be coordinated. After checking these Shop Drawings, the Contractor shall promptly supply necessary template information to all concerned as may be required to facilitate the progress of the job. All procedures for template information shall be in accordance with the handbook, "Recommended Procedure for Processing Hardware Schedules and Templates."
- F. Finish of all hardware shall be 630 (brush stainless steel) unless otherwise specified in the hardware schedule.
- G. Manufacturer shall be:
 - 1. Builders Brass Works (BBW), Los Angeles, CA;
 - 2. Corbin Russwin Architectural Hardware, Monroe, NC;
 - 3. Door Controls International, Dexter, MI;
 - 4. Dor-O-Matic Automatics, Princeton, IL;
 - 5. Glynn-Johnson Corp., Indianapolis, IN;
 - 6. Grant, West Nyak, NY;
 - 7. Hager Companies, St. Louis, MO;
 - 8. Knappe & Vogt Mfg. Co., Grand Rapids, MI;
 - 9. LCN Closers, Princeton, IL;
 - 10. McKinney Products Co., Scranton, PA;
 - 11. Norton Door Controls, Monroe, NC;
 - 12. Pemko Mfg. Co., Memphis, TN;
 - 13. Quality Marine Hardware, Chino, CA;
 - 14. Rixson Specialty Door Controls, Monroe, NC;
 - 15. Sargent Mfg., New Haven, CT;
 - 16. Schlage Lock Co., Colorado Springs, CO;
 - 17. Stanley Works- Hardware Division, New Britain, CT;

18. Trimco/Triangle Brass Mfg. Co., Los Angeles, CA;
19. Von Duprin Inc., Indianapolis, IN;
20. Zero International, Bronx, NY; or
21. Approved Equal.

2.03 KEYING

- A. All locks and cylinders shall be masterkeyed to the City's existing keying system.
- B. All lock cylinders shall be construction masterkeyed or provided with construction cylinders and construction keys. Five (5) construction master keys shall be obtained by the Contractor, of which three (3) may be retained by the Contractor for use during construction, and the remaining two (2) construction keys shall be provided to the Engineer for its use.
- C. The Contractor shall furnish five (5) keys per cylinder keying combination. All keys along with five (5) master keys shall be delivered to the Engineer at the completion of the job.
- D. All keying (except when matching existing keying system or when less than ten (10) locksets are required) shall be done at the factory unless otherwise approved by the Engineer.
- E. A keying schedule shall be coordinated between the City, the Contractor, and the Manufacturer. The Contractor shall have the hardware manufacturer submit a keying schedule for approval prior to placing an order for the locks and keying of cylinders.

2.04 FASTENERS

- A. The Contractor shall provide all necessary screws, bolts, and other fasteners of suitable size and type to secure the hardware into position. The fasteners shall match the hardware in material and finish.
- B. The hardware provided, such as expansion bolts, sex bolts, toggle bolts and other approved anchorages shall be coordinated with the job and to each setting condition.
- C. Phillips head screws shall be used at exposed conditions. Machine screws shall be used at metal doors and frames.

2.05 HINGES

- A. Two hinges shall be provided for each door leaf up to and including 5 feet in height, and an additional hinge shall be added for each 2-1/2 feet or fractions thereof of additional door height
- B. Width of hinges shall be determined by trim conditions.
- C. Ball-bearing hinges shall be furnished on all doors having door closers and/or exit devices. All ball-bearing hinges shall have flush tips.
- D. All hinges on exterior doors shall be provided with non-removable pins and security studs.

- E. Hinges shall be 630 (brush finished) stainless steel unless otherwise specified in the finish hardware schedule.
- F. Hinges and sizes shall be as follows:

Door Thickness, inches	Door Width, inches	Hinge Width	Hinge Height, inches
1-3/8	36 and under	Reg. Wt., interior use only	3-1/2
1-3/8	37 and over	Reg. Wt., interior use only	4
1-3/4	30 and under	Reg. Wt., interior use/ exterior use	4-1/2
1-3/4	30 to 39	Reg. Wt., interior use Hvy. Wt., exterior use	4-1/2
1-3/4	40 and over	Reg. Wt., 4 ball bearing, interior use Hvy. Wt., 4 ball bearing, exterior use	4-1/2

- G. Hinges shall be plain bearing type (regular weight) conforming to BHMA No. A 2133; ball bearing hinges (regular weight) conforming to BHMA No. A 2112 or No. A 5112; and/or ball bearing hinges (heavy weight) conforming to BHMA No. A 2111 or No. A 5112. Hinge manufacturers design options such as 3-knuckle hinges and concealed ball bearing hinges are acceptable. Plain hinges shall be provided with self-lubricating bushings.

2.06 OVERHEAD CLOSERS

- A. All overhead closers shall be the product of one manufacturer. Closers shall have high-strength cast-iron cases with rectangular covers, adjustable spring power and adjustable back-check, and full rack and pinion action. Closers shall have back-check regulating screws, with separate screws for closing and latching speeds.
- B. Surface door closers shall be spray painted to match door hardware.
- C. Soffit shoes shall be provided where corner brackets or regular arm closers are not used and where they are necessary for proper function of the hardware.
- D. Where door closers or other items have lever or similar arms, attachment to doors shall be with sex bolts only.
- E. Closers for out swinging exterior doors shall be top-jamb-mounted and furnished with adapter plates for doors under 7 feet 6 inches in height. If necessary, closers may be mounted on drop brackets on doors above 7 feet 6 inches in height.
- F. Closers shall be:
 1. Corbin Russwin DC6000;
 2. Sargent 250; LCN 4040; or
 3. Approved Equal.
- G. The Contractor and its hardware manufacturer shall be responsible to provide the right arm with the closers. Arms shall be parallel with the closed door whenever possible.
- H. Closers shall be provided with sex bolts for fastening through doors, frames and transoms.

2.07 LOCKSETS AND LATCHSETS

- A. All locksets and latchsets shall be mortise type with anti-friction 2 piece latchbolts with a minimum 3/4-inch-throw and 1-inch-throw dead bolts with hardened roller inserts. Locksets and latchsets at fire rated doors shall meet code requirements and shall be modified as necessary. All locksets, latchsets, privacy sets, and passage sets shall be provided with lever handles conforming to handicapped person requirements unless specified elsewhere. All locksets and latchsets shall be provided with satin stainless steel finish 630 (US 32D) unless otherwise specified.
- B. Function of locksets or latchsets shall be appropriate for doors use. Lever type hardware shall meet handicapped accessibility requirements. Provide Corbin Russwin ML2000 (NSF trim); Sargent 8100 (LNL trim); or Schlage L9000 (06A trim).
- C. The hardware face plate design shall be coordinated with doors provided.
- D. Mortise deadlocks shall be of weight and quality comparable to locksets and latchsets specified.
- E. Lock strikes shall be boxed type of sufficient length and having curved lips to protect the trim and jambs and be so shaped as to avoid the possibility of tearing clothing. All strikes shall be provided with metal strike boxes.
- F. All locks shall be provided with the same cylinder and keyway for master keying. They shall be the product of the same manufacturer as the locksets unless otherwise specified. The correct cylinders with all necessary modifications and components such as cams, collars, rings, retainers, plates, fasteners, etc., shall be provided for other specialty hardware such as exit devices, store front locksets, and sliding door locks where the hardware manufacture specified is different than cylinder manufacturer.
- G. Padlocks shall be heavy duty type, keyed as directed and shall be of same manufacturer as locksets.

2.08 EXIT DEVICES

- A. All exit devices shall be the product of one manufacturer. The design of outside trim, inside trim, and crossbar shall match. Exit device shall be (wherever possible) constructed of stainless steel unless otherwise specified. The finish shall be 630 (US 32D) satin finish stainless steel unless otherwise specified. Exit devices shall be UL labeled and shall be of corrosive-resistant hardware.
- B. The exit devices shall have side-mounted crossbars unless otherwise specified. They shall be provided with stainless steel lever arms and investment-cast cases. Where bronze or aluminum lever arms are required they shall be drop-forged with pressure-cast cases.
- C. The exit devices shall be provided with stainless steel latch bolt, tailpiece, latch bolt retractor and axle, compression springs, cylinder cam, and lever arm operating stand. Tail piece shall be cadmium plated steel of not less than 3/8-inch diameter. The cylinder shall be retained in the case by a threaded bronze ring. All other interior working members shall be drop-forged bronze. The back plate shall be constructed of stainless

steel and screws, pins, socket head retaining screws, and other fasteners shall be stainless steel unless otherwise specified.

2.09 HOLDERS

- A. Overhead type door holders shall be concealed type of correct size for door, 90 degree openable unless 180 degree opening shown, and allowing for checkmating. Interior doors shall be provided with overhead stops if wall type stops cannot be used and floor stops make a tripping hazard. Finish shall be chrome plated bronze with satin finish, US 26D, unless otherwise specified.
- B. Concealed Overhead Door holders shall be FS type 1164 or Glynn-Johnson 320 Series.
- C. Surface Overhead Door holders shall be FS type 1161 or Glynn-Johnson 90M Series.

2.10 COORDINATORS

- A. Provide coordinator device on all pairs of doors required or specified to have automatic flush bolts, or panic exit devices. Comply with UL, List of Inspected Fire Protection Equipment and Material, and NFPA 80 requirements
- B. Provide manufacturer's standard units equipped with a safety release mechanism which allows the active leaf to close if under extreme pressure and whose active door lever, located nearest the active doorstop, holds the active door ajar until the trigger mechanism is released to the retracted position by the closing of the inactive leaf.
- C. ANSI/BHMA: A156.3, BHMA 5.1, Type 21A.

2.11 SILENCERS

- A. All interior doors shall be provided with rubber silencers, 3 for each single door and 2 for each pair of doors. Silencers or mutes shall be GJ 64 or Sargent 3446.

2.12 WALL STOPS

- A. Cast bronze extra heavy-duty wall mounted doorstop, one per leaf.
- B. Convex rubber bumper.
- C. ANSI/BHMA: A156.16, L12101.

2.13 THRESHOLDS

- A. All doors so detailed shall receive a threshold similar to that specified with a maximum of 1/2-inch rise at entry ways. Return miters shall be furnished at thresholds on floor closers.
- B. ANSI/BHMA: A156.21, J12100.

2.14 WEATHERSTRIPPING AND SEALS

- A. Weatherstripping and seals shall be as manufactured by:

1. Pemko Manufacturing Co.;
 2. National Guard Products Inc.;
 3. (NGP); Zero International Co.; or
 4. Approved Equal.
- B. Provide heavy-duty automatic drop-seal sound-stripping door-bottom unit of manufacturer's standard design, with operating seal bar of the following material, retained in an extruded metal bar and capable of operating to close a 3/4-inch gap (from door bottom to floor or threshold). House mechanism and operating bar in the following metal housing, for mounting in doors as follows.
1. Housing: Extruded aluminum, 0.062-inch thick, with mill aluminum finish.
 2. Seal: Closed-cell extruded silicone.
 3. Mounting: Full-mortise.
 4. ANSI/BHMA: A156.22, R3E344.
- C. Exterior doors (except for roll-up doors and entrance doors) shall have head, jambs, and astragals weatherstripped with not less than 5/16-inch by 5/8-inch closed cell, neoprene sponge rubber, unless otherwise specified or shown.
- D. Interior doors shall have head, jambs, and astragals sealed with self-adhesive bubble configuration door seal designed against smoke, air, sound, and weather infiltration. The seals shall be fire tested and labeled as a gasketing for use on steel frames with wood or steel doors for 20-minutes C-label, 1 hour B-label, and 1-1/2-hour B-label doors. Seals shall be S88D by:
1. Pemko; #TM 181 by NGP: or
 2. Approved Equal.

PART 3 EXECUTION

3.01 GENERAL

- A. All required items of hardware, including cylinders for locks, and all fitting, adjusting, and securing of each item neatly and firmly in place, shall be in perfect working order. Any Work not in perfect working order shall form a basis for corrective measures.

3.02 HARDWARE SCHEDULE

- A. The hardware schedule is arranged for convenience of locating hardware and does not preclude in any way the requirements that all necessary hardware shall be furnished and properly installed. Hardware not specifically called out shall be similar to that required for similar uses.

3.03 HARDWARE SCHEDULE

3.04 LATCHES AND BOLTS

- A. Latches and bolts shall be installed to automatically engage in keepers, whether activated by closers or by manual push. In no case should additional manual pressure be required to engage latch or bolt in keepers.

3.05 CLOSERS AND HINGES

- A. Closers and hinges shall be carefully adjusted to operate the doors noiselessly and evenly, and hinges shall be installed so as not to bind. Closers, closer arms, and hold-open arms shall be attached with sex bolts.
- B. Except at exterior doors, closers shall not be mounted on corridor or vestibule side of door.

3.06 WEATHERSTRIPPING AND SEALS

- A. All doors shall be provided with weatherstripping or seals unless mutes, product weatherstripping or other special seals are specified. Whenever two types of seals are shown on the Finish Hardware Schedule on a given door they both are to be provided.

3.07 PROTECTIVE TAPE AND COATINGS

- A. The Contractor shall provide a strippable coating or removable tape protection or other approved means to prevent any damage or staining of hardware during construction. Such protective measures shall be removed prior to final cleaning and the hardware polished before City's acceptance of project.

3.08 HARDWARE SCHEDULE

Injection Well Pump Station:

- a) Door No. 101B, 101C, S1A, S2A, 201A, 201B, 203A, 301A, 301C, and R1 – Single Doors
 - a. Mortise Hinges
 - b. Panic Exit Devices
 - c. Overhead, Surface-Mounted Door Closers
 - d. Heavy – Duty, Concealed Overhead Holders and Stops (exterior doors only)
 - e. Stripping and Seals
 - f. Threshold
 - g. Wall Stops (201A, 203A, 301A, and 301C)
- b) Door No. 203B– Single Door
 - a. Mortise Hinges
 - b. Lockset (function selection shall be determined during shop drawing review)
 - c. Overhead, Surface - Mounted Door Closer
 - d. Wall stop

Injection Well Electrical Service Center:

- a) Door No. 101A, 102A, 102D, 102E, 104A, 104B, 105A, 105C, 105D – Single Doors
 - a. Mortise Hinges
 - b. Panic Exit Devices
 - c. Overhead, Surface-Mounted Door Closers
 - d. Heavy – Duty, Concealed Overhead Holders and Stops (exterior doors only)
 - e. Stripping and Seals
 - f. Threshold

- b) Door No. 101B, 101C, 103A, 107A, 108A, and 109A – Double Doors
 - a. Mortise Hinges
 - b. Panic Exit Devices (both door leafs)
 - c. Overhead Surface – Mounted Door Closers (both door leafs)
 - d. Heavy Duty, Concealed Overhead Holders and Stops (both door leafs)
 - e. Astragal
 - f. Coordinator
 - g. Dust Proof Strikes
 - h. Stripping and Seals
 - i. Threshold

END OF SECTION

SECTION 08 81 00

GLASS GLAZING

PART 1 GENERAL

1.01 SUMMARY

A. Scope

1. Contractor shall provide all labor, materials, tools, equipment and incidentals as shown, specified and required to furnish and install glass and glazing.
2. Extent of glass and glazing is shown.
3. Types of products required include the following.
 - a. Low-E, tinted, fully tempered, insulating, float glass.
 - b. Structural and non-structural glazing sealants.
 - c. Miscellaneous glazing, spacers, tapes and other materials.

B. Performance Requirements: For glass performance, manufacture, size, type, construction and thickness, comply with the following

1. Provide glass and glazing systems capable of withstanding normal thermal movements and wind and impact loads without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants (both structural and weather-resisting) to remain watertight, airtight and to maintain structural performance characteristics specified; deterioration of glazing materials; or other defects in construction.
2. Normal Thermal Movement: Provide glass that allows for thermal movements resulting from a maximum temperature range of 120° F in ambient and 180° F surface temperature acting on glass framing members and glazing components. Base structural performance calculations on surface temperatures of materials caused by both solar heat gain and nighttime-sky loss.
3. Comply with requirements of Consumer Product Safety Commission, Part 1201, Safety Standards for Architectural Glazing Materials, for all the Work.
4. Structural Performance: Provide structural calculations for analysis of required glass thicknesses for glass lites shown, that are used to establish final fabricating and detailing requirements. Indicate compliance with the following minimum criteria for all glass shown
 - a. Project Wind Speed: Reference Sheet S-0000-001 and the other governing authorities having jurisdiction at the Site.
 - b. Importance Factor: Category 1; $I_w = 1.15$; Design Factor: 1.15.
 - c. Exposure Category: Exposure C; $C_e = 1.13$.
 - d. Wind Stagnation Pressure: $q_s = 12.6$ psf.
 - e. Long-Duration Loading: One month.
 - f. Short-Duration Loading: Sixty seconds, based on three-second gust speed.
 - g. Probability of Breakage for Vertical Glazing: Eight lites per 1,000 under wind action.
 - h. Maximum Lateral Deflection: For glass supported on all four edges, provide thickness required to limit center deflection at design wind pressure to 1/50 times the short side length or 1-inch, whichever is less.

5. Glass thicknesses shown are minimums. Confirm glass thicknesses by analyzing Project structural loadings and in-service conditions using Supplier's recommended load tables and other structural performance criteria specified. Where Supplier's load tables indicate acceptability of lesser thickness material than required by performance criteria specified, provide specified thicknesses and features as a minimum. Where load tables indicate the need for greater thickness, or additional features, than specified, provide greater thicknesses and features at no additional cost to the City. Comply with practice for determining minimum thickness and types of glass, to resist loadings required by governing authorities having jurisdiction at the Site, according to ANSI/ASTM E 1300.
6. Test sealant in accordance with sealant supplier's recommendations.
7. Glazing Sealant System Compatibility
 - a. Glazing sealants shall be compatible with the channel surfaces, joint fillers, insulating glass sealing system, laminated glass interlayer material and other materials in contact with the glazing channel in compliance with ASTM C 1087.
 - b. Provide insulating glass secondary sealant system compatible with structural silicone glazing system and in compliance with ASTM C 1249.
 - c. Provide only materials specified and Supplier's recommended variation of the specified materials, which are known to be fully compatible with the actual installation conditions, as shown by Supplier's published data or certification submitted to Engineer for approval.
8. Adhesion of Elastomeric Joint Sealants: Comply with ASTM C 793 and ASTM C 794.
9. Center-of-Glass U-Values: NFRC 100 methodology using LBL-35298 WINDOW 4.1 computer-aided software design, expressed as Btu/square foot by height by degree F.
10. Center-of-Glass Solar Heat Gain Coefficient: NFRC 200 methodology using LBL-35298 WINDOW 4.1 computer-aided software design.
11. Solar Optical Properties: NFRC 300.

C. Definitions

1. Interspace: The space between lites of an insulating glass unit that contains dehydrated air or a specified gas.
2. Deterioration of Coated Glass: Defects that develop from normal use, that are attributed to the manufacturing process, and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to Supplier's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.
3. Deterioration of Laminated Glass: Defects that develop from normal use, that are attributed to the manufacturing process, and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to Supplier's written instructions. Defects include edge separation, delamination materially obstructing vision through glass or structural performance or safety of units; blemishes exceeding those allowed by specified laminated glass standards; and cracking, crazing or color change of films concealed in the lamination.
4. Deterioration of Insulating Glass: Failure of the hermetic seal under normal use that is attributed to the fabricating process or incompatibility of sealants or mishandling during installation, and not to causes other than glass breakage and practices for maintaining and cleaning glass contrary to Supplier's written instructions. Evidence

of failure shall include the obstruction of vision by dust, moisture, or film on interior surfaces of insulating glass.

D. Coordination

1. Review installation procedures under this Section and other sections and coordinate the installation of items that must be installed with, or before, the glass and glazing work.

1.02 QUALITY ASSURANCE

A. Reference Codes and Standards

1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
AAMA 800	Voluntary Specifications and Test Methods for Sealants
ANSI Z97.1	Safety Glazing Materials Used in Buildings
ANSI/ASTM E 774	Specification for Classification of the Durability of Sealed Insulating Glass Units.
ANSI/ASTM E 1300	Practice for Determining Load Resistance of Glass in Buildings
ASCE 7	Minimum Design Loads for Buildings and Other Structures
ASTM C 509	Specification for Elastomeric Cellular Performance Gasket and Sealing Material.
ASTM C 719	Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants under Cyclic Movement (Hockman Cycle)
ASTM C 793	Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants
ASTM C 794	Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants
ASTM C 864	Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
ASTM C 920	Specification for Elastomeric Joint Sealants
ASTM C 1021	Practice for Laboratories Engaged in Testing of Building Sealants

Reference	Title
ASTM C 1036	Specification for Flat Glass
ASTM C 1048	Specification for Heat-Treated Flat Glass-Kinds HS, Kind FT Coated and Uncoated Glass
ASTM C 1087	Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems
ASTM C 1115	Specification for Dense Elastomeric Silicone Rubber Gaskets and Accessories.
ASTM C 1172	Specification for Laminated Architectural Flat Glass
ASTM C 1249	Guide for Secondary Seal for Sealed Insulating Glass Units for Structural Sealant Glazed Applications
ASTM C 1281	Specification for Preformed Tape Sealants for Glazing Applications
ASTM C 1330	Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants
ASTM D 412	Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension
ASTM D 624	Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
ASTM D 2240	Test Method for Rubber Property-Durometer Hardness
ASTM E 548	Guide for General Criteria Use for Evaluating Laboratory Competence
16 CFR	Consumer Product Safety Commission, CPSC Part 1201, Safety Standard for Architectural Glazing Materials
GANA	Glazing Manual
GANA	Laminated Glass Design Guide
GANA	Glass Tempering Division, GTA 95-1-31, Specification for Decorative Architectural Flat Glass
LBL-35298 Window 4.1	A PC Program for Analyzing the Thermal Performance of Fenestration Products
NFPA 80	Standard for Fire Doors and Fire Windows
NFPA 252	Standard Methods of Fire Tests of Door Assemblies
NFPA 257	Standard on Fire Tests for Window and Glass Block Assemblies
NFRC 100	Procedure for Determining Fenestration Product U-Factors
NFRC 200	Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence
NFRC 300	Procedures for Determining Solar Optical Properties of Simple Fenestration Products
NGA	Glazier Certification Program
PGMC	Primary Glass Manufacturers Council - Specifiers' Guide to Architectural Glass
SIGMA TM-3000-90	Vertical Glazing Guidelines and TB-3001-90, Sloped Glazing Guidelines
Underwriters' Laboratories, Inc	UL Building Materials Directory

- B. Warranty
1. A warranty for the products specified under this Section shall be provided in accordance with the General Conditions. The Warranty shall be for one (1) year from the date of the Notice of Substantial Completion certificate issued for the Work. If extended warranties are required, a special paragraph calling for an extended warranty will be included in this Section.
 2. Special Warranties 1
 - a. The special warranties specified in this Section shall not deprive the City of other rights or remedies the City may otherwise have under the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under the Contract Documents.
 3. Special Warranties 2
 - a. Laminated Glass: Provide written warranty, signed by the Supplier and Contractor and running to benefit of the City, agreeing to replace, for a period of five (5) years from the date of the Notice of Substantial Completion certificate issued for the Work, glass units that show deterioration, as specified.
 - b. Insulating Glass: Provide written warranty, signed by the Supplier and Contractor and running to the benefit of the City, agreeing to replace, for a period of ten (10) years from the date of the Notice of Substantial Completion certificate issued for the Work, glass that shows signs of deterioration, as specified.
 - c. Structural Silicone: Provide structural silicone Supplier's twenty (20)-year limited adhesion warranty and non-staining warranty for silicone structural adhesive, commencing from the date of the Notice of Substantial Completion certificate issued for the Work. Perform all testing required to achieve the warranties.
- C. Primary Glass Supplier and Glazing Materials Supplier Qualifications
1. Provide glass and glazing materials manufactured by firms specializing in the production of the types of glass and glazing products specified, in compliance with specified standards.
 2. Provide glass from Suppliers who are members of GANA and PGMC and participate in certification programs.
 3. Obtain glass and glazing materials from Suppliers who will send a qualified technical representative to the Site, for the purpose of advising the installer of proper procedures and precautions for the use of the materials and who will assist Engineer with opinions on the acceptability of materials and the Work.
- D. Installer's Qualifications
1. The installer of the glass and glazing materials shall be a firm with documented skill and successful experience in the installation of the types of materials required and who agrees to employ only tradesmen who are trained, skilled and have successful experience in the types of materials and glazing systems specified and who are certified under the National Glass Association Glazier Certification Program as Level 3 (Master Glaziers).
 2. Submit records of experience and certifications to Engineer.
- E. Glass Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing specified, as documented according to ASTM E 548.

- F. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct testing specified, as documented according to ASTM E 548.
- G. Source Limitation: All materials provided under this Section shall be obtained from a single supplier or suppliers who, with Contractor, shall assume full responsibility for the completeness of the Work. The Supplier shall be the source of information on all material furnished regardless of the manufacturing source of that material.
- H. Regulatory Requirements
 - 1. Wherever a fire resistance-rating classification is shown or scheduled for doors or windows, (1 hour, 2 hour, 3 hour), provide glass complying with the requirements specified and established by UL, NFPA and other governing authorities having jurisdiction at the Site.
 - 2. Safety Glass: Comply with ANSI Z97.1, with label on each piece of glass as required by governing authorities having jurisdiction.
- I. Codes: Comply with applicable requirements of codes referenced in Section 01 42 19 - Reference Standards.

1.03 ENVIRONMENTAL CONDITIONS

- A. Product in this Section shall be subjected to environmental conditions in accordance with Section 01 11 80 - Environmental Conditions.

1.04 SUBMITTALS

- A. Preconstruction/Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.
 - 1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification Sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.
 - 2. 12 inch square samples of each type of glass required.
 - 3. Insulating glass samples need not be hermetically sealed, but edge construction, wavelength-selective interlayer and low-E coatings shall be included and identified. Include specially prepared samples with each interlayer film product's identity marked on film and incorporated into sample.

4. Submit 12-inch long samples of each color for each type of exposed-to-view glazing sealant and gasket. Install sample between two strips of material similar to, or representative of, channel surfaces where sealant or gasket will be used, held apart to represent typical joint widths.
5. Review of samples by Engineer will be for color, texture and pattern only. Compliance with other requirements is the responsibility of Contractor.
6. Shop Drawings: Submit the following
 - a. Copies of Suppliers' specifications, "spec-data" sheets, installation instructions for each type of glass, glazing sealant or compound, gasket and associated miscellaneous material and all recommended installation precautions for required materials and components, which are not included in other submittals, specified in other specification sections. Coordinate the submittal of such other data with this submittal, and with the submittal of samples required by other sections.
 - b. Delegated Design: structural performance calculations indicating that detailing and fabrication have been based on the results of the required analysis and performance criteria specified. Calculations shall be prepared, signed and stamped with the seal of a Registered Professional Engineer, licensed to practice in the State of Florida, and recognized as an expert in the required work.
 - c. Plans and elevations showing location of each type and kind of glass specified and details of glazing system. Include Supplier's recommendations for glazing.
 - d. Supplier's guarantees, as specified.
 - e. Supplier qualifications.
 - f. Installer's qualifications.
 - g. Age of silicone sealant.
 - h. Certification that fabricated products comply with Supplier's published performance.
 - i. Dimensions and details of Supplier's glue line thickness and bite dimensions and verifications.
7. Test Reports
 - a. Certified laboratory test reports for required performance tests in compliance with ASTM E 548.
 - b. Delegated Design; structural silicone sealant performance features and calculations indicating sealant joints have been detailed and fabricated in compliance with silicone sealant supplier's recommended guidelines for dissimilar metal adhesion. Structural and other performance calculations for the structural silicone joints shall be prepared, signed and stamped with the seal of a Registered Professional Engineer, licensed to practice in the State of Florida, and recognized as an expert in the required work.
 - c. Adhesion and compatibility test report from glazing sealant supplier indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.
8. Certificates of Compliance
 - a. Certification that all glass materials subject to the applicable standards of the CPSC are in compliance. The certification shall be issued in conformance with procedures stated in the standard.

- b. Include primary glass supplier's published data, and letters of certification, based on certified test laboratory reports, indicating that each material complies with specified requirements and is acceptable for the applications shown.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

A. Suppliers

1. The Engineer and the City believe that the Suppliers indicated in this Section are capable of producing products, which will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular Supplier or product, nor shall it be construed that a named Supplier's standard product will comply with the requirements of this Section.

B. Supplier Qualifications

1. Provide laminated and insulating glass fabrications from suppliers who are licensed by primary glass supplier to produce specified units and with documented skill and successful experience in this type of work and who agree to employ only tradesmen who are trained, skilled and have successful experience in this type of work.
2. Provide laminated and insulating glass fabrications from suppliers who are members of GANA or SIGMA and participate in certification programs.
3. Obtain laminated and insulating glass fabrications from suppliers who will, if required, send a qualified technical representative to the Site, for the purpose of assisting Engineer with opinions on the acceptability of materials and installation methods.

2.02 GLASS

A. Low-E, Tinted, Fully Tempered, Insulating, Float Glass Units: For all exterior doors and windows.

1. Insulating Glass Units: Provide preassembled units consisting of two lites of glass separated by a dehydrated interspace, and complying with ASTM E 2190 for Class C units, permanently and hermetically sealed together at edges with spacers and sealant.
2. System Sealing: Dual seal with polyisobutylene primary sealant and silicone secondary sealant, complying with ASTM C 1249.
3. Overall Unit Thickness: 1 inch.
4. Thickness of Each Glass Lite: 1/4 inch.
5. Outdoor Lite: Tinted, fully tempered, float glass, Kind FT.
6. Interspace Content: Argon.
7. Indoor Lite: Clear, Low-E, fully tempered, float glass; Kind FT.
8. Low-E Coating: Pyrolytic on third surface.
9. Visible Light Transmittance: 36 percent minimum.
10. Winter Nighttime U-Factor: .29.
11. Summer Daytime U-Factor: .28 maximum.
12. Solar Heat Gain Coefficient: 0.40, maximum.
13. Light to Solar Gain Ratio: 1.78

14. Shading Coefficient: 0.40.
15. Outdoor Visible Light Reflectance: 7 percent.
16. Provide safety glazing labeling.
17. Products and Suppliers: Provide one of the following:
 - a. Sungate 500, OptiGray, Fully Tempered, Insulating Glass by PPG Industries, Incorporated;
 - b. Energy Advantage, Gray, Fully Tempered, Insulating Glass by Pilkington North America, Incorporated; or
 - c. Approved Equal.

2.03 GLAZING SEALANTS, TAPES AND GASKETS

- A. Colors: Provide black or other natural color wherever no other color is available. Wherever material is not exposed-to-view, provide Supplier's standard color, which has the best overall performance characteristics for the application shown.
 1. Provide Supplier's standard colors as shown or, if not shown, provide color selected by Engineer from Supplier's standard colors to either blend or contrast with adjoining surfaces.
 2. Hardness specified is intended to indicate the general range necessary for overall performance. Submit glazing and sealant supplier's recommendations for actual hardness for each condition of installation and use. Except as shown or specified, provide glazing materials within the following ranges of hardness (Shore A, fully cured, at 75 °F)
 - a. 15 to 35 for elastomeric compounds and tapes used with rigid stops and frames for large glass sizes (in excess of 100 united inches). Provide material sufficiently hard to withstand exposure to abrasion and vandalism.
 - b. 25 to 50 for rubber like curing compounds used with rigid stops and frames for medium and small glass sizes (less than 100 united inches). Provide materials sufficiently hard to withstand impact of moving sash and doors.
 - c. 35 to 60 for molded gaskets used with rigid stops and frames, depending upon strength needed for application or insertion of units.
 - d. 75 to 80 for structural gaskets (not supported by stops).
 - e. Non Elastomeric Compounds: (Shore A not applicable) 2 to 12 mm penetration for 5.0 seconds of penetrometer needle on nominally cured compound, complying with ASTM D 2451.
 3. Provide size and shape of gaskets and preformed glazing units as recommended by the Supplier and as indicated on approved Shop Drawings.
 4. Comply with ASTM C 920 and other requirements for each liquid-applied, chemically curing sealant specified.
 5. Where additional movement capability is specified, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement, in compliance with ASTM C 719, to withstand the specified percentage change in the joint width existing at the time of installation and remain in compliance with other requirements in ASTM C 920 for uses shown.

- B. Preformed Butyl Rubber Back-Bedding Mastic Glazing Tape
 - 1. Preformed tape of polymerized butyl or mixture of butyl and polyisobutylene with inert fillers with built in spacer of synthetic rubber, solvent based with minimum 95 percent solids, non sag consistency, tack free time of 24 hours or less, paintable, non staining, complying with AAMA 806.3.
 - 2. Products and Suppliers
 - a. Polyshim II Glazing Tape by Tremco, Incorporated; or
 - b. Approved Equal.

- C. Dense Compression Wedge Gaskets
 - 1. Provide molded or extruded, closed-cell silicone wedge gaskets in compliance with ASTM C 1115, Type C.
 - 2. Products and Suppliers
 - a. Dense Silicone Wedge Gaskets SCR-900 by Tremco, Incorporated; or
 - b. Approved Equal.

- D. Exterior, One Part, Silicone Rubber Sealant
 - 1. Silicone rubber based, one part elastomeric sealant, complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT, M, G, A and O.
 - 2. Products and Suppliers: Provide one of the following
 - a. Spectrem I by Tremco, Incorporated;
 - b. 863 Architectural Silicone Sealant by Pecora Corporation; or
 - c. Approved Equal.

- E. Structural Silicone Sealant
 - 1. Provide a one-component, self-priming, shelf-stable, neutral-cure, elastomeric adhesive complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT, G and A, and specifically formulated for silicone structural glazing complying with the following as-cured physical properties, after seven days at 77 °F and 50 percent relative humidity
 - 2. Durometer Hardness, Shore A, points; ASTM D 2240: 27 to 40.
 - 3. Ultimate Tensile, ASTM D 412: 225 to 350 psi.
 - 4. Ultimate Elongation, ASTM D 412: 525 to 550 percent.
 - 5. Tear Strength, Die B; ASTM D 624: 40 to 49 ppi.
 - 6. Peel Strength, ASTM C 794: 30 to 40 ppi.
 - 7. Products and Suppliers: Provide one of the following
 - a. DOW CORNING 995 Silicone Structural Adhesive by Dow Corning Corporation;
 - b. 895 Silicone by Pecora Corporation; or
 - c. Approved Equal.

2.04 MISCELLANEOUS GLAZING MATERIALS

- A. Provide products of material, size, and shape complying with referenced glazing standards, requirements of Suppliers of glass and glazing materials for applications shown, and approved Shop Drawings. Provide materials with a proven record of compatibility with surfaces shown and specified.

- B. Setting Blocks: Elastomeric material, 80 to 90 Shore A durometer hardness, with proven compatibility with sealants used in the Work and as recommended by the glass supplier.
- C. Spacers and Edge Blocks: Elastomeric blocks or continuous extrusions, with a Shore A durometer hardness recommended by glass supplier to maintain lites in place and to limit lateral movement for installation shown, and with proven compatibility with sealants used in the Work.
- D. Cylindrical Glazing Sealant Backing: Closed cell or waterproof jacketed rod stock of synthetic rubber or plastic foam complying with ASTM C 1330, Type O (open-cell material), proven to be compatible with sealants used, flexible and resilient, with 5 to 10 psi compression strength for 25 percent deflection.
- E. Cleaners, Primers and Sealers: Type recommended by sealant, gasket and glass supplier.

2.05 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

- A. Glass supplier's recommended glazing channel dimensions are intended to provide for necessary minimum bite on the glass, minimum edge clearance and adequate sealant thicknesses, with reasonable tolerances. Contractor shall be responsible for correct glass size for each opening, within the tolerances and necessary dimensions established on approved Shop Drawings.

2.06 TOLERANCES

- A. Allowable Tolerances: Provide fully tempered and heat-strengthened glass, formed by horizontal roller-hearth process, free of tong marks, and not exceeding the following flatness tolerances (either face, any direction, any location) based on 1/4 inch glass thickness with inversely proportionate tolerances for other thicknesses
 1. For 12 inch Run: 1/16 inch bow.
 2. For 3 foot Run: 1/8 inch bow.
 3. For 7 foot Run: 1/4 inch bow.
 4. For 10 foot Run: 3/8 inch bow.

2.07 SOURCE QUALITY CONTROL

- A. To the greatest extent possible, provide each type of glass and glazing materials from one supplier.
- B. Providing insulating glass with a certified Class A rating according to SIGMA.
- C. Obtain glass and sealant test results for product test reports from qualified testing agencies regularly engaged in the business of testing glass and sealant products.

PART 3 EXECUTION

3.01 SHIPMENT AND STORAGE

- A. Product shall be shipped and stored in accordance with Section 01 66 00 - Product Storage and Handling Requirements.

- B. Supplier shall provide Contractor with detailed recommendations and instructions for product storage.
- C. Packing, Shipping, Handling and Unloading
 - 1. Deliver materials to the Site to ensure uninterrupted progress of the Work. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete in ample time to prevent delay of that Work.
- D. Storage and Protection
 - 1. Store materials to permit easy access for inspection and identification. Keep all material off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.
 - 2. Protect glass and glazing materials according to Supplier's written instructions to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
 - 3. For insulating glass that will be exposed to substantial altitude changes, comply with insulating glass supplier's written recommendations for venting and sealing to avoid hermetic seal ruptures.
- E. Acceptance at Site
 - 1. All boxes, crates and packages shall be inspected by Contractor upon delivery to the Site. Contractor shall notify Engineer, in writing, if any loss or damage exists to equipment or components. Replace loss and repair damage to new condition in accordance with Supplier's instructions.

3.02 INSTALLATION

- A. Comply with combined recommendations of glass, window and glazing products Suppliers and other materials used in glazing, except where more stringent requirements are shown or specified, and as shown on approved Shop Drawings.
- B. Comply with GANA, Glazing Manual, except as shown and specified otherwise, and except as specifically recommended otherwise by the Suppliers of the glass and glazing materials, as accepted by Engineer on approved Shop Drawings.
- C. Inspect each piece of glass immediately before installation, and remove from Site all that have observable edge damage or face imperfections.
- D. Unify appearance of each series of lights by setting each piece to match others as nearly as possible. Inspect each piece and set with pattern, draw and bow oriented in the same direction as other pieces.
- E. Cut and install tinted glass as recommended in Supplier's technical bulletin as provided on approved Shop Drawings.
- F. Install sealants as recommended by sealant suppliers, and as recommended on approved Shop Drawings.
- G. Do not attempt to cut, seam, nip or abrade glass on Site, which is tempered, heat strengthened, or coated.

- H. Do not proceed with installation of liquid glazing sealants under adverse weather conditions, or when temperatures are below or above Supplier's recommended limitations for installation.
- I. Proceed with glazing only when forecasted weather conditions are favorable to proper cure and development of high early bond strength. Wherever channel action is affected by ambient temperature variations, install glazing sealants only when temperatures are in the middle third of Supplier's recommended installation temperature range, so that sealant will not be subjected to excessive elongation or compression, and bond stress will not be excessive at extremely low or high temperatures.
- J. Coordinate the installation of the glass and glazing work with the in order to avoid delay of the Work.
- K. Tape and Sealant Glazing
 1. Place setting blocks in sill rabbets, sized and located to comply with referenced glazing publications. Set blocks in thin course of compatible sealant for heel bead. Position glass on setting blocks and press against tape for full contact.
 2. Provide spacers for glass lites where the length plus width is larger than 4 foot-2 inches. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 3. Provide 1/8-inch minimum bite for spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
 4. Provide edge spacers are shown on approved Shop Drawings and as required to prevent glass lites from moving sideways in glazing channel.
 5. Cut glazing tape to length and set against permanent stops. Install horizontal strips first, extending over width of opening, before applying vertical strips.
 6. Remove paper backing from tape. Place glazing tape on free perimeter of glass. Install tapes continuously. Do not stretch tape to make them fit openings. Place joints in tapes at corners of openings with adjoining lengths butted together, not lapped. Seal butt joints of tape with joint sealant.
 7. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
 8. Install removable stop, avoiding displacement of tape, and exert pressure on tape for full continuous contact. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops. Caulk space above glazing tape to top of glazing stop. Tool exposed surfaces of sealant compounds to provide a substantial "wash" away from the glass.
 9. Clean and trim excess glazing materials from the installation, and eliminate stains and discolorations.
 10. Where wedge shaped gaskets are driven into one side of the channel to pressurize the sealant or gasket on the opposite side, provide adequate anchorage to ensure that gasket will not "walk" out when subjected to dynamic movement. Anchor gasket to stop with matching ribs, or by proven adhesives, including embedment of gasket

tail in cured heel bead. Do not exceed edge pressures stipulated by glass suppliers for installing glass lites.

11. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended on approved Shop Drawings and to prevent corners from pulling away; seal corner joints and butt joints with sealant as recommended by gasket Supplier and as shown on approved Shop Drawings.
- L. Dry Gasket Glazing: Install glass in gaskets as recommended by the glass and window Supplier. Refer to Section 08 11 16 - Aluminum Doors and Frames, and 08 51 13 - Aluminum Windows.
- M. Structural Sealant Glazing: Install glass using a system of structural silicone sealants as recommended by the glass and sealant suppliers
- N. Cure glazing sealants and compounds in compliance with Supplier's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability.
- O. The installer shall advise Contractor of procedures required for the protection of glass and glazing sealants and compounds during the construction period, so that they will be without deterioration or damage, other than normal weathering, at the time of Substantial Completion.
- P. Furnish specific instructions on the precautions and provisions required to prevent glass damage resulting from the alkaline wash from concrete surfaces and similar sources of possible damage.
- Q. Protect exterior glass from breakage immediately upon installation, by attachment of crossed streamers to framing held away from glass. Do not apply markers of any type to surfaces of glass.
- R. Remove and replace glass, which is broken, chipped, cracked, abraded or damaged in other ways during the construction period, including natural causes, accidents and vandalism.
- S. Maintain glass in a reasonably clean condition during construction, so that it will not be damaged by corrosive action and will not contribute (by wash off) to the deterioration of glazing materials and other portions of the Work.
- T. Remove non-permanent labels and wash and polish glass on both faces not more than four days prior to Substantial Completion. Comply with glass supplier's recommendations for cleaning.
- U. Inspection
 1. Examine the framing and glazing channel surfaces, backing, removable stop design, and the conditions under which the glass and glazing is to be performed, and notify Engineer, in writing, of any conditions detrimental to the proper and timely completion of the Work. Do not proceed with the glazing until unsatisfactory conditions have been corrected in a manner acceptable to Engineer.

V. Preparation

1. Clean the glazing channel, or other framing members to receive glass, immediately before glazing. Remove coatings, which are not firmly bonded to the substrate. Remove lacquer from metal surfaces wherever elastomeric sealants are used.

- W. Apply primer or sealer to joint surfaces wherever recommended by sealant and glass supplier.

3.03 FIELD TESTING AND COMMISSIONING

- A. The Supplier shall provide detailed procedures for Field Testing and Commissioning for the products specified in this Section.
- B. Field Testing and Commissioning shall be performed under the direction of experienced and qualified personnel provided by the Supplier.
- C. Watertight and airtight installation of each piece of glass is required, except as otherwise shown. Each installation must withstand normal temperature changes, wind loading, impact loading (for operating sash and doors) without failure of any kind including loss or breakage of glass, failure of sealants or gaskets to remain watertight and air tight, deterioration of glazing materials and other defects in the Work.
- D. After nominal cure of exterior glazing sealants, which are exposed to the weather, test for water leaks. Flood the joint exposure with water directed from a 3/4 inch hose held perpendicular to wall face, 2 foot 0 inches from joint, connected to a water system with 30 psi minimum normal water pressure. Move stream of water along joint at an approximate rate of 20 foot-0 inches per minute.
- E. Test approximately five percent of total glazing system, in locations which are typical of every joint condition, and which can be inspected easily for leakage on opposite face. Conduct tests in the presence of Engineer, who will determine the actual percentage of joints to be tested and the actual period of exposure to water from the hose, based upon the extent of observed leakage, or lack thereof.
- F. Repair glazing installation at leaks or, if leakage is excessive, replace glazing sealants as directed by Engineer.
- G. Wherever nature of observed leakage indicates the possibility of inadequate glazing joint bond strength, Engineer may direct that additional testing be performed at a time when joints have been fully cured, followed by natural exposure through both extreme temperatures, and returned to the range of temperature in which it is feasible to conduct testing. Repair or replace the Work as required and directed by the Engineer

END OF SECTION

SECTION 08 91 19
FIXED LOUVERS

PART 1 GENERAL

1.01 SUMMARY

- A. Scope
 - 1. This Section specifies intake and exhaust air louvers and accessories.
- B. Performance and Design Requirements
 - 1. Louver shall be suitable for air supply or discharge service and shall be sized as shown.

1.02 QUALITY ASSURANCE

- A. Reference Codes and Standards
 - 1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
 - 2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
AA 45	Designation System for Aluminum Finishes
AMCA Standard 500	Test Methods for Louvers, Dampers, and Shutters
ASTM B221	Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
ASTM C1071	Standard Specification for Thermal and Acoustical Insulation (Mineral Fiber, Duct Lining Material)

- B. Certification
 - 1. Louvers shall bear the AMCA certified ratings seal for both air performance and water penetration

C. Design Requirements

1. Louvers shall comply with the Florida Building Code and meet the design pressures shown on the Plans and meet the Impact Standards, in compliance with Florida Building Code (FBC) High Velocity Hurricane Zones (HVHZ) Protocols and required product Notice of Acceptance (NOA) or Florida statewide product approval.

1.02 ENVIRONMENTAL CONDITIONS

- A. Product in this Section shall be subjected to environmental conditions in accordance with Section 01 11 80 – Environmental Conditions.

1.03 SUBMITTALS

- A. Preconstruction/Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.

1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.

2. Product Data
 - a. Certified results of pressure drop test data and water penetration data for all louvers.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

A. Suppliers

1. The Engineer and the City believe that the following Suppliers are capable of producing equipment and products, which will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular Supplier or product, nor shall it be construed that a named Supplier's standard product will comply with the requirements of this Section.
2. Candidate Suppliers include the following:
 - a. Construction Specialties,
 - b. Airolite,

- c. Ruskin, or
- d. Approved Equal.

B. Supplier Qualifications

- 1. The Supplier shall have five (5) years of experience manufacturing and installing fixed louvers in similar-sized projects.

2.02 MATERIALS

- A. Materials used for the construction of the equipment provided under this specification shall be as follows:

Component	Material
Blades	ASTM B221, 6063-T52 extruded aluminum alloy
Frame	ASTM B221, 6063-T52 extruded aluminum alloy
Fasteners	Stainless steel
Bird screen	Stainless Steel

2.03 EQUIPMENT FEATURES

A. Blades

- 1. Furnish 6 inch fixed louvers. Blades shall be of the fixed, drainable type with interlocking blade braces to provide an uninterrupted horizontal line. Blades for all louvers shall be minimum 0.081 inch thick. Slideable interlocked mullions shall have provisions for expansion and contraction.

B. Frame

- 1. The frame shall be minimum 0.125 inch thick for all louvers. The louver frame shall be assembled by welding. The head, sill, and jamb shall be one-piece structural members and shall have an integral calking slot and retaining bead.

C. Screen

- 1. The louver shall be furnished with a removable bird screen constructed of 1/2-inch mesh stainless steel, 0.063 inch wire and secured within a 0.90 inch extruded aluminum frame. The screen shall be mounted on the interior louver face but independent of the louver.

D. Finish

- 1. Unless otherwise specified, all louvers shall receive a 215-R1, Aluminum Association Code AA-M12C22A41, clear anodized finish after assembly. Minimum coating thickness shall be 0.7 mil.

PART 3 EXECUTION

3.01 SHIPMENT AND STORAGE

- A. Equipment shall be shipped and stored in accordance with Section 01 60 00 - Common Product Requirements.

- B. Supplier shall provide Contractor with detailed recommendations and instructions for equipment storage.

3.02 INSTALLATION

- A. The louver shall be aligned, connected, and installed as specified and in accordance with the Supplier's recommendations. A bituminous coat shall be applied to all aluminum surfaces in contact with concrete or masonry.

3.03 FIELD TESTING AND COMMISSIONING

- A. The Supplier shall provide detailed procedures for Field Testing and Commissioning for the products specified in this Section.
- B. Field Testing and Commissioning shall be performed under the direction of experienced and qualified personnel provided by the Supplier.
- C. After completion of installation, all louvers with operating dampers, both manually and automatically operated, shall be completely field tested to ensure compliance with these Specifications.

END OF SECTION

SECTION 08 92 00
REMOVABLE ALUMINUM FLOOD BARRIER

PART 1 GENERAL

1.01 DESCRIPTION & GENERAL NOTES

A. Scope:

1. This section specifies removable aluminum flood barriers.

B. Work Included:

1. Provide flood barrier(s) factory assembled with frame(s) and hardware in accordance with the contract documents.
2. All Barrier heights shall be finished to 12" min. above Base Flood Elevation (BFE) unless otherwise stated by the Engineer of Record (EOR). The BFE is 5.00 feet-NAVD88. Moreover, Contractor shall provide Barrier to a height of 24" as a minimum.

C. General Notes:

1. The structural design of these Removable Flood Panels is generic and has been designed for hydrostatic hydrodynamic and impact debris flood loads with water pressures corresponding to maximum water height and flow speed of 5 ft. /sec. up to 8 ft. /sec. in order to certify minimum required flood elevation to top of Flood Panels.
2. It shall be determined, on a job by job basis, the required Panel height and flow speed for the design of Removable Flood Panels, based on FEMA's criteria (See Note #2) as well as per ASCE 24-14 Standard. Installation and construction of these Flood Panels for use within flood hazard areas shall be in accordance with the American Society of Civil Engineers Flood Resistant Design and Construction Standard SEI/ASCE 24-14.
3. Design criteria is for Type 2 Closures in chapter 7, section 70 1.1.2 of the Army Corp of Engineers, EP 1165-2-314 12/1195 and based on the 2018 Edition of the International Building Code, the corresponding provisions of ASCE 24-14, FEMA flood proofing non- residential structures manual FEMA 102, FEMA P-936 and FEMA Technical Bulletin 3-93. Design flood loads have been determined in accordance with ASCE 7-16. Design wind loads have been determined in accordance with ASCE 7-16 for 180 mph Basic Wind Speed for category 2 building. This flood barrier design criteria is for buildings in an "A" or "AE" flood zone and is not to be used in a Coastal "A" zone or high velocity "V" zone.
4. Flood barrier design have tested by an independent testing lab for water infiltration in accordance with FEMA 102 manual for flood proofing of non-residential structures, specifications Section 8, Page 70. Type 2 Flood closures or barriers are permitted allowable seepage rates. Seepage amounts will vary with building conditions encountered. ASCE 24-14 chapter 6 states "sump pumps shall be provided to remove water accumulated due to any passage of vapor and seepage of water during the flooding event." Owner acknowledges and is responsible for all drains, piping and sump pumps required to meet ASCE 24-14 requirements to offset water build up behind the barrier system.
5. Flood Panel manufacturer to install and use gaskets and approved sealants following all the recommendations and specifications of the manufacturers respectively.

6. Contractor or installer to verify all dimensions, wall and floor conditions at site before proceeding with the work, and shall notify this engineer if any discrepancy is found that would alter the structural design of these Flood Panels.
7. Existing slabs and walls adjacent to opening where Flood Panel is to be installed shall be given a surface treatment by means of water proof sealer before flood Panel is installed. Surface must be smooth, square, plumb and level.
8. Existing slabs and walls adjacent to openings where Flood Panels are to be installed shall be structurally designed by engineer of record, to sustain the same hydrostatic, hydrodynamic and impact pressures that correspond to maximum water elevation above finished floor at top of Panel.
9. Drop-in anchors embedded into concrete for removable support installation shall be covered with a cap or similar device to protect their inside hold from dust, so that machine screws can easily be installed at time of flood warning. Concrete anchors by others.
10. Separation of Panel to window/door shall be measured from back of Panel to window/door including any knob, handle, or protruding device, and shall be 2" minimum.
11. All aluminum extrusions to be 6063-T6 alloy, and 6005-T5 alloy.
12. All sheet metal screws shall be as manufactured by ITW/Buildex "TEK Screws", or equal, and to be made of non-corrosive material.
13. All bolts to be galvanized steel ASTM A-307 designation or 304 Series Stainless Steel.
14. All gaskets installed shall be neoprene per drawings.
15. All welding to conform to the American Welding Society AWS D1.2/d1.4m 2017 Regulations. Use certified welders. Use ER-5356 Electrodes for aluminum a E70 for steel.
16. The engineer or Flood Panel Manufacturer is not responsible for construction safety at site which is the owner, general contractor or installer's responsibility. Flood Panel Manufacturer to be responsible for providing the tenant with shop drawings and proper instructions for the installation of these Flood Panels.
17. Surfaces against which the sealing gasket presses must be built "paper-smooth" to prevent excessive water extrusion, beyond that allowed by requirements. All surfaces must be plumb, square and level.

1.02 STANDARDS

- A. Comply with the provisions of (as applicable):
 1. AWS Structural Welding Code D1.2/D1.4M 2017 Reg.
 2. ASTM A36, A240
 3. ASCE 7-16, ASCE 24-14, SEI/ASCE 24-14
 4. FBC Chapter 20, Section 2003.8.4.
 5. QA program that is registered to ISO 9001:2000
 6. 2018 Edition of the International Building Code
 7. FEMA 3-93, FEMA 102, FEMA P-936

1.03 SUBMITTALS

- A. The following information shall be provided in accordance with Section 01 33 00:
1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Construction Manager shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
 2. Calculations and signed and sealed drawings:
 - a. Submit calculations, approved by a qualified engineer, to verify the barrier's ability to withstand the design pressure loading, based on current building code and specified load combinations. Signed and sealed drawings and calculation set available upon request.
 3. Shop Drawings:
 - a. Submit shop drawings for flood barriers including dimensioned plans and elevations, sections, connections, and anchorage.
 4. Manufacturers Data:
 - a. Submit installation and maintenance instructions for flood barriers.
 5. Warranties:
 - a. Provide manufacturer's warranty and warranty qualification stating that flood barriers for above project will be free from defects and workmanship for a period of three (3) year from date of substantial completion.
 - b. Flood Certificate, signed final inspection by Architect or EOR of installed flood barriers and final installation pictures of each opening shall be submitted for Manufacturer to issue a warranty.
 6. Flood Certificate:
 - a. Responsibility for filing the building FEMA "Flood Proofing Certificate" is the responsibility of the Contractor.
 7. Flood Emergency Operation Plan per FEMA 3-93
 - a. Responsibility of building owner and design professional.
 8. Inspection and Maintenance Plan per FEMA 3-93
 - a. Responsibility of owner and Building Manager.

1.04 QUALIFICATIONS

- A. The manufacturer of the flood barrier(s) shall present evidence attesting to at least 5 years of successful experience in the design, manufacture, and site implementation of the flood barrier system type specified.

PART 2 PRODUCTS

2.01 ACCEPTABLE FLOOD BARRIER MANUFACTURERS

- A. Flood barriers shall be as manufactured by Flood Panel LLC or equal.

2.02 MATERIALS

- A. Aluminum Panels to be of 6005-T5.
- B. Intermediate and End Posts:
 - 1. The majority of the post is to be from grade ST37 (S235 JR) or galvanized steel with the exception of below ground supports which are to be of grade 304 stainless steel or equal.
- C. All steel to be primed with one coat Sherwin Williams Kern Flash rust inhibitive, lead free, primer, or equal.
- D. Base Gaskets to be sandwich composite combination low/high compressed set gaskets mechanically retained in the flood barriers; 40D medium compression set gaskets retained mechanically in the top of each flood barrier and low compression gaskets in the jambs and mid-span supports.

2.03 DESIGN

- A. The Flood Barrier System shall be designed for the loads and load combinations listed on the ASCE 7-16, Section 2.0 (Combinations of Loads), including the following flood loads according with ASCE 7-16 Section 5.3.3 (Loads During Flooding):
 - 1. Hydrostatic Loads, caused by water which is either stagnant or moves at velocities less than 8 ft./sec., according with ASCE 24-14, Section 6.2.1 and ASCE 7-16, Sections 5.3.3.2 and C5.3.3.2.
 - 2. Hydrodynamic Loads: Hydrodynamic loads not considered since flow of water is moving at velocities less than 8ft./sec., according with ASCE 24-14, Section 6.2.1 (Dry Flood proofing Limitations).
 - 3. Wave Loads: Only Non-breaking wave action is considered since Non-breaking waves on vertical walls can also be computed as hydrostatic forces, according with FEMA 550-2006, Section 3.4 (Wave Loads) and ASCE 7-16 Section 5.3.3.4 (Wave Loads). Breaking waves and broken waves are proper of other areas where Dry-Flood proofing is not allowed according with ASCE 24- 14, Section 6.2.1 (Dry Flood proofing Limitations).
 - 4. Impact Loads: Not considered since Hydrostatic analysis is performed for flow of water moving at velocities of less than 5 ft/sec.
- B. The Flood Barrier System shall be designed for a maximum wind load pressure of +/- 126 psf.
- C. Frame(s) and Intermediate post(s) shall have mounting holes for connecting anchors and bolts. Anchor type, size, and method dependent on load capabilities of structure.

- D. The individual Flood barrier sections shall be 3" deep by 12.25" tall with a top interlocking gasket slot system which includes gaskets and gasket channels between sections and full height in the jamb channels. Multiple barriers are to be stacked to meet or exceed the base flood elevation plus additional 12" or 24" for wave action per the job requirements and location. Embed plates may be required at the sill and jambs based on the condition at the opening and the loads imposed on the system. Jamb supports are to be continuous structural steel channels designed specifically for the Flood barrier system and are to be anchored and sealed to the condition with embeds or mechanical anchors.
- E. Dimensions and quantities:
 - 1. Height: 24" as a minimum, and 12" above BFE.
 - 2. Width: Refer to Drawings in the Injection Well Pump Station No.2 Building.
 - 3. Quantity: 1 Barrier for the Injection Well Pump Station No.2 Building.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Flood barrier(s) shall be installed in accordance with Manufacturer's instructions and approved shop drawings.
- B. Contractor to verify that all surfaces against which the sealing gasket presses must be built "paper-smooth" to prevent excessive water extrusion, beyond that allowed by requirements. All surfaces must be plumb, square, and level before installation can begin.
- C. All embed plates shall be installed using Dow Corning 995 caulk or equal or waterproof grout at back of support covering full height and width of support and producing squeeze out on all sides to assure proper seal.
- D. Existing slabs, walls, and columns adjacent to openings where flood barriers are to be installed shall be waterproofed with a waterproof membrane or a water proof sealer surface treatment prior to the installation of the flood barriers by the Contractor.
- E. All fixed mill finish aluminum supports must have a protective barrier between the support and the concrete and any dissimilar metals to prevent corrosion.
- F. Install all supports true and plumb without racking or warping.
- G. The Flood Barrier installer must provide photos of each opening during and following installation. Inspection of each opening is required per the Flood Certificate by the architect or engineer of record to verify installation compliance with the manufacturers shop drawings and installation instructions. Installer can then uninstall the barrier system and the building contractor shall move the barriers to a storage location as directed by the Building Manager or Owner.

3.02 HANDLING, CLEANING, INSPECTION, AND STORAGE

- A. Materials delivered to the site shall be unloaded and stored with minimum handling. Storage space shall be in a dry location with adequate ventilation, free from dust or water, and easily accessible for inspection and handling. Materials shall be stacked on

nonabsorptive strips or wood platforms. Doors and frames shall not be covered with tarps, polyethylene film, or similar coverings. Finished surfaces shall be protected during shipping and handling using manufacturer's standard method, except that no coatings or lacquers shall be applied to surfaces to which calking and glazing compounds must adhere.

- B. Inspect all barriers for damaged parts.
- C. Repair or replace damaged installed products and components.
- D. Touch up all damaged surfaces. Use of abrasive, caustic, or acid cleaning agents is not allowed.
- E. Clean all exposed surfaces and let dry before storing.

3.03 PROTECTION

- A. Contractor shall move all barriers to designated storage location and shall stack the barriers in a manner that does not damage the gaskets. Position all gaskets away from high traffic areas in the storage area to prevent damage to the gaskets.
- B. Protect installed product and finish surfaces from damage during handling, storage, and installation.
- C. Protect all installed product and finished surfaces during normal and general operation.

END OF SECTION

SECTION 09 51 13
ACOUSTICAL PANEL CEILINGS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Scope

1. CONTRACTOR shall provide all labor, materials, tools, equipment and incidentals as shown, specified and required to furnish and install acoustical panel ceilings. The Work also includes:
 - a. Providing openings in acoustical panel ceilings to accommodate the Work under this and other Sections and building into the acoustical panel ceilings all items to be embedded in, or penetrate, acoustical panel ceilings.
2. Extent of acoustical panel ceilings is shown.
3. Types of products include the following:
 - a. Non-directionally textured, ceramic, acoustical panel ceiling tiles.
 - b. Intermediate duty exposed acoustical panel suspension system.
 - c. Acoustical sealants.
 - d. Miscellaneous fasteners, clips, hangers, tie-wire and other accessories.

B. Coordination

1. Review installation procedures under this and other Sections and coordinate the installation of items that must be installed with, or before, the acoustical panel ceilings Work.
2. Coordinate furnishing and installing products for maintaining the fire-resistance-rating of ceiling construction at perimeters and penetrations where built-in and recessed items and transitions with other building components occur in the acoustical panel ceilings Work.
3. Notify other contractors in advance of the construction of the acoustical panel ceilings Work to provide other contractors with sufficient time for the installation of items included in their contracts that must be installed with, or before, the acoustical panel ceilings Work.

C. Related Work

1. Section 07 21 05, Building Insulation.
2. Section 07 92 00, Joint Sealants.

1.02 REFERENCES

A. Standards referenced in this Section are listed below:

1. American Society for Testing and Materials, (ASTM).
 - a. ASTM A 153/A 153M, Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - b. ASTM A 366/A 366M, Specification for Commercial Steel Sheet, Carbon, (0.15 maximum percent) Cold-Rolled.

- c. ASTM A 510, Specification for General Requirements for Wire Rods and Coarse Round Wire,
 - d. ASTM A 641/A 641M, Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
 - e. ASTM B 221, Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - f. ASTM C 423, Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
 - g. ASTM C 635, Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.
 - h. ASTM C 636, Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
 - i. ASTM C 834, Specification for Latex Sealants.
 - j. ASTM E 84, Test Method for Surface Burning Characteristics of Building Materials.
 - k. ASTM E 119, Test Methods for Fire Tests of Building Construction and Materials.
 - l. ASTM E 413, Classification for Rating Sound Insulation.
 - m. ASTM E 488, Test Methods for Strength of Anchors in Concrete and Masonry Elements.
 - n. ASTM E 580, Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels in Areas Requiring Seismic Restraint.
 - o. ASTM E 795, Practice for Mounting Test Specimens During Sound Absorption Tests.
 - p. ASTM E 1264, Classification for Acoustical Ceiling Products.
 - q. ASTM E 1414, Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum.
 - r. ASTM E 1477, Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers.
 - s. ASTM F 593, Specification for Stainless Steel Bolts, Hex Cap Screws and Studs.
 - t. ASTM F 594, Specification for Stainless Steel Nuts.
- 2. Architectural Metal Products Division of the National Association of Architectural Metal Manufacturers, (AMP).
 - a. AMP, 501, Finishes for Aluminum.
 - 3. Ceiling and Interior Systems Construction Association, (CISCA).
 - a. CISCA, Acoustical Ceilings: Use and Practice.
 - b. CISCA, Ceiling Systems Handbook.
 - 4. Underwriters' Laboratories, Inc., (UL).
 - a. UL, Fire Resistance Directory.

1.03 QUALITY ASSURANCE

- A. Installer's Qualifications:
 - 1. Engage a single installer regularly performing installation of acoustical panel ceilings with documented skill and successful experience in the installation of the types of materials required; and who agrees to employ only tradesmen who are trained, skilled and have successful experience in installing the types of materials specified.
 - 2. Submit name and qualifications to Engineer along with the following information on a minimum of three successful projects:

- a. Names and telephone numbers of owners, architects or engineers responsible for projects.
 - b. Approximate contract cost of the acoustical panel ceilings.
 - c. Amount of area installed.
- B. Testing Agency Qualifications: The independent testing agency shall demonstrate to Engineer's satisfaction, based on evaluation of criteria submitted by testing agency, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work. Submit name and qualifications to the Owner/Engineer.
- C. Regulatory Requirements:
- 1. Wherever a fire-resistance-rated construction assembly classification is shown or scheduled that includes acoustical panel ceiling assemblies (2-hour, 1-hour and similar designations), provide components complying with the applicable requirements for materials and installation established by UL, and other governing authorities having jurisdiction at the Site.
 - 2. UL Compliance: Comply with UL's "Fire Resistance Directory", for applicable fire-resistant construction systems.
 - 3. Size anchorage devices for ceiling hangers for three times supported load, except size direct-pull concrete inserts for five times supported load, for structural classification specified, complying with ASTM C 635, Table 1, Direct Hung, unless more stringent requirements are specified by governing authorities having jurisdiction at the Site and in compliance with ASTM E 488.
 - 4. Attachment Devices: Size internal attachment devices within suspended ceiling system for five times the design load indicated in ASTM C 635, Table 1, Direct Hung.
- D. Source Quality Control:
- 1. Furnish all components of each acoustical panel ceiling system from a single manufacturer and from a single supplier with adequate resources to provide products of consistent performance characteristics, physical properties and appearance, without delaying the Work.

1.04 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00.
- B. Samples: Submit the following:
 - 1. Full size samples for each acoustical panel specified. Samples shall show the full range of exposed color and texture to be expected in the completed Work.
 - 2. 12-inch long samples of each exposed runner and molding.
 - 3. Owner/Engineer review will be for color and texture only. Compliance with other requirements is the responsibility of Contractor.
- C. Shop Drawings: Submit the following:
 - 1. Copies of manufacturer's product specifications and installation instructions for each acoustical ceiling material required, and for each suspension system. Include certified laboratory test reports and other data as required to show compliance with these Specifications.

- a. Include manufacturer's recommendations for cleaning and refinishing acoustical units, including precautions against materials and methods, which may be detrimental to finishes and acoustical performances.
 2. Reflected ceiling plans of suspension systems, showing hanger, anchor and acoustical panel locations, drawn to a scale of 1/4-inch equal to 1 foot-0 inch, and details of all transitions of acoustical panels with other items such as light fixtures, air diffusers, and perimeter walls and all supporting and suspension system details, including method of attachment of suspension system hangers to building structure, drawn to a scale of 3/4-inches equal to 1 foot-0 inches.
 3. Show and coordinate locations of ceiling-mounted items, automatic fire suppression system sprinkler heads, speakers, and penetrations for other items of Work that are to be coordinated with the ceiling and show framing and support details for Work supported by the suspension system.
 4. Complete information on all anchors and supports indicating maximum resistance to tension, in compliance with performance criteria specified.
 5. Qualifications Data: Submit qualifications in accordance with paragraph 1.03:
 - a. Installer.
 - b. Testing laboratory.
- D. Test Reports: Submit the following:
1. Certify compliance with ASTM C 635 and other specified requirements and indicate structural classification of each type of suspension system.
 2. Evidence of acoustical panel ceiling system's compliance with requirements of governing authorities having jurisdiction at the Site.
 3. Certified field quality control test reports for required anchor performance tests.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Packing, Shipping, Handling and Unloading:
1. Deliver materials to the Site to ensure uninterrupted progress of the Work. Deliver anchor bolts and anchorage devices which are to be embedded, in ample time to prevent delay of that Work.
 2. Deliver accepted materials in original, unopened, undamaged, protective packaging, with manufacturer's and testing and inspection agencies labels accurately indicating brand name, pattern, size, thickness and fire-resistance-rating of packaged materials.
 3. All markings and labels shall be legible and intact.
 4. Inspect acoustical panel ceiling materials and reject components differing from accepted Samples and Shop Drawings. Immediately remove rejected components from the Site and do not incorporate into the Work.
 5. Handle materials in a manner that avoids chipping edges or damaging units in any way and as recommended by manufacturer's approved installation recommendations and the recommendations of specified standards.
- B. Storage and Protection
1. Store materials to permit easy access for inspection and identification. Keep all material off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.

2. Store materials in a fully enclosed space where they will be protected against damage and constantly within limits of manufacturer's written recommended environmental conditions.
 3. Store materials in original protective packaging to prevent soiling, physical damage or wetting.
 4. Store cartons open at each end to stabilize moisture content and temperature.
- C. Acceptance at Site:
1. All boxes, crates and packages shall be inspected by Contractor upon delivery to the Site. Contractor shall notify Engineer, in writing, if any loss or damage exists to equipment or components. Replace loss and repair damage to new condition in accordance with manufacturer's instructions.

1.06 JOB CONDITIONS

- A. Environmental Requirements
1. Before installing acoustical panels permit them to reach room temperature and a stabilized moisture content.
 2. Do not install interior acoustical panel ceilings until the space has been enclosed and is weathertight, and until installation of moisture-bearing material in the space has been completed and the space is nominally dry, and until ambient conditions of temperature and humidity are continuously maintained at levels indicated for final occupancy.
- B. Scheduling
1. Do not begin installation of acoustical panel ceilings until all Work above ceilings has been completed and accepted by the Owner's Representative.
 2. Furnish cast-in-place and built-in-place anchors and their locations, to other trades for installation well in advance of time needed for coordinating locations of acoustical panel ceiling supports with other Work that must share plenum area above acoustical panel ceilings.

1.07 EXTRA MATERIALS

- A. Extra Materials
1. At time of completing the installation, deliver stock of extra material and store in a secure area at the Site as directed by the Owner's Representative. Furnish full-size units, packaged with protective covering for storage, and identified with appropriate labels.
 2. Acoustical Panels: Furnish an amount equal to two percent of the amount installed, or at least one full package of acoustical panels.
 3. Do not provide partial packages of materials. Round-up quantities to furnish only complete, unopened and undamaged packages; with legible labels accurately representing contents of package indicating compliance with approved Samples and Shop Drawings, and matching materials actually installed.
 4. Submit quantities of each system component required for the Work, based on actual purchase order to manufacturer for materials to be used on this Project, with calculations establishing quantity of extra materials to be furnished to Owner.

PART 2 PRODUCTS

2.01 SYSTEM PERFORMANCE

A. Performance Criteria

1. General

- a. Standards: Provide manufacturer's standard acoustical panel ceiling systems that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light deflections.
 - b. References: In general, the recommendations of CISCA, "Acoustical Ceilings: Use and Practice" shall be considered part of this Section, unless otherwise specified.
 - c. Standards for Terminology and Performance: Applicable publications by the Ceiling and Interior Systems Construction Association (CISCA), including "Ceiling Systems Handbook" and ASTM C 635.
2. Noise Reduction Coefficient (NRC): The average of sound absorption coefficients when tested in accordance with ASTM C 423 for a specification range of ten points, for middle frequencies of 250, 500, 1000, and 2000 Hertz with face of test specimen mounted in compliance with ASTM C 795 for Mounting Type E-400 (400 millimeter air space) standard mounting according to ASTM E 1264. Provide not less than the following:
- a. NRC Rating: Range of 0.50, except as otherwise specified.
3. Ceiling Attenuation Class: Provide acoustical panel ceilings that have been tested for sound transmission loss through the acoustical tile ceiling, determined in accordance with ASTM E 1414 and ASTM E 413. Provide not less than the following:
- a. CAC Class: 40, for Mounting Type E-400.

2.02 CEILING PANELS

- A. General: Unless otherwise specified, provide standard lay-in panels of the type selected by Engineer. Provide sizes shown on reflected ceiling plans or, if not otherwise shown, 24-inch by 24-inch grid-size panels.
- B. Acoustical Panels
1. Acoustical Panels: Provide mineral wool panels with factory painted glass scrim surface finish, not less than 5/8-inch thick, weighing .47 pounds per square foot. Provide tegular edge (SLN) with white surface finish color.
 2. Fire-Test-Response Characteristics of Acoustical Panels: Provide acoustical panels with surface-burning characteristics complying with ASTM E 1264 for Class A materials on face side; as determined by testing identical products in compliance with ASTM E 84.
 3. Physical Properties: Provide the following:
 - a. Flame Spread, ASTM E 84: 0.
 - b. Smoke Development, ASTM E 84: 5.
 - c. Fuel Contribution, ASTM E 84: 0.
 4. Complete selection of manufacturer's standard and custom panel face profiles, patterns and textures for final selection by Engineer.

5. Light Reflectance Ratings: Except as otherwise shown or specified, provide factory-finished acoustical panels that have been tested in compliance with ASTM E 1477 by a recognized testing laboratory, to show a light reflectance rating of not less than the following:
 - a. Light Reflectance: Not less than 0.86.
- C. Products and Manufacturers: Provide one of the following:
 1. Rockfon Koral SLN 1120 by ROCKFON.
 2. Or approved equal.

2.03 CEILING SUSPENSION SYSTEMS

- A. General: Comply with ASTM C 635, as applicable to the type of suspension system required for the type of acoustical panel ceiling units specified.
 1. Structural Class, Intermediate-Duty System (Direct Hung): 12.0 minimum to 15.9 maximum, pounds per linear foot of main runners.
 - a. Main Runners: 0.015-inch thick metal, minimum.
 - b. Cross Tees: 0.015-inch thick metal, minimum.
 2. Structural Class, Heavy-Duty System (Direct Hung): 16 pounds per linear foot of main runners, minimum.
 - a. Main Runners: 0.020-inch thick metal, minimum.
 - b. Cross Tees: 0.020-inch thick metal, minimum.
- B. Exposed Suspension System: Manufacturer's standard, 5/16-inch wide by 1-1/2-inch high exposed runners, cross-runners and accessories, with exposed cross runners stepped to lay flush with main runners; manufactured from hot-dipped galvanized G90, commercial steel CS Type B, complying with ASTM A 653; double-webbed construction with stainless steel clip end tap feature interlocking with cross tee slots to prevent lateral pull-out.
 1. Finish of Exposed Members: Provide aluminum-capped components for all exposed cross tee and main tee faces.
 - a. Acoustical Panel Ceilings - Finish: Manufacturer's standard baked enamel finish, white, unless otherwise selected by Engineer.
- C. Products and Manufacturers: Provide one of the following:
 1. Chicago Metallic 1200 Non-Fire Rated and 1250 Fire Rated Systems - Direct Hung Suspension Systems by Rockfon.
 2. Or approved equal.

2.04 MISCELLANEOUS MATERIALS

- A. Hangers
 1. Wire Hangers: Galvanized, soft-temper steel wire complying with ASTM A 641/A 641M, Class C zinc coating, pre-stretched; bare steel diameter of 8-gauge (0.162-inch).
 2. Rod Hangers: Commercial steel complying with ASTM A 510, mild carbon steel; 1/4-inch bare steel rod diameter; hot-dip galvanized in compliance with ASTM A 153/A 153M, Class B-1.

3. Flat Hangers: Commercial steel sheet complying with ASTM A 366/A 366M; bare steel size of 1-inch by 3/16-inches, minimum, and of lengths shown; hot-dip galvanized in compliance with ASTM A 153/A 153M, Class B-1.
4. Angle Hangers: 2-inch by 2-inch by 1/4-inch, bare steel size, minimum; hot-dip galvanized in compliance with ASTM A 153/A 153M, Class B-1.
5. Anchors
 - a. Provide fabricated from stainless steel components complying with ASTM F 593 and ASTM F 594, Group 1, alloy Type 316 for bolts, and anchors with holes or loops for attaching hangers.
 - b. Comply with ASTM E 488 for concrete inserts, clips, bolts, screws and other devices applicable to the indicated method of structural anchorage for acoustical panel ceiling hangers.
- B. Hold-Down Clips for Non-Fire-Resistance-Rated Ceilings: For interior ceilings consisting of acoustical panels weighing less than one pound per square foot, provide hold-down clips spaced 2 foot-0 inches on centers on all cross tees.
- C. Impact Clips: Where required, provide manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.
- D. Sheet Metal Edge Molding and Trim: Type and profile shown, or if not shown, manufacturer's standard metal channel molding for edges and penetrations that fit acoustical panel edge details and suspension systems specified; formed from commercial grade sheet steel of same material, color and finish as used for exposed flanges of suspension system members.
 1. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
 2. For circular penetrations in ceiling, provide shop-fabricated edge moldings fabricated to diameter required to fit penetrations exactly.
 3. For narrow-face suspension systems, provide suspension system and manufacturer's standard edge moldings that match width and configuration of exposed runners.
- E. Extruded Aluminum Edge Molding and Trim: Type and profile shown, or if not shown, manufacturer's standard extruded aluminum molding for edges and penetrations that fit

acoustical panel edge details and suspension systems specified; including splice plates, corner pieces, and attachment and other clips, complying with the following:

1. Aluminum Alloy: 6063-T5 complying with ASTM B 221.
 2. Finish of Exposed Members: Provide the following finish for all edge moldings and trim components:
 - a. Finish: Manufacturer's standard baked enamel finish, white, unless otherwise selected by Engineer.
 - b. Finish: Natural color anodized aluminum, 0.4-mil coating; NAAMM AA-C22A31 complying with AMP 501.
- F. Acoustical Sealant for Exposed and Concealed Joints: Provide a modified acrylic-latex, non-sag, paintable, non-staining, sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints in building construction as demonstrated by testing representative assemblies according to ASTM E 90 and acceptable for use with UL Design Designations specified.

PART 3 EXECUTION

3.01 INSPECTION

- A. Contractor shall examine the conditions under which the acoustical panel ceiling Work is to be performed and notify Engineer, in writing, of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to Engineer.

3.02 PREPARATION

- A. Concrete Inserts: Provide inserts for incorporation into formwork. Furnish layouts for cast-in-place ceiling support anchors whose installation is specified in other Sections.
- B. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid the use of less-than-half width panels at borders and comply with accepted Shop Drawing layout.

3.03 INSTALLATION

- A. General
 1. As a minimum standard, unless otherwise shown, specified, required by accepted Shop Drawings, or governing authorities having jurisdiction at the Site, install acoustical panel ceilings to comply with CISCA's "Ceiling System Handbook."
 2. Where acoustical panel ceilings must resist lateral forces, comply with requirements of governing authorities having jurisdiction at the Site and ASTM E 580.
- B. Install suspension systems to comply with ASTM C 636, with hangers supported only from building structural members. Locate hangers near each end and spaced four feet along each carrying channel or direct-hung runners, unless otherwise shown.
 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system.

2. Splay hangers only where required and, if permitted by governing authorities having jurisdiction at the Site for fire-resistance-rated construction assemblies, to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 3. Where width of ducts and other obstructions within ceiling plenum produces hanger spacing that interfere with the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by Reference Standards and publications.
 4. Secure wire hangers to ceiling suspension members by looping or wire-tying with a minimum of three tight turns, either directly to structure or to inserts, eye screws, clips or other anchorage devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 5. Connect hangers directly to structural members, including additional framing members introduced for ceiling support, by attaching to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause hangers to deteriorate or otherwise fail due to age, corrosion or elevated temperatures.
 6. Do not support ceilings directly from permanent metal forms or floor deck. Furnish cast-in-place hanger inserts that extend through forms.
 7. Do not attach hangers to steel deck tabs.
 8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 9. Do not connect or suspend steel framing from ducts, pipes or conduit.
 10. Sway-brace suspended steel framing with hangers used for support.
 11. Space hangers not more than 4 foot-0 inches on centers along each member, supported directly from hangers and provide hangers not more than 8-inches from ends of each member.
 12. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or post-installed anchors.
 13. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- C. Arrange acoustical panels and orient directionally-patterned panels in the manner shown on accepted Shop Drawings.
1. Install acoustical panels in coordination with suspension system, with edges concealed by support of suspension members.
 2. Install acoustical panels with pattern running in one direction.
 3. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
 4. Install acoustical panels with undamaged edges and fitted accurately into suspension system runners and edge moldings.
 5. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

6. Install hold-down clips for each panel, spaced as recommended by acoustical panel manufacturer for the application specified, except do not exceed spacing required by governing authorities having jurisdiction at the Site, or for fire-resistance-ratings.
- D. Install edge moldings and trim of the type shown at edges of each acoustical ceiling area, and at locations where edge of units would otherwise be exposed after completion of the Work.
 1. Sealant Bed: Apply acoustical sealant in a continuous ribbon, concealed on back of vertical legs of molding before fastening to vertical surface.
 2. Secure moldings to building construction by fastening with screw-anchors into the substrate, through holes drilled in vertical leg. Space holes not more than 3- inches from each end and not more than 16-inches on centers along each molding, leveling with ceiling suspension system to tolerances specified.
 3. Miter corners of moldings accurately to provide hair-line joints, securely connected to prevent dislocation.
 4. Do not use exposed fasteners, including blind rivets, on molding or trim.
 - E. Install sound attenuation insulation in areas shown. Lay insulation directly on ceiling system, and close major openings to completely cover all areas shown to receive sound attenuation insulation.

3.04 FIELD QUALITY CONTROL

- A. Testing Agency
 1. Contractor shall engage a qualified independent testing agency, accepted by Engineer, to perform quality control testing.
 2. Perform all specified testing in compliance with the requirements of ASTM E 488.
 3. Extent and Testing Frequency: Testing shall take place in successive stages in areas described below. Proceed with installation of acoustical panel ceilings only after results for previously installed hangers comply with requirements.
 4. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion, but no acoustical panels have been installed, perform the following tests:
 - a. Within each test area testing agency will, select one of every ten anchors used to attach hangers to concrete and will test them for 1,140 pounds of tension. It will also select one of every two post-installed anchors used to attach bracing wires to concrete and will test them for 1,620 pounds of tension.
 - b. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until twenty consecutively pass and then will resume initial testing frequency.
 5. Testing agency shall report test results promptly and in writing to Engineer.
 6. Where fasteners and anchors are removed and replaced, additional testing shall be performed to determine compliance with specified requirements.
- B. Allowable Tolerances
 1. Surfaces to Receive Acoustical Treatment: Free from irregularities and level to within 1/4-inch in 12 feet.
 2. Deflection

- a. Suspension System Components, Hangers, and Fastening Devices Supporting Light Fixtures, Ceiling Grilles, and Acoustical Units: Maximum deflection 1/360 of the span.
- b. Deflection Test: ASTM C 635.
3. Allowable Tolerance of Finished Acoustical Ceiling System: Level within 1/8-inch in 12 feet-0 inches.
4. Accessibility Percentage: 100.

3.05 ADJUSTMENT AND CLEANING

- A. Do not proceed with installation of acoustical panels until testing is completed and non-complying fasteners and anchors have been replaced with new material complying with the requirements of these Specifications.
- B. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings and suspension system members. Comply with manufacturer's written instructions for cleaning and touch-up of minor finish damage. Remove and replace Work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.
- C. Installer shall advise Contractor and Engineer of required protection for the acoustical panel ceilings, including manufacturer's recommended temperature and humidity limitations and dust control, so that the Work will be without damage and deterioration at the time of acceptance by Owner. Contractor shall provide required protection.

END OF SECTION

09 61 53
CONCRETE HARDENER

PART 1 GENERAL

1.01 SUMMARY

- A. Scope
 - 1. This Section specifies concrete hardener.
 - 2. Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all concrete hardener work.
 - 3. The extent of the concrete hardener includes all interior concrete floors not shown or scheduled to be finished with another material.
 - 4. The types of concrete hardener work required include, but are not necessarily limited to, silicate penetrant.

- B. Coordination
 - 1. Review installation procedures under this and other specification sections and coordinate the installation of items that must be installed with, or before, the concrete hardener work.

1.02 QUALITY ASSURANCE

- A. Reference Codes and Standards
 - 1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
 - 2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.
 - 3. Provide a five (5)-year written guarantee, signed by Contractor and installer, stating that should concrete floors show signs of dusting because of wear and abrasion they will be re-installed, in the manner specified herein, at no additional cost to The City, from the date of Final Acceptance of the Work.

- B. Installer's Qualifications: Engage a single installer regularly engaged in the installation of concrete hardeners with five (5) years experience in the application of the types of materials required, and who agrees to employ only tradesmen with specific skills and experience in this type of work. Installer shall meet the requirements of the concrete hardener supplier for providing guarantee coverage. Submit name and qualifications to Engineer.
- C. Source Quality Control: Obtain all material from only one supplier who will send a qualified technical representative to the Site for the purpose of advising the installer of proper procedures and precautions for the use of the material, at no additional cost to the City.

1.03 ENVIRONMENTAL CONDITIONS

- A. Product in this Section shall be subjected to environmental conditions in accordance with Section 01 11 80 – Environmental Conditions.
 - 1. Do not apply concrete hardener to uncured concrete. Comply with Supplier's written instructions for minimum ten days of curing time.
 - 2. Apply hardener only when temperature of concrete is 50°F or above.

1.04 SUBMITTALS

- A. Preconstruction/Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.
 - 1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.
 - 2. Copies of Supplier's specifications, recommendations and installation instructions. Include Supplier's published data, indicating the material complies with the requirements and is intended for the application shown.
 - 3. Submit installer's qualifications in accordance with Paragraph 1.2, above.
 - 4. Certificates: Submit a certificate of coverage signed by a duly authorized representative of the Supplier.
- B. Informational Submittals: The following minimum informational submittals shall be submitted in accordance with the timing requirements specified in these Contract

Documents, prior to Substantial Completion and in accordance with Section 01 33 00 - Submittals.

1. Maintenance Manuals (including Warranty) in accordance with Section 01 78 23 - Operating and Maintenance Data: Upon completion of the Work, furnish five (5) copies of detailed maintenance manual including the following information
 - a. Product name and number.
 - b. Name, address and telephone number of Supplier and local distributor.
 - c. Detailed procedures for routine maintenance and cleaning.
 - d. Detailed procedure for light repair such as scratches and staining.
2. Guarantee: Submit for approval written guarantee agreeing to replace the concrete hardener should it fail to perform as specified in this Section.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

A. Suppliers

1. The Engineer and the City believe that the following Suppliers are capable of producing equipment and products, which will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular Supplier or product, nor shall it be construed that a named Supplier's standard product will comply with the requirements of this Section.
2. Candidate Suppliers include the following:
 - a. Masterkure HD 300 WB by BASF.
 - b. Or Approved Equal.

B. Supplier Qualifications

1. The Supplier shall have five (5) years of experience manufacturing and installing concrete hardener in similar-sized projects.

2.02 MATERIALS

- A. Materials specified are considered the minimum acceptable for the purposes of durability, strength, and resistance to erosion and corrosion. The Contractor may propose alternative materials for the purpose of providing greater strength or to meet required stress limitations. However, alternative materials must provide at least the same qualities as those specified for the purpose. If alternatives are proposed, the proposals shall be accompanied with documentation supporting the claimed superiority of the proposed substitutions. The Engineer shall be the sole decider in the equivalency of alternative materials of construction.
- B. Concrete Hardener: Provide a clear, colorless, aqueous solution of chemically active silicates and fluosilicates plus a wetting and penetrating agent, that reacts with the free lime and calcium carbonates to bind soft, loose particles together and form a hard dense vitreous surface which is resistant to chemical attack and the growth of mildew, fungi and other organisms. Use potable water only.

2.03 MIXES

- A. Follow Supplier's written instructions for the proper mixing, dilution and coverage of each coat.

2.04 FINISH

- A. The finished installation of the concrete hardener shall have a smooth, uniform even finish without discontinuities or discolorations.

PART 3 EXECUTION

3.01 SHIPMENT AND STORAGE

- A. Product shall be shipped and stored in accordance with Section 01 60 00 - Common Product Requirements.
- B. Supplier shall provide Contractor with detailed recommendations and instructions for product storage.
- C. Packing, Shipping, Handling and Unloading
 1. Deliver materials to the Site to ensure uninterrupted progress of the Work. Deliver anchor bolts and anchorage devices which are to be embedded, in ample time to prevent delay of that Work.
 2. Deliver materials in concrete hardener Supplier's original unopened containers.
 3. Include the following information on the label
 - a. Name of material and the Supplier.
 - b. Formula or specification number, lot number and date of Supplier.
 - c. Mixing instructions, shelf life and curing time when applicable.
 4. Failure to comply with these requirements shall be sufficient cause for the rejection of the material in question, by Engineer, and requiring its removal from the Site. In such a case, supply new material conforming to the specified requirements, at no additional cost to The City.
 5. Handle materials carefully to prevent inclusion of foreign materials.
 6. Do not open containers or mix components until all necessary preparatory Work has been completed.
- D. Storage and Protection
 1. Store materials to permit easy access for inspection and identification. Keep all material off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.
 2. Store materials so as to preclude the inclusion of foreign material.
 3. Protect material from freezing.
- E. Acceptance at Site
 1. All boxes, crates and packages shall be inspected by Contractor upon delivery to the Site. Contractor shall notify Engineer, in writing, if any loss or damage exists to equipment or components. Replace loss and repair damage to new condition in accordance with Supplier's instructions.

3.02 SUPPLIER'S FIELD SERVICES

- A. Supplier shall provide assistance during product installation as required by the Contractor.

3.03 INSTALLATION

- A. Inspection
 - 1. Examine the substrates and the conditions under which the concrete hardener work is to be performed and notify Engineer in writing of any conditions detrimental to the proper and timely completion of the Work and performance of the concrete hardener. Do not proceed with the concrete hardener work until unsatisfactory conditions have been corrected in a manner acceptable to Engineer.
- B. Substrate Preparation
 - 1. Steel trowel concrete in strict accordance with printed directions supplied by the concrete hardener Supplier.
 - 2. Provide concrete free of all honeycombing and fins.
 - 3. Do not use sealers, curing or parting compounds on the concrete.
 - 4. Provide wet curing only.
 - 5. Surfaces to receive concrete hardener shall be clean, dry and free of all loose dirt, oil, wax and other foreign matter.
- C. The Supplier shall provide the Contractor with detailed recommendations and instructions for installation of the product specified in this Section.
- D. Supplier shall provide assistance during product installation as required by the Contractor.
- E. Product shall be installed at the locations shown and in accordance with the recommendations of the Supplier.
- F. Provide the services of a Supplier's technical representative for the purpose of advising the installer of proper procedures and precautions for the use of the material prior and during the installation of the concrete hardener.
- G. Apply concrete hardener using the coverage recommended by the Supplier per coat.
- H. Apply a minimum of three separate coats.
- I. Apply a fourth coat using undiluted material should the Supplier's technical representative recommend this procedure, based on field conditions, and as directed by Engineer.
- J. Apply each coat by spray.
- K. Mop up excess solution or puddles.
- L. After each of the first and second applications, allow the floor to dry until no longer visibly wet.

- M. To avoid the development of crystals, when applying the third coat, flush the surface liberally with clean, hot water. at the same time, brush the floor rapidly with a stiff bristle broom. Mop up excess water.
- N. Follow Supplier's written instructions should white crystals develop after the first or second coat. Consult Supplier's technical representative.
- O. Protection
 - 1. Do not allow concrete hardener to overflow or spill onto adjoining surfaces.
 - 2. Remove concrete hardener that is splashed on surfaces not designated to receive concrete hardener immediately by flushing with water.
- P. Sequencing
 - 1. Coordinate the Work so that the concrete hardener is installed when best results will be obtained, as recommended by the Supplier's technical representative.
- Q. Adjustment and Cleaning
 - 1. Clean adjacent surfaces of concrete hardener resulting from the Work. Use solvent or cleaning agent recommended by the concrete hardener Supplier. Leave all finished work in a clean neat appearance.
 - 2. Protect the concrete hardener until fully cured.

END OF SECTION

SECTION 09 84 05
ACOUSTICAL PANELS

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:

1. Contractor shall provide all labor, materials, tools, equipment and incidentals as shown, specified and required to furnish and install acoustical panels in the Injection Well Electrical Service Center – Generator Room 101. The Work also includes:
 - a. Providing openings in acoustical panels to accommodate the Work under this and other Sections and building into the acoustical panels all items to be embedded in, or penetrate, acoustical panels.
2. Extent of acoustical panels is shown.
3. Types of products include the following:
 - a. Perforated acoustical wall and ceiling panels in pattern specified.
 - b. Polyethylene wrapped fiberglass acoustical fill.
 - c. Miscellaneous supports, tracks, hardware, fasteners and brackets.
 - d. Acoustical sealants

B. Coordination:

1. Review installation procedures under this and other Sections and coordinate the installation of items that must be installed with, or before, the acoustical panels Work.

C. Related Sections:

1. Section 03 30 00, Cast-In-Place Concrete.
2. Section 04 20 00, Unit Masonry.
3. Section 07 92 00, Joint Sealants.

1.02 REFERENCES

A. Standards referenced in this Section are listed below:

1. AASHTO, Guide Specification for the Structural Design of Sound Barriers.
2. AIMA, Performance Data, Architectural Acoustical Materials.
3. ASTM A 36 / A36M, Standard Specification for Carbon Structural Steel.
4. ASTM A 653 / A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
5. ASTM A 924 / A924M - 07 Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
6. ASTM B 117 - 07a Standard Practice for Operating Salt Spray (Fog) Apparatus
7. ASTM C 423: Sound Absorption of Acoustical Materials in Reverberation Rooms, Methods of Test for.
8. ASTM D 2244, Color Differences from Instrumentally Measured Color Coordinates.

9. ASTM E 84: Surface Burning Characteristics of Building Materials, Standard Test Method for.
10. ASTM E 90: Airborne Sound Transmission Loss of Building Partitions and Elements, Standard Test method for Laboratory Measurement of.
11. ASTM E 413: Sound Insulation, Classification for Rating.
12. ASTM E 488: Test Methods for Strength of Anchors in Concrete and Masonry.
13. ASTM E 548: Standard Guide for General Criteria Used for Evaluating Laboratory Competence.
14. ASTM C 553, Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
15. ASTM C 612, Specification for Mineral Fiber Block and Board Thermal Insulation.
16. ASTM E 795: Practices for Mounting Test Specimens during Sound Absorption Tests.
17. ASTM E 1414 - 06 Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum.
18. ASTM F 593: Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
19. ASTM F 594: Standard Specification for Stainless Steel Nuts.
20. ASTM G 151 - 06 Standard Practice for Exposing Nonmetallic Materials in Accelerated Test Devices that Use Laboratory Light Sources.
21. UL, Fire Resistance Directory.
22. UL Building Materials List, Guide No. 40 U18.1, Acoustical Materials.
23. UL Guide No. 40 U8.1, Fire Hazard Classification.

1.03 DEFINITIONS

- A. Noise Reduction Coefficient (NRC): It is a measure of how much sound is absorbed by a given material. It is listed as a decimal and relates to percentage sound absorbed.

1.04 QUALITY ASSURANCE

- A. Fabricator's Qualifications:
 1. Engage a single fabricator regularly performing fabrication of acoustical panels with documented skill and successful experience in the fabrication of the types of panels required and able to show evidence of local installations in satisfactory operation.
- B. Installer's Qualifications:
 1. Engage a single installer regularly performing installation of acoustical panels with documented skill and successful experience in the installation of the types of materials required; and who agrees to employ only tradesmen who are trained, skilled and have successful experience in installing the types of materials specified.
 2. Submit name and qualifications to Engineer along with the following information on a minimum of three successful projects:
 - a. Names and telephone numbers of owners, architects or engineers responsible for projects.
 - b. Approximate contract cost of the acoustical panels.
 - c. Amount of area installed.

- C. Component Supply and Compatibility:
1. Furnish all components of each acoustical panels system from a single manufacturer and from a single supplier with adequate resources to provide products of consistent performance characteristics, physical properties and appearance, without delaying the Work.
 2. Manufacturer and fabricator must own their own paint and finish facility to assure single source and quality control.
 3. Shop Assembly: Preassemble acoustical room component systems in the shop to the greatest extent possible, as to minimize field splicing and assembly of units at the Site. Disassemble units only to the extent necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinate installation.
- D. Regulatory Requirements: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
1. Codes: Comply with applicable requirements of the governing codes.
 2. UL Fire Hazard Classification: Acoustical panels shall comply with fire hazard classification for flame spread, including fuel contribution and smoke development classifications. Provide acoustical panel Work which has been tested, rated and labeled by UL for the indicated rating as listed in the Classified Building Materials Index: by UL.
 - a. Classification: Maximum of 10 for flame spread, 25 for fuel contributed, and 10 for smoke developed (Class A).
 3. Attachment Devices: Size internal attachment devices within suspended panel system for five times the design load indicated in ASTM C 635, Table 1, Direct Hung.
- E. Mock Ups:
1. Before proceeding with final purchase of materials and installation of acoustical panel systems, but after Engineer's acceptance of Samples and Shop Drawings, install 100 square foot samples of each type of each acoustical panel system, including all accessory trim, built-in items that may be specified in other Sections, indicating the final relationship and configurations of the various parts and components and the quality of workmanship that shall be achieved in the Work. Locate mock-ups in areas selected by Engineer to show a representative installation of each type of acoustical panel system.
 2. Incorporate materials and methods of installation that are identical to Project requirements.
 3. Obtain Engineer's acceptance of visual qualities of mock up before start of acoustical panels Work. Retain and protect mock up during construction as a standard for judging completed acoustical room component system. Do not alter or remove approved mock ups.
 4. Build as many mock-ups as required to obtain Engineer's acceptance. Disassemble rejected mock-ups and remove all components from Site. Do not incorporate rejected mock-up components into the Work. Accepted mock-ups may be incorporated into the finished Work.
 5. Acoustical panels Work that proceeds without approved mock-ups shall be stopped, and mock-ups prepared for Engineer's acceptance.
 6. Acoustical panels that do not meet the standard of workmanship on the accepted mock-up shall be removed and replaced with new material.

1.05 SUBMITTALS

- A. Action Submittals: Submit the following:
1. Shop Drawings: Submit the following:
 - a. Wall elevations of suspension systems, showing hanger, anchor and acoustical panel locations, drawn to a scale of 1/4-inch equal to 1 foot-0 inch, and details of all transitions of acoustical panels with other items such as light fixtures, air diffusers, and perimeter walls and all supporting and suspension system details, including method of attachment of suspension system hangers to building structure, drawn to a scale of 3/4-inches equal to 1 foot-0 inches.
 - b. Show and coordinate locations of wall-mounted items and penetrations for other items of Work that are to be coordinated with the wall, and show framing and support details for Work supported by the suspension system.
 - c. Complete information on all anchors and supports indicating maximum resistance to tension, in compliance with performance criteria specified.
 2. Product Data:
 - a. Copies of manufacturer's product specifications and installation instructions for each acoustical panel required, and for each suspension system. Include certified laboratory test reports and other data as required to show compliance with these Specifications.
 - 1) Include manufacturer's recommendations for cleaning and refinishing acoustical panels, including precautions against materials and methods, which may be detrimental to finishes and acoustical performances.
 3. Samples: Submit the following:
 - a. Full size samples for each acoustical panel specified. Samples shall show the full range of exposed color and texture to be expected in the completed Work.
 - b. 12-inch long samples of the following:
 - 1) Perforated acoustical wall panels in pattern specified.
 - 2) Polyethylene wrapped fiberglass acoustical fill.
 - 3) Miscellaneous supports, tracks, hardware, fasteners and brackets.
 - c. Engineer's review will be for color and texture only. Compliance with other requirements is the responsibility of Contractor.
- B. Informational Submittals: Submit the following:
1. Certificates:
 - a. Certify compliance with ASTM C 635 and other specified requirements and indicate structural classification of each type of suspension system.
 - b. Evidence of acoustical panel system's compliance with requirements of governing authorities having jurisdiction at the Site.
 - c. Verification that material purchased for the Work complies with material designations specified as confirmed by approved Shop Drawings.
 - d. Manufacturer's certificate on results of load testing the completed perforated exterior sound barriers, demonstrating compliance with all applicable OSHA, ANSI and building code requirements and the system performance criteria specified for superimposed loadings and deflection limitations.

2. Test and Evaluation Reports:
 - a. Certified test reports showing compliance with specified performance characteristics and physical properties.
 - b. Existing Conditions Report.
 3. Qualification Statements:
 - a. Installer.
 - b. Testing Agency.
 - c. Fabricator.
- C. Closeout Submittals: Submit the following:
1. Operations and Maintenance Data: Furnish five copies of manufacturer's instructions for recommended maintenance practices for each type of acoustical room component systems, including the following:
 - a. Product name and number.
 - b. Name, address and telephone number of manufacturer and local distributor.
 - c. Detailed procedures for routine maintenance and cleaning.
 - d. Detailed procedures for light repairs such as dents, scratches and staining

1.06 DELIVERY, STORAGE AND HANDLING

- A. Comply with applicable requirements of Section 01 66 00, Product Storage and Handling Requirements.

1.07 SITE CONDITIONS

- A. Existing Conditions:
1. Existing Conditions: Review the existing conditions effecting the surface preparation and installation of acoustical panels and submit a report to the Engineer before installation. Existing facilities must meet all the requirements listed in 1.07.B. below. All deficiencies must be corrected before beginning installation.
- B. Field Measurements: Verify locations of wall obstructions before fabrication and indicate measurements on Shop drawings.
- C. Environmental Requirements:
1. Do not begin installation of panels until wet-work and other Work, which may damage the panels, has been completed and is dry.
 2. Maintain a uniform temperature in the range of 55 to 85 degrees F prior to and during installation of materials.
 3. Do not install acoustical panel until space has been enclosed and is weather-tight and ambient conditions of temperature and humidity are continuously maintained at values near those indicated for final occupancy.
 4. Air-Quality Limitations: Protect acoustical panels from exposure to airborne odors, such as tobacco smoke, and install panels under conditions free from odor contamination of ambient air.

1.08 SEQUENCING

- A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates walls or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.09 SCHEDULING

- A. Do not begin installation of acoustical panels until all Work above ceilings attached to walls has been completed and accepted by Engineer.

1.10 WARRANTY

- A. General Warranty: The special warranties specified in this Article shall not deprive Owner of other rights or remedies Owner may otherwise have under the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under the Contract Documents.
- B. Special Warranties:
 - 1. Sag, Warp or Rot Warranty:
 - a. Provide written warranty, signed by Contractor and manufacturer and running to benefit of Owner, agreeing to replace, for a period of one year from the date of Substantial Completion, acoustical panel systems that sag, warp or rot, as specified.
 - b. Factory-applied finished shall be warranted for 10 years against fading, chalking or cracking.

1.11 MAINTENANCE

- A. Extra Materials:
 - 1. At time of completing the installation, deliver stock of extra material and store in a secure area at the Site as directed by Owner. Furnish full-size units, packaged with protective covering for storage, and identified with appropriate labels.
 - 2. Acoustical Panels: Furnish an amount equal to two percent of the amount installed, or at least one full package.
 - 3. Do not provide partial packages of materials. Round-up quantities to furnish only complete, unopened and undamaged packages; with legible labels accurately representing contents of package indicating compliance with approved Samples and Shop Drawings, and matching materials actually installed.
 - 4. Submit quantities of each system component required for the Work, based on actual purchase order to manufacturer for materials to be used on this Project, with calculations establishing quantity of extra materials to be furnished to Owner.

PART 2 PRODUCTS

2.01 SYSTEM PERFORMANCE

A. Design Criteria:

1. Standards for Terminology and Performance: Applicable publication by the Acoustical and Insulating Materials Association (AIMA), including, Performance Data, Architectural Acoustical Materials.
2. AASHTO Guide Specification for the Structural Design of Sound Barriers.

B. Performance Criteria:

1. UL Fire Hazard Classification: Provide acoustical panels with fire hazard classification rating for flame spread, including fuel contribution and smoke development classifications. Provide acoustical panel Work which has been tested, rated and labeled by UL for the indicated rating as listed in the, Classified Building Materials Index: by UL.
 - a. Classification: Maximum of 10 for flame spread, 25 for fuel contributed, and 10 for smoke developed (Class A).
2. Noise Reduction Coefficient (NRC): The average of sound absorption coefficients when tested in accordance with ASTM C 423 for a specification range of ten points, for middle frequencies of 250, 500, 1000, and 2000 Hertz with face of test specimen mounted in compliance with ASTM E 795 for Mounting Type E-400 (400-millimeter air space) standard mounting according to ASTM E 1264. Provide not less than the following:
 - a. NRC Rating: Range of 0.50, except as otherwise specified.

2.02 PERFORATED METAL ACOUSTICAL PANELS

- A. Panel Construction: 0.032-inch thick stucco-embossed aluminum sheets, 5005-H134 alloy, conforming to ASTM E1264, Type VII. Panels shall have 3/32-inch diameter holes 3/16-inch on centers for a total open area of 23 percent. Panels shall be "V" ridged on 6-inch centers to a depth of 2-3/4-inches. Panels shall be formed to create integral sides and ends. Framing member shall be 2-inch deep, 0.063-inch thick aluminum "C" channels. Panels shall be one-piece construction. One vertical seam is allowed in corrugated panels.
- B. Size:
 1. Width: 30-inches.
 2. Length: A complete selection of manufacturer's standard lengths in order to provide continuous acoustical wall units. Provide two framing members on panels up to 8-foot-0 inches in length and three framing members on panels over 8-foot-0 inches in length.
- C. Brackets, Inserts, Fasteners: Provide 11-gage Type 316 stainless steel brackets for 4-inch wall offset mounting. Provide wall inserts 3/4-inches long and capable of resisting 220 pounds in tension.
- D. Recycled Content: 25 percent.
- E. Finish: Factory applied polyurethane enamel finish.

- F. Colors: Selected from manufacturer's standard color charts.
- G. Acoustical Fill: 2-inch fiberglass, 1.5 pounds per cubic foot density complying with ASTM C553 and ASTM C612. All acoustical insulation shall be wrapped in flame-resistant, Class A, per ASTM E 84, 2-mil thick black polyethylene. Panels shall have reinforcing with the same finish at each end to give the insulation a totally enclosed bed in which to lie. Under no conditions shall the insulation be visible.
- H. Sound Absorption Coefficient, 10-foot, 0-inch long panels. Provide the following minimum:

Frequency (Hz)	Sound Absorption Coefficient (sabins)
125	6.2
250	20.5
500	35.3
1000	34.5
2000	31.5
4000	33.1

- I. Product and Manufacturer: Provide one of the following:
 1. Eckoustic Functional Panels by Eckel Industries, Incorporated, Acoustical Division.
 2. Alpro Acoustical Wall Panel by Gordon Incorporated.
 3. Or Approved Equal.

2.03 MISCELLANEOUS MATERIALS

- A. Anchors:
 1. Provide built-in-place anchors fabricated from stainless steel components complying with ASTM F 593 and ASTM F 594, Group 1, alloy Type 316 for bolts, and anchors with holes or loops for attaching hangers.
- B. Acoustical Sealant for Exposed and Concealed Joints: Provide a modified acrylic-latex, non-sag, paintable, non-staining, sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints in panel construction as demonstrated by testing representative assemblies.
 1. Sealants used inside the weatherproofing system, shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Installation Adhesives: Adhesives used inside the weatherproofing system, shall have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and have no urea formaldehyde.

PART 3 EXECUTION

3.01 INSPECTION

- A. Contractor shall examine the conditions under which the acoustical panel Work is to be performed and notify Engineer, in writing, of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to Engineer.

3.02 PREPARATION

- A. Verify and coordinate the location of all items, which may affect the installation of the acoustical panels Work. Submit acoustical panel layout after measuring existing conditions for approval prior to erection.
- B. Measure each wall area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid the use of less than half width panels at borders and comply with accepted Shop Drawing layout.

3.03 INSTALLATION

- A. General:
 - 1. As a minimum standard, unless otherwise shown, specified, required by accepted Shop Drawings, or governing authorities having jurisdiction at the Site, install acoustical panels to comply with CISCA's "Ceiling System Handbook."
 - 2. Where acoustical panels must resist lateral forces, comply with requirements of governing authorities having jurisdiction at the Site and ASTM E 580.

3.04 INSTALLATION, ACOUSTICAL PANELS

- A. General: Install materials in accordance with manufacturer's instructions.
- B. Arrange acoustical wall acoustical panels with a uniform spacing of 8-inches maximum clearance between continuous panel runs.
- C. Begin installation of continuous runs of acoustical panels at a point 12-inches above the finished floor (minimum) or as shown. Provide 8-inches between vertical panels. Terminate wall panel 8 inches below ceiling. Panels that are obstructed by wall mounted equipment shall be fabricated to follow the contours of the equipment, maintaining the 8-inch boarder. Cover all wall surfaces with panels as shown.

3.05 FIELD QUALITY CONTROL

- A. Allowable Tolerances:
 - 1. Surfaces to Receive Acoustical Treatment: Free from irregularities and level to within ¼-inch in 12 feet.
 - 2. Allowable Tolerance of Finished Acoustical Room Component System, ASTM C 635: Level within 1/8-inch in 4 feet-0 inches.

3.06 ADJUSTMENT AND CLEANING

- A. Do not proceed with installation of acoustical panels until testing is completed and non-complying fasteners and anchors have been replaced with new material complying with the requirements of these Specifications.
- B. Clean exposed surfaces of acoustical panels, including trim, edge moldings and suspension system members. Comply with manufacturer's written instructions for cleaning and touch up of minor finish damage. Remove and replace Work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

- C. Installer shall advise Contractor and Engineer of required protection for the acoustical panels, including manufacturer's recommended temperature and humidity limitations and dust control, so that the Work will be without damage and deterioration at the time of acceptance by Owner. Contractor shall provide required protection.
- D. Panels damaged before SUBSTANTAL COMPLETION, shall be immediately removed from the PROJECT SITE and replaced at no expense to the Owner.

END OF SECTION

SECTION 09 90 00
PAINTING AND COATING

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:

1. This Section specifies coating systems, surface preparations, and application requirements for coating systems.

B. Definitions:

1. Specific coating terminology used in this Section is in accordance with definitions contained in ASTM D16, ASTM D3960, and the following definitions.
 - a. Definitions:
 - 1) Abrasive: Material used for blast cleaning, such as sand, grit or shot.
 - 2) Abrasive Blast Cleaning: Cleaning/surface preparation by abrasive propelled at high speed.
 - 3) Anchor Pattern: Profile or texture of prepared surface(s).
 - 4) ANSI: American National Standards Institute.
 - 5) Bug Holes: Small cavities, usually not exceeding 15 mm in diameter, resulting from entrapment of air bubbles in the surface of formed concrete during placement and compaction.
 - 6) Coating/Paint/Lining Thickness: The total thickness of primer, intermediate and/or finish coats.
 - 7) Coating System Applicator (CSA): A generic reference to the specialty subcontractor or subcontractors retained by the Contractor to install the coating systems specified in this Section.
 - 8) Coating System Manufacturer (CSM): Refers to the acceptable coating system manufacturer, abbreviated as the CSM.
 - 9) Coating System Manufacturer's Technical Representative(s) (CTR): Refers to the technical representative(s) of the acceptable Coating System Manufacturer and is abbreviated as CTR.
 - 10) Dew point: Temperature of a given air/water vapor mixture at which condensation starts.
 - 11) Dry Film Thickness (DFT): Depth of cured film, usually expressed in mils (0.001 inch). Use this definition as opposed to existing definition.
 - 12) Drying Time: Time interval between application and curing of material.
 - 13) Dry to Recoat: Time interval between application of material and ability to receive next coat.
 - 14) Dry to Touch: Time interval between application of material and ability to touch lightly without damage.
 - 15) Feather Edging: Reducing the thickness of the edge of paint.
 - 16) Feathering: Operation of tapering off the edge of a point with a comparatively dry brush.

- 17) Field Coat: The application or the completion of application of the coating system after installation of the surface at the site of the work.
- 18) Hold Point: A defined point, specified in this Section, at which work shall be halted for inspection.
- 19) Holiday: a discontinuity, skip, or void in coating or coating system film that exposes the substrate.
- 20) Honeycomb: Segregated condition of hardened concrete due to non-consolidation.
- 21) ICRI: International Concrete Repair Institute.
- 22) Incompatibility: Inability of a coating to perform well over another coating because of bleeding, poor bonding, or lifting of old coating; inability of a coating to perform well on a substrate.
- 23) Laitance: A layer of weak, non-durable concrete containing cement fines that is brought to the surface through bleed water because of concrete finishing and/or over-finishing.
- 24) Mil: 0.001 inch.
- 25) NACE: National Association of Corrosion Engineers.
- 26) Overspray: Dry spray, particularly such paint that failed to strike the intended surface.
- 27) Pinhole: A small diameter discontinuity in a coating or coating system film that is typically created by outgassing of air from a void in a concrete substrate resulting in exposure of the substrate or a void between coats.
- 28) Pot Life: Time interval after mixing of components during which the coating can be satisfactorily applied.
- 29) Resurfacer/Resurfacing Material: A layer of cementitious and/or resin-base material used to fill or otherwise restore surface continuity to worn or damaged concrete surfaces.
- 30) Shelf Life: Maximum storage time for which a material may be stored without losing its usefulness.
- 31) Shop Coat: One or more coats applied in a shop or plant prior to shipment to the site of the work, where the field or finishing coat is applied.
- 32) Spreading Rate: Area covered by a unit volume of paint at a specific thickness.
- 33) SSPC: The Society for Protective Coatings.
- 34) Stripe Coat: A separate coat of paint applied to all weld seams, pits, nuts/bolts/washers and edges by brush. This coat shall not be applied until any previous coat(s) have cured and, once applied, shall be allowed to cure prior to the application of the subsequent coat(s).
- 35) Surface Saturated Dry (SSD): Refers to concrete surface condition where the surface is saturated (damp) without the presence of standing water.
- 36) Tie Coat: An intermediate coat used to bond different types of paint coats. Coatings used to improve the adhesion of a succeeding coat.
- 37) Touch-Up Painting: The application of paint on areas of painted surfaces to repair marks, scratches, and areas where the coating has deteriorated to restore the coating film to an unbroken condition.
- 38) TPC: Technical Practice Committee.

- 39) Volatile Organic Compound (VOC) Content: The portion of the coating that is a compound of carbon, is photochemically reactive, and evaporates during drying or curing, expressed in grams per liter (g/l) or pounds per gallon (lb/gal).
- 40) Immersion: Refers to a service condition in which the substrate is below the waterline or submerged in water or wastewater at least intermittently if not constantly.
- 41) Weld Splatter: Beads of metal scattered near seam during welding.
- 42) Wet Film Thickness (WFT): The primer or coating film's thickness immediately following application. Wet film thickness is measured in mils or thousandths of an inch (0.001 inch) and is abbreviated WFT.

1.02 QUALITY ASSURANCE

A. References:

1. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued, or replaced.

Reference	Title
ANSI/ASC 29.4 Exhaust Systems	Abrasive Blasting Operations - Ventilation and Safe Practice
ANSI/NSF 61	Drinking Water System Components Health Effects
ANSI B74.18	Grading of Certain Abrasive Grain on Coated Abrasive Material
ASTM D16	Standard Terminology for Paint, Related Coatings, Materials, and Applications
ASTM D2200 (SSPC-VIS1)	Pictorial Surface Preparation Standards for Painting Steel Surfaces
ASTM D3960	Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings
ASTM D4262	Standard Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces
ASTM D4263	Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
ASTM D4414	Standard Practice for Measurement of Wet Film Thickness by Notch Gages
ASTM D4417	Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel
ASTM D4541	Standard Test Methods for Pull-Off Strength of Coatings On Metal Substrates Using Portable Adhesion Testers
ASTM D4787	Standard Practice for Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates

Reference	Title
ASTM D5162	Standard Practice for Discontinuity (Holiday) Testing of Nonconductive Protective Coating on Metallic Substrates
ASTM D7234	Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Adhesion Testers.
ASTM E337	Standard Test Method for Measuring Humidity With a Psychrometer
ASTM F1869	Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
FS 595b	Federal Standard Colors
ICRI 03732	Guideline for Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays
NACE Publication 6D-163	A Manual for Painter Safety
NACE Publication 6F-163	Surface Preparation of Steel or Concrete Tank/Interiors
NACE Publication 6G-164 A	Surface Preparation Abrasives for Industrial Maintenance Painting
NACE Standards	January 1988 Edition of the National Association of Corrosion Engineers, TPC.
NACE Standard RP0188	Standard Recommended Practice – Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates
NACE Standard RP0288	Standard Recommended Practice, Inspection of Linings on Steel and Concrete
NACE Standard RP0892	Standard Recommended Practice, Linings Over Concrete in Immersion Service
NACE Publication TPC2	Coatings and Linings for Immersion Service
NAPF 500-03	Surface Preparation Standard for Ductile Iron Pipe and Fittings in Exposed Locations Receiving Special External Coatings and/or Special Internal Linings
NAPF 500-03-04	Abrasive Blast Cleaning for Ductile Iron Pipe
NAPF 500-03-05	Abrasive Blast Cleaning for Cast Ductile Iron Fittings
OSHA 1910.144	Safety Color Code for Marking Physical Hazards
OSHA 1915.35	Standards – 29CFR - Painting
SSPC	Paint Application Specification No. 1.
SSPC-AB 1	Mineral and Slag Abrasives
SSPC-PA 1	Shop, Field, and Maintenance Painting of Steel
SSPC-PA 2	Measurement of Dry Coating Thickness with Magnetic Gages
SSPC-PA 9	Measurement of Dry Coating Thickness on Cementitious Substrates Using Ultrasonic Gages
SSPC-PA Guide 1	Guide for Illumination of Industrial Painting Project
SSPC-PA Guide 3	A Guide to Safety in Paint Application
SSPC-PA Guide 6	Guide for Containing Debris Generated During Paint Removal Operations
SSPC-PA Guide 11	Guide for Coating Concrete
SSPC SP1	Solvent Cleaning
SSPC SP2	Hand Tool Cleaning
SSPC SP3	Power Tool Cleaning
SSPC SP5	White Metal Blast Cleaning
SSPC SP6	Commercial Blast Cleaning
SSPC SP7	Brush-Off Blast Cleaning
SSPC SP10	Near-White Blast Cleaning
SSPC SP11	Power Tool Cleaning to Bare Metal
SSPC SP12	Surface Preparation and Cleaning of Steel and Other Hard Materials by High and Ultra-High Pressure Water Jetting Prior to Recoating
SSPC SP13	Surface Preparation of Concrete
SSPC-TR2	Wet Abrasive Blast Cleaning
SSPC-TU-3	Overcoating

Reference	Title
SSPC-TU-4	Field Methods for Retrieval and Analysis of Soluble Salts on Substrates.
SSPC V2	Systems and Specifications: Steel Structures Painting Manual, Volume 2
SSPC-VIS 1	Visual Standard for Abrasive Blast Cleaned Steel
SSPC-VIS 3	Visual Standard for Power and Hand – Tool Cleaned Steel
SSPC-VIS 4	Visual Standards (Waterjetting)
SSPC-VIS 5	Visual Standards (Wet Abrasive Blast Cleaning)
WPCF Manual of Practice No. 17	Paints and Protective Coatings for Wastewater Treatment Facilities. Guide and Paint Application Specifications.

B. Standardization:

1. Materials and supplies provided shall be the standard products of CSMs. Materials in each coating system shall be the products of a single CSM.
2. The standard products of CSMs other than those specified may be acceptable when it is demonstrated to the Construction Manager that they are equal in composition, durability, usefulness, and convenience for the purpose intended. Requests for consideration of CSMs other than those specified in this Section will be considered, provided the following minimum conditions are met. Such requests are not a substitution for submittals after the alternative CSMs have been considered and accepted.
 - a. The proposed coating system shall use an equal or greater number of separate coats to achieve the required total dry film thickness.
 - b. The proposed coating system shall use coatings of the same generic type as that specified including curing agent type.
 - c. Requests for consideration of products from CSMs other than those specified in this Section shall include information listed in paragraph 1.04, demonstrating that the proposed CSM's product is equal to the specified coating system.
 - d. The Contractor and the proposed alternative CSM shall provide a list of references for the proposed product where the coating of the same generic type has been applied. The reference list shall include the project name, city, state, owner, phone number of owner; coating system reference and number from this Section 09 90 00; type of facility in which it was used, generic type, and year coating was applied.

C. Quality Control Requirements:

1. The Contractor is responsible for the workmanship and quality of the coating system installation. Inspections by the Construction Manager or the CTR will not relieve or limit the Contractor's responsibilities.
2. The Contractor's methods shall conform to requirements of this specification and the standards referenced in this Section. Changes in the coating system installation requirements will be allowed only with the written acceptance of the Construction Manager before work commences.
3. Only personnel who are trained by the CTR specifically for this contract or who are approved by the CSM specifically for this contract shall be allowed to perform the coating system installation specified in this Section.
4. Contaminated, outdated, diluted materials, and/or materials from previously opened containers shall not be used.

5. For repairs, the Contractor shall provide the same products, or products recommended by the CSM, as used for the original coating.
6. The Contractor shall identify the points of access for inspection by the Owner or the Construction Manager. The Contractor shall provide ventilation, ingress and egress, and other means necessary for the Construction Manager's personnel to access safely the work areas.
7. The Contractor shall conduct the work so that the coating system is installed as specified and shall inspect the work continually to ensure that the coating system is installed as specified. Coating system work that does not conform to the specifications or is otherwise not acceptable shall be corrected as specified.
8. The Contractor shall complete the Coating System Inspection Checklist, Form 09 90 00-A, included in Section 01 99 90, for coating system installations. Follow the sequential steps required for proper coating system installation as specified and as listed in the Coating System Inspection Checklist. For each portion of the work, install the coating system and complete sign-offs as specified prior to proceeding with the next step. After completing each step as indicated on the Coating System Inspection Checklist, the Contractor shall sign the checklist indicating that the work has been installed and inspected as specified.
9. The Contractor shall provide written daily reports that present, in summary form, test data, work progress, surfaces covered, ambient conditions, quality control inspection test findings, and other information pertinent to the coating system installation.

D. Inspection at Hold Points:

1. The Contractor shall conduct inspections at Hold Points during the coating system installation and record the results from those inspections on Form 09 90 00-A. The Contractor shall coordinate such Hold Points with the Construction Manager such that the Construction Manager may observe Contractor's inspections on a scheduled basis. The Contractor shall provide the Construction Manager a minimum of two (2) hours of notice prior to conducting Hold Point Inspections. The Hold Points shall be as follows:
 - a. Environment and Site Conditions. Prior to commencing an activity associated with coating system installation, the Contractor shall measure, record, and confirm acceptability of ambient air temperature and humidity as well as other conditions such as proper protective measures for surfaces not to be coated and safety requirements for personnel. The acceptability of the weather and/or environmental conditions within the structure shall be determined by the requirements specified by the CSM of the coating system being used.
 - b. Conditions Prior to Surface Preparation. Prior to commencing surface preparation, the Contractor shall observe, record, and confirm that oil, grease, and/or soluble salts have been eliminated from the surface.
 - c. Monitoring of Surface Preparation. Spot checking of degree of cleanliness, surface profile, and surface pH testing, where applicable. In addition, the compressed air used for surface preparation or blow down cleaning shall be checked to confirm it is free from oil and moisture.
 - d. Post Surface Preparation – Upon completion of the surface preparation, the Contractor shall measure and inspect for proper degree of cleanliness and surface profile as specified in this Section 09 90 00 and in the CSM's written instructions.

- e. Monitoring of Coatings Application – The Contractor shall inspect, measure, and record the wet film thickness and general film quality (visual inspection) for lack of runs, sags, pinholes, holidays, etc. as the application work proceeds.
- f. Post Application Inspection – The Contractor shall identify defects in application work including pinholes, holidays, excessive runs or sags, inadequate or excessive film thickness and other problems as may be observed.
- g. Post Cure Evaluation – The Contractor shall measure and inspect the overall dry film thickness. The Contractor shall conduct a DFT survey, as well as perform adhesion testing, holiday detection, or cure testing as required based on the type of project and the specific requirements in this Section 09 90 00 and/or in the CSM's written instructions.
- h. Follow-up to Corrective Actions and Final Inspection. The Contractor shall measure and reinspect corrective coating work performed to repair defects identified at prior Hold Points. This activity also includes final visual inspection along with follow-up tests such as holiday detection, adhesion tests, and DFT surveys.

1.03 DELIVERY AND STORAGE

A. General:

1. Materials shall be delivered to the job site in their original, unopened containers. Each container shall be properly labeled. Materials shall be handled and stored to prevent damage to or loss of label.
2. Labels on material containers shall show the following information:
 - a. Name or title of product.
 - b. CSM's batch number.
 - c. CSM's name.
 - d. Generic type of material.
 - e. Application and mixing instructions.
 - f. Hazardous material identification label.
 - g. Shelf life expiration date.
3. Materials shall be stored in enclosed structures and shall be protected from weather and excessive heat or cold in accordance with the CSM's recommendations. Flammable materials shall be stored in accordance with state and local requirements.
4. Containers shall be clearly marked indicating personnel safety hazards associated with the use of or exposure to the materials.
5. Material Safety Data Sheets (MSDS) for each material shall be provided to the Construction Manager.
6. The Contractor shall store and dispose of hazardous waste according to federal, state and local requirements. This requirement specifically addresses waste solvents and coatings.

1.04 SUBMITTALS:

A. General:

1. Provide in accordance with Section 01 33 00:

- a. A copy of this specification section, with addendum updates included, and referenced and applicable sections, with addendum updates included, with each paragraph check-marked (✓) to indicate specification compliance or marked to indicate requested deviations from specification requirements or those parts which are to be provided by the Contractor or others. Check marks shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Construction Manager shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined shall signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for requested deviations to the specification requirements shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.
- b. CSM's current printed recommendations and product data sheets for coating systems including:
 - 1) Volatile organic compound (VOC) data.
 - 2) Surface preparation recommendations.
 - 3) Primer type, where required.
 - 4) Maximum dry and wet-mil thickness per coat.
 - 5) Minimum and maximum curing time between coats, including atmospheric conditions for each.
 - 6) Curing time before submergence in liquid.
 - 7) Thinner to be used with each coating.
 - 8) Ventilation requirements.
 - 9) Minimum atmospheric conditions during which the paint shall be applied.
 - 10) Allowable application methods.
 - 11) Maximum allowable moisture content.
 - 12) Maximum shelf life.
- c. Affidavits signed and sealed by an officer of the CSM's corporation, attesting to full compliance of each coating system component with current and promulgated federal, state, and local air pollution control regulations and requirements.
- d. Material Safety Data Sheets (MSDS) for materials to be delivered to the job site, including coating system materials, solvents, and abrasive blast media.
- e. List of cleaning and thinner solutions allowed by the CSMs.
- f. Storage requirements including temperature, humidity, and ventilation for Coating System Materials as recommended by the CSMs.
- g. CSM's detailed, written instructions for coating system treatment and graphic details for coating system terminations in the structures to be coated including pipe penetrations, metal embedments, gate frames, and other terminations to be determined from the contract drawings. This information shall also include detail treatment for coating system at joints in concrete.
- h. The Contractor and CSA shall provide a minimum of five project references each including contact name, address, and telephone number where similar coating work has been performed by their companies in the past five years.

1.05 RESPONSIBILITIES OF THE CTR

A. General:

1. The Contractor shall retain or obtain the services of the CTR to be on site to perform the Contractor and/or CSA application training and to routinely inspect and verify in writing that the application personnel have successfully performed surface preparation, filler/surface application, coating system application, and Quality Control Inspection in accordance with this Section 09 90 00 and to warrantable level of quality. This must include checking the required degree of cleanliness, surface pH for concrete substrates, surface profile of substrates, proper mixing of coating materials, application (including checking the wet and dry film thickness of the coating systems), proper cure of the coating systems, and proper treatment of coating systems at terminations, transitions, and joints and cracks in substrates. Refer to paragraph 1.05 Coating System Installation Training. for further details on these CTR requirements. This inspection is in addition to the inspection performed by the Contractor in accordance with this Section 09 90 00.

B. Coating System Installation Training:

1. Provide a minimum of 8 hours of classroom and off site training for application and supervisory personnel (both the Contractor's and CSA's). Provide training to a minimum of two supervisory personnel from the CSA and one supervisor from the Contractor. Alternatively, the CTR shall provide a written letter from the CSM stating that the application personnel (listed by name) who shall perform coating work are approved by the CSM without further or additional training.
2. One CTR can provide training for up to fourteen application personnel and three supervisory personnel at one time. The training shall include the following as a minimum:
 - a. A detailed explanation of mixing, application, curing, and termination details.
 - b. Hands-on demonstration of how to mix and apply the coating systems.
 - c. A detailed explanation of the ambient condition requirements (temperature and humidity) and surface preparation requirements for application of the coating system as well as a detailed explanation of re-coat times, cure times, and related ambient condition requirements.
 - d. When training is performed, the CTR shall provide a written letter stating that training was satisfactorily completed by the personnel listed by name in the letter.

C. Coating System Inspection:

1. While on site to routinely inspect and verify, the CTR shall perform the following activities to confirm acceptability and conformance with the specifications:
 - a. Inspect ambient conditions during various coating system installation at hold points for conformance with the specified requirements.
 - b. Inspect the surface preparation of the substrates where the coating system will terminate or will be applied for conformance to the specified application criteria.
 - c. Inspect preparation and application of coating detail treatment (for example, terminations at joints, metal embedments in concrete, etc.).
 - d. Inspect application of the filler/surface materials for concrete and masonry substrates.

- e. Inspect application of the primers and finish coats including wet and dry film thickness of the coatings.
- f. Inspect coating systems for cure.
- g. Review adhesion testing of the cured coating systems for conformance to specified criteria.
- h. Review coating system continuity testing for conformance to specified criteria.
- i. Inspect and record representative localized repairs made to discontinuities identified via continuity testing.
- j. Conduct a final review of completed coating system installation for conformance to the specifications.
- k. Prepare and submit a site visit report following each site visit that documents the acceptability of the coating work in accordance with the CSM's Recommendations.

D. Final Report:

- 1. Upon completion of coating work for the project, the CTR shall prepare a final report. That report shall summarize daily test data, observations, drawings, and photographs in a report to be submitted in accordance with paragraph 2.02. Include substrate conditions, ambient conditions, and application procedures, observed during the CTR's site visits. Include a statement that the completed work was performed in accordance with the requirements of this Section 09 90 00 and the CSM's recommendations.

PART 2 PRODUCTS

2.01 MATERIALS

A. General:

- 1. Notwithstanding the listing of product names in this Section 09 90 00, the Contractor shall provide affidavits, signed and sealed by an officer of the CSM's corporation, attesting to full compliance of each coating system component with current and promulgated federal, state, and local air pollution control regulations and requirements. No coatings shall be applied to a surface until the specified affidavits have been submitted and have been reviewed and accepted. Failure to comply with this requirement shall be cause for rejection and removal of such materials from the site.
- 2. The following list specifies the material requirements for coating systems. Coating systems are categorized by generic name followed by an identifying abbreviation. If an abbreviation has a suffix number, it is for identifying subgroups within the coating system. Coating Systems E-5 and E-6 shall be NSF 61 certified.

Material Requirements for Coating Systems:

Coating System	CSM	First Coat(s)	Finish Coat(s)
Epoxy Coatings			
E-1	PPG PMC	Amerlock 2/400 Series	Amerlock 2/400 Series
	Carboline	Carboguard 890	Carboguard 890
	International Paint/ICI *	Devran 224 HS	Devran 224

Material Requirements for Coating Systems:

Coating System	CSM	First Coat(s)	Finish Coat(s)
	Tnemec	Series V69	Series V69
E-1-G	PPG PMC	Amerlock 2/400 Series	Amerlock 2/400 Series
	Carboline	Carboguard 894	Carboguard 894
	International Paint/ICI *	Devran 223/224HS	Devran 224HS
	Tnemec	Series V27 or V69	Series V69
E-2	PPG PMC	Amerlock 2/400 Series	Amerlock 2/400 Series
	Carboline	Carboguard 890	Carboguard 890
	International Paint/ICI	Bar-Rust 236	Bar-Rust 236
	Tnemec	Series V27 or V69	Series V69
E-3	PPG PMC	Amerlock 2/400 Series	Amerlock 2/400 Series
	Carboline	Carboguard 890	Carboguard 890
	International Paint/ICI	Bar-Rust 236	Bar-Rust 236
	Tnemec	Series V69	Series V69
E-4	PPG PMC	Amerlock 2/400 Series	Amerlock 2/400 Series
	Carboline	Carboguard 890	Carboguard 890
	International Paint/ICI	Bar-Rust 236	Bar-Rust 236
	Tnemec	Series V69	Series V69
E-5	PPG PMC	Amercoat 395FD	Amercoat 395FD
	Carboline	Carboguard 691	Carboguard 691
	International Paint/ICI	Bar-Rust 233H	Bar-Rust 233H
	Tnemec	Series V69	Series V69
E6	PPG PMC	Amercoat 395FD	Amercoat 395FD
	Carboline	Carboguard 691	Carboguard 691
	International Paint/ICI	Tru-Glaze 4408 - WB	Tru-Glaze 4408 - WB
	Tnemec	Series V69	Series V69
E7	PPG PMC	Amercoat 385	Amercoat 385
	Carboline	Sanitile 120	Carboguard 890
	International Paint/ICI	Bar-Rust 236	Bar-Rust 236
	Tnemec	Series V69	Series V69
E8	PPG PMC	Amercoat 385	Amercoat 385
	Carboline	Carboguard 1340	Carboguard 1340
	International Paint/ICI	Prep and Prime (Gripper)	Tru-Glaze 4408 - WB
	Tnemec	Series 201	Series 201
E-9	PPG PMC	Amercoat 395 FD	Amercoat 395 FD
	Carboline	Carboguard 890	Carboguard 890

Material Requirements for Coating Systems:

Coating System	CSM	First Coat(s)	Finish Coat(s)
E-9-C	International Paint/ICI	Bar-Rust 231	Bar-Rust 231
	Tnemec	Series 104	Series 104
	PPG PMC	Amercoat 395 FD	Amercoat 395 FD
	Carboline	Carboguard 890	Carboguard 890
E-10	International Paint/ICI	Bar-Rust 231	Bar-Rust 231
	Tnemec	Series 104	Series 104
	PPG PMC	Amerlock 2/400 Series	Amerlock 2/400 Series
	Carboline	Carboguard 890	Carboguard 890
E-10	International Paint/ICI	Bar-Rust 236	Bar-Rust 236
	Tnemec	Series V69	Series V69
	PPG PMC	Amerlock 2/400 Series	Amerlock 2/400 Series
	Carboline	Carboguard 890	Carboguard 890

Specialty Epoxy Linings

EA-1	Carboline	Plasite 4500S		Plasite 4500S		
	Sauereisen	Sewergard 210S		Sewergard 210S		
	Tnemec	Series 435		Series 435		
Coating System	CSM	Base Coat	Filler/Surfacer	Glaze Coat		
EA-2	Carboline Carboguard	Plasite 4500S	Carboguard 510	Plasite 4500S		
	Sauereisen	Sewergard 210S	Series 209 HB	Sewergard 210S		
	Tnemec	Series 435	Series 218	Series 435		
EA-3	Carboline	N/A	Carboguard 510SG	Plasite 4500S		
	Tnemec	N/A	Series 218	Series G435		
Coating System	CSM	Primer	Base Coat	Glaze Coat		
EA-4	Carboline	N/A	Plasite 5371	Plasite 4500S		
	Sauereisen	N/A	Sewergard 210T	Sewergard 210G		
	Tnemec	N/A	Series 434	Series 435		
Coating System	CSM	Primer	Filler/ Surfacer	Base Coat w/Scrim Cloth	Saturation Coat w/Silica Sand	Finish Coats
EA-5	Tnemec	Series 201	Series 218	Series 239	Series 239	Series 282
	Carboline	Semstone 110/110EP	Carboguard 510	Semstone 145	Semstone 145	Semstone 145

Elastomeric Coatings

EC-1	Carboline	Carboguard 671		Polibrid 705 (2 coats)
	Tnemec	Series 1		Series 406 (2 coats)
EC-2	Carboline	Carboguard 671		Polibrid 705 (2 coats)
	Tnemec	Series V69		Series 264

Epoxy Flooring Systems

Coating System	CSM	Primer	Intermediate Coat	Finish Coat
EF-1	Stonhard	Stonhard Standard Primer	Stonshield Undercoat and Broadcoat	Stonshield Sealer

Material Requirements for Coating Systems:

Coating System	CSM	First Coat(s)		Finish Coat(s)
	Tnemec	Series 238	Series 238 with Broadcoat	Series 284 Clear
EF-2	Stonhard	Stonhard Standard Primer	Stonclad GS	Stonkote GS-4
	Tnemec	Series 238	Series 238	Series 280
Epoxy Polyurethane				
		Primer Coat(s)	Intermediate Coat(s)	
EU-1	PPG PMC	Amercoat	Amercoat 385	Amercoat 450H
	Carboline	Carbozinc 859	Carboguard 890	Carbothane 134 VOC
	International Paint/ICI	Cathacoat 313	Devran 233 or 224HS	Devthane 379
	Tnemec	Series 90-97	Series V69	Series 1075
EU-1-FRP	PPG PMC	Amerlock 2/400 Series		Amersfield VOC
	Carboline	Carbocrylic 120		Carbothane 134 VOC
	International Paint/ICI	Devran 223/224		Devthane 378H
	Tnemec	Series V27		Series 1075
Grease				
G	Texaco	N/A		Rust Inhibitive Grease
	Chevron	N/A		E.P. Roller Grease
High Heat				
HH-1	High Temperature Coatings, Inc.	Hi Temp 1027		1000 VS (any color)
HH-2	High Temperature Coatings, Inc.	Hi Temp 1027		1000 VS (black or aluminum)
Latex Acrylic				
L-1	PPG PMC	Amercoat 148		Amercoat 220
	Carboline	Carbocrylic 120		Carbocrylic 3359
	International Paint/ICI	UH Gripper 3210		Dulux Pro 1406
	Tnemec	Series 1028 or 1029		Series 1028 or 1029
L-2	PPG PMC	Amercoat 220		Amercoat 220
	Carboline	Carbocrylic 120		Carbocrylic 3359
	International Paint/ICI	Prep and Prime Gripper		Ultrahide 250-1406
	Tnemec	Series 1028 or 1029		Series 1028 or 1029
L-3	PPG PMC	Amercoat 148		Amercoat 220
	Carboline	Carbocrylic 3359 DTM		Carbocrylic 3359 DTM
	International Paint/ICI	Devflex 4020 PF		Dulux Pro 1406
	Tnemec	Series 1028 or 1029		Series 1028 or 1029
L-4	PPG PMC	Amercoat 148		Amercoat 220
	Carboline	Sanitile 120		Sanitile 155
	International Paint/ICI	Prepared Prime Gripper		Ultrahide 250-1406

Material Requirements for Coating Systems:

Coating System	CSM	First Coat(s)	Finish Coat(s)
	Tnemec	Series 1028 or 1029	Series 1028 or 1029
Miscellaneous			
M-1	Carboline	Carbowrap Priming Paste	Tape A, B, or C (temp. dependent)
	Denso	Denso Paste	Densyl Tape
	Trenton	Waxtape Primer	#1 Wax Tape
M-2	Carboline	Carbomastic 15	Carbomastic 15
	International Paint/ICI	Bar-Rust 231 (231K 9100)	Bar-Rust 231 (231K 9100)
	Tnemec	Series 135 (1243)	Series 135 (1243)
Penetrating Stain			
	CSM	Primer	Finish
S-1	Carboline	Carbocrete Sealer WB	Carbocrete Sealer WB
	International Paint/ICI	Groundworks	Groundworks
	Tnemec	Series 617	Series 617
S-2	Tnemec	N/A	Series 636 Dur A Pell 20
	Curecrete Chemical Company	N/A	Ashford Formula
S-3	Tnemec	N/A	Series V626 Dur A Pell GS
S-4	Tnemec	N/A	Series V626 Dur A Pell GS
	Professional Products of Kansas	N/A	PWS-15 Super

*See CSM's Product Data Sheets for acceptable thinners for VOC compliance or do not thin.

2.02 PRODUCT DATA

A. General:

1. Prior to application of coatings, submit letter(s) from the CTR(s) identifying the application personnel who have satisfactorily completed training as specified in paragraph 1.05 or a letter from the CSM stating that personnel who shall perform the work are approved by the CSM without need for further or additional training.
2. Submit reports specified in paragraph 1.02 Quality Control Requirements and 1.05 Coating System Inspection when the work is underway.
3. Submit the Coating System Inspection Checklists, using Form 09 90 00-A, included in Section 01 99 90, for the coating work.
4. CTR final report in accordance with paragraph 1.05 Final Report.

PART 3 EXECUTION

3.01 COATINGS

A. General:

1. Coating products shall not be used until the Construction Manager has accepted the affidavits specified in paragraphs 1.04 and 2.01, the Construction Manager has

inspected the materials, and the CTR has trained the Contractor and CSA in the surface preparation, mixing and application of each coating system.

2. Erect and maintain protective enclosures as stipulated per SSPC-Guide 6 Guide for Containing Debris Generated During Paint Removal Operations.

B. Shop and Field Coats:

1. Shop Applied Prime Coat: Except as otherwise specified, prime coats may be shop-applied or field-applied. Shop-applied primer shall be compatible with the specified coating system and shall be applied at the minimum dry film thickness recommended by the CSM. Data sheets identifying the shop primer used shall be provided to the on-site coating application personnel. Adhesion tests shall be performed on the shop primer as specified in paragraph 3.01 Adhesion Confirmation. Damaged, deteriorated and poorly applied shop coatings that do not meet the requirements of this Section 09 90 00 shall be removed and the surfaces recoated. If the shop primer coat meets the requirements of this Section 09 90 00, the field coating may consist of touching up the shop prime coat and then applying the finish coats to achieve the specified film thickness and continuity.
2. Field Coats: Field coats shall consist of one or more prime coats and one or more finish coats to build up the coating to the specified dry film thickness. Unless otherwise specified, finish coats shall not be applied until other work in the area is complete and until previous coats have been inspected.
3. Adhesion Confirmation: The Contractor shall perform an adhesion test after proper cure in accordance with ASTM D3359 to demonstrate that (1) the shop applied prime coat adheres to the substrate, and (2) the specified field coatings adhere to the shop coat. Test results showing an adhesion rating of 5A on immersed surfaces and 4A or better on other surfaces shall be considered acceptable for coatings 5 mils or more in thickness (Method A). Test results showing an adhesion rating of 5B on immersed surfaces and 4B or better on other surfaces shall be considered acceptable for coating thicknesses less than 5 mils.

C. Application Location Requirements:

1. Equipment, Nonimmersed: Items of equipment, or parts of equipment that are not immersed in service, shall be shop primed and then finish coated in the field after installation with the specified or acceptable color. If the shop primer requires topcoating within a specified period, the equipment shall be finish coated in the shop and then touch-up painted after installation. If equipment removal and reinstallation is required for the project, touch-up coating work shall be performed in the field following installation.
2. Equipment, Immersed: Items of equipment, or parts and surfaces of equipment that are immersed when in service, with the exception of pumps and valves, shall have surface preparation and coating work performed in the field. Coating systems applied to immersed equipment shall be pinhole free.
3. Steel Water Tanks: The interior surfaces of steel water tanks or reservoirs shall have surface preparation and coating work performed in the field.

3.02 PREPARATION

A. General:

1. Surface preparations for each type of surface shall be in accordance with the specific requirements of each coating specification sheet (COATSPEC) and the following. In the event of a conflict, the COATSPEC sheets shall take precedence.
2. Surfaces to be coated shall be clean and dry. Before applying coating or surface treatments, oil, grease, dirt, rust, loose mill scale, old weathered coatings, and other foreign substances shall be removed. Oil and grease shall be removed before mechanical cleaning is started. Where mechanical cleaning is accomplished by blast cleaning, the abrasive used shall be washed, graded and free from contaminants that might interfere with the adhesion of the coatings. The air used for blast cleaning shall be sufficiently free of oil and moisture so as not to cause detrimental contamination of the surfaces to be coated.
3. Where deemed necessary by the Owner's representative, a NACE International certified coatings inspector, provided by the Owner, will inspect and approve surfaces to be coated before application of a coating. Surface defects identified by the inspector shall be corrected by the Contractor at no additional cost to the Owner.
4. Cleaning and painting shall be scheduled so that dust and spray from the cleaning process shall not fall on wet, newly coated surfaces. Hardware, hardware accessories, nameplates, data tags, machined surfaces, sprinkler heads, electrical fixtures, and similar uncoated items which are in contact with coated surfaces shall be removed or masked prior to surface preparation and painting operations. Following completion of coating, removed items shall be reinstalled. Equipment adjacent to walls shall be disconnected and moved to permit cleaning and painting of equipment and walls and, following painting, shall be replaced and reconnected.

B. Blast Cleaning:

1. When abrasive blast cleaning is required to achieve the specified surface preparation the following requirements for blast cleaning materials and equipment shall be met:
 - a. Used or spent blast abrasive shall not be reused on this project.
 - b. The compressed air used for blast cleaning shall be filtered and shall contain no condensed water and no oil. Moisture traps shall be cleaned at least once every four hours or more frequently as required to prevent moisture from entering the supply air to the abrasive blasting equipment.
 - c. Oil separators shall be installed just downstream of compressor discharge valves and at the discharge of the blast pot discharges. These shall be checked on the same frequency as the moisture traps as defined above.
 - d. Regulators, gauges, filters, and separators shall be in use on compressor air lines to blasting nozzles times during this work.
 - e. An air dryer or desiccant filter drying unit shall be installed which dries the compressed air prior to blast pot connections. This dryer shall be used and maintained for the duration of surface preparation work.
 - f. The abrasive blast nozzles used shall be of the venturi or other high velocity type supplied with a minimum of 100 psig air pressure and sufficient volume to obtain the blast cleaning production rates and cleanliness/specified.
 - g. The Contractor shall provide ventilation for airborne particulate evacuation (meeting pertinent safety standards) to optimize visibility for both blast cleaning and inspection of the substrate during surface preparation work.

- h. If, between final surface preparation work and coating system application, contamination of prepared and cleaned metallic substrates occurs, or if the prepared substrates' appearance darkens or changes color, recleaning by water blasting, reblasting and abrasive blast cleaning shall be required until the specified degree of cleanliness is reclaimed.
- i. The Contractor is responsible for dust control and for protection of mechanical, electrical, and other equipment adjacent to and surrounding the work area.

C. Solvent Cleaning:

- 1. Any solvent wash, solvent wipe, or cleaner used, including but not limited to those used for surface preparation in accordance with SSPC SP-1 Solvent Cleaning and shall be of the emulsifying type which emits no more than 340 g/l VOCs for AIM regions, 250 g/l for CARB regions and 100 g/l for SCAQMD regions, contains no phosphates, is biodegradable, removes no zinc, and is compatible with the specified primer.
- 2. Clean white cloths and clean fluids shall be used in solvent cleaning.

D. Metallic Surfaces:

- 1. Metallic surfaces shall be prepared in accordance with applicable portions of surface preparation specifications of the Society for Protective Coatings (SSPC) specified for each coating system. See Coat Spec for each coating system in this Section 09 90 00. The profile depth of the surface to be coated shall be in accordance with the COATSPEC requirements in this Section measured by Method C of ASTM D4417. Blast particle size shall be selected by the Contractor to produce the specified surface profile. The solvent in solvent cleaning operations shall be as recommended by the CSM.
- 2. Preparation of metallic surfaces shall be based upon comparison with SSPC-VIS1-89 (ASTM D2200), and as described in the Coat Spec for each coating system. If dry abrasive blast cleaning is selected and to facilitate inspection, the Contractor shall, on the first day of cleaning operations, abrasive blast metal panels to the standards specified. Plates shall measure a minimum of 8-1/2 inches by 11 inches. Panels meeting the requirements of the specifications shall be initialed by the Contractor and the Construction Manager and coated with a clear non-yellowing finish. One of these panels shall be prepared for each type of abrasive blasting and shall be used as the comparison standard throughout the project.
- 3. Blast cleaning requirements for steel, ductile iron and stainless steel substrates are as follows:
 - a. Steel piping shall be prepared in accordance with SSPC SP-6 (Commercial Blast Cleaning) and primed before installation. Ductile iron piping surfaces including fittings shall be prepared in accordance with NAPF 500-03, NAPF 500-03-04, and NAPF 500-03-05.
 - b. Stainless steel surfaces shall be abrasive blast cleaned to leave a clean uniform appearance with a minimum surface profile of 1.5 to 2.5 mils that is uniform.
 - c. Remove traces of grit, dust, dirt, rust scale, friable material, loose corrosion products or embedded abrasive from substrate by vacuum cleaning prior to coating application.
 - d. Care must be taken to prevent contamination of the surface after blasting from worker's fingerprints, deleterious substances on workers' clothing, or from atmospheric conditions.

- e. Ambient environmental conditions in the enclosure must be constantly monitored and maintained to ensure the degree of cleanliness is held and no “rust back” occurs prior to coating material application.

E. Concrete Surfaces:

1. Inspection of concrete surfaces prior to surface preparation and surface preparation of concrete surfaces shall be performed in accordance with SSPC-SP13 (also called NACE 6).
2. Prepare substrate cracks, areas requiring resurfacing and perform detail treatment including but not limited to, terminating edges, per CSM recommendations. This shall precede surface preparation for degree of cleanliness and profile.
3. The surface profile for prepared concrete surfaces to be coated shall be evaluated by comparing the profile of the prepared concrete with the profile of graded abrasive paper, as described in ANSI B74.18 or by comparing the profile with the ICRI 03732 (surface profile replicas). Surface profile requirements shall be in accordance with the Coat Spec requirements and the CSM’s recommendations.
4. Surface cleanliness of prepared concrete substrates shall be inspected after cleaning, preparation, and/or drying, but prior to making repairs or applying a coat in the coating system. If concrete surfaces are repaired, they shall be reinspected for surface cleanliness prior to application of the coating system.
5. Surface preparation of concrete substrates shall be accomplished using methods such as dry abrasive blast cleaning, high, or ultra high-pressure water blast cleaning in accordance with SSPC-SP-13. The selected cleaning method shall produce the requirements set forth below.
 - a. A clean substrate that is free of calcium sulfate, loose coarse or fine aggregate, laitance, loose hydrated cement paste, and otherwise deleterious substances shall be achieved. Blast cleaning and other means necessary shall be used to open up air voids or bugholes to expose their complete perimeter. Leaving shelled over, hidden air voids beneath the exposed concrete surface is not acceptable. Concrete substrate must be dry prior to the application of filler/surface or coating system materials.
 - b. Acceptable surface preparation must produce a concrete surface with a minimum pH of 8.0 to be confirmed by surface pH testing. If after surface preparation, the surface pH remains below 8.0, perform additional water blasting, cleaning, or abrasive blast cleaning until additional pH testing indicates an acceptable pH level.
 - c. Following inspection by the Contractor of the concrete surface preparation, thoroughly vacuum clean concrete surfaces to be coated to remove loose dirt, and spent abrasive (if dry blast cleaning is used) leaving a dust free, sound concrete substrate. Debris produced by blast cleaning shall be removed from the structures to be coated and disposed of legally off site by the Contractor.
6. Should abrasive blast cleaning or high or ultrahigh pressure water blasting not remove degraded concrete, chipping or other abrading tools shall be used to remove the deteriorated concrete until a sound, clean substrate is achieved which is free of calcium sulfate, loose coarse or fine aggregate, laitance, loose hydrated cement paste, and otherwise deleterious substances. Concrete substrates must be dry prior to the application of filler/surfacers or coating system materials.
7. Surface cleanliness of prepared concrete substrates shall be inspected after cleaning, preparation, and/or drying, but prior to application of coating materials. If

concrete surfaces are repaired, they shall be reinspected for surface cleanliness and required surface profile prior to application of the coating system.

8. Moisture content of concrete to be coated shall be tested in accordance with ASTM D4263, Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method and ASTM F 1869, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride. The ASTM D4263 plastic sheet test shall be conducted at least once for every 500 sq. ft. of surface area to be coated. The presence of any moisture on plastic sheet following test period constitutes a non-acceptable test. For concrete surfaces to be coated which are on the negative or back side of concrete walls or structures exposed to soils (back filled) or immersed and waterproofed in accordance with Section 07 10 00, perform calcium chloride tests in accordance with ASTM F-1869 once for each 500 sq. ft. of surface area to be coated. Comply with CSM's written recommendations regarding acceptance/non-acceptance of moisture vapor emissions.

F. Masonry Surfaces:

1. Prepare masonry surfaces such as Concrete Masonry Units (CMU) to remove chalk, loose dirt, dried mortar splatter, dust, peeling, or loose existing coatings, or otherwise deleterious substances to leave a clean, sound substrate.
2. Be certain masonry surfaces are dry prior to coating application. If pressure washing or low-pressure water blast cleaning is used for preparation, allow the masonry to dry for at least 5 days under dry weather conditions or when the minimum ambient temperature is 70 degrees F prior to coating application work.

G. Fiberglass Reinforced Plastic (FRP) Surfaces:

1. Prepare FRP surfaces by sanding to establish uniform surface roughness and to remove gloss from the resin in the FRP. Next, vacuum clean to remove loose FRP dust, dirt, and other materials. Next, solvent clean using clean white rags and allow solvent to evaporate completely before application of coating materials.

3.03 APPLICATION

A. Workmanship:

1. Coated surfaces shall be free from runs, drips, ridges, waves, laps, and brush marks. Coats shall be applied to produce an even film of uniform thickness completely coating corners and crevices.
2. The Contractor's equipment shall be designed for application of the materials specified. Compressors shall have suitable traps and filters to remove water and oils from the air. A paper blotter test shall be performed by the Contractor when requested by the Construction Manager to determine if the air is sufficiently free of oil and moisture so as not to produce deteriorating effects on the coating system. The amount of oil and moisture in spray air shall be less than the amount recommended by the CSM. Spray equipment shall be equipped with mechanical agitators, pressure gages, and pressure regulators, and spray nozzles of the proper sizes.
3. Each coat of coating material shall be applied evenly and sharply cut to line. Care shall be exercised to avoid overspraying or spattering paint on surfaces not to be coated. Glass, hardware, floors, roofs, and other adjacent areas and installations shall be protected by taping, drop cloths, or other suitable measures.

4. Coating applications method shall be conventional or airless spray, brush or roller, or trowel as recommended by CSM.
 5. Allow each coat to cure or dry thoroughly, according to CSM's printed instructions, prior to recoating.
 6. Vary color for each successive coat for coating systems when possible.
 7. When coating complex steel shapes, prior to overall coating system application, stripe coat welds, edges of structural steel shapes, metal cut-outs, pits in steel surfaces, or rough surfaces with the primer coat. This involves applying a separate coat using brushes or rollers to ensure proper coverage. Stripe coat via spray application is not permitted.
- B. Coating Properties, Mixing and Thinning:
1. Coatings, when applied, shall provide a satisfactory film and smooth even surface. Glossy undercoats shall be lightly sanded to provide a surface suitable for the proper application and adhesion of subsequent coats. Coating materials shall be thoroughly stirred, strained, and kept at a uniform consistency during application. Coatings consisting of two or more components shall be mixed in accordance with the CSM's instructions. Where necessary to suit the conditions of the surface, temperature, weather and method of application, the coating may be thinned as recommended by the CSM immediately prior to use. The volatile organic content (VOC) of the coating as applied shall comply with prevailing air pollution control regulations. Unless otherwise specified, coatings shall not be reduced more than necessary to obtain the proper application characteristics. Thinner shall be as recommended by the CSM.
- C. Atmospheric Conditions:
1. Coatings shall be applied only to surfaces that are dry, and only under conditions of evaporation rather than condensation. Coatings systems shall not be applied during rainy, misty weather, or to surfaces upon which there is frost or moisture condensation. During damp weather, when the temperature of the surface to be coated is within 10 degrees F of the dew point, forced dehumidification equipment may be used to maintain a temperature of minimum 40 degrees F and 10 degrees F above the dew point for the surfaces to be coated, the coated surface, and the atmosphere in contact with the surface. These conditions shall be maintained for a period of at least 8 hours or as recommended by the CSM. Where conditions causing condensation are severe, dehumidification equipment, fans, and/or heaters shall be used inside enclosed areas to maintain the required atmospheric and surface temperature requirements for proper coating application and cure.
- D. Concrete Substrate Temperatures and Detail Treatment:
1. When the surface temperatures of the concrete substrates to be coated are rising or when these substrates are in direct sunlight, outgassing of air from the concrete may result in bubbling, pinhole formations, and/or blistering in the coating system. The application of the filler/surface and the coating system will only be allowed during periods of falling temperature. This will require that application of the filler/surface and coating system shall only occur during the cooler evening hours. Contractor shall include any cost for working outside of normal hours in the bid.
 2. Should bubbles, pinholes, or discontinuities form in the applied coating system material, they shall be repaired as recommended by the CSM. Should pinholes develop in the filler/surfacer material or in the first coat of the coating material, the pinholes shall be repaired in accordance with the CSM's recommendations prior to

application of the next coat of material. Whenever pinholes occur, the air void behind or beneath the pinhole shall be opened up completely and then completely filled with the specified filler/surfacer material. Next, the coated area around the pinhole repair shall be abraded and the coating reapplied over that area.

3. Perform application detail work per CSM's current written recommendations and/or drawings.

E. Protection of Coated Surfaces:

1. Items that have been coated shall not be handled, worked on, or otherwise disturbed, until the coating is completely dry and hard. After delivery at the site, and upon permanent erection or installation, shop-coated metalwork shall be recoated or retouched with specified coating when it is necessary to maintain the integrity of the film.

F. Method of Coating Application:

1. Where two or more coats are required, alternate coats shall contain sufficient compatible color additive to act as indicator of coverage, or the alternate coats shall be of contrasting colors. Color additives shall not contain lead, or lead compounds, which may be destroyed or affected by hydrogen sulfide or other corrosive gas, and/or chromium.
2. Mechanical equipment, on which the equipment manufacturer's coating is acceptable, shall be touch-up primed and coated with two coats of the specified coating system to match the color scheduled. Electrical and instrumentation equipment specified in Divisions 26 and 40 shall be coated as specified in paragraph 3.03 Electrical and Instrumentation Equipment and Materials.
3. Coatings shall not be applied to a surface until it has been prepared as specified. The primer or first coat shall be applied by brush to ferrous surfaces that are not blast-cleaned. Coats for blast-cleaned ferrous surfaces and subsequent coats for nonblast-cleaned ferrous surfaces may be either brush or spray applied. After the prime coat is dry, pinholes and holidays shall be marked, repaired in accordance with CSM's recommendations and retested before succeeding coats are applied. Unless otherwise specified, coats for concrete and masonry shall be brushed, rolled, or troweled.

G. Film Thickness and Continuity:

1. WFT of the first coat of the coating system and subsequent coats shall be verified by the Contractor, following application of each coat.
2. The surface area covered per gallon of coating for various types of surfaces shall not exceed those recommended by the CSM. The first coat, referred to as the prime coat, on metal surfaces refers to the first full paint coat and not to solvent wash, grease emulsifiers or other pretreatment applications. Coatings shall be applied to the thickness specified, and in accordance with these specifications. Unless otherwise specified, the average total thickness (dry) of a completed protective coating system on exposed metal surfaces shall be not less than 1.25 mils per coat. The minimum thickness at any point shall not deviate more than 25 percent from the required average. Unless otherwise specified, no less than two coats shall be applied.
3. In testing for continuity of coating about welds, projections (such as bolts and nuts), and crevices, the Construction Manager shall determine the minimum conductivity for smooth areas of like coating where the dry-mil thickness has been accepted. This

conductivity shall be the minimum required for these rough or irregular areas. Pinholes and holidays shall be recoated to the required coverage.

4. The ability to obtain specified film thickness is generally compromised when brush or roller application methods are used and, therefore, more coats may need to be applied to achieve the specified dry film thickness.
5. For concrete substrates, the Contractor shall apply a complete skim coat of the specified filler/surfacer material over the entire substrate prior to application of the coating system. This material shall be applied such that all open air voids and bugholes in the concrete substrate are completely filled prior to coating application.

H. Special Requirements:

1. Before erection, the Contractor shall apply all but the final finish coat to interior surfaces of roof plates, roof rafters and supports, pipe hangers, piping in contact with hangers, and contact surfaces that are inaccessible after assembly. The final coat shall be applied after erection. Structural friction connections and high tensile bolts and nuts shall be coated after erection. Areas damaged during erection shall be hand-cleaned or power-tool cleaned and recoated with primer coat prior to the application of subsequent coats. Touch-up of surfaces shall be performed after installation. Surfaces to be coated shall be clean and dry at the time of application. Except for those to be filled with grout, the underside of equipment bases and supports that have not been galvanized shall be coated with at least two coats of primer specified for system E-2 prior to setting the equipment in place. Provide coating system terminations at leading edges and transitions to other substrates in accordance with the CSM's recommendations or detail drawings.

I. Electrical and Instrumentation Equipment and Materials:

1. Electrical and instrumentation equipment and materials shall be coated by the equipment manufacturer as specified below.
 - a. Finish: Electrical equipment shall be treated with zinc phosphate, bonderized or otherwise given a rust-preventive treatment. Equipment shall be primed, coated with enamel, and baked. Minimum dry film thickness shall be 3 mils.
 - 1) Unless otherwise specified, instrumentation panels shall be coated with system E-1 for indoor mounting and system EU-1 for outdoor mounting.
 - 2) Before final acceptance, the Contractor shall touch up scratches on equipment with identical color coating. Finish shall be smooth, free of runs, and match existing finish. Prior to touching up scratches, Contractor shall fill them with an appropriate filler material approved by the CSM.
 - b. Color: Exterior color of electrical equipment shall be FS 26463 (ANSI/NSF 61) light gray. Interior shall be painted FS 27880 white. Nonmetallic electrical enclosures and equipment shall be the equipment manufacturer's standard grey color.
 - 1) Exterior color of instrumentation panels and cabinets mounted indoors shall be FS 26463 light gray; unless otherwise specified, exterior color for cabinets mounted outdoors shall be FS 27722, white. Cabinet interiors shall be FS 27880, white.

J. Soluble Salt Contamination of Metallic Substrates:

1. Contractor shall test in accordance with SSPC-TU-4 metallic substrates to be coated that have been exposed to seawater or coastal air or to industrial fallout of

particulate or other sources of soluble chlorides (such as wastewater exposure). If testing indicates detrimental levels of soluble salts, those in excess of 25 ppm, the Contractor shall clean and prepare these surfaces to remove the soluble salts.

3.04 CLEANUP

A. General:

1. Upon completion of coating, the Contractor shall remove surplus materials, protective coverings, and accumulated rubbish, and thoroughly clean surfaces and repair overspray or other coating-related damage.

3.05 COATING SYSTEM SPECIFICATION SHEETS (COATSPEC)

A. General:

1. Coating systems for different types of surfaces and general service conditions for which these systems are normally applied are specified on the following COATSPEC sheets. Surfaces shall be coated in accordance with the COATSPEC to the system thickness specified. Coating systems shall be as specified in paragraph 3.06. In case of conflict between the schedule and the COATSPECS, the requirements of the schedule shall prevail.
2. Coating Specification Sheets included in Table A are included this paragraph 3.05.

Table A Coating Specification Sheets

Coating System ID	Coating Material	Surface	Service Condition
E-1	Epoxy	Metal	Interior; exterior, covered, not exposed to direct sunlight, non-corrosive exposure.
E-1-G	Epoxy	Galvanized Steel	Interior; exterior, covered non-corrosive exposure. Do not use in immersion service.
E-2	Epoxy	Metal	Immersed, nonpotable; non-immersed, moderately corrosive environment, color required.
E-3	Epoxy	Concrete or Masonry	Immersed, nonpotable; non-immersed, corrosive environment, color required.
E-4	Epoxy	Concrete, masonry, plaster, gypsum board	Interior
E-5 (NSF 61 certified)	Epoxy	Metal	Interior potable water tanks and reservoirs and other metal components in contact with water being treated and stored for potable use.
E-6 (NSF 61 certified)	Epoxy	Concrete	Interior potable water tanks and reservoirs and other metal components in contact with water being treated or stored.
E-7	Epoxy	Plastic	Interior; exterior covered, not exposed to direct sunlight.
E-8	Clear epoxy	Wood	Interior
E-9	Epoxy	Metal	Immersed, nonpotable; non-immersed, corrosive environment, color required. (Not for Biogenic Sulfide Corrosion areas.)
E-9-C	Epoxy	Concrete or masonry	Immersed, nonpotable; non-immersed, moderately corrosive environment, color required. (Not for Biogenic Sulfide Corrosion areas.)
E-10	Polyamidoamine epoxy	Metal or concrete	Below grade (buried).

Table A Coating Specification Sheets

Coating System ID	Coating Material	Surface	Service Condition
EF-1	Amine Epoxy Broadcast Floor Coating	Concrete Floors	Light duty, wheeled traffic, frequent foot traffic, mildly corrosive.
EF-2	Amine Epoxy Troweled Floor Coating	Concrete Floors	Heavy-duty, wheeled traffic, frequent foot traffic, wet and moderately corrosive.
EA-1	Blended Amine Cured Epoxy	Metal	Immersed, nonpotable; non-immersed, corrosive environment, color not required especially for headspace environments that are corrosive due to biogenic sulfide corrosion.
EA-2	Blended Amine Cured Epoxy	Concrete or masonry	Immersed, nonpotable; non-immersed, corrosive environment, color not required, new construction especially for headspace environments that are corrosive due to biogenic sulfide corrosion.
EA-3	Blended Amine Cured Epoxy	Concrete or Masonry	Immersed, nonpotable; non-immersed, corrosive environment, color not required, new or existing construction, especially for headspace environments that are corrosive due to biogenic sulfide corrosion.
EA-4	Blended Amine Cured Epoxy – For Very Corrosive Conditions	Concrete or Masonry Potable	Non-immersed or immersed, very corrosive environment. Very high H ₂ S conditions.
EA-5	Novolac Epoxy Lining	Concrete	Secondary containment for spills of HFS acid or ferric chloride.
G	Grease	Metal	Ferrous Metal: Ferrous metal surfaces shall be prepared in accordance with SSPC SP-1 (Solvent Cleaning.)
HH-1	Proprietary Primer Plus Silicone Topcoat	Metal	Temperature to 750 degrees F.
HH-2	Proprietary Primer Plus Silicone Topcoat (black or aluminum only)	Metal	Temperature to 1200 degrees F.
L-1	Latex	Concrete, masonry, plaster, gypsum board	Interior and Exterior including existing exterior coated concrete.
L-2	Latex	PVC and CPVC pipe	Exterior, direct sunlight exposure.
L-3	Latex-Direct to Metal	Ferrous Metal	Interior or Exterior
L-4	Latex	Wood	Interior
M-1	Petrolatum based mastic or wax based wrapping tapes	Metal	Below grade (buried) or where little to no surface preparation can be performed on piping or structural steel.
M-2	Epoxy mastic or equal	Ferrous Metal	Interior, corrosive environment, confined enclosures, where minimal surface preparation is possible.
EU-1	Zinc-epoxy-polyurethane system	Ferrous Metal	Exterior, exposed to direct sunlight, moderately corrosive non-immersed.
EU-1-FRP	Specialty Primer plus Polyurethane Finish Coat	Exterior of FRP pipe and tanks, etc.	Exterior, exposed to direct sunlight, non-immersed.
EC-1	Hybrid Polyurethane	Concrete or dense masonry where existing crack or joint movement is suspected of propagating through rigid cured epoxy coatings	Service Condition: Interior or exterior, exposed to direct sunlight or not, corrosive (immersion pH 4.0 or lower and/or headspace pH 4.0 or lower and/or gaseous H ₂ S concentrations between 10 and 150 ppm typically.)

Table A Coating Specification Sheets

Coating System ID	Coating Material	Surface	Service Condition
EC-2 (NSF-61)	Modified Polyurethane	Concrete or dense masonry where existing crack or joint movement is suspected due to thermal conditions and would propagate through rigid epoxy coating systems and/or where NSF-61 certification is required	Interior or exterior, submerged or non-submerged indirect sunlight – moderately corrosive.
S-1	Penetrating acrylic stain, color required	Concrete	Non-immersed, exposure to moisture and sunlight.
S-2	Silane/Siloxane or Blended Sealer	Concrete Floors	Wet, non-immersed, non-corrosive. Interior or exterior for waterproofing.
S-3	RTV Silicone Rubber Based Sealer	Concrete or Masonry Walls	Exterior or Interior – Weathering Exposure, Non-Corrosive.
S-4	Acrylic Co-polymer Blend	Concrete Floors	Wet, non-immersed, non-corrosive, interior for oil and water repellent.

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A. Coating System Identification: E-1

1. Coating Material:	Epoxy
2. Surface:	Metal
3. Service Condition:	Interior; exterior, covered, not exposed to direct sunlight, non-corrosive exposure.
4. Surface Preparation:	
a. General:	Shop primed surfaces which are to be incorporated in the work shall be prepared in the field by cleaning surfaces in accordance with SSPC SP-2 (Hand Tool Cleaning). Damaged shop coated areas shall be cleaned in accordance with SSPC SP-5 (White Metal Blast Cleaning) to achieve a uniform surface profile of 2.0 to 2.5 mils and spot primed with the primer specified. Shop epoxy primed surfaces shall require light abrasive and vacuum cleaning blasting prior to receiving finish coats.
b. Ferrous Metal:	Bare ferrous metal surfaces shall be prepared in accordance with SSPC SP-6 (Commercial Blast Cleaning) to achieve a uniform, surface profile of 2.0 to 2.5 mils. Ferrous metal with rust bleeding shall be cleaned in accordance with SSPC SP-1 (Solvent Cleaning). Areas of rust penetration shall be spot blasted to SSPC SP-10 (Near White Blast) (to achieve the 2.0- to 2.5-mil surface profile) and spot primed with the specified primer. For ductile iron surfaces, refer to the requirements in paragraph 3.02 Metallic Surfaces.
c. Nonferrous and Galvanized Metal:	Nonferrous and galvanized metal shall be prepared in accordance with SSPC SP-7 (Brush-off Blast Cleaning) to achieve uniform, minimum surface profile 1.0 to 1.5 mils.
5. Application:	Field
a. General:	Prime coat may be thinned and applied as recommended by the CSM, provided the coating as applied complies with prevailing air pollution control regulations.
b. Ferrous Metal:	Prime coats shall be an epoxy primer compatible with the specified finish coats and applied in accordance with the written instructions of the CSM.
c. Nonferrous and Galvanized Metal:	Nonferrous and galvanized metal shall be cleaned prior to the application of the prime coat in accordance with SSPC SP-1 (Solvent Cleaning).
6. System Thickness:	10 mils dry film.
7. Coatings:	
a. Primer:	One coat at CSM's recommended dry film thickness.
b. Finish:	One or more coats at CSM's recommended dry film thickness per coat to achieve the specified system thickness.

B. Coating System Identification: E-1-G

1. Coating Material:	Epoxy
2. Surface:	Galvanized Steel
3. Service Condition:	Interior; exterior, covered, non-corrosive exposure. Do not use in immersion service.
4. Surface Preparation:	
a. General:	Damaged galvanized steel areas with exposed ferrous metal and/or rusted shall be cleaned in accordance with SSPC SP-5 (White Metal Blast Cleaning) or Power Tool Cleaned to Bare Metal in accordance with SSPC-SP-11 to achieve a uniform 1.0- to 1.5-milprofile and spot primed with the primer specified.
b. Galvanized Metal:	Nonferrous and galvanized metal shall be prepared in accordance with SSPC SP-7 (Brush-off Blast Cleaning) impart a 1- to 2-milprofile to the galvanized steel surfaces. Where this cannot be performed, prepare by abrading in accordance with SSPC-SP-3, Power Tool Cleaning to impart a 1.0- to 1.5-mil profile uniformly to the galvanized steel surfaces.
5. Application:	Field
a. General:	Prime coat may be thinned and applied as recommended by the CSM, provided the coating as applied complies with prevailing air pollution control regulations.
b. Galvanized Metal:	Nonferrous and galvanized metal shall be cleaned prior to the application of the

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	prime coat in accordance with SSPC SP-1 (Solvent Cleaning).
6. System Thickness:	5 to 8 mils dry film.
7. Coatings:	
a. Primer:	One coat at CSM's recommended dry film thickness.
b. Finish:	One or more coats at CSM's recommended dry film thickness per coat to the specified system thickness. If the coated galvanized steel is to be exposed to ultraviolet light, apply one polyurethane top coat from coating system EU-1 over the second coat of the two epoxy coats specified.

C. Coating System Identification: E-2

1. Coating Material:	Epoxy
2. Surface:	Metal
3. Service Condition:	Immersed, nonpotable; non-immersed, moderately corrosive environment, color required.
4. Surface Preparation:	
a. Ferrous Metal:	Ferrous metal surfaces shall be prepared in accordance with SSPC SP-5 (White Metal Blast Cleaning) to achieve a uniform surface profile of 2.0 to 2.5 mils. Damaged shop coating shall be cleaned in accordance with SSPC SP-5 (White Metal Blast Cleaning) and vacuum cleaning and spot primed with the primer specified. Shop epoxy primed surfaces shall require light abrasive blasting or abrading prior to receiving finish coats if the maximum recoat time for the primer has been exceeded. This cleaning must produce a uniform 1.0- to 1.5-mil profile in the intact shop primer. For ductile iron surfaces, refer to the requirements in paragraph 3.02 Metallic Surfaces.
b. Nonferrous and Galvanized Metal:	Nonferrous and galvanized metal shall be prepared in accordance with SSPC SP-7 (Brush-off Blast Cleaning) to achieve a uniform surface profile of 1.0 to 1.5 mils. Galvanized steel with this E-2 coating system shall not be used in immersion service in wastewater.
5. Application:	Field
a. General:	Prime coat may be thinned and applied as recommended by the CSM, provided the coating as applied complies with prevailing air pollution control regulations.
b. Ferrous Metal:	Prime coat shall be an epoxy primer compatible with the specified finish coats.
c. Nonferrous and Galvanized Metal:	Nonferrous and galvanized metal, non-immersed, shall be coated prior to the application of the prime coat with a grease emulsifying agent in accordance with the CSM's written instructions. Nonferrous metal to be immersed shall not be painted. Galvanized metal shall not be immersed even if it is painted.
6. System Thickness:	16 mils dry film.
7. Coatings:	
a. Primer:	One coat at CSM's recommended dry film thickness.
b. Finish:	Two or more coats at CSM's recommended dry film thickness per coat to the specified system thickness.

D. Coating System Identification: E-3

1. Coating Material:	Epoxy
2. Surface:	Concrete or masonry
3. Service Condition:	Immersed, nonpotable; non-immersed, corrosive environment, color required.
4. Surface Preparation:	
a. Concrete:	Concrete surfaces shall be allowed to cure for at least 28 days and allowed to dry to the moisture content recommended by the CSM before coating work proceeds. Moisture content may be tested by the Construction Manager with a Delmhorst Instrument Company moisture detector, or equal. Except as otherwise specified, loose concrete, form oils, surface hardeners, curing compounds, and laitance shall be removed from surfaces by abrasive blasting and chipping, and voids and cracks

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	shall be repaired as specified in Section 03 30 00. Surface preparation can be performed by abrasive blast cleaning or water blast cleaning and must achieve a uniform concrete surface profile of CSP3 in accordance with ICRI 03732. After cleaning, air voids or bugholes in the concrete shall be filled with a surfacer or block filler compatible with the specified primer and finish coats.
b. Masonry:	<p>Masonry surfaces shall be allowed to cure for at least 28 days after being constructed and be allowed to dry to the moisture content recommended by the CSM. Holes or other joint defects shall be filled with a material compatible with the primers and finish coats or shall be filled with masonry mortar that shall cure for at least 28 days. Loose or splattered mortar shall be removed by scraping and chipping.</p> <p>Masonry surfaces shall be cleaned with clear water by washing and scrubbing to remove foreign, loose, and deleterious substances.</p> <p>Muriatic acid shall not be used. After cleaning, masonry surfaces shall be sealed or filled with a sealer or block filler compatible with the specified primer.</p>
5. Application:	Field
a. General:	<p>Apply filler/surfacer as recommended by CSM to fill bugholes and air voids or block texture, etc. leaving a uniformly filled surface that does not produce blowholes or outgassing causing pinholing of the coating system. Filler/surfacers shall dry a minimum of 48 hours prior to application of prime coat or as required by the CSM.</p> <p>Prime coat shall be thinned and applied as recommended by the CSM, provided the coating as applied complies with prevailing air pollution control regulations.</p> <p>Drying time between coats shall be as recommended by CSM.</p>
6. System Thickness:	15 mils dry film.
7. Coatings:	
a. Primer:	One coat at CSM's recommended dry film thickness.
b. Finish:	Two or more coats at CSM's recommended dry film thickness per coat to the specified system thickness.
E. Coating System Identification: E-4	
1. Coating Material:	Epoxy
2. Surfaces:	Concrete, masonry, plaster, gypsum board.
3. Service Condition:	Interior
4. Surface Preparation:	
a. Concrete:	Concrete surfaces shall be allowed to age for at least 28 days and allowed to dry to the moisture content recommended by the CSM. Moisture content may be tested by the Construction Manager with a Delmhorst Instrument Company moisture detector, or equal. Loose concrete, form oils, surface hardeners, curing compounds and laitance shall be removed from surfaces, and voids and cracks shall be repaired as specified in Section 03 30 00. Surface preparation shall produce a concrete surface profile of CSP-2 in accordance with ICRI 03732. After cleaning, air voids or bugholes in the concrete shall be filled with a surfacer or block filler compatible with the specified primer and finish coats.
b. Masonry:	Masonry surfaces shall be allowed to age for at least 28 days. Holes or other joint defects shall be filled with mortar and repointed. Loose or splattered mortar shall be removed by scraping and chipping. Masonry surfaces shall be cleaned with clear water by washing and scrubbing to remove foreign and deleterious substances. Muriatic acid shall not be used. After cleaning, exterior masonry surfaces shall be sealed or filled with a sealer or block filler compatible with the specified primer.
c. Plaster:	Plaster surfaces shall be dry, clean, and free from grit, loose plaster, and surface irregularities. Cracks and holes shall be repaired with acceptable patching materials, keyed to existing surfaces, and sandpapered smooth. Surfaces shall be cleaned with clean water by washing and scrubbing to remove foreign and deleterious substances.

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5. Application:	Field
a. General:	Block Filler shall be multiple component epoxy block filler or an acrylic based or waterborne epoxy based block filler and shall dry a minimum of 48 hours prior to primer application or as required by the CSM. Prime coat shall be thinned and applied as recommended by CSM, provided the coating as applied complies with prevailing air pollution control regulations. Drying time between coats shall be as recommended by CSM.
6. System Thickness:	10 mils dry film, excluding block filler and sealer.
7. Coatings:	
a. Primer:	One coat at CSM's recommended dry film thickness.
b. Finish:	One or more coats at CSM's recommended dry film thickness per coat to the specified system thickness.

F. Coating System Identification: E-5 (NSF 61 certified)

1. Coating Material:	Epoxy
2. Surface:	Metal
3. Service Condition:	Interior potable water tanks and reservoirs and other metal components in contact with water being treated and stored for potable use.
4. Surface Preparation:	
a. Ferrous Metal:	Ferrous metal surfaces shall be prepared in accordance with SSPC SP-5 (White Metal Blast Cleaning) to achieve a uniform surface profile of 2.0 to 2.5 mils. Shop primed surfaces which are to be incorporated in the work shall be prepared in the field by cleaning surfaces in accordance with SSPC SP-2 (Hand Tool Cleaning) or SSPC-SP-3 (Power Tool Cleaning). Damaged shop coating shall be cleaned in accordance with SSPC SP-5 (White Metal Blast Cleaning) and spot primed with the primer specified. Cleaning shall produce a surface profile of 2.0 to 2.5 mils. Shop epoxy primed surfaces shall require light abrasive blasting or abrading prior to receiving finish coats if the maximum recoat limit has been exceeded for the primer. This cleaning shall produce a uniform surface profile of 1.0 to 1.5 mils in the intact primer.
b. Nonferrous and Galvanized Metal:	Nonferrous and galvanized metal shall be prepared in accordance with SSPC SP-7 (Brush-off Blast Cleaning) to achieve a 1.0- to 1.5-mil profile that is uniform.
5. Application:	Field
a. General:	Prime coat shall be thinned and applied as recommended by the CSM, provided the coating as applied complies with prevailing air pollution control regulations.
b. Ferrous Metal:	Prime coat shall be an epoxy primer compatible with the specified finish coats.
c. Nonferrous and Galvanized Metal:	Nonferrous and galvanized metal above the high water elevation shall be cleaned prior to the application of the prime coat in accordance with SSPC SP-1 (Solvent Cleaning).
6. System Thickness:	10 mils dry film.
7. Coatings:	
a. Primer:	One coat at the CSM's recommended dry film thickness.
b. Finish:	One or more coats at CSM's recommended dry film thickness per coat to the specified system thickness.

G. Coating System Identification: E-6 (NSF 61 certified)

1. Coating Material:	Epoxy
2. Surface:	Concrete
3. Service Condition:	Interior potable water tanks and reservoirs and other metal components in contact with water being treated or stored.
4. Surface Preparation:	
a. Concrete:	Concrete surfaces shall be allowed to cure for at least 28 days and allowed to dry to the moisture content recommended by the CSM. Moisture content may be tested by

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	the Construction Manager with a Delmhorst Instrument Company moisture detector, or equal. Except as otherwise specified, loose concrete, form oils, surface hardeners, curing compounds, and laitance shall be removed from surfaces by abrasive blasting and chipping, and voids and cracks shall be repaired as specified in Section 03 30 00. Abrasive blast cleaning or water blast cleaning methods can be used and must produce a uniform concrete surface profile of a CSP-3 in accordance with ICRI 03732. After cleaning, air voids or bugholes in the concrete shall be filled with a surfacer or block filler compatible with the specified primer and finish coats.
b. Masonry:	Masonry surfaces shall be allowed to cure for at least 28 days. Holes or other joint defects shall be filled with mortar and repointed and allowed to cure for 28 days or shall be filled with materials compatible with the primer and finish coats. Loose or splattered mortar shall be removed by scraping and chipping. Masonry surfaces shall be cleaned with clear water by washing and scrubbing to remove foreign and deleterious substances. Muriatic acid shall not be used. After cleaning, masonry surfaces shall be sealed or filled with a sealer or block filler compatible with the specified primer.
5. Application:	Field
a. General:	Surfacer or block filler shall dry a minimum of 48 hours prior to application of prime coat or as recommended by the CSM. Prime coat shall be thinned and applied as recommended by the CSM, provided the coating as applied complies with prevailing air pollution control regulations. Drying time between prime coat and finish coat shall be as recommended by CSM.
6. System Thickness:	15 mils dry film.
7. Coatings:	
a. Primer:	One coat at CSM's recommended dry film thickness.
b. Finish:	Two or more coats at CSM's recommended dry film thickness per coat to the specified system thickness.

H. Coating System Identification: E-7

1. Coating Material:	Epoxy
2. Surface:	Plastic
3. Service Condition:	Interior; exterior covered, not exposed to direct sunlight.
4. Surface Preparation:	Plastic shall be prepared in accordance with SSPC SP-1 (Solvent Cleaning) and light sanding to produce a uniform surface roughness(uniform surface profile of 1.0 to 1.5 mils) on the plastic.
5. Application:	Field
6. System Thickness:	5 mils dry film.
7. Coatings:	One or more coats at CSM's recommended dry film thickness per coat to the specified system thickness.

I. Coating System Identification: E-8

1. Coating Material:	Clear epoxy
2. Surface:	Wood
3. Service Condition:	Interior
4. Surface Preparation:	Wood surfaces shall be cleaned of dirt, oil or other foreign substances with mineral spirits, scrapers, sandpaper or wire brush. Finished surfaces exposed to view shall be smoothed by planing or sandpapering. Millwork shall be sandpapered and given a coat of the specified exterior primer on sides before installation. Built-in surfaces of windowsills shall be double primed. Glazing rabbets and beads in exterior sash and doors shall be double primed. Small, dry, seasoned knots shall be surfaced scraped, sandpapered, and thoroughly cleaned and shall be given a thin coat of a clear knot sealer before application of the priming coat. Large, open, unseasoned knots, and beads or streaks of pitch shall be scraped off; however, if the pitch is still soft, it shall be removed with mineral spirits or turpentine, and the resinous area

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	shall be coated with knot sealer prior to priming. After priming, holes and imperfections shall be filled with putty or plastic wood, colored to match the finish coat, allowed to dry and sandpapered smooth.
5. Application:	Field
a. General:	Prime coat shall be thinned and applied as recommended by the CSM, provided the coating as applied complies with prevailing air pollution control regulations.
6. System Thickness:	4 mils
7. Coatings:	
a. Primer:	One coat at CSM's recommended dry film thickness.
b. Finish:	One or more coats at CSM's recommended dry film thickness per coat to the specified system thickness.

J. Coating System Identification: E-9

1. Coating Material:	Epoxy
2. Surface:	Metal
3. Service Condition:	Immersed, nonpotable; non-immersed, corrosive environment, color required. (Not for Biogenic Sulfide Corrosion areas.)
4. Surface Preparation:	
a. Ferrous Metal:	Ferrous metal surfaces shall be prepared in accordance with SSPC SP-5 (White Metal Blast Cleaning) to achieve a uniform surface profile of 2.5 to 3.0 mils.
b. Nonferrous and Galvanized Metal:	Shop primed surfaces which are to be incorporated in the work shall be prepared in the field by cleaning surfaces in accordance with SSPC SP-2 (Hand Tool Cleaning) or SSPC-SP-3 (Power Tool Cleaning). Damaged shop coating shall be cleaned in accordance with SSPC SP-5 (White Metal Blast Cleaning) to achieve a uniform surface profile of 2.5 to 3.0 mils and spot primed with the primer specified. Shop epoxy primed surfaces shall require light abrasive blasting or abrading to achieve a uniform surface profile of 1.0 to 1.5 mils in the intact shop primer prior to receiving finish coats if the maximum recoat time for the primer has been exceeded. For ductile iron surfaces, refer to the requirements in paragraph 3.02 Metallic Surfaces.
5. Application:	Field
a. General:	Prime coat may be thinned and applied as recommended by the CSM, provided the coating as applied complies with prevailing air pollution control regulations.
b. Ferrous Metal:	Prime coat shall be an epoxy primer compatible with the specified finish coats.
c. Nonferrous and Galvanized Metal:	Nonferrous and galvanized metal, non-immersed, shall be coated prior to the application of the prime coat with a grease emulsifying agent in accordance with the CSM's written instructions. Non-ferrous metal to be immersed shall not be painted. Galvanized metal shall not be immersed even if it is painted with this coating system.
6. System Thickness:	15 to 20 mils dry film.
7. Coatings:	
a. Primer:	One coat at CSM's recommended dry film thickness.
b. Finish:	Two or more coats at CSM's recommended dry film thickness per coat to the specified system thickness.

K. Coating System Identification: E-9-C

1. Coating Material:	Epoxy
2. Surface:	Concrete or masonry
3. Service Condition:	Immersed, nonpotable; non-immersed, moderately corrosive environment, color required. (Not for Biogenic Sulfide Corrosion areas.)
4. Surface Preparation:	

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a. Concrete:	Concrete surfaces shall be allowed to cure for at least 28 days following initial concrete placement and allowed to dry to the moisture content recommended by the CSM before coating work proceeds. Moisture content may be tested by the Construction Manager with a Delmhorst Instrument Company moisture detector, or equal. Except as otherwise specified, loose concrete, form oils, surface hardeners, curing compounds, and laitance shall be removed from surfaces by abrasive blasting and chipping, and voids and cracks shall be repaired as specified in Section 03 30 00. Cleaning can be performed using abrasive blast cleaning or water blast cleaning methods to produce a minimum concrete surface profile of CSP-3 in accordance with ICRI 03732. After cleaning, all air voids or bugholes in the concrete shall be filled with a surfacer or block filler compatible with the specified primer and finish coats.
b. Masonry:	Masonry surfaces shall be allowed to cure for at least 28 days after being constructed and be allowed to dry to the moisture content recommended by the CSM. Holes or other joint defects shall be filled with a material compatible with the primers and finish coats or shall be filled with masonry mortar that shall cure for at least 28 days. Loose or splattered mortar shall be removed by scraping and chipping. Masonry surfaces shall be cleaned with clear water by washing and scrubbing to remove foreign and deleterious substances. Muriatic acid shall not be used. After cleaning, masonry surfaces shall be sealed or filled with a sealer or block filler compatible with the specified primer.
5. Application:	Field
a. General:	Apply filler/surfacer as recommended by CSM to fill bugholes and air voids or block texture, etc. leaving a uniformly filled surface that does not produce blowholes or outgassing causing pinholing of the coating system. Filler/Surfacers shall dry a minimum of 48 hours prior to application of prime coat or as required by the CSM. Prime coat shall be thinned and applied as recommended by the CSM, provided the coating as applied complies with prevailing air pollution control regulations. Drying time between coats shall be as recommended by CSM.
6. System Thickness:	16 to 20 mils dry film.
7. Coatings:	
a. Primer:	One coat at CSM's recommended dry film thickness.
b. Finish:	Two or more coats at CSM's recommended dry film thickness per coat to the specified system thickness.
L. Coating System Identification: E-10	
1. Coating Material:	Polyamidoamine epoxy
2. Surface:	Metal or concrete
3. Service Condition:	Below grade (buried, exterior) in contact with soil
4. Surface Preparation:	
a. Ferrous Metal:	Ferrous metal surfaces shall be prepared in accordance with SSPC SP-5 (White Metal Blast Cleaning).
b. Nonferrous Metal:	Nonferrous and galvanized metal shall be prepared in accordance with SSPC SP-7 (Brush-off Blast Cleaning) to achieve a uniform surface profile of 2.0 to 2.5 mils.
c. Concrete:	Concrete surfaces shall be allowed to age for at least 28 days and allowed to dry to the moisture content recommended by the CSM. Moisture content may be tested by the Construction Manager with a Delmhorst Instrument Company moisture detector, or equal. Except as otherwise specified, loose concrete and laitance shall be removed from surfaces by abrasive blasting and chipping, and voids and cracks shall be repaired as specified in Section 03 30 00. Concrete surface preparation can be performed using abrasive blast cleaning or water blast cleaning methods and must achieve a concrete surface profile of CSP-3 in accordance with ICRI

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	03732.
5. Application:	Field
6. System Thickness:	16 mils
7. Coating:	Two or more coats at CSM's recommended dry film thickness per coat to the specified system thickness.

M. Coating System Identification: EF-1

1. Coating Material:	Epoxy Resin Based Floor Coating
2. Surface:	Concrete Floors
3. Service Condition:	For interior light duty applications light wheel traffic, mostly foot traffic, and mildly corrosive. Mainly for wear resistance, aesthetics, and cleanability. Non-slip texture can be varied depending on wetness of exposure. Test patches to be installed for deciding on level of non-slip texture required.
4. Surface Preparation:	<p>Concrete floor slabs shall be allowed to age for at least 28 days and must meet a moisture vapor transmission rate of less than 3.0 lbs. of moisture per 24 hours per 1,000 SF in accordance with ASTM F1869. It is also essential that a well-sealed and intact vapor barrier has been installed beneath all slabs on grade to receive this floor coating system. Except as otherwise specified, loose concrete, curing compounds, and laitance shall be removed by abrasive blast cleaning or preferably by shotblasting. Surface preparation shall produce a clean sound concrete substrate with a concrete surface profile of CSP-6 minimum in accordance with ICRI 03732. Surface preparation shall be in accordance with SSPC-SP-13.</p> <p>Additionally, all coating termination and transition details shall be prepared in accordance with the CSM's standard detail drawings. This includes coating termination details, coating transitions at vertical and vertical to horizontal corners, coating terminations at joints, concrete crack treatment, pipe penetration treatment, coating terminations at metal embedments in the concrete substrate, and other details. The CSM's standard detail drawings shall be submitted for all such coating applications. If standard details are not available for a given detail treatment, the CSM shall be required to produce one at no additional cost to the owner, the engineer, or any other party.</p> <p>If wet abrasive or water blasting surface preparation methods were used, the concrete substrate shall be allowed to dry under warm conditions (minimum of 75 degrees F) for at least 5 days prior to coating application. Following surface preparation work and dry-out, all surfaces to be coated shall be vacuum cleaned to remove all loose dirt, dust, or other loose materials.</p>
5. Application:	Carefully follow CSM's written instructions regarding mixing, thinning, application, recoat limitations (windows) and curing of coating materials.
6. System Thickness:	125 mils dry film.
7. Coatings:	
a. Primer:	Brush or roller apply at 6.0 - 10.0 mils DFT.
b. Broadcast Applied:	Brush or roller catalyzed resin and broadcast aggregate to rejection (should achieve 100 to 105 mils DFT).
c. Top:	Brush or roller apply at 8.0 - 10.0 mils.
	Install all termination and transition details in accordance with the CSM's detail drawings.

N. Coating System Identification: EF-2

1. Coating Material:	Epoxy Resin Based Floor Coating
2. Surface:	Concrete Floors
3. Service Condition:	For interior - heavy-duty exposure applications. Frequent, heavy wheeled traffic and moderately corrosive exposure conditions. Mainly for wear resistance, impact resistance, protection of concrete, and aesthetics. Non-slip texture can be varied as needed. Test patches to be installed for deciding on level of non-slip texture required.
4. Surface Preparation:	Concrete floor slabs shall be allowed to age for at least 28 days and must meet a

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	<p>moisture vapor transmission rate of less than 3.0 lbs. of moisture per 24 hours per 1,000 SF in accordance with ASTM F1869. It is also essential that a well-sealed and intact vapor barrier has been installed beneath all slabs on grade to receive this floor coating system. Except as otherwise specified, loose concrete, curing compounds, and laitance shall be removed by abrasive blast cleaning or preferably by shotblasting. Surface preparation shall produce a clean sound concrete substrate with a concrete surface profile of CSP-7 minimum in accordance with ICRI 03732. Surface preparation shall be in accordance with SSPC-SP-13.</p> <p>Additionally, all coating termination and transition details shall be prepared in accordance with the CSM's standard detail drawings. This includes coating termination details, coating transitions at vertical and vertical to horizontal corners, coating terminations at joints, concrete crack treatment, pipe penetration treatment, coating terminations at metal embedments in the concrete substrate, and other details. The CSM's standard detail drawings shall be submitted for all such coating applications. If standard details are not available for a given detail treatment, the CSM shall be required to produce one at no additional cost to the owner, the engineer, or any other party.</p> <p>If wet abrasive or water blasting surface preparation methods were used, the concrete substrate shall be allowed to dry under warm conditions (minimum of 75 degrees F) for at least 5 days prior to coating application. Following surface preparation work and dry-out, all surfaces to be coated shall be vacuum cleaned to remove all loose dirt, dust, or other loose materials.</p>
5. Application:	Carefully follow CSM's written instructions regarding mixing, thinning, application, recoat limitations (windows) and curing of coating materials.
6. System Thickness:	250 mils dry film.
7. Coatings:	
a. Primer:	Brush or roller apply at 6.0 - 10.0 mils DFT.
b. Trowel Applied:	Trowel apply to 230 - 236 mils.
c. Top:	Brush or roller apply at 8.0 - 10.0 mils. Cumulative dry film thickness.
	Install all termination and transition details in accordance with the CSM's detail drawings.
0. Coating System Identification: EA-1	
1. Coating Material:	Blended Amine Cured Epoxy
2. Surface:	Metal
3. Service Condition:	Immersed, nonpotable; non-immersed, corrosive environment, color not required especially for headspace environments that are corrosive due to biogenic sulfide corrosion.
4. Surface Preparation:	
a. Ferrous Metal:	<p>Ferrous metal surfaces shall be prepared in accordance with SSPC SP-5 (White Metal Blast Cleaning) to achieve a uniform surface profile of 3.0 to 3.5 mils. Blast Cleaning shall produce a minimum surface profile of 3.0 mils.</p> <p>Shop primed surfaces which are to be incorporated in the work shall be prepared in the field by cleaning surfaces in accordance with SSPC SP-11 (Power Tool Cleaning to Bare Metal). Damaged shop coated areas shall be cleaned in accordance with SSPC SP-5 (White Metal Blast Cleaning) and spot primed with the primer specified. Shop epoxy primed surfaces shall require light abrasive blasting and blow down cleaning prior to receiving finish coats. Cast or ductile iron surfaces to be coated shall be abrasive blast cleaned to a clean, gray uniform metal appearance free of variations in color and loose materials. Ductile iron surfaces shall be prepared in accordance with paragraph 3.02 Metallic Surfaces.</p>
b. Nonferrous and Galvanized Metal:	Nonferrous and galvanized metal shall be prepared in accordance with SSPC SP-7 (Brush-off Blast Cleaning) to achieve a uniform surface profile of 2.0 to 2.5 mils. Galvanized metal should generally not be used in these environments.
5. Application:	Field
a. General:	Prime coat may be thinned and applied as recommended by the CSM, provided the

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	coating as applied complies with prevailing air pollution control regulations. Drying time between coats shall be as specified by the CSM for the site conditions. If the maximum recoat time is exceeded, surface preparation shall require solvent washing, light abrasive blasting, or other procedures per CSM's instructions.
b. Ferrous Metal:	If shop priming is required or field priming is necessary, the prime coat shall be an epoxy primer compatible with the specified coating system. Generally, the EA-1 coating system is self-priming and does not require a primer unless there is a special reason to prime the steel to hold the blast cleaning from rusting back.
6. System Thickness:	30 to 40 mils dry film.
7. Coatings:	
a. Primer:	One coat at CSM's recommended dry film thickness only if required by special circumstances.
b. Finish:	One or more coats at CSM's recommended dry film thickness per coat to the specified system thickness.
c. Testing:	Holiday detection shall be performed over 100% of the coated surface area to identify any holidays or pinholes that must be repaired.
d. Pinhole and Holiday Repair Procedure:	<p>Pinholes and holidays identified by Holiday Detection shall be repaired as follows:</p> <ul style="list-style-type: none"> • Using a pencil grinder, remove a ½-inch diameter area of the coating system material back to the ferrous metal substrate. The metal must be shiny • Aggressively sand or abrade the intact coating system surface 2 inches around the complete periphery of the ½-inch diameter removal area to produce a uniform 6 to 8 mils profile • Vacuum clean the prepared area to remove all dust and dirt to achieve a clean, sound surface. Tape the peripheral area to prevent coating application onto unprepared surfaces • Brush apply one coat of the finish coating material. Following proper recoat cure time, apply additional coats of the finish coating system to achieve 60 mils DFT at the coating removal area and feather the coating onto the roughened coated surfaces to form a neat repair outline
P. Coating System Identification: EA-2	
1. Coating Material:	Blended Amine Cured Epoxy
2. Surface:	Concrete or masonry
3. Service Condition:	Immersed, nonpotable; non-immersed, corrosive environment, color not required, new construction especially for headspace environments that are corrosive due to biogenic sulfide corrosion.
4. Surface Preparation:	<p><i>Confirm that the exterior of buried concrete structures will be waterproofed in accordance with Section 07 10 00 prior to application of this coating.</i></p> <p>All coating termination and transition details shall be prepared in accordance with the CSM's standard detail drawings. This includes coating termination details, coating transitions at vertical and vertical to horizontal corners, coating terminations at joints, concrete crack treatment, pipe penetration treatment, coating terminations at metal embedments in the concrete substrate, and other details. The CSM's standard detail drawings shall be submitted for all such coating applications. If standard details are not available for a given detail treatment, the CSM shall be required to produce one at no additional cost to the owner, the engineer, or any other party.</p> <p>If wet abrasive or water blasting surface preparation methods were used, the concrete substrate shall be allowed to dry under warm conditions (minimum of 75 degrees F) for at least 5 days prior to coating application. Following surface preparation work and dry-out, all surfaces to be coated shall be vacuum cleaned to remove all loose dirt, dust, or other loose materials.</p>
a. Concrete:	Concrete surfaces shall be allowed to cure for at least 28 days and allowed to dry to the moisture content recommended by the CSM. Moisture content may be tested by the Construction Manager with a Delmhorst Instrument Company moisture detector, or equal. Except as otherwise specified, loose concrete, form oils, surface

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	<p>hardeners, curing compounds, and laitance shall be removed from surfaces by abrasive blasting and chipping, and voids and cracks shall be repaired as specified in Section 03 30 00. Surface Preparation must open up all shelled over air voids or bugholes to expose fully the void's depth, width, and length. Concrete shall be abraded to achieve a uniform concrete surface profile of CSP-5 in accordance with ICRI 03732. After surface preparation has been accepted, a complete skim coat of the specified filler surfacer shall be applied over all concrete surfaces and all bugholes (air voids) shall be completely filled using this same material. The filler/surfacer material shall be applied as a complete parge coat of the substrate. If the parge coat (filler/surfacer material) is non-polymer modified, it must be brush blast cleaned following adequate cure per CSM's instructions to produce a uniform anchor pattern of CSP-4 in accordance with ICRI 03732 prior to coating application.</p>
b. Masonry:	<p>Masonry surfaces shall be allowed to cure for at least 28 days. Holes or other joint defects shall be filled with mortar and repointed and allowed to cure for 28 days or shall be filled with a repair material compatible with the coating system that does not require hydration cure time. Loose or splattered mortar shall be removed by scrapping and chipping.</p> <p>Masonry surfaces shall be cleaned with clear water by washing and scrubbing to remove foreign and deleterious substances.</p> <p>Muriatic acid shall not be used. After cleaning, masonry surfaces shall be skim coated with a surfacer or block filler compatible with the specified coating system.</p>
5. Application:	Field
a. General:	<p>Surfacer or filler shall be applied per CSM's recommendations prior to application of coating to fill all bugholes and voids and create a complete parge coat of the prepared substrate. This parge coat shall completely fill all bugholes and voids in the substrate, and will also completely cover the substrate unless specified otherwise above such filled voids by 1/8 inch (125 mils) of thickness.</p> <p>Drying time between coats shall be as specified by the CSM for the site conditions. If the maximum recoat time is exceeded, surface preparation shall require solvent washing, light abrasive blasting, or other procedures per CSM's instructions.</p>
6. System Thickness:	60 mils dry film in addition to the parge coat.
7. Coatings:	
a. Finish:	One or more coats at CSM's recommended dry film thickness per coat to the specified system thickness.
b. Testing:	Holiday detection shall be performed over 100% of the coated surface area to identify any holidays or pinholes, which could compromise coating system performance. Holiday testing to be performed after application and adequate cure of the spray applied epoxy coating material. Holiday detection shall be performed in accordance with NACE RPO188.
c. Pinhole and Holiday Repair Procedure:	<p>Pinholes and holidays identified by Holiday Detection shall be repaired as follows:</p> <ul style="list-style-type: none"> • Using a grinder or other suitable power tool, remove the coating system at all pinholes or holidays in an area at least 2 inches in diameter or in both dimensions around the defect back to the concrete substrate. • Chip out and remove the concrete to expose the full dimensions in all three directions of the air void responsible for the defect. • Aggressively abrade or sand the intact coating system surface at least 3 inches beyond the removal area in all directions to produce a uniform 6- to 8-mil profile in the intact coating system. • Vacuum clean the prepared area to remove all dust, dirt, etc. leaving clean sound surfaces. • Tape to mask the periphery of the prepared intact coating area to prevent coating repair application onto the prepared area. • Using a putty knife or other suitable tool, fill the opened void with the approved filler/surfacer material completely and strike-off. Allow to cure per CSM's recommendations. • Apply the coating system in the number of coats necessary to achieve the specified 60 mils DFT over the defect and coating removal area and feather

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	the coating onto the abraded coated surfaces around the removal area to avoid a lip and to achieve a neat repair outline. Allow to cure properly.
Q. Coating System Identification: EA-3	
1. Coating Material:	Blended Amine Cured Epoxy
2. Surface:	Concrete or masonry
3. Service Condition:	Immersed, nonpotable; non-immersed, corrosive environment, color not required, new or existing construction, especially for headspace environments that are corrosive due to biogenic sulfide corrosion.
4. Surface Preparation:	<p>All coating termination and transition details shall be prepared in accordance with the CSM's standard detail drawings. This includes coating termination details, coating transitions at vertical and vertical to horizontal corners, coating terminations at joints, concrete crack treatment, pipe penetration treatment, coating terminations at metal embedments in the concrete substrate, and other details. The CSM's standard detail drawings shall be submitted for all such coating applications. If standard details are not available for a given detail treatment, the CSM shall be required to produce one at no additional cost to the owner, the engineer, or any other party.</p> <p>If wet abrasive or water blasting surface preparation methods were used, the concrete substrate shall be allowed to dry under warm conditions (minimum of 75 degrees F) for at least 5 days prior to coating application. Following surface preparation work and dry-out, all surfaces to be coated shall be vacuum cleaned to remove all loose dirt, dust, or other loose materials.</p>
a. Concrete:	<p>Concrete surfaces shall be allowed to age for at least 28 days and allowed to dry to the moisture content recommended by the CSM. Moisture content may be tested by the Construction Manager with a Delmhorst Instrument Company moisture detector, or equal. Except as otherwise specified, loose concrete, form oils, surface hardeners, curing compounds, and laitance shall be removed from surfaces by abrasive blasting and chipping, and voids and cracks shall be repaired as specified in Section 03 30 00. Concrete shall be abraded also to achieve a uniform concrete surface profile of CSP 6 minimum per ICRI 310.2. If the parge coat (filler/surfacer material) is non-polymer modified, it shall be brush blasted following adequate cure per the CSM's instructions to produce a uniform concrete surface profile of CSP-4 in accordance with ICRI 03732 prior to coating application. After cleaning, air voids or bugholes in the concrete shall be filled with a surfacer or block filler. The filler/surfacer material shall be applied as a complete parge coat of the substrate.</p> <p>For existing concrete that has been degraded, apply a skim coat of a surfacer or filler material to restore the substrate to a coatable condition. Be certain the filler surfacer material is compatible with the coating system.</p>
b. Masonry:	<p>Masonry surfaces shall be allowed to age for at least 28 days. Holes or other joint defects shall be filled with mortar and repointed. Loose or splattered mortar shall be removed by scrapping and chipping.</p> <p>Masonry surfaces shall be cleaned with clear water by washing and scrubbing to remove foreign and deleterious substances.</p> <p>Muriatic acid shall not be used. After cleaning, masonry surfaces shall be sealed or filled with sealer or block filler compatible with the specified coating system.</p>
5. Application:	Field
a. General:	<p>Surfacer or filler shall be applied and dry per CSM's recommendations prior to application of coating.</p> <p>Drying time between filler/surfacer and coating system shall be as specified by the CSM for the site conditions. If the maximum recoat time is exceeded, surface preparation shall require solvent washing, light abrasive blasting, or other procedures per CSM's instructions. The parge coat shall completely fill all bugholes and voids in the substrate and it will also completely cover the substrate unless specified otherwise above such filled voids by 1/8 inch of thickness.</p>
6. System Thickness:	125 mils dry film (or 1/8 inch) in addition to the parge coat.
7. Coatings:	

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a. Primer:	Self-priming.
b. Finish:	One coat at CSM's recommended dry film thickness – trowel applied.
c. Testing:	Holiday detection shall be performed over 100% of the coated surface area to identify any holidays or pinholes that could compromise coating system performance. Holiday detection shall be performed after adequate cure of the spray applied epoxy coating material. Holiday detection shall be performed in accordance with NACE RPO188.
d. Pinhole and Holiday Repair Procedure:	<p>Pinholes and holidays identified by Holiday Detection shall be repaired as follows:</p> <ul style="list-style-type: none"> • Using a grinder or other suitable power tool, remove the coating system at all pinholes or holidays in an area at least 2 inches in diameter or in both dimensions around the defect back to the concrete substrate. • Chip out and remove the concrete to expose the full dimensions in all three directions of the air void responsible for the defect. • Aggressively abrade or sand the intact coating system surface at least 3-inches beyond the removal area in all directions to produce a uniform 6- to 8-mil profile in the intact coating system. • Vacuum clean the prepared area to remove all dust, dirt, etc. leaving clean sound surfaces. • Tape to mask the periphery of the prepared intact coating area to prevent coating repair application onto the prepared area. • Using a putty knife or other suitable tool, fill the opened void with the approved filler/surfacer material completely and strike-off. Allow to cure per CSM's recommendations. • Apply the coating system in the number of coats necessary to achieve the specified 60 mils DFT over the defect and coating removal area and feather the coating onto the abraded coated surfaces around the removal area to avoid a lip and to achieve a neat repair outline. Allow to cure properly.

R. Coating System Identification: EA-4

1. Coating Material:	Blended Amine Cured Epoxy
2. Surface:	Concrete or masonry
3. Service Condition:	Immersed, nonpotable; non-immersed, very corrosive environment, color not required, new or existing construction, especially for headspace environments that are very corrosive due to biogenic sulfide corrosion.
4. Surface Preparation:	<p>All coating termination and transition details shall be prepared in accordance with the CSM's standard detail drawings. This includes coating termination details, coating transitions at vertical and vertical to horizontal corners, coating terminations at joints, concrete crack treatment, pipe penetration treatment, coating terminations at metal embedments in the concrete substrate, and other details. The CSM's standard detail drawings shall be submitted for all such coating applications. If standard details are not available for a given detail treatment, the CSM shall be required to produce one at no additional cost to the owner, the engineer, or any other party.</p> <p>If wet abrasive or water blasting surface preparation methods were used, the concrete substrate shall be allowed to dry under warm conditions (minimum of 75 degrees F) for at least 5 days prior to coating application. Following surface preparation work and dry-out, all surfaces to be coated shall be vacuum cleaned to remove all loose dirt, dust, or other loose materials.</p>
a. Concrete:	Concrete surfaces shall be allowed to age for at least 28 days and allowed to dry to the moisture content recommended by the CSM. Moisture content may be tested by the Construction Manager with a Delmhorst Instrument Company moisture detector, or equal. Except as otherwise specified, loose concrete, form oils, surface hardeners, curing compounds, and laitance shall be removed from surfaces by abrasive blasting and chipping, and voids and cracks shall be repaired as specified in Section 03 30 00. Concrete shall be abraded also to achieve a uniform concrete surface profile of CSP 5 minimum. If the parge coat (filler/surfacer material) is non-polymer modified, it shall be brush blasted following adequate cure per the CSM's instructions to produce a uniform concrete surface profile of CSP-4 in accordance

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	with ICRI 03732 prior to coating application. After cleaning, air voids or bugholes in the concrete shall be filled with a surfacer or block filler. The filler/surfacer material shall be applied as a complete parge coat of the substrate.
	For existing concrete that has been degraded, apply a skim coat of a surfacer or filler material to restore the substrate to a coatable condition. Be certain the filler surfacer material is compatible with the coating system.
b. Masonry:	Masonry surfaces shall be allowed to age for at least 28 days. Holes or other joint defects shall be filled with mortar and repointed. Loose or splattered mortar shall be removed by scrapping and chipping.
	Masonry surfaces shall be cleaned with clear water by washing and scrubbing to remove foreign and deleterious substances.
	Muriatic acid shall not be used. After cleaning, masonry surfaces shall be sealed or filled with sealer or block filler compatible with the specified coating system.
5. Application:	Field
a. General:	Surfacer or filler shall be applied and dry per CSM's recommendations prior to application of coating.
	Drying time between filler/surfacer and coating system shall be as specified by the CSM for the site conditions. If the maximum recoat time is exceeded, surface preparation shall require solvent washing, light abrasive blasting, or other procedures per CSM's instructions. The parge coat shall completely fill all bugholes and voids in the substrate and it will also completely cover the substrate unless specified otherwise above such filled voids by 1/8 inch of thickness.
6. System Thickness:	140 to 145 mils dry film in addition to the parge coat.
7. Coatings:	
a. Primer:	Self-priming.
b. Troweled Coat:	One coat at CSM's recommended dry film thickness – trowel applied. (125 mils)
c. Finish (Glaze Coat):	15 to 20 mils dry.
d. Testing:	Holiday detection shall be performed over 100% of the coated surface area to identify any holidays or pinholes that could compromise coating system performance. Holiday detection shall be performed after application and adequate cure of the spray applied epoxy coating material. Holiday detection shall be performed in accordance with NACE RPO188.
e. Pinhole and Holiday Repair Procedure:	<p>Pinholes and holidays identified by Holiday Detection shall be repaired as follows:</p> <ul style="list-style-type: none"> • Using a grinder or other suitable power tool, remove the coating system at all pinholes or holidays in an area at least 2 inches in diameter or in both dimensions around the defect back to the concrete substrate • Chip out and remove the concrete to expose the full dimensions in all three directions of the air void responsible for the defect. • Aggressively abrade or sand the intact coating system surface at least 3-inches beyond the removal area in all directions to produce a uniform 6- to 8-mil profile in the intact coating system. • Vacuum clean the prepared area to remove all dust, dirt, etc. leaving clean sound surfaces. • Tape to mask the periphery of the prepared intact coating area to prevent coating repair application onto the prepared area. • Using a putty knife or other suitable tool, fill the opened void with the approved filler/surfacer material completely and strike-off. Allow to cure per CSM's recommendations • Apply the coating system in the number of coats necessary to achieve the specified 60 mils DFT over the defect and coating removal area and feather the coating onto the abraded coated surfaces around the removal area to avoid a lip and to achieve a neat repair outline. Allow to cure properly.
S. Coating System Identification: EA-5	
1. Coating Material:	Novolac Epoxy Lining
2. Surface:	Concrete or masonry

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3. Service Condition:	Chemical area process slabs, chemical loading and unloading areas, secondary spill containment areas for ferric chloride or 25% hydrofluoro-silicic acid.																				
4. Surface Preparation:	<p>All coating termination and transition details shall be prepared in accordance with the CSM's standard detail drawings. This includes coating termination details, coating transitions at vertical and vertical to horizontal corners, coating terminations at joints, concrete crack treatment, pipe penetration treatment, coating terminations at metal embedments in the concrete substrate, and other details. The CSM's standard detail drawings shall be submitted for all such coating applications. If standard details are not available for a given detail treatment, the CSM shall be required to produce one at no additional cost to the owner, the engineer, or any other party.</p> <p>If wet abrasive or water blasting surface preparation methods were used, the concrete substrate shall be allowed to dry under warm conditions (minimum of 75 degrees F) for at least 5 days prior to coating application. Following surface preparation work and dry-out, all surfaces to be coated shall be vacuum cleaned to remove all loose dirt, dust, or other loose materials.</p>																				
a. Concrete:	Concrete surfaces shall be allowed to cure for at least 28 days and allowed to dry to the moisture content recommended by the CSM. Moisture content may be tested by the Construction Manager with a Delmhorst Instrument Company moisture detector, or equal. Except as otherwise specified, loose concrete, form oils, surface hardeners, curing compounds, and laitance shall be removed from surfaces by abrasive blasting and chipping, and voids and cracks shall be repaired as specified in Section 03 30 00. Surface Preparation must open up all shelled over air voids or bugholes to expose fully the void's depth, width, and length. Concrete shall be abraded to achieve a uniform concrete surface profile of CSP-5 in accordance with ICRI 03732. After surface preparation has been accepted, a complete skim coat of the specified filler surfacer shall be applied over all concrete surfaces and all bugholes (air voids) shall be completely filled using this same material. The filler/surfacer material shall be applied as a complete parge coat of the substrate. If the parge coat (filler/surfacer material) is non-polymer modified, it must be brush blast cleaned following adequate cure per CSM's instructions to produce a uniform anchor pattern of CSP-4 in accordance with ICRI 03732 prior to coating application.																				
5. Application:	Field																				
a. General:	<p>Prime coat shall be applied as recommended by the CSM.</p> <p>Surfacers or filler materials shall be trowel applied per CSM's recommendations. Work surfacer/filler into all voids to displace air and fill bugholes.</p> <p>Surfacer/filler and prime coat thicknesses are in addition to the system thickness specified below.</p>																				
6. System Thickness:	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Location</th> <th style="text-align: left;">System Thickness (mils dry film)</th> </tr> </thead> <tbody> <tr> <td>[FECL Receiving Station</td> <td></td> </tr> <tr> <td style="padding-left: 20px;">Slab</td> <td>110-145 (with silica sand)</td> </tr> <tr> <td style="padding-left: 20px;">Sump walls and floor</td> <td>40</td> </tr> <tr> <td>Storage Tank Secondary Containment</td> <td></td> </tr> <tr> <td style="padding-left: 20px;">Floor and other horizontal surfaces</td> <td>60-75</td> </tr> <tr> <td style="padding-left: 20px;">Vertical Surfaces</td> <td>40</td> </tr> <tr> <td>Metering Pump Secondary Containment</td> <td></td> </tr> <tr> <td style="padding-left: 20px;">Floor and other horizontal surfaces</td> <td>60-75 (with silica sand)</td> </tr> <tr> <td style="padding-left: 20px;">Vertical Surfaces</td> <td>40]</td> </tr> </tbody> </table>	Location	System Thickness (mils dry film)	[FECL Receiving Station		Slab	110-145 (with silica sand)	Sump walls and floor	40	Storage Tank Secondary Containment		Floor and other horizontal surfaces	60-75	Vertical Surfaces	40	Metering Pump Secondary Containment		Floor and other horizontal surfaces	60-75 (with silica sand)	Vertical Surfaces	40]
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7. Coatings:																					
a. Primer:	As recommended by the CSM.																				
b. Surfacer/Filler:	1/16-inch minimum thickness above plane of concrete to create a monolithic and																				

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	pinhole free surface. Surfacer or filler shall be applied per CSM's recommendations prior to application of coating system to fill all bugholes and voids and create a coatable surface by being applied as a complete 1/8 inch thick parge coat. This is for containment walls, curbs and bases and not for floor surfaces.
c. Base Coat Floor Surfaces:	For floor surfaces, the base coat shall be applied at thickness recommended by CSM and broadcast with aggregate to create a non-slip surface (texture to be as recommended by the CSM). Following application of the broadcast aggregate and removal of all excess aggregates, the base coat will be applied to encapsulate the non-slip aggregate embedded.
d. Base Coat and Saturation Coat:	For trench or sump surfaces and unloading areas, the base coat shall be applied to the thickness recommended by the CSM and then scrim cloth shall be embedded in it. Next, the same material will be applied as a saturation coat to encapsulate fully the scrim cloth. This shall be applied to the thickness recommended by the CSM.
e. Base Coat for Containment Wall and Base Surfaces:	For containment wall, curb, and equipment base surfaces shall be applied to the thickness recommended by the CSM.
f. Base Coat General:	The basecoat will be an aggregate filled coating as will the saturation coat. Both shall be applied in strict accordance with the CSM's recommendations. The aggregate used in these coating systems for hydrofluorosilica aggregates resistant to the HFS or fully encapsulated with resin to prevent attack of the silica aggregate.
g. Finish:	The finish coat or coats shall be applied to the thickness recommended by the CSM. All coating system thicknesses are in addition to the parge coat.
h. Testing:	Holiday detection shall be performed over 100% of the coated surface area to identify any holidays or pinholes that must be repaired. Holiday detection to be performed after proper application and cure of the coating system. Holiday detection to be performed in accordance with NACE RPO188.
i. Pinhole and Holiday Repair Procedure:	Pinholes or holidays identified by Holiday Detection shall be repaired as follows: <ul style="list-style-type: none"> • Using a grinder or other suitable power tool, remove the coating system at all pinholes or holidays in an area at least 2 inches in diameter or in both dimensions around the defect back to the concrete substrate. • Chip out and remove the concrete to expose the full dimensions in all three directions of the air void responsible for the defect. • Aggressively abrade or sand the intact coating system surface at least 3 inches beyond the removal area in all directions to produce a uniform 6- to 8-mil profile in the intact coating system. • Vacuum clean the prepared area to remove all dust, dirt, etc. leaving clean sound surfaces. • Tape to mask the periphery of the prepared intact coating area to prevent coating repair application onto the prepared area. • Using a putty knife or other suitable tool, fill the opened void with the approved filler/surfacer material completely and strike-off. Allow to cure per CSM's recommendations. • Apply the coating system in the number of coats necessary to achieve the specified finish coat thickness over the defect and coating removal area and feather the coating onto the abraded coated surfaces around the removal area to avoid a lip and to achieve a neat repair outline. Allow to cure properly. • Curing time between coats shall be as specified by the CSM for the site conditions. If the maximum recoat time is exceeded, surface preparation shall require solvent washing, light abrasive blasting, or other procedures per CSM's instructions.

T. Coating System Identification: EC-1

1. Coating Material:	Hybrid Polyurethane
2. Surface:	Concrete or dense masonry where existing crack or joint movement is suspected of propagating through rigid cured epoxy coatings.
3. Service Condition:	Interior or exterior, exposed to direct sunlight or not, corrosive (immersion pH 4.0 or

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	lower and/or headspace pH 4.0 or lower and/or gaseous H ₂ S concentrations between 10 and 150 ppm typically).
4. Surface Preparation:	<p><i>Confirm that the exterior of buried concrete structures will be waterproofed in accordance with Section 07 10 00 prior to application of this coating. If a coating is used for exterior waterproofing, use System E-10.</i></p> <p>All coating termination and transition details shall be prepared in accordance with the CSM's standard detail drawings. This includes coating termination details, coating transitions at vertical and vertical to horizontal corners, coating terminations at joints, concrete crack treatment, pipe penetration treatment, coating terminations at metal embedments in the concrete substrate, and other details. The CSM's standard detail drawings shall be submitted for all such coating applications. If standard details are not available for a given detail treatment, the CSM shall be required to produce one at no additional cost to the owner, the engineer, or any other party.</p> <p>If wet abrasive or water blasting surface preparation methods were used, the concrete substrate shall be allowed to dry under warm conditions (minimum of 75 degrees F) for at least 5 days prior to coating application. Following surface preparation work and dry-out, all surfaces to be coated shall be vacuum cleaned to remove all loose dirt, dust, or other loose materials.</p>
a. Concrete:	Concrete surfaces shall be allowed to cure for at least 28 days and allowed to dry to the moisture content recommended by the CSM. Moisture content may be tested by the Construction Manager with a Delmhorst Instrument Company moisture detector, or equal. Except as otherwise specified, loose concrete, form oils, surface hardeners, curing compounds, and laitance shall be removed from surfaces by abrasive blasting and chipping, and voids and cracks shall be repaired as specified in Section 03 30 00. Surface Preparation must open up all shelled over air voids or bugholes to expose fully the void's depth, width, and length. Concrete shall be abraded to achieve a uniform concrete surface profile of CSP-5 in accordance with ICRI 03732. After surface preparation has been accepted, a complete skim coat of the specified filler surfacer shall be applied over all concrete surfaces and all bugholes (air voids) shall be completely filled using this same material. The filler/surfacer material shall be applied as a complete parge coat of the substrate. If the parge coat (filler/surfacer material) is non-polymer modified, it must be brush blast cleaned following adequate cure per CSM's instructions to produce a uniform anchor pattern of CSP-4 in accordance with ICRI 03732 prior to coating application.
5. Application:	Field
a. General:	<p>Surfacers or filler materials shall be applied per CSM's recommendations prior to application of prime coat to fill bugholes and voids. These materials must be compatible with the primers and finish coats.</p> <p>Prime coat shall be thinned and applied as recommended by the CSM, provided the coating as applied complies with prevailing air pollution control regulations.</p>
6. System Thickness:	35-50 mils dry film in addition to the parge coat.
7. Coatings:	
a. Primer:	One coat at 2-3 mils dry film thickness
b. Finish:	One or more coats at CSM's recommended dry film thickness per coat to the specified system thickness.
c. Testing:	Holiday detection shall be performed over 100% of the coated surface area to identify any holidays or pinholes that must be repaired.
d. Pinhole and Holiday Repair Procedure:	<p>Pinholes or holidays identified by Holiday Detection shall be repaired as follows:</p> <ul style="list-style-type: none"> • Using a grinder or other suitable power tool, remove the coating system at all pinholes or holidays in an area at least 2 inches in diameter or in both dimensions around the defect back to the concrete substrate. • Chip out and remove the concrete to expose the full dimensions in all three directions of the air void responsible for the defect. • Aggressively abrade or sand the intact coating system surface at least 3-inches beyond the removal area in all directions to produce a uniform 6- to 8-mil

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	<p>profile in the intact coating system.</p> <ul style="list-style-type: none"> • Vacuum clean the prepared area to remove all dust, dirt, etc. leaving clean sound surfaces • Tape to mask the periphery of the prepared intact coating area to prevent coating repair application onto the prepared area • Using a putty knife or other suitable tool, fill the opened void with the approved filler/surfacer material completely and strike-off. Allow to cure per CSM's recommendations • Apply the coating system in the number of coats necessary to achieve the specified 35-50 mils DFT over the defect and coating removal area and feather the coating onto the abraded coated surfaces around the removal area to avoid a lip and to achieve a neat repair outline. Allow to cure properly.
U. Coating System Identification: EC-2 (NSF-61)	
1. Coating Material:	Modified Polyurethane
2. Surface:	Concrete or Dense Masonry where existing crack or joint movement is suspected due to thermal conditions and would propagate through rigid epoxy coating systems and/or where NSF-61 certification is required.
3. Service Condition:	Interior or exterior, submerged or non-submerged indirect sunlight – moderately corrosive.
4. Surface Preparation:	<p>All coating termination and transition details shall be prepared in accordance with the CSM's standard detail drawings. This includes coating termination details, coating transitions at vertical and vertical to horizontal corners, coating terminations at joints, concrete crack treatment, pipe penetration treatment, coating terminations at metal embedments in the concrete substrate, and other details. The CSM's standard detail drawings shall be submitted for all such coating applications. If standard details are not available for a given detail treatment, the CSM shall be required to produce one at no additional cost to the owner, the engineer, or any other party.</p> <p>If wet abrasive or water blasting surface preparation methods were used, the concrete substrate shall be allowed to dry under warm conditions (minimum of 75 degrees F) for at least 5 days prior to coating application. Following surface preparation work and dry-out, all surfaces to be coated shall be vacuum cleaned to remove all loose dirt, dust, or other loose materials.</p>
a. Concrete:	Concrete surfaces shall be allowed to cure for at least 28 days and allowed to dry to the moisture content recommended by the CSM. Moisture content may be tested by the Construction Manager with a Delmhorst Instrument Company moisture detector, or equal. Except as otherwise specified, loose concrete, form oils, surface hardeners, curing compounds, and laitance shall be removed from surfaces by abrasive blasting and chipping, and voids and cracks shall be repaired as specified in Section 03 30 00. Surface Preparation must open up all shelled over air voids or bugholes to expose fully the void's depth, width, and length. Concrete shall be abraded to achieve a uniform concrete surface profile of CSP-5 in accordance with ICRI 03732. After surface preparation has been accepted, a complete skim coat of the specified filler surfacer shall be applied over all concrete surfaces and all bugholes (air voids) shall be completely filled using this same material. The filler/surfacer material shall be applied as a complete parge coat of the substrate. If the parge coat (filler/surfacer material) is non-polymer modified, it must be brush blast cleaned following adequate cure per CSM's instructions to produce a uniform anchor pattern of CSP-4 in accordance with ICRI 03732 prior to coating application.
5. Application:	Field
a. General:	<p>Surfacer or filler shall be applied per CSM's recommendations prior to application of prime coat to fill bugholes and voids. These materials must be compatible with the primers and finish coats.</p> <p>Prime coat shall be thinned and applied as recommended by the CSM, provided the coating as applied complies with prevailing air pollution control regulations.</p>
6. System Thickness:	50-75 mils dry film.
7. Coatings:	

Coating System Specification Sheets (COATSPEC)

a. Primer:	One coat at 3-5 mils dry film thickness
b. Finish:	One or more coats at CSM's recommended dry film thickness per coat to the specified system thickness.
c. Testing:	Holiday detection shall be performed over 100% of the coated surface area to identify any holidays or pinholes that must be repaired.
d. Pinhole and Holiday Repair Procedure:	<p>Pinholes or holidays identified by Holiday Detection shall be repaired as follows:</p> <ul style="list-style-type: none"> • Using a grinder or other suitable power tool, remove the coating system at all pinholes or holidays in an area at least 2 inches in diameter or in both dimensions around the defect back to the concrete substrate. • Chip out and remove the concrete to expose the full dimensions in all three directions of the air void responsible for the defect. • Aggressively abrade or sand the intact coating system surface at least 3-inches beyond the removal area in all directions to produce a uniform 6- to 8-mil profile in the intact coating system. • Vacuum clean the prepared area to remove all dust, dirt, etc. leaving clean sound surfaces. • Tape to mask the periphery of the prepared intact coating area to prevent coating repair application onto the prepared area. • Using a putty knife or other suitable tool, fill the opened void with the approved filler/surfacer material completely and strike-off. Allow to cure per CSM's recommendations. • Apply the coating system in the number of coats necessary to achieve the specified 35-50 mils DFT over the defect and coating removal area and feather the coating onto the abraded coated surfaces around the removal area to avoid a lip and to achieve a neat repair outline. Allow to cure properly.

V. Coating System Identification: EU-1

1. Coating Material:	Zinc-Epoxy-Polyurethane System
2. Surface:	Ferrous Metal
3. Service Condition:	Exterior, exposed to direct sunlight, moderately corrosive, non-immersed.
4. Surface Preparation:	
a. General:	Shop primed surfaces which are to be incorporated in the work shall be prepared in the field by cleaning surfaces in accordance with SSPC SP-2 (Hand Tool Cleaning). Damaged shop coated areas shall be cleaned in accordance with SSPC SP-3 (Power Tool Cleaning) and recoated with the primer specified.
b. Ferrous Metal:	<p>Bare ferrous metal surfaces shall be prepared in accordance with SSPC SP-6 (Commercial Blast Cleaning) 2.5 – 3.0. Ductile iron surfaces to be coated shall be abrasive blast cleaned in accordance with paragraph 3.02 Metallic Surfaces.</p> <p>Ferrous metal with rust bleeding shall be cleaned in accordance with SSPC-SP-11 (Power Tool Cleaning to Bare Metal). Areas of rust penetration shall be spot blasted to SSPC SP-10 (Near White Blast) and spot primed with the specified primer.</p>
c. Galvanized Metal:	<p>Damaged galvanized steel areas with exposed ferrous metal and/or rusted shall be cleaned in accordance with SSPC SP-5 (White Metal Blast Cleaning) or Power Tool Cleaned to Bare Metal in accordance with SSPC-SP-11 to achieve a uniform 1.0- to 1.5-mil profile and spot primed with the primer specified.</p> <p>Nonferrous and galvanized metal shall be prepared in accordance with SSPC SP-7 (Brush-off Blast Cleaning) to impart a 1.0- to 2.0-mil profile to the galvanized steel surfaces. Where this cannot be performed, prepare by abrading in accordance with SSPC-SP-3, Power Tool Cleaning to impart a 1.0- to 1.5-mil profile uniformly to the galvanized steel surfaces.</p> <p>For EU-1 over galvanized steel, delete the zinc rich primer.</p>
5. Application:	Field
a. General:	Prime coat may be thinned and applied as recommended by the CSM, provided the coating as applied complies with prevailing air pollution control regulations.
b. Ferrous Metal:	Prime coats shall be a zinc rich epoxy or polyurethane primer compatible for use with urethane finish coats and applied in accordance with written instructions of the

Coating System Specification Sheets (COATSPEC)

	CSM or in the case of CARB or SCAQMD applications, prime with specified primer that is not zinc rich. In these cases, only a two-coat system is applied.
6. System Thickness:	3 to 4 mils of zinc rich primer, one intermediate or primer epoxy coat at 5 to 6 mils and one finish coat of polyurethane at 2 to 3 mils DFT.
7. Coatings:	
a. Primer:	One coat at CSM's recommended dry film thickness.
b. Intermediate:	One coat at CSM's recommended dry film thickness.
c. Finish:	One coat at CSM's recommended dry film thickness per coat to meet the specified system thickness.

W. Coating System Identification: EU-1-FRP

1. Coating Material:	Specialty Primer plus Polyurethane Finish Coat
2. Surface:	Exterior of FRP Pipe and Tanks, etc.
3. Service Condition:	Exterior, exposed to direct sunlight, non-immersed.
4. Surface Preparation:	
a. General:	Clean to remove loose dirt, dust, or other contaminants. Prepare surfaces by sanding to produce roughness to achieve a uniform, minimum surface profile of 1.5 to 2.0 mils. Solvent clean thoroughly using solvent as recommended by the CSM. Thoroughly clean to remove loose debris by vacuum cleaning.
5. Application:	Field
a. General:	Apply primer coat and thin as recommended by the CSM provided the coating applied complies with prevailing air pollution control regulations. Apply finish coat as recommended by the CSM.
6. System Thickness:	Primer to 2 to 4 mils and finish coat is 2 to 3 mils DFT.
7. Coatings:	
a. Primer:	One coat at CSM's recommended dry film thickness.
b. Finish:	One coat at CSM's recommended dry film thickness per coat to meet the specified system thickness.

X. Coating System Identification: G

1. Coating Material:	Grease
2. Surface:	Metal
3. Surface Preparation:	
a. Ferrous Metal:	Ferrous metal surfaces shall be prepared in accordance with SSPC SP-1 (Solvent Cleaning).
4. Application:	Field Coating shall be applied with stiff brush, hand swab, or airless spray gun.
5. System Thickness:	50 square feet per gallon
6. Coating:	One coat of grease coating.

Y. Coating System Identification: HH-1

1. Coating Material:	Proprietary Primer plus Silicone Topcoat
2. Surface:	Metal
3. Service Condition:	Temperature to 750 degrees F.
4. Surface Preparation:	Metal surfaces shall be prepared in accordance with SSPC SP-10 (Near White Metal Blast Cleaning) to achieve a uniform surface profile of 2.0 to 2.5 mils.
5. Application:	Field Curing as required by CSM.
6. System Thickness:	6.5 to 8.0 mils dry film

Coating System Specification Sheets (COATSPEC)

7. Coating:	Primer at 5 to 6 mils DFT plus one topcoat at 1.5 to 2.0 mils DFT.
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Z. Coating System Identification: HH-2

1. Coating Material:	Proprietary Primer plus Silicone Topcoat (available in black or aluminum only)
2. Surface:	Metal
3. Service Condition:	Temperature to 1200 degrees F.
4. Surface Preparation:	Metal surfaces shall be prepared in accordance with SSPC SP-10 (Near White Metal Blast Cleaning) to achieve a uniform surface profile of 2.0 to 2.5 mils.
5. Application:	Field Curing as required by CSM.
6. System Thickness:	6.5 to 8.0 mils dry film
7. Coating:	Primer at 5 to 6 mils DFT plus one topcoat at 1.5 to 2.0 mils DFT.

AA. Coating System Identification: L-1

1. Coating Material:	Latex
2. Surfaces:	Concrete, masonry, plaster, gypsum board.
3. Service Condition:	Interior and exterior including existing exterior coated concrete.
4. Surface Preparation:	
a. Concrete:	Concrete surfaces shall be allowed to age for at least 28 days and allowed to dry to the moisture content recommended by the CSM. Moisture content may be tested by the Construction Manager with a Delmhorst Instrument Company moisture detector, or equal. Loose concrete and laitance shall be removed from surfaces, and voids and cracks shall be repaired as specified in Section 03 30 00.
b. Existing Coated Concrete:	Remove all loose coating down to a sound substrate or intact, well-adhered existing coating by scraping or other means. Then, abrade all surfaces to achieve a 0.5- to 1.5-mil uniform profile and vacuum clean to remove all loose dirt, paint chips, and dirt.
c. Masonry:	Masonry surfaces shall be allowed to age for at least 28 days. Holes or other joint defects shall be filled with mortar and repointed. Loose or splattered mortar shall be removed by scraping and chipping. Masonry surfaces shall be cleaned with clear water by washing and scrubbing to remove foreign and deleterious substances. Muriatic acid shall not be used. After cleaning, masonry surfaces shall be filled with block filler compatible with the specified primer.
d. Plaster:	Plaster surfaces shall be dry, clean, and free from grit, loose plaster, and surface irregularities. Cracks and holes shall be repaired with acceptable patching materials, keyed to existing surfaces, and sandpapered smooth. Surfaces shall be cleaned with clear water by washing and scrubbing to remove foreign and deleterious substances. After cleaning, surfaces shall be sealed with a compatible sealer.
e. Gypsum Wallboard:	Tape joints and spackled nail heads shall be sanded smooth and dusted. Seal with PVA sealer for interior uses only.
5. Application:	Field
a. General:	Sealer or filler shall dry a minimum of 48 hours prior to primer application. Drying time between coats shall be as recommended by CSM.
6. System Thickness:	4 mils dry film.
7. Coatings:	
a. Primer:	One coat at CSM's recommended dry film thickness.
b. Finish:	Two or more coats at CSM's recommended dry film thickness per coat to the specified system thickness.

BB. Coating System Identification: L-2

1. Coating Material:	Latex
2. Surface:	PVC and CPVC pipe.
3. Service Condition:	Exterior, direct sunlight exposure.

Coating System Specification Sheets (COATSPEC)

4. Surface Preparation:	Plastic pipe shall be cleaned with solvent compatible with the specified primer and sanded to roughen surfaces to achieve a uniform surface profile of 1.0 to 1.5 mils. Vacuum clean after sanding to remove all loose dust, plastic particles, and dirt.
5. Application:	Field
6. System Thickness:	3 mils dry film.
7. Coatings:	
a. Primer:	One coat at CSM's recommended dry film thickness.
b. Finish:	One or more coats at CSM's recommended dry film thickness per coat to the specified system thickness.

CC. Coating System Identification: L-3

1. Coating Material:	Latex - Direct to Metal
2. Surface:	Ferrous Metal
3. Service Condition:	Interior or Exterior
4. Surface Preparation:	
a. Ferrous Metals:	<p>Bare ferrous metal surfaces shall be prepared in accordance with SSPC SP-6 (Commercial Blast Cleaning) unless specified otherwise. Impart a 1.5- to 2.0-mil profile to substrate.</p> <p>Ferrous metal with rust bleeding shall be cleaned in accordance with SSPC SP-1 (Solvent Cleaning). Areas of rust penetration shall be spot blasted to SSPC SP-10 (Near White Blast) and spot primed with the specified primer.</p> <p>Shop primed surfaces which are to be incorporated in the work shall be prepared in the field by cleaning surfaces in accordance with SSPC SP-2 (Hand Tool Cleaning) or SSPC-SP-3 (Power Tool Cleaning).</p>
b. Nonferrous and Galvanized Metal:	Galvanized or nonferrous surfaces shall be prepared in accordance with SSPC SP-1 (Solvent Cleaning) after Brush Blast Cleaning in accordance with SSPC-SP-7.
5. Application:	Field
6. System Thickness:	6 to 8 mils dry film excluding sealer
7. Coatings:	
a. Primer:	One coat at CSM's recommended dry film thickness.
b. Finish:	Two or more coats at CSM's recommended dry film thickness per coat to the specified system thickness.

DD. Coating System Identification: L-4

1. Coating Material:	Latex
2. Surface:	Wood
3. Service Condition:	Interior
4. Surface Preparation:	Wood surfaces shall be cleaned of dirt, oil or other foreign substances with mineral spirits, scrapers, sandpaper or wire brush. Finished surfaces exposed to view shall be smoothed by planing or sandpapering. Millwork shall be sandpapered and given a coat of the specified primer on all sides before installation. Built-in surfaces of windowsills shall be double primed. Glazing rabbets and beads in exterior sash and doors shall be double primed. Small, dry, seasoned knots shall be surfaced scraped, sandpapered, and thoroughly cleaned and shall be given a thin coat of an acceptable knot sealer before application of the priming coat. Large, open, unseasoned knots, and beads or streaks of pitch shall be scraped off; however, if the pitch is still soft, it shall be removed with mineral spirits or turpentine, and the resinous area shall be coated with knot sealer prior to priming. After priming, holes and imperfections shall be filled with putty or plastic wood, colored to match the finish coat, allowed to dry and sandpapered smooth.
5. Application:	Field
6. System Thickness:	4.0 mils dry film.
7. Coatings:	

Coating System Specification Sheets (COATSPEC)

a. Primer:	One coat at CSM's recommended dry film thickness.
b. Finish:	Two or more coats at CSM's recommended dry film thickness per coat to the specified system thickness.

EE. Coating System Identification: M-1

1. Coating Material:	Petrolatum based mastic or wax based wrapping tapes.
2. Surfaces:	Metal
3. Service Condition:	Below grade (buried) or where little to no surface preparation can be performed on piping or structural steel.
4. Surface Preparation:	Remove loose scale, rust, dirt, excessive moisture, or frost from the surface in accordance with SSPC SP-2 (Hand Tool Cleaning).
5. Application:	<p>All surfaces shall be hand rubbed or brushed with a priming paste recommended by the CSM. Sharp projections such as threads, irregular contours, or badly pitted areas shall receive a liberal amount of priming paste to ensure maximum protection of metal throughout.</p> <p>On irregular shaped surfaces, i.e., nuts, bolts, flanges, valves, etc., the Contractor shall use either of the following systems recommended by the CSM.</p> <p>A. Apply recommended mastic by hand in sufficient quantity to build an even contour over entire surface. The Contractor shall pay particular attention to ensure that folds and air pockets within the mastic layer are thoroughly pressed out prior to subsequent application of tape.</p> <p>OR:</p> <p>B. An extra layer of tape shall be cut and carefully molded around sharp projections, nuts, bolts, etc., before final application of tape, in order to meet specified system thickness.</p> <p>Tape shall be spirally wrapped with a 55 percent overlap and sufficient tension and pressure to provide continuous adhesion without stretching the tape. Edges of tape must be continuously smoothed and sealed by hand during wrapping. On vertical application, contractor shall begin at bottom and proceed upward creating a weatherboard overlap.</p>
6. System Thickness:	Smooth contours shall have a minimum thickness of 50 mils while nuts, bolts, and sharp projections shall be 100 mils.
7. Tape:	Number and types of tape wraps shall be in accordance with the CSM's written instructions.

FF. Coating System Identification: M-2

1. Coating Material:	Epoxy mastic or equal
2. Surface:	Ferrous Metal
3. Service Condition:	Interior, corrosive environment, confined enclosures, where minimal surface preparation is possible.
4. Surface Preparation:	
a. Ferrous Metal:	All uncoated ferrous metal surfaces shall be prepared in accordance with SSPC SP-3 (Power Tool Cleaning), or SSPC-SP-11 (Power to Cleaning to Bare Metal) prior to assembly. Surface preparation to achieve a uniform surface profile of 2.0 to 2.5 mils. Shop primed ferrous metal surfaces and fabricated assemblies shall be clean and dry prior to the application of field coats. Following assembly, the Contractor shall smooth welds and prominences using power tools prior to the application of the field applied coatings.
5. Application:	Field
a. General:	Prior to the application of field applied coatings, welds, back-to-back angles, sharp or rough edges and weld splatter shall be brushed with the specified prime coat and allowed to cure overnight.
6. System Thickness:	15 mils dry film.
7. Coatings:	

Coating System Specification Sheets (COATSPEC)

a. Prime:	One coat of the CSM's recommended dry film thickness.
b. Finish:	One or more coats of CSM's recommended dry film thickness per coat to the specified system thickness.

GG. Coating System Identification: S-1

1. Coating Material:	Penetrating acrylic stain, color required.
2. Surface:	Concrete
3. Service Condition:	Non-immersed, exposure to moisture and sunlight.
4. Surface Preparation:	Brush-off blast or industry standard acid etch or other preparation as approved by the CSM.
5. Application:	
a. General:	Drying time between coats shall be as specified by the CSM for the site conditions.
b. Coatings:	Minimum of two coats overall (coat as many times as required to achieve desired color).
6. System Thickness:	200 square feet per gallon maximum or as recommended by the CSM.
7. Color Selection:	As approved by the Construction Manager consistent with neighborhood selection. The Contractor to price materials based on custom color.

HH. Coating System Identification: S-2

1. Coating Material:	Penetrating Water Repellent (Clear and Non-Film Building)
2. Surface:	Concrete Floors
3. Service Condition:	Exterior and Interior.
4. Surface Preparation:	Clean surfaces of all traces of dirt, dust, efflorescence, mold, salt, grease, oil, asphalt, laitance, curing compounds, paint, coatings, and other foreign materials by brush-off blast, water blasting, and/or chemical cleaners or other preparation as approved by the CSM.
a. Concrete	Concrete surfaces shall be allowed to age for at least 28 days and allowed to dry to the moisture content recommended by the CSM. Moisture content may be tested by the Construction Manager with a Delmhorst Instrument Company moisture detector, or equal. Loose concrete and laitance shall be removed from surfaces, and voids and cracks shall be repaired as specified in Section 03 30 00.
5. Application:	
a. General:	Drying time before placing into service shall be as recommended by the CSM for site conditions.
6. System Coverage:	Follow CSM's recommendations.
7. Color Selection:	Clear.

II. Coating System Identification: S-3

1. Coating Material:	Penetrating Water Repellent (Clear & Non-Film Building)
2. Surface:	Concrete and Masonry Walls
3. Service Condition:	Exterior and Interior – For Anti-Graffiti Applications
4. Surface Preparation:	Clean surfaces of all traces of dirt, dust, efflorescence, mold, salt, grease, oil, asphalt, laitance, curing compounds, paint, coatings, and other foreign materials by brush-off blast, water blasting, and/or chemical cleaners or other preparation as approved by the CSM.
a. Concrete	Concrete surfaces shall be allowed to age for at least 28 days and allowed to dry to the moisture content recommended by the CSM. Moisture content may be tested by the Construction Manager with a Delmhorst Instrument Company moisture detector, or equal. Loose concrete and laitance shall be removed from surfaces, and voids and cracks shall be repaired as specified in Section 03 30 00.
b. Masonry:	Masonry surfaces shall be allowed to age for at least 28 days. Holes or other joint defects shall be filled with mortar and repointed. Loose or splattered mortar shall be removed by scraping and chipping. Masonry surfaces shall be cleaned with clear water by washing and scrubbing to remove foreign and deleterious substances.

Coating System Specification Sheets (COATSPEC)

	Muriatic acid shall not be used.
5. Application:	
a. General:	Drying time before placing into service shall be as recommended by the CSM for site conditions.
6. System Coverage:	Follow CSM's recommendations.
7. Color Selection:	Clear.

JJ. Coating System Identification: S-4

1. Coating Material:	Penetrating Oil and Water Repellent (Non-Film Forming)
2. Surface:	Concrete Floors
3. Service Condition:	Exterior and Interior
4. Surface Preparation:	Clean surfaces of all traces of dirt, dust, efflorescence, mold, salt, grease, oil, asphalt, laitance, curing compounds, paint, coatings, and other foreign materials by brush-off blast, water blasting, and/or chemical cleaners or other preparation as approved by the CSM.
a. Concrete	Concrete surfaces shall be allowed to age for at least 28 days and allowed to dry to the moisture content recommended by the CSM. Moisture content may be tested by the Construction Manager with a Delmhorst Instrument Company moisture detector, or equal. Loose concrete and laitance shall be removed from surfaces, and voids and cracks shall be repaired as specified in Section 03 30 00.
5. Application:	
a. General:	Drying time before placing into service shall be as recommended by the CSM for site conditions.
b. Coatings:	One coat, flood horizontal surface so coating ponds for at least 60 seconds. Broom over all puddles thoroughly until complete penetration is achieved
6. System Thickness:	Follow CSM's recommendations.
7. Color Selection:	Clear.

3.06 COATING SYSTEMS SCHEDULE (FINISH SCHEDULE)

A. General:

1. Specific coating systems, colors, and finishes for rooms, galleries, piping, equipment, and other items that are coated or have other architectural finishes are specified in the following coating system schedule. Unless otherwise specified in the coating system schedule, the word "interior" shall mean the inside of a building or structure, and the word "exterior" shall mean outside exposure to weather elements.

Coating Systems Schedule (Finish Schedule)

Location/Surface	Coating System Identification	Standard Color
A. General: All Surfaces not Specified by Area or Structure		
1. Structural Steel, Metal Decking, and Galvanized Acoustical Decking	Uncoated or E-2	
2. Equipment and Metal Appurtenances		
a. Equipment, non immersed, unless otherwise specified		
1) Indoors	E-1	FS 25051 Blue
2) Outdoors	EU-1	FS 20040 Brown
b. Equipment, immersed, unless otherwise specified	E-2	Beige
c. High temperature equipment operable at		
1) 200 to 750 degrees F	HH-1	FS 26306 Grey
2) above 750 degrees F to 1200 degrees F	HH-2	Aluminum or Black
d. Existing equipment		
1) Not damaged nor modified by work in this contract	Uncoated	--
2) Damaged, exposed, or modified by work in this contract		
a) Indoors	E-1 (see paragraph 3.02)	Match existing color
b) Outdoors	EU-1 without primer (see paragraph 3.02)	Match existing color
e. Diffusers and grilles on coated surfaces, unless otherwise specified		
1) Indoors	E-1	Match background color
2) Outdoors	EU-1	Match background color
f. Diffusers and grilles on uncoated surfaces, unless otherwise specified		
1) Indoors	E-1	FS 25051 Blue
2) Outdoors	EU-1	FS 20040 Brown
g.		
1)		
2)		
a)		
b)		
h. Electrical switchgear panels, unit substations, motor control centers, power transformers, distribution centers, and relay panels; indoors and outdoors	See paragraph 3.03 Electrical and Instrumentation Equipment and Materials	ANSI 61 Grey (outside) FS 27880 White (inside)
i. Instrumentation panels, graphic indicating panels, indicating and transmitting field panels, unless otherwise specified		
1) Indoors	See paragraph 3.03 Electrical and Instrumentation Equipment and Materials	FS 26306 Grey (outside) FS 27880 White (inside)

Coating Systems Schedule (Finish Schedule)

Location/Surface	Coating System Identification	Standard Color
2) Outdoors	See paragraph 3.03 Electrical and Instrumentation Equipment and Materials	FS 27722 White (outside) FS 27880 White (inside)
j. Existing electrical and instrumentation panels		
1) Not damaged by work in this contract	Uncoated	--
2) Damaged or exposed to outside surfaces by work in this contract		
a) Indoors	E-1 (see paragraph 3.02 Masonry Surfaces)	FS 26306 Grey
b) Outdoors	EU-1 without primer (see paragraph 3.02 Masonry Surfaces)	FS 26306 Grey (Electrical) FS 27722 White (Instrumentation)
3. Conduit, Piping and Ductwork		
a. Ferrous, non-ferrous and galvanized piping, and appurtenant hangers and supports, non-immersed, unless otherwise specified.		
1) Indoors - noncorrosive	E-1	FS 25051 Blue
2) Outdoors - noncorrosive	EU-1	FS 20040 Brown
3) Indoors - in corrosive environment	EA-1	To be determined
4) Buried piping	M-1 or M-2	Not required
b. Ferrous piping, appurtenant and supports, immersed	E-2	To be determined
c. Conduit, outlet and junction boxes, lighting transformers, lighting, communication and small power panels, control stations, piping, lagged ductwork, appurtenant hangers, clamps, and supports on coated surfaces, unless otherwise specified.		
1) Indoors	E-1	Match background color
2) Outdoors	EU-1	Match background color
d. Conduit, outlets and junction boxes, lighting transformers, lighting, communication and small power panels, control stations, piping, lagged ductwork, appurtenant hangers, clamps and supports on uncoated surfaces, unless otherwise specified		
1) Indoors	E-1	FS 25051 Blue
2) Outdoors	EU-1	FS 20040 Brown
e. Existing conduit, outlet and junction boxes, lighting transformers, lighting communication and small power panels, control stations, piping, lagged ductwork, appurtenant hangers, clamps, and supports		
1) Not damaged nor modified by work in this contract	Uncoated	--
2) Damaged, exposed, or modified by work in this contract		
a) Indoors	E-1 (see paragraph 3.02 Masonry Surfaces)	Match existing color

Coating Systems Schedule (Finish Schedule)

Location/Surface	Coating System Identification	Standard Color
b) Outdoors	EU-1 without primer (see paragraph 3.02 Masonry Surfaces)	Match existing color
f. Racked conduits and cable trays	Uncoated	--
g. Insulated pipe jacketing	Uncoated	--
h. Plastic, fiberglass and flexible conduit and piping		
1) Unless otherwise specified	Uncoated	--
2) PVC and CPVC Piping	L-2	FS 25051 Blue
a) Exposed to direct sunlight	L-2	FS 25051 Blue
b) Not exposed to direct sunlight	E-7	FS 25051 Blue
i. High temperature piping operable at		
1) 200 to 750 degrees F	HH-1	FS 26306 Grey
2) Above 750 degrees F to 1,200 degrees F	HH-2	Aluminum or Black
j. Exposed ductwork, unless otherwise specified	Uncoated	--
4. Concrete, Grout, and Masonry		
a. Immersed tank and channel walls and bottoms unless otherwise specified	Uncoated	--
b. Outside concrete walls below grade common with dry area or room	In accordance with Section 07 10 00	--
c. Walls and ceilings		
1) Precast concrete, colored and ground face masonry	Uncoated	--
2) Outdoors, unless otherwise specified	Uncoated	--
3) Indoors, unless otherwise specified	Uncoated	-
d. Concrete equipment bases unless otherwise specified	E-4	Match equipment color
e. Floors unless otherwise specified	Reference the Room Finish Schedule	
f. Existing coated surfaces.	L-1	Match existing color
5. Door and Door Frames		
a. Doors unless otherwise specified		
1) Aluminum	Uncoated	--
b. Door frames unless otherwise specified		
1) Aluminum	Uncoated	--
6. Handrails, Gratings, Floor Plates, Manhole Covers, and Hatches		
a. Unless otherwise specified	Uncoated	
7. Metal Stairs, Ladders, Platforms, and Supports Except Tread and Grating		
a. Unless otherwise specified	Uncoated	-
8. Aluminum Flashing, Light Standards, Supports, and Louvers		
a. Indoors and outdoors, unless otherwise specified	Uncoated	--
9. Precast Concrete Metalwork		
a. Fasteners, anchors, supports, etc.	EU-1	Match wall
10. Other		
a. Fire hydrants	EU-1	FS 21302 Red

Coating Systems Schedule (Finish Schedule)

Location/Surface	Coating System Identification	Standard Color
b. Flap gates	EA-1	Beige
c. Sluice gates		
1) Gate	--	--
2) Stem, except potable	G	--
3) Operator		
a) Indoors	E-2	FS 25051 Blue
b) Outdoors	EU-1	FS 20040 Brown
d. Tanks		
1) Steel tanks unless otherwise specified		
a) Inside of wastewater or similar tanks	E-2	--
b) Outside of tank		
(1) Indoors	E-1	FS 25051 Blue
(2) Outdoors	EU-1	FS 25051 Blue
e. Pipe, ductwork, equipment and appurtenances made from fiberglass, plastic, rubber, including flexible hose, conduit, and plastic coated tubing, in areas not exposed to view (indoors) (metal hangers and supports are coated with E-1)	Uncoated	--
f. Buried, sleeve-type and flanged pipe, couplings, valves, mechanical and electrical penetrations	M-1 or M-2	Manufacturer's color
B. Wet Well		
1. Piping and appurtenant hangers and supports above max. water level elevation:	EA-1	--
a. Injection Well PS = 10 ft NAVD88		
b. Drainage PS = -2.0 ft NAVD88		
2. Piping and appurtenance hangers and supports below max. water level elevation:	E-2	--
a. Injection Well PS = 10 ft NAVD88		
b. Drainage PS = -2.0 ft NAVD88		
3. Walls and ceiling above max. water level elevation:	Uncoated	--
a. Injection Well PS = 10 ft NAVD88		
b. Drainage PS = -2.0 ft NAVD88		
4. Walls and ceiling below max. water level elevation:	Uncoated	--
a. Injection Well PS = 10 ft NAVD88		
b. Drainage PS = -2.0 ft NAVD88		
C. RO Concentrate Wet Well		
1. Piping and appurtenant hangers and supports above max. water level elevation:	EA-1	--
a. Concentrate PS = 8 ft NAVD88		
2. Piping and appurtenance hangers and supports below max. water level elevation:	E-2	--
a. Concentrate PS = 8 ft NAVD88		
3. Walls and ceiling above max. water level elevation:	EA-3	--
a. Concentrate PS = 8 ft NAVD88		
4. Walls and ceiling below max. water level elevation:	EA-3	--
a. Concentrate PS = 8 ft NAVD88		

Note: Owner will select color from coating manufacturer's list of EPA approved colors for potable water.

3.07 INSPECTION AND TESTING BY OWNER

A. General:

1. Inspection by the Owner or others does not limit the Contractor's or CSA's responsibilities for quality workmanship or quality control as specified or as required by the CSM's instructions. Inspection by the Owner is in addition to any inspection required to be performed by the Contractor.
2. The Owner may perform, or contract with an inspection agency to perform, quality control inspection and testing of the coating work covered by this Section 09 90 00. These inspections may include the following:
 - a. Inspect materials upon receipt to ensure that are supplied by the CSM.
 - b. Inspect to verify that specified storage conditions for the coating system materials, solvents and abrasives are provided.
 - c. Inspect and record findings for the degree of cleanliness of substrates.
 - d. Inspect and record the pH of concrete and metal substrates.
 - e. Inspect and record substrate profile (anchor pattern)
 - f. Measure and record ambient air and substrate temperature.
 - g. Measure and record relative humidity.
 - h. Check for the presence of substrate moisture in the concrete.
 - i. Inspect to verify that correct mixing of coating system materials is performed in accordance with CSM's instructions.
 - j. Inspect, confirm, and record that the "pot life" of coating system materials is not exceeded during installation. Inspect to verify that recoat limitations for coating materials are not exceeded.
 - k. Perform adhesion testing.
 - l. Measure and record the thickness of the coating system.
 - m. Inspect to verify proper curing of the coating system in accordance with the CSM's instructions.
 - n. Perform holiday or continuity testing for coatings that will be immersed or coatings that will be exposed to aggressively corrosive conditions.

3.08 FINAL INSPECTION

A. General

1. Contractor shall conduct a final inspection to determine whether coating system work meets the requirements of the specifications.
2. The Construction Manager will subsequently conduct a final inspection with the Contractor to determine the work is in conformance with requirements of the contract documents.
3. Any rework required shall be marked. Such areas shall be recleaned and repaired as specified at no additional cost to the Owner.

END OF SECTION

SECTION 09 97 24

EPOXY COATING SYSTEM FOR REFURBISHING AND PROTECTION OF CONCRETE STRUCTURES

PART 1 GENERAL

1.01 DESCRIPTION

- A. This section covers the work required to provide all labor, materials, and equipment necessary for the interior protection of new sanitary sewer structures, for the purpose of eliminating infiltration and inflow, providing corrosion protection, and filling of cracks and voids for such structures. Like items of equipment provided hereunder shall be the end products of one manufacturer in order to achieve standardization for appearance, operation, maintenance, spare parts and manufacturer's service. See CONTRACT CONDITIONS and Division 1, GENERAL REQUIREMENTS, which contain information and requirements that apply to the Work specified herein and are mandatory for this Project.

1.02 QUALITY ASSURANCE

A. REFERENCES

1. This section contains references to the following documents. They are a part of this section as specified and modified herein. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

B. COMMERCIAL STANDARDS (Latest Revision)

ACI RAP-3	Spall Repair by Low Pressure Spraying
ACI 546R	Concrete Repair Guide

1.03 SUBMITTALS

- A. Submittals shall be made in accordance with Section 01300 - Submittals.
- B. Submit manufacturer's material data and application and installation instructions for all products to be used.
- C. Provide documentation that the proposed structural protection/ rehabilitation process has a minimum 15-year history for concrete sanitary sewer structures on projects of similar size and scope.
- D. The CONTRACTOR shall furnish detailed and complete data pertaining to the surfaces of the structure to be coated, the coating products, surface preparation and installation to the ENGINEER for approval. The submission of this data shall be made in a timely

manner to prevent project delay. At the request of the ENGINEER, the CONTRACTOR shall test for adverse chemical conditions that may hinder overall product performance.

- E. Work plan for completion of the sanitary structure coating inclusive of surface preparation shall be submitted for each site.
- F. Submit safety plan. It is the CONTRACTOR's responsibility to comply with OSHA standards and all regulations pertaining to the work including confined space entry requirements.

1.04 QUALITY ASSURANCE

- A. Use, mix, apply and cure all products in accordance with the manufacturer's recommendations and instructions.
- B. Provide recommended daily or per lot test specimens for compressive strength and other testing per applicable ASTM standards.
- C. Qualification of Work Crew
 - 1. The lining material Manufacturer shall maintain a listing of competent approved applicators that have demonstrated requisite skill and training to be qualified applicators of their materials.
 - 2. Prior to project commencement, the CONTRACTOR must satisfy the ENGINEER that the applicator=s work crew personnel have performed satisfactory work in similar capacities elsewhere for a sufficient period of time to be fully qualified to properly perform the work as specified.
 - 3. Applicator=s foreman shall have at least 4 years' experience with similar work and project conditions.
 - 4. Applicator=s nozzlemen shall be qualified by having had similar work experience.
 - 5. Applicator=s work crew responsibilities prior to application of lining material shall include the following:
 - a. Surface preparation as specified herein.
 - b. Ensure the operating air pressure is uniform and provides adequate nozzle velocity for proper compaction.
 - c. Continuously regulate the water content so that the applied materials consistently achieve proper compaction with a low percentage of rebound and no visible "sag".
 - d. Ensure that the installation equipment nozzle is held at the proper distance away from and as nearly perpendicular to the prepared sub-surface as the working conditions will permit to secure maximum material compaction with minimum rebound and no visible "sag".
 - e. Follow a sequence routine that will fill corners with adequately compacted material applied at a maximum practicable layer thickness.
 - f. Determine necessary operating procedures for placement in confined spaces, extended distances or around unusual obstructions where placement velocities and mix consistency may need

to be adjusted.

g. Direct the crew as to when to start and stop the flow of materials during installation and to immediately stop all work when material is not arriving uniformly at the nozzle.

h. Ensure that slough pockets are removed and prepared for installation of replacement material.

i. Bring the installed materials to established finished elevations in a neat and timely manner and within established tolerances.

6. Applicator's job foreman shall operate the mixing/placing equipment and direct the work of mixing crew personnel. Applicator's work crew shall also maintain proper line pressures throughout the mixing/placing equipment to ensure the necessary consistent nozzle velocity. Applicator's work crew shall further see that all material fed to the nozzle is uniformly fed through this equipment.

1.05 WARRANTY

A. CONTRACTOR shall warrant to the OWNER and guarantee the work under this Section against defective workmanship and materials for a period of two (2) years commencing on the date the coated wetwell is placed in service.

B. Individual warranty period shall be established for each completed pump station.

PART 2 PRODUCTS

2.01 MATERIALS

A. Patching Mix

1. Patching material shall be rapid-setting, fiberglass fiber-reinforced, high-early-strength, corrosion-resistant, hand-mixed and hand-applied, calcium aluminate based cementitious material, SewperCoat 2000 HS, or equal and have the following minimum requirements:

Compressive Strength	ASTM C109	>5500 psi, 24 hrs.
Bond Strength	ASTM C882	>2500 psi, 28 days
Shrinkage	ASTM C157	<0.07 at 28 days

B. Hydraulic Cement

1. Hydraulic cement shall be used for stopping active infiltration and filling voids. Hydraulic cement shall be Bonsal Hydraulic Cement, Water Plug (Thoro) Hydraulic Cement, Xypex Patch=N Plug, or equal.

C. Sprayable Liner Material (Mortar Mix)

1. Liner material shall be calcium aluminate, acid resistant cementitious product for building back deteriorated substrates to original dimensions and structural integrity, and shall have the following minimum requirements:

Compressive Strength	ASTM C109	>7000 psi	28 days
Tensile Strength	ASTM C496	>700 psi	28 days

Flexural Strength	ASTM C348	>1300 psi	28 days
Shrinkage	ASTM C157	348	28 days
Bond	ASTM C882	>2000 psi	28 days

Liner material shall be SewperCoat PG, or equal, meeting the minimum requirements specified herein.

D. Water

1. Water used to mix product(s) shall be clean and potable. Questionable water shall be tested by a laboratory per ASTM C-94 procedure. Potable water need not be tested.

E. Steel Reinforcement Primer

1. Single component, zinc-rich, epoxy primer for steel reinforcement. Primer shall be BASF ZincRich Rebar Primer, or equal.

PART 3 EXECUTION

3.01 GENERAL

- A. The CONTRACTOR shall provide all equipment necessary to individually gauge, control, and monitor the actual amounts of all component materials necessary to complete the lining installation. The type of equipment and methods used to gauge, control, and monitor component materials shall be subject to approval by the ENGINEER and Manufacturer.
- B. All lining materials shall be thoroughly mixed by mechanical means to ensure all agglomerated particles are reduced to original size or removed prior to placement into the application equipment (i.e., the hopper). Each batch of material should be entirely discharged before recharging with fresh material. Mixing equipment shall be cleaned at regular intervals to remove all adherent materials.
- C. The addition of water to the mix shall be in strict accordance with the Manufacturer's recommendations.
- D. Re-mixing or tempering shall not be permitted. Rebound materials shall not be reused.

3.02 PROTECTION OF ADJACENT SURFACES

- A. During progress of the work, adjacent areas or grounds which may be permanently discolored, stained or otherwise damaged by dust and rebound material, shall be adequately protected and, if contacted, shall be cleaned by early scraping, brushing or washing as the surroundings permit.

3.03 COATING SYSTEM INDEX FOR NEW STRUCTURES

- A. **System No. 445 - New Sanitary Sewer Structure Coating System.**

Surface Preparation (Concrete): Place covers over inverts to prevent extraneous material from entering structure before cleaning

Remove all loose, unsound or cracked concrete by chisel and hammer.

Remove all laitance, grease, oil, dirt, sanitary waste, foreign contaminants and all existing coatings by high pressure water and/or abrasive blasting. Blasting should be performed sufficiently close to the surface so as to open up surface voids, bug holes, air pockets, and other subsurface irregularities and to remove spalled or loose concrete. Concrete surface pH shall be tested by CONTRACTOR, in the presence of the ENGINEER, using an Insta-check surface pH pencil as manufactured by Phydriion, or equal. Surface shall indicate a pH range of 10.0 to 12.0 (or as recommended by liner material manufacturer) prior to material application. Blasting of concrete surface shall continue until required pH levels have been achieved.

Surface Profile (Concrete): ICRI CSP 4 (Minimum)

Surface Preparation: Per section 09 90 00.

Repair and Patching: Repair inverts and fill voids with patching material in accordance with manufacturer's application instruction.

Mortar Coat: Sprayable Calcium Aluminate Cement Mortar at nominal application thickness of 1/4-inch to 1/2-inch. Mortar shall be spray-applied with fine brush finish. Do not apply mortar to piping or other mechanical systems.

Piping and Valves: Per section 09 99 00-

Color: Mortar Coat - Dark Grey.

Testing: Mortar mixes and completed coating system application shall be tested as specified herein article 3.05. All imperfections shall be immediately repaired by CONTRACTOR and retested.

Recoating Requirements: In accordance with manufacturer's instructions as contained in the material data sheets.

3.04 SAMPLING AND TESTING

- A. A recognized independent testing laboratory shall test mortar materials used on the project. The Manufacturer, instead of an independent laboratory, may test project sample specimens, provided the Owner, ENGINEER, and Manufacturer are in agreement of this testing method prior to project commencement. Specific materials recommended by the ENGINEER shall then be tested.
- B. The cost of sampling and testing of the mortar mix during placement and the surface to which it is applied shall be born by the CONTRACTOR. Other testing required showing conformance with these specifications shall be the responsibility of the CONTRACTOR. Certified test reports and certificates, when so directed, shall be submitted in duplicate to the ENGINEER and to such other agencies or persons the ENGINEER may designate.
- C. Any materials failing to meet the requirements of these specifications shall not be incorporated into the work plan.

D. Testing Structures

1. At the direction of the OWNER or his assignee, ALL coated structures shall be tested by any one of the following methods:
 - a. Visual inspection for leaks.
 - b. Perform an exfiltration test:
 - i. For structures 0 to 6 feet deep, if water loss is 1 inch or less in 5 minutes, structure coating is acceptable.
 - ii. For structures over 6 foot deep, if water loss is 1 inch plus 1/8 inch for each additional foot of depth or less in 5 minutes, structure is acceptable.

3.05 REPAIR OF DEFECTS

- A. All structures considered as unsatisfactory shall be repaired. The costs of such repairs for post-coating defect repair shall be paid for by the CONTRACTOR and the OWNER shall make no payments for repair of unsatisfactory or defective work by the CONTRACTOR.

3.06 CLEANING

- A. Clean structure interiors and remove all construction-related materials, equipment and debris from the structures prior to reinstatement of the structures to service.

END OF SECTION

10 11 00
VISUAL DISPLAY UNITS

PART 1 GENERAL

1.01 SUMMARY

- A. Scope
 - 1. This Section specifies visual display board assemblies.
- B. Performance Requirements
 - 1. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
- C. Preinstallation Meetings
 - 1. Preinstallation Conference: Conduct conference at Work Site.

1.02 QUALITY ASSURANCE

- A. Reference Codes and Standards
 - 1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
 - 2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
ASTM B 221	Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM E 84	Standard Test Method for Surface Burning Characteristics of Building Materials

B. Warranty

1. A warranty for the equipment specified under this Section shall be provided in accordance with the General Conditions. The Warranty shall be for one (1) year from the date of the Notice of Substantial Completion certificate issued for the Work. If extended warranties are required, a special paragraph calling for an extended warranty will be included in this Section.
2. Special Warranty 1: Supplier agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within a warranty period of ten (10) years from the date of the Notice of Substantial Completion certificate issued for the Work.
 - a. Failures include, but are not limited to, the following
 - 1) Surfaces lose original writing and erasing qualities.
 - 2) Surfaces exhibit crazing, cracking, or flaking.
 - 3) Warranty Period: Ten (10) years from date of Substantial Completion.

C. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by the Supplier.

D. Source Limitations: Obtain each type of visual display unit from single source from single supplier.

1.03 ENVIRONMENTAL CONDITIONS

A. Equipment in this Section shall be subjected to environmental conditions in accordance with Section 01 11 80 – Environmental Conditions.

B. Environmental Limitations: Do not deliver or install visual display units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.04 SUBMITTALS

A. Preconstruction/Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.

1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The City shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.

2. Product Data: For each type of product.
 - a. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for visual display units.
 3. Shop Drawings: For visual display units.
 - a. Include plans, elevations, sections, details, and attachment to work.
 - b. Show locations of panel joints. Show locations of field-assembled joints for factory-fabricated units too large to ship in one piece.
 - c. Show locations and layout of special-purpose graphics.
 - d. Include sections of typical trim members.
 4. Samples for Initial Selection: For each type of visual display unit indicated, for units with factory-applied color finishes, and as follows
 - a. Samples of facings for each visual display panel type, indicating color and texture.
 - b. Fabric swatches of fabric facings for tackboards.
 - c. Actual factory-finish color samples, applied to aluminum substrate.
 - d. Include accessory Samples to verify color selected.
 5. Samples for Verification: For each type of visual display unit indicated.
 - a. Visual Display Panel: Not less than 8-1/2 by 11 inches, with facing, core, and backing indicated for final work. Include one (1) panel for each type, color, and texture required.
 - b. Trim: 6-inch-long sections of each trim profile.
 - c. Display Rail: 6-inch-long section of each type.
 - d. Support System: 6-inch-long sections.
 - e. Accessories: Full-size Sample of each type of accessory.
 6. Product Schedule: For visual display units. Use same designations indicated on Plans.
 7. Qualification Data: For Installer.
 8. Warranty Information: Prior to starting the Work, submit sample copy of warranty to be provided.
- B. Informational Submittals: The following minimum informational submittals shall be submitted in accordance with the timing requirements specified in these Contract Documents, prior to Substantial Completion and in accordance with Section 01 33 00 - Submittals.
1. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for surface-burning characteristics of tackboards.
 2. Warranty: Submit Supplier's warranty showing conformance to provisions of this Section.
 3. Maintenance Data: For visual display units to include in maintenance manuals.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

A. Suppliers

1. The Engineer and the City believe that the following Suppliers are capable of producing equipment and products, which will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular Supplier or product, nor shall it be construed that a named Supplier's standard product will comply with the requirements of this Section.
2. Candidate Suppliers include the following:
 - a. Vinyl Plus Tackboard by PolyVision Corporation;
 - b. 800 Series Tackboard by Claridge Products and Equipment, Incorporated; or
 - c. Approved Equal.

B. Supplier Qualifications

1. The Supplier shall have five (5) years of experience manufacturing and installing visual display units in similar-sized projects.

2.02 MATERIALS

- #### **A. Materials specified are considered the minimum acceptable for the purposes of durability, strength, and resistance to erosion and corrosion. The Contractor may propose alternative materials for the purpose of providing greater strength or to meet required stress limitations. However, alternative materials must provide at least the same qualities as those specified for the purpose. If alternatives are proposed, the proposals shall be accompanied with documentation supporting the claimed superiority of the proposed substitutions. The Engineer shall be the sole decider in the equivalency of alternative materials of construction.**
1. Plastic-Impregnated-Cork Sheet: Seamless, homogeneous, self-sealing sheet consisting of granulated cork, linseed oil, resin binders, and dry pigments that are mixed and calendared onto fabric backing; with washable vinyl finish and integral color throughout with surface-burning characteristics indicated.
 2. Extruded Aluminum: ASTM B 221, Alloy 6063.

2.03 TACKBOARD PANELS

A. Tackboard Panels

1. Facing: 1/8-inch-thick plastic-impregnated cork.
2. Core: Supplier's standard.
3. Core: 3/8-inch-thick hardboard.
4. Size: 36-inches by 48-inches.

2.04 GENERAL FINISH REQUIREMENTS

- #### **A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.**

- B. Protect mechanical 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.

2.05 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 EXECUTION

3.01 SHIPMENT AND STORAGE

- A. Product shall be shipped and stored in accordance with Section 01 60 00 - Common Product Requirements.
- B. Supplier shall provide Contractor with detailed recommendations and instructions for product storage.
- C. Deliver factory-fabricated visual display units completely assembled in one (1) piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to ship in one piece, provide two (2) or more pieces with joints in locations indicated on approved Shop Drawings.

3.02 SUPPLIER'S FIELD SERVICES

- A. Supplier shall provide assistance during equipment installation as required by the Contractor.

3.03 INSTALLATION

- A. The Supplier shall provide the Contractor with detailed recommendations and instructions for installation of the product specified in this Section.
- B. Supplier shall provide assistance during product installation as required by the Contractor.
- C. Product shall be provided at the following locations: Control Room 203, Electrical Room 301, Switchgear Room 101, and in accordance with the recommendations of the Supplier.
- D. General: Install visual display surfaces at mounting heights as directed by the Engineer and in accordance with the manufacturer's instructions. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.
- E. Field-Assembled Visual Display Board Assemblies: Coordinate field-assembled units with grounds, trim, and accessories indicated. Join parts with a neat, precision fit.

1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to the City as indicated on approved Shop Drawings.
 2. Where size of visual display board assemblies or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by the City from Supplier's standard structural support accessories to suit conditions indicated.
- F. Factory-Fabricated Visual Display Board Assemblies: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display board assemblies with fasteners at not more than 16 inches (400 mm) o.c. Secure tops and bottoms of boards to walls.
- G. Examination
1. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.
 2. Examine roughing-in for electrical power systems to verify actual locations of connections before installation of motorized, sliding visual display units.
 3. Examine walls and partitions for proper preparation and backing for visual display units.
 4. Examine walls and partitions for suitable framing depth where sliding visual display units will be installed.
 5. Proceed with installation only after unsatisfactory conditions have been corrected.
- H. Preparation
1. Comply with Supplier's written instructions for surface preparation.
 2. Clean substrates of substances, such as dirt, mold, and mildew, that could impair the performance of and affect the smooth, finished surfaces of visual display boards.
 3. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display units and wall surfaces.
 4. Prime wall surfaces indicated to receive visual display units and as recommended in writing by primer/sealer Supplier and visual display unit Supplier.
- I. Cleaning And Protection
1. Clean visual display units according to Supplier's written instructions. Attach one removable cleaning instructions label to visual display unit in each room.
 2. Touch up factory-applied finishes to restore damaged or soiled areas.
 3. Cover and protect visual display units after installation and cleaning.

END OF SECTION

10 14 00

SIGNAGE

PART 1 GENERAL

1.01 SUMMARY

A. Scope

1. This Section specifies signage.
2. The Contractor shall provide building signage and appurtenant work, complete and in place, in accordance with the Plans.

1.02 QUALITY ASSURANCE

A. Reference Codes and Standards

1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
Americans with Disabilities Act (ADA)	ADA Accessibility Guidelines (ADAAG)
Building Code	Refer to the Plans to determine which Building Code applies. The applicable Building Code, defined by the Plans, is referred to herein as "the CODE."
National Fire Protection Association (NFPA)	
NFPA 704	Identification of the Hazards of Materials for Emergency Response
Occupational Safety and Health Administration (OSHA)	

- B. Single Source Responsibility: Building signage shall be provided by a single Supplier, unless otherwise indicated.

C. Warranty

1. A warranty for the products specified under this Section shall be provided in accordance with the General Conditions. The Warranty shall be for one (1) year from the date of the Notice of Substantial Completion certificate issued for the Work. If extended warranties are required, a special paragraph calling for an extended warranty will be included in this Section.
2. Special Warranty 1: Furnish Supplier's fifteen (15)-year written warranty to cover defects in materials, products, and manufacturing workmanship.
3. Special Warranty 2: Shall include coverage against chipping, fading, rusting, shattering, or peeling.

1.03 ENVIRONMENTAL CONDITIONS

- A. Products in this Section shall be subjected to environmental conditions in accordance with Section 01 11 80 – Environmental Conditions.
- B. Protect surrounding portions of the Work from damage that may result from operations under this Section.

1.04 SUBMITTALS

- A. Preconstruction/Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.
 1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.
 2. Shop Drawings
 - a. Shop Drawings shall be drawn to sufficient scale and shall include dimensions, show elevations and details of construction of each building signage type, schedule of building signage, mounting details, location and installation requirements, thickness of materials, joints, provisions for expansion and contraction, connections, accessories, and trim.
- B. Informational Submittals: The following minimum informational submittals shall be submitted in accordance with the timing requirements specified in these Contract

Documents, prior to Substantial Completion and in accordance with Section 01 33 00 - Submittals.

1. Literature: Supplier's Specifications, technical data, installation methods, and maintenance instructions, and the following:
 - a. Supplier's full range color charts, indicating custom color availability for color selection by the City.
2. Warranty: Submit a copy of the warranty.
3. Certifications
 - a. Certification by the building signage Supplier that the building signage provided is suitable for, and compatible with, the required installation.
 - b. Certification by the building signage Supplier that the building signage provided is suitable for, and compatible with, the substrates and surfaces indicated.
 - c. Certification of Supplier qualifications demonstrating compliance with the qualifications requirements indicated.
 - d. When requested by the Engineer, furnish other certifications as may be required to demonstrate compliance with the Plans.
4. Samples: The Contractor shall submit two (2) samples of each of the following. Unless otherwise indicated, samples shall be full size and shall show gauges, configuration, construction, finish and color proposed for the various components. Samples shall be clearly marked to show the Supplier's name, product identification, finish and color. New samples shall be resubmitted of each, as required, until approved by the Engineer. Upon approval, the samples shall become the standard for acceptance for the project with regard to color, finish, and quality of each item. Approval of samples shall not relieve the Contractor from compliance with the Plans.
 - a. Full-size sample of each typical building signage type.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

- A. Suppliers
 1. The Engineer and the City believe that the following Suppliers indicated in this Section are capable of producing products which will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular Supplier or product, nor shall it be construed that a named Supplier's standard product will comply with the requirements of this Section.
- B. Supplier Qualifications
 1. Building signage Supplier shall have a minimum of ten (10) years of building signage manufacturing experience.
 2. Building signage Suppliers shall have the ability to print signs in Spanish.
 3. Suppliers without these qualifications will not be accepted.

2.02 GENERAL

- A. Building signage shall be recommended by the Supplier for the installation indicated.
- B. Building signage shall be suitable for, and compatible with, the required installation.

- C. Building signage shall be suitable for, and compatible with, the substrates and surfaces indicated.

2.03 UNISEX RESTROOM SIGN

- A. Etched plaque signs for unisex restroom sign shall be:
 - 1. Sign Etch I Series by ASI-Signage; or
 - 2. Approved Equal.
 - a. Signs shall consist of raised braille characters and conform to ADAAG.
 - b. Signs shall be 8-inch (203 mm) by 8-inch (203 mm) by 0.125-inches (3.2 mm) aluminum with brushed square edges. Raised surfaces shall have a brushed finish and recessed surfaces shall be painted black, or color as selected by the City. Signs shall be provided with a top coat of urethane spray containing UV inhibitors and antioxidant compounds and shall be rated for interior and exterior use.
 - c. Unless otherwise noted, all lettering shall be Helvetica Medium in both upper and lower case, as specified and scheduled.
 - d. Signs shall be mounted as scheduled, as recommended in writing by the Supplier, and as approved by the Engineer.

2.04 RESTRICTIVE CAUTION SIGNS

- A. Signs shall be:
 - 1. SetonUltraTuff by Seton, Branford, Connecticut; or
 - 2. Approved Equal.
- B. Signs shall be constructed of a printed polyester film permanently bonded to a rigid fiberglass panel and over-laminated with a total thickness of 0.11-inch (2.8 mm) minimum.
 - 1. Tedlar by Seton, or
 - 2. Approved Equal.
- C. Signs shall be 14-inches (356 mm) wide by 10-inches (254 mm) tall in rounded corners. Color of signs and letters shall be in accordance with OSHA standards. All other aspects of the Restrictive/Caution Signs shall be in accordance with OSHA standards. If OSHA standards do not apply, the color shall be red with white letters, 1-inch (25 mm) high.
- D. Signs shall be wall and door surface mounted in accordance with Supplier standard. Signs shall be mounted as scheduled, as recommended in writing by the Supplier, and as approved by the Engineer.
- E. Sign sizes shall be adjusted to suit the number of letters in each sign with a 1 1/2-inch (38.1 mm) minimum border all around. Two lines are permitted. Left-hand justify the letters.

2.05 HAZARDOUS IDENTIFICATION SYSTEM

- A. System shall be manufactured by:
 - 1. Seton, Branford, Connecticut; or

2. Approved Equal.
 - a. System shall confirm to NFPA 704.
 - b. System shall use a diamond-shaped symbol divided into four smaller diamonds.
 - 1) Health hazard diamond (left): blue background with a rating number in contrasting color.
 - 2) Flammability hazard diamond (top): red background with a rating number in contrasting color.
 - 3) Instability hazard diamond (right): yellow background with a rating number in contrasting color.
 - 4) Special hazard diamond (bottom): white background with a rating number in contrasting color.
 - c. Colors used for the diamonds shall provide an adequate contrast so that the rating numbers are easily identified.
 - d. Signs mounted on walls and doors shall be high performances plastic signs.
 - e. Signs adhered to drums and containers shall be vinyl.
 - f. Unless otherwise noted, exterior signs shall be a minimum of 15-inches (381 mm) by 15-inches (381 mm) and interior signs shall be a minimum of 10-inches (254 mm) by 10-inches (254 mm)

2.06 BUILDING SIGNS

- A. Supplier and Product
 1. Subject to the requirements indicated, provide Supplier and product listed below:
 - a. Seton Identification Products; Fiberglass, Style No. M0027; or
 - b. Approved Equal.
- B. Description
 1. Signs shall be high performance fiberglass, constructed of a printed polyester film permanently bonded to a rigid fiberglass panel and over-laminated with a total thickness of 0.10-inch (2.5 mm) minimum.
 2. Signs shall be suitable for interior or exterior use, and resist UV light, dirt, and harsh chemicals.
 3. Signs shall be 14-inches (355 mm) wide by 10-inches (250 mm) tall with rounded corners. Colors, letters, and other aspects of the signs shall be in accordance with OSHA standards. If OSHA standards do not apply, the color shall be red selected by the Engineer, unless otherwise indicated.
 4. Sign sizes shall be adjusted to suit the number of letters in each sign with a 1 1/2-inch (38 mm) minimum border. Two lines are permitted. Letters shall be left justified.

PART 3 EXECUTION

3.01 SHIPMENT AND STORAGE

- A. Product shall be shipped and stored in accordance with Section 01 66 00 - Product Storage and Handling Requirements.
- B. Supplier shall provide Contractor with detailed recommendations and instructions for product storage.

- C. Deliver materials to Site in Supplier's original, unopened packages, containers, or bundles with labels intact, which clearly identify contents.
- D. Store materials carefully in accordance with the Supplier's written instructions, in an area that is protected from deleterious elements, and in a manner that will prevent damage to the products.
- E. Handle materials in strict accordance with Supplier's written instructions.

3.02 SUPPLIER'S FIELD SERVICES

- A. Supplier shall provide assistance during product installation as required by the Contractor.

3.03 INSTALLATION

- A. The Supplier shall provide the Contractor with detailed recommendations and instructions for installation of the product specified in this Section.
- B. Supplier shall provide assistance during product installation as required by the Contractor.
- C. Product shall be installed at the locations shown and in accordance with the recommendations of the Supplier.
- D. Following installation, Supplier shall provide Certificate of Proper Installation
- E. Installation shall comply with the requirements of the Contract Documents, with applicable references, with the requirements of the CODE, NFPA 704, OSHA, and with Supplier's written instructions. Where a conflict occurs among these requirements, the more stringent shall apply, as directed by the Engineer.
- F. The Contractor shall provide corrosion resistant fasteners, anchors, and shims required for a complete installation, and shall be secure, plumb, level, straight, and true to line, allowing for required movement, including expansion and contraction.
- G. The Contractor shall provide separation of dissimilar materials to ensure no galvanic action occurs.
- H. Horizontal lines shall be level, and vertical lines shall be plumb.
- I. The Contractor shall block and reinforce walls as required to support building signage, and appurtenances.
- J. Locations
 - 1. Signage shall be installed at the locations indicated or as otherwise required by the CODE, ADAAG, NFPA 704, and OSHA. Where a conflict occurs between the requirements of this Section and the references herein, the more stringent shall apply, as directed by the Engineer.
 - 2. Where not indicated, signs shall be installed as directed by the Engineer.

3. Signs shall be mounted 60-inches (1520-millimeters) above the floor, unless otherwise indicated.

K. Inspection

1. The Contractor shall be totally responsible for the proper performance and completion of the Work under this Section.
2. Systems and components shall be inspected before installation.
 - a. Damaged or defective items shall be rejected and marked as such and shall be removed from the Site.
 - b. Exposed surfaces that exhibit pitting, seam marks, roller marks, stains, discoloration, or other surface imperfections on the finished units shall be rejected.
3. The Contractor shall verify dimensions, tolerances, and method of attachment with adjacent portions of the Work.
 - a. Examine substrates, areas, and conditions where building signage will be installed for compliance with the requirements for installation, taking into account tolerances, and other conditions affecting performance of installed building signage.
 - 1) Provide inserts, backing, blocking, anchoring devices, and reinforcements that must be built into other portions of the Work for the installation of building signage and appurtenances. Coordinate delivery with other Work to avoid delay.
 - b. Notify the Engineer in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in an acceptable manner.
 - c. Commencement of the installation by the Contractor shall indicate Engineer's acceptance of the substrate, areas, and conditions.

L. Preparation

1. Sequence installation properly with the installation and protection of other portions of the Work, so that neither will be damaged by the installation of the other.

M. Cleaning Finishing and Protection

1. Adhesive papers used for masking which become firmly bonded when exposed to heat and/or light shall not be used.
 - a. Remove masking film and temporary labels as soon as possible after installation. Films and labels left in place after installation shall be the responsibility of the Contractor.
 - b. Residue shall not be left on any surfaces.
2. Upon completion of the installation, building signage and appurtenances shall be cleaned of dirt and other foreign matter to the satisfaction of the Engineer.
 - a. Cleaning shall be performed again immediately prior to acceptance of the Work, when directed by the Engineer.
 - b. Cleaning shall be performed in accordance with the Supplier's written instructions.
3. Building signage shall be protected from damage from subsequent construction operations.

4. The Contractor shall make adjustments required until accepted.
5. The Contractor shall remove scratches and blemishes to the satisfaction of the Engineer.
6. Damaged or defective items shall be removed and replaced at the direction of the Engineer.
7. When building signage work is completed, remove unused materials, containers, and equipment, and clean the Site of building signage debris.

3.04 SIGN SCHEDULES

- A. The Contractor shall develop sign schedules as part of the Work in compliance with the codes aforementioned in this Section. The number and location of the signs in the Work shall be coordinated with the Engineer as part of the 100% Submittal and Review Workshop. The sign schedules included below are not all encompassing and are to be considered as guidance of the detail to be provided for the sign schedules

Quantity	Sign Wording	Location
1		
1		

- B. Restrictive/Caution Sign Schedule

Quantity	Sign Wording	Location
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END OF SECTION

10 28 05

TOILET AND BATH ACCESSORIES

PART 1 GENERAL

1.01 SUMMARY

A. Scope

1. This Section specifies toilet and bath accessories.
2. Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all toilet and bath accessories work.
3. Extent of toilet and bath accessories is shown on the Plans.
4. Types of products required include the following
 - a. Toilet tissue dispensers.
 - b. Toilet seat tissue dispensers.
 - c. Mirrors.
 - d. Grab bars.
 - e. Liquid soap dispensers.
 - f. Electric hand dryers.
 - g. Surface mounted sanitary napkin disposal unit.
 - h. Surface mounted sanitary napkin dispenser.
 - i. Combination shelf with utility hook and mop strips.
 - j. Undersink guards.
 - k. Miscellaneous fasteners, accessories and trim as required for a complete and functioning installation.

B. Coordination

1. Furnish inserts and anchoring devices which must be set in concrete or built into masonry and gypsum wallboard for the installation of toilet accessories. Coordinate delivery with other portions of the Work to avoid delay of the Work.
2. Refer to concrete and masonry sections of these Specifications for installation of inserts and anchorage devices.
3. Refer to Division 26 - Electrical for electrical power connections to hand dryers, lights and receptacles.

C. Sequencing

1. Coordinate accessory locations with other portions of the Work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
2. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.02 QUALITY ASSURANCE

A. Reference Codes and Standards

1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
Americans with Disabilities Act of 2010 (ADA)	Title II ADAAG
ANSI A 117.1	Guidelines for accessible and useable buildings and facilities providing accessibility and useability for physically handicapped people (ICC/ANSI A 117.1).2
ASTM A 167	Specification for Stainless Steel and Heat-Resisting Chromium-Nickel; Steel Plate, Sheet and Strip
ASTM A 366	Specification for Commercial Steel Sheet, Carbon, Cold Rolled
ASTM A 386	Specification for Zinc Coating (Hot-Dip) on Assembled Steel Products
ASTM B 456	Specification for Electro Deposited Coatings of Nickel Plus Chromium
FBC	Florida Building Code with local amendments
FS DD-G-451	Glass (Laboratory)
FS WW-P-541	Plumbing Fixtures (Land Use)
NFPA 70	National Electric Code
UL Certifications Directory	

- B. Component Supply and Compatibility
 1. Provide products of the same Supplier for each type of bath accessory unit and for units exposed in the same areas.
 2. Stamped names or labels on exposed faces of units will not be permitted.
- C. Provide locks with the same keying for each type of bath accessory units in the Work, wherever possible. Furnish two keys for each lock.
- D. 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.

- E. Requirements of Regulatory Agencies
 - 1. Codes: Comply with applicable provisions of the Florida Building Code.
 - 2. ANSI A117.1, Accessible and Usable Buildings and Facilities.
 - 3. Americans with Disabilities Act of 2010 (ADA) Title II ADAAG.

1.03 ENVIRONMENTAL CONDITIONS

- A. Equipment in this Section shall be subjected to environmental conditions in accordance with Section 01 11 80 – Environmental Conditions

1.04 SUBMITTALS

- A. Preconstruction/Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.

- 1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.

- 2. Shop Drawings
 - a. Setting drawings, templates, instructions and directions for installation of anchorage devices in other portions of the Work.
- 3. Product Data
 - a. Copies of Supplier's technical data and installation instructions for each toilet accessory.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

- A. Suppliers
 - 1. The Engineer and the City believe that the following Suppliers indicated in this Section are capable of producing equipment and products, which will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular Supplier or product, nor shall it be construed that a named Supplier's standard product will comply with the requirements of this Section.

B. Supplier Qualifications

1. The Supplier shall have 5 (five) years of experience manufacturing and installing toilet and bath accessories in similar-sized projects.

2.02 MATERIALS

- A. Materials specified are considered the minimum acceptable for the purposes of durability, strength, and resistance to erosion and corrosion. The Contractor may propose alternative materials for the purpose of providing greater strength or to meet required stress limitations. However, alternative materials must provide at least the same qualities as those specified for the purpose. If alternatives are proposed, the proposals shall be accompanied with documentation supporting the claimed superiority of the proposed substitutions. The Engineer shall be the sole decider in the equivalency of alternative materials of construction.

2.03 TOILET TISSUE DISPENSERS

- A. General: Provide toilet tissue dispensers at each water closet.
- B. Multi-roll Toilet Tissue Dispenser: Fabricate shelf of not less than 18 gauge stainless steel, to store and dispense not less than two 4-1/2-inch by 4-1/2-inch core tissue rolls. Fabricate flange from a single piece, with seamless construction.
- C. Products and Suppliers: Provide one of the following
1. No. 0697-GAL by American Specialties, Incorporated.
 2. No. 2730 by Bobrick.
 3. Approved Equal.

2.04 TOILET SEAT TISSUE DISPENSERS

- A. General: Provide surface-mounted toilet seat tissue dispensers at each water closet.
- B. Surface-mounted Toilet Seat Tissue Dispenser: Satin-finish stainless steel. Dispenses 250 single- or half-fold toilet seat covers.
- C. Products and Suppliers: Provide one of the following
1. No. 9477-SM by American Specialties, Incorporated.
 2. Approved Equal.

2.05 MIRRORS

- A. Custom Sized Angle Framed Mirrors
1. General: Provide single pane, polished tempered glass mirrors.
 2. Stainless Steel Frames: Fabricate frames from 3/4-inch by 3/8-inch 18 gauge, Type 304 stainless steel angle with corners heliarc welded, ground and polished smooth to a uniform satin finish. Provide all mirrors installed on concealed hanging brackets that lock onto top and bottom of frame by tamper-proof set screws.
 3. Products and Suppliers: Provide one of the following
 - a. Custom Sized 0600-B Mirrors by American Specialties, Incorporated.

- b. No. 165-2436 by Bobrick.
- c. Approved Equal.

2.06 GRAB BARS

- A. General: Provide grab bars where shown. Provide custom specials where required or specified.
- B. Custom Stainless Steel Grab Bars: Provide stainless steel knurled grab bars, 1-1/2-inch outside diameter, 16 gauge.
 - 1. Mounting: Concealed, with Supplier's standard flanges and anchorages for type of installation.
 - 2. Provide custom dimensions specified.
- C. Products and Suppliers: Provide one of the following
 - 1. 3200 Series custom Type 57 and Type-01 (18-inches long – vertically) by American Specialties, Incorporated.
 - 2. Approved Equal.

2.07 LIQUID SOAP DISPENSERS

- A. General: Provide surface-mounted liquid soap dispensers, one per lavatory; 8-3/4-inches long by 4-1/2-inches high by 3-7/8-inches wide, with one liquid soap dispensing valve. Provide face plate dimensions of 10-1/4-inches by 6-inch with 1/2-inch side returns.
- B. Liquid Soap Dispenser: Fabricate units from 18 gauge stainless steel, with pin-type tumbler locking device. Provide 16 gauge stainless steel full face door plate using one-piece construction with integral soap tank and all-purpose soap valve, to dispense liquid soap in measured quantity by pump action with stainless steel internal springs, ABS piston, stainless steel push button and internal parts. Cabinet shall have no exposed fastening devices.
 - 1. Capacity: 52 fluid ounces.
 - 2. Locking: Pin-type tumber lock with ten extra keys.
- C. Products and Suppliers: Provide one of the following
 - 1. No. 0326 by American Specialties, Incorporated.
 - 2. No. 2111 by Bobrick.
 - 3. Approved Equal.

2.08 SURFACE-MOUNTED ELECTRIC HAND DRYER (ACCESSIBILITY COMPLIANT)

- A. Provide surface mounted units with die-cast aluminum casing with anti-microbial scuff resistant lacquer coating on the exterior.
- B. Filtration: Anti-microbial HEPA filter.
- C. Time Cycle
 - 1. Hand Dry Time: 12 seconds.

- D. Activation: Touch-free infra-red activation.
- E. Finish: Silver, gloss lacquer.
- F. Products and Suppliers: Provide one of the following:
 - 1. Dyson Airblade Hand Dryer AB-02 by Dyson; or
 - 2. Approved Equal.

2.09 SURFACE MOUNTED SANITARY NAPKIN DISPOSAL UNIT

- A. Fabricate disposal units from not less than 22 gauge stainless steel, with flange of one-piece seamless construction without metered corners. Provide self-closing upper door equipped with a full length stainless steel piano hinge and lift handles on each end. Trap door shall have a hidden stainless steel spring tensioned self-catching lock and shall be hinged on front face. Provide a fold-down stainless steel purse shelf of 22 gauge stainless steel.
- B. Products and Suppliers: Provide one of the following:
 - 1. No. 0473-A by American Specialties, Incorporated; or
 - 2. Approved Equal.

2.10 SURFACE MOUNTED SANITARY NAPKIN/TAMPON DISPENSER

- A. Surface-Mounted Sanitary Napkin/Tampon Dispenser Units: Fabricate units of not less than 22 gauge stainless steel. Provide stainless steel door mounted on full-length heavy-duty stainless steel piano hinge with pin tumbler locks. Provide ten extra keys.
- B. Operation: Gratis.
- C. Dispenser Capacity: Simultaneously dispenses both napkins and tampons
 - 1. Napkins: 30 napkins; 15 (4-inch by 3-inch by 1-1/8-inch).
 - 2. Tampons: 27 tampons; 5-inch; cylinder.
- D. Products and Suppliers: Provide one of the following:
 - 1. 0864 by American Specialties, Incorporated; or
 - 2. Approved Equal.

2.11 MISCELLANEOUS ITEMS

- A. Combination Shelf with Utility Hook and Mop Strip: Provide 18 gauge stainless steel shelf with 3/4-inch lip, five 18 gauge stainless steel hook strips and four mop holders. Shelf shall be 34-inches wide and 8-inches deep.
 - 1. Products and Suppliers: Provide one of the following:
 - a. No. 1308-4 by American Specialties, Incorporated: or
 - b. Approved Equal.
- B. Undersink Guards

1. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping; allow service access without removing coverings.
2. Material and Finish: Antimicrobial, molded plastic, white.
3. Product and Supplier; Provide one of the following:
 - a. HANDY SHIELD-MAXX by Plumberex Specialty Products, Incorporated.
 - b. Truebro Lav Guard 2 by IPS Corporation; or
 - c. Approved Equal.

PART 3 EXECUTION

3.01 SHIPMENT AND STORAGE

- A. Products shall be shipped and stored in accordance with Section 01 60 00 - Common Product Requirements.
- B. Supplier shall provide Contractor with detailed recommendations and instructions for product storage.

3.02 SUPPLIER'S FIELD SERVICES

- A. Supplier shall provide assistance during product installation as required by the Contractor.

3.03 INSTALLATION

- A. The Supplier shall provide the Contractor with detailed recommendations and instructions for installation of the product specified in this Section.
- B. Supplier shall provide assistance during product installation as required by the Contractor.
- C. Product shall be installed at the locations shown and in accordance with the recommendations of the Supplier.
- D. Inspection
 1. Examine the areas and conditions under which toilet accessories are to be installed and notify Engineer, in writing, of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to Engineer.
- E. Install items required to meet accessibility codes in accordance with ANSI A117.1 and the Florida Building Code.
- F. Determine that substrates are completed and ready to accept surface-mounted or recessed accessories. Refer to Section 03 30 00 - Cast-In-Place Concrete, Section 04 20 00 - Unit Masonry.
- G. Use concealed fastenings wherever possible.

- H. Provide anchors bolts, fasteners and other necessary anchorages, and attach accessories securely to walls, floors and partitions in locations as shown.
- I. Install concealed mounting devices and fasteners fabricated of the same material as the accessories as recommended by the Supplier.
- J. Install exposed mounting devices and fasteners finished to match the accessories.
- K. Provide theft-resistant fasteners for all accessory mountings.
- L. Secure and install toilet room accessories in accordance with the Supplier's instructions for each item and each type of substrate construction.
- M. Lock grab bars to concealed mounting plate installed in wall.
- N. Adjustment and Cleaning
 - 1. Adjust accessories for proper operation.
 - 2. After completion of installation, clean and polish all exposed surfaces.
 - 3. Deliver keys and instruction sheets to the City.

END OF SECTION

10 43 16
FIRST AID CABINETS

PART 1 GENERAL

1.01 SUMMARY

- A. Scope
1. This Section specifies first aid equipment.
 2. Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all first aid equipment in Control Room 203.
 3. Extent of the first aid equipment is specified.
 4. Types of products required include the following
 - a. First aid station.
 - b. Emergency oxygen kit.
 - c. Folding pole stretcher and utility blanket kit.
 - d. Emergency burn relief station.
 - e. Miscellaneous mounting brackets, accessories, fasteners.

1.02 QUALITY ASSURANCE

- A. Reference Codes and Standards
1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
 2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
Occupational Safety and Health Act of 1970.	

- B. Quality Source Control
 - 1. Furnish as complete first aid equipment produced by one supplier, including hardware, accessory items, mounting brackets, and fastenings.
 - 2. Furnish all equipment by one supplier unless otherwise accepted by Engineer.

1.03 ENVIRONMENTAL CONDITIONS

- A. Equipment in this Section shall be subjected to environmental conditions in accordance with Section 01 11 80 – Environmental Conditions.

1.04 SUBMITTALS

- A. Preconstruction/Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.

- 1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.

- 2. Shop Drawings.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

- A. Suppliers
 - 1. The Engineer and the City believe that the Suppliers indicated in this Section are capable of producing equipment and products, which will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular Supplier or product, nor shall it be construed that a named Supplier's standard product will comply with the requirements of this Section.
- B. Supplier Qualifications
 - 1. The Supplier shall have five (5) years of experience manufacturing and installing first aid cabinets in similar-sized projects.

2.02 MATERIALS

- A. Materials specified are considered the minimum acceptable for the purposes of durability, strength, and resistance to erosion and corrosion. The Contractor may propose alternative materials for the purpose of providing greater strength or to meet required stress limitations. However, alternative materials must provide at least the same qualities as those specified for the purpose. If alternatives are proposed, the proposals shall be accompanied with documentation supporting the claimed superiority of the proposed substitutions. The Engineer shall be the sole decider in the equivalency of alternative materials of construction.
- B. Industrial First Aid Kit: Provide the following
1. Quantity: 1 unit.
 2. Description: Each unit shall consist of a balanced assortment of first aid supplies adequate to administer first aid for up to 50 people. Provide 24 gage steel, weatherproof, dustproof, rust resistant case with rounded corners with carrying handle and wall brackets.
 3. Product and Supplier: Provide the following
 - a. Industrial First Aid Kit Number 50 by Johnson & Johnson Incorporated.
 - b. 36 Unit by Figgie International Incorporated, Fire Protection/Safety Group, Scott Aviation Division.
 - c. #50 Person Original Safety First Aid Kit by Northern Safety Company, Incorporated.
 - d. Or Approved Equal.
- C. Emergency Oxygen Kit: Provide the following
1. Quantity: 1 unit.
 2. Description: Each unit shall consist of two oxygen cylinders, each cylinder containing 100 liters U.S.P. pure oxygen minimum. Provide a push button regulator gage, oronasal mask and 5 foot 0 inches of tubing; completely assembled; ready for use.
 3. Product and Supplier: Provide the following;
 - a. Lif O Gen Twin Pac with carrying case by Lif O Gen Division of U.S. Divers Company.
 - b. Or Approved Equal.
- D. Folding Pole Stretcher and Utility Blanket First Aid Kit
1. Quantity: 1 unit.
 2. Description: Each unit shall consist of a collapsible emergency stretches, 62 inch by 80 inch utility blanket and industrial first aid kit all housed in an anodized aluminum 24 7/8 inch by 40 1/4 inch by 10 inch wall mounted cabinet.
 3. Product and Supplier: Provide the following
 - a. Emergency Stretcher/Utility Blanket Kit by Ferno Washington Incorporated.
 - b. Or Approved Equal.
- E. Emergency Burn Relief Kit: Provide the following
1. Quantity: 1 unit.

2. Description: Each unit shall consist of 6 yards of 4 inch gauze bandage; 24 inch by 72 inch gauze compress and 4 ounce aerosol can of benzocaine. Provide all items contained within a 24 gage steel, waterproof, dustproof, rust resistant case with rounded corners and hanger brackets for wall mounting.
3. Product and Supplier: Provide the following:
 - a. P/N 70495 00 by Figgie International Incorporated, Fire Protection/Safety Group, Scott Aviation Division.
 - b. Or Approved Equal.

PART 3 EXECUTION

3.01 SHIPMENT AND STORAGE

- A. Equipment shall be shipped and stored in accordance with Section 01 66 00 - Product Storage and Handling Requirements.
- B. Supplier shall provide Contractor with detailed recommendations and instructions for product storage.

3.02 SUPPLIER'S FIELD SERVICES

- A. Supplier shall provide Contractor with detailed recommendations and instructions for product storage.

3.03 INSTALLATION

- A. The Supplier shall provide the Contractor with detailed recommendations and instructions for installation of the product specified in this Section.
- B. Product shall be installed at the locations as directed by Engineer and in accordance with the recommendations of the Supplier.
- C. Inspection
 1. Contractor shall examine the substrates and conditions under which the first aid equipment is to be installed and notify Engineer in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to Engineer.
- D. Install first aid equipment as specified and in accordance with the Supplier's instructions. Position units plumb and true, securely anchored in place with proper clips, brackets and bolts for the type of mounting required. Location as directed by Engineer.

END OF SECTION

10 44 00

FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SUMMARY

A. Scope

1. This Section specifies the following.
 - a. Portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.
 - 1) Multipurpose Dry-Chemical Type in Steel Container.
 - 2) Carbon Dioxide Type in Steel Container.

B. Performance Requirements

1. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
2. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1.02 QUALITY ASSURANCE

A. Reference Codes and Standards

1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
ASTM A 1008/A 1008M	Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
ASTM C 1048	Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass
ASTM E 814	Standard Test Method for Fire Tests of Penetration Firestop Systems

Reference	Title
National Association of Architectural Metal Manufacturers (NAAMM)	AMP 500, "Metal Finishes Manual for Architectural and Metal Products,"
National Fire Protection Association (NFPA)	NFPA 10: Standard for Portable Fire Extinguishers, 2018 Edition

B. Warranty

1. A warranty for the equipment specified under this Section shall be provided in accordance with the General Conditions. The Warranty shall be for one (1) year from the date of the Notice of Substantial Completion certificate issued for the Work. If extended warranties are required, a special paragraph calling for an extended warranty will be included in this Section.
2. Special Warranty 1: Supplier's standard form in which Supplier agrees to repair or replace fire extinguishers that may fail in materials or workmanship within a warranty period of six (6) years from the date of the Notice of Substantial Completion certificate issued by the Engineer for the Work. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10.
 - b. Faulty operation of valves or release levers.

1.03 ENVIRONMENTAL CONDITIONS

- A. Equipment in this Section shall be subjected to environmental conditions in accordance with Section 01 11 80 – Environmental Conditions.

1.04 SUBMITTALS

- A. Preconstruction/Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.
 1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.
 If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.
 The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.
 2. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

3. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule. Use same product designations as indicated on the Plans.
 4. Warranty Information: Prior to starting the Work, submit sample copy of warranty to be provided.
- B. Informational Submittals: The following minimum informational submittals shall be submitted in accordance with the timing requirements specified in these Contract Documents, prior to Substantial Completion and in accordance with Section 01 33 00 - Submittals.
1. Operations and Maintenance Manuals (including Warranty) in accordance with Section 01 78 23 - Operations and Maintenance Data.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

- A. Suppliers
1. The Engineer and the City believe that the Suppliers indicated in this Section are capable of producing equipment and products, which will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular Supplier or product, nor shall it be construed that a named Supplier's standard product will comply with the requirements of this Section.
- B. Supplier Qualifications
1. The Supplier shall have five (5) years of experience manufacturing and installing fire protection specialties in similar-sized projects.

2.02 MATERIALS

- A. Materials specified are considered the minimum acceptable for the purposes of durability, strength, and resistance to erosion and corrosion. The Contractor may propose alternative materials for the purpose of providing greater strength or to meet required stress limitations. However, alternative materials must provide at least the same qualities as those specified for the purpose. If alternatives are proposed, the proposals shall be accompanied with documentation supporting the claimed superiority of the proposed substitutions. The Engineer shall be the sole decider in the equivalency of alternative materials of construction.

2.03 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each mounting location indicated.
1. Suppliers: Subject to compliance with requirements, available Suppliers offering products that may be incorporated into the Work include, but are not limited to the following
 - a. Guardian Fire Equipment, Inc.;
 - b. JL Industries, Inc.; a division of the Activar Construction Products Group;
 - c. Kidde Residential and Commercial Division;
 - d. Larsens Manufacturing Company; or
 - e. Approved Equal.

2. Valves: Supplier's standard.
 3. Handles and Levers: Supplier's standard.
 4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.
- B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 4-A:60-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.
- C. Carbon Dioxide Type: UL-rated 10-B:C, 10-lb nominal capacity, with carbon dioxide in Supplier's standard enameled-metal container.

2.04 MOUNTING BRACKETS

- A. Mounting Brackets: Supplier's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.

2.05 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.01 SHIPMENT AND STORAGE

- A. Equipment shall be shipped and stored in accordance with Section 01 60 00 - Common Product Requirements.
- B. Supplier shall provide Contractor with detailed recommendations and instructions for product storage.

3.02 SUPPLIER'S FIELD SERVICES

- A. Supplier shall provide assistance during product installation as required by the Contractor.
- B. Product provided under this Section shall be tested only under the direction of personnel provided by the Supplier.

3.03 INSTALLATION

- A. The Supplier shall provide the Contractor with detailed recommendations and instructions for installation of the product specified in this Section.

- B. Supplier shall provide assistance during product installation as required by the Contractor.
- C. Product shall be installed at the locations shown and in accordance with the recommendations of the Supplier.
- D. Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
 - 1. Mounting Brackets: 54 inches above finished floor to top of fire extinguisher.
- E. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.
- F. Identification: Apply vinyl lettering at locations indicated.

END OF SECTION

SECTION 22 05 14
PLUMBING SPECIALTIES

PART 1 GENERAL

1.01 THE SUMMARY

- A. The Contractor shall provide plumbing piping and specialties, complete and operable, as indicated in accordance with the Contract Documents.

1.02 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with Section 01 33 00 - Shop Drawings, Product Data And Samples.
- B. Shop Drawings
 - 1. General arrangement drawings of system components
 - 2. Catalog cuts and other manufacturer information for products
- C. Samples: electrically fused test joint for drainage and vent piping

1.03 WORKMANSHIP AND MATERIALS

- A. WORK shall be in strict accordance with the Plumbing Code and codes of the State of Florida, and any other authorities having jurisdiction.
- B. The CONTRACTOR shall have required certifications and shall be thoroughly familiar with the local codes.
- C. The CONTRACTOR shall obtain and pay for necessary permits.
- D. Protection
 - 1. Care shall always be taken to protect floors, stairways, and walls during the make-up and installation of piping and equipment.
 - 2. The CONTRACTOR shall remove stains and repair damage before final acceptance of the WORK.
- E. Identifying Marks
 - 1. If the ENGINEER finds materials that have identifying marks removed or lack such marks completely, such items will be rejected until the CONTRACTOR has furnished proof that said items conform to the Specifications.
 - 2. Adequacy and extent of such proof will be determined by the ENGINEER.

PART 2 PRODUCTS

2.01 GENERAL

- A. Plumbing piping, fixtures, specialties, and equipment shall be as recommended by the manufacturer for the intended usage.

- B. Floor drains or floor sinks shall be provided for equipment drains.
- C. No equipment drains shall discharge to floor slabs.
- D. Any pipe, plumbing fitting or fixture, solder, or flux used in the installation or repair of any public water system or any plumbing in a facility providing water for human consumption, shall be "lead free" except when necessary for the repair of leaded joints of cast iron pipes.
 - 1. Lead free means not more than 0.2 percent lead when used with respect to solder and flux, not more than 8 percent when used with respect to pipes and pipe fittings, and not more than 4 percent with respect to plumbing fixtures.
- E. When 304 or 316 stainless steel is specified, and the stainless steel will be subjected to heat from welding then provide 304L and 316L stainless steel instead.

2.02 PVC PIPING AND FITTINGS FOR SANITARY DRAIN, STORM DRAIN AND VENTS

- A. PVC Schedule 40 corrosion resistant sanitary pipe, IPS sizes 1/8" through 24", shall be rated for temperatures up to and including 200 °F, and Pressure rating (120 psi to 810 psi) depending on pipe schedule, pipe size, and temperature as stated in Harvel Plastics, Inc. engineering bulletin (Product Bulletin 112/401). Pipe shall be suitable for PVC plastic drain, waste, and vent (DWV) applications. Pipe material shall be generally resistant to most acids, bases, salts, aliphatic solutions, oxidants, and halogens. Chemical resistance data is available and should be referenced for proper material selection. Pipe exhibit excellent physical properties and flammability characteristics (independently tested flame and smoke characteristics-ULC). Typical applications include chemical processing, plating, high purity applications, potable water systems, water and wastewater treatment, drainage, irrigation, agricultural, and other applications involving corrosive fluid transfer.
- B. This specification outlines minimum manufacturing requirements for Polyvinyl Chloride (PVC) Schedule 40 iron pipe size (IPS) pressure pipe. This pipe is intended for use in applications where the fluid conveyed does not exceed 200° F. This pipe shall meet and or exceed the industry standards and requirements as set forth by the American Society for Testing and Materials (ASTM D1785 & D2665) and the National Sanitation Foundation (NSF International STD 61 & Std 14).
- C. The material used in the manufacture of the pipe shall be domestically produced rigid polyvinyl chloride (PVC) compound, Type I Grade I, with a Cell Classification of 12454 as defined in ASTM D1784, trade name designation H707 PVC. This compound shall be white or gray in color as specified, and shall be approved by NSF International for use with potable water (NSF Std 61).
- D. All sizes of PVC Schedule 40 pipe shall be manufactured in strict accordance to the requirements of ASTM D1785 for physical dimensions and tolerances. PVC Sch 40 pipe sizes 1-1/2" through 24" diameters shall also meet the requirements of ASTM D2665 Standard Specification for PVC plastic drain, waste and vent (DWV) pipe and shall be dual marked as such. Each production run of pipe manufactured in compliance to the standard, shall also meet or exceed the test requirements for materials, workmanship, burst pressure, flattening, and extrusion quality defined in ASTM D1785 and ASTM D2665 as applicable. All belled-end pipe shall have tapered sockets to create an interference-type fit, which meet or exceed the dimensional requirements and the

minimum socket length for pressure-type sockets as defined in ASTM D2672. All PVC Schedule 40 pipe must also meet the requirements of NSF Standard 14 and CSA Standard B137.3 rigid PVC pipe for pressure applications, and shall bear the mark of these Listing agencies. This pipe shall have a flame spread rating of 0-25 when tested for surface burning characteristics in accordance with CAN/ULC-S102-2-M88 or equivalent.

- E. Product marking shall meet the requirements of ASTM D1785 and ASTM D2665 as applicable and shall include: the manufacturer's name (or the manufacturer's trademark when privately labeled); the nominal pipe size; the material designation code; the pipe schedule and pressure rating in psi for water @ 73 °F; the ASTM designation D1785; the ASTM designation D2665 (when dual marked); the independent laboratory's seal of approval for potable water usage; and the date and time of manufacture.
- F. All PVC Schedule 40 pipe shall be manufactured from a Type I, Grade I Polyvinyl Chloride (PVC) compound with a Cell Classification of 12454 per ASTM D1784. The pipe shall be manufactured in strict compliance to ASTM D1785 and D2665 (where applicable), consistently meeting and/or exceeding the Quality Assurance test requirements of these standards with regard to material, workmanship, burst pressure, flattening, and extrusion quality. The pipe shall be manufactured in the USA, using domestic materials, by an ISO 9001 certified manufacturer. Standard lengths of pipe sizes 6" and larger shall be beveled each end by the pipe manufacturer. All pipe shall be stored indoors after production at the manufacturing site until shipped from factory. This pipe shall carry the National Sanitation Foundation (NSF) seal of approval for potable water applications.

2.03 WATER PIPING AND FITTINGS

- A. Water piping to be type K copper (underground and type L copper above ground. All fittings to be soldered construction.

2.04 INSULATION

- A. Hot water piping, valves, and fittings shall be provided with one-inch-thick insulation in accordance with the requirements of Section 23 07 19 – HVAC PIPING INSULATION.
- B. Coverings
 1. Cover valves, flanges, fittings, and ends-of-insulation with a pre-molded high- and low-temperature PVC fitting cover, end cap, or similar pre-formed unit.
 2. The pre-formed covers shall be sized to receive the same thickness of insulation as used in the adjacent piping and shall be in accordance with Section 23 07 19 – PIPE INSULATION.
- C. Exposed Piping
 1. Exposed supply and drain piping shall be insulated and jacketed with ADA compliant safety cover under all lavatories in order to prevent burns and abrasions to handicapped persons.
 2. Removable insulated covers shall be Plumberex Specialty Products Handy-Shield type, or equal.

2.05 HANGERS, SUPPORTS, AND MISCELLANEOUS METAL WORK

- A. General

1. For utility piping such as cold water, hot water, compressed and vacuum air, and sanitary drain pipes located inside the building, the CONTRACTOR shall provide hangers and supports for vertical, axial, and seismic (lateral bracing) loads in accordance with the Code.
 2. No perforated strap hangers nor wire supports will be permitted.
 3. The CONTRACTOR shall obtain the services of a registered mechanical or structural professional engineer for design of the supports, and the Shop Drawings showing installation shall be stamped by the registered engineer.
 4. Pipe supports shall be as indicated in Section 23 05 29 – Hangers And Supports For HVAC.
- B. Hangers supporting insulated piping shall be sized to fit the pipe plus the insulation.
- C. Insulation at support points shall be provided with metal shields in order to prevent damage to the insulation.
- D. Spacing
1. Pipe support spacing for steel and cast iron pipe shall be as indicated in Section 23 00 00 – Heating, Ventilating And Air Conditioning General.
 2. Copper tube support spacing shall be not more than 6 feet between supports.
- E. Rod sizes for pipe hangers shall be as recommended by the hanger manufacturer.
- F. Pipe hangers used to support uninsulated copper tube shall be constructed of copper or copper-plated.
- G. Vertical piping shall be supported at the base with fittings made for this purpose or shall be supported from the nearest horizontal member or floor with a riser extension pipe clamp.
- H. Inserts
1. Anchors that are installed into existing concrete shall be Grinnell Figure 117, Modern Figure 740, or equal, expansion case inserts.
 2. Drill clean holes for the insertion of case and patch concrete around the hole, as required.
 3. Continuous-slotted concrete inserts, if used, shall be Crawford Figure 148, Fee & Mason Figure 9000, or equal.
 4. The CONTRACTOR shall provide secondary angle supports between main inserts in order to handle the loads which can be properly supported by such arrangement.
 5. Inserts shall be galvanized.

2.06 PIPE SLEEVES

- A. Sleeves shall be constructed from Schedule 40 galvanized steel pipe, one size larger than the pipe passing through, or where pipe is insulated, one size larger than the pipe plus insulation.
- B. At exposed wall or ceiling surfaces, install a suitable chromium plated brass wall plate approved by the ENGINEER.

- C. At exterior wall pipe penetrations the space between the sleeve and pipe shall be made watertight with a modular or link rubber seal. The link seal shall be applied at both ends of the sleeve.
- D. To prevent accidental liquid spills from passing to a lower level, provide the following:
 - 1. For sleeves: Extend sleeve 1 inch above finished floor and provide sealant for watertight joint.
 - 2. For blocked out floor openings: Provide 1 1/2 inch angle set in silicone adhesive around opening.
 - 3. For drilled penetrations: Provide 1 1/2 inch angle ring or square set in silicone adhesive around penetration.
- E. Pipe penetration sleeve materials shall comply with all fire stopping requirements for each penetration. Caulk opening at fire-rated walls minimum one-half inch depth with an approved fire barrier caulk.

2.07 VALVES

- A. Water shutoff valves shall be of the ball valve type, including on fixture supply piping.
- B. Ball Shut-Off Valves
 - 1. Provide ball shut-off valves on cold water piping at entrances to pipe chases and other inaccessible areas and wherever indicated or required to obtain the maximum efficiency for shut-off control on the water system.
 - 2. Ball shut-off valves shall be placed on hot and cold water connections to equipment and fixtures.
 - 3. Show the locations of shut-off valves on the Shop Drawings.

2.08 ACCESS DOORS AND COVERS

- A. Access doors, where required in ceilings for access to valves, controls, and other equipment, shall be Karp Assoc., Style DSC-210, Inryco-Milcor, Style AT, or equal.
- B. The doors shall be of sufficient size to allow access but shall be not less than 12-inch by 12-inch.
- C. Ceilings with lay-in acoustical tile do not require access panels.
- D. Valves and equipment located above ceiling tile shall have a 3/4-inch-diameter blue plastic button with a letter "V" set in the tile.
- E. Floor Covers
 - 1. Floor access covers in unfinished concrete floors not exposed to chemicals shall be constructed of galvanized cast iron with a clear opening of not less than 8-inch by 8-inch, and shall be Alhambra Foundry Company, Model A-2015, Neenah Foundry Co., No.R-6687, or equal.
 - 2. In traffic or chemical areas, access covers shall be Alhambra Foundry Company, Model A-1240, Neenah Foundry Co., Model R-1977, or equal, with a clear opening of not less than 10 inches in diameter.

2.09 CLEANOUTS

- A. Cleanouts shall be heavy plugs with tapered shoulders against caulked lead or heavy brass plugs.
- B. Where underground or concealed, cleanouts shall be brought to floor level and to accessible locations with access covers and frames.
- C. Manufacturers, or Equal

Service	Josam Series	J.R. Smith No.	Zurn No.
Exposed Locations	58500-20	4405	Z-1440-A
Underground (finished floors)	56010/30	4143	ZN-1400-2
Walls, Concealed	58790-20	4535	ZN-1445-1-A
Traffic Areas	56070	4240	Z-1420-27

- D. Cleanouts shall have a minimum diameter of 3 inches.
- E. Stack cleanouts shall be installed at the base of each stack.
- F. Cleanouts shall be fabricated from galvanized cast iron with ABS plastic cleanout plugs.

2.10 SHOCK ABSORBERS

- A. Building cold and hot water piping that is connecting self-closing faucets, quick-action valves, water closets, emergency showers, washers, and dishwashers, shall be protected by shock absorbers located at each fixture or battery of fixtures.
- B. Shock absorbers shall be corrosion-resistant, permanently sealed, and shall be sized and installed to the manufacturer's printed recommendations.
- C. Manufacturers, or Equal
 1. Josam "SHOKTROLS"
 2. Jay R. Smith "HYDROTROL"
 3. Zurn, Model Z-1022

2.11 BACKFLOW PREVENTER

- A. Provide reduced pressure backflow prevention units where indicated.
- B. The units shall be of bronze body construction, with celcon check seats and stainless steel relief valve seats, shafts, and bolts.
- C. The units shall be provided with tight-seating check valve and relief assemblies, and bronze bodies with non-rising stem ball valve test cocks.
- D. The units shall be Watts Regulator Co., No. LF909 Series, or equal.
- E. Installation shall meet local code requirements.

2.12 PAINTING

- A. Ferrous metal, except finished, galvanized, and machined surfaces, shall have surfaces prepared and primed in the shop in accordance with the requirements of Section 09 90 00 – PAINTING AND COATING.
- B. Prime colors shall be compatible with finish coats that are applied in the field.
- C. Self-contained units such as wall-mounted hose racks shall be supplied with factory-applied finish coats of baked enamel.
- D. Field painting shall comply with the requirements of Section 09 90 00 – PAINTING AND COATING.

PART 3 EXECUTION

3.01 PREPARATION

- A. The CONTRACTOR shall coordinate the roughing-in process with provisions for wall and floor sleeves, pipe inserts, and cutting of roof and floor penetrations, such that drain lines will have the required invert elevations and slopes.

3.02 OPENINGS

- A. New Construction
 - 1. The CONTRACTOR shall provide necessary openings in walls, floors, and roofs for the passage of piping and plumbing equipment within and into the building.
 - 2. Openings shall be as indicated or as required to provide passage for the plumbing WORK.

3.03 INSTALLATION AND APPLICATION

- A. The CONTRACTOR shall provide plumbing specialties in accordance with manufacturer's printed instructions.
- B. Pipe shall be arranged in a neat and orderly manner to occupy the minimum amount of space and so that the pipe will not obstruct passageways and movement of building occupants or interfere with normal operation and maintenance of any equipment.
- C. Pipe shall be carefully placed and properly sloped and shall be neatly and firmly supported by hangers or supports.
- D. Piping in buildings shall be as close to the ceilings or walls as possible unless indicated otherwise.
- E. Joints
 - 1. Screwed joints shall be made with joint compound and be tight and leak-proof.
 - 2. A sufficient number of brass-to-ferrous metal seat unions shall be placed in lines such that any pipe, valve, or piece of equipment may be easily disconnected.
- F. Drainage and Sanitary Lines

1. Drainage and sanitary lines shall be properly run, trapped, and vented in order to conform to Code requirements.
 2. Changes in direction shall be made with "Y" branch fittings and shall be of the same size as the pipe.
 3. Changes in pipe size shall be made with reducing fittings.
 4. The minimum depth of cover shall be 3 feet.
- G. Horizontal soil, drain, and waste pipes shall be provided with a slope of at least 1/4 inch per foot, unless indicated otherwise.
- H. Cleanouts shall be installed such that the tops of the drains are flush with the finished floor.
- I. Joints in PE pipe shall be installed such that the longitudinal pull out resistance of each joint is at least equal to the tensile strength of the pipe

3.04 EQUIPMENT DAMAGE AND REMOVAL

- A. The CONTRACTOR's operations shall be carried out in such a manner as to guard against damage to those portions of the structure and equipment that are to remain in the finished WORK.
- B. Any damage caused by the CONTRACTOR or SubContractor through their operations shall be repaired to the satisfaction of the ENGINEER.

3.05 TESTING

- A. The CONTRACTOR shall perform such tests as are required by local ordinances and Codes in the presence of a local governing authority inspector to show that piping is tight, leak-free, and otherwise satisfactory, and shall also perform such tests as the ENGINEER may direct to insure that fixtures and equipment operate properly.
- B. The CONTRACTOR shall pay the costs to perform such tests and the costs of making changes or repairs until the WORK is acceptable to the governing authorities.

3.06 DISINFECTION

- A. The line shall then be filled with water and maintained under not less than 10 psig pressure, for not less than 48 hours, during which period each valve on the line shall be opened and closed several times, after which it shall be flushed clean and then tested by the OWNER.
- B. After potable water supply lines are successfully pressure tested, they shall be disinfected by introducing an HTH solution, liquid chlorine, or chlorine solution of sufficient strength.
- C. Potable water systems shall be purged of deleterious matter and disinfected prior to utilization. The method to be followed shall be that prescribed by the health authority or water purveyor having jurisdiction or, in the absence of a prescribed method, the procedure described in either AWWA C651 or AWWA C652, or as described in this section.

1. The pipe system shall be flushed with clean, potable water until dirty water does not appear at the points of outlet.
 2. The system or part thereof shall be filled with a water/chlorine solution containing not less than 50 parts per million (50 mg/L) of chlorine, and the system or part thereof shall be valved off and allowed to stand for 24 hours; or the system or part thereof shall be filled with a water/chlorine solution containing not less than 200 parts per million (200 mg/L) of chlorine and allowed to stand for 3 hours.
 3. Following the required standing time, the system shall be flushed with clean potable water until the chlorine is purged from the system.
 4. The procedure shall be repeated where shown by a bacteriological examination that contamination remains present in the system.
- D. This procedure shall be repeated as often as necessary until the line is pronounced safe for use by the OWNER.
- E. No cross-connection between the water main and any pipe not yet disinfected will be permitted.

END OF SECTION

SECTION 23 05 29
HANGERS AND SUPPORTS FOR HVAC

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. REFERENCE SPECIFICATIONS

- 1. Section 23 31 13 - HVAC Duct

B. CODES

- 1. Comply with ASCE/SEI 7-05 and IBC 2020.

C. STANDARDS

- 1. 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.
- 2. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
- 3. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- 4. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction
- 5. Design trapeze pipe hangers and equipment supports, including comprehensive engineering Analysis by a qualified professional engineer, using performance requirements and design criteria as indicated.

1.03 CONTRACTOR SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
 - 1. Trapeze pipe hangers.
 - 2. Metal framing systems.
 - 3. Fiberglass strut systems. Pipe stands.
 - 4. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Design Calculations: Calculate requirements for designing trapeze hangers.
3. Welding Certificates

1.04 QUALITY ASSURANCE

- A. Comply with Special Inspection Requirements of IBC 2020.
- B. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Pipe Welding Qualifications: Qualify procedures and operators according to ASME boiler and Pressure Vessel Code.

PART 2 PRODUCTS

2.01 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: Pre-galvanized or hot dipped. Non-corrosive areas only.
 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 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. Copper Pipe Hangers
 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.02 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, 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 for non-corrosive areas. PVC coated or stainless components for corrosive areas.

2.03 METAL FRAMING SYSTEMS

- A. MFMA Manufacturer Metal Framing Systems:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.
 - c. Flex-Strut Inc.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut Corporation; Tyco International, Ltd.
 - g. Wesanco, Inc.
 - 2. Description: Shop or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
 - 3. Standard: MFMA-4.
 - 4. Channels: Continuous slotted steel channel with in-turned lips.
 - 5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 - 6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
 - 7. Metallic Coating: Hot-dipped galvanized.
 - 8. Paint Coating: Vinyl or Acrylic.
 - 9. Plastic Coating: PVC.

2.04 THERMAL-HANGER SHIELD INSERTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Carpenter & Paterson, Inc.
 - 2. Clement Support Services.
 - 3. ERICO International Corporation.
 - 4. National Pipe Hanger Corporation.
 - 5. PHS Industries, Inc.
 - 6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
 - 7. Piping Technology & Products, Inc.
 - 8. Rilco Manufacturing Co., Inc.
 - 9. 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 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-in. beyond sheet metal shield for piping operating below ambient air temperature.

2.05 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.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless- steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.06 PIPE STANDS

- A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
- C. Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.
- D. High-Type, Single-Pipe Stand:
 1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
 2. Base: Plastic.
 3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous thread rods.
 4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless steel, roller-type pipe support.
- E. High-Type, Multiple-Pipe Stand:
 1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
 2. Bases: One or more; plastic.
 3. Vertical Members: Two or more protective-coated-steel channels.
 4. Horizontal Member: Protective-coated-steel channel.

- 5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.
- F. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.07 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon steel shapes.

2.08 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Non-staining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000 psi, 28-day compressive strength.

PART 3 EXECUTION

- A. Hanger And Support Installation Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. 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-69 and MSS SP-89. 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. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4-in. 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.
- F. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 07 71 00 Roof Specialties for curbs.
- G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- I. 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.
- J. Install lateral bracing with pipe hangers and supports to prevent swaying.
- K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, DN 65 and larger and at changes in direction of piping. Install concrete inserts before
- L. concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- M. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- O. Insulated Piping:
1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight distribution plate for pipe DN 100 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 DN 100 and larger if pipe is installed on rollers.
 4. Shield Dimensions for Pipe: Not less than the following:
 - a. DN 8 to DN 90: 12-in. long and 0.05-in. thick.
 - b. DN 100: 12-in. long and 0.06-in. thick.
 - c. DN 125 and DN 150: 18-in. long and 0.06-in. thick.

- d. DN 200 to DN 350: 24-in. long and 0.075-in. thick.
- 5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.02 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.

3.03 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.

3.04 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 1.5-in.

3.05 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 0.002-in.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 09 90 00 "Painting and Coating."
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.06 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- C. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- D. Use carbon-steel pipe hangers and supports and metal framing systems and attachments for general service applications.
- E. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- F. Use padded hangers for piping that is subject to scratching.
- G. Use thermal-hanger shield inserts for insulated piping and tubing.
- H. 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 non-insulated or insulated, stationary pipes DN 15 to DN 750.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 degrees F, pipes DN 100 to DN 600, requiring up to 4-in. of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes DN 20 to DN 900, requiring clamp flexibility and up to 4-in. of insulation.
 - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes DN 15 to DN 600 if little or no insulation is required.
 - 5. Pipe Hangers (MSS Type 5): For suspension of pipes DN 15 to DN 100, 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 non-insulated, stationary pipes DN 20 to DN 200.
 - 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated, stationary pipes DN 15 to DN 200.
 - 8. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated, stationary pipes DN 15 to DN 200.
 - 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated, stationary pipes DN 15 to DN 200.
 - 10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of non-insulated, stationary pipes DN 10 to DN 200.
 - 11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated, stationary pipes DN 10 to DN 80.
 - 12. U-Bolts (MSS Type 24): For support of heavy pipes DN 15 to DN 750. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 - 13. Pipe Saddle Supports (MSS Type 36): For support of pipes DN 100 to DN 900, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.

14. Pipe Stanchion Saddles (MSS Type 37): For support of pipes DN 100 to DN 900, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 15. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes DN 65 to DN 900 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
 16. Single-Pipe Rolls (MSS Type 41): For suspension of pipes DN 25 to DN 750, from two rods if longitudinal movement caused by expansion and contraction might occur.
 17. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes DN 65 to DN 600, from single rod if horizontal movement caused by expansion and contraction might occur.
 18. Complete Pipe Rolls (MSS Type 44): For support of pipes DN 50 to DN 1050 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
 19. Pipe Roll and Plate Units (MSS Type 45): For support of pipes DN 50 to DN 600 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
 20. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes DN 50 to DN 750 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- I. 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 DN 24 to DN 600.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers DN 20 to DN 600 if longer ends are required for riser clamps.
- J. 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-in. for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 degrees 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 degrees F piping installations.
- K. 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.
Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- M. 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 1.25-in.
 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.

- N. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

- O. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

- P. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

**SECTION 23 05 93
TESTING, ADJUSTING AND BALANCING FOR HVAC**

PART 1 GENERAL

1.01 THE SUMMARY

- A. The WORK included in this Section shall consist of the furnishing of all labor, instruments, tools, and services as required for the total system balancing of the heating, ventilating, and air conditioning (HVAC) systems as indicated in the Contract Documents.
- B. The WORK under this Section shall include the following items:
 - 1. Preparation for balancing of air systems;
 - 2. Preparation of control systems; and,
 - 3. Notification requirements by the General Contractor of systems readiness.

1.02 REFERENCES

Reference	Title
Associated Air Balance Council (AABC) MN-4	Test and Balance Procedures Florida
Energy Code	Section C408 System Commissioning

PART 2 EQUIPMENT (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

- A. All equipment will be commissioned in compliance to Florida Energy Code
- B. Testing, adjusting, and balancing (TAB) of the air conditioning systems and related ancillary equipment shall be performed by a certified, independent third-party, AABC Agency, selected and employed by the CONTRACTOR and approved by the OWNER.
- C. The preparation for and corrections necessary for the testing, adjusting, and balancing of these systems, as described herein, are the responsibility of the CONTRACTOR.
- D. Make changes or replacements to fan sheaves and belts, dampers, valves, and the like, as may be required for correct balance as advised by the TAB firm, as part of the WORK.
- E. Provide and coordinate the services of qualified, responsible subcontractors, suppliers, and personnel, as required to correct, repair, or replace deficient items or conditions found during the course of the Project, including the testing, adjusting, and balancing period.
- F. Operate the systems for the length of time necessary to properly verify their completion and readiness for TAB.

1. Scheduling Project completion schedules shall allow for sufficient time to permit the completion of TAB services prior to OWNER occupancy.
2. Allow adequate time for coordinating OWNER-required services associated with the testing and balancing activities during the construction period and prior to Substantial Completion.

G. Manuals

1. Submittal data stating equipment size and selected options.
2. Manufacturers operation and maintenance manuals for each piece of equipment, except equipment not furnished as part of this project.
3. Name and address of at least one service agency.
4. HVAC controls system maintenance and calibration information including wiring diagrams, schematics and control sequence descriptions.
5. A narrative of how each system is intended to operate, including recommended set points.

H. Accessibility

1. Install valves, dampers, and miscellaneous adjustment devices in a manner that will leave them accessible and readily adjustable.
2. Should any such device not be readily accessible, provide access as requested by the TAB firm.
3. Malfunctions encountered by TAB personnel and reported to the CONTRACTOR shall be corrected by the CONTRACTOR immediately such that the balancing work can proceed with minimal delays.

I. The TAB firm shall check, adjust, and balance the components of the HVAC system in order to obtain the optimal performance of the equipment.

J. The WORK is intended to be accomplished after the system components are installed and operating as indicated and required.

K. It shall be the responsibility of the CONTRACTOR to place the equipment into service.

L. The following components of the HVAC systems shall be tested, adjusted, and balanced:

1. air moving equipment.
2. air distribution systems.
3. heating and cooling systems; and,

3.02 CONTROL SYSTEMS (TESTING AND VERIFICATION).FIELD TESTING

A. During the progress of the work, tests shall be performed as indicated and as required by authorities having jurisdiction, including the local building department, the OWNER, the OWNER's insuring agency, and the ENGINEER.

B. Perform such tests as part of the WORK, including qualified personnel, equipment apparatus, additional thermometer wells, gauge connections, instrument connections, and services as required to perform the tests.

- C. Submit 6 copies of each complete test report to the ENGINEER for review, and send 2 copies of the accepted report to the OWNER.

3.03 DEFECTIVE WORK

- A. Leaks, damage, and defects discovered or resulting from tests shall be repaired or replaced to a like-new condition.
- B. Leaky pipe joints, ductwork, and the like, shall be removed and replaced with acceptable materials.
- C. Reporting
 - 1. During the balancing process, as abnormalities and malfunctions of equipment or components are discovered by the TAB personnel, the TAB firm shall advise the ENGINEER and OWNER in writing such that the conditions may be corrected by the CONTRACTOR.
 - 2. The written document need not be formal, but must be understandable and legible.
 - 3. The TAB firm shall not instruct nor direct subcontractors in any of the WORK.

3.04 CONTRACTOR'S RESPONSIBILITIES

- A. Have the building and air conditioning systems in complete operational readiness for the TAB WORK to begin.
- B. Allow sufficient time for the TAB firm to perform their WORK within the construction schedule.
- C. Complete the WORK by systems or floors, whichever is the more efficient method for testing systems.
- D. Scheduling
 - 1. Within 2 weeks after the construction schedule has been developed, schedule a TAB coordination meeting to include the TAB firm, the CONTRACTOR and primary subcontractors, the ENGINEER, and the OWNER for the purpose of developing a testing schedule for the Project.
 - 2. Submit copies of the proposed schedule to the TAB firm at least one week prior to the coordination meeting.
- E. Promptly correct deficiencies of materials and workmanship identified as delaying completion of the TAB firm's WORK.
- F. Assume responsibility for added costs to the OWNER resulting from failure to have the building and air conditioning systems ready for TAB when scheduled, and from failure to correct deficiencies promptly.
- G. Coordinate with the TAB firm to compile and submit:
 - 1. One set of HVAC specifications;
 - 2. One copy of relevant revisions, clarifications, and modifications;
 - 3. One complete set of Drawings, less the Civil and Structural sheets;
 - 4. One set of the HVAC floor plans of the conditioned spaces;

5. One copy of approved submittal data for installed equipment; and,
 6. One copy of related changes as required to accomplish the indicated test procedures.
- H. Provide all HVAC control communications software with the appropriate licenses and hardware interfaces.

3.05 TAB FIRM'S RESPONSIBILITIES

- A. The following observations and tests shall be performed by the TAB firm:
1. During the construction submittal stage and before the submittal documents are finalized, review the mechanical and HVAC submittals, drawings and specifications for balance-ability and furnish commentary.
 2. A commissioning plan shall be developed that will include a narrative of activities to be accomplished, list of equipment to be tested, functions to be tested, conditions under the test will be performed, and a measurable criteria for performance.
 3. During construction, review approved HVAC submittals such as control diagrams, air handling devices, and the like, that pertain to TAB work and balancing.
 4. Perform construction observations and submit a written report including the following topics.
 - a. The ductwork prior to insulation and ceiling cover-up; and,
 - b. The piping prior to insulation and ceiling cover-up.
 5. Perform a pre-balance site review and submit a written report.

3.06 OPERATIONAL READINESS

- A. "Operational readiness," as referred to in this Section, shall be defined as the time when the construction status of the building permits the closing of doors, windows, ceilings, and the like, in order to obtain simulated or projected operating conditions.
- B. Operational readiness of the HVAC system shall require that the following items have been accomplished:
1. Air Distribution Systems
 - a. The installation conforms to the indicated design requirements.
 - b. Volume, smoke, and smoke/fire dampers have been properly located and are functional.
 - c. Dampers have tight closure and open fully with smooth and free operation.
 - d. Supply, return, exhaust, and transfer grilles, registers, diffusers, and terminal devices have been installed and secured in a full open position.
 - e. Air handling systems, units, and associated apparatus, such as heating and cooling coils, filter sections, access doors, and the like, have been sealed to eliminate uncontrolled bypass or leakage of air.
 - f. Final clean filters are in place, coils are clean with fins straightened, bearings are properly greased, belts are aligned and tightened, and the system is completely operational.
 - g. It has been verified that all systems are operating within the design pressure limits of the piping and ductwork.

- h. Fans (supply, return, and exhaust) are operating and verified for freedom from vibration, proper fan rotation and belt tension.
 - i. Heater elements in motor starters are of proper size and rating, in accordance with the starter manufacturer's requirements.
 - j. Motor amperage and voltage have been recorded on each phase at start-up, and verified that they do not exceed nameplate ratings.
 - k. Terminal units (mixing boxes and fan powered boxes) have been installed and controls are functional.
2. Automatic Controls
- a. A meeting has been held with the ENGINEER, the TAB firm, and the OWNER, for a pre-submittal review of the proposed controls strategy.
 - b. Control components have been installed in accordance with project requirements and are functional, including electrical interlocks, damper sequences, air and water resets, fire and freeze stats, high- and low- temperature thermostats, safeties, and the like.
 - c. Controlling instruments have been calibrated and set for design operating conditions with the exception of components that require input from the TAB firm, but a default has been set.
 - 1) Cooperate with the TAB firm and provide all software and interfaces in order to communicate with the system.
 - d. Controls, sensors, operators, sequences, and the like, have been checked before notifying the TAB firm that the Energy Management System is operational.
 - 1) Furnish technical support (technicians and necessary computers) for a complete check of these systems.
 - e. Fire alarm detection devices, sequences, inter-locks, and the like, have been checked before notifying the TAB firm that the system is operational.
 - 1) Checked devices shall include the Fireman's Override Panel.
 - 2) Provide all detection devices (fire and smoke), complete with all smoke zones identified along with all alarm and event chart devices identified.
 - 3) Certify that the systems are totally operational prior to the TAB beginning.
 - f. A start-up report has been submitted.
 - 1) The start-up report shall include the submitted and actual RPM, and the actual and nameplate voltage and amperage of all motors.
 - 2) This requirement applies to each piece of electrically-driven air conditioning equipment in the system, including supply and exhaust fans, other fans of fractional horsepower, pumps, and the like.
 - 3) Furnish the addresses and initial set points of all controlled devices.

3.07 NOTIFICATION OF SYSTEM READINESS

- A. After the above operational readiness items have been accomplished, notify the ENGINEER in writing, certifying that the WORK has been accomplished and that the building and the air conditioning systems are in operational readiness for testing, adjusting, and balancing.
- B. With the notification, include a copy of tabulated data as required.

- C. The ENGINEER will notify the TAB firm of the readiness for balancing, and forward copies of the CONTRACTOR's certification and tabulated motor voltages, currents, and RPM.
- D. If the TAB firm has been notified as described above and the inspection reveals that the TAB services notification is premature, costs of the inspection and wasted work accomplished by the TAB firm shall be reimbursed to the appropriate parties by the CONTRACTOR.

3.08 TESTING AND BALANCING

- A. In coordination with the TAB firm, submit an overview of system TAB procedures including:
 - 1. An agenda;
 - 2. Field observation reports;
 - 3. System testing, including:
 - a. Traverses to be made;
 - b. Instrumentation to be used;
 - c. How correction factors for grilles and diffusers will be obtained;
 - d. How measurements will be verified at maximum and minimum;
 - e. How control components will be verified; and,
 - 4. Report forms with each systems components identified and numbered.
- B. Personnel
 - 1. All personnel employed on the WORK shall be employees of the TAB firm.
 - 2. The WORK shall be performed under the direct supervision of an AABC-Certified Test and Balance Engineer.
 - 3. Submit resumes for each person on the Project, including education, experience, and certification.
- C. Warranty
 - 1. The TAB firm shall submit a National Performance Guaranty in accordance with AABC National Standards.

3.09 INSTRUMENTATION

- A. Ensure that instruments being used are currently calibrated and listed in the TAB report, showing instrument description, serial number, and date of calibration.
- B. The accuracy of instruments used shall be as indicated in the current AABC National Standards.

3.10 FINAL AIR BALANCE

- A. When systems are complete and ready for operation, the TAB firm shall perform a final air balance for all air systems and record the results.
- B. The volume of air for the supply, return, exhaust, and outside air equipment and terminals shall be tested and balanced within the tolerances of the AABC Standard.

- C. Air handling unit and fan volumes shall be adjusted by changing fan speed.
- D. Air distribution device volume shall be adjusted using the spin-in damper for flexible duct-connected devices, and the damper for duct-connected devices.
- E. Air distribution devices shall be balanced with air patterns as indicated.
- F. Duct volume dampers shall be adjusted to provide air volume to branch ducts where such dampers are indicated.
- G. The general scope of balancing by the TAB firm shall include the following items:
 - 1. Filters: Check air filters and filter media and balance only systems with essentially clean filters and filter media.
 - 2. Fan Speed: Measure and record RPM at each fan speed.
 - 3. Voltage and Amperage Readings: Measure and record the final operating amperages and voltage for each motor.
 - 4. Static Pressure Profile
 - a. Static pressure profiles shall be measured and recorded across each supply fan, cooling coil, heating coil, return air fan, air handling unit filter, and exhaust fan, and at the furthest air device or terminal unit from the air handler supplying that device.
 - b. Furnish static pressure profiles for systems which do not perform as designed.
 - 5. Equipment Air Flow: Adjust and record exhaust, return, outside, and supply air CFM and temperatures, as applicable, at each fan and coil.
 - 6. Coil Temperatures
 - a. Set controls for full cooling and for full heating loads.
 - b. Read and record entering and leaving dry bulb and wet bulb temperatures (cooling only) at each cooling coil, heating coil, and HVAC terminal unit.
 - c. At the time of reading, record water flow and entering and leaving water temperatures.
 - d. In variable flow systems, adjust the air and water flow to design for all the above readings.
 - 7. Zone Air Flow: Adjust each zone of multi-zone units, each HVAC terminal unit, and air handling unit for design CFM.
 - 8. Outlet Air Flow
 - a. Adjust each exhaust inlet and supply diffuser, register and grille to within the tolerances shown in the AABC Standard.
 - b. Include all terminal points of air supply and all points of exhaust.
 - 9. Pitot Tube Traverses
 - a. For use in future troubleshooting by maintenance personnel, measure air velocity in all exhaust ducts, main supply ducts, outside air, and return ducts, and record by the Pitot tube traverse method shown in the AABC Standard.
 - b. Locations of these traverse test stations shall be described both verbally and by graphic representation on the sheet containing the data.
 - 10. Maximum and minimum airflow on terminal boxes shall be adjusted, measured, and recorded.

3.11 TAB FINAL ACCEPTANCE AND BALANCING

- A. Submit report of test procedures and results identified as “Final Commissioning Report”. The report shall include:
 - 1. Results of functional performance tests
 - 2. Disposition of deficiencies found during testing including measurable criteria for test acceptance
 - 3. Functional performance test procedures used during the commissioning process.
- B. At the time of TAB final acceptance inspection, the TAB firm shall recheck, in the presence of the ENGINEER, specific and random selections of data that were recorded in the certified test and balance report.
- C. Points and areas for recheck shall be selected by the ENGINEER.
- D. Measurements and test procedures shall be the same as the submitted and approved test and balance agenda.
- E. Selections for verification, specific plus random, shall not exceed 10 percent of the total number tabulated in the report, except where special air systems require a complete recheck for safety reasons.
- F. If 10 percent of the random verification tests demonstrate a measured flow deviation of 10 percent or more from that recorded in the certified test and balance report, the report shall be automatically rejected.
- G. In the event the report is rejected, all systems shall be readjusted and tested, new data recorded, a new certified test and balance report submitted, and a new inspection test made, as part of the WORK.
- H. Final Acceptance will not occur until after the successful completion of the TAB verification process.

END OF SECTION

SECTION 23 07 13
HVAC DUCT INSULATION

PART 1 – GENERAL

1.1 THE SUMMARY

- A. The CONTRACTOR shall provide Ductwork insulation, complete and in place, as indicated in accordance with the Contract Documents.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Federal Specifications:
 - 1. HH-1-558B Insulation Blocks, Boards, Blankets, Felts, Sleeving (Pipe and Tube Covering), and Pipe Fitting Covering, Thermal (Mineral fiber, Industrial Type)
- B. Commercial Standards:
 - 1. ASTM C 547 Mineral Fiber Pipe Insulation
 - 2. TM E 84 Test Method for Surface Burning Characteristics of Building Materials.
- C. Section 23 07 19 "HVAC Piping Insulation."
- D. Section 23 31 13 "HVAC Duct" for duct liners.

1.3 CONTRACTOR 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).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
 - 3. Detail application of field-applied jackets.
 - 4. Detail application at linkages of control devices.
- C. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

1.4 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 E 84, 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.

1.5 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.

1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 23 05 29 "Hangers and Supports for HVAC."
- 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.
- C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 – PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in Part 3 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 C 871.

- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory- applied FSK jacket. Factory-applied jacket requirements are specified in "Factory- Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the WORK include, but are not limited to, the following:
 - a. CertainTeed Corp.; SoftTouch Duct Wrap.
 - b. Johns Manville; Microlite.
 - c. Knauf Insulation; Friendly Feel Duct Wrap.
 - d. Manson Insulation Inc.; Alley Wrap.
 - e. Owens Corning; SOFTR All-Service Duct Wrap.
- G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the WORK include, but are not limited to, the following:
 - a. CertainTeed Corp.; Commercial Board.
 - b. Fibrex Insulations Inc.; FBX.
 - c. Johns Manville; 800 Series Spin-Glas.
 - d. Knauf Insulation; Insulation Board.
 - e. Manson Insulation Inc.; AK Board.
 - f. Owens Corning; Fiberglas 700 Series.

2.2 FIRE-RATED INSULATION SYSTEMS

- A. Fire-Rated Board: Structural-grade, press-molded, xonolite calcium silicate, fireproofing board suitable for operating temperatures up to 1700 degrees F. Comply with ASTM C 656, Type II, Grade 6. Tested and certified to provide a 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction.

- a. Products: Subject to compliance with requirements, available products that may be incorporated into the WORK include, but are not limited to, the following:
Johns Manville; Super Firetemp M.
- B. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the WORK include, but are not limited to, the following:
 - a. CertainTeed Corp.; FlameChek.
 - b. Johns Manville; Firetemp Wrap.
 - c. Nelson Fire Stop Products; Nelson FSB Flameshield Blanket.
 - d. Thermal Ceramics; FireMaster Duct Wrap.
 - e. 3M; Fire Barrier Wrap Products.
 - f. Unifrax Corporation; FyreWrap.

2.3 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. Products: Subject to compliance with requirements, available products that may be incorporated into the WORK include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.Eagle Bridges - Marathon Industries; 225.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.Mon-Eco Industries, Inc.; 22-25.
 - 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 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. Products: Subject to compliance with requirements, available products that may be incorporated into the WORK include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.

- b. Eagle Bridges - Marathon Industries; 225.
 - 2. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.Mon-Eco Industries, Inc.; 22-25.For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. PVC Jacket Adhesive: Compatible with PVC jacket.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the WORK include, but are not limited to, the following:
 - a. Dow Corning Corporation; 739, Dow Silicone.
 - b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 - c. P.I.C. Plastics, Inc.; Welding Adhesive.
 - d. Speedline Corporation; Polyco VP Adhesive.
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
 - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the WORK include, but are not limited to, the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
 - b. Vimasco Corporation; 749.
 - 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.014 US perm at 0.043-in. dry film thickness.
 - 3. Service Temperature Range: Minus 20 to plus 180 degrees F.
 - 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 - 5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the WORK include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-30.
 - b. Eagle Bridges - Marathon Industries; 501.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
 - d. Mon-Eco Industries, Inc.; 55-10.
2. Water-Vapor Permeance: ASTM F 1249, 0.046 US perm at 0.035-in. dry film thickness.
3. Service Temperature Range: 0 to plus 180 degrees F.
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the WORK include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
 - b. Eagle Bridges - Marathon Industries; 570.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.
2. Water-Vapor Permeance: ASTM F 1249, 0.05 US perm at 0.031-in. dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 degrees F.
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the WORK include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.

- b. Eagle Bridges - Marathon Industries; 550.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
 - d. Mon-Eco Industries, Inc.; 55-50.
 - e. Vimasco Corporation; WC-1/WC-5.
- 2. Water-Vapor Permeance: ASTM F 1249, 1.8 US perms at 0.063-in. dry film thickness.
 - 3. Service Temperature Range: Minus 20 to plus 180 degrees F.
 - 4. Solids Content: 60 percent by volume and 66 percent by weight.
 - 5. Color: White.

2.5 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
 - 1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Products: Subject to compliance with requirements, available products that may be incorporated into the WORK include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
 - b. Vimasco Corporation; 713 and 714.
 - 3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.
 - 4. Service Temperature Range: 0 to 180 degrees F.
 - 5. Color: White.

2.6 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the WORK include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.Eagle Bridges - Marathon Industries; 405.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller

- Company; 95-44.
- c. Mon-Eco Industries, Inc.; 44-05.

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 degree F.
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the WORK include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
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 degrees F.
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.7 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 C 1136, Type I.
 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
 3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
 4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
 5. Vinyl Jacket: White vinyl with a permeance of 1.30 US perm when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.8 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Glass-Fiber Fabric: Approximately 6 oz./sq. yard with a thread count of 50 strands by 50 strands/sq. in for covering ducts.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the WORK include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Chil-Glas No. 5.
- B. Woven Polyester Fabric: Approximately 1 oz./sq. yd with a thread count of 100 strands by 100 strands/sq. in., in a Leno weave, for ducts.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the WORK include, but are not limited to, the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Mast-A-Fab.
 - b. Vimasco Corporation; Elastafab 894.

2.9 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. Products: Subject to compliance with requirements, available products that may be incorporated into the WORK include, but are not limited to, the following:
 - a. Alpha Associates, Inc.; Alpha-Maritex 84215 and 84217/9485RW, Luben 59.

2.10 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
- C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the WORK include, but are not limited to, the following:
 - a. Johns Manville; Zeston.
 - b. P.I.C. Plastics, Inc.; FG Series.
 - c. Proto Corporation; LoSmoke.
 - d. Speedline Corporation; SmokeSafe.
 - 2. Adhesive: As recommended by jacket material manufacturer.

3. Color: White.

D. Metal Jacket:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the WORK include, but are not limited to, the following:

- a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
- b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
- c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209M, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

- a. Sheet and roll stock ready for shop or field sizing.
- b. Finish and thickness are indicated in field-applied jacket schedules.
- c. Moisture Barrier for Indoor Applications: 0.003-in. thick, heat-bonded polyethylene and kraft paper.
- d. Moisture Barrier for Outdoor Applications: 0.003-in. thick, heat-bonded polyethylene and kraft paper.

3. Stainless-Steel Jacket: ASTM A 167 or ASTM A 240/A 240M.

- a. Factory cut and rolled to size.
- b. Material, finish, and thickness are indicated in field-applied jacket schedules.
- c. Moisture Barrier for Indoor Applications: 0.003-in. thick, heat-bonded polyethylene and kraft paper.
- d. Moisture Barrier for Outdoor Applications: 0.003-in. thick, heat-bonded polyethylene and kraft paper.

2.11 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the WORK include, but are not limited to, the following:

- a. ABI, Ideal Tape Division; 428 AWF ASJ.
- b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.

- c. Compac Corporation; 104 and 105.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
 - 2. Width: 3-in.
 - 3. Thickness: 0.011-in.
 - 4. Adhesion: 5.7 lbf./in. in width.
 - 5. Elongation: 2 percent.
 - 6. Tensile Strength: 41 lbf./in. 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 C 1136.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the WORK include, but are not limited to, the following:
 - a. ABI, Ideal Tape Division; 491 AWF FSK.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - c. Compac Corporation; 110 and 111.
 - d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
 - 2. Width: 3-in.
 - 3. Thickness: 0.0063-in.
 - 4. Adhesion: 5.7 lbf./in. in width.
 - 5. Elongation: 2 percent.
 - 6. Tensile Strength: 41 lbf./in. in width.
 - 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the WORK include, but are not limited to, the following:
 - a. ABI, Ideal Tape Division; 370 White PVC tape.
 - b. Compac Corporation; 130.
 - c. Venture Tape; 1506 CW NS.

2. Width: 2-in.
3. Thickness: 0.006-in.
4. Adhesion: 4.0 lbf./in. in width.
5. Elongation: 500 percent.
6. Tensile Strength: 19 lbf./in. in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the WORK include, but are not limited to, the following:
 - a. ABI, Ideal Tape Division; 488 AWF.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
 - c. Compac Corporation; 120.
 - d. Venture Tape; 3520 CW.
2. Width: 2-in.
3. Thickness: 0.004-in.
4. Adhesion: 6.3 lbf./in. in width.
5. Elongation: 5 percent.
6. Tensile Strength: 35 lbf./in. in width.

2.12 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the WORK include, but are not limited to, the following:
 - a. ITW Insulation Systems; Gerrard Strapping and Seals.
 - b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015-in. thick, wide with wing seal or closed seal.
3. Aluminum: ASTM B 209M, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 2-in. thick, 0.5-in. wide with wing seal or closed seal.
4. 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, 0.10-in. diameter shank, length to suit depth of insulation indicated.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the WORK include, but are not limited to, the following:
 - 1) AGM Industries, Inc.; CWP-1.
 - 2) GEMCO; CD.
 - 3) Midwest Fasteners, Inc.; CD.
 - 4) Nelson Stud Welding; TPA, TPC, and TPS.
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.10-in. diameter shank, length to suit depth of insulation indicated with integral 1.5-in. galvanized carbon-steel washer.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the WORK include, but are not limited to, the following:
 - 1) AGM Industries, Inc.; CHP-1.
 - 2) GEMCO; Cupped Head Weld Pin.
 - 3) Midwest Fasteners, Inc.; Cupped Head.
 - 4) Nelson Stud Welding; CHP.
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. Products: Subject to compliance with requirements, available products that may be incorporated into the WORK include, but are not limited to, the following:
 - 1) AGM Industries, Inc.; Tactoo Perforated Base Insul-Hangers.
 - 2) GEMCO; Perforated Base.
 - 3) Midwest Fasteners, Inc.; Spindle.
 - b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.03-in. thick by 2-in. square.
 - c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.10-in. 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. Products: Subject to compliance with requirements, available products that may be incorporated into the WORK include, but are not limited to, the following:
 - 1) GEMCO; Nylon Hangers.
 - 2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.
 - b. Baseplate: Perforated, nylon sheet, 0.03-in. thick by 1.5-in. in diameter.
 - c. Spindle: Nylon, 0.10-in. diameter shank, length to suit depth of insulation indicated, up to 2.5-in.
 - 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. Products: Subject to compliance with requirements, available products that may be incorporated into the WORK include, but are not limited to, the following:
 - 1) AGM Industries, Inc.; Tactoo Self-Adhering Insul-Hangers.
 - 2) GEMCO; Peel & Press.
 - 3) Midwest Fasteners, Inc.; Self Stick.
 - b. Baseplate: Galvanized carbon-steel sheet, 0.03-in. thick by 2-in. square.
 - c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.10-in. 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-in. thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1.5-in diameter.
- a. Products: Subject to compliance with requirements, available products that may be incorporated into the WORK include, but are not limited to, the following:
 - 1) AGM Industries, Inc.; RC-150.

- 2) GEMCO; R-150.
 - 3) Midwest Fasteners, Inc.; WA-150.
 - 4) Nelson Stud Welding; Speed Clips.
- 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- in. thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1.5-in. diameter.
- 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) GEMCO.
 - 2) Midwest Fasteners, Inc.
- C. Staples: Outward-clinching insulation staples, nominal 0.75-in. wide, stainless steel or Monel.
- D. Wire: 0.08-in. nickel-copper alloy, 0.063-in. soft-annealed, stainless steel, or 0.063-in. soft annealed, galvanized steel.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the WORK include, but are not limited to, the following:
- a. C & F Wire.

2.13 CORNER ANGLES

- A. PVC Corner Angles: 0.031-in. thick, minimum 1-in. by 1-in., PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.
- B. Aluminum Corner Angles: 0.039-in. thick, minimum 1-in. by 1-in., aluminum according to ASTM B 209M, Alloy 3003, 3005, 3105, or 5005; Temper H-14.
- C. Stainless-Steel Corner Angles: 0.024-in thick, minimum 1-in. by 1-in., stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316.

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-in. wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4-in. o.c.
3. Overlap jacket longitudinal seams at least 1.5-in. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2-in. 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-in. 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-in. 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-in.
 4. Seal jacket to wall flashing with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated):
1. 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-in.
- E. Insulation Installation at Floor Penetrations:
1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2-in.

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-in. and smaller, place pins along longitudinal centerline of duct. Space 3-in. maximum from insulation end joints, and 16-in. o.c.
 - b. On duct sides with dimensions larger than 18-in., place pins 16-in. o.c. each way, and 3-in. 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-in. from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 0.5-in. outward-clinching staples, 1-in. 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 degrees F. at 18-ft. 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-in.
 5. Overlap unfaced blankets a minimum of 2-in. on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18-in. 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-in. wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6-in. 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-in. and smaller, place pins along longitudinal centerline of duct. Space 3-in. maximum from insulation end joints, and 16-in. o.c.
 - b. On duct sides with dimensions larger than 18-in. space pins 16-in. o.c. each way, and 3-in. 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-in. from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 0.5-in. outward-clinching staples, 1-in. 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 degrees F. at 18-ft. 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-in.
 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-in. wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6-in. o.c.

3.6 FIELD-APPLIED JACKET INSTALLATION

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
 1. Draw jacket smooth and tight to surface with 2-in. overlap at seams and joints.
 2. Embed glass cloth between two 0.063-in. thick coats of lagging adhesive.
 3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- B. Where FSK jackets are indicated, install as follows:
 1. Draw jacket material smooth and tight.
 2. Install lap or joint strips with same material as jacket.
 3. Secure jacket to insulation with manufacturer's recommended adhesive.

4. Install jacket with 1.5-in. laps at longitudinal seams and 3-in. wide joint strips at end joints.
 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- C. Where PVC jackets are indicated, install with 1-in. overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- D. Where metal jackets are indicated, install with 2-in. overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12-in. o.c. and at end joints.

3.7 FIRE-RATED INSULATION SYSTEM INSTALLATION

- A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.
- B. Insulate duct access panels and doors to achieve same fire rating as duct.

3.8 FINISHES

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below.
 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. Color: Final color as selected by OWNER. Vary first and second coats to allow visual inspection of the completed WORK.
- C. Do not field paint aluminum or stainless-steel jackets.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 1. Inspect ductwork, randomly selected by OWNER, 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.

- D. All insulation applications will be considered defective WORK if sample inspection reveals noncompliance with requirements.

3.10 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply, return and outdoor air duct and plenum.
2. Indoor, exposed supply, return and outdoor air duct and plenum.
3. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
4. Indoor, exposed, Type I, commercial, kitchen hood exhaust.
5. Indoor, concealed oven and warewash exhaust.
6. Indoor, exposed oven and warewash exhaust.

B. Items Not Insulated:

1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
2. Factory-insulated flexible ducts.
3. Factory-insulated plenums and casings.
4. Flexible connectors.
5. Vibration-control devices.
6. Factory-insulated access panels and doors.

3.11 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed, round, supply-air, return-air, and outside air duct and plenum insulation shall be one of the following:

1. Mineral-Fiber Blanket: 1.5-in. thick and 1.5-lb/cu. ft. nominal density.

- B. Concealed, rectangular, supply-air, return-air and outside air duct and plenum insulation shall be one of the following:

1. Mineral-Fiber Blanker: 1.5-in. thick and 1.5-lb/cu. ft. nominal density.
2. Mineral-Fiber Board: 1.5-in. thick and 2.0-lb/cu. ft. nominal density.

- C. Concealed, Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated blanket or board; thickness as required to achieve 2-hour fire rating.
- D. Exposed, round, supply-air, return-air and outside air duct and plenum insulation shall be one of the following:
 - 1. Mineral-Fiber Blanket: 1.5-in. thick and 1.5-lb/cu. ft. nominal density.
- E. Exposed, rectangular, supply-air, return-air and outside air duct and plenum insulation shall be one of the following:
 - 1. Mineral-Fiber Board: 1.5-in. thick and 2.0-lb/cu. ft. nominal density.
- F. Exposed, Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated blanket or board; thickness as required to achieve 2-hour fire rating.

3.12 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, Concealed:
 - 1. None.
- D. Ducts and Plenums, Exposed:
 - 1. PVC : 0.02-in. thick.

3.13 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. If more than one material is listed, selection from materials listed is CONTRACTOR's option.
- B. Ducts and Plenums:
 - 1. Stainless Steel Jacket

END OF SECTION

SECTION 23 07 19
HVAC PIPING INSULATION

PART 1 GENERAL

1.01 THE SUMMARY

- A. The CONTRACTOR shall provide pipe insulation, complete and in place, as indicated in accordance with the Contract Documents.

1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

Reference	Title
HH-1-558B	Insulation Blocks, Boards, Blankets, Felts, Sleeving (Pipe and Tube Covering), and Pipe Fitting Covering, Thermal (Mineral Fiber, Industrial Type)
ASTM C 547	Mineral Fiber Pipe Insulation
ASTM E 84	Test Method for Surface Burning Characteristics of Building Materials

1.03 CONTRACTOR SUBMITTALS

- A. Submit complete Shop Drawings of thermal insulation, with manufacturer's data on materials, covering, jackets, and finish, in accordance with the requirements of Section 01 33 00 -Submittals.
- B. Furnish the following certifications:
 - 1. Certification from the manufacturer that the insulation has been installed in accordance with the manufacturer's recommendations.

PART 2 PRODUCTS

2.01 GENERAL

- A. Components of the insulation, including covering, mastics, and adhesives, shall have a flame-spread rating of not greater than 25 and a smoke development rating of not greater than 50.
- B. Ratings shall be as established by tests in accordance with ASTM E 84, and the above federal and commercial specification standards.
- C. Insulation shall be applied in strict accordance with the manufacturer's instructions.

2.02 BASIC MATERIALS

Unless otherwise indicated, the insulation thickness shall be as follows: Pipe		Minimum Thickness of Insulation (inches)
Heat-traced piping	3-inch and smaller	1
	4-inch and larger	1-1/2

2.03 PIPING INSULATION

- A. Except as indicated otherwise, piping shall be insulated with heavy density, unfaced, fiberglass pipe insulation.
- B. Pipe insulation shall have an average density of 4 pounds per cubic foot or greater, and its conductivity (k) shall not exceed 0.23 BTU-inch per (hour) (square foot) (degree F) at a mean temperature of 75 degrees F.
- C. The insulation shall be protected at pipe supports by placing a 1/16-inch thick Type 304 stainless steel shim between the insulation and the support; the shim shall be at least 6 inches long.
- D. The insulation shall be oversized for installation over electric heating cable.
- E. The insulation shall have a factory-applied white fire-retardant vapor-barrier jacket of kraft paper and aluminum foil laminated together and reinforced with fiberglass yarn.
- F. Fittings and valves shall be covered with the same material as the pipe, cut in segments to fit snugly without open spaces, held in place with copper wire or cement, and then covered with the same jacketing material as the pipe.
- G. Jacketing
 - 1. A final covering of the insulation for piping shall be of 0.030-inch thick PVC or equivalent strength smooth aluminum, preformed jacketing with a factory-attached moisture barrier.
 - 2. Valves, flanges, fittings, and ends of insulation shall be covered with a pre-molded, precision-formed, high-low temperature PVC fitting cover or end cap, or equivalent preformed unit to match the piping insulation jacket.
 - 3. The pre-molded covers shall be sized to receive the same thickness of insulation as used on the adjacent piping, and shall be sized to cover and protect the insulated fitting.
 - 4. Joints shall be sealed with silicone mastic or solvent welding to provide a continuous air- and weather-tight joint.
 - 5. Strapping shall be 1/2-inch wide, Type 3003 aluminum or stainless steel.
 - 6. Pre-molded fittings shall be Zeston 2000 PVC, or equal.
- H. Standard Temperature Insulation

1. Standard temperature insulation shall be used for process, cold and hot water, steam, and condensate piping and equipment with surface temperatures up to 850 degrees F.
 2. Pipe insulation and jacketing shall be applied to piping where indicated, including associated fittings, flanges, and valves.
 3. Pipe insulation shall consist of a molded-type pipe covering, constructed of fibrous glass with a minimum k-factor of 0.23 at 75 degrees F mean temperature.
- I. Manufacturers, or Equal
1. Armstrong Contracting and Supply Corp.
 2. Certain-Teed Corporation.
 3. Johns Manville.
 4. Owens-Corning.
 5. P.P.G. Industries, Inc.

PART 3 EXECUTION

3.01 GENERAL

- A. Insulation and liners shall be installed by a qualified insulation contractor in strict accordance with the manufacturer's recommendations.
- B. Piping, fittings, and valves to be insulated shall be clean and dry prior to installation of insulation.

3.02 FIBERGLASS INSULATION

- A. Fiberglass insulation shall be securely held in place before the final covering is applied.
- B. A scrim fabric, similar to a 20 x 10 thread count mesh and 100 percent fiberglass, shall be pasted in place to hold the pipe insulation securely to the pipe.
- C. The scrim fabric shall be at least 4-inches wide, with at least 2 applications per length of pipe insulation, and one at each joint.

3.03 JACKETING

- A. Joints shall be neatly finished with no ragged ends.
- B. When finished, the covering shall show no exposed staples or other binding used during installation.
- C. Staples, if used, shall be stainless steel.

3.04 LAGGING FABRIC

- A. The final lagging fabric shall be neatly pasted in place with a 3-inch longitudinal overlap using a Luben No. 9 adhesive, or equal.
- B. Each transverse joint shall have a 3-inch butt strip of the same fiberglass fabric.

- C. Final joints shall be neatly finished with no ragged ends and the covering shall present a neat, uniform surface when finished.
- D. The fabric shall show no exposed staples or other binding used during construction; staples, if used, shall be stainless steel.

3.05 COMPRESSION COUPLINGS AND EXPANSION JOINTS

- A. The rigid insulation blocks shall be held in place with stainless steel bands, approximately 1/2 inch wide by 0.015 inch thick.
- B. After banding, the blocks shall be finished with a trowel coat of insulating cement to filling voids, and troweled to a smooth, neat finish.
- C. The installation shall then be covered with an acoustical insulation consisting of a fiberglass fabric weighing 24.6 oz. per sq yd, and coated with a loaded vinyl weighing 83.4 oz. per sq yd.
- D. 83.4 oz. per sq yd.
- E. The acoustical insulation shall be Alpha-Sonic Style No. 75, or equal.
- F. The acoustical insulation shall be covered with a 100-percent fiberglass lagging fabric as indicated.

END OF SECTION

SECTION 23 09 23
HVAC CONTROLS

PART 1 – GENERAL

1.1 THE SUMMARY

- A. Section 23 - Refrigerant Piping - The HVAC Sub-Contractor shall:
 - 1. Furnish and install all pressure and temperature sensor wells and sockets, which are specified to be supplied by this section.

- B. Section 23 - Ductwork Accessories - The HVAC Sub-Contractor shall:
 - 1. Furnish and install all automatic dampers and provide necessary blank off plates or transitions required to install dampers that are smaller than duct size.
 - 2. Assemble multiple section dampers with required interconnecting and jackshaft linkage and extend required number of shafts through duct for external mounting of damper motors.
 - 3. Furnish and install all necessary sheet metal baffle plates to eliminate stratification and provide the air volumes specified. Locate baffles by experimentation. Fix and seal permanently in place only after stratification problems have been eliminated.
 - 4. Furnish and install airflow stations specified under this section.
 - 5. Furnish and install access doors or other approved means of access through ducts for service to control equipment.

- C. Section 26 Electrical - The Electrical Sub-Contractor shall:
 - 1. Furnish and install and connect all power wiring. Power wiring shall be defined as:
 - a. Wiring of all power feeds through all disconnect starters and variable speed controllers to electric motors.
 - b. Provide local power disconnects, where required.
 - c. Provide circuit breakers, starters in motor control centers, and 120-, 208-, 240- and 480-volt power feeders from the starters and circuit breakers to the HVAC equipment, as indicated.
 - d. Wiring of 120 VAC normal/emergency power feeds to all temperature control panels.
 - e. Power wiring to 120/277-volt single-phase motors shown on electrical plans and all VAV boxes shown (with or without fan motors).

- f. A dedicated 120 VAC outlet for the graphics interface computer and printer station as shown on the plans.
 - g. All conduit, wiring and terminations between the ATC Panel and the Facility SCADA System
- D. Section 23 Electrical - The HVAC Sub-Contractor shall:
 - 1. Provide controls, sensors and control panels relating to the HVAC systems, including starters, thermostats, motorized dampers, louver operators and other equipment as indicated.
 - 2. Provide control wiring of 120-volt and less as indicated in this Section and in conformance the requirements of Division 26 - Electrical and Division 40 - Instrumentation and Control.
- E. Starters, whether as an integral or separate part of the equipment, shall be in accordance with the requirements of Section 26 29 00 - Low-Voltage Motor Control Centers.
- F. Enclosures shall be of the same NEMA class as the electrical equipment in the same area.
- G. Starters shall be of the same manufacturer as the starters indicated under Section 26 29 00 - Low-Voltage Motor Control Centers.
- H. Low-voltage control wiring shall be in accordance with the National Electric Code.
- I. Control wiring for line voltage 120-volt and higher shall be in conformance with the requirements of Section 26 05 19 - Wires and Cables.
- J. Control Stations shall be in conformance with the requirements of Section 26 05 15 - Local Control Stations and Miscellaneous Electrical Devices.
- K. Conduit shall be in conformance with the requirements of Section 26 05 33 - Electrical Raceway Systems and Section 26 05 43 - Underground Raceway Systems.

1.2 FIRE ALARM AND DETECTION SYSTEM

- A. Tests shall occur after the contractor has completed the installation, started up the system, and performed tests.
- B. Division 28 shall design and provide a complete, electrically-supervised, 24-VDC, automatic fire alarm system as indicated.
- C. The fire alarm system shall meet the requirements of NFPA 72, the International Fire Code, and local Building code requirements for smoke detection systems control.
- D. Actuation of any automatic smoke detector or manual pull station shall cause the building alarm devices to sound, the outside strobe lights to activate, and the HVAC equipment to shut down.
- E. Smoke detectors shall be of the manual resetting type, or of a type that requires reset from a remote control panel.

F. Dry Contacts

1. The unit shall include one set of dry contacts, rated at 120 volts and 5 amps, to send an alarm signal to the main building HVAC control panel.
2. The dry contacts shall change state when any zone in the fire alarm system goes into an alarm state.
3. The supplier's schematic diagram in their Shop Drawings shall indicate the terminals associated with the common dry contact from each panel.

G. Smoke Detectors

1. Ductwork

- a. Fans with smoke detectors shall be provided at the intake ductwork for exhaust fans.
- b. The detector shall shut off the respective fan upon the detection of smoke.
- c. The detector shall send a separate signal to the Fire Alarm Control Panel

2. Air Handling Units

- a. The detector shall shut off the respective air handling unit upon the detection of smoke.
- b. The detector shall send a separate signal to the Fire Alarm Control Panel
- c. Division 23 shall provide control wiring from the smoke detectors to the Air Handling Unit Controller

3. Detectors will send an individual alarm signal to the fire panel.

4. The detectors shall be designed to ignore invisible airborne particles or smoke densities that are below the factory-set alarm point.

5. The smoke detectors shall be capable of operating at a humidity range of 10 to 90 percent RH.

1.3 TRAINING

- A. Provide a minimum of 2 on-Site or classroom training sessions, 4 hours each, throughout the Contract period for personnel designated by the OWNER.

1.4 RELATED SECTIONS

- A. The General Conditions of the Contract, Supplementary Conditions, and General Requirements are a part of this specification and shall be used in conjunction with this section as a part of the contract documents. Consult them for further instructions pertaining to this WORK. The CONTRACTOR is bound by the provisions of Division 0 and Division 1.

B. The following sections constitute related WORK:

1. Section 1 - Submittal Requirements
2. Section 1 - Commissioning
3. Section 23 - Heating Ventilation and Air Conditioning
4. Section 23 - Heat-Generation Equipment
5. Section 23 - Air Handling Equipment
6. Section 23 - Air Conditioning Equipment
7. Section 23 - Air Distribution
8. Section 23 - Test and Balance
9. Section 26 - Basic Electrical requirements
10. Section 26 - Wiring Methods
11. Section 26 - Electrical Power (Uninterruptible Power Supplies, Variable Frequency Drives)
12. Section 26 - Emergency Systems
13. Section 26 - Fire Alarm and Detection System

1.5 CODES AND STANDARDS

- A. All WORK, materials, and equipment shall comply with the rules and regulations of all codes and ordinances of the local, state, and federal authorities having jurisdiction.
- B. Such codes, when more restrictive, shall take precedence over the Contract Documents.
- C. The installation shall comply with the following codes:
 1. National Electric Code (NEC)
 2. International Building Code (IBC)
 3. International Mechanical Code (IMC)
 4. ASHRAE/ANSI 135-2016: Data Communication Protocol for Building Automation and Control Systems (BACNET)
 5. All BAS DDC controllers and local user displays shall be UL-listed under Standard UL 916, category PAZX and Standard ULC C100, category UUKL7.

6. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference and labeled as such.
7. ASHRAE/ANSI 135-2016: Data Communication Protocol for Building Automation and Control Systems (BACnet).

1.6 SYSTEM DESCRIPTION

A. Performance Standards

1. The system shall conform to the minimum standards indicated in Tables 1 and 2, below.
2. Information transmission and display times shall be based upon network, rather than modem, connections.
3. Programmable controllers shall be capable of executing DDCPID control loops at a selectable frequency adjustable down to once per second.
4. The CONTRACTOR shall be responsible for selecting execution times consistent with the mechanical process under control.
5. The system shall report all values with an end-to-end accuracy as listed or better than those listed in Table 1.
6. Control loops shall maintain measured variable at set point within the tolerances listed in Table 2.

Table 1 – Reporting Accuracy

MEASURED VARIABLE	REPORTED ACCURACY
Space Temperature	plus or minus one degree F
Ducted Air	plus or minus one degree F
Outside Air	plus or minus 2 degrees F
Dew Point	plus or minus 3 degrees F
Water Temperature	plus or minus one degree F
Delta-T	plus or minus 0.25 degree F
Relative Humidity	plus or minus 5 percent RH

Water Flow	plus or minus 5 percent of full scale
Airflow (terminal)	plus or minus 10 percent of full scale (see Note 1)
Airflow (measuring stations)	plus or minus 5 percent of full scale
Airflow (pressurized spaces)	plus or minus 3 percent of full scale
Air Pressure (ducts)	plus or minus 0.1 inch w.g.
Air Pressure (space)	plus or minus 0.01 inch w.g.
Water Pressure	plus or minus 2 percent of full scale (see Note 2)
Electrical (A, V, W, Power Factor)	5 percent of reading (see Note 3)
Carbon Monoxide (CO)	plus or minus 5 percent of reading
Carbon Dioxide (CO ₂)	plus or minus 50 ppm

Note 1: 10 percent to 100 percent of full scale

Note 2: for both absolute and differential

pressure Note 3: not including utility-supplied

meters

Table 2 - Control Stability and Accuracy

CONTROLLED VARIABLE	CONTROL ACCURACY	RANGE OF MEDIUM
Airflow	plus or minus 10 percent of full scale	----
Space Temperature	plus or minus 2.0 degrees F	----
Duct Temperature	plus or minus 3 degrees F	----
Humidity	plus or minus 5 percent RH	----

1.7 SUBMITTALS

- A. Furnish submittals in accordance with the requirements of Section 01 33 00 – Contractor Submittals.
- B. No WORK may begin on any segment of the Project until submittals have been successfully reviewed for conformity with the design intent.
- C. Submittals shall include:
 - 1. Direct Digital Control System Hardware
 - a. A complete bill of materials of equipment to be used, indicating quantity, manufacturer, model number, and other relevant technical data.
 - b. Manufacturer's description and technical data, such as performance curves, product specification sheets, and installation and maintenance instructions for the following items and other relevant items not listed:
 - 1) Direct Digital Controller (controller panels)
 - 2) Transducers/Transmitters
 - 3) Sensors (including accuracy data)
 - 4) Actuators
 - 5) Valves
 - 6) Relays/Switches
 - 7) Control Panels
 - 8) Power Supply
 - 9) Batteries

10) Wiring

2. Wiring diagrams and layouts for each control panel, showing all termination numbers.
3. Schematic diagrams for all field sensors and controllers, and floor plans of all sensor locations and control hardware.
4. Diagrams
 - a. Submit schematic diagrams for all control, communication, and power wiring.
 - b. Submit a schematic drawing of the central system installation. Show all interface wiring to the control system.
 - c. Submit riser diagrams of wiring between central control unit and all control panels.

D. Controlled Systems

1. Schematic Diagrams
 - a. Submit a schematic diagram of each controlled system.
 - b. Indicate all control points labeled, with point names shown or listed.
 - c. Graphically show the location of all control elements in the system.
2. Schematic Wiring Diagrams
 - a. Submit a schematic wiring diagram for each controlled system.
 - b. Label all elements.
 - c. Where a control element is the same as that shown on the control system schematic, it shall be labeled with the same name.
 - d. Label all terminals.
3. Instrument List
 - a. Submit an instrumentation list for each controlled system.
 - b. Each element of the controlled system shall be listed in table format.
 - c. The table shall show element name, type of device, manufacturer, model number, and product data sheet number.
4. Description
 - a. A complete description of the operation of the control system, including sequences of operation.

- b. Include and reference a schematic diagram of the controlled system.
5. I/O
- a. Submit a points list for each system controller, including both inputs and outputs (I/O), point number, the controlled device associated with the I/O point, and the location of the I/O device.
6. Quantities of items submitted will be reviewed but shall be the responsibility of the CONTRACTOR.

1.8 QUALITY ASSURANCE

- A. All products used in this project installation shall be new and currently under manufacture, and shall be the version currently being sold by the manufacturer for use in new installations.
- B. This installation shall not be used as a test site for any new products unless explicitly approved by the OWNER in writing. Spare parts shall be available for at least five years after completion of this contract.

1.9 WARRANTY

- A. Labor and materials for the control system specified shall be warranted free from defects for a period of 12 months after final completion and OWNER receives beneficial use of the system.
- B. Control system failures during the warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to the OWNER.
- C. The CONTRACTOR shall respond to the OWNER's request for warranty service within 24 hours during normal business hours.
- D. All WORK shall have a single warranty date, even when the OWNER has received beneficial use due to an early system start-up.
- E. If the WORK specified is split into multiple contracts or a multi-phase contract, then each contract or phase shall have a separate warranty start date and period.

PART 2 – PRODUCTS

- A. Temperature Controls
 - 1. Temperature control Panels provided by HVAC equipment manufacturers shall be in accordance with specification 40 67 00.
 - 2. The temperature control system shall be as indicated on contract documents and shall consist of DDC controllers.
 - 3. HVAC Sub-Subcontractor shall be responsible for the installation, calibration and operator training as necessary for a complete and full operating temperature control system.

4. The temperature control system shall be a complete stand-alone building automation system, modular in construction and not requiring a central computer for operation or programming.
5. All programming shall be possible from a keypad/display on any field panel and from a remote computer.
6. Systems which do not have a keypad/display capability shall be provided with a portable interface with required cables and software.

B. BAS Components

1. The basic elements of the Building Automation System (BAS) structure shall be built from only standard components kept in inventory by the BAS supplier.
2. The components shall not require customizing other than setting jumpers and switches, and adding firmware modules, software modules or software programming to perform required functions.
3. The BAS shall possess a fully modular architecture, permitting expansion through the addition of more DDCP units, sensors, actuators, and operator terminals.
4. Expansion beyond this must be able to be accomplished in additional panels or expansion modules without abandoning any initial equipment.

C. Direct Digital Control Panel

1. The Direct Digital Control Panel's (DDCP's) software shall include a complete operating system, control algorithm application packages, and a complete custom control, calculation application package to accomplish the indicated sequence of operation.
2. In addition to pre-programmed package software, DDCP controllers shall be provided with field-flexible programming capabilities without the use of external equipment such as EPROM programmers in order to meet the indicated requirements.
3. Each DDCP shall be capable of performing all specified control functions in a completely independent manner.
4. Each DDCP unit shall be capable of sharing point information with other such units, such that control sequences or control loops executed at one control unit may receive input signals from sensors connected to other units within the network.

D. Programming

1. Control software shall utilize "block" programming techniques connecting tested control blocks to form control sequencing.
2. Line-by-line programming requiring complete definition will not be accepted as a programming technique.

3. The programmer shall fill in the control parameters for each block to perform the required control sequence.

2.2 CONTROLLER SOFTWARE

- A. Each intelligent field panel shall be completely user programmable, and shall include the indicated programs installed in the base operating system.
- B. Alarms
 1. The alarm program shall provide for alarm reporting as follows:
 - a. Pilot light indication at local ATC Panel
 - b. Remote annunciation of identified alarm "HVAC Fail" to facility SCADA System via hardwired contact closure from Building Main Control Panel.
- C. Analog Input Scaling
 1. Analog inputs shall be scaled and labeled to read out in engineering units of the variable being measured (e.g., DEG., CFM, etc.).
- D. Analog Outputs
 1. Each analog output shall be user programmable to be direct or reverse acting and vary the output between 2 and 10 VDC.
 2. The panel shall allow the user to program minimum and maximum output levels as well as a manual fixed output level.
 3. The analog output shall be assignable to operate based on any physical input or calculated value on the network.
- E. System Calendar
 1. The master temperature control panel shall be provided with a 365/366 day battery-backed clock, with an automatic daylight savings time switch-over on the day entered.
- F. PID Control
 1. In order to provide precise control, each analog output shall be programmable with a proportional plus integral plus derivative (PID) program.
 2. Individual constants shall be programmable for the P, I, and D functions.
 3. The integral time interval shall be user programmable.
 4. The current proportional term, the integral term, and the PID sum shall be dynamically displayed on the screen to provide assistance to start-up and service personnel in tuning the system.

- G. The diagnostics program in each panel shall monitor and report system status.

2.3 BUILDING CONTROLLERS

A. General

1. Each controller shall meet the following requirements.
 - a. The Building Controller shall be provided with sufficient memory to support its operating system, database, and programming requirements.
 - b. Controllers that perform scheduling shall be provided with a real-time clock.

B. Communication

1. The Building Controller shall be provided with a service communication port for connection to a portable operator terminal.

C. Environment

1. Building Controller hardware shall be suitable for the anticipated ambient conditions.
2. Controllers used outdoors or in wet ambient conditions shall be mounted within waterproof enclosures, and shall be rated for operation at minus 40 degrees F to plus 150 degrees F.
3. Controllers used in conditioned space shall be mounted in dust-protective enclosures, and shall be rated for operation at 32 degrees F to 120 degrees F.

D. Keypad

1. Provide a local keypad and display or a connection for a portable operator terminal for each Building Controller.
2. The keypad shall be provided for interrogating and editing data.
3. An optional system security password shall be available to prevent unauthorized use of the keypad and display.
4. If the manufacturer does not provide this keypad and display, provide a portable operator terminal.

E. Serviceability

1. Provide diagnostic LEDs for power, communication, and processor.
2. All wiring connections shall be made to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.

F. Memory

1. The Building Controller shall maintain all BIOS and programming information in the event of a power loss for at least 72 hours.
2. Applications shall be maintained in flash memory.

G. Immunity to Power and Noise

1. The controller shall operate at 90 percent to 110 percent of its nominal voltage rating, and shall perform an orderly shutdown below 80 percent nominal voltage.
2. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 3 feet.

2.4 INPUT/OUTPUT INTERFACE

A. Hardwired inputs and outputs may tie into the system through building controllers, advanced application controllers, or application-specific controllers.

B. Input points and output points shall be protected such that shorting of the point to itself, to another point, or to ground will cause no damage to the controller.

C. All input and output points shall be protected from voltage up to 24 V of any duration, such that contact with this voltage will cause no damage to the controller.

D. Binary Inputs

1. Provide binary inputs to allow the monitoring of ON-OFF signals from remote devices.
2. The binary inputs shall provide a wetting current of at least 12 mA in order to be compatible with commonly available control devices, and shall be protected against the effects of contact bounce and noise.
3. Binary inputs shall sense “dry contact” closure without external power (other than that provided by the controller) being applied.

2.5 AUXILIARY CONTROL DEVICES

A. General

1. All materials and equipment used shall be standard components, of regular manufacture for this application.
2. All systems and components shall have been thoroughly tested and proven in actual use.
3. Exceptions to the indicated requirements will not be accepted.

B. Control Valves

1. Control valves shall be of the 2-way or 3-way type, as indicated.
2. Provide valve actuators and trim in order to provide the following minimum close-off (differential) pressure ratings:

- a. Water Valves (2-way): 50 percent of total system (pump) head
 - b. Water Valves (3-way): 300 percent of pressure differential between ports A and B at design flow, or 100 percent of total system (pump) head
3. Water Valves
- a. Body and trim style and materials shall be in accordance with manufacturer's recommendations for the design conditions and indicated service, with equal percentage ports for modulating service.
 - b. Valve Sizing Criteria:
 - 1) Two-position Service: line size
 - 2) Two-way Modulating Service: Pressure drop shall be equal to twice the pressure drop through heat exchanger (load), 50 percent of the pressure difference between supply and return mains, or 5 psi, whichever is greater.
 - 3) Three-way Modulating Service: Pressure drop shall be equal to twice the pressure drop through the coil exchanger (load), 5 psi maximum.
 - 4) Where butterfly valves are to be used for modulating service, the valve shall be sized no smaller than a drop of one line size.
 - c. Ball valves will be accepted for modulating, floating or 2-position operation where the valve size is less than one inch.
 - d. Ball valves shall be provided with bronze cast brass ANSI Class 250 bodies, a nickel-plated brass ball, a brass stem, and an RTFE seat with EPDM O-ring seal.
 - e. Globe Valves
 - 1) Control valves up to 4-inch shall be of the globe type.
 - 2) Globe valves of sizes up to and including 2-1/2-inch shall be provided with a screwed configuration.
 - 3) Provide a flanged configuration for globe valves 3-inch and larger.
 - 4) All globe-type control valves shall be provided with a cast iron ANSI Class 125 body, as a minimum, with a brass-guided plug, self-adjusting EPR ring U-cup packing, and a molded elastomer disc seat.
 - f. Butterfly Valves
 - 1) Valves larger than 4-inch shall be of the butterfly type.
 - 2) All butterfly valves shall be provided with ANSI Class 150, polyester coated, cast iron, lug type bodies, with aluminum bronze discs, Buna-N elastomer

seats, acetal bushing, and self-adjusting stem seals.

C. Valve Actuators

1. Electronic valve actuators shall be suitable for direct-coupled mounting to the valve bonnet.
2. Valve actuators shall be properly sized to provide sufficient torque to position the valve throughout its operating range.
3. All globe valve actuators shall be of the spring return type.
4. Where butterfly valves are indicated, double-acting non-spring return actuators may be used.
5. Unless otherwise indicated, provide normally open valves for heating water applications and normally closed valves for chilled water applications.

D. Damper Actuators

1. Electronic damper actuators shall be of the direct-couple rotary type, suitable for mounting directly on the damper end shaft.
2. Electronic damper actuators shall be properly sized to provide sufficient torque to position the damper throughout its operating range.
3. On dampers with multiple sections, provide one actuator per section.
4. Damper actuators used on economizers and outside air dampers shall be of the spring return type.

E. Control Panels

1. All programmable logic controllers controllers for HVAC equipment located indoors shall be installed in NEMA enclosures matching the electrical equipment in the same area.
2. All programmable logic controllers mounted on HVAC equipment located outdoors shall be installed in NEMA 4X enclosures.
3. Enclosures shall be of suitable size to accommodate power supplies, relays, and accessories as required for the application.
4. Each enclosure shall include a subpanel for direct mounting of the enclosed devices, including matched key locks for all enclosures.
5. Construction
 - a. Control panels shall contain all relays, control switches, transformers, pilot lights, timers, time clocks, step controllers, gages, thermostats, and other accessories as necessary for the particular system.
 - b. The panels shall be constructed of aluminum with a baked enamel finish, and shall

include a hinged front door with locking handle.

- c. All manual switches and direct-reading gauges shall be flush-mounted on the front face, and identified by engraved and riveted Bakelite or laminated plastic nameplates with white letters on black background.
 - d. Manual switches shall be of heavy-duty, oil-tight construction.
6. Wiring
- a. Control devices shall be pre-wired internally.
 - b. Terminate all wires leaving the panel at separate numbered terminal strips.
 - c. Provide individual connectors for every item of mechanical equipment, all integral and remote pilot lights, and other devices indicated for each panel.
 - d. Power and control circuit requirements shall be as indicated on the Electrical Drawings.
 - e. Identify all wires by color coding or numerical tags at both ends.
 - f. Wire each control device without splices to the terminal strip.
 - g. Provide integral circuit protection for all panel-mounted control devices.
 - h. Wire each panel with a single 20-amp, 120-volt, AC feeder in accordance with the requirements of Section 26 05 15 – Local Control Panels.
7. Panel electrical wiring diagrams shall be secured to the inside of the panel door.

F. Differential Pressure Switches (Air)

- 1. Provide differential pressure switches across fans and filters for status indication.
- 2. The differential pressure switches shall be provided with an adjustable setpoint from 0.05 inch w.c. to 12 inches w.c., with a switch differential that progressively increases from 0.04 inch w.c. at minimum to 0.8 inch w.c. at maximum.
- 3. The switch shall be SPDT-rated for 15A (non-inductive) at 125VAC.

G. Float Switches

- 1. Provide float switches in condensate drain pans as required by code.
- 2. Float switches shall utilize a magnetically actuated dry reed switch.
- 3. The float shall be constructed of seamless polypropylene.
- 4. The switch shall be SPDT-rated for 16A (non-inductive) at 120VAC.

H. Smoke Detectors

1. Division 26 – shall provide HVAC duct and area smoke detectors and wire into the fire alarm system.
 2. Division 23 – shall provide interlock wiring between duct smoke detectors and controls
- I. Differential Pressure Transducers (Air)
1. Provide differential pressure transducers for monitoring air system and airflow measuring station differential pressures.
 2. Differential pressure transducers shall be 100 percent solid-state, and shall include glass-on-silicon, ultra-stable capacitance sensors.
 3. Each differential pressure transducer shall incorporate short circuit and reverse polarity protection.
 4. Transducer output shall be either 0-10 VDC or 4-20 mA.
 5. Provide the differential pressure transducers in an enclosure that is suitable for duct mounting.
 6. The desired set point shall be within the top 50 percent of the transducer's operating range.
- J. Current Sensing Relays
1. Provide current switches for indication of equipment status.
 2. Amperage ratings shall be adjustable, with the desired set point to be within the top 50 percent of the current relay's operating range.
 3. Current sensing relays shall incorporate trip indication LEDs, and shall be sized for proper operation with the equipment served.
- K. Thermostats - Line Voltage
1. Materials: cold-rolled steel; beige thermoplastic; liquid sensing element
 2. Contact Rating
 - a. 6 amps running; 36 amps locked rotor; 120 VAC
 - b. 3.5 amps running; 21 amps locked rotor; 208 VAC
 - c. 3.0 amps running; 8 amps locked rotor; 240 VAC
 3. Switch Action: single-pole, double-throw; open on rising temperature
 4. Sensing Element: coiled bulb and capillary

5. Range: 0 to 130 degrees F
6. Manufacturers
 - a. Dry Locations (no hose valves or open water processes in room): Trane, Johnson Controls or equal
 - b. Wet (hose valves or open water processes in room) or Outdoor Locations: Trane, Johnson Controls, or equal in NEMA 4X enclosure.

L. Duct and Well Temperature Sensors

1. Sensors for duct and water temperature sensing shall incorporate either RTD or thermistor sensing devices.
2. The sensing element accuracy shall be 0.1 percent or better over the sensor span.
3. Where the element is being used for sensing mixed air or coil discharge temperatures or the duct cross sectional area is in excess of 10 square feet, the element shall be of the averaging type.
4. Immersion sensors shall use matched Type 316 stainless steel bulb wells.
5. Provide duct and immersion sensors with conduit connection housings.
6. Provide sensors with adequate standoffs for insulation installation.

M. Selector Switches

1. Selector switches shall be of the 2- or 3-position, knob or key type as required by the sequence of operation.
2. Selector switches shall be of oil-tight construction and fitted with snap-fit contact blocks rated for 10A, 600 VAC/DC operation.
3. Provide labels indicating switch position.

N. Pushbutton Switches

1. Pushbutton switches shall be of either the maintained or momentary type as required by the sequence of operation.
2. Pushbutton switches shall be of oil-tight construction and fitted with snap-fit contact blocks rated for 10A, 600 VAC/DC operation.
3. Provide labels indicating switch function.

O. Pilot Lights

1. Provide pilot lights as required by the sequence of operation.
2. Pilot lights shall utilize multi-colored dome lenses and replaceable LED lamps.

3. Provide labels indicating light function.

2.6 WIRING AND RACEWAYS

- A. Provide copper wiring, plenum cable, and raceways as indicated in the applicable Sections of Division 26 – Electrical.
- B. All insulated wire shall be copper conductor, and UL-labeled for 90-degree C minimum service.

2.7 CONTROL SYSTEM CONTRACTORS AND MANUFACTURERS, OR EQUAL

- A. Trane – Authorized Field Office, Gardiner Trane
- B. Schneider Electric – Authorized Field Office, Wadsworth Solutions
- C. Johnson Controls – Factory Branch Office
- D. Siemens – Factory Branch Office
- E. Honeywell – Factory Branch Office
- F. The above list of manufacturers applies to controller software, custom application programming language, building controllers, custom application controllers; and application specific controllers; all other indicated products (e.g., sensors, valves, dampers and actuators) need not necessarily be manufactured by the above manufacturers.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. The Drawings shall be thoroughly examined for control device and equipment locations, and any discrepancies, conflicts, or omissions shall be reported to the ENGINEER for resolution before rough-in work is started.
- B. Inspect the Project Site to verify that the equipment may be installed as indicated, and report any discrepancies, conflicts, or omissions to the ENGINEER for resolution before rough-in work is started.
- C. Examine the Contract Documents for other parts of the WORK, and if head room or space conditions appear inadequate, report these discrepancies to the ENGINEER and obtain written instructions for any changes that may be necessary to accommodate the WORK with the work of others.
- D. Changes in the WORK made necessary by the failure or neglect of the CONTRACTOR to report such discrepancies shall be considered to be part of the Contract.

3.2 COORDINATION

- A. Site
 - 1. Where the WORK will be installed in close proximity to, or will interfere with, the work

of other trades, the CONTRACTOR shall assist in accommodating space conditions to make a satisfactory adjustment.

2. If the CONTRACTOR installs the WORK before coordinating with other trades, so as to cause any interference with the work of other trades, the CONTRACTOR shall make the necessary changes in the WORK in order to correct the condition as part of the Contract.
3. Coordinate and schedule the WORK with all other work in the same area, or with work that is dependent upon other work, in order to facilitate mutual progress.

B. Coordination with Other Controls

1. Other controls and control devices that are to be part of or integrated into the control system specified in this section. These controls shall be integrated into the system and coordinated by the contractor as follows:
2. All communication media and equipment shall be provided as specified in Part 2, "Communication" of this Specification.
3. Each supplier of a control product is responsible for the configuration, programming, startup, and testing of that product to meet the sequences of operation described in this Section.
4. The HVAC Sub-Contractor shall coordinate and resolve any incompatibility issues that arise between the control products provided under this section and those provided under other sections or divisions of this specification.
5. The HVAC Sub-Contractor is responsible for the integration of control products provided by multiple suppliers regardless of where this integration is described within the contract documents.

C. Coordination with Facility SCADA System

1. Each Automatic Temperature Control System Panel (ATC) shall annunciate critical alarms with Pilot Light (Red) illumination.
2. Zone alarms will also be annunciated to the Facility SCADA system via hard wired contact closure at Building Main Control Panel.
3. All other local Pilot Light indication (Green – System On) (Yellow – System Caution) (Blue – System Off) are considered non-critical and not required to be annunciated to the Facility SCADA System
4. Division 23 - shall provide necessary relays and termination strip for wiring to the Facility SCADA System. Conduit and wiring between the Main Panel and the SCADA system shall be by Electrical Sub - Contractor
5. See general sheets for ATC panel and Pilot Light layout.

3.3 GENERAL WORKMANSHIP

- A. Install equipment, piping, wiring, and raceway parallel to building lines (i.e., horizontal, vertical, and parallel to walls) wherever possible.

- B. Provide sufficient slack and flexible connections to allow for vibration isolation of piping and equipment.
- C. Install all equipment in readily accessible locations as defined by the National Electrical Code (NEC).
- D. Verify the integrity of all wiring to ensure continuity and freedom from shorts and grounds.
- E. All equipment, installation, and wiring shall comply with acceptable industry specifications and standards for performance, reliability, and compatibility and shall be executed in strict adherence to local codes and standard practices.

3.4 WIRING FOR CONTROL SYSTEMS

- A. Furnish and install all wire, conduit, raceways, and cable systems as required for the complete operation of the Building Management and Control System in accordance with the requirements of Section 26 05 19 – Wire and Cable.

3.5 SENSOR INSTALLATION

- A. Install sensors in accordance with the manufacturer's recommendations.
- B. Mount sensors rigidly and adequately for the environment within which the sensor operates.
- C. Room temperature sensors shall be installed on concealed junction boxes properly supported by the wall framing.
- D. All wires attached to sensors shall be air-sealed in their raceways or in the wall in order to stop air transmitted from other areas from affecting sensor readings.
- E. Averaging Sensors
 - 1. Sensors used in mixing plenums and hot and cold decks shall be of the averaging type.
 - 2. Averaging sensors shall be installed in a serpentine manner vertically across the duct.
 - 3. Support each bend with a capillary clip.
- F. Temperature Sensors
 - 1. All pipe-mounted temperature sensors shall be installed in wells.
 - 2. Install all liquid temperature sensors with heat-conducting fluid (thermal mastic) in thermal wells.
- G. Pressure Transducers
 - 1. The piping to the pressure ports on all pressure transducers shall contain a capped test port located adjacent to the transducer.

2. All pressure transducers, other than those controlling VAV boxes, shall be located in field device panels and not on the equipment monitored or on ductwork.
3. Mount transducers in a vibration-free location accessible for service without the need for ladders or special equipment.
4. All air and water differential pressure sensors shall be provided with gauge tees mounted adjacent to the taps, and water gauges shall be provided with shutoff valves installed before the tee.

3.6 ACTUATORS

- A. Mount and link control damper actuators according to manufacturer's instructions.
- B. To compress seals when spring-return actuators are used on normally closed dampers, the actuator shall be powered to an approximately 5-degree open position, the damper closed manually, and then the linkage tightened.
- C. Check the operation of damper/actuator combination in order to confirm that the actuator modulates damper smoothly throughout the stroke to both OPEN and CLOSED positions.
- D. Provide all mounting hardware and linkages for the actuator installation.
- E. Electric and Electronic Actuators
 1. Dampers
 - a. Actuators shall be direct-mounted on the damper shaft or jackshaft unless indicated as a linkage installation.
 - b. For low-leakage dampers with seals, the actuator shall be mounted with a minimum 5 degrees available for tightening the damper seals.
 - c. Actuators shall be mounted in accordance with the manufacturer's recommendations.
 2. Valves
 - a. Actuators shall be connected to valves with adapters approved by the actuator manufacturer.
 - b. The actuators and adapters shall be mounted in accordance with the actuator manufacturer's recommendations.

3.7 CONTROLLERS

- A. General
 1. Provide a separate controller for each Zone area or other HVAC system.
 2. A DDC controller may control more than one system in a zone provided that all points associated with the system are assigned to the same DDC controller.

3. Control of an AHU or other mechanical equipment item shall not be split between multiple controllers; points used for control loop reset, such as outside air or space temperature, are exempt from this requirement.

B. Building Controllers and Custom Application Controllers

1. Building controllers and custom application controllers shall be selected to provide a minimum of 15 percent spare I/O point capacity for each point type found at each location.
2. If input points are not universal, 15 percent of each type shall be required, and if outputs are not universal, 15 percent of each type is required.
3. A minimum of one spare is required for each type of point used.
4. The future use of spare capacity shall require providing the field device, field wiring, point database definition, and custom software.
5. No additional controller boards or point modules shall be required to implement use of such spare points.

3.8 PROGRAMMING

- A. Provide sufficient internal memory for the specified sequences of operation and trend logging.

- B. Provide a minimum of 25 percent of available memory free for future use.

C. BACnet Points

1. Provide a detailed BACnet points list.
2. In addition to standard I/O information, the BACnet points list shall contain the proposed I/O names and BACnet object description.
3. The proposed I/O names and object descriptions are subject to change as directed by the ENGINEER.
4. Deliver an as-built list of the BACnet points with actual names and BACnet object addresses to the OWNER at Project completion.

D. Software Programming

1. Provide programming for the system and adhere to the indicated sequences of operation.
2. Provide all other system programming necessary for the operation of the system but not indicated in this Section.
3. Embed into the control program sufficient comment statements to clearly describe each section of the program, reflecting the language used in the sequences of

operation.

3.9 CONTROL SYSTEM CHECKOUT AND TESTING

A. Start-up Testing

1. All testing listed in this article shall be performed by the CONTRACTOR and shall make up part of the necessary verification of an operating control system.
2. This testing shall be completed before the ENGINEER is notified of the system demonstration.

B. Furnish all labor and test apparatus required to calibrate and prepare for service of all instruments, controls, and accessory equipment furnished under this Section.

C. Verify that all control wiring is properly connected, free of shorts and ground faults, and that terminations are tight.

D. Enable the control systems and verify calibration of all input devices individually.

E. Perform calibration procedures according to manufacturers' recommendations.

F. Verify that all binary output devices (e.g., relays, solenoid valves, two-position actuators and control valves, magnetic starters, etc.) operate properly and that the normal positions are correct.

G. Verify that all analog output devices (e.g., I/Ps, actuators, etc.) are functional, that start and span are correct, and that direction and normal positions are correct.

H. Control Valves

1. Check all control valves and automatic dampers in order to ensure proper action and closure.
2. Make any necessary adjustments to valve stem and damper blade travel.

I. Verify that the system operation adheres to the sequences of operation.

J. Simulate and observe all modes of operation by overriding and varying inputs and schedules.

K. Tune all PID loops and optimize START/STOP routines.

L. Alarms and Interlocks

1. Check each alarm separately by including an appropriate signal at a value that will trip the alarm.
2. Interlocks shall be tripped using field contacts to check the logic, as well as to ensure that the fail-safe condition for all actuators is in the proper direction.

3. Interlock actions shall be tested by simulating alarm conditions to check the initiating value of the variable and interlock action.

3.10 CONTROL SYSTEM DEMONSTRATION AND ACCEPTANCE

A. Demonstration

1. Prior to acceptance, the control system shall undergo a series of performance tests to verify operation and compliance with this Section.
2. These tests shall occur after the CONTRACTOR has completed the installation, started up the system, and performed tests.

3.11 TRAINING

- A. Provide a minimum of 2 on-Site or classroom training sessions, 4 hours each, throughout the Contract period for personnel designated by the City.

END OF SECTION

SECTION 23 23 00
REFRIGERANT LINES

PART 1 – GENERAL

1.1 THE SUMMARY

- A. The CONTRACTOR shall provide copper tube for refrigeration service, complete and in place, as indicated in accordance with the Contract Documents

1.2 REFERENCES

- A. AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)
- B. AHRI 710 (2009) Performance Rating of Liquid-Line Driers
- C. AHRI 711 (2009) Performance Rating of Liquid-Line Driers
- D. AHRI 720 (2002) Refrigerant Access Valves and Hose Connectors
- E. ANSI/AHRI 750 (2007) Thermostatic Refrigerant Expansion Valves
- F. ANSI/AHRI 760 (2007) Performance Rating of Solenoid Valves for Use With Volatile Refrigerants
- G. AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR- CONDITIONING ENGINEERS (ASHRAE)
- H. ANSI/ASHRAE 15 & 34
- I. ASHRAE 17 (2008) Method of Testing Capacity of Thermostatic Refrigerant Expansion Valves
- J. AMERICAN WELDING SOCIETY AWS A5.8/A5.8M (2011) Specification for Filler Metals for Brazing and Braze Welding, AWS BRH (2007; 5th Ed) Brazing Handbook, AWS D1.1/D1.1M (2010) Structural Welding Code – Steel, AWS Z49.1 (2005) Safety in Welding and Cutting and Allied Processes
- K. ASME INTERNATIONAL (ASME)
- L. ASME B1.20.1 (1983; R 2006) Pipe Threads, General Purpose
- M. ASME B16.11 (2009) Forged Fittings, Socket-Welding and Threaded
- N. ASME B16.21 (2011) Nonmetallic Flat Gaskets for Pipe Flanges
- O. ASME B16.22 (2001; R 2010) Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
- P. ASME B16.26 (2011) Standard for Cast Copper Alloy Fittings for Flared Copper Tubes

- Q. ASME B16.3 (2011) Malleable Iron Threaded Fittings, Classes 150 and 300
- R. ASME B16.5 (2009) Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard
- S. ASME B16.9 (2007) Standard for Factory-Made Wrought Steel Buttwelding Fittings
- T. ASME B31.1 (2010) Power Piping
- U. ASME B31.5 (2010) Refrigeration Piping and Heat Transfer Components
- V. ASME B31.9 (2011) Building Services Piping
- W. ASME B40.100 (2005; R 2010) Pressure Gauges and Gauge Attachments
- X. ASME BPVC SEC IX (2010) BPVC Section IX-Welding and Brazing Qualifications
- Y. ASTM INTERNATIONAL (ASTM)
- Z. ASTM A193/A193M (2011) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and Other Special Purpose Applications
- AA. ASTM A334/A334M (2004a; R 2010) Standard Specification for Seamless and Welded Carbon and Alloy-Steel Tubes for Low-Temperature Service
- BB. ASTM A53/A53M (2010) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
- CC. ASTM A653/A653M (2011) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- DD. ASTM B117 (2011) Standard Practice for Operating Salt Spray (Fog) Apparatus EE.
- ASTM B280 (2008) Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
- FF. ASTM B32 (2008) Standard Specification for Solder Metal
- GG. ASTM B62 (2009) Standard Specification for Composition Bronze or Ounce Metal Castings
- HH. ASTM B75 (2002; R 2010) Standard Specification for Seamless Copper Tube
- II. ASTM B75M (1999; R 2011) Standard Specification for Seamless Copper Tube (Metric)
- JJ. ASTM B813 (2010) Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube

KK. ASTM D3308 (2006) PTFE Resin Skived Tape LL.

ASTM D520 (2000; R 2011) Zinc Dust Pigment

MM.ASTM E84 (2011b) Standard Test Method for Surface Burning Characteristics of Building Materials

1.3 QUALITY ASSURANCE

- A. Submit four (4) copies of qualified procedures, and list of names and identification symbols of qualified welders and welding operators, prior to non- factory welding operations. Piping shall be welded in accordance with the qualified procedures using performance qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPVC SEC IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer may be accepted as permitted by ASME B31.1. Notify the Contracting Officer 24 hours in advance of tests to be performed at the work site, if practical. The welder or welding operator shall apply the personally assigned symbol near each weld made, as a permanent record.
- B. Contract Drawings: Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. Carefully investigate the plumbing, fire protection, electrical, structural and finish conditions that would affect the work to be performed and arrange such work accordingly, furnishing required offsets, fittings, and accessories to meet such conditions.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect stored items from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Proper protection and care of all material both before and during installation is the Contractor's responsibility. Replace any materials found to be damaged at the Contractor's expense. During installation, cap piping and similar openings to keep out dirt and other foreign matter.

PART 2 – PRODUCTS

2.1 REFRIGERANT PIPING SYSTEM

- A. Refrigerant piping, valves, fittings, and accessories shall be in accordance with ANSI/ASHRAE 15 & 34 and ASME B31.5, except as specified herein. Refrigerant piping, valves, fittings, and accessories shall be compatible with the fluids used and capable of withstanding the pressures and temperatures of the service. Refrigerant piping, valves, and accessories used for refrigerant service shall be cleaned, dehydrated, and sealed (capped or plugged) prior to shipment from the manufacturer's plant. Submit drawings, at least 2 weeks prior to beginning construction, provided in adequate detail to demonstrate compliance with contract requirements. Drawings shall consist of:

1. Piping layouts which identify all valves and fittings.
2. Plans and elevations which identify clearances required for maintenance and operation.

2.2 PIPE, FITTINGS AND END CONNECTIONS (JOINTS)

A. Copper Tubing:

1. Copper tubing shall conform to ASTM B280 annealed or hard drawn as required.
2. Copper tubing shall be soft annealed where bending is required and hard drawn where no bending is required.
3. Soft annealed copper tubing shall not be used in sizes larger than 1-3/8 inches. Joints shall be brazed except that joints on lines 7/8 inch and smaller may be flared. Cast copper alloy fittings for flared copper tube shall conform to ASME B16.26 and ASTM B62.
4. Wrought copper and bronze solder-joint pressure fittings shall conform to ASME B16.22 and ASTM B75M ASTM B75. Joints and fittings for brazed joint shall be wrought-copper or forged-brass sweat fittings.
5. Cast sweat-type joints and fittings shall not be allowed for brazed joints. Brass or bronze adapters for brazed tubing may be used for connecting tubing to flanges and to threaded ends of valves and equipment.

B. Solder

1. Solder shall conform to ASTM B32, grade Sb5, tin-antimony alloy for service pressures up to 1034 kPa 150 psig. Solder flux shall be liquid or paste form, non-corrosive and conform to ASTM B813.

C. Brazing Filler Metal

1. Filler metal shall conform to AWS A5.8/A5.8M, Type BAg-5 with AWS Type 3 flux, except Type BCuP-5 or BCuP-6 may be used for brazing copper-to-copper joints.

2.3 VALVES

1. Valves shall be designed, manufactured, and tested specifically for refrigerant service. Valve bodies shall be of brass, bronze, steel, or ductile iron construction. Valves 25 mm 1 inch and smaller shall have brazed or socket welded connections. Valves larger than 25 mm 1 inch shall have butt welded end connections.
2. Threaded end connections shall not be used, except in pilot pressure or gauge lines where maintenance disassembly is required and welded flanges cannot be used. Internal parts shall be removable for inspection or replacement without applying heat or breaking pipe connections.
3. Valve stems exposed to the atmosphere shall be stainless steel or corrosion resistant metal plated carbon steel. Direction of flow shall be legibly and permanently indicated on the valve body.

4. Control valve inlets shall be fitted with integral or adapted strainer or filter where recommended or required by the manufacturer. Purge, charge and receiver valves shall be of manufacturer's standard configuration.
- B. Refrigerant Stop Valves
1. Valve shall be the globe or full-port ball type with a back-seating stem especially packed for refrigerant service. Valve packing shall be replaceable under line pressure. Valve shall be provided with a handwheel operator and a seal cap. Valve shall be the straight or angle pattern design as indicated.
- C. Check Valves
1. Valve shall be the swing or lift type as required to provide positive shutoff at the differential pressure indicated. Valve shall be provide with resilient seat.
- D. Liquid Solenoid Valves
1. Valves shall comply with ANSI/AHRI 760 and be suitable for continuous duty with applied voltages 15 percent under and 5 percent over nominal rated voltage at maximum and minimum encountered pressure and temperature service conditions.
 2. Valves shall be direct-acting or pilot-operating type, packless, except that packed stem, seal capped, manual lifting provisions shall be furnished. Solenoid coils shall be moisture-proof, UL approved, totally encapsulated or encapsulated and metal jacketed as required.
 3. Valves shall have safe working pressure of 600 psi and a maximum operating pressure differential of at least 200 psi at 85 percent rated voltage. Valves shall have an operating pressure differential suitable for the refrigerant used.
- E. Expansion Valves
1. Valve shall conform to ANSI/AHRI 750 and ASHRAE 17. Valve shall be the diaphragm and spring-loaded type with internal or external equalizers, and bulb and capillary tubing.
 2. Valve shall be provided with an external superheat adjustment along with a seal cap. Internal equalizers may be utilized where flowing refrigerant pressure drop between outlet of the valve and inlet to the evaporator coil is negligible and pressure drop across the evaporator is less than the pressure difference corresponding to 2 degrees F of saturated suction temperature at evaporator conditions. Bulb charge shall be determined by the manufacturer for the application and such that liquid will remain in the bulb at all operating conditions. Gas limited liquid charged valves and other valve devices for limiting evaporator pressure shall not be used without a distributor or discharge tube or effective means to prevent loss of control when bulb becomes warmer than valve body.
 3. Pilot-operated valves shall have a characterized plug to provide required modulating control. A de-energized solenoid valve may be used in the pilot line to

close the main valve in lieu of a solenoid valve in the main liquid line. An isolatable pressure gauge shall be provided in the pilot line, at the main valve.

4. Automatic pressure reducing or constant pressure regulating expansion valves may be used only where indicated or for constant evaporator loads.

F. Safety Relief Valves

1. Valve shall be the two-way type, unless indicated otherwise.
2. Valve shall bear the ASME code symbol. Valve capacity shall be certified by the National Board of Boiler and Pressure Vessel Inspectors. Valve shall be of an automatically reseating design after activation.

G. Evaporator Pressure Regulators, Direct-Acting

1. Valve shall include a diaphragm/spring assembly, external pressure adjustment with seal cap, and pressure gauge port. Valve shall maintain a constant inlet pressure by balancing inlet pressure on diaphragm against an adjustable spring load. Pressure drop at system design load shall not exceed the pressure difference corresponding to a 2 degrees F change in saturated refrigerant temperature at evaporator operating suction temperature. Spring shall be selected for indicated maximum allowable suction pressure range.

H. Refrigerant Access Valves

1. Refrigerant access valves and hose connections shall be in accordance with AHRI 720.

2.4 PIPING ACCESSORIES

A. Filter Driers

1. Driers shall conform to AHRI 711/AHRI 710. Sizes 15 mm 5/8 inch and larger shall be the full flow, replaceable core type. Sizes 1/2 inch and smaller shall be the sealed type. Cores shall be of suitable desiccant that will not plug, cake, dust, channel, or break down, and shall remove water, acid, and foreign material from the refrigerant.
2. Filter driers shall be constructed so that none of the desiccant will pass into the refrigerant lines. Minimum bursting pressure shall be 1,500 psi.
3. Filter driers must have bi-directional functionality for reverse cycle operation.

B. Sight Glass and Liquid Level Indicator

1. Assembly and Components: Assembly shall be pressure- and temperature- rated and constructed of materials suitable for the service. Glass shall be borosilicate type.
2. Ferrous components subject to condensation shall be electro-galvanized.

C. Gauge Glass

1. Gauge glass shall include top and bottom isolation valves fitted with automatic checks, and packing followers; red-line or green-line gauge glass; elastomer or polymer packing to suit the service; and gauge glass guard.
- D. Bull's-Eye and Inline Sight Glass Reflex Lens
1. Bull's-eye and inline sight glass reflex lens shall be provided for dead-end liquid service. For pipe line mounting, two plain lenses in one body suitable for backlighted viewing shall be provided.
- E. Moisture Indicator
1. Indicator shall be a self-reversible action, moisture reactive, color changing media. Indicator shall be furnished with full-color-printing tag containing color, moisture and temperature criteria. Unless otherwise indicated, the moisture indicator shall be an integral part of each corresponding sight glass.
- F. Vibration Dampeners
1. Dampeners shall be of the all-metallic bellows and woven-wire type.
- G. Flexible Pipe Connectors
1. Connector shall be a composite of interior corrugated phosphor bronze or Type 300 Series stainless steel, as required for fluid service, with exterior reinforcement of bronze, stainless steel or monel wire braid. Assembly shall be constructed with a safety factor of not less than 4 at 300 degrees F. Unless otherwise indicated, the length of a flexible connector shall be as recommended by the manufacturer for the service intended.
- H. Strainers
1. Strainers used in refrigerant service shall have brass or cast iron body, Y-or angle-pattern, cleanable, not less than 60-mesh noncorroding screen of an area to provide net free area not less than ten times the pipe diameter with pressure rating compatible with the refrigerant service. Screens shall be stainless steel or monel and reinforced spring-loaded where necessary for bypass-proof construction.
- I. Pressure and Vacuum Gauges
1. Gauges shall conform to ASME B40.100 and shall be provided with throttling type needle valve or a pulsation dampener and shut-off valve. Gauge shall be a minimum of 3-1/2 inches in diameter with a range from 0 kPa 0 psig to approximately 1.5 times the maximum system working pressure. Each gauge range shall be selected so that at normal operating pressure, the needle is within the middle-third of the range
- J. Temperature Gauges
1. Temperature gauges shall be the industrial duty type and be provided for the required temperature range. Gauges shall have Fahrenheit scale in 2 degrees graduations scale (black numbers) on a white face. The pointer shall be

adjustable. Rigid stem type temperature gauges shall be provided in thermal wells located within 1.5 m 5 feet of the finished floor. Universal adjustable angle type or remote element type temperature gauges shall be provided in thermal wells located 5 to 7 feet above the finished floor. Remote element type temperature gauges shall be provided in thermal wells located 1.1 m 7 feet above the finished floor.

K. Thermal Well

1. Thermal well shall be identical size, 1/2 or 3/4 inch NPT connection, brass or stainless steel. Where test wells are indicated, provide captive plug-fitted type 1/2 inch NPT connection suitable for use with either engraved stem or standard separable socket thermometer or thermostat. Mercury shall not be used in thermometers. Extended neck thermal wells shall be of sufficient length to clear insulation thickness by 1 inch.

L. Pipe Hangers, Inserts, and Supports

1. Pipe hangers, inserts, guides, and supports shall conform to MSS SP-58 and MSS SP-69.

M. Escutcheons

1. Escutcheons shall be chromium-plated iron or chromium-plated brass, either one piece or split pattern, held in place by internal spring tension or set screws.

2.5 FABRICATION

A. Factory Coating

1. Unless otherwise specified, equipment and component items, when fabricated from ferrous metal, shall be factory finished with the manufacturer's standard finish, except that items located outside of buildings shall have weather resistant finishes that will withstand [125] [500] hours exposure to the salt spray test specified in ASTM B117 using a 5 percent sodium chloride solution. Immediately after completion of the test, the specimen shall show no signs of blistering, wrinkling, cracking, or loss of adhesion and no sign of rust creepage beyond 3 mm 1/8 inch on either side of the scratch mark. Cut edges of galvanized surfaces where hot-dip galvanized sheet steel is used shall be coated with a zinc-rich coating conforming to ASTM D520, Type I.

B. Refrigerant Pipe Insulation

1. Insulation shall be a flexible, closed-cell elastomeric pipe insulation, AP Armaflex, AC Accoflex.
2. Adhesive shall be Armaflex 520, 520 Black or 520 BLV Adhesive. The insulation must conform to ASTM C534 Grade 1, Type I.
3. Insulation materials shall have a closed cell structure to prevent moisture from wicking which makes it an efficient insulation.
4. Insulation materials shall be manufactured without the use of CFC's, HFC's or

HCFC's. It is also formaldehyde free, low VOCs, fiber free, dust free and resists mold and mildew.

5. Insulation materials shall have a flame-spread index of less than 25 and a smoke-developed index of less than 50 as tested in accordance with ASTM E 84. In addition, the products, when tested, shall not melt or drip flaming particles, and the flame shall not be progressive.
6. Insulation materials shall have a maximum thermal conductivity of 0.27 Btu-in./h-ft²-°F at a 75°F mean temperature as tested in accordance with ASTM C 177 or ASTM C 518.
7. Insulation materials shall have a maximum water vapor transmission of 0.08 perm-inches when tested in accordance with ASTM E 96, Procedure A.
8. As a minimum, insulated items installed indoors shall have a flame spread index no higher than 75 and a smoke developed index no higher than 150.
9. Insulated items (no jacket) installed indoors and which are located in air plenums, in ceiling spaces, and in attic spaces shall have a flame spread index no higher than 25 and a smoke developed index no higher than 50.
10. Flame spread and smoke developed indexes shall be determined by ASTM E84.
11. Insulation shall be tested in the same density and installed thickness as the material to be used in the actual construction. Material supplied by a manufacturer with a jacket shall be tested as a composite material.
12. Jackets, facings, and adhesives shall have a flame spread index no higher than 25 and a smoke developed index no higher than 50 when tested in accordance with ASTM E84.
13. All liquid and suction lines shall be insulated continuously from a point 6" inside the display case to the suction service valve at the compressor.
14. All low temperature lines (+10°F and below) shall be insulated with a minimum of 1" wall thickness.
15. All medium and high temperature lines (above +10°F) shall be insulated with a minimum of 3/4" wall thickness.
16. Heat reclaim lines shall be insulated from the condensing unit to the heat reclaim units with 3/4" thickness.
17. All refrigerant copper lines must be free of extraneous chemicals such as corrosive cleaners or building materials' dust prior to the installation of the insulation. The insulation must be clean and dry prior to installation.
18. Refrigerant pipe shall be sealed while slipping on insulation to prevent foreign matter from entering the tube.
19. Insulation is to be slid onto pipe; longitudinal slitting of the insulation is not allowed except on mitered sections. Insulation shall be pushed onto pipe, not

pulled.

20. Insulation shall be mitered, pleathered and longitudinally slit inside throat to fit over all Ptraps, tees and elbows or bends over 90°.
21. All butt joints and mitered seams shall be adhered with full coverage of adhesive on both surfaces. Insulation shall not be stretched when adhering.
22. Insulation must be installed in an adequately ventilated area. It may be necessary to increase insulation thickness if adequate ventilation is not present, Do not crowd the insulation, allow for adequate air movement.
23. At the beginning, at every 12 to 18 feet, and at the ends of piping runs, the insulation shall be adhered directly to the copper using a 2" strip of adhesive. Insulation should not be adhered to the pipe at the extreme low points in any piping run.
24. Saddles shall be installed under all insulated lines at unistrut clamps, clevis hangers, or locations where insulation may be compressed.
25. Armafix IPH or NPH insulation pipe hangers can be installed at the compression locations and the seams shall be sealed with Armaflex 520, 520 Black or 520 BLV contact adhesive.
26. To minimize the movement of Armafix, a pair of non-skid pads be adhered to the clamps. In addition, to prevent loosening of the clamps, use of an anti- vibratory fastener, such as a nylon-locking nut.
27. Wood dowels or blocks, of a thickness equal to the insulation, shall be inserted and must be completely sealed into the insulation at the saddle locations. All seams shall be sealed with Armaflex 520, 520 Black or 520 BLV contact adhesive.
28. Hangers clamped directly to the pipe shall be insulated over the hanger; insulation shall be fully adhered to the hanger. In addition, hangers with double rods shall be insulated between the rods. All seams of the insulation shall be sealed with adhesive.
29. All insulation exposed to sunlight or installed outdoors shall be protected with two coats of WB Armaflex Finish or weather resistant coating.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. After becoming familiar with all details of the work, perform a verification of dimensions in the field. Submit a letter, at least 2 weeks prior to beginning construction, including the date the site was visited, conformation of existing conditions, and any discrepancies found before performing any work.

3.2 INSTALLATION

- A. Pipe and fitting installation shall conform to the requirements of ASME B31.1. Pipe shall be cut accurately to measurements established at the jobsite, and worked into place without springing or forcing, completely clearing all windows, doors, and other openings. Cutting or other weakening of the building structure to facilitate piping installation will not be permitted without written approval. Pipe or tubing shall be cut square, shall have burrs removed by reaming, and shall permit free expansion and contraction without causing damage to the building structure, pipe, joints, or hangers.
1. Directional Changes: Changes in direction shall be made with fittings, except that bending of pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide weep bends are formed. Mitering or notching pipe or other similar construction to form elbows or tees will not be permitted. The centerline radius of bends shall not be less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be accepted.
 2. Functional Requirements: Piping shall be installed 4 mm/m 1/2 inch/10 feet of pipe in the direction of flow to ensure adequate oil drainage. Open ends of refrigerant lines or equipment shall be properly capped or plugged during installation to keep moisture, dirt, or other foreign material out of the system. Piping shall remain capped until installation. Equipment piping shall be in accordance with the equipment manufacturer's recommendations and the contract drawings. Equipment and piping arrangements shall fit into space allotted and allow adequate acceptable clearances for installation, replacement, entry, servicing, and maintenance.
- B. Fittings and End Connections
1. Threaded Connections: Threaded connections shall be made with tapered threads and made tight with PTFE tape complying with ASTM D3308 or equivalent thread-joint compound applied to the male threads only. Not more than three threads shall show after the joint is made.
- C. Brazed Connections
1. Brazing shall be performed in accordance with AWS BRH, except as modified herein. During brazing, the pipe and fittings shall be filled with a pressure regulated inert gas, such as nitrogen, to prevent the formation of scale. Before brazing copper joints, both the outside of the tube and the inside of the fitting shall be cleaned with a wire fitting brush until the entire joint surface is bright and clean. Brazing flux shall not be used. Surplus brazing material shall be removed at all joints. Steel tubing joints shall be made in accordance with the manufacturer's recommendations. Joints in steel tubing shall be painted with the same material as the baked-on coating within 8 hours after joints are made. Tubing shall be protected against oxidation during brazing by continuous purging of the inside of the piping using nitrogen. Piping shall be supported prior to brazing and not be sprung or forced.
- D. Welded Connections
1. Welded joints in steel refrigerant piping shall be fusion-welded. Branch connections shall be made with welding tees or forged welding branch outlets. Pipe shall be thoroughly cleaned of all scale and foreign matter before the piping

is assembled. During welding the pipe and fittings shall be filled with an inert gas, such as nitrogen, to prevent the formation of scale.

Beveling, alignment, heat treatment, and inspection of weld shall conform to ASME B31.1. Weld defects shall be removed and rewelded at no additional cost to the Government. Electrodes shall be stored and dried in accordance with AWS D1.1/D1.1M or as recommended by the manufacturer. Electrodes that have been wetted or that have lost any of their coating shall not be used.

E. Flared Connections

1. When flared connections are used, a suitable lubricant shall be used between the back of the flare and the nut in order to avoid tearing the flare while tightening the nut.

F. Coating

1. Line sets shall be coated, after field installation and testing, with HERESITE VRL-506 (gray) air dry phenolic coating system. Coating system shall be applied within 16 hours after line installation.

G. Flanged Connections

1. When steel refrigerant piping is used, union or flange joints shall be provided in each line immediately preceding the connection to each piece of equipment requiring maintenance, such as compressors, coils, chillers, control valves, and other similar items. Flanged joints shall be assembled square end tight with matched flanges, gaskets, and bolts. Gaskets shall be suitable for use with the refrigerants to be handled.

H. Valves General

1. Refrigerant stop valves shall be installed on each side of each piece of equipment such as compressors condensers, evaporators, receivers, and other similar items in multiple-unit installation, to provide partial system isolation as required for maintenance or repair. Stop valves shall be installed with stems horizontal unless otherwise indicated. Ball valves shall be installed with stems positioned to facilitate operation and maintenance. Isolating valves for pressure gauges and switches shall be external to thermal insulation. Safety switches shall not be fitted with isolation valves. Filter dryers having access ports may be considered a point of isolation. Purge valves shall be provided at all points of systems where accumulated no condensable gases would prevent proper system operation. Valves shall be furnished to match line size, unless otherwise indicated or approved.

I. Expansion Valves

1. Expansion valves shall be installed with the thermostatic expansion valve bulb located on top of the suction line when the suction line is less than 2-1/8 inches in diameter and at the 4 o'clock or 8 o'clock position on lines larger than 2-1/8 inches. The bulb shall be securely fastened with two clamps. The bulb shall be insulated. The bulb shall be installed in a horizontal portion of the suction line, if possible, with the pigtail on the bottom. If the bulb must be installed in a vertical line, the bulb tubing shall be facing up.

J. Valve Identification

1. Each system valve, including those which are part of a factory assembly, shall be tagged. Tags shall be in alphanumeric sequence, progressing in direction of fluid flow. Tags shall be embossed, engraved, or stamped plastic or nonferrous metal of various shapes, sized approximately 1-3/8 inch diameter, or equivalent dimension, substantially attached to a component or immediately adjacent thereto. Tags shall be attached with nonferrous, heavy duty, bead or link chain, 14 gauge annealed wire, nylon cable bands or as approved. Tag numbers shall be referenced in Operation and Maintenance Manuals and system diagrams.

K. Vibration Dampers

1. Vibration damper shall be provided in the suction and discharge lines on spring mounted compressors. Vibration dampers shall be installed parallel with the shaft of the compressor and shall be anchored firmly at the upstream end on the suction line and the downstream end in the discharge line.

L. Strainers

1. Strainers shall be provided immediately ahead of solenoid valves and expansion devices. Strainers may be an integral part of an expansion valve.

M. Filter Dryer

1. A liquid line filter dryer shall be provided on each refrigerant circuit located such that all liquid refrigerant passes through a filter dryer.
2. Dryers shall be sized in accordance with the manufacturer's recommendations for the system in which it is installed.
3. Dryers shall be installed such that it can be isolated from the system, the isolated portion of the system evacuated, and the filter dryer replaced. Dryers shall be installed in the horizontal position except replaceable core filter dryers may be installed in the vertical position with the access flange on the bottom.

N. Sight Glass

1. A moisture indicating sight glass shall be installed in all refrigerant circuits downstream of all filter dryers and where indicated. Sight glasses shall be full line size.

O. Discharge Line Oil Separator

1. Discharge line oil separator shall be provided in the discharge line from each compressor. Oil return line shall be connected to the compressor as recommended by the compressor manufacturer.

P. Accumulator

1. Accumulators shall be provided in the suction line to each compressor.

Q. Flexible Pipe Connectors

1. Connectors shall be installed perpendicular to line of motion being isolated. Piping for equipment with bidirectional motion shall be fitted with two flexible connectors, in perpendicular planes. Reinforced elastomer flexible connectors shall be installed in accordance with manufacturer's instructions. Piping guides and restraints related to flexible connectors shall be provided as required.

R. Temperature Gauges

1. Temperature gauges shall be located specifically on, but not limited to the following: the liquid line leaving a receiver and the suction line at each evaporator or liquid cooler. Thermal wells for insertion thermometers and thermostats shall extend beyond thermal insulation surface not less than 25 mm 1 inch.

S. Pipe Hangers, Inserts, and Supports

1. Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69, except as modified herein. Pipe hanger types 5, 12, and 26 shall not be used. Hangers used to support piping 50 mm 2 inches and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Piping subjected to vertical movement, when operating temperatures exceed ambient temperatures, shall be supported by variable spring hangers and supports or by constant support hangers.

T. Hangers

1. Type 3 shall not be used on insulated piping. Type 24 may be used only on trapeze hanger systems or on fabricated frames.

U. Inserts

1. Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustments may be used if they otherwise meet the requirements for Type 18 inserts.

V. C-Clamps

1. Type 19 and 23 C-clamps shall be torqued in accordance with MSS SP-69 and have both locknuts and retaining devices, furnished by the manufacturer.
2. Field-fabricated C-clamp bodies or retaining devices are not acceptable.

W. Angle Attachments

1. Type 20 attachments used on angles and channels shall be furnished with an added malleable-iron heel plate or adapter.

X. Saddles and Shields

1. Where Type 39 saddle or Type 40 shield are permitted for a particular pipe attachment application, the Type 39 saddle, connected to the pipe, shall be used

on all pipe 4 inches and larger when the temperature of the medium is 60 degrees F or higher. Type 40 shields shall be used on all piping less than 4 inches and all piping 4 inches and larger carrying medium less than 16 degrees C 60 degrees F. A high-density insulation insert of cellular glass shall be used under the Type 40 shield for piping 2 inches and larger.

Y. Horizontal Pipe Supports

1. Horizontal pipe supports shall be spaced as specified in MSS SP-69 and a support shall be installed not over 1 foot from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 5 feet apart at valves. Pipe hanger loads suspended from steel joist with hanger loads between panel points in excess of 50 pounds shall have the excess hanger loads suspended from panel points.

Z. Vertical Pipe Supports

1. Vertical pipe shall be supported at each floor, except at slab-on-grade, and at intervals of not more than 4.5 m 15 feet not more than 2.4 m 8 feet from end of risers, and at vent terminations.

AA. Pipe Guides

1. Type 35 guides using, steel, reinforced polytetrafluoroethylene (PTFE) or graphite slides shall be provided where required to allow longitudinal pipe movement. Lateral restraints shall be provided as required. Slide materials shall be suitable for the system operating temperatures, atmospheric conditions, and bearing loads encountered.

AA. Steel Slides

1. Where steel slides do not require provisions for restraint of lateral movement, an alternate guide method may be used. On piping 4 inches and larger, a Type 39 saddle shall be used. On piping under 4 inches, a Type 40 protection shield may be attached to the pipe or insulation and freely rest on a steel slide plate.

CC. High Temperature Guides with Cradles

1. Where there are high system temperatures and welding to piping is not desirable, then the Type 35 guide shall include a pipe cradle, welded to the guide structure and strapped securely to the pipe. The pipe shall be separated from the slide material by at least 4 inches, or by an amount adequate for the insulation, whichever is greater.

DD. Multiple Pipe Runs

1. In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member.
2. Spacing of the base support members shall not exceed the hanger and support spacing required for an individual pipe in the multiple pipe run.

EE. Structural Attachments

1. Attachment to building structure concrete and masonry shall be by cast-in concrete inserts, built-in anchors, or masonry anchor devices. Inserts and anchors shall be applied with a safety factor not less than 5. Supports shall not be attached to metal decking.
2. Masonry anchors for overhead applications shall be constructed of ferrous materials only.
3. Structural steel brackets required to support piping, headers, and equipment, but not shown, shall be provided under this section.

FF. Seismic Requirements

1. Piping and attached valves shall be supported and braced to resist seismic loads as specified under UFC 3-310-04 and Sections 13 48 00 SEISMIC SECTION 23 23 00
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GG. Pipe Alignment Guides

1. Pipe alignment guides shall be provided where indicated for expansion loops, offsets, and bends and as recommended by the manufacturer for expansion joints, not to exceed 1.5 m 5 feet on each side of each expansion joint, and in lines 4 inches or smaller not more than 2 feet on each side of the joint.

HH. Pipe Anchors

1. Anchors shall be provided wherever necessary or indicated to localize expansion or to prevent undue strain on piping. Anchors shall consist of heavy steel collars with lugs and bolts for clamping and attaching anchor braces, unless otherwise indicated. Anchor braces shall be installed in the most effective manner to secure the desired results using turnbuckles where required. Supports, anchors, or stays shall not be attached where they will injure the structure or adjacent construction during installation or by the weight of expansion of the pipeline. Where pipe and conduit penetrations of vapor barrier sealed surfaces occur, these items shall be anchored immediately adjacent to each penetrated surface, to provide essentially zero movement within penetration seal. Detailed drawings of pipe anchors shall be submitted for approval before installation.

II. Building Surface Penetrations

1. Sleeves shall not be installed in structural members except where indicated or approved. Sleeves in no-load bearing surfaces shall be galvanized sheet metal, conforming to ASTM A653/A653M, Coating Class G-90, 20 gauge. Sleeves in load bearing surfaces shall be uncoated carbon steel pipe, conforming to ASTM A53/A53M, Schedule 30. Sealants shall be applied to moisture and oil-free surfaces and elastomers to not less than 1/2 inch depth. Sleeves shall not be installed in structural members.

JJ. Refrigerated Space

1. Refrigerated space building surface penetrations shall be fitted with sleeves fabricated from hand-lay-up or helically wound, fibrous glass reinforced polyester or epoxy resin

with a minimum thickness equal to equivalent size Schedule 40 steel pipe. Sleeves shall be constructed with integral collar or cold side shall be fitted with a bonded slip-on flange or extended collar. In the case of masonry penetrations where sleeve is not cast-in, voids shall be filled with latex mixed mortar cast to shape of sleeve and flange/external collar type sleeve shall be assembled with butyl elastomer vapor barrier sealant through penetration to cold side surface vapor barrier overlap and fastened to surface with masonry anchors. Integral cast-in collar type sleeve shall be flashed with not less than 4 inches of cold side vapor barrier overlap of sleeve surface. Normally noninsulated penetrating round surfaces shall be sealed to sleeve bore with mechanically expandable seals in vapor tight manner and remaining warm and cold side sleeve depth shall be insulated with not less than 4 inches of foamed-in-place rigid polyurethane or foamed-in-place silicone elastomer. Vapor barrier sealant shall be applied to finish warm side insulation surface. Warm side of penetrating surface shall be insulated beyond vapor barrier sealed sleeve insulation for a distance which prevents condensation. Wires in refrigerated space surface penetrating conduit shall be sealed with vapor barrier plugs or compound to prevent moisture migration through conduit and condensation therein.

KK. General Service Areas

1. Each sleeve shall extend through its respective wall, floor, or roof, and shall be cut flush with each surface. Pipes passing through concrete or masonry wall or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves shall be of such size as to provide a minimum of 1/4 inch all-around clearance between bare pipe and sleeves or between jacketed-insulation and sleeves.
2. Except in pipe chases or interior walls, the annular space between pipe and sleeve or between jacket over-insulation and sleeve shall be sealed in accordance with Section 07 92 00 JOINT SEALANTS.

LL. Waterproof Penetrations

1. Pipes passing through roof or floor waterproofing membrane shall be installed through a 17 ounce copper sleeve, or a 0.032 inch thick aluminum sleeve, each within an integral skirt or flange.
2. Flashing sleeve shall be suitably formed, and skirt or flange shall extend not less than 8 inches from the pipe and be set over the roof of floor membrane in a troweled coating of bituminous cement. The flashing sleeve shall extend up the pipe a minimum of 2 inches above the roof or floor penetration. The annular space between the flashing sleeve and the bare pipe or between the flashing sleeve and the metal-jacket-covered insulation shall be sealed as indicated. Penetrations shall be sealed by either one of the following methods.
3. Waterproofing Clamping Flange: Pipes up to and including 10 inches in diameter passing through roof or floor waterproofing membrane may be installed through a cast iron sleeve with caulking recess, anchor lugs, flashing clamp device, and pressure ring with brass bolts. Waterproofing membrane shall be clamped into place and sealant shall be placed in the caulking recess.
4. Modular Mechanical Type Sealing Assembly: In lieu of a waterproofing clamping

flange and caulking and sealing of annular space between pipe and sleeve or conduit and sleeve, a modular mechanical type sealing assembly may be installed. Seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe/conduit and sleeve with corrosion protected carbon steel bolts, nuts, and pressure plates. Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal rubber sealing elements to expand and provide a watertight seal between the pipe/conduit seal between the pipe/conduit and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe/conduit and sleeve involved. The Contractor electing to use the modular mechanical type seals shall provide sleeves of the proper diameters.

MM. Escutcheons

1. Finished surfaces where exposed piping, bare or insulated, pass through floors, walls, or ceilings, except in boiler, utility, or equipment rooms, shall be provided with escutcheons. Where sleeves project slightly from floors, special deep-type escutcheons shall be used. Escutcheon shall be secured to pipe or pipe covering.

NN. Access Panels

1. Access panels shall be provided for all concealed valves, vents, controls, and items requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced and maintained or completely removed and replaced.

OO. Identification Tags

1. Provide identification tags made of brass, engraved laminated plastic or engraved anodized aluminum indicating service and item number on all valves and dampers. Tags shall be 1-3/8 inch minimum diameter and marking shall be stamped or engraved. Indentations shall be black for reading clarity. Tags shall be attached to valves with No. 12 AWG copper wire, chrome-plated beaded chain or plastic straps designed for that purpose.

3.3 CLEANING AND ADJUSTING

1. Clean uncontaminated system(s) by evacuation and purging procedures currently recommended by refrigerant and refrigerant equipment manufacturers, and as specified herein, to remove small amounts of air and moisture. Systems containing moderate amounts of air, moisture contaminated refrigerant, or any foreign matter shall be considered contaminated systems. Restoring contaminated systems to clean condition including disassembly, component replacement, evacuation, flushing, purging, and re-charging, shall be performed using currently approved refrigerant and refrigeration manufacturer's procedures. Restoring contaminated systems shall be at no additional cost to the Government as determined by the Contracting Officer. Water shall not be used in any procedure or test.

3.4 REFRIGERANT PIPING TESTS

A. General

1. After all components of the refrigerant system have been installed and connected, subject the entire refrigeration system to pneumatic, evacuation, and startup tests as described herein. Submit a schedule, at least 2 weeks prior to the start of related testing, for each test. Identify the proposed date, time, and location for each test. Conduct tests in the presence of the Contracting Officer. Water and electricity required for the tests will be furnished by the Government. Provide all material, equipment, instruments, and personnel required for the test. Provide the services of a qualified technician, as required, to perform all tests and procedures indicated herein.
2. SYSTEMS. Submit 6 copies of the tests report in bound 8 1/2 by 11 inch booklets documenting all phases of the tests performed. The report shall include initial test summaries, all repairs/adjustments made, and the final test results.

B. Preliminary Procedures

Prior to pneumatic testing, equipment which has been factory tested and refrigerant charged as well as equipment which could be damaged or cause personnel injury by imposed test pressure, positive or negative, shall be isolated from the test pressure or removed from the system. Safety relief valves and rupture discs, where not part of factory sealed systems, shall be removed and openings capped or plugged.

C. Pneumatic Test

1. Pressure control and excess pressure protection shall be provided at the source of test pressure. Valves shall be wide open, except those leading to the atmosphere. Test gas shall be dry nitrogen, with minus 70 degree F dewpoint and less than 5 ppm oil. Test pressure shall be applied in two stages before any refrigerant pipe is insulated or covered. First stage test shall be at 10 psi with every joint being tested with a thick soap or color indicating solution. Second stage tests shall raise the system to the minimum refrigerant leakage test pressure specified in ANSI/ASHRAE 15 & 34 with a maximum test pressure 25 percent greater. Pressure above 100 psig shall be raised in 10 percent increments with a pressure acclimatizing period between increments. The initial test pressure shall be recorded along with the ambient temperature to which the system is exposed. Final test pressures of the second stage shall be maintained on the system for a minimum of 24 hours. At the end of the 24 hour period, the system pressure will be recorded along with the ambient temperature to which the system is exposed. A correction factor of 0.3 psi will be allowed for each degree F change between test space initial and final ambient temperature, plus for increase and minus for a decrease. If the corrected system pressure is not exactly equal to the initial system test pressure, then the system shall be investigated for leaking joints. To repair leaks, the joint shall be taken apart, thoroughly cleaned, and reconstructed as a new joint. Joints repaired by caulking, remelting, or back-welding/brazing shall not be acceptable. Following repair, the entire system shall be retested using the pneumatic tests described above. The entire system shall be reassembled once the pneumatic tests are satisfactorily completed.

D. Evacuation Test

1. Following satisfactory completion of the pneumatic tests, the pressure shall be relieved and the entire system shall be evacuated to an absolute pressure of 300 micrometers. During evacuation of the system, the ambient temperature shall be higher than 35 degrees F. No more than one system shall be evacuated at one time by one vacuum pump. Once the desired vacuum has been reached, the vacuum line shall be closed and the system shall stand for 1 hour. If the pressure rises over 500 micrometers after the 1 hour period, then the system shall be evacuated again down to 300 micrometers and let set for another 1 hour period. The system shall not be charged until a vacuum of at least 500 micrometers is maintained for a period of 1 hour without the assistance of a vacuum line. If during the testing the pressure continues to rise, check the system for leaks, repair as required, and repeat the evacuation procedure. During evacuation, pressures shall be recorded by a thermocouple-type, electronic-type, or a calibrated-micrometer type gauge.

E. System Charging and Startup Test

1. Following satisfactory completion of the evacuation tests, the system shall be charged with the required amount of refrigerant by raising pressure to normal operating pressure and in accordance with manufacturer's procedures. Following charging, the system shall operate with high-side and low-side pressures and corresponding refrigerant temperatures, at design or improved values. The entire system shall be tested for leaks. Fluorocarbon systems shall be tested with halide torch or electronic leak detectors.

F. Refrigerant Leakage

1. If a refrigerant leak is discovered after the system has been charged, the leaking portion of the system shall immediately be isolated from the remainder of the system and the refrigerant pumped into the system receiver or other suitable container. Under no circumstances shall the refrigerant be discharged into the atmosphere.

G. Contractor's Responsibility

1. At all times during the installation and testing of the refrigeration system, take steps to prevent the release of refrigerants into the atmosphere. The steps shall include, but not be limited to, procedures which will minimize the release of refrigerants to the atmosphere and the use of refrigerant recovery devices to remove refrigerant from the system and store the refrigerant for reuse or reclaim. At no time shall more than 3 ounces of refrigerant be released to the atmosphere in any one occurrence. Any system leaks within the first year shall be repaired in accordance with the requirements herein at no cost to the Government including material, labor, and refrigerant if the leak is the result of defective equipment, material, or installation.

END OF SECTION

SECTION 23 31 13

HVAC DUCT

PART 1 – GENERAL

1.1 THE REQUIREMENT

- A. Provide ductwork, complete and operable, as indicated in accordance with the Contract Documents.
- B. Furnish design calculations used to determine duct wall thickness and reinforcements.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

Reference	Title
AMCA 500	Test Methods for Louvers, Dampers, and Shutters
ASTM D 638	Standard Test Method for Tensile Properties of Plastics
ASTM D 790	Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
ASTM D 2240	Standard Test Method for Rubber Property - Durometer Hardness
ASTM D 2310	Standard Classification for Machine-Made "Fiberglass" (Reinforced Thermosetting Resin) Pipe
ASTM D 2563	Standard Practice for Classifying Visual Defects in Glass-Reinforced Plastic Laminate Parts
ASTM D 2992	Standard Practice for Obtaining Hydrostatic or Pressure Design Basis for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe and Fittings
ASTM D 2996	Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe
ASTM E 84	Standard Test Method for Surface Burning Characteristics of Building Materials
SMACNA	Thermoset FRP Duct Construction Manual

A. Codes and Standards, General

1. Perform and provide the WORK in full accordance with the latest rules and regulations or publications of the State Energy Resources Conservation and Development Commission, the State Fire Marshall, the Industrial Safety Orders, the Health and Safety Rules (Air Conditioning systems), the local Plumbing Code, the local Building Code, and other local codes.
2. In the absence of applicable codes, follow the installation and workmanship standards set by the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).
3. Provide the ductwork systems in accordance with the latest edition of the ASHRAE Handbook, SMACNA Manual, and the International Mechanical Code.
4. Where conflict between these standards arises, the most stringent criterion shall control. Ducts shall be listed for use without the necessity for internal fire protection sprinklers or

any devices relied on to cut off air flow in the event of fire by Factory Mutual Research Standard 4922.

5. ASHRAE Standards: Comply with AS~E handbook, Equipment Volume, Chapter "Duct Construction," for fabrication and installation of metal duct.
6. NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilation Systems," NFPA 90B "Standard for the Installation of Warm Air Heating and Air Conditioning Systems," and NFPA 91 "Standard for the Installation of Blower and Exhaust Systems."
7. Field Reference Manual: Have available for reference at Project field office a copy of SMACNA "Round Industrial Duct Construction Standards."
8. Comply with SMACNA's "HVAC Duct Construction Standards, Metal and Flexible" for fabrication and installation of metal duct, and SMACNA's "Round Industrial Duct Construction Standards" intended for use by designers of industrial ventilation systems.

1.3 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with the requirements of Section 013300 – Contractor Submittals.
- B. Shop Drawings:
 1. The HVAC design drawings define the general layout, configuration, routing, size, and the general intent of the design and are not fabrication drawings. CONTRACTOR's shall be responsibility to develop the shop drawings required for the construction of the HVAC system(s).
 2. Submit detailed fabrication drawings with layouts and all necessary dimensions and details on equipment, and ductwork. Show all fittings, and supports necessary to accommodate the equipment provided in a complete and functional system. Show main and branch runs, fittings, offsets, takeoffs, accessories, supports, anchorage, point loads and seismic restraints, and dimensions of sub-assemblies to be shipped.

1.4 QUALITY ASSURANCE

- A. Qualifications, General
 1. Ductwork shall be fabricated and installed by experienced workers who have experience with fabrication, and installation of ductwork.
 2. Work and materials shall be in full accordance with the latest rules and regulations or publications of the State Energy Resources Conservation and Development Commission, the State Fire Marshall, the Industrial Safety Orders, the Health and Safety Rules (Air Conditioning systems), the local Plumbing Code, the local Building Code, and other local codes.
 3. Nothing in the Contract Documents shall be construed to permit work in violation of the above codes, rules and regulations.

4. In the absence of applicable codes, the installation and workmanship shall follow the standards set by the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE). Use firms regularly engaged in the manufacture of ETFE coated stainless steel duct products of types, materials, and sizes required.
5. The manufacturer shall perform their own sheet metal fabrication and coating processes.
6. Use manufacturers whose ETFE-coated stainless steel duct shall have been in satisfactory use for not less than 5 years.
7. The OWNER shall have the right to tour the manufacturer's plant any time that fabrication is being performed on duct intended for the Project.
8. Installer Qualifications: The installation contractor shall have at least 3 years of successful experience on duct projects, specifically industrial exhaust systems.

B. Inspection and Testing

1. All ductwork shall be inspected and approved by a qualified QC person in order to ensure proper welding and dimensional tolerances. The Inspector shall provide a written approval to the resident engineer or owner, stating that the ductwork has been inspected and is free of any defects.

1.5 DELIVERY, STORAGE, AND HANDLING

A. General

1. Duct, fittings, and dampers shall be protected from damage and shall be supported by minimum 4-inch wide strapping to avoid damage due to flex strains and point loading during shipping and installation.
2. Debris and other extraneous material shall not be allowed to enter the duct.
3. Duct, fittings, and dampers shall not be thrown or dropped.

B. Material Protection

1. Protect coated duct from damage due to normal handling during shipment and storage.
2. Protection shall be applied to ends of the duct in order to prevent dirt and moisture from entering ducts and fittings.
3. Protection must be of suitable strength and material to withstand tearing and puncture.
4. Multiple pieces may be bolted together at the factory to provide protection and limit the number of open ends requiring protection.

- C. Consignee must inspect shipment upon delivery and note any and all damages and discrepancies on bill of lading and notify manufacturer within 24 hours.

D. Coated duct

1. Coated duct shall not be stored in an area where it will have a chance to be damaged from traffic or debris.
2. All coated duct shall be stored on cardboard, Styrofoam, or similar material.
3. Where possible, store coated duct inside and protect from dirt and debris.
4. Where necessary to store outside, store coated duct above grade and enclose with waterproof wrapping in order to protect from dirt and debris.
5. If the coating is scratched during shipping or handling it must be inspected using the methods described in Part 2 - Products.
6. Contact the manufacturer for approved repair procedures.

1.6 WARRANTY

- A. Provide the ductwork manufacturer's standard warranty.
- B. Furnish the warranty to the ENGINEER upon final acceptance of the completed systems by the OWNER.

PART 2 – PRODUCTS

2.1 HANGERS AND SUPPORTS

- A. Ductwork shall be firmly anchored or connected to supporting members.
- B. Provide necessary hangers, supports, concrete inserts, and anchors for material and equipment to be installed.
- C. No perforated strap hangers nor wire supports will be accepted.
- D. Construct the anchors and inserts of 304 stainless steel.
- E. Locate hangers and supports not greater than 10 feet from each expansion loop or joint.
- F. Provide hangers and supports for ductwork and equipment in accordance with SMACNA standards.

2.2 GALVANIZED AND ALUMINUM DUCTWORK (ALL DUCTWORK SHALL BE ALUMINUM UNLESS OTHERWISE NOTED)

- A. General
 1. Provide air-tight and well-braced ductwork.
 2. Carefully support the ductwork in horizontal runs, with rod and angle supports at no greater than 8-foot intervals.
 3. Run ductwork as close as possible to the indicated layouts.

B. Construction

1. Construct sheet metal ducts and plenums with air-tight joints and seams in accordance with ASHRAE standards and the SMACNA Duct Construction Manual.
2. Tape the joints on concealed ducts with pressure-less tape and adhesive, except for welded and soldered joints.
3. Ductwork materials shall be aluminum, unless otherwise indicated.
4. Provide the following duct gauges, as a minimum:

Maximum Dimension of Duct (inches)	Galvanized Steel U.S. Standard Gauge	Aluminum B and S Gauge
12 and less	26	24
13 through 30	24	22
31 through 54	20	20
55 through 84	20	18

5. All low pressure ductwork shall be designed for 3 inches vacuum and pressure and be constructed of sheet metal of not less than the gauge designated in table above, and gauge designations provided by Brown and Sharpe Standards.
6. Radius of bends shall be not less than 1.5 duct diameters, unless otherwise indicated.
7. Provide turning vanes on all mitered elbows and extractors, as required and indicated.
8. Except where accepted by the ENGINEER, provide fan discharge connections and ductwork reductions with duct side slopes not exceeding 30 degrees.
9. Properly insulate aluminum duct and supports from concrete or dissimilar metals by an applied bituminous coating or by rubber gaskets at contact points.
10. Construct interior partitions from aluminum, in accordance with the latest ASHRAE guide recommendations for construction for high-pressure rectangular duct work.
11. Construct the units in accordance with the ASHRAE guide recommendations for high-pressure ductwork.
12. Seams shall be lock-formed and mastic-filled.
13. Provide rectangular casing seams in the corners of the silencer shell in order to provide maximum unit strength and rigidity.
14. Provide interior partitions with die-formed entrance and exit shapes in order to provide the

maximum aerodynamic efficiency and minimum self-noise characteristics in the sound attenuator.

15. Blunt noses or squared off partitions will not be accepted.
16. Use solid galvanized steel to attach the interior partitions to the casing, welded to the outer casing.
17. Attachment of the interior partitions to the tracks shall be such that a minimum of 4 thicknesses of metal exist at this location.
18. The track assembly shall stiffen the exterior casing, provide a reinforced attachment detail for the interior partitions, and shall maintain a uniform airspace width along the length of the silencer for consistent aerodynamic and acoustic performance.
19. In addition to the above attachments, secure the interior partitions to the outer casing with welded nose clips at both ends of the sound attenuator.
20. Achieve airtight construction by the use of a duct-sealing compound applied at the Site.
21. Sound traps shall not fail structurally when subjected to a differential air pressure of 8 inches w.g. inside-to-outside of casing.

C. Seams

1. Provide double-locked seams.
2. Provide rectangular ducts with longer than a 12-inch dimension with full-perimeter standing seams not less than one inch high.
3. Provide reinforcements at intervals not greater than 30 inches along the duct.
4. No "S" seams will be accepted.

D. Low-Pressure Ductwork

1. Design all low-pressure ductwork for 3 inches vacuum and pressure.
2. Construct low-pressure ductwork of sheet aluminum of not less than 18-gauge, where the largest dimension of a duct is 12 inches or less in width or diameter, and not less than 16-gauge for widths or diameters larger than 12 inches.
3. Gauge designations refer to Brown and Sharpe Standards.

E. Access Doors

1. Provide access doors in the ductwork at all fire dampers, motorized and back draft dampers, filters, and as indicated.
2. Provide doors with the following features:

- a. continuously hinged;
 - b. double-skinned;
 - c. constructed of either 22-gauge galvanized steel or 20-gauge aluminum to match the ductwork material;
 - d. one cam lock for sizes up to 16 inches square or 2 cam locks for sizes over 16 inches square;
 - e. match insulation thickness in door with ductwork insulation; and,
 - f. foam sealing gaskets on all four sides.
3. Access Doors Manufacturer, or Equal
 - a. Ruskin, SMACNA Standard Duct Access Doors

F. Flexible Connections

1. Attach the equipment to the ducts through using flexible connections in order to facilitate removal of the units and for sound isolation.
2. Provide flexible connectors consisting of heavy duct canvas or woven glass fabric, silicon-coated.
3. Canvas connectors shall be composed of a heavy cotton that is impregnated for waterproofing and fire retardance.
4. Use glass fabric where temperatures exceed 200 degrees F.
5. The weight of the canvas shall be 20 ounces per sq yd.
6. The weight of the glass fabric shall be approximately 12 ounces per sq yd.
7. Flexible duct shall be insulated.
8. The maximum length of flexible duct shall not exceed 10 feet.
9. Flexible duct connections shall be composed of banded or flanged 8-oz canvas, reinforced plastic, or equal, at each point where a blower unit is connected to a duct.
10. Maintain a minimum clearance of 3 inches between the duct and the source of vibration.
11. Provide materials that join and support the flexible duct in accordance with the latest edition of SMACNA.

G. Supports

1. Provide aluminum angles with 304 stainless steel threaded hanger rods as supports for horizontal ducts and plenums.
2. Supports for vertical ducts shall be aluminum of the angle bracket type.
3. Sufficiently brace inlet ducts to withstand the maximum negative pressure.

H. Seismic Restraints

1. Design the duct supports and restraints for static, dynamic, and seismic loads in Zone 4 in accordance with the International Building Code.
2. Seismic restraints shall not induce stresses in the ductwork caused by thermal expansion and contraction.

I. Duct Dimensions

1. Increase sheet metal duct dimensions by 2 inches for internally lined ducts.

J. Corrosion-Resistant Ducts

1. Provide exhaust hoods as indicated, constructed of Type 316 stainless steel.
2. Fabricate the stainless steel ducts of the same gauge as the galvanized steel ducts.

K. Balancing Dampers

1. Provide butterfly or multi-blade dampers as indicated and required in order to balance the air quantities to their indicated values.
2. Provide a locking quadrant on each manual damper, with easy access for operation.

L. Inspection Doors

1. Provide duct inspection doors consisting of a 12-inch by 16-inch steel frame with gasketing around its periphery, and either a hinged glass or a removable visual panel.
2. Doors shall be constructed of Plexiglas, Lucite, or equal.
3. On smaller ducts, provide separate 6-inch by 8-inch doors with 6-inch by 6-inch visual panels.
4. Provide duct inspection doors at each duct-mounted fire damper and electric duct heater.

M. Bird Screens

1. Provide removable bird screens on outside air intakes and exhaust air discharges to outside air.
2. Secure the screens in frames constructed of the same metal as the screens.

3. The bird screens shall be 1/2-inch mesh by 14-gauge, and shall be of same material and finish as duct, hood, louver, or equipment to which the screens are attached.

N. Turning Vanes

1. Square-turn elbows shall be fitted with shop-fabricated double-blade turning vanes mounted inside the rails.
2. Construction shall be of the same material as the ductwork and shall be rigid enough to prevent vibration at high air flow.

O. Air Extractors

1. Provide an air extractor on each take-off from the main supply duct adjacent to a diffuser, register, or grille, where a splitter is not used.
2. Provide extractors with synchronized steel curved blades, heavy side rails, and a screw operator.
3. Air Extractors Manufacturer, or Equal
 - a. Carnes
 - b. Tuttle and Bailey

PART 3 – EXECUTION

3.1 GENERAL

A. Floor, Wall and Roof Openings for New Construction

1. Provide necessary openings in walls, floors and roofs for the passage of heating and ventilating equipment in buildings.
2. The openings shall be as indicated, or as required to provide passage for the heating and ventilating WORK.
3. Provide hanger and support inserts into masonry or structural steel as required for proper completion of the WORK.

B. Floor, Wall and Roof Openings for Existing Construction

1. Provide openings for piping and equipment as required in the existing construction, whether or not they are specifically indicated.
2. Cut the openings in a neat and orderly manner without damaging existing structures. Do not overcut corners.
3. Patch openings to match the existing construction.

4. Provide and assume responsibility for hangers and supporting members in the existing masonry or structural steel as required for proper completion of the WORK.

C. Interior and Exterior Wall Penetrations

1. Where ducts pass through exterior walls, interior partitions or pass through walls dividing two separate controlled areas, conceal the space between construction openings and the duct with sheet metal flanges of the same gauge as the duct.
2. Overlap the opening on 4 sides by at least 1-1/2 inches.

3.2 INSTALLATION

A. General

1. Field Measurements

- a. Duct lengths shall be determined from measurements taken at the Site.
- b. The indicated dimensions are approximate and shall not be used for fabrication.

2. Install ducts as indicated.

3. Necessary provisions shall be taken into consideration during fabrication and installation of ductwork to provide for expansion and contraction.

4. Ductwork shall be free from vibration when in operation.

5. Provide necessary vibration isolation devices.

6. Apply antiseize compound to bolt threads.

7. Provide smooth bends or internal turning vanes at elbows, tees, and other points where the air flow changes direction.

8. The inside of duct, specials, and fittings shall be smooth, clean, and free from blisters, sand and dirt.

9. Ductwork shall be airtight.

10. Joints shall be carefully and neatly constructed, as indicated and as recommended by the manufacturer.

11. Flanges

- a. Tighten flange bolts sufficiently to slightly compress the gasket and make a seal, but not so tightly as to distort the flanges.
- b. Provide a flat washer under each nut and bolt head.

12. Dampers

- a. Position the dampers to fit into the connecting ductwork at the indicated locations.
- b. Install axles in the horizontal position unless otherwise necessary for proper operation of the damper.

13. Supports and Hangers

- a. Support the ductwork in accordance with the manufacturer's recommendations and as indicated.
- b. Duct supports shall comply with SMACNA Standards and applicable code requirements.
- c. Supports and hangers shall transmit loads into the building structural frame through a system of intermediate beams and struts as necessary to comply with the indicated requirements.
- d. Supports or hangers employing clip angles or similar devices for attachment to the duct will not be accepted.
- e. Design the supports to resist IBC seismic forces.

14. Alignment and Elevation

- a. Provide ductwork to the indicated lines and elevations, and slope as indicated to facilitate water drainage.
- b. Use laser beam equipment or surveying instruments to maintain alignment and elevation.
- c. If laser beam equipment is used, perform periodic elevation measurements with surveying instruments in order to verify accuracy.

B. Control Dampers

1. General

- a. Coordinate damper submittals for type, quantity, and size in order to ensure compatibility with sheet metal design.
- b. Follow the manufacturer's instructions for field installation of control dampers.
- c. Unless specifically designed for vertical blade application, mount the dampers with the blade axis horizontal.

2. Duct Openings

- a. Duct openings shall be free of obstructions and irregularities that might interfere with blade or linkage rotation or actuator mounting.
- b. Duct openings shall measure 3/4 inch larger than damper dimensions, and shall be

square, straight, and level.

3. Damper Sections

- a. Individual damper sections, as well as entire multiple section assemblies, shall be completely square and free of racking, twisting, and bending.
- b. Measuring the damper sections diagonally from upper corners to opposite lower corners of each damper section, both dimensions shall be within 1/8 inch of each other.

4. Shafts

- a. Install an extended shaft or jackshaft in accordance with the manufacturer's instructions.
- b. If a sticker on the damper face shows recommended extended shaft location, attach the shaft on the labeled side of damper to that blade.

5. Operation

- a. Damper blades, axels, and linkage shall operate without binding.
 - b. After installation but before system operation, cycle the damper in order to ensure proper operation.
 - c. On multiple section assemblies, sections shall open and close simultaneously.
6. Provide a visible and accessible indication of damper position on the drive shaftend.
7. Support ductwork or damper actuator in areas of damper when required in order to prevent sagging due to damper or damper actuator weight.
8. After installing low-leakage dampers with seals, caulk between the frame and the duct or opening in order to prevent leakage around the perimeter of damper.

C. Smoke Dampers

1. Coordinate smoke damper and smoke/fire damper installations, wiring, and checkout in order to ensure that the dampers function properly and that they respond to the proper fire alarm system general, zone, and detector trips.
2. Immediately report discrepancies to the ENGINEER not less than 14 Days prior to inspection by the code authority having jurisdiction.

D. ETFE-Coated Stainless Steel Exhaust Duct and Fittings

1. General

- a. Examine areas and conditions under which coated duct are to be installed.
- b. Do not proceed with the WORK until unsatisfactory conditions have been corrected

in a manner acceptable to the installer.

- c. Install ducts and fittings in accordance with recognized industry practices which will achieve an air-tight installation.
- d. Install each run with a minimum number of joints.
- e. Align the duct accurately at connections, with internal surfaces smooth.
- f. Support ducts rigidly with suitable ties, braces, hangers, and anchors of a type in accordance with SMACNA "Industrial Duct Construction Standards."

2. Coating

- a. Assemble and install coated stainless steel duct while using extreme care not to scratch surface of coating.
- b. If the coating is scratched, immediately contact the manufacturer for repair instructions, and repair as directed.

3. Penetrations on coated ductwork

- a. Do not penetrate coatings during installation.
- b. Do not use fastening devices such as Tek-style screws, rivets, and the like, on any part of a coated duct application.
- c. Test holes and slots for monitoring shall be predetermined before fabrication and coating unless approved Fab-Tech Field Modification Kits, or equal, are used.
- d. Install coated stainless steel duct as indicated, following applicable codes and in conformance with SMACNA HVAC Duct Construction Standards.

4. Routing

- a. Locate coated stainless steel duct runs, except as otherwise indicated, vertically and horizontally, and avoid diagonal runs wherever possible.
- b. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run duct in the shortest route that does not obstruct usable space or block access for servicing the building and equipment.
- c. Hold ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of the building.
- d. Wherever possible in finished and occupied spaces, conceal the duct from view, by locating in mechanical shafts, hollow wall construction, or above suspended ceilings.
- e. Do not encase horizontal runs in solid partitions, except if indicated.
- f. Coordinate the layout with suspended ceiling and lighting layouts and similar finish WORK.

5. Electric Equipment Spaces

- a. Do not route duct through or directly over transformers, electrical equipment and electrical enclosures.

3.3 DUCT CLEANING

- A. The ducts shall be blown clean of dust and debris using compressed air.
- B. Do not use system fans for duct cleaning.

3.4 FIELD TESTING

- A. Leak-test the ductwork after installation, in accordance with the National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems, a publication of the Associated Air Balance Council (AABC).
- B. The maximum allowable leakage criteria shall be in conformance with ASHRAE standards.

END OF SECTION

SECTION 23 34 16
HVAC FANS

PART 1 – GENERAL

1.1 THE SUMMARY

- A. Provide fans, blowers, ventilators, and appurtenances, complete and operable, as indicated in accordance with the Contract Documents.
- B. Where 2 or more fans, blowers, ventilators or appurtenances of the same type or size are required, they shall be furnished by the same manufacturer.

1.2 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with the requirements of Section 01300 – Contractor Submittals.
- B. Shop Drawings
 - 1. Submit certified fan curves for each fan
- C. O&M Data
 - 1. Submittals shall include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

1.3 EXTRA MATERIALS

- A. Furnish, tag, and box for shipment and storage the following spare parts:
 - 1. Drive Belts: Provide one for each fan

1.4 REFERENCES

- A. The following is a list of standards that may be referenced in this section:
 - 1. Air Moving and Conditioning Association (AMCA):
 - Bulletin 300, Setup No. 1.
 - Standard 99, Standards Handbook, Reverberant Room Method for Sound Testing of Fans.
 - Standard 210, Laboratory Methods of Testing Fans for Rating.
 - 2. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE):
 - HVAC Applications chapter in “Seismic Restraint Design”.

3. Institute of Electrical and Electronics Engineers, Inc. (IEEE): 112, Standard Test Procedure for Polyphase Induction Motors and Generators.
4. National Electrical Manufacturers Association (NEMA): MG 1-12.53a, Motors and Generators.
5. National Fire Protection Association (NFPA):
70, National Electric Code (NEC).
90A, Standard for the Installation of Air Conditioning and Ventilating Systems.
6. Occupational Safety and Health Act (OSHA).
7. Underwriters Laboratories Inc. (UL): Product Directories.

1.5 MOTORS

- A. All motors shall conform to the latest IEEE and NEMA requirements for mechanical and electrical characteristics, including service factors.
- B. Motors shall be in accordance with the requirements of Section 26 05 10 – Electric Motors.
- C. Each motor shall bear the manufacturer’s nameplate with complete motor data.
- D. Each motor shall be of ample size and construction to carry continuously all loads which might be imposed by the piece of equipment it drives throughout the full range of operation of the equipment, and the maximum motor loading shall in all cases be less than or equal to the nameplate horsepower rating, exclusive of the service factor.
- E. All 2-speed motors shall be 2-winding motors.

PART 2 – PRODUCTS

2.1 PROPELLER WALL FANS

- A. Provide panel-mounted belt-driven propeller wall fans as indicated.
- B. Fans shall have an aluminum blade, a spun-steel venturi mounting panel, a steel wire guard, a motor mount, and resilient anti-vibration pads at the mounting points of the panel.
- C. The propeller blade shall be statically and dynamically balanced.
- D. Fans shall be complete with gravity shutters, wall mount housing, bird screen, motor side guard, and an externally mounted disconnect switch.
- E. Fan, panel mount, shutters, housing, blades, screen, and guard shall be coated with Greenkote High performance Epoxy, or equal except where otherwise indicated.
- F. See Drawings for fan requirements
- G. Manufacturers, or Equal

1. Greenheck, (Model SBC)
2. Aerovent
3. Penn

2.2 INLINE SUPPLY FANS

- A. Provide inline supply fans as indicated.
- B. Provide fans of the centrifugal, direct driven, inline type.
- C. Fan housing shall be of square design construction of heavy-gauge galvanized steel, and shall include square duct mounting collars and removable access panels.
- D. The fan wheel shall be of the centrifugal backward inclined type, of aluminum construction, and shall include a wheel cone matched to the inlet cone.
- E. The fan motor shall be of the heavy-duty ball bearing type, mounted out of the air stream, and provided with belt guards.
- F. Fans shall be completely coated outside and on surfaces in contact with the air stream with Greenkote High performance Epoxy, or equal.
- G. See drawings for fan requirements
- H. Manufacturer, or Equal
 1. Greenheck, Model (TCB)
 2. Cook

2.3 INLINE EXHAUST FANS

- A. Provide inline supply fans as indicated.
- B. Provide fans of the centrifugal, direct driven, inline type.
- C. Fan housing shall be of square design construction of heavy-gauge galvanized steel, and shall include square duct mounting collars and removable access panels.
- D. The fan wheel shall be of the centrifugal backward inclined type, of aluminum construction, and shall include a wheel cone matched to the inlet cone.
- E. The fan motor shall be of the heavy-duty ball bearing type, mounted out of the air stream, and provided with belt guards.
- F. Fans shall be completely coated outside and on surfaces in contact with the air stream with Greenkote High performance Epoxy, or equal.
- G. See drawings for fan requirements

- H. Manufacturer, or Equal
 - 1. Greenheck, Model (TCB)
 - 2. Cook

2.4 HORIZONTAL DISCHARGE WALL EXHAUST FANS

- A. Provide upblast centrifugal belt-driven wall-mounted exhausters as indicated.
- B. Upblast roof exhaust fans shall be of all-aluminum construction. Fans to have Florida NOA rating for wind velocity as required by code.
- C. Centrifugal ventilators shall be constructed of heliarc-welded extruded aluminum, and shall be provided with a cast aluminum power assembly.
- D. Units shall be provided with V-belt drives, vibration eliminators, and motor as indicated.
- E. Fans
 - 1. Provide fan motors with externally mounted disconnect switches and shall be of the open drip-proof type.
 - 2. Fans shall be completely coated outside and on all surfaces in contact with the exhausted air stream with Greenkote High performance Epoxy, or equal, thermosetting polyester urethane, Technicoat 10-2, or equal, except where otherwise indicated.
 - 3. The fans shall be complete with motor-operated dampers or gravity backdraft dampers, roof curb, and bird screen.
- F. Manufacturer, or Equal
 - 1. Greenheck, Model CUBE-H
 - 2. Cook

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Fans, blowers, ventilators, and hoods shall be installed in strict accordance with the manufacturer's recommendations.
- B. Pipe the housing drains to the nearest utility drain.

END OF SECTION

SECTION 23 37 13
DIFFUSERS, REGISTERS, AND GRILLES

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. Adjustable Grilles
 - 2. Fixed face registers and grilles

1.3 ACTION SUBMITTALS

- A. Product Data:
 - 1. Data sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static pressure drop, noise ratings.
 - 2. Diffuser, Register, and Grille Schedule :Indicate drawing designation, room location, quantity, model number size and accessories furnished.
- B. Samples for initial Selection: For Diffusers, registers, and grilles with factory applied color finishes.
- C. Samples for verification: For diffusers, registers, and grilles in manufacturer standard sizes to verify color selected.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordinated Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using the input from installers of the items of involved:
 - 1. Ceiling suspension assembly members.
 - 2. Method of attaching hangers to building structures.
 - 3. Size and location of initial access modules for acoustical tile.
 - 4. Ceiling mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers access panels, and special moldings.
 - 5. Duct access panels.

- B. Source quality control reports.

PART 2 – PRODUCTS

2.1 REGISTERS AND GRILLES

A. Adjustable grille:

1. Manufactures: Subject to compliance with requirements, available manufactures offering products that may be incorporated into the work include, but are not limited to the following:
 - a. A-J Manufacturing Co.,Inc.
 - b. Anemostat products; a Mestek Company
 - c. Carnes
 - d. Dayus Register & Grille Inc.
 - e. Hart and Cooley Inc.
 - f. Kruegar
 - g. Nailor Industries Inc.
 - h. Price Industries
 - i. Titus
 - j. Tuttle & Bailey.
2. Material: Aluminum.
3. Finish: Baked enamel, white.
4. Core Construction: Integral.
5. Mounting: Wall

2.2 DAMPERS

A. Fire Dampers:

1. Fire dampers must be 3 hour static rated approved for use in walls, floors, and partitions.
2. Must meet NFPA Standards 80, 90A and 101
3. Device closure activated by fusible link at 165 °F
4. Material: 304 stainless steel

5. Mounting: Vertical wall

2.3 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, “Method of Testing for Rating the Performance of Air Outlets and Inlets.”

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Examine areas where diffusers, registers and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, air flow pattern, throw and pressure drop. Make final locations where indicated , as much as practical. For units installed in lay in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify City for a determination of final location.
- C. Install diffusers, registers and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors and fire dampers.

3.3 ADJUSTING

- A. After installation, adjust diffusers, registers and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

SECTION 23 60 00

AIR CONDITIONING EQUIPMENT

PART 1 - GENERAL

1.1 THE REQUIREMENT

- A. Provide air conditioning units and appurtenances, complete and operable, in accordance with the Contract Documents.
- B. Where two or more air conditioning units or appurtenances of the same type or size are required, they shall be furnished by the same Manufacturer.

1.2 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with the requirements of Section 013300 - Contractor Submittals.
- B. The submittals shall include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.
- C. Furnish a certified fan curve for each fan.

1.3 CODE REQUIREMENTS

- A. The WORK shall be in strict accordance with the Florida Building Code, Florida Mechanical Code, and other authorities having jurisdiction.
- B. Obtain the required certifications and become thoroughly familiar with the local codes.
- C. Obtain and pay for all necessary permits.

1.4 REFERENCES

Reference	Title
AMCA	Air Movement and Control Association
ANSI	American National Standards Institute
ARI	Air Conditioning and Refrigeration Institute
NFPA	National Fire Protection Association
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
DOE	Department of Energy
CSA	Canadian Standards Association

Reference	Title
BAS	Building Automation Solutions
AMCA 99	Standard Handbook
AMCA 210	Laboratory Methods of Testing Fans for Rating Purposes
AMCA 300	Test Code for Sound Rating Air Moving Devices
AMCA 301	Method of Publishing Sound Ratings for Air Moving Devices
AMCA 500	Test Methods for Louvers, Dampers, and Shutters
ANSI/AFBMA 9	Load Ratings and Fatigue Life for Ball Bearings
ANSI/UL 900	Test Performance of Air Filter Units
ARI 410	Forced-Circulation Air Cooling and Air Heating Coils
ARI 430	Standard for Application of Central-Station Air Handling Units
ARI 260	Sound Rating of Ducted Air Moving and Conditioning Equipment
NFPA 90A	Installation of Air Conditioning and Ventilation Systems
SMACNA	Low Pressure Duct Construction Standards
AMCA 611-95	Methods of Testing Airflow Measurement Stations for Rating
ASHRAE 52.1/52.2	Method of Testing General Ventilation Air Cleaning Devices for Removal Efficiency by Particle Size
ASHRAE 62	Ventilation for Acceptable Indoor Air Quality
ASHRAE 90.1	Energy Standard for Buildings Except Low-Rise Residential Buildings

PART 2 – PRODUCTS

2.1 SPLIT-TYPE AIR CONDITIONING UNIT (AHU & CND)

A. General

1. Where indicated, provide an air-to-air, electric split heat pump designed to function as a year-round air conditioning system.
2. Main units shall be of the indoor, single-packaged, horizontal type, and shall include an expansion cooling coil with provisions for connection of the remote, air-cooled heat pump condenser.
3. The entire unit shall be UL-listed and shall carry a UL label.
4. Filters
 - a. The main unit shall have an outdoor air inlet with filter, and factory-supplied, one-inch throwaway return air filters.
 - b. Provide 3 spare sets of filters with the main unit.

5. Overall Efficiency
 - a. The overall main unit cooling EER (Energy Efficiency Ratio) shall be rated 10.8 or greater.
- B. Unit Compressors
 1. The compressors shall be welded, fully hermetic, and provided with a crankcase heater and suitable vibration isolators.
 2. The compressors shall be by the same manufacturer as the heat pump unit, and shall be tested and designed in the main unit to operate down to negative 20 degrees F on the heating cycle without shutting off.
 3. The compressors shall be capable of operating to 45 degrees F, at published air flow rates, on the cooling cycle.
 4. The compressors shall be provided with a 5-year warranty.
- C. Condensing Unit
 1. The condensing unit shall consist of the following items:
 - a. coil, with integral subcooling;
 - b. supporting casing, with stand; and,
 - c. wind deflector.
 2. The condensing coil shall be constructed of aluminum plate fins on mechanically-expanded copper tubes.
 3. The tubes shall be cleaned, dehydrated, sealed, leak-tested at 150 psig, and pressure-tested at 500 psig.
 4. The unit casing shall have a Weather Armor, or equal, baked enamel finish.
 5. Provide access panels for electrical connections.
 6. The condensing coil shall be coated with Technicoat 10-2, or equal, except as otherwise indicated.
- D. Fan
 1. The fan shall be a direct-drive, propeller type, and shall be protected by guards.
 2. Motor
 - a. The fan motor shall be a permanent split-capacitor type.
 - b. The motor shall be pre-lubricated, and shall be provided with built-in overload protection.

- c. Motors shall be in accordance with the requirements of Section 260510 – Electric Motors.
 3. Fan shaft shall be corrosion protected.
 4. Fan blades shall have an iridite or aluminum furnish.
 5. A magnetic contactor shall be field-supplied for all condensers.
- E. Controls
 1. Controls shall be factory-wired to operate on a 24-volt, single-phase, 60-Hz power supply.
 2. Provide a factory-mounted multi-position switch to control the unit for continuous fan and cooling operation.
 3. Provide the units with a 24-volt control circuit suitable for connection to the 24-volt remote room thermostat.
 4. Protection
 - a. Compressor protection shall include high-pressure and low-pressure switches, a current lockout, and inherent over-temperature protection.
 - b. Provide a condenser fan interlock.
 - c. Units shall include an evaporator defrost thermostat designed to provide coil freeze-up protection during low ambient temperature conditions.
 5. Condenser Fan Cycling
 - a. Provide a condenser fan cycling control to cycle fan in response to outdoor ambient temperature; Motormaster, or equal.
 - b. The solid-state head pressure control shall be provided with a solid-state control for varying the fan speed to maintain a 100-degree F condensing temperature.
 - c. The control enclosure shall be weathertight and shall have a Weather Armor, or equal, finish.
 - d. The heat pump cooling and heating system shall be protected with high-pressure stats, low-pressure stats, loss-of-charge protection, indoor coil freezestats, and current- and temperature-sensitive overload devices.
 6. Wire each of the indicated devices through the Signal-LOC circuit in order to prevent compressor restart until a reset has been performed at the thermostat.
 7. The standard room thermostat shall contain a compressor malfunction light, designed to illuminate if any of the indicated safety controls trip the compressor through the lockout circuit.

8. The units shall have separate and independent refrigeration and control systems, each designed to allow for standby operation of either compressor if one unit is locked out.
9. Provide 2-stage compressor heating and cooling, with a built-in lockout to prevent resistance heat operation of the electric strip above 40 degrees F ambient.

10. Electrical Connections

- a. Units with factory-installed electric heat shall have a single point power connection to a terminal block.
- b. Cabinets shall contain suitable openings to accommodate the routing of utility connections.
- c. The main unit shall contain a terminal strip in the control compartment to allow for terminal-to-terminal connection of the room thermostat and field-installed accessories.

11. Thermostats

- a. The thermostat assembly shall provide staged heating and cooling, manual and automatic changeover, and fan controls.
- b. The standard subbase shall include a compressor malfunction light (LK-OUT), designed to illuminate if the compressor lockout is activated.
- c. Outdoor thermostats shall provide for the staging of electric resistance heat according to outdoor temperature.
- d. Thermostats shall be wired into the electric heater contactors, and shall have an adjustable set point to provide efficient resistance heat staging.

12. Time Guard Circuit

- a. Provide a time guard circuit to prevent compressor short cycling as a result of a rapid change in the thermostat setting.
- b. The circuit shall automatically prevent a compressor restart until at least 5 minutes after a shutdown.

13. Head Pressure Control

- a. Provide a solid-state, outdoor, fan speed control in order to maintain head pressure control down to a temperature of -20 degrees F during a cooling cycle.
- b. The control shall be inoperative during a heating cycle.

F. Evaporative Coils

1. The evaporator coils shall be of nonferrous construction, with aluminum plate fins

mechanically bonded to seamless copper tubing.

2. The coils shall be fed through the thermostatic expansion valve.

G. Evaporative Air Fan

1. Evaporator unit shall be provided with two (2) fans with VFD.

2. The evaporator air fan shall be capable of delivering the proper volumetric flow rate of air at the indicated external static pressure.

3. Each fan shall be centrifugal, forward-curved, and direct-driven by a motor operating at RPM indicated by VFD.

4. The fan motor shall be in accordance with the requirements of Section 26 05 10 – Electric Motors.

H. Cabinets and Filters

1. Cabinets shall be zinc-surfaced alloyed steel, bonderized, and coated with a polyester enamel.

2. Sections shall be insulated to prevent sweating and to muffle sound.

3. A self-contained filter frame for standard one-inch throwaway filters shall be located inside the cabinet.

4. Filters shall be factory-supplied.

5. Cabinet shall be vertical discharge with front return.

I. Provide hot gas and liquid line shutoff valves in order to connect to a remote, air-cooled condenser coil.

J. Unit shall be shipped with a holding charge.

K. The condensing unit and the indoor evaporator shall be by the same manufacturer.

L. Electrical disconnect switch integral to unit

M. Air Conditioner Manufacturers, or Equal

1. Trane

2. Carrier

3. Daikin

PART 3 – GENERAL

3.1 INSTALLATION

- A. All air conditioning equipment shall be installed in strict accordance with the manufacturer's recommendations.

END OF SECTION

SECTION 26 00 00
ELECTRICAL WORK, GENERAL

PART 1 GENERAL

1.01 SUMMARY

A. Scope

1. This Section specifies general requirements for all electrical work.
2. Provide the electrical work, complete and operable, as indicated in accordance with the Contract Documents.
3. The provisions of this Section shall apply to all sections in Division 26 - Electrical, except as otherwise indicated.
4. The Work of this Section is required for operation of electrically-driven equipment provided under the Specifications and Drawings.
5. The Contractor's attention is directed to the requirement for proper coordination of the Work of this Section with other components of the Work as provided in the equipment specifications, the Instrumentation Specifications, and Section 26 05 10 - Electrical Motors.
6. Concrete, excavation, backfill, and steel reinforcement required for encasement, installation, or construction of the Work of Division 26 - Electrical is included as a part of the Work of those respective specification sections, including duct banks, manholes, handholes, equipment housekeeping pads, and light pole bases.
7. Equipment supports and foundations shall be in conformance with the requirements of Section 43 05 11 - General Requirements for Equipment.
8. The Contractor shall note the requirement to provide all major electrical equipment by a single electrical equipment manufacturer. See additional requirements herein.

1.02 QUALITY ASSURANCE

A. Reference Codes and Standards

1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
ANSI	American National Standards Institute
FBC	Florida Building Code
NEC (NFPA 70)	National Electrical Code
NETA	International Electrical Testing Association
NEMA 250	Enclosure for Electrical Equipment (1000 Volts Maximum)
NRTL	National Recognized Testing Laboratory
NECA	National Electrical Contractor Association

- B. Electrical equipment shall be listed by and shall bear the label of Underwriters' Laboratories, Inc. (UL) or an independent testing laboratory acceptable to the local code enforcement agency having jurisdiction.
- C. Installation of electrical equipment and materials shall comply with OSHA Safety and Health Standards (29 CFR 1910 and 29 CFR 1926, as applicable), state building standards, and applicable local codes and regulations.
- D. Where the requirements of the Specifications conflict with UL, NEMA, NFPA, or other applicable standards, the more stringent requirements shall govern.

1.03 ENVIRONMENTAL CONDITIONS

- A. Equipment in this Section shall be subjected to environmental conditions in accordance with Section 01 11 80 – Environmental Conditions.

1.04 SUBMITTALS

- A. Preconstruction/Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.
 1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.
 If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.
 The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.
 2. Custom-prepared Shop Drawings.

3. Drawings or data indicating "optional" or "as required" equipment will not be accepted.
4. Cross out options not proposed or delete from the Shop Drawings.
5. Check marked Specifications shall be included with submittals as required.
6. Clearly list deviations and justification for acceptance.
7. Provide written responses to all comments on submittals in re-submittals.
8. Shop Drawings: Include the following
 - a. Complete material lists stating Supplier and brand name of each item or class of material.
 - b. Shop Drawings for grounding work not specifically indicated
 - c. Front, side, rear elevations, and top views with dimensional data
 - d. Location of conduit entrances and access plates
 - e. Component data
 - f. Connection diagrams, terminal numbers, internal wiring diagrams, conductor size, and cable numbers
 - g. Method of anchoring, weight
 - h. Types of materials and finish
 - i. Nameplates
 - j. Temperature limitations, as applicable
 - k. Voltage requirement, phase, and current, as applicable
 - l. Front and rear access requirements
 - m. Test reports
 - n. Grounding requirements
9. Catalog Cuts
 - a. Submit catalog cuts or photocopies of applicable pages of bulletins or brochures for mass produced, non-custom manufactured material.
 - b. Stamp the catalog data sheets in order to indicate the name of the Work, applicable specification sections and paragraphs, model number, and options.
10. Materials and Equipment Schedules
 - a. Within 30 Days of the commencement date in the Notice to Proceed, deliver to the Contractor a complete list of materials, equipment, apparatus, and fixtures that are proposed for use.
 - b. Include in the list the type, size, name of Suppliers, catalog number, and such other information as required to identify the item.
11. Technical Manuals
 - a. Submit complete information in accordance with the requirements of Section 01 33 00 – Submittals.
 - b. As-Built Drawings
 - 1) A set of "Red-Lined" electrical plans shall be carefully maintained at the job site. Actual conditions are to be put on the As-Built Drawings in red on a daily basis so the As-Built Drawings will continuously show locations and routings of cables, conduits, pull boxes, circuit numbers, and other information required by the Contractor. An up-to-date copy of the "Red-Lined" drawing shall be submitted to the City by the Contractor once every two weeks. At the

end of the Work, the contractor shall turn over As-Built Drawings in AutoCAD format to the City.

- 2) Prepare As-Built Drawings, showing invert and top elevations and routing of duct banks and concealed below-grade electrical installations.
- 3) Furnish the As-Built Drawings to the Contractor in accordance with the requirements of Section 01 33 00 – Submittals
- 4) In addition, each "As Built" single line diagram shall be framed under glass and mounted on wall near respective units of switchboards, switchgear, unit substations, integrated power centers, MCC's, etc.
- 5) As-Built Drawings shall be framed under glass and mounted on the wall in the related Main Electrical Room and other Electrical Room.
- 6) Prepare As-Built Drawings of encased concealed and exposed raceways, ducts, raceways, junction boxes, pull boxes, and electrical and instrumentation equipment.
- 7) Show routings, burial depths, manhole and pullboxes locations and sizes, and where applicable, connections to drainage systems.

1.05 BASIS FOR WIRING DESIGNS

- A. The Drawings and Specifications describe specific sizes of switches, breakers, fuses, conduits, conductors, motor starters and other wiring equipment. These sizes are based on specific power consuming equipment (heaters, lights, motors for fans, compressors, pumps, etc.) Wherever another trade provides power consuming equipment which differs from Drawings and Specifications, the wiring for such equipment shall be changed to proper sizes to match at no additional expense to the City.

1.06 SIGNAGE AND MARKINGS

- A. Identification
 1. Provide danger, caution, and warning signs and equipment identification markings in accordance with applicable federal, state, OSHA, and NEC requirements.
- B. Local Disconnect Switches
 1. Legibly mark each local disconnect switch for motors and equipment in order to indicate its purpose, unless the purpose is indicated by the location and arrangement.
- C. Warning Signs
 1. 600 Volts Nominal, or Less
 - a. Mark entrances to rooms and other guarded locations that contain live parts with conspicuous signs prohibiting unqualified persons from entering.
 2. Greater than 600 Volts
 - a. Buildings, rooms, or enclosures containing exposed live parts or exposed conductors operating at greater than 600 volts nominal shall be lockable.
 - b. Provide permanent and conspicuous warning signs reading as follows: Danger – High Voltage – Keep Out.

3. Mark indoor electrical installations that are open to unqualified persons and contain metal-enclosed switchgear, unit substations, transformers, and other similar associated equipment over 600 volts nominal, with appropriate caution signs.
 4. Outside Branch Circuits and Feeders over 600 Volts
 - a. Post warning signs in plain view where unauthorized persons might come in contact with live parts: Warning – High Voltage – Keep Out.
- D. Isolating Switches
1. Provide isolating switches not interlocked with an approved circuit-interrupting device with a sign warning against opening them under load.

1.07 PERMITS AND INSPECTION

- A. Obtain permits and pay inspection fees according to the General Conditions.
- B. When indicated, pay connection and turn-on service charges required by Florida Power and Light (FPL).

1.08 AREA DESIGNATIONS

- A. Designations for raceway system enclosures shall comply with the requirements of Section 26 05 33 – Electrical Raceway Systems.
- B. Designations for electrical work specifically indicated in other specification sections shall comply with the requirements of those specification sections unless indicated otherwise.
- C. Designations for electrical work not included in the above Paragraphs shall be NEMA 4X.
- D. Installations in hazardous locations shall conform strictly to NEC requirements for the indicated Class, Group, and Division.
- E. All exterior areas, process areas, tanks and treatment basins shall be at a minimum considered wet and corrosive.
- F. There are multiple classified areas on this Work Site. The Contractor shall reference Area Classification Summary sheet in the General Sheets.

1.09 TESTS

- A. The Contractor shall be responsible for factory and field tests indicated in Division 26 - Electrical, as required by the Design-BUILDER, and as required by other authorities having jurisdiction.
- B. Furnish necessary testing equipment.
- C. Pay the costs of the tests, including replacement parts and labor, due to damage resulting from damaged equipment or from testing and correction of a faulty installation.
- D. Reporting
 1. Where test reporting is indicated, submit proof-of-design test reports for mass-produced equipment with the Shop Drawings.

2. Submit factory performance test reports for custom-manufactured equipment for approval prior to shipment.
 3. Submit field test reports for review prior to Substantial Completion.
- E. Remove and replace equipment or material that fails a test, or, if the Design-Builder approves, repair and retested for compliance.
- F. Corrections to equipment or materials with a factory warranty shall be as recommended by the Supplier and shall be performed in a manner that does not void the warranty.

1.10 DEMOLITION AND RELATED WORK

- A. Perform electrical demolition work as indicated.
- B. The Contractor is cautioned that demolition work may also be indicated on non-electrical drawings, as shown on the Plans.
- C. Coordinate with all trades regarding electrical de-energization, disconnection, and removal, and the overall sequence of construction.
- D. Electrical Requirements for Removed Equipment
1. Remove dedicated wiring and exposed conduits back to the source.
 2. Abandon in place wiring that shares conduits with other equipment wiring, except power wiring. Remove power wiring from the power source to the first pullbox or manhole remote from the panel, and abandon in place the remaining wiring.
 3. Encased Conduits
 - a. Abandon in place wiring routed through encased conduits.
 - b. Cut encased conduits flush to the floor and grout flush with the floor.
 4. Remove remote-mounted starters, disconnect switches, circuit breakers, sensors, and transmitters.
- E. Where new lighting and receptacles are installed, remove old lighting, receptacles, switches, wiring, and conduits, and replace in their entirety.
- F. Junction Boxes
1. Wiring and conduits indicated to be extended shall be terminated in a new junction box with terminal strips.
 2. Provide a junction box with a NEMA rating in accordance with the area in which it is located, and sized as required.
 3. Properly identify wires and terminals before disconnection.
- G. Removed materials and equipment not indicated to be returned to the County shall, upon removal, become the Contractor's property and shall be disposed of off-site.
- H. Remove and relocate material and equipment indicated to be relocated or reused, and reinstall with care in order to prevent damage.
- I. Place materials indicated to be returned to the City in boxes, with the contents clearly marked, and store at a location determined by the City.

- J. Identification
 - 1. Where motor control centers and panelboards are indicated to have components, assemblies, or circuits removed and reconnected, provide the affected MCC compartments with new engraved nameplates worded as indicated and matching the existing, or modify the panelboard schedule to indicate the revised circuits.
 - 2. Pencil or magic marker markings directly on the MCC or panelboard will not be accepted.

1.11 CONSTRUCTION SEQUENCING

- A. Because the continuance of plant operation during the expansion process is critical, the Design-Builder shall carefully examine the Work to be provided in, on, or adjacent to existing equipment. Schedule the Work, subject to the City's approval, to minimize required shutdown time.
- B. Submit a written sequencing request, including the sequence and duration of activities to be performed during plant shutdown.
- C. Switching, safety tagging, and the like, as required for plant shutdown or to isolate existing equipment, shall be performed by the City.
- D. In no case shall the Contractor begin any work in, on, or adjacent to existing equipment without written authorization from the Contractor and the City.

1.12 MODIFICATIONS

- A. Perform modifications or alterations to existing electrical facilities as required to successfully install and integrate the proposed electrical equipment as indicated.
- B. Perform modifications to existing equipment, panels, and cabinets in a professional manner.
- C. Repair coatings to match existing.
- D. The costs for modifications to existing electrical facilities that are required for a complete and operating system shall be included as part of the Work.
- E. Existing Utilities
 - 1. Exercise extreme caution when digging trenches to not damage existing underground utilities.
 - 2. The cost of repairs of damages caused during construction shall be included as a part of the Work.
- F. Field Verifications
 - 1. Visit the Site before submitting a Bid to become better acquainted with the Work under this Contract.
 - 2. The lack of knowledge will not be accepted as justification for extra compensation to perform the Work.
 - 3. The Contractor shall be responsible for identifying available existing circuit breakers in lighting panels for the intended use as required.

4. The Contractor shall be responsible for field verifying the available space in substation switchboards to integrate new power circuit breakers.
 5. The cost for the above verifications shall be included as part of the Work.
- G. Installation of Temporary Equipment
1. To facilitate the continuous operation of existing equipment, provide the temporary equipment as indicated.
 2. Submit installation and connection details for review and acceptance by the Contractor.
 3. Costs associated with these temporary installations shall be included as part of the Work.
 4. Temporary wiring and equipment shall remain the property of the Contractor unless indicated otherwise.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Materials specified are considered the minimum acceptable for the purposes of durability, strength, and resistance to erosion and corrosion. The Contractor may propose alternative materials for the purpose of providing greater strength or to meet required stress limitations. However, alternative materials must provide at least the same qualities as those specified for the purpose. If alternatives are proposed, the proposals shall be accompanied with documentation supporting the claimed superiority of the proposed substitutions. The Engineer shall be the sole decider in the equivalency of alternative materials of construction.

2.02 MATERIAL REQUIREMENTS

- A. Provide sealing fittings in chlorine and hydrofluosilicic (HFS) acid areas.
- B. Construct NEMA 4X enclosures of Type 316 stainless steel, except in chlorine areas where non-metallic enclosures shall be provided.
- C. Do not coat NEMA 4X enclosures.
- D. Construct NEMA 7 enclosures of cast aluminum where used with aluminum conduit.
- E. Do not coat NEMA 7 and 9 enclosures.
- F. Construct NEMA 1, 3R, and 12 enclosures of steel, and prime and coat with ANSI 61 light grey paint.

2.03 GENERAL

- A. Provide equipment and materials that are new and are the products of experienced and reputable Suppliers in the industry.
- B. Provide equipment and materials listed by UL and bearing the UL label, where UL requirements apply.

- C. Provide similar items in the Work as products of the same Supplier.
- D. Major electrical equipment shall be supplied by a single electrical manufacturer. This requirement does not include Supplier/Vendor-provided package systems and control panels; however, it is the City's preference to standardize on as much of the major electrical components as possible. Major electrical equipment that shall be applicable to this requirement shall include the following:
 - 1. Medium Voltage Switchgear and Control Panels
 - 2. Unit Substation Transformers (liquid-filled and dry type)
 - 3. Low Voltage Switchgear
 - 4. Low Voltage Motor Control Centers
 - 5. MV and LV Variable Frequency Drives
 - 6. Medium Voltage Manual Transfer Switches (MV-MTS)
 - 7. Switchboards and Panelboards
 - 8. Disconnect and Automatic Transfer Switches
 - 9. Diesel Generators (Certified Tier 4 Final)
 - 10. Generator Paralleling and Controls
 - 11. Neutral Grounding Resistors
 - 12. Utility Grade Protective Relays
- E. Provide equipment and materials of industrial grade standard of construction.
- F. Where a NEMA enclosure type is indicated in a non-hazardous location, use that type of enclosure despite the fact that certain modifications such as cutouts for control devices may negate the NEMA rating.
- G. On devices indicated to display dates, display the year as 4 digits.
- H. Temperature Ratings of Equipment Terminations
 - 1. Provide terminations and lugs rated for use with 75-degree C conductors.
 - 2. Wire sizes in the Contract Documents are based on NEC ampacity tables using the 75-degree C ratings.

2.04 MOUNTING HARDWARE

- A. Miscellaneous Hardware
 - 1. Provide nuts, bolts, and washers constructed of stainless steel.
 - 2. Provide threaded rods for trapeze supports constructed from continuous threaded stainless steel, 3/8-inch diameter minimum.
 - 3. Struts
 - a. Construct struts for mounting of conduits and equipment of aluminum except where additional strength is needed, then use stainless steel (316). Coat the back of aluminum struts with bitumastic coating where it comes in contact with concrete.
 - b. Use Fiberglass (FRP) struts in Chlorine areas.
 - c. Where contact with concrete or dissimilar metals may cause galvanic corrosion, use suitable non-metallic insulators in order to prevent such corrosion.

- d. Do not use aluminum strut for free-standing support frames. Use stainless steel except in chlorine areas where FRP strut shall be used.
- e. Strut supplier
 - 1) Unistrut,
 - 2) B-Line, or
 - 3) Approved Equal.
- 4. End Caps
 - a. Provide plastic protective end caps for all exposed metal strut ends.
 - b. End caps supplier:
 - 1) Unistrut, Model P2860, or
 - 2) Approved Equal.
- 5. Anchors
 - a. Provide stainless steel expansion anchors for attaching equipment to concrete walls, floors, and ceilings.
 - b. Wood plugs will not be accepted.
 - c. Anchor supplier:
 - 1) "Power-Bolt" or "Power-Stud" as manufactured by Power Fasteners, Inc.; similar by Hilti.; or
 - 2) Approved Equal.

2.05 PROTECTIVE MATTING

- A. Provide full-width, high-voltage switchboard matting in front of indoor switchgear, service equipment, and motor control centers.
- B. For 600-volt equipment, provide matting that is 1/4 inch thick and 36 inches wide.
- C. Matting supplier:
 - 1. W.H. Salisbury and Company;
 - 2. Mats, Inc.;
 - 3. Rhino; or
 - 4. Approved Equal.

2.06 NAMEPLATES

- A. Electrical nameplates shall be provided on each electrical item supplied; including control panels as specified in Division 40 - Process Integration, power distribution equipment, panelboards, motor control centers, switchgear, variable frequency drives, pull boxes, termination cabinets and the like.
- B. Equipment mounted nameplates shall be stainless steel fastened using stainless steel screws or approved alternate by the Supplier.
- C. Field applied nameplates shall be made from laminated phenolic plastic.
 - 1. Nominals size: 3/4 inch high by 2 inches long.
 - 2. Black backgrounds with 3/16-inch white letters.

3. Fastened using self-tapping stainless steel screws with interior sealant. Adhesive may be used if tapping screws derate the enclosures NEMA rating.
- D. Nameplate data shall include the following minimum information:
1. Equipment description
 2. Equipment model and serial number
 3. Equipment name and tag number in accordance with the Contract Documents
 4. Supplier information
 5. Manufacturing date
 6. Equipment rating data and information

PART 3 EXECUTION

3.01 GENERAL

- A. Incidentals
1. Provide materials and incidentals required for a complete and operable system, even if not required explicitly by the Contract Documents.
 2. Typical incidentals are terminal lugs not furnished with Supplier/Vendor-supplied equipment, compression connectors for cables, splices, junction and terminal boxes, and control wiring required by Supplier/Vendor-furnished equipment to connect with other equipment indicated in the Contract Documents.
- B. Field Control of Location and Arrangement
1. The Plans diagrammatically indicate the desired location and arrangement of outlets, conduit runs, equipment, and other items.
 2. Exact locations shall be determined by the Contractor in the field, based on the physical size and arrangement of equipment, finished elevations, and other obstructions.
 3. Follow the locations on the Drawings, however, as closely as possible.
 4. Electrical layout drawings are diagrammatic, unless otherwise detailed or dimensioned. The contractor shall coordinate the location of electrical material or equipment with the Work. This includes laying out electrical equipment to conform to the details shown on the Plans and with actual process and mechanical equipment. Contractor shall provide working space around all equipment and clear working space about electrical equipment in accordance with the NEC as a minimum standard.
 5. In general, conduit routing is not shown on the Plans. Conduit routings and stub-up locations that are shown are approximate. The contractor is responsible for routing all conduits including those shown on electrical and instrumentation one-line diagrams, risers and home runs shown on floor plans. The Contractor shall coordinate conductor and conduit quantities; conduit routings and stub-up locations with approved equipment submittals, other trades and field conditions.
 6. This Work includes several packaged systems for process and HVAC systems. It also includes performance-type specifications. Specific equipment, devices and controls vary depending on the Supplier/Vendor of these systems. The Contractor shall install and wire all equipment and controls; including packaged systems, and perform all tests necessary to assure conformance to the Contract Documents and ensure that

the equipment is ready and safe for energization. The Contractor shall account for these systems variances in the bid. Additional conduit and cable is required to be provided as a part of these specification requirements that is not shown on the Plans. The Contractor shall review these specifications and include conduit, cable and ancillary materials as required for these systems.

7. Conduits

- a. Where conduit development drawings or "home runs" are indicated, route the conduits in accordance with those requirements.
- b. Provide exposed or encased routings as indicated, except conceal conduit in finished areas unless indicated otherwise.
- c. Size conduits encased in a slab for conduit OD not to exceed 1/3 of the slab thickness, and lay out and space as to not impede concrete flow.

8. Placement

- a. Install conduit and equipment in such a manner as to avoid obstructions, to preserve headroom, and to keep openings and passageways clear.
- b. Locate luminaires, switches, convenience outlets, and similar items within finished rooms as indicated.
- c. Where exact locations are not indicated, such locations will be determined by the Contractor.
- d. If equipment is installed without instruction and must be moved, the cost of moving shall be included as part of the Work.
- e. Slightly adjust luminaire locations based on actual field conditions in order to avoid obstructions and to minimize shadows, and update As-Built Drawings accordingly.

9. Circuits

- a. Wherever conduits and wiring for lighting and receptacles are not indicated, it shall be the Contractor's responsibility to provide lighting and receptacle-related conduits and wiring as required, based on the actual installed fixture layout and the circuit designations as indicated.
- b. Provide No. 12 AWG minimum wiring, and 3/4-inch minimum conduits (exposed) and one-inch minimum conduits (encased).
- c. Where circuits are combined in the same raceway, derate conductor ampacities in accordance with NEC requirements.

10. Workmanship

- a. Install materials and equipment in workman like manner and in strict accordance with the printed recommendations of the Supplier, and using workers skilled in the particular Work.
- b. Coordinate installation in the field with other trades in order to avoid interferences.

11. Protection of Equipment and Materials

- a. Fully protect materials and equipment against damage from any cause.
- b. Cover materials and equipment, both in storage and during construction, in such a manner that no finished surfaces will be damaged, marred, or splattered with water, foam, plaster, or paint.
- c. Keep moving parts clean and dry.

- d. Replace or refinish damaged materials or equipment, including faceplates of panels and switchboard sections, as part of the Work.
- C. Provide incoming utility power equipment in conformance with the utility's requirements.
- D. Provide power wiring in conduit for the HVAC equipment in accordance with the requirements of Division 23 – Heating, Ventilating, and Air Conditioning.
- E. Provide starters shall be in accordance with the requirements of Section 26 29 00 – Low Voltage Motor Control Center for starters in MCC'S, and with Section 26 05 15 – Local Control Stations and Miscellaneous Electrical Devices for starters not in MCC'S, except for starters in HVAC equipment which are indicated in Division 23 – Heating, Ventilating and Air Conditioning.
- F. Provide control wiring operating at 120 volts and less as indicated in Division 23 – Heating, Ventilating and Air Conditioning.

3.02 CORE DRILLING

- A. Perform core drilling as required for the installation of raceways through concrete walls and floors.
- B. Base the locations of floor penetrations, as may be required, on field conditions.
- C. Verify exact core drilling locations based on equipment actually furnished as well as exact field placement.
- D. To the extent possible, identify the existence and locations of encased raceways and other piping in existing walls and floors with the City prior to any core drilling activities.
- E. Repair damage to walls, floors, encased conduits, wiring, and piping as part of the Work.

3.03 CONCRETE HOUSEKEEPING PADS

- A. Provide concrete housekeeping pads for outdoor and indoor floor-standing electrical equipment as indicated on the Drawings and as required herein.
- B. Extend housekeeping pads for equipment, including future units, 4 inches (nominal) with 1" bevel above the surrounding finished floor or grade, and one inch larger in both dimensions than the equipment, unless otherwise indicated.
- C. Provide concrete housekeeping curbs for and conduit stub-ups in indoor and outdoor locations that are not concealed by equipment enclosures.
- D. Extend housekeeping curbs to 4 inches above the finished floor or grade.

3.04 EQUIPMENT ANCHORING

- A. Floor-supported, wall, or ceiling-hung equipment and conductors shall be anchored in place by methods that will meet requirements in the area where the Work is located.

- B. Provide wall-mounted panels that weigh more than 500 pounds or that are within 18 inches of the floor with fabricated steel support pedestals.
- C. If the supported equipment is a panel or cabinet enclosed within removable side plates, match supported equipment in physical appearance and dimensions.
- D. Provide transformers hung from 4-inch stud walls and weighing more than 300 pounds with auxiliary floor supports.
- E. Provide leveling channels anchored to the concrete pad for switchgear and pad-mounted transformer installations.
- F. Supplier's Recommendations
 - 1. Anchoring methods and leveling criteria in the printed recommendations of the equipment suppliers are a part of the Work of this Contract.
 - 2. Submit such recommendations as Shop Drawings as indicated.

3.05 CLEANING

- A. Before Final Acceptance, thoroughly clean the electrical work of cement, plaster, and other materials.
- B. Remove temporary tags, markers, stickers, and the like.
- C. Remove oil and grease spots with a non-flammable cleaning solvent, by carefully wiping and scraping cracks and corners.
- D. Apply touch-up paint to scratches on panels and cabinets.
- E. Vacuum-clean electrical cabinets and enclosures.
- F. Clean luminaires inside and out.
- G. Dispose cleaning debris and refuse off-Site.

3.06 INSTALLATION AND TEST FORMS

- A. All applicable electrical equipment startup and commissioning will be documented as required by individual specification sections.
- B. All applicable Division 26 - Electrical forms in Section 01 99 90 - Reference Forms shall be completed prior to acceptance.

END OF SECTION

SECTION 26 01 26

ELECTRICAL TESTS

PART 1 GENERAL

1.01 SUMMARY

A. Scope

1. This Section specifies the Work necessary to test, commission, start-up, and demonstrate that the electrical work satisfies the criteria of these Specifications and functions as required by the Contract Documents. All electrical testing shall be performed by a third-party electrical testing company that is industry qualified to perform testing for medium and low voltage electrical equipment. Submit the resume/qualifications of the electrical testing company, including electrical test equipment for Engineer review and approval.
2. The Work of this Section includes furnishing the labor, equipment, and power required to support the testing indicated in other Divisions of these Specifications. Electrical testing indicated herein and functional testing of power and controls not tested under Division 40 – Process Integration, shall be completed before commencement of the 7-day test of Section 01 75 00 - Equipment Testing and Plant Startup. This scope may require the Design-Builder to activate circuits, shutdown circuits, run equipment, make electrical measurements, replace blown fuses, and install temporary jumpers, etc.
3. The requirements of Section 26 00 00 – Electrical Work, General, apply to the Work of this Section.
4. Carry out tests indicated herein for individual items of materials and equipment in other specification sections. Testing shall be done in accordance with the Supplier's instructions, these Specifications, and applicable NETA Acceptance Testing Specifications, NEMA, ANSI, NFPA, and ASTM Standards.

1.02 QUALITY ASSURANCE

A. Reference Codes and Standards

1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida

Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
ANSI	American National Standards Institute
IEEE	Institute of Electrical and Electronics Engineers, Inc.
IEEE 400-2001	Guide for Field Testing and Evaluation of the Insulation of Shielded Power Cable Systems
IEEE 576-2000	Recommended Practice for Installation, Termination, and Testing of Insulated Power Cable as Used in Industrial and Commercial Applications
NETA	International Electrical Testing Association
NFPA 70	National Electrical Code (NEC)

3. The publications listed below form a part of this Section to the extent referenced.
4. Where reference is made standards, the revision in effect at the time of bid opening shall apply.
5. The publications listed below form a part of this Section to the extent referenced.
6. Where reference is made standards, the revision in effect at the time of bid opening shall apply.

1.03 ENVIRONMENTAL CONDITIONS

- A. Equipment in this Section shall be subjected to environmental conditions in accordance with Section 01 11 80 – Environmental Conditions.

1.04 SUBMITTALS

- A. Preconstruction/Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.

1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.

2. Submit in accordance with Section 01 33 00 - Submittals, and Section 26 00 00 - Electrical Work, General.
3. Submit complete system test procedures for review. Test procedures shall include but not be limited to
 - a. Detailed procedures in sufficient detail to verify conformance with these Specifications.
 - b. Incorporation of the Test Record Sheets included at the end of this Section. Additional forms shall be completed as required in Section 01 99 90 – Reference Forms.
 - c. Detailed comprehensive testing schedule including
 - 1) Each major piece of electrical distribution equipment.
 - 2) Each major electrical subsystem.
 - 3) Duration of each test.
 - 4) Milestone test completion date.
 - 5) Ambient Conditions at time of test
 - 6) Date of test results submittals following completion of the tests.
 - 7) Names and qualifications of the individual(s) responsible for performing the testing; including certifications.
4. Following completion of the test submit the completed test results to the Contractor for review. The results shall include a dedicated section with the “as-left” settings of all devices, relays, circuit breakers, etc.
5. Test result shall be submitted in one submittal.
6. Test reports shall be based on NETA’s latest Acceptance Testing Specifications having a sign-off, pass/fail data filed for each line item covered by NETA’s Acceptance Testing Specifications latest edition.

PART 2 TESTING AND REPORTS

2.01 PRE-ENERGIZATION AND OPERATING TESTS

- A. The complete electrical system shall be performance tested when first installed on-Site. Each protective, switching, and control circuit shall be adjusted in accordance with the recommendations of the protective device study and tested by actual operation using current injection or equivalent methods as necessary to ensure that each and every such circuit operates correctly to the satisfaction of the authority having jurisdiction.
 1. Instrument Transformers: All instrument transformers shall be tested to verify correct polarity and burden.
 2. Protective Relays: Each protective relay shall be demonstrated to operate by injecting current or voltage, or both, at the associated instrument transformer output terminal and observing that the associated switching and signaling functions occur correctly and in proper time and sequence to accomplish the protective function intended.
 3. Medium Voltage Circuit Breakers and Switching Circuits: Each MV circuit breaker and switching circuit shall be observed to operate the associated equipment being switched.
 4. Control and Signal Circuits: Each control or signal circuit shall be observed to perform its proper control function or produce a correct signal output.

5. Metering Circuits: All metering circuits shall be verified to operate correctly from voltage and current sources, similarly to protective relay circuits. Verify that all values (actual and calculated) are correct for all programmable meters and protective relays.
 6. Acceptance Tests: Complete acceptance tests shall be performed, after the station installation is completed, on all assemblies, equipment, conductors, and control and protective systems, as applicable, to verify the integrity of all the systems.
 7. Relays and Metering Utilizing Phase Differences: All relays and metering that use phase differences for operation shall be verified by measuring phase angles at the relay under actual load conditions after operation commences.
- B. Test Report. A test report covering the results of the tests required in the Pre-Energization and Operating Tests shall be delivered to the authority having jurisdiction prior to energization. Acceptance Testing shall be in accordance with NETA ATS-2013, Electrical Power Distribution Equipment and Systems, published by the InterNational Electrical Testing Association.

2.02 TEST REQUIREMENTS

- A. The following test requirements supplement test and acceptance criteria that may be stated elsewhere.
1. Lighting: Switching, include remote control, if present in system. Circuitry is in accordance with panel schedules. All interior and exterior lighting shall be checked for proper operation.
 2. Power Instrumentation: Demonstrate that voltmeter and ammeter switches are functional. Demonstrate that kilowatt meters are within catalog accuracy as installed.
 - a. Visual and Mechanical Inspection
 - 1) Compare equipment nameplate data with the Plans and Specifications.
 - 2) Inspect physical and mechanical condition.
 - 3) Verify tightness of electrical connections.
 - 4) Inspect cover gasket, cover glass, condition of spiral spring, disk clearance, contacts, and case-shorting contacts, as applicable.
 - 5) Verify freedom of movement, end play, and alignment of rotating disk(s).
 - b. Electrical Tests
 - 1) Verify accuracy of meters at all cardinal points.
 - 2) Calibrate watt-hour meters according to Supplier's published data.
 - 3) Verify all instrument multipliers.
 - 4) Verify that current transformer and voltage transformer secondary circuits are intact.
 3. Demonstrate mechanical and/or electrical interlocking by attempting to subvert the intended sequence.
 4. Activate ground fault tripping by operating test features provided with ground current protective systems and by injecting a known and reasonable current in the ground current sensor circuit. In general, ground fault tripping should occur at a ground current equivalent to 20 percent of phase current. Current injection is not required of circuit 400 amperes or less.
 5. Low Voltage Cables - 600 volts Maximum

- a. Visual and Mechanical Inspection
 - 1) Compare cable data with the Plans and Specifications.
 - 2) Inspect exposed sections of cables for physical damage and correct connection in accordance with single-line diagram.
 - 3) Inspect bolted electrical connections for high resistance using one of the following methods
 - a) Use of low-resistance ohmmeter
 - b) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with Supplier's published data or NETA ATS- 2013, Table 100.12.
 - c) Perform thermographic survey in accordance with below paragraph "Thermographic Survey".
 - 4) Inspect compression-applied connectors for correct cable match and indentation.
 - 5) Inspect for correct identification and arrangements.
 - 6) Inspect cable jacket insulation and condition.
- b. Electrical Tests
 - 1) Perform insulation-resistance test on each conductor with respect to ground and adjacent conductors. Applied potential shall be 500 volts dc for 300 volt rated cable and 1000 volts dc for 600 volt rated cable. Test duration shall be one minute.
 - a) Motor feeders tested with motors disconnected and controller open.
 - b) Motor control circuits tested and verified for proper operation with control stations and overcurrent devices connected.
 - c) Panelboard feeders tested with feeder breaker open and panel-board connected. If a lighting transformer is associated with the panelboard, it shall be connected and the test made for both primary and secondary sides.
 - d) Conductors of main lighting feeders, including lighting panel with branch circuits open.
 - e) Prior to performing insulation resistance tests on cables, verify that they are not connected to a solid state device.
 - f) Equipment which may be damaged during this test shall be disconnected.
 - g) The Contractor shall be consulted if minimum insulation values cannot be obtained.
 - 2) Perform resistance measurements through all bolted connections with low-resistance ohmmeter, if applicable.
 - 3) Perform continuity test to insure correct cable connection.
- c. Test Values – Visual and Mechanical
 - 1) Compare bolted connection resistance to values of similar connections. Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.
 - 2) Bolt-torque levels should be in accordance with NETA ATS-2013, Table 100.12 unless otherwise specified by the Supplier.
 - 3) Results of the thermographic survey shall be in accordance with the below paragraph "Thermographic Survey."

- d. Test Values – Electrical
 - 1) Compare bolted connection resistance values to values of similar connections. Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.
 - 2) Insulation-resistance values shall be in accordance with Supplier’s published data. In the absence of Supplier’s published data, use NETA ATS-2013 Table 100.1. Values of insulation resistance less than this table or Supplier’s recommendations shall be investigated.
 - 3) Cable shall exhibit continuity.
 - 4) Deviations in resistance between parallel conductors shall be investigated.
- 6. Cables, Medium and High
 - a. Visual and Mechanical Inspection
 - 1) Compare cable data with the Plans and Specifications.
 - 2) Inspect exposed sections of cables for physical damage.
 - 3) Inspect bolted electrical connections for high resistance using one of the following methods
 - a) Use of low-resistance ohmmeter.
 - b) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with Supplier’s published data or NETA ATS- 2013, Table 100.12.
 - c) Perform thermographic survey in accordance with below section “Thermographic Survey.”
 - 4) Inspect compression-applied connectors for correct cable match and indentation.
 - 5) Inspect shield grounding, cable support, and termination.
 - 6) Verify that visible cable bends meet or exceed ICEA and Supplier’s minimum allowable bending radius.
 - 7) Inspect fireproofing in common cable areas.
 - 8) If cables are terminated through window-type current transformers, make an inspection to verify that neutral and ground conductors are correctly placed and that shields are correctly terminated for operation of protective devices.
 - 9) Visually inspect jacket and insulation condition.
 - 10) Inspect for correct identification and arrangements.
 - b. Electrical Tests
 - 1) Perform a shield-continuity test on each power cable by ohmmeter method.
 - 2) Perform an insulation-resistance test utilizing a megohmmeter with a voltage output of at least 2500 volts. Individually test each conductor with all other conductors and shields grounded. Test duration shall be one minute.
 - 3) Perform resistance measurements through all bolted connections with low-resistance ohmmeter.
 - 4) Perform DC high potential test for all new MV cables in accordance with IEEE Standard 400.
 - c. Test Values

- 1) Compare bolted connection resistance to values of similar connections. Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.
 - 2) Bolt-torque levels should be in accordance with NETA ATS-2009, Table 100.12 unless otherwise specified by Supplier.
 - 3) Microhm or millivolt drop values shall not exceed the high levels of the normal range as indicated in the Supplier's published data. If Supplier's data is not available, investigate any values which deviate from similar connections by more than 50 percent of the lowest value.
 - 4) Shielding shall exhibit continuity. Investigate resistance values in excess of ten ohms per 1000 feet of cable.
7. Test ground interrupter (GFI) receptacles and circuit breakers for proper operation by methods sanctioned by the receptacle supplier.
8. Dry type Transformers
- a. The Contractor shall test in accordance with Section 26 01 26 – Electrical Tests.
 - b. Visual and Mechanical Inspection
 - 1) Physical and insulator damage.
 - 2) Proper Winding Connections.
 - 3) Bolt torque level in accordance with NETA ATS, Table 10.1, unless otherwise specified by Supplier.
 - 4) Defective wiring.
 - 5) Proper Operation of fans, indicators, and auxiliary devices.
 - 6) Removal of shipping brackets, fixtures, or bracing.
 - 7) Free and properly installed resilient mounts.
 - 8) Cleanliness and improper blockage of ventilation passages.
 - 9) Verify that tap-changer is set at correct ratio for rated output voltage under normal operating conditions.
 - 10) Verify proper secondary voltage phase-to-phase and phase-to-ground after energization and prior to loading
 - c. Electrical Tests
 - 1) Insulation Resistance Test
 - a) Applied megohmmeter DC voltage in accordance with NETA ATS, Table 7.2.3 for each
 - (1) Winding-to-Winding
 - (2) Winding-to-Ground
 - b) 10-minute test duration with resistances tabulated at 30 seconds, 1 minute, and 10 minutes.
 - c) Results temperature corrected in accordance with NETA ATS, Table 7.2.4.
 - d) Temperature corrected insulation resistance values equal to, or greater than, ohmic values established by Supplier.
 - e) Insulation resistance test results to compare within one percent of adjacent windings.
 - f) Perform tests and adjustments for fans, controls, and alarm functions as suggested by Supplier.
9. Safety Switches, 600 Volts Maximum

- a. Visual and Mechanical Inspection
 - 1) Proper blade pressure and alignment.
 - 2) Proper operation of switch operating handle.
 - 3) Adequate mechanical support for each fuse.
 - 4) Proper contact-to-contact tightness between fuse clip and fuse.
 - 5) Cable connection bolt torque level in accordance with NETA ATS, Table 10.1.
 - 6) Proper phase barrier material and installation.
 - 7) Verify that fuse sizes and types correspond to one-line diagram.
 - b. Electrical Tests
 - 1) Insulation Resistance Tests
 - a) Applied megohmmeter dc voltage in accordance with NETA ATS, Table 10.2.
 - b) Phase-to-phase and phase-to-ground for 1 minute on each pole.
 - c) Insulation resistance values equal to, or greater than, ohmic values established by Supplier.
 - 2) Contact Resistance Tests
 - a) Contact resistance in microhms across each switch blade and fuse holder.
 - b) Investigate deviation of 50 percent or more from adjacent poles or similar switches
10. Perform mechanical operational test and verify electrical and mechanical interlocking system operation and sequencing.
11. A functional test and check of electrical components is required prior to performing subsystem testing and commissioning. Compartments and equipment shall be cleaned as required by other provisions of these Specifications before commencement of functional testing. Functional testing shall comprise
- a. Visual and physical check of cables, circuit breakers, transformers, and connections associated with each item of new and modified equipment.
 - b. Verification that electrical equipment has been labeled with Arc Flash protection boundary and PPE levels, as required by Section 26 05 73 – Protective Device Studies, and Section 26 00 00 – Electrical Work, General.
 - c. Setting of protective relays in conformance with results of the Short Circuit Study required by Section 26 05 73 – Protective Device Studies and testing of relays to assure that relays will trip at the current value and time required by the Study.
 - d. Circuit Breakers
 - 1) Circuit breakers that have adjustable time or pick-up settings for ground current, instantaneous overcurrent, short-time overcurrent, or long-time overcurrent, shall be field-adjusted by a representative of the circuit breaker supplier.
 - 2) Time and pickup setting shall correspond to the recommendations of the Short Circuit Study.
 - 3) Setting shall be tabulated and proven for each circuit breaker in its installed position.
 - 4) Test results shall be certified by the person performing the tests and shall be submitted to the Design-Builder.

12. Grounding Systems

a. Visual and Mechanical Inspection

- 1) Equipment and circuit grounds in motor control centers, panelboards, switchboards, and switchgear assemblies for proper connection and tightness.
- 2) Ground bus connections in motor control centers, panelboards, switchboards, and switchgear assemblies for proper termination and tightness,
- 3) Effective transformer core and equipment grounding.
- 4) Accessible connections to grounding electrodes for proper fit and tightness.
- 5) Accessible exothermic-weld grounding connections to verify that molds were fully filled and proper bonding was obtained.

b. Electrical Tests

- 1) Fall-of-Potential Test
 - a) In accordance with IEEE 81, Section 8.2.1.5 for measurement of main ground system's resistance.
 - b) Main ground electrode system resistance to ground to be no greater than 5 ohms.
- 2) Two-Point Direct Method Test
 - a) In accordance with IEEE 81, Section 8.2. 1.1 for measurement of ground resistance between main ground system, equipment frames, and system neutral and derived neutral points.
 - b) Equipment ground resistance shall not exceed main ground system resistance by 0.50 ohm.

13. Metering

a. Visual and Mechanical Inspection

- 1) Verify meter connections in accordance with appropriate diagrams.
- 2) Verify meter multipliers.
- 3) Verify that meter types and scales conform to Contract Documents.
- 4) Check calibration of meters at cardinal points.
- 5) Check calibration of electrical transducers.

14. AC Induction Motors

a. General: Inspection and testing limited to motors rated 5 horsepower and larger.

b. Visual and Mechanical Inspection

- 1) Proper electrical and grounding connections.
- 2) Shaft alignment.
- 3) Blockage of ventilating air passageways.
- 4) Operate motor and check for:
 - a) Excessive mechanical and electrical noise.
 - b) Overheating.
 - c) Correct rotation.
 - d) Check vibration detectors, resistance temperature detectors, or motor inherent protectors for functionality and proper operation.
 - e) Excessive vibration.
 - f) Check operation of space heaters.

- c. Electrical Tests
 - 1) Insulation Resistance Tests
 - 2) In accordance with IEEE 43 at test voltages established by NETA ATS, Table 10.2 for
 - a) Motors above 200 horsepower for 10-minute duration with resistances tabulated at 30 seconds, 1 minute, and 10 minutes.
 - b) Motors 200 horsepower and less for 1-minute duration with resistances tabulated at 30 and 60 seconds.
 - c) Insulation resistance values equal to, or greater than, ohmic values established by the Supplier.
 - d) Calculate polarization index ratios for motors above 200 horsepower. Investigate index ratios less than 1.5 for Class A insulation and 2.0 for Class B insulation.
 - 3) Insulation resistance test on insulated bearings in accordance with Supplier's instructions.
 - 4) Measure running current and voltage, and evaluate relative to load conditions and nameplate full-load amperes.

15. Low Voltage Motor Control

- a. Visual and Mechanical Inspection
 - 1) Proper barrier and shutter installation and operation.
 - 2) Proper operation of indicating and monitoring devices.
 - 3) Proper overload protection for each motor.
 - 4) Improper blockage of air cooling passages.
 - 5) Proper operation of drawout elements.
 - 6) Integrity and contamination of bus insulation system.
 - 7) Check Door and Device Interlocking System by
 - a) Closure attempt of device when door is in "Off" or "Open" position.
 - b) Opening attempt of door when device is in "Off" or "Open" position.
 - 8) Check Key Interlocking Systems for
 - a) Key captivity when device is in "On" or "Closed" position.
 - b) Key removal when device is in "Off" or "Open" position.
 - c) Closure attempt of device when key has been removed.
 - d) Correct number of keys in relationship to number of lock cylinders
 - e) Existence of other keys capable of operating lock cylinders; destroy duplicate sets of keys
 - 9) Check Nameplates for Proper Identification of
 - a) Equipment Title and Tag Number with Latest One-Line Diagram
 - b) Pushbuttons
 - c) Control Switches
 - d) Pilot Lights
 - e) Control Relays
 - f) Circuit Breakers
 - g) Indicating Meters

- 10) Verify that fuse and circuit breaker sizes and types conform to Contract Documents.
 - 11) Verify that current and potential transformer ratios conform to Contract Documents.
 - 12) Check Bus Connections for High Resistance by Low Resistance Ohmmeter and Thermographic Survey
 - a) Ohmic value to be zero.
 - b) Bolt torque level in accordance with NETA ATS, Table 10.1, unless otherwise specified by Supplier.
 - c) Thermographic survey temperature gradient of two degrees C, or less.
 - 13) Check Operation and Sequencing of Electrical and Mechanical Interlock Systems by
 - a) Closure attempt for locked open devices.
 - b) Opening attempt for locked closed devices.
 - c) Key exchange to operate devices in "Off" normal positions.
 - 14) Verify performance of each control device and feature furnished as part of the motor control center.
 - 15) Control Wiring
 - a) Compare wiring to local and remote control, and protective devices with elementary diagrams.
 - b) Check for proper conductor lacing and bundling.
 - c) Check for proper conductor identification.
 - d) Check for proper conductor lugs and connections.
 - e) Exercise Active Components
 - 16) Inspect Contactors for:
 - a) Correct mechanical operations.
 - b) Correct contact gap, wipe, alignment, and pressure.
 - c) Correct torque of all connections.
 - d) Compare overload heater rating with full-load current for proper size.
 - e) Compare motor protector and circuit breaker with motor characteristics and power factor correction capacitors for proper size.
 - 17) Perform phasing check on double-ended motor control centers to ensure proper bus phasing from each source.
- b. Electrical Tests
- 1) Insulation Resistance Tests
 - a) Applied megohmmeter dc voltage in accordance with NETA ATS, Table 10.2.
 - b) Bus section phase-to-phase and phase-to-ground for 1 minute on each phase.
 - c) Contactor phase-to-ground and across open contacts for 1 minute on each phase.
 - d) Starter section phase-to-phase and phase-to-ground on each phase with starter contacts closed and protective devices open.
 - e) Test values to comply with NETA ATS, Table 10.2.

- 2) Current Injection through Overload Unit at 300 percent of Motor Full-Load Current and Monitor Trip Time
 - a) Trip time in accordance with Supplier's published data.
 - b) Investigate values in excess of 120 seconds.
 - 3) Control Wiring Tests
 - a) Apply secondary voltage to control power and potential circuits.
 - b) Check voltage levels at each point on terminal boards and each device terminal.
 - c) Insulation resistance test at 1,000 volts DC on control wiring except that connected to solid state components. Insulation resistance to be 1 megohm minimum.
 - d) Operational test by initiating control devices to affect proper operation.
16. Automatic and Manual Transfer Switches
- a. Visual and Mechanical Inspection
 - 1) Check doors and panels for proper interlocking.
 - 2) Check connections for high resistance by low resistance ohmmeter.
 - 3) Check positive mechanical and electrical interlock between normal and alternate sources.
 - 4) Check for Proper Operation
 - a) Manual transfer function switch.
 - b) Generator under load and non-load conditions.
 - c) Auto-exerciser of generator under load and no-load conditions.
 - d) Verify settings and operation of control devices.
 - b. Electrical Tests
 - 1) Insulation Resistance Tests
 - a) Applied megohmmeter dc voltage in accordance with NETA ATS, Table 10.2 for each phase with switch "closed" in both source positions.
 - b) Phase-to-phase and phase-to-ground for 1 minute.
 - c) Test values in accordance with Supplier's published data.
 - 2) Contact Resistance Test
 - a) Contact resistance in microhms across each switchblade for both source positions.
 - b) Investigate values exceeding 500 micro-ohms.
 - c) Investigate values deviating from adjacent pole by more than 50 percent.
 - d) Set and Calibrate in Accordance with Specifications
 - 3) Voltage and frequency sensing relays.
 - a) Time delay relays.
 - b) Engine start and shutdown relays.
 - 4) Perform Automatic Transfer Tests by
 - a) Simulating loss of normal power.
 - b) Return to normal power.
 - c) Simulating loss of alternate power.
 - d) Simulating single-phase conditions for normal and alternate sources.

- 5) Monitor and Verify Operation and Timing of
 - a) Normal and alternate voltage sensing relays.
 - b) Engine starting sequence.
 - c) Timing delay upon transfer and retransfer.
 - d) Engine cool down and shutdown.
 - e) Interlocks and limit switch functions.
 - f) Engine cool down and shutdown feature.
- B. Subsystem testing shall occur after the proper operation of alarm and status contacts has been demonstrated or otherwise accepted by the Contractor and after process control devices have been adjusted as accurately as possible. Alarm conditions shall be simulated for each alarm point, and alarm indicators shall be checked for proper operation. It is intended that the Contractor will adjust limit switches and level switches to their operating points prior to testing and will set pressure switches, flow switches, and timing relays as dictated by operating results.
- C. Metering and indication lights for motors and other devices shall be tested for proper operation.
- D. All control circuits such as motor, interlock and remote shall be tested for proper operation.
- E. After initial settings have been completed, each subsystem shall be operated in the manual mode and it shall be demonstrated that operation is in compliance with the Contract Documents. Once the manual mode of operation has been proven, automatic operation shall be demonstrated to verify such items as proper start and stop sequence of pumps, proper operation of valves, proper speed control, etc.
- F. Motor operated valves shall be tested after having been phased and tested for correct motor rotation and after travel and torque limit switches have been adjusted by a representative of the valve supplier. Tests shall verify status indication, proper valve travel, and correct command control from local and remote devices.
- G. All lighting panels, lighting control panels (LCPs), circuits and fixtures; and power panels, circuits and receptacles shall be tested for proper operation.
- H. Provide ground resistance tests on the main grounding electrode or system in the presence of the Contractor and submit results.
 1. Visual and Mechanical Inspection
 - a. Verify ground system is in compliance with the Plans and Specifications.
 2. Electrical Tests
 - a. Perform fall-of-potential test or alternative in accordance with IEEE Standard 81 on the main grounding electrode or system.
 - b. The earth resistance of each ground electrode shall be measured and recorded before electrodes are connected to the grounding loop.
 - c. Perform point-to-point tests to determine the resistance between the main grounding system and all major electrical equipment frames, system neutral, and/or derived neutral points.
 3. Test Values

- a. The resistance between the main grounding electrode and ground shall be no greater than five ohms for commercial or industrial systems and one ohm or less for generating or transmission station grounds unless otherwise specified by the County.
 - b. Investigate point-to-point resistance values which exceed 0.5 ohm.
- I. Subsystems shall be defined as individual and groups of pumps, conveyor systems, chemical feeders, air conditioning units, ventilation fans, air compressors, etc.
- J. Thermographic Survey
1. Visual and Mechanical Inspection
 - a. Inspect physical, electrical, and mechanical condition.
 - b. Remove all necessary covers prior to thermographic inspection. Utilize appropriate caution, safety devices, and personal protective equipment.
 2. Equipment to be inspected shall include all 120 volt and higher current-carrying devices including all switchgear, switchboards, distribution panels, cable and bus connections, motor control centers and starters, disconnect switches, and other critical equipment. Testing of lighting luminaires, field instrumentation, SCADA and PLC's are not required.
 3. Provide report including the following
 - a. Description of equipment to be tested.
 - b. Discrepancies.
 - c. Temperature difference between the area of concern and the reference area.
 - d. Probable cause of temperature difference.
 - e. Areas inspected. Identify inaccessible and/or unobservable areas and/or equipment.
 - f. Identify load conditions at time of inspection.
 - g. Provide photographs and/or thermograms of the deficient area.
 - h. Recommended action.
 4. Test Parameters
 - a. Inspect distribution systems with imaging equipment capable of detecting a minimum temperature difference of 1 °C at 30 °C.
 - b. Equipment shall detect emitted radiation and convert detected radiation to visual signal.
 - c. Thermographic surveys should be performed during periods of maximum possible loading but not less than 40 percent of rated load of the electrical equipment being inspected. Refer to ANSI/NFPA 70B-2010, Section 11-17 (Infrared Inspection).
 5. Test Values
 - a. Suggested actions based on temperature rise can be found in Table 100.18.

Table 100.18 Thermographic Survey Suggested Actions Based on Temperature Rise

Temperature difference (ΔT) based on comparisons between similar components under similar loading	Temperature difference (ΔT) based upon comparisons between component and ambient air temperatures.	Recommended Action
1°C - 3°C	1°C - 10°C	Possible deficiency; warrants investigation

Table 100.18 Thermographic Survey Suggested Actions Based on Temperature Rise

4°C - 15°C	11°C - 20°C	Indicates probable deficiency; repair as time permits
-----	21°C - 40°C	Monitor until corrective measures can be accomplished
>15°C	>40°C	Major discrepancy; repair immediately

- b. Temperature specifications vary depending on the exact type of equipment. Even in the same class of equipment (i.e., cables) there are various temperature ratings. Heating is generally related to the square of the current; therefore, the load current will have a major impact on ΔT . In the absence of consensus standards for ΔT , the values in this table will provide reasonable guidelines.
 - c. An alternative method of evaluation is the standards-based temperature rating system as discussed in Chapter 8.9.2, Conducting an IR Thermographic Inspection, Electrical Power Systems Maintenance and Testing, by Paul Gill, PE, 1998.
 - d. It is a necessary and valid requirement that the person performing the electrical inspection be thoroughly trained and experienced concerning the apparatus and systems being evaluated as well as knowledgeable of thermographic methodology.
6. Re-Inspection
- a. All items that are reported deficient in the thermography reports section of the inspection report shall be re-inspected after repairs have been made.
 - b. Original Specification will apply to re-inspections.
 - c. Submit re-inspection reports and indicate that repairs have fixed the anomaly or indicate any remaining anomalies.

2.03 TEST REPORTS

- A. The test report shall include the following
 - 1. Summary of project.
 - 2. Description of equipment tested.
 - 3. Description of test.
 - 4. Test data.
 - 5. Analysis and recommendations.
- B. Test data records shall include the following minimum requirements
 - 1. Identification of the testing organization.
 - 2. Equipment identification.
 - 3. Humidity, temperature, and other atmospheric conditions that may affect the results of the tests/calibrations.
 - 4. Date of inspections, tests, maintenance, and/or calibrations.
 - 5. Identification of the testing technician.
 - 6. Indication of inspections, tests, maintenance, and/or calibrations to be performed and recorded.
 - 7. Indication of expected results when calibrations are to be performed.
 - 8. Indication of “as-found” and “as-left” results.

9. Sufficient spaces to allow all results and comments to be indicated.
- C. The testing firm shall furnish a copy or copies of the complete report to the County as required in the acceptance contract.
- D. The test record sheets listed below shall be used to record testing of electrical equipment and of the electrical installation as required by these Specifications. Sample copies of each sheet are attached.

Sheet	Title
1	Insulation Resistance (Power, Control Wire, and Cable) Test Record
2	Insulation Resistance (Instrument Wire and Cable) Test Record
3	Ground Electrode Testing Test Record
4	Neutral Grounding Resistor Test Record
5	Bonding Resistance Readings (Nonelectrical Equipment/Structures) Test Record
6	Bonding Resistance Readings (Electrical Equipment) Test Record
7	Insulation Resistance (Transformer) Test Record
8	Insulation Resistance (Equipment) Test Record
9	Insulation Resistance (Equipment) Test Record
10	Equipment Absorption Ratio and Polarization Index Test Record
11	Record Feeder Breaker (480 V MCC) Test Record
12	Breaker/Contactor (480 V MCC) Test Record
13	460 V Motor Circuit (480 V MCC) Test Record
14	Medium Voltage Motor Circuit Test Record
15	Electric Motor Run-In Test Record
16	Thermographic Test Record

PART 3 EXECUTION

3.01 COMMISSIONING

- A. Commissioning during the 7-Day test in Section 01 75 00 – Equipment Testing and Plant Startup shall not be attempted until all subsystems have been found to operate satisfactorily. Commissioning shall only be attempted as a function of normal plant operation in which plant process flows and levels are routine and equipment operates automatically in response to flow and level parameters or computer command, as applicable. Simulation of process parameters shall be considered only upon receipt of a written request by the Contractor.
- B. Motor Current Tabulation
 1. The motor current tabulation required by Section 26 05 73 – Protective Device Studies shall reflect the values occurring during commissioning.
 2. Switchboard ammeters and kilowatt meters shall be recorded every half-hour during the commissioning.
 3. Motors which have current/power measurement capabilities shall have this data recorded every 5 minutes while operating during commissioning.
 4. Power monitored amperes, voltage, and kilowatts for each phase shall be recorded every 5 minutes during commissioning

**EQUIPMENT ABSORPTION RATIO
AND POLARIZATION INDEX
TEST RECORD**

TEST EQUIPMENT: _____ TEST VOLTAGE: _____

AMBIENT TEMPERATURE: _____ °C _ °F DATE: _____

EQUIP. TEMP., IF KNOWN: _____ °C _ °F REL. HUMIDITY: _____

NOTES: 1. Perform test as indicated on Test Records for each individual equipment type. Reference the following sheets

- Transformers 7
- Equipment 8
- Motors and Generators 9

2. Absorption Ratio = $\frac{\text{1-Minute Resistance Value}}{\text{30-Second Resistance Value}}$

3. Polarization Index = $\frac{\text{10-Minute Resistance Value}}{\text{1-Minute Resistance Value}}$

OHMS TO GROUND 30-SECOND READING ØA TO GROUND	OHMS TO GROUND 1-MINUTE READING ØA TO GROUND	OHMS TO GROUND 10-MINUTE READING ØA TO GROUND	DIELECTRIC ABSORPTION RATIO	POLARIZATION INDEX
OHMS TO GROUND 30-SECOND READING ØB TO GROUND	OHMS TO GROUND 1-MINUTE READING ØB TO GROUND	OHMS TO GROUND 10-MINUTE READING ØB TO GROUND	DIELECTRIC ABSORPTION RATIO	POLARIZATION INDEX
OHMS TO GROUND 30-SECOND READING ØC TO GROUND	OHMS TO GROUND 1-MINUTE READING ØC TO GROUND	OHMS TO GROUND 10-MINUTE READING ØC TO GROUND	DIELECTRIC ABSORPTION RATIO	POLARIZATION INDEX

TESTER'S INITIALS/DATE _____

DISTRIBUTION:

Design-Builder/Date _____

**FEEDER BREAKER (480 V MCC)
TEST RECORD**

EQUIPMENT DESIGNATION		
LOAD (kW/kVA)	VOLTAGE	F.L.A.
CIRCUIT BREAKER MFG.	RATING	SETTING
CONDUCTOR SIZE	POWER	GROUND

1. Check nameplate data of breaker against approved Supplier/Vendor drawings. _____
2. Check breaker components for cleanliness. _____
3. Check mechanical function of breaker. _____
4. Check wiring for proper identification. _____
5. Check conduits/cables for tagging. _____
6. Check components for identification. _____
7. Check equipment for conformance of area classification. _____
8. Check installation for seals, breathers, and drains. _____
9. Verify power conductor continuity. _____
10. Check that power cable insulation resistance test (megger) is completed. _____

DISTRIBUTION:

Design-Builder/Date _____

**BREAKER/CONTACTOR (480 V MCC)
TEST RECORD**

EQUIPMENT DESIGNATION			
LOAD (kW/kVA)		VOLTAGE	F.L.A.
CIRCUIT BREAKER MFG.		RATING	SETTING
CONTACTOR MFG.		SIZE	
CONDUCTOR SIZE	POWER	CONTROL	GROUND

1. Check nameplate data of breaker, contactor fuses and relays against approved Supplier/Vendor drawings. _____
2. Check main and auxiliary contacts. _____
3. Check contactor/breaker components for cleanliness. _____
4. Check control fuses, CPT rating, and coil voltage. _____
5. Check mechanical function of contactor and breaker. _____
6. Check wiring for proper identification. _____
7. Check conduits/cables for tagging. _____
8. Check components for identification. _____
9. Check equipment for conformance to area classification. _____
10. Check installation for seals, breathers, and drains. _____
11. Verify continuity of all power and control leads. _____
12. Check that power and control cable Insulation Resistance Test (megger) is completed. _____
13. Complete functional operation check of the control circuit using the Plans and approved Supplier/Vendor drawings. Close and open the contactor using all control devices. _____

DISTRIBUTION:

Design-Builder/Date _____

**460 V MOTOR CIRCUIT (480 V MCC)
TEST RECORD**

EQUIPMENT DESIGNATION		
MOTOR TAG NO.	VOLTAGE	F.L.A.
KW/HP	RPM	S.F.
CIRCUIT BREAKER MFG.	RATING	SETTING
STARTER MFG.	SIZE	O/L HTR. SIZE
C.T. RATIO	O/L RELAY SETTING	
CONDUCTOR SIZE	GROUND	
POWER		

1. Check motor starter for cleanliness. _____
2. Check nameplate data and tagging of motor starter components for conformance to approved Supplier/Vendor drawings. _____
3. Check conduits and/or cables for correct tagging. _____
4. Check equipment and installation for conformance to area classification. _____
5. Check main and auxiliary contacts of breaker and contactors. _____
6. Manually check mechanical operation of breaker, contactor, O/L relay, and O/L reset device. _____
7. Check continuity of power and control cables. _____
8. Complete functional operation check of the motor control circuit using the Plans and approved Supplier/Vendor drawings. Close and open the starter using all control devices. _____
9. Verify proper operation of motor winding space heater unit. _____

DISTRIBUTION:

Design-Builder/Date _____

**MEDIUM VOLTAGE MOTOR CIRCUIT
TEST RECORD**

EQUIPMENT DESIGNATION _____			
MOTOR DESCRIPTION TAG NO. _____ SUPPLIER _____ KW/HP _____ FLA _____	SERIAL NUMBER. _____ SERVICE FACTOR. _____ RATED VOLTAGE. _____		
STARTER DESCRIPTION SUPPLIER _____ CONTACTOR RATING _____ RATED CURRENT _____ FUSE SIZE. _____	C.T. RATIO _____ TYPE _____ RATED VOLTAGE _____ O/L RELAY SETTING _____		
CONDUCTOR SIZE	POWER	CONTROL	GROUND

1. Check motor starter for cleanliness. _____
2. Check nameplate data and tagging of motor starter components for conformance to approved Supplier/Vendor drawings. _____
3. Check conduits and/or cables for correct tagging. _____
4. Check equipment and installation for conformance to area classification. _____
5. Check installation for seals, breathers, and drains. _____
6. Check main and auxiliary contacts of breaker and contactors. _____
7. Check mechanical operation of breakers, contactors, and relay and O/L reset devices. _____
8. Check continuity of power and control cables. _____
9. Verify calibration and setting of protective relays. _____
10. Check wiring to surge arrestors, capacitors, stator RTDs and current transformers. _____
11. Complete functional operation check of the motor control circuit using the Plans and approved Supplier/Vendor drawings. Close and open the starter using all control devices. _____

GENERAL COMMENTS

DISTRIBUTION:

Design-Builder/Date _____

**ELECTRIC MOTOR RUN-IN
TEST RECORD**

TEST EQUIPMENT: _____ REFERENCE DRAWING: _____

NOTES: 1. Duration of tests to comply with the Specifications.

TEST	REMARKS	INITIALS/DATE
RESISTANCE Bonding resistance measured from motor frame to main ground/earth system tap. _____ ohms		
VOLTAGE Actual voltage measured at Motor Control Center. _____ volts		
ROTATION CHECK Bump motor to verify rotation. Motor to be uncoupled.		
NO LOAD CURRENT At beginning of test _____ amps At end of test _____ amps		
TEMPERATURE OF BEARING Check bearing for high temperature Before start: 15 minutes after start 30 minutes after start 1 hour after start 2 hours after start 3 hours after start		
VIBRATION Make visual inspection during run-test. Record any unusual vibration in remarks column.		
NOISE Record any unusual noise in remarks column.		

 DISTRIBUTION:

Design-Builder/Date _____

**THERMOGRAPHIC INSPECTION
TEST RECORD**

EQUIPMENT: _____

THERMAL AND ELECTRICAL INFORMATION

THERMAL DATA (°F/°C) AND RISE				MANUAL READINGS			
A Phase	____/____	Reference Temperature	____ °F	A Phase	____ A	A/ B Volts	____ V
B Phase	____/____		____ ° C	B Phase	____ A	B/C Volts	____ V
C Phase	____/____	ΔT or Rise	____ °F	C Phase	____ A	A/C Volts	____ V
Neutral	____/____		____ ° C	Neutral	____ A	A/N Volts	____ V
ANOMALY TEMP(°F/°C)							
PROBLEM DESCRIPTION:							
RECOMMENDATION:							

ANOMALY PRIORITY

<p>CRITICAL - IMMEDIATE ATTENTION SUGGESTED</p> <p>SEVERE - PROBABLE FAILURE, PROMPT ACTION RECOMMENDED</p> <p>INTERMEDIATE - MONITOR PROBLEM, SCHEDULE MAINTENANCE</p> <p>MINOR - SCHEDULE ROUTINE MAINTENANCE AT NEXT OPPORTUNITY</p>

DISTRIBUTION:

Design-Builder/Date _____

END OF SECTION

**SECTION 26 05 10
ELECTRIC MOTORS**

PART 1 GENERAL

1.01 SUMMARY

A. Scope

1. This Section specifies low voltage electric motors.
2. The Contractor shall provide electric motors, accessories, and appurtenances complete and operable, in conformance to the Contract Documents.
3. The provisions of this Section apply to low-voltage (460V), 3-phase, AC squirrel cage induction motors throughout the Contract Documents, except as indicated otherwise.
4. The Contractor shall assign to the equipment supplier the responsibility to select suitable electric motors for the equipment. The choice of motor supplier shall be subject to review by the Contractor. Such review will consider future availability of replacement parts and compatibility with driven equipment

1.02 QUALITY ASSURANCE

A. Reference Codes and Standards

1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
ABMA 9	Load Ratings and Fatigue Life for Ball Bearings
ABMA 11	Load Ratings and Fatigue Life for Roller Bearings
IEEE 112	Standard Test Procedures for Polyphase Induction Motors and Generators
IEEE 841	Standard for Petroleum and Chemical Industry- Premium-Efficiency, Severe Duty Totally Enclosed Fan-Cooled (TEFC) Squirrel Cage Induction Motors - Up to and Including 500 HP
NEMA ICS 2	Industrial Control and Systems Controllers, Contactors and Overload Relays Rated Not More Than 2000 Volts AC or 750 Volts DC

Reference	Title
NEMA 250	Enclosures for Electrical Equipment (1000 volts maximum)
NEMA MG 1	Motors and Generators
Department of Energy	Energy Policy and Conservation Act, Final Rules EERE-2010-BT-STD-0027-0117
UL 674	Electric Motors and Generators for Use in Division 1 – General Requirements, Hazardous (Classified) Locations
UL 1004	Electric Motors

1.03 ENVIRONMENTAL CONDITIONS

- A. Equipment in this Section shall be subjected to environmental conditions in accordance with Section 01 11 80 – Environmental Conditions.

1.04 SUBMITTALS

- A. The following minimum submittals shall be submitted in accordance with Section 01 33 00 - Submittals.

1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.

2. Machine name and specification number of driven machine
3. Motor supplier
4. Motor type or model and dimension drawing. Include motor weight.
5. Nominal horsepower
6. NEMA design/starting code letter
7. Enclosure
8. Frame size
9. Winding insulation class and temperature rise class
10. Voltage, phase, and frequency ratings
11. Service factor
12. Full load current at rated horsepower for application voltage
13. Full load speed

14. Guaranteed minimum full load efficiency. Also nominal efficiencies at 1/2 and 3/4 load.
15. Type of thermal protection or overtemperature protection, if included
16. Wiring diagram for devices such as temperature, or zero speed switches, as applicable
17. Bearing data. Include recommendation for lubricants of relubricatable type bearings.
18. If utilized with a variable frequency controller, verify motor is inverter duty type. Include minimum speed at which motor may be operated for the driven machinery. Provide shaft grounding details and information.
19. Power factor at 1/2, 3/4 and full load.
20. Recommended size for power factor correction capacitors to improve power factor to 0.95 percent lagging when operated at full load.
21. Motor winding space heater rated for 120Vac.
22. If water cooling is required for motor thrust bearings, the Shop Drawing submittals shall indicate this requirement.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

A. Suppliers

1. The Contractor and the City believe that the following Suppliers are capable of producing equipment and products, which will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular Supplier or product, nor shall it be construed that a named Supplier's standard product will comply with the requirements of this Section.
2. Candidate Suppliers include the following:
 - a. Nidec, U.S. Motors,
 - b. General Electric,
 - c. Siemens
 - d. Toshiba
 - e. ABB, Baldor/Reliance
 - f. No other equal

2.02 MATERIALS

- A. Materials specified are considered the minimum acceptable for the purposes of durability, strength, and resistance to erosion and corrosion. The Contractor may propose alternative materials for the purpose of providing greater strength or to meet required stress limitations. However, alternative materials must provide at least the same qualities as those specified for the purpose. If alternatives are proposed, the proposals shall be accompanied with documentation supporting the claimed superiority of the proposed substitutions. The Engineer shall be the sole decider in the equivalency of alternative materials of construction.

2.03 GENERAL REQUIREMENTS

- A. Electric motors driving identical machines shall be identical.

- B. Maximum motor loading shall be equal to nameplate horsepower rating or less, exclusive of service factor and be verifiable from the submittal data of the driven machinery.
- C. Motor Capacity
 - 1. The Contractor shall size motors for the larger of the following criteria.
 - a. Size motors to continuously carry the maximum load that develops across the full range of driven equipment operation.
 - b. Size motors for minimum size indicated
 - 2. In every case, motor size shall be derated from nameplate values as follows
 - a. Ambient Temperature
 - 1) For ambient temperatures up to but not exceeding 40 degrees C, no derating is required.
 - 2) For ambient temperatures exceeding 40 degrees but less than 50 degrees C, derate nameplate HP ratings to 85 percent.
 - 3. Increased circuit breaker, magnetic starter, and conductor and conduit capacities required for motors larger than the indicated sizes shall be provided as part of the Work.
- D. Exempt Motors: Motors for valve operators, submersible pumps, or motors which are an integral part of standard manufactured equipment, i.e., non-NEMA mounting, common shaft with driven element, or part of domestic or commercial use apparatus may be excepted from these requirements to the extent that such variation reflects a necessary condition of motor service or a requirement of the driven equipment.

2.04 DESIGN REQUIREMENTS

- A. General: Electric motors shall comply with NEMA MG-1 - Motor and Generator. Motors used with adjustable frequency drives shall comply with NEMA MG-1, Part 31, and shall be clearly identified as "Inverter Duty."
- B. NEMA Design: Electric motors shall be NEMA Design B unless otherwise indicated. In no case shall starting torque or breakdown torque be less than the value in NEMA MG 1. Motors shall be suitable for the indicated starting method.
- C. Motor Voltage Ratings: Low voltage motors shall have voltage ratings in accordance with the following, unless otherwise indicated
 - 1. Motors below 1/2 HP shall be rated 115 volts, single phase, 60 Hz. Dual voltage motors rated 115/230 volts, 115/208 volts, or 120-240 volts are acceptable, provided leads are brought out to the conduit box.
 - 2. Motors 1/2 HP and larger shall be rated 460 volts, 3 phase, 60 Hz. Dual voltage motors rated 230/460 volts or 208/230/460 volts are acceptable, provided every lead is brought out to the conduit box.
- D. Insulation: Three phase motors shall be provided with Class F tropicalized insulation, rated to operate at a maximum ambient temperature of 40 degrees C and at the altitudes where the motors will be installed and operated, without exceeding Class B temperature rise limits stated in NEMA MG 1-12.44. Single phase motors shall have Class F tropicalized insulation with temperature rise not to exceed the insulation class. Motors to be operated from Variable Frequency drives (VFDs) shall be provided with

insulation systems to withstand 1600 volt spikes, with dV/dT output filters as defined in NEMA MG 1-31. The adjustable frequency drive supplier shall coordinate with the motor supplier to determine when additional dV/dT protection is required. Where required, it shall be furnished and installed as per the Supplier's written instructions.

E. Stator

1. The stator shall be assembled from high grade electrical sheet steel laminations adequately secured together.
2. The stator windings shall consist of materials such as polyester film, synthetic varnish or glass cloth. Windings shall be random or form wound, adequately insulated and securely braced to resist failure due to electrical stress and vibrations.
3. Any junction in motor insulation, such as coil connections or between slot and end winding sections, shall have protection equivalent to that of the slot sections of coils. The entire winding of all motors when finished, shall be epoxy encapsulated, after subjecting to a process which removes all moisture and insures freedom of air pockets.
4. For 200 and larger horsepower outdoor motors, three phase leads shall be connected by the motor supplier to the surge protection equipment described further in these Specifications, in a separate junction box mounted on the side of the motor. At least 18 inch clearance shall be provided to the conduit entry point in the box for the installation. This box shall be located in accordance with conduit terminations indicated on the Plans.
5. For motors larger than 200 horsepower and larger motors (plus for other motors if required elsewhere in the Specifications), six (6) 100 ohm (at 20 degrees C) platinum resistance temperature detectors (RTD) shall be provided embedded in the stator winding and wired to a separate gasketed terminal box mounted on the stator frame. Two (2) detectors per phase are required and shall be placed at locations determined to give close approximation of the hottest spot temperatures.
6. Resistance temperature devices shall have a stability of better than 2% of the maximum exposed temperature for at least one year of service or 0.25 degrees C, whichever is greater. Repeatability of the resistance temperature device shall be better than 0.025% of the maximum temperature of 0.05 degrees C, whichever is greater.
7. Provide winding tropical/fungus protection.

F. Rotor

1. The shaft shall be made of high grade machine steel or steel forging of size and design adequate to withstand the load stresses. The rotor shall be fabricated of high grade electrical sheet steel laminations adequately fastened together and to the shaft. Squirrel cage windings may be cast aluminum or copper alloy bar-type construction with brazed end rings.
2. Provide winding tropical/fungus protection.

G. Motors located in non-hazardous areas shall be totally enclosed, fan cooled (TEFC). All motors shall have a Service Factor of 1.15 unless otherwise indicated. Motors operated on VFD's shall have a 1.15 service factor (sine) and 1.0 service factor (inverter).

H. Motors for use in hazardous locations shall have enclosures suitable for the classification indicated. Such motors shall be U.L. listed and be stamped as such.

- I. Motors installed outdoors shall be provided with 120 volt AC space heaters, wired to a terminal strip in a low voltage motor junction box, except if otherwise noted. If provided by the Supplier when not specified, the Supplier shall not require that they be connected or the Design-Builder shall connect them at no extra cost to the County, in order to keep the warranty in force.
- J. Motor enclosures shall be suitable for corrosive duty and shall have cast iron end bells. As minimum, all motor enclosures shall be TEFC unless specifically noted otherwise.
- K. NEMA Premium Efficiency Motors
 - 1. Motors with a nameplate rating of 1 HP and larger shall be NEMA premium efficient units. Motors shall be stamped with the efficiency on the nameplate with the caption "NEMA Nominal Efficiency" or "NEMA Nom. Eff." Such motors shall have efficiencies determined by the test as set forth in ANSI/IEEE 112 - Standard Test Procedure for Polyphase Induction Motors and Generators, Method B.
 - 2. Efficiency: Nominal efficiency and minimum efficiency shall be defined in accordance with the following tables. Both efficiencies shall be included in the Shop Drawing submittal.

Open Drip Proof (ODP)
Full- Load Efficiencies of NEMA Premium Efficiency Motors
Rated 600 Volts or Less

HP	2 POLE		4 POLE		6 POLE	
	Nom. Effic.	Min. Effic.	Nom. Effic.	Min. Effic.	Nom. Effic.	Min. Effic.
1	77.0	74.0	85.5	82.5	82.5	80.0
1.5	84.0	81.5	86.5	84.0	86.5	84.0
2	85.5	82.5	86.5	84.0	87.5	85.5
3	85.5	82.5	89.5	87.5	88.5	86.5
5	86.5	84.0	89.5	87.5	89.5	87.5
7.5	88.5	86.5	91.0	89.5	90.2	88.5
10	89.5	87.5	91.7	90.2	91.7	90.2
15	90.2	88.5	93.0	91.7	91.7	90.2
20	91.0	89.5	93.0	91.7	92.4	91.0
25	91.7	90.2	93.6	92.4	93.0	91.7
30	91.7	90.2	94.1	93.0	93.6	92.4
40	92.4	91.0	94.1	93.0	94.1	93.0
50	93.0	91.7	94.5	93.6	94.1	93.0
60	93.6	92.4	95.0	94.1	94.5	93.6
75	93.6	92.4	95.0	94.1	94.5	93.6
100	93.6	92.4	95.4	94.5	95.0	94.1
125	94.1	93.0	95.4	94.5	95.0	94.1
150	94.1	93.0	95.8	95.0	95.4	94.5
200	95.0	94.1	95.8	95.0	95.4	94.5
250	95.0	94.1	95.8	95.0	95.8	95.0
300	95.4	94.5	95.8	95.0	95.8	95.0
350	95.4	94.5	95.8	95.0	95.8	95.0
400	95.8	95.0	95.8	95.0	--	--
450	96.2	95.4	96.2	95.4	--	--
500	96.2	95.4	96.2	95.4	--	--

Totally Enclosed Fan Cooled (TEFC)
Full- Load Efficiencies of NEMA Premium Efficiency Motors
Rated 600 Volts or Less

HP	2 POLE		4 POLE		6 POLE	
	Nom. Effic.	Min. Effic.	Nom. Effic.	Min. Effic.	Nom. Effic.	Min. Effic.
1	77.0	74.0	85.5	82.5	82.5	80.0
1.5	84.0	81.5	86.5	84.0	86.5	84.0
2	85.5	82.5	86.5	84.0	87.5	85.5
3	85.5	82.5	89.5	87.5	88.5	86.5
5	86.5	84.0	89.5	87.5	89.5	87.5
7.5	88.5	86.5	91.0	89.5	90.2	88.5
10	89.5	87.5	91.7	90.2	91.7	90.2
15	90.2	88.5	93.0	91.7	91.7	90.2
20	91.0	89.5	93.0	91.7	92.4	91.0
25	91.7	90.2	93.6	92.4	93.0	91.7
30	91.7	90.2	94.1	93.0	93.6	92.4
40	92.4	91.0	94.1	93.0	94.1	93.0
50	93.0	91.7	94.5	93.6	94.1	93.0
60	93.6	92.4	95.0	94.1	94.5	93.6
75	93.6	92.4	95.0	94.1	94.5	93.6
100	93.6	92.4	95.4	94.5	95.0	94.1
125	94.1	93.0	95.4	94.5	95.0	94.1
150	94.1	93.0	95.8	95.0	95.4	94.5
200	95.0	94.1	95.8	95.0	95.4	94.5
250	95.0	94.1	95.8	95.0	95.8	95.0
300	95.4	94.5	95.8	95.0	95.8	95.0
350	95.4	94.5	95.8	95.0	95.8	95.0
400	95.8	95.0	95.8	95.0	--	--
450	96.2	95.4	96.2	95.4	--	--
500	96.2	95.4	96.2	95.4	--	--

L. Two-speed motors shall be of the 2 winding type.

2.05 ACCESSORY REQUIREMENTS

- A. Horizontal motors 3 HP and larger and every vertical motor shall have split-type cast metal conduit boxes. Motors shall be provided with oversized conduit boxes. Motors other than open drip-proof shall be gasketed.
- B. Lifting Devices: Motors weighing 265 lb (120 Kg) or more shall have suitable lifting eyes for installation and removal.
- C. Special Requirements: The Design-Builder shall refer to individual equipment specifications for special requirements such as motor winding thermal protection or multi-speed windings.

- D. Grounding Lugs: Provide motor grounding lug suitable to terminate ground wire, sized as indicated.
- E. Nameplate: Motors shall be fitted with permanent stainless steel nameplates indelibly stamped or engraved with NEMA Standard motor data, in conformance with NEMA MG-1-10.40. Inverter duty motors shall be clearly identified as such. At a minimum the following data shall be included on the nameplate:
 - 1. NEMA Standard MG 1 motor data.
 - 2. Permanently fastened to the motor frame.
 - 3. ABMA bearing identification number for motors meeting IEEE 841.
 - 4. NEMA nominal efficiency for all motors.
 - 5. NEMA nominal and minimum efficiency for motors meeting IEEE 841.
 - 6. UL frame temperature limit code for explosion proof motors.
 - 7. Space heater data.
 - 8. Over Temperature Protection Type Number.
 - 9. Temperature device rating and alarm and shutdown setpoint.
 - 10. Provide motor nameplates for motors with space heaters located in Class I, Division 2 – Existing Conditions, Groups C, and D areas in accordance with NEC 501.125(B).
- F. Where motors are indicated by elementary schematics or specifications to have zero speed switches, the switches shall be factory mounted integral to the motors. Switches shall close contact when the motor is at zero speed.
- G. Inverter duty motors shall be provided with shaft grounding rings. Rings shall be factory installed, and shall be by:
 - 1. Aegis, or
 - 2. Approved Equal.
- H. The motor warranty shall include coverage against VFD-induced bearing damage or failure.

2.06 MOTOR THERMAL PROTECTION

- A. Single-Phase Motors: Single-phase 120-, 208-, or 230-volt motors shall have integral thermal overload protection or shall be inherently current limited.
- B. Thermostats: all three phase motors shall have winding thermostats shall be snap action, bi-metallic, temperature-actuated switch. Thermostats shall be provided with one normally closed contact. The thermostat switch point shall be precalibrated by the Supplier. All inverter duty motors shall be provided with winding thermostats, unless RTDs are specified.
- C. RTDs: Bearing RTDs and/or winding RTDs (2 per phase) shall be provided where indicated. RTDs shall be 100 ohm platinum. Contractor shall provide a trip relay for each high temperature alarm signal.

2.07 MOTOR BEARINGS

- A. Bearings shall conform to Section 43 05 11 - General Requirements for Equipment, except as indicated herein.
- B. Bearings shall be ball or roller anti-friction type. Bearings shall be grease lubricated. Unless specified otherwise, the bearings shall have a B-10 life as follows

Motor HP	B-10 Life (hrs)
Less than 50	24,000
50 to 200	40,000
Greater than 200	10,000

- C. Fractional Horsepower: Motors with fractional horsepower through 2 HP shall be provided with lubricated-for-life ball bearings.
- D. Horizontal Motors Over 2 HP: Motors larger than 2 HP shall be provided with relubricatable ball bearings. Lubrication shall be in accordance with Supplier's recommendation for smooth operation and long life of the bearings.
- E. Vertical Motors Over 2 HP: Vertical motors larger than 2 HP shall be provided with relubricatable ball, spherical, roller, or plate type thrust bearings. Lubrication shall be in accordance with Supplier's recommendation for smooth operation and long life of the bearings.
- F. Water Cooled Motors: If water cooling is required for the thrust bearings, cooling water lines shall be provided complete with shut-off valve, strainer, solenoid valve, flow indicator, thermometer, throttling valve, and, (where subject to freezing), insulation with heat tracing.
- G. Inverter Duty Motors: Provide an insulated bearing to prevent circulating bearing currents.

2.08 NOISE

- A. All motors shall have an equivalent A-weighted sound level of 80 db A as determined in accordance with IEEE Standard No. 85 under full load and full speed conditions, unless otherwise specified.

PART 3 PRODUCTS

3.01 INSTALLATION

- A. Equipment shall be installed in accordance with Section 43 05 11 - General Requirements for Equipment.
- B. Supplier's services shall be provided as specified in Section 01 60 00 - Common Product Requirements.
- C. The Supplier shall provide the Contractor with detailed recommendations and instructions for installation of the equipment specified in this Section.

- D. Supplier shall provide assistance during equipment installation as required by the Contractor.
- E. The equipment shall be installed at the locations shown and in accordance with the recommendations of the Supplier.
- F. Following installation, Supplier shall provide Certificate of Proper Installation.
- G. Motor installation shall be performed in accordance with the motor supplier's written recommendations and the written requirements of the Supplier of the driven equipment. Shaft grounding devices shall be connected to the grounding system in accordance with the Supplier's recommendations.
- H. Related electrical work involving connections, controls, switches, and disconnects shall be performed in accordance with the applicable Sections of Division 26 - Electrical.

3.02 FACTORY TESTING

- A. Motors rated 100 HP and larger shall be factory tested in conformance with IEEE 112, IEEE 43 - Recommended Practice for Testing Resistance of Rotating Machinery, and NEMA MG-2. Except where specific testing or witnessed shop tests are required by the specifications for driven equipment, factory test reports may be copies of routine test reports of electrically duplicate motors. Test report shall indicate test procedure and instrumentation used to measure and record data. Test report shall be certified by the motor supplier's test personnel and be submitted to Contractor.

3.03 FIELD TESTING AND COMMISSIONING

- A. Field Testing and Commissioning shall be in accordance with the requirements of Section 01 75 00 - Equipment Testing and Plant Startup.
- B. The Supplier shall provide detailed procedures for Field Testing and Commissioning procedures for the equipment specified in this Section.
- C. Field Testing and Commissioning shall be performed under the direction of personnel provided by the Supplier.
- D. The Contractor shall perform the following field tests.
 - 1. Inspect each motor installation for any deviation from rated voltage, phase, frequency, and improper installation.
 - 2. Visually check for proper phase and ground connections. Verify that multi-voltage motors are connected for proper voltage. Verify shaft grounding devices are properly grounded.
 - 3. Check winding and bearing temperature detectors and space heaters for functional operation.
 - 4. Test for proper rotation prior to connection to the driven equipment.
 - 5. Visually check that motor overload heaters are properly sized and that MCP breaker settings are correct for the motor installed.
 - 6. Test insulation (megger test) of new and re-used motors in accordance with NEMA MG-1. Test voltage shall be 1000 VAC plus twice the rated voltage of the motor.

- E. All applicable Division 26 – Electrical forms in Section 01 99 90 - Reference Forms shall be completed prior to acceptance.

END OF SECTION

SECTION 26 05 15

LOCAL CONTROL STATIONS AND MISCELLANEOUS ELECTRICAL EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

A. Scope

1. The Contractor shall provide complete local control stations (LCP or VCP) and terminal cabinets (CTC and STC) as indicated herein or in other sections of the Specifications. The stations shall be designed to provide the sequence of operation in Section 40 61 96 – Process Control Descriptions and The P&ID Drawings and/or as required by specific equipment specifications.
2. This Section also specifies miscellaneous electrical devices used throughout this project. These devices are not limited to use within local control stations.
3. Vendor (VCP) or local control panels (LCP) shall be provided as specified in Section 40 67 00 – Control System Equipment Panels and Racks.

1.02 QUALITY ASSURANCE

A. Reference Codes and Standards

1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
NEMA 250	Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
UL 94	Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
UL 508A	Industrial Control Panels
UL 698A	Industrial Control Panels Relating to Hazardous (Classified) Locations
NFPA 79	Electrical Standard for Industrial Machinery

Reference	Title
NFPA 70	National Electrical Code (NEC)
NEMA ICS 6	Industrial Control and Systems: Enclosures
ANSI/UL 497-1995	Standard for Protectors for Paired Conductor Communications Circuits
UL 1012	Power Supplies
EIA RS-310C	Racks, Panels, and Associated Equipment
UL 1449	UL Standard for Safety for Surge Protective Devices

- B. Industrial control panels and/or local control stations shall comply with the requirements of NEC (including Article 409), NEMA, and UL.

1.03 ENVIRONMENTAL CONDITIONS

- A. Equipment in this Section shall be subjected to environmental conditions in accordance with Section 01 11 80 – Environmental Conditions.

1.04 SUBMITTALS

- A. Preconstruction/Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.

1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.

2. Furnish Shop Drawings in accordance with 26 00 00 – Electrical Work, General.
3. Ladder diagrams and written descriptions explaining ladder diagram operation and system operation.
4. Include catalog cuts of control equipment including enclosures, overcurrent devices, relays, pilot devices, terminations, and wire troughs.

PART 2 PRODUCTS

2.01 GENERAL

- A. The Contractor shall provide the equipment, panels and stations to satisfy the functional requirements in the relevant mechanical equipment and Instrumentation and Control specifications and the Electrical Elementary Schematics. Each panel and station shall be fabricated with UL labeled components. Equipment not specifically indicated as being Work of other specification sections shall be provided under this Section. All equipment, panels and stations shall be wired under this Section.
- B. The controls shall be 120 V maximum. Where the electrical power supply is 240 V, single phase or 480 V, 3 phase, the station shall be provided with a fused control power transformer. Control conductors shall be provided in accordance with Section 26 05 19 – Wire and Cable.
- C. Each panel and/or station shall be provided with identified terminal strips for the connection of external conductors. The Contractor shall provide sufficient terminal blocks to connect 25 percent additional conductors for future use. Termination points shall be identified in accordance with Shop Drawings. The panels and/or stations shall be the source of power for all 120 VAC solenoid valves interconnected with the panels and/or stations. Equipment associated with the panels and/or stations shall be ready for service after connection of conductors to equipment, controls, panels and/or stations.
- D. Wiring to door-mounted devices shall be extra flexible and anchored to doors using wire anchors cemented in place. Exposed terminals of door-mounted devices shall be guarded to prevent accidental personnel contact with energized terminals.
- E. Enclosures
 1. In finished rooms, enclosures shall be NEMA 12 steel enclosures painted with ANSI 61 exterior and white interior.
 2. In all other non-hazardous areas, such as generator room, pump room, utility corridor, and all outdoor areas, enclosures shall be NEMA 4X 316 stainless steel. Where possible, penetrations shall be made in such a manner to maintain the NEMA 4X rating. If this is not possible, the penetrations shall be made in such a manner to minimize entry of foreign materials into the enclosure, subject to approval by the Design-Builder.
 3. In hazardous areas, enclosures shall be cast aluminum NEMA 7 and shall be UL listed for use in hazardous or classified locations.
 4. In chemical areas for alum, sodium hypochlorite, NEMA 4X fiberglass enclosures shall be used.
 5. Enclosures shall be freestanding, pedestal-mounted, or equipment skid-mounted, as indicated. Internal control components shall be mounted on a removable mounting pan. Mounting pan shall be finished white.
 6. Outdoor mounted enclosures shall be provided with thermostatically controlled heaters. Heaters shall be operated at $\frac{1}{2}$ rated voltage (240volt heaters shall be sized and operated at 120 volts).
- F. Disconnect Switches

1. Heavy duty, fused or non-fused as indicated, single throw fusible switches shall be rated not less than 65 KA at 480 VAC.
 2. Horsepower rated
 3. UL listed
 4. Padlockable in "Off" position and door interlock
 5. Enclosure per area classification in Section 26 00 00 – Electrical Work, General.
 6. 480 V, 3-phase, 3-pole (6-pole when used with 2-speed motor).
 7. Auxiliary control contact shall be connected to the equipment control circuit to de-energize the controls prior to opening the power contacts.
 8. As manufactured by:
 - a. Eaton,
 - b. Square D/Schneider Electric,
 - c. ABB, or
 - d. Siemens
- G. All field instruments and field analyzers specified in Div. 40 that require AC power shall have a lock-out style selector switch for locking on or locking off the 120 Vac power source. The selector switch shall use a control station in NEMA-12, 4, 4X, or 7 as required by the area classification. Provide lockable toggle switch and enclosure. Provide surge protection device that matches the enclosure type of the power disconnect type control station, field instrument, or field analyzer: Telematic TP48 transmitter surge protection device or Approved Equal.
- H. Identification of panel-mounted devices, conductors, and electrical components shall be in accordance with Section 26 00 00 – Electrical Work, General.
- I. Panel-mounted devices shall be mounted a minimum of 3-feet above finished floor elevation, but not higher than 6'-6" above finished floor, unless noted otherwise.

2.02 PANEL/STATION COMPONENTS

- A. Pushbuttons and selector switches shall be the heavy-duty, corrosion-resistant, oil-tight type, sized to 30-mm. Miniature style devices shall not be acceptable. Devices shall be as manufactured by:
1. Square D/Schneider Electric,
 2. Siemens,
 3. Eaton,
 4. ABB, or
 5. Approved Equal.
- B. Selector switches shall be provided with auxiliary contacts as required or as shown. At a minimum the following contacts shall be provided for switch position monitoring:
1. Hand-Off-Automatic switches:
 - a. In Hand contact
 - b. In Auto contact
 2. Run/Stop or On/Off: In Run or In On contact

- C. Pilot lights shall be Type E34 as manufactured by Eaton, Type 3SBO as manufactured by:
 - 1. Siemens Energy and Automation Inc.,
 - 2. General Electric Company Type CR104P,
 - 3. Square D Company equivalent, or
 - 4. Approved Equal.

- D. Pilot lights shall be of the proper control voltage push-to-test, LED type, heavy-duty, corrosion-resistant NEMA 4X with legend plates as specified herein, indicated on the Plans, or otherwise directed by the Contractor.

- E. Legend plates shall be plastic, black field (background) with white lettering.
 - 1. Lens colors shall be red for "run," "open," or "on"; green for "stopped," "closed," or "off"; amber for "alarm" or "fail", and white for "control power on".
 - 2. Provide hazardous location type pilot devices in classified locations.

- F. Control Relays (CR) shall be Type D3 as manufactured by Eaton, Type CR420 as manufactured by:
 - 1. General Electric Company,
 - 2. Potter-Brumfield equivalent,
 - 3. Square D Company equivalent,
 - 4. Siemens Energy and Automation Inc. equivalent, or
 - 5. Approved Equal.

- G. Relays shall be general purpose plug-in type with coil voltage as shown on the Plans and sealed 10 ampere contacts. All relays shall have three SPDT contacts rated 120/240 VAC and 28 VDC minimum. NEMA machine tool relays shall be provided. Miniature type or "ice cube" relays are not acceptable.

- H. Timing Relays (TR) shall be the general purpose plug-in type, Type TR as manufactured by:
 - 1. Eaton,
 - 2. Type TUC as manufactured by Diversified Electronics,
 - 3. Schneider Electric equivalent,
 - 4. Siemens Energy and Automation Inc. equivalent, or
 - 5. Approved Equal.

- I. Timing relays shall be electronic type with 120 VAC coils unless otherwise specified or indicated on the Plans. Timers shall be provided with two SPDT timed output contacts. Contact ratings shall be the same as for control relays as specified above.

- J. Elapsed time meters shall be non-resettable type, read to a maximum of 99999.9 hours and shall be as manufactured by:
 - 1. Schneider,
 - 2. Eaton, or
 - 3. Approved Equal.

- K. Magnetic starters shall be:

1. NEMA rated, Size 1 minimum. IEC or dual NEMA/IEC rated type shall not be acceptable.
 2. FVNR type unless indicated otherwise.
 3. Combination starters with magnetic only instantaneous trip circuit breakers such as:
 - a. Schneider Mag-Gard,
 - b. Eaton Electrical HMCP,
 - c. General Electric Mag-Break, or
 - d. Approved Equal.
 4. Breakers shall be rated 65 KA minimum.
 5. Control transformers shall be provided with primary and secondary fuses, 120 V maximum control voltage. VA rating of transformer shall be based on devices on the control schematic.
- L. Terminal strips shall be provided for every panel and shall be the flanged fork or ring lug type suitable for No. 12 AWG stranded wire minimum. Provide 25 percent spare terminals in each panel.

2.03 FACTORY TESTING

- A. Each panel/station shall be factory assembled and tested for sequence of operation prior to delivery.

2.04 SPARE PARTS

- A. Provide a minimum of 10 percent spare LED lamps (minimum 2) and one spare lens for each color pilot lamp in each panel.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Equipment shall be installed in accordance with Section 43 05 11 – General Requirements for Equipment and Section 26 00 00 – Electrical Work, General.
- B. Supplier's services shall be provided as specified in Section 01 60 00 – Common Product Requirements.
- C. The Supplier shall provide the Contractor with detailed recommendations and instructions for installation of the equipment specified in this Section.
- D. Supplier shall provide assistance during equipment installation as required by the Contractor.
- E. The equipment shall be connected and installed at the locations shown and in accordance with the recommendations of the Supplier
- F. Panels/stations shall be installed in accordance with Section 26 00 00 – Electrical Work, General and in accordance with the Supplier's recommendations.

- G. Panels/stations shall be protected at the site from loss, damage, and the effects of weather. Panels/stations shall be stored in an indoor, dry location. Heating shall be provided in areas subject to corrosion and humidity.
- H. Panels/station interiors and exteriors shall be cleaned, and coatings shall be touched up to match original finish upon completion of the Work.
- I. Conduit, conductors, and terminations shall be installed in accordance with Section 26 00 00 – Electrical Work, General.

3.02 FIELD TESTING AND COMMISSIONING

- A. Field Testing and Commissioning shall be in accordance with the requirements of Section 01 75 00 – Equipment Testing and Plant Startup.
- B. Each panel/station shall be tested again for functional operation in the field after the connection of external conductors and prior to equipment startup.

END OF SECTION

SECTION 26 05 19

WIRE AND CABLE

PART 1 GENERAL

1.01 SUMMARY

A. Scope

1. The Contractor shall provide wire and cable, complete and operable, in accordance with the Contract Documents.
2. In the event that motors provided are larger horsepower than the motors indicated, raceways, conductors, starters, overload elements, and branch circuit protectors shall be revised as necessary to control and protect the increased motor horsepower in accordance with Section 26 05 10 – Electrical Motors. Revisions are part of the Work of this Section.
3. This Specification specifies the requirements for low voltage (600Vac) and medium voltage (5/8kVac) cables for power, control and signal applications.

1.02 QUALITY ASSURANCE

A. Reference Codes and Standards

1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
ASTM B3	Soft or Annealed Copper Wire
ASTM B8	Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM B33	Tinned Soft or Annealed Copper Wire for Electrical Purposes
ICEA S-68-516	Ethylene-Propylene-Rubber-Insulated Wire
NEMA WC7	Cross-Linked-Thermosetting Insulated Wire and Cable for the Transmission and Distribution of Electric Energy
UL 44	Rubber-Insulated Wires and Cables
UL 83	Thermoplastic-Insulated Wires and Cables
AEIC CS8	Ethylene Propylene Rubber Insulated Shielded Power Cables Rated 5 Through 69 KV
ASTM B189	Lead Coated and Lead-Alloy-Coated Soft Copper Wire for Electrical Purposes
ICEA S-93-639	Ethylene-Propylene-Rubber-Insulated Wire
IEEE 383	Type Test of Class IE Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations
IEEE-386	Separable Insulated Connector Systems for Power Distribution Systems Above 600V
NEMA WC7	Cross-Linked-Thermosetting Insulated Wire and Cable for the Transmission and Distribution of Electric Energy
NETA	International Electrical Testing Association Inc. Acceptance Testing or Maintenance Testing
NFPA 70	National Electric Code (NEC)
UL 1072	2001-8000 Volt Non-shielded Solid-Dielectric Single Conductor Power Cable

1.03 ENVIRONMENTAL CONDITIONS

- A. Equipment in this Section shall be subjected to environmental conditions in accordance with Section 01 11 80 – Environmental Conditions.

1.04 SUBMITTALS

- A. Preconstruction/Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.

1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the

reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.

2. The Contractor shall submit Shop Drawings in accordance with 26 00 00 – Electrical Work, General.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Materials specified are considered the minimum acceptable for the purposes of durability, strength, and resistance to erosion and corrosion. The Contractor may propose alternative materials for the purpose of providing greater strength or to meet required stress limitations. However, alternative materials must provide at least the same qualities as those specified for the purpose. If alternatives are proposed, the proposals shall be accompanied with documentation supporting the claimed superiority of the proposed substitutions. The Engineer shall be the sole decider in the equivalency of alternative materials of construction.

2.02 GENERAL

- A. Conductors, include grounding conductors, shall be stranded copper. Aluminum conductor wire and cable shall not be permitted. Insulation shall bear the UL label, the Supplier's trademark, and identify the type, voltage, and conductor size. Conductors except flexible cords and cables, fixture wires, and conductors that form an integral part of equipment such as motors and controllers shall conform to the requirements of Article 310 of the National Electric Code, latest edition, for current carrying capacity. Flexible cords and cables shall conform to Article 400, and fixture wires shall conform to Article 402. Wiring shall have wire markers at each end.

2.03 LOW VOLTAGE WIRE AND CABLE

- A. Power and Lighting Wire
 1. Wire rated for 600 volts in duct or conduit for power and lighting circuits shall be XHHW-2 rated 90 degrees C suitable for wet locations except where required otherwise by the Plans. VFD rated cables shall be used on low voltage VFD outputs.
 2. Conductors for feeders as defined in Article 100 of the NEC shall be sized to prevent a voltage drop exceeding 3 percent at the farthest outlet of power, heating, and lighting loads, or combinations of such loads, and where the maximum total voltage drop on both feeders and branch circuits to the farthest connected load does not exceed 5 percent.
 3. Conductors for branch circuits as defined in Article 100 of the NEC shall be sized to prevent voltage drop exceeding 3 percent at the farthest connected load or combinations of such loads and where the maximum total voltage drop on both feeders and branch circuits to the farthest connected load does not exceed 5 percent.

4. Wiring for 600 volt class power and lighting shall be as manufactured by:
 - a. Okonite,
 - b. General Cable, Southwire, or
 - c. Approved Equal.

B. Control Wire

1. Control wire in duct or conduit shall be the same type as power and lighting wire indicated above.
2. Control wiring shall be No.14 AWG, single, pair or multiconductor cables.
3. Control wires inside panels and cabinets shall be machine tool grade type MTW, UL approved, rated for 90 degrees C at dry locations, and be as manufactured by:
 - a. American,
 - b. General Cable, or
 - c. Approved Equal.
4. All control wiring of 10 or more No. 14 shall be preassembled as manufactured by Clifford of Vermont, Inc., Quik-Pull, meeting the following requirements
 - a. #14 AWG stranded copper XHHW-2, 600 Volt
 - b. Each conductor numbered every 1½ Inches
 - c. Sequential footage tape.
 - d. Round compact units, spiral configuration
 - e. UL listed. Custom wire assembly
5. Assemblies are identified as QP-10, 20 to 100 maximum. Example: Where QP-20 is shown it supersedes the count if 16#14 are shown.

C. Instrumentation Cable

1. Instrumentation cable shall be rated at 600 volts, single pair or multiconductor signals cables.
2. Individual conductors shall be No. 16 AWG stranded copper, and No. 14 AWG for runs in excess of 2000 ft. Insulation shall be color coded pvc/nylon: black-white for 2 conductor cable and black-red-white for 3 conductor cable.
3. Instrumentation cables shall be composed of the individual conductors, an aluminum polyester foil shield, a No. 22 or larger AWG stranded tinned copper drain wire, and a PVC outer jacket with a thickness of 0.047-inches.
4. Single pair, No. 16 AWG, twisted, shielded cable shall be Belden Part No. 3090A, similar by:
 - a. General Cable,
 - b. Belden or
 - c. Approved Equal.
5. Single triad, No. 16 AWG, twisted, shielded cable shall be Belden Part No. 3091A, similar by:
 - a. General Cable,
 - b. Belden or
 - c. Approved Equal.

D. Tray Cable

1. Multi-conductor tray cable shall be rated 600 volts, listed by UL as Type TC cable per Article 336 of the NEC. The individual conductors shall be UL listed as Type XHHW-2, with a sunlight-resistant PVC overall jacket.
 2. Conductor sizes shall be the same as for power and lighting wire and control wire above.
- E. Low Voltage VFD Power Cable
1. VFD power cable shall be three (3) conductor, stranded copper, PVC jacketed, shielded type, tray cable (TC) rated 600 volts with three (3) symmetrical ground conductors. The individual conductors shall be UL listed as Type XHHW-2 or RHW-2 rated for 110 degrees C at wet and dry locations, with XLPE insulation rated for 2kV.
 2. VFD Cables shall be as manufactured by:
 - a. Belden,
 - b. Alpha,
 - c. General Cable,
 - d. Nexans Americable, or
 - e. Approved Equal.

2.04 MEDIUM VOLTAGE CABLE

- A. Individual conductors shall be copper, Class B, stranded.
- B. 5/8 KV Cable
1. Cable used duct banks shall be composed of a single conductor, ethylene-propylene rubber (EPR) insulation rated at 105 degrees C, shield, and black polyvinyl chloride (PVC) jacket. Insulation level shall be 133 percent, 115 mil. Shielding, applied over the insulation screen, shall consist of bare or tinned copper concentric wires. Concentric shield wires shall be round shaped and sized on the basis of a 1/3 neutral.. Cable shall be UL Type MV-105 in accordance with UL 1072 and ICEA-S-93-639/NEMA-WC74 - Medium Voltage Power Cables, as manufactured by:
 - a. Okonite,
 - b. Prysmian,
 - c. Kerite, or
 - d. Approved Equal.
 2. Cable used for indoor motor or transformer feeders shall be similar to the cable above, but shall have a flat copper type shield with 33% overlap (min.), as manufactured by:
 - a. Okonite,
 - b. Prysmian,
 - c. Kerite, or
 - d. Approved Equal.
 3. Tray cable shall be composed of one or 3 conductors, a copper grounding conductor, ethylene-propylene rubber (EPR) insulation rated at 105 degrees C, interlocked aluminum armor, and yellow PVC outer jacket. Insulation level shall be 133 percent, 115 mil. Tray cable shall be UL Type MV-105 in accordance with UL 1072 and ICEA-S-93-639/NEMA-WC74 as manufactured by:
 - a. Okonite,

- b. Prysmian,
 - c. Kerite,
 - d. Approved Equal.
- C. Medium Voltage VFD Power Cable
1. The MV-VFD cable shall be a flexible, braid and foil shielded power cable specifically engineered for use in medium voltage variable frequency drive applications.
 2. The MV-VFD cable shall be three conductor, soft annealed flexible stranded tinned copper, 8kV rated with 133% insulation level, rated for 90 degree C.
 3. The cable shall have 3 symmetrically arranged insulated grounding conductors.
 4. Individual shielded wires shall have insulation from extruded thermosetting 90 degree C Ethylene Propylene Rubber (EPR).
 5. The entire cable shall have flame retardant, chemical and sunlight resistant outer jacket with armor and EMI shields.
 6. The MV-VFD cables shall comply with IEEE 1580, UL 1309 and UL 1072.
 7. Manufacturers: Nexans AmerCable, Presmian, Southwire, or equal.

2.05 CABLE SPLICES AND TERMINATIONS

- A. Compression connectors shall be:
1. Burndy Hi Lug,
 2. Thomas & Betts Sta-Kon, or
 3. Approved Equal.
- B. Threaded connectors shall be split bolt type of high strength copper alloy. Pressure type, twist-on connectors (wire nuts) will not be acceptable.
- C. Pre-insulated fork tongue lugs shall be:
1. Thomas & Betts,
 2. Burndy, or
 3. Approved Equal.
- D. General purpose insulating tape shall be:
1. Scotch No. 33,
 2. Plymouth Slip-knot, or
 3. Approved Equal.
- E. High temperature tape shall be polyvinyl as manufactured by:
1. Plymouth,
 2. 3M, or
 3. Approved Equal.
- F. Labels for coding 600 volt wiring shall be computer printable or pre-printed, self-laminating, self-sticking, as manufactured by:
1. W.H. Brady,

2. 3M, or
 3. Approved Equal.
- G. Stress cone material for make-up of medium voltage shielded cable shall be as manufactured by:
1. Raychem,
 2. 3M, or
 3. Approved Equal.
- H. Shielded power cable shall be spliced using kits specifically designed to splice medium voltage, shielded power cables. Splice kits shall be designed for continuous submergence. Heat shrink splice kits shall be:
1. Raychem Type HVS, or
 2. Approved Equal.
- I. "Cold" splicing will not be acceptable.

PART 3 EXECUTION

3.01 SHIPMENT AND STORAGE

- A. Equipment shall be shipped and stored in accordance with Section 01 60 00 - Common Product Requirements.
- B. Supplier shall provide Contractor with detailed recommendations and instructions for product storage.

3.02 GENERAL

- A. The Contractor shall provide, terminate and test all power, control, and instrumentation conductors.
- B. Multiconductor control and signal cables shall be used as indicated on the Drawings.
- C. The Contractor shall, as a minimum, provide the number of control wires listed in the conduit schedule or on the Plans. Excess wires shall be treated as spares.

3.03 INSTALLATION

- A. The Supplier shall provide the Contractor with detailed recommendations and instructions for installation of the product specified in this Section.
- B. Supplier shall provide assistance during product installation as required by the Contractor.
- C. Conductors shall not be pulled into raceway until raceway has been cleared of moisture and debris.
- D. Pulling tensions on raceway cables shall be within the limits recommended by the cable Supplier. Wire pulling lubricant, where needed, shall be UL approved.

- E. Instrumentation wire shall not be run in the same raceway with power and control wiring except where specifically indicated.
- F. Wire in panels, cabinets, and wireways shall be neatly grouped using nylon tie straps, and shall be fanned out to terminals.
- G. Single conductor cable in cable trays shall be No. 1/0 or larger and shall be of a type listed and marked for use in cable trays. Tray cable smaller than 1/0 shall be multi-conductor, with outer jacket.

3.04 SPLICES AND TERMINATIONS

A. General

- 1. Wire taps and splices shall be properly taped and insulated according to their respective classes.
- 2. In general, there shall be no cable splices in underground manholes or pullboxes. If splices are necessary, the cables shall be spliced using submersible cable splices, suitable for continuous submergence. Splices in underground manholes and pullboxes may be made only with the approval of the Engineer and the City.
- 3. Stranded conductors shall be terminated directly on equipment box lugs making sure that conductor strands are confined within lug. Use forked-tongue lugs where equipment box lugs have not been provided.
- 4. Excess control and instrumentation wires shall be long enough to terminate at any terminal block in the enclosure, be properly taped, be identified with origin, and be neatly coiled.

B. Control Wire and Cable

- 1. Control conductors shall be spliced or terminated only at the locations indicated and only on terminal strips or terminal lugs of vendor furnished equipment.
- 2. In motor control centers, and control panels, control wire and spare wire shall be terminated to terminal strips.
- 3. The Contractor shall provide as a minimum the number of control wires listed in the conduit schedule or as indicated in the Contract Documents. Excess wires shall be treated as spares.

C. Instrumentation Wire and Cable

- 1. Shielded instrumentation cables shall be grounded at one end only, preferably the receiving end on a 4 - 20 mA system.
- 2. Two and 3 conductor shielded cables installed in conduit runs which exceed available standard cable lengths may be spliced in pullboxes with the prior approval of the Design-Builder. Such cable runs shall have only one splice per conductor.

D. Power Wire and Cable

- 1. 120/208-volt, 120/240-volt, and 480/277-volt branch circuit conductors may be spliced in suitable fittings at locations determined by the Engineer. Cables rated above 2,000 volts shall be spliced or terminated only at equipment terminals indicated.

2. Splices to motor leads in motor terminal boxes shall be wrapped with mastic material to form a mold and then shall be taped with a minimum of 2 layers of varnished cambric tape overtaped with a minimum of 2 layers of high temperature tape.
3. Shielded power cable shall be terminated with pre-assembled stress cones in a manner approved by the cable and terminal supplier. The Contractor shall submit the proposed termination procedure as a Shop Drawing.
4. VFD shielded power cables shall have the shield grounded at all locations where it is exposed. Shielded power cables shall have shields grounded at both end of the circuit.

3.05 CABLE IDENTIFICATION

- A. General: Wire and cable shall be identified for proper control of circuits and equipment and to reduce maintenance effort. Identification shall be installed at every termination point. Also, refer to Section 26 05 53 – Electrical Identification.
- B. Identification Numbers: The Contractor shall assign to each control and instrumentation wire and cable a unique identification number. Numbers shall be assigned to conductors having common terminals and shall be shown on As-Built Drawings. Identification numbers shall appear within 3-inches of conductor terminals. "Control Conductor" shall be defined as any conductor used for alarm, annunciator, or signal purposes.
 1. Multiconductor cable shall be assigned a number which shall be attached to the cable at intermediate pull boxes and at stub-up locations beneath free-standing equipment. It is expected that the cable number shall form a part of the individual wire number. Individual control conductors and instrumentation cable shall be identified at pull points as described above. The instrumentation cable numbers shall incorporate the loop numbers assigned in the Contract Documents.
 2. 120/208-volt system feeder cables and branch circuit conductors shall be color coded as follows: Phase A - black, Phase B - red, Phase C - blue, and Neutral - white. The 120/240-volt system conductors shall be color coded as follows: Line 1 - Black, Line 2 - Red, and Neutral - White. The 480/277 volt system conductors shall be color coded as follows: Phase A - Brown, Phase B - Orange, Phase C - Yellow, and Neutral - Gray. Color coding tape shall be used where colored insulation is not available. Branch circuit switch shall be yellow. Insulated ground wire shall be green, and neutral shall be gray. Color coding and phasing shall be consistent throughout the Site, but bars at panelboards, switchboards, and motor control centers shall be connected Phase A-B-C, top to bottom, or left to right, facing connecting lugs. Any phase changes necessary for proper rotation shall be made at the driven equipment and not in the local disconnect.
 3. General purpose AC control cable shall be red. General purpose DC control cable shall be blue.
 4. Spare cable shall be terminated on terminal screws and shall be identified with a unique number as well as with destination.
 5. Terminal strips shall be identified by computer printable, cloth, self-sticking marker strips attached under the terminal strip.

3.06 FIELD TESTING AND COMMISSIONING

- A. Field Testing and Commissioning shall be in accordance with the requirements of Section 01 75 00 – Equipment Testing and Plant Startup.

- B. The Contractor shall provide detailed procedures for Field Testing and Commissioning procedures for the equipment specified in this Section.

- C. Cable Assembly and Testing: Cable assembly and testing shall comply with applicable requirements of ICEA Publication No. S-95-658/NEMA WC70 - Ethylene-Propylene-Rubber Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy. Factory test results shall be submitted in accordance with Section 01 33 00 - Submittals, prior to shipment of cable. The following field tests (in addition to the tests specified in Section 26 01 26 - Electrical Tests) shall be the minimum requirements
 1. Insulation resistance testing, using a DC megohmmeter, shall be performed on cables operating at more than 2,000 volts to ground. Time-resistance readings shall be taken and recorded at intervals of 30 seconds and one minute. Time-resistance voltage levels shall be per the cable supplier's recommendations.
 2. Power cable rated at 600 volts shall be tested for insulation resistance between phases and from each phase to a ground using a megohmmeter.
 3. Field testing shall be done after cable is installed in the raceways.
 4. Field tests shall be performed by a certified test organization acceptable to the cable supplier. Test results shall be submitted to the Engineer for review and acceptance.
 5. Cables failing the tests shall be replaced with a new cable or be repaired. Repair methods shall be as recommended by the cable supplier and shall be performed by persons certified by the industry.

- D. Continuity Test: Control and instrumentation cable shall be tested for continuity, polarity, undesirable ground, and origination. Such tests shall be performed after installation and prior to placing cable in service.

END OF SECTION

SECTION 26 05 26

GROUNDING

PART 1 GENERAL

1.01 SUMMARY

A. Scope

1. This Section specifies electrical grounding for all electrical equipment and control panels, including aluminum or steel pedestals for electrical equipment. Grounding shall be provided to all switchgears and MCCs, motors, transformers and accessories, generators and accessories, control panels, cable trays, instrumentation equipment, HVAC equipment, mag-meters, steel piping and building foundation rebars, and all lightning protection systems.
2. Provide the electrical grounding system, complete and operable, as indicated in accordance with the Contract Documents.
3. The requirements of Section 26 00 00 – Electrical Work, General apply to this Section.
4. Single Supplier
 - a. Like products shall be the end product of one Supplier in order to achieve standardization of appearance, operation, maintenance, spare parts, and Supplier's services.

- B. Coordinate with lightning protection requirements. All lightning down conductors shall be bonded to the building ground grid.

1.02 QUALITY ASSURANCE

A. Reference Codes and Standards

1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
IEEE 81	Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
IEEE Std 81.2-1991	Guide to Measurement of Impedance and Safety Characteristics of Large, Extended or Interconnected Grounding Systems
NETA - ATS	InterNational Electrical Testing Association Inc. - Acceptance Testing Specifications
NFPA 70	National Electric Code (NEC) Article 250

1.03 ENVIRONMENTAL CONDITIONS

- A. Equipment in this Section shall be subjected to environmental conditions in accordance with Section 01 11 80 – Environmental Conditions.

1.04 SUBMITTALS

- A. Preconstruction/Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.

1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.

2. Furnish submittals in accordance with the requirements of Section 01 33 00 - Submittals and Section 26 00 00 – Electrical Work, General.
3. Shop Drawings
 - a. Submit Supplier’s product information for connections, clamps, and grounding system components, showing compliance with the requirements of this Section.

PART 2 PRODUCTS

2.01 GENERAL

- A. Components of the grounding electrode system shall be manufactured in accordance with UL 467 - Standard for Safety Grounding and Bonding Equipment, and shall conform to the applicable requirements of National Electrical Code Article 250 and local codes.

2.02 GROUNDING SYSTEM

- A. Grounding loop conductors shall be bare annealed copper conductors.
- B. Grounding conductors shall be No. 4/0 unless indicated otherwise.
- C. Ground Rods
 - 1. Unless indicated otherwise, provide ground rods minimum of 3/4 inch in diameter, 10 feet long, and with a uniform covering of electrolytic copper metallurgically bonded to a rigid steel core.
 - 2. Provide corrosion-resistant copper-to-steel bond.
 - 3. The rods shall conform to UL 467.
 - 4. The rods shall be of the sectional type, joined by threaded copper alloy couplings.
- D. Make buried and concrete-encased cable-to-cable and cable-to-ground rod connections using exothermic welds by:
 - 1. Cadweld,
 - 2. Thermoweld, or
 - 3. Approved Equal.
- E. Exposed Connectors
 - 1. Exposed grounding connectors shall be of the compression type (connector-to-cable), constructed of high-copper alloy, and manufactured specifically for the particular grounding application.
 - 2. The connectors shall be:
 - a. FCI-Burndy,
 - b. O.Z. Gedney, or
 - c. Approved Equal.
- F. Use grounding clamps to bond each separately-derived system to the grounding electrode conductors.
- G. Equipment Grounding Circuit Conductors
 - 1. The conductors shall be the same type and insulation as the load circuit conductors.
 - 2. The minimum size shall be as outlined in Table 250.122 of the National Electrical Code, unless indicated otherwise.
 - 3. Metallic conduit systems shall have an equipment grounding wires as well as being equipment grounding conductors themselves.
- H. Grounding materials supplier:
 - 1. Copperweld,
 - 2. Thermoweld,
 - 3. FCI-Burndy, or
 - 4. Approved Equal.

PART 3 EXECUTION

3.01 GROUNDING

- A. Provide a separate grounding conductor, securely grounded in each raceway and cable tray independent of raceway material.
- B. Provide a separate grounding conductor for each motor and connect at motor box.
- C. Do not use bolts for securing the motor box to the frame or the cover for grounding connectors.
- D. Sizes shall be as indicated on the Conduit Schedule and in accordance with NEC Article 250.
- E. Route the conductors inside the raceway.
- F. Provide a grounding-type bushing for secondary feeder conduits that originate from the secondary section of each MCC section, switchboard, or panelboard.
- G. Individually bond the raceway to the ground bus in the secondary section.
- H. Provide a green insulated wire as grounding jumper from the ground screw to a box grounding screw, and, for grounding type devices, to the equipment grounding conductor.
- I. Provide a separate grounding conductor in each individual raceway for parallel feeders.
- J. Interconnect the secondary switchgear MCC or panelboard neutral bus to the ground bus in the secondary switchgear compartment only at the service entrance point or after a transformer.
- K. Provide the duct bank ground system as indicated, including trenching, splices, ground rods, and connections to equipment and structures.
- L. Measure ground impedance in accordance with IEEE STD 81 after installation but before connecting the electrode to the remaining grounding system.
- M. Low Voltage Grounded System (600V or less)
 - 1. A low-voltage grounded system is defined as a system where the local power supply is a transformer, with the transformer secondary grounded.
 - 2. Grounding system connections for a premises-wired system supplied by a grounded AC service shall be provided with a grounding electrode connector connected to the grounded service conductor at each service, in accordance with the NEC.
 - 3. The grounded circuit conductor shall not be used for grounding non-current-carrying parts of equipment, raceways, and other enclosures except where specifically listed and permitted by the NEC.
- N. Embedded Ground Connections
 - 1. Underground and grounding connections embedded in concrete shall be UL-listed ground grid connectors.
 - 2. The connection shall be made in accordance with the Supplier's instructions.

3. Do not conceal or cover ground connections until the Design-Builder has established that every grounding connection conforms to the requirements of the Contract Documents and has given the Design-Builder written confirmation.
- O. Ground Ring
1. Furnish trenching and materials as necessary to install the ground ring as indicated.
 2. The bonding conductor shall be in direct contact with the earth and of the indicated size.
 3. Provide a minimum burial depth of 36 inches or as indicated on the Plans, whichever is greater.
 4. Re-compact disturbed soils to their original density in 6-inch lifts.
 5. Coordinate connections with facilities having lightning protection.
- P. Duct Bank Ground
1. Embed a grounding conductor in every duct bank as indicated.
- Q. Ground Rods
1. Provide ground rods at the indicated locations.
 2. A single electrode that does not have resistance-to-ground of 3 ohms or less shall be augmented by additional electrodes to obtain this value.
 3. Take the resistance-to-ground measurement during dry weather, a minimum of 48 hours after a rainfall.
 4. Rods forming an individual ground array shall be Or Approved Equal in length.
- R. Shield Grounding
1. Shielded instrumentation cable shall have its shield grounded at one end only unless the Shop Drawings indicate that the shield will be grounded at both ends.
 2. The grounding point shall be at the control panel or at the receiving end of the signal carried by the cable.
 3. The termination of the shield drain wire shall be on its own terminal screw.
 4. Jumper together the terminal screws, using manufactured terminal block jumpers or a No. 14 green insulated conductor.
 5. Connect the ground bus via a green No. 12 conductor to the main ground bus for the panel.
- S. Equipment Pedestal Grounding
1. All equipment pedestals (steel, galvanized steel, aluminum, stainless steel, etc.) shall be bonded to the ground grid with minimum #6 AWG bare copper ground conductor.

3.02 FIELD TESTING AND COMMISSIONING

- A. Field Testing and Commissioning shall be in accordance with the requirements of Section 01 75 00 – Equipment Testing and Plant Startup.
- B. Field Testing and Commissioning shall be performed as specified herein and as required by Section 26 01 26 – Electrical Tests.
- C. Fall-of-Potential Test

1. In accordance with IEEE 81, Section 8.2.1.5 for measurement of main ground system's resistance.
 2. Main ground electrode system resistance to ground to be no greater than 3 ohms.
- D. Two-Point Direct Method Test
1. In accordance with IEEE 81, Section 8.2.1.1 for measurement of ground resistance between main ground system, equipment frames and system neutral and derived neutral points.
 2. Equipment ground resistance not to exceed main ground system resistance by 0.25 ohms.
- E. Test several points of the system including: The neutral of every voltage level used in the system, enclosure of switchgears, motor control centers and panelboards and metal enclosure of outlet or fixture at remote location designated by the Engineer. Initial resistance to ground shall not be over 2.5 ohms for water pipe grounds and 15 ohms for made grounds.

END OF SECTION

SECTION 26 05 33
ELECTRICAL RACEWAY SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. Scope

1. This Section specifies electrical raceway systems, including but not be limited to conduit systems, cable tray systems, hardware and support systems, and electrical duct bank systems.
2. Provide electrical raceway systems, complete and in place, as indicated in accordance with the Contract Documents.
3. In the event that individual equipment loads provided are larger than indicated in the Contract Documents, revise raceways, conductors, starters, overload elements, and branch circuit protectors as necessary in order to control and protect the increased connected load in conformance to NEC requirements as part of the Work.

1.02 QUALITY ASSURANCE

A. Reference Codes and Standards

1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
ANSI C80.1	Rigid Steel Conduit-Zinc Coated
ANSI C80.3	Electrical Metallic Tubing-Zinc Coated
ASTM F512	Smooth-Wall Polyvinylchloride Conduit and Fittings for Underground Installation
FEDSPEC WW-C-581E	Conduit, Metal, Rigid and Intermediate; and Coupling, Elbow, and Nipple, Electrical Conduit; Zinc Coated

Reference	Title
FEDSPEC W-C-1094A	Conduit and Conduit Fittings, Plastic, Rigid
JIC EMP-1	Electrical Standards for Mass Production Equipment
NEMA ICS 6	Industrial Control and Systems Enclosures
NEMA TC2	Electrical Plastic Tubing (EPT) and Conduit (EPC 40 and EPC 80)
NEMA TC6	PVC and ABS Plastic Utilities Duct for Underground Installation
NEMA VE1	Cable Tray Systems
NEMA 250	Enclosures for Electrical Equipment (1000 volts maximum)
NFPA 70	National Electrical Code (NEC)
NFPA 79	Electrical Standards for Industrial Machinery
FBC	Florida Building Code
UL 1	Flexible Metal Electrical Conduit
UL 6	Rigid Metal Electrical Conduit
UL 360	Liquid Tight Flexible Electrical Conduit
UL 514	Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers
UL 651	Rigid Nonmetal Electrical Conduit
UL 797	Electrical Metallic Tubing
UL 870	Wireways, Auxiliary Gutters, and Associated Fittings
UL 884	Underfloor Raceways and Fittings
UL 886	Outlet Boxes and Fittings for Hazardous (Classified) Locations

1.03 ENVIRONMENTAL CONDITIONS

- A. Equipment in this Section shall be subjected to environmental conditions in accordance with Section 01 11 80 – Environmental Conditions.

1.04 SUBMITTALS

- A. Preconstruction/Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.

1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons

for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up Specification Sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.

2. Supplier's descriptive literature for materials.
3. Certification that Contractor has been trained to work on PVC-coated conduit systems.
4. Detailed conduit routing drawings for conduit proposed to be installed in and/or under concrete slabs. Contractor shall reference these Specifications, electrical and structural details for requirements.
5. Provide details for conduit support systems. Furnish submittals in accordance with Section 01 33 00 - Submittals, and Section 26 00 00 - Electrical Work, General.
6. Submit complete catalog cuts of raceways, fittings, boxes, supports, and mounting hardware, marked where applicable to show proposed materials and finishes.
7. Submit dimensioned layout drawings of cable tray routings, including elevations.
8. As-Built Drawings
 - a. Prepare As-Built Drawings of encased concealed and exposed raceways, ducts, raceways, junction boxes, pull boxes, and electrical and instrumentation equipment.
 - b. Furnish the As-Built Drawings to the Contractor in accordance with the requirements of Section 01 33 00 - Submittals.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

A. Suppliers

1. The Engineer and City believe that the Suppliers indicated in this Section capable of producing equipment and products, which will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular Supplier or product, nor shall it be construed that a named Supplier's standard product will comply with the requirements of this Section.

2.02 MATERIALS

- A. Materials specified are considered the minimum acceptable for the purposes of durability, strength, and resistance to erosion and corrosion. The Contractor may propose alternative materials for the purpose of providing greater strength or to meet required stress limitations. However, alternative materials must provide at least the same qualities as those specified for the purpose. If alternatives are proposed, the proposals shall be accompanied with documentation supporting the claimed superiority of the proposed substitutions. The Engineer shall be the sole decider in the equivalency of alternative materials of construction.

2.03 GENERAL

- A. Pull and junction boxes, fittings, and other indicated enclosures that are dedicated to the raceway system shall comply with the requirements of this Section.
- B. All process areas shall be considered wet and corrosive areas as a minimum.
- C. The Contractor shall note classified areas as listed and indicated on the plans.

2.04 CONDUIT

- A. Rigid Aluminum (RAL) Conduits
 1. Provide rigid aluminum conduit manufactured from 6063 alloy, temper T-1.
 2. Provide rigid aluminum conduit manufactured in accordance with NEMA C80.5 – Electrical Rigid Aluminum Conduit, and UL-6A – Electrical Rigid Metal Conduit - Aluminum, Red Brass and Stainless Steel.
 3. Supplier:
 - a. V.A.W. of America,
 - b. Allied,
 - c. Alcoa, or
 - d. Approved Equal.
- B. Rigid Non-Metallic Conduit
 1. Provide sunlight-resistant rigid non-metallic conduit manufactured from Schedule 40 or 80 PVC as indicated on the Drawings. Provide Schedule 80 PVC for extreme conditions.
 2. Provide rigid non-metallic conduit manufactured in accordance with NEMA TC-2 - Electrical Plastic Tubing and Conduit, and UL-651 - Standard for Rigid Non-metallic Conduit.
 3. Supplier:
 - a. Carlon,
 - b. Cantex, or
 - c. Approved Equal.
- C. Liquid-Tight Flexible Conduit
 1. Provide liquid-tight flexible conduit constructed of a flexible galvanized metal core with a sunlight-resistant thermoplastic outer jacket.

2. Provide liquid-tight flexible conduit manufactured in accordance with the requirements of UL-360 - Steel Conduits, Liquid-Tight Flexible.
 3. Supplier:
 - a. Anaconda, Sealtite;
 - b. Electriflex, Liguatite; or
 - c. Approved Equal.
- D. PVC Coated Galvanized Rigid Steel
1. The conduit shall meet the requirements of galvanized rigid steel conduits.
 2. The PVC outer coating shall be no less than 40mils and the inside coating with 2 mils of urethane coating.
 3. The PVC coated GRS conduits shall be manufactured in accordance with UL-6, ANSI C80.1 and NEMA RN1.
 4. Manufacturers, or equal: Robroy Industries, Pema Cote, and Thomas and Betts,
- E. EMT and IMC conduits shall not be acceptable.

2.05 FITTINGS AND BOXES

- A. For use with metallic conduit, provide cast and malleable iron fittings of the threaded type with 5 full threads.
- B. Fittings and Boxes.
1. Provide fittings and boxes with neoprene gaskets and non-magnetic stainless steel screws.
 2. Attach covers by means of holes tapped into the body of the fitting.
 3. Covers for fittings attached by means of clips or clamps will not be accepted.
 4. Provide boxes larger than standard cast or malleable types manufactured of Type 316 stainless steel, NEMA 4X.
 5. Terminations
 - a. In outdoor areas, terminate conduit in rain-tight hubs as manufactured by:
 - 1) Myers,
 - 2) O.Z. Gedney,
 - 3) Appleton, or
 - 4) Approved Equal.
 - b. In other than outdoor areas, provide sealed locknuts and bushings.
 6. Hazardous Locations
 - a. In hazardous locations, provide conduit, fittings, and boxes suitable for the indicated Class and Division.
 - b. Provide conduits terminated in NEMA 7 boxes with a male bushing, inside the box by:
 - 1) Adalet Type PEM, or
 - 2) Approved Equal.
- C. Cast Aluminum Fittings and Boxes

1. Provide cast aluminum boxes and fittings with less than 0.40 percent copper content, and use with aluminum conduit.
 2. Supplier:
 - a. O.Z. Gedney,
 - b. Appleton,
 - c. Crouse-Hinds, or
 - d. Approved Equal.
- D. Malleable Iron Fittings and Boxes
1. For use with galvanized steel conduit, provide fittings and boxes constructed of malleable iron or gray-iron alloy with zinc plating.
 2. Supplier:
 - a. O.Z. Gedney,
 - b. Crouse-Hinds,
 - c. Appleton, or
 - d. Approved Equal.
- E. PVC Fittings and Boxes
1. For use with rigid non-metallic conduit, provide fittings manufactured of solvent-welded PVC.
 2. Provide boxes manufactured of PVC or fiberglass reinforced polyester (FRP).
 3. Supplier:
 - a. Carlon,
 - b. Crouse-Hinds,
 - c. Hoffman, or
 - d. Approved Equal.
 4. Provide welding solvent as required for the installation of non-metallic conduit and fittings.
- F. Fiberglass Reinforced Polyester (FRP)
1. Provide FRP fittings when passing through slabs or transitioning from concrete encased PVC to exposed aluminum.
- G. Stainless Steel Boxes
1. Provide stainless steel boxes with PVC-coated RGS conduit and where indicated.
 2. Provide NEMA 4X stainless steel boxes, constructed of Type 316 stainless steel.
 3. Provide stainless steel of a minimum of 14-gauge thickness, with a brushed finish.
 4. Door Hinges
 - a. Provide doors with full-length stainless steel piano hinges.
 - b. Non-hinged boxes will not be accepted.
 5. Supplier:
 - a. Hoffman,
 - b. Rohn,
 - c. Hammond, or

d. Approved Equal.

H. Sheet Steel Boxes

1. Sheet steel boxes shall be galvanized steel outlet and switch boxes.
2. Supplier:
 - a. Raco,
 - b. Steel City,
 - c. Appleton Electric, or
 - d. Approved Equal.

2.06 CABLE TRAYS

- A. When required, provide cable tray systems composed of straight sections, fittings, and accessories as defined in the latest NEMA Standards publication VE-1 - Ventilated Cable Tray.
1. Provide cable trays and fittings shall constructed of aluminum
 2. Provide cable trays of the ladder type with 6 inch spacing.
 3. Provide tray sizes with a 4-inch minimum usable load depth and 12-inch minimum width, as indicated.
 4. Provide loading capacities that meet the NEMA weight classification with a safety factor of 1.5.
 5. In corrosive locations, provide cable trays manufactured of stainless steel.
 6. Supplier:
 - a. Husky,
 - b. B-Line,
 - c. T.J. Cope, or
 - d. Approved Equal.

2.07 WIREWAY

- A. Provide wireway of the lay-in type and NEMA-rated for the area in which it is to be installed in accordance with the requirements of Section 26 00 00 – Electrical Work, General.
- B. Separate power, control, signal and communications cables by grounded metallic dividers in wireways or run in separate wireways.
1. Fittings and Covers
 - a. Provide fittings and sections with non-magnetic stainless steel screws.
 - b. Attach covers by hinges and clamps to the bodies.
 - c. Covers attached by means of clips or screws will not be accepted.
 - d. Provide covers and bodies constructed of aluminum or minimum 14-gauge steel.
 2. Grounding
 - a. Ground the steel and aluminum wireway bodies.
 - b. Provide steel dividers with steel wireways or aluminum dividers with aluminum wireways, and ground by means of an individual grounding conductor.
 - c. Non-metallic dividers will not be accepted.

3. Terminations
 - a. In outdoor areas, terminate conduit in rain-tight hubs as manufactured by:
 - 1) Myers,
 - 2) O.Z. Gedney, or
 - 3) Approved Equal.
 - b. In other than outdoor areas, provide sealed locknuts and bushings.

PART 3 EXECUTION

3.01 INSTALLATION

- A. The Supplier shall provide the Contractor with detailed recommendations and instructions for installation of the product specified in this Section.
- B. Run wiring in raceway unless indicated otherwise.
- C. Provide raceway systems that are electrically and mechanically complete before conductors are installed.
- D. Bends and Offsets
 1. Provide bends and offsets that are smooth and symmetrical, and accomplished with tools designed for this purpose.
 2. Provide factory elbows wherever possible.
- E. Combined Raceways
 1. Raceways other than those containing power conductors may be combined in strict accordance with the NEC and with prior written permission from the Engineer.
 2. In general, combine only raceways containing the same type (control, signal, and the like) and voltage of conductors/cables, or dedicated conduits from one source to one device/equipment, in accordance with the NEC.
 3. Permission from the Engineer shall not relieve the Contractor of responsibility to meet national, state and local requirements.
 4. Do not combine wiring for redundant systems into single raceways.
- F. Routing
 1. Where raceway routings are indicated, follow those routings to the extent possible.
 2. In general, conduit routing is not shown on the Plans. The Contractor is responsible for routing all conduits including those shown on the electrical and instrumentation one-line diagrams; conduit systems required by fire protection, HVAC, lightning protection systems and homeruns shown on floor plans. The Contractor shall verify conduit quantities and locations for conduits with approved equipment submittals prior to installation; including quantities in duct banks.
 3. Conduit routings and stub-up locations that are shown are approximate; exact routing to be as required for equipment furnished and field conditions. Conduit routing shall be surface-mounted except where shown on the Plans or where approved by the Engineer. Approval will require detailed routing drawings to be submitted and approved by the Engineer prior to installation. Conduits routed in slabs shall meet the

requirements of these Specifications and details as shown on the Plans; including structural details.

4. Where raceways are indicated but routing is not indicated, such as home runs or on conduit developments and schedules, raceway routing shall be the Contractor's choice and provided in strict accordance with the NEC as well as customary installation practice.
 5. Provide the raceway encased, exposed, concealed, or under-floor as indicated, except conceal conduit in finished areas unless specifically indicated otherwise.
 6. Adjust routings in order to avoid obstructions.
- G. Coordination
1. Coordinate between trades prior to installing the raceways.
 2. The lack of such coordination shall not be justification for extra compensation, and any costs for removal and re-installation to resolve conflicts shall be part of the Contract Price.
- H. Support rod attachment for ceiling-hung trapeze and cable tray installations shall meet the requirements in the area where the Project is located.
- I. Support wireways in accordance with the Supplier's recommendations for the requirements indicated in Section 26 00 00 – Electrical Work, General.
- J. Provide cable tray anchoring that meets or exceeds the Supplier's recommendations as indicated in Section 26 00 00 – Electrical Work, General.
- K. Install exposed raceways parallel or perpendicular to structural beams.
- L. Expansion Fittings
1. Install expansion fittings with external bonding jumpers wherever exposed raceways cross building expansion joints.
 2. Install expansion/deflection fittings where conduit movement is expected in more than one dimension, and where conduits transition out of structures in locations where differential settlement may occur.
 3. Encased Expansion Fittings
 - a. Install encased expansion fittings wherever encased conduits cross building expansion joints.
 - b. Deflection type fittings shall not be required for encased conduits crossing an expansion joint within a single structure.
 4. Provide expansion and expansion/deflection fittings constructed of the same material as the raceway to which they are installed.
- M. Install expansion fittings with bonding jumpers wherever raceways cross building expansion joints.
- N. Install exposed raceways at least 1/2 inch from walls or ceilings except that at locations above finished grade where damp conditions do not prevail, install exposed raceways at least 1/4 inch from the face of walls or ceilings by the use of clamp backs or struts.

- O. Wherever contact with concrete or dissimilar metals can produce galvanic corrosion of equipment, provide a means of suitable insulation in order to prevent such corrosion.

3.02 CONDUIT

- A. In all indoor areas, provide exposed conduit manufactured of rigid aluminum except as follows and unless indicated otherwise
 - 1. In areas with chlorine or hydrofluosilicic acid, provide Schedule 80 PVC conduit.
 - 2. In areas containing lime or ferric chloride, provide Schedule 80 PVC conduit.
 - 3. In Class I, Div I or Div II hazardous locations, provide rigid aluminum conduit.
 - 4. For conduit containing only grounding system bonding conductors, provide Schedule 80 PVC conduit.
 - 5. All outdoor areas including vaults shall be PVC coated galvanized rigid steel conduits.
- B. Power conduit encased in concrete shall be constructed of Schedule 40 PVC.
- C. Analog control or instrumentation conduit shall be RGS.
- D. Concrete Encasement
 - 1. Where PVC or RGS conduit is stubbed up from a concrete encasement, provide a PVC-coated RGS elbow.
 - 2. The conduit shall emerge from the concrete in a direction perpendicular to the surface whenever possible.
 - 3. Do not encase conduit in the bottom floor slab below grade.
- E. Size
 - 1. Provide exposed conduit of 3/4-inch minimum trade size.
 - 2. Provide encased conduit of one-inch minimum trade size.
- F. Install supports at distances required by the NEC at a minimum.
- G. Concrete cover for conduit and fittings shall not be less than 1-1/2 inches for concrete exposed to earth or weather, or less than 3/4 inch for concrete not exposed to weather or in contact with the ground.
- H. Penetrations
 - 1. Provide conduit passing through walls or floors with plastic sleeves.
 - 2. Perform core drilling in accordance with the requirements of Section 26 00 00 – Electrical Work, General.
 - 3. Conduits passing through a slab, wall, or beam shall not significantly impair the strength of the construction.
- I. Conduits embedded within a slab, wall, or beam (other than those merely passing through) shall meet the following requirements
 - 1. Conduits with their fittings embedded within a column shall not displace greater than 4 percent of the gross area of cross-section.
 - 2. Conduits shall not be larger in outside dimension than 1/3 the overall thickness of the slab, wall, or beam in which it is embedded; and,

3. Conduits shall not be spaced closer than 3 outside diameters on centers.
- J. Place the conduit such that cutting, bending, or displacing reinforcement from its proper location will not be required.
- K. Coat threads with a conductive lubricant before assembly.
- L. Joints
1. Provide joints that are tight, thoroughly grounded, secure, and free of obstructions in the pipe.
 2. Adequately ream the conduit in order to prevent damage to the wires and cables inside.
 3. Use strap-wrenches and vises to install the conduit, in order to prevent wrench marks on the conduit.
 4. Replace conduit with wrench marks.
- M. Slope
1. Wherever possible, slope the conduit runs to drain at one or both ends of the run.
 2. Wherever conduit enters a substructure below grade, slope the conduit in order to drain water away from the structure.
 3. Take extreme care in order to avoid pockets or depressions in the conduit.
- N. Installation of rigid steel conduit through a core-drilled hole in an exterior wall or floor below-grade or otherwise indicated on the Drawings shall utilize a sealing device as manufactured by:
1. Link Seal, or
 2. Approved Equal.
- O. Connections
1. Make connections to lay-in-type grid lighting fixtures by using flexible metal conduit not exceeding 4 feet in length.
 2. Make connections to motors and other equipment subject to vibration by using liquid-tight flexible conduit not exceeding 3 feet in length.
 3. Provide equipment subject to vibration that is normally provided with wiring leads with a cast junction box for the make-up of connections.
- P. Provide conduit seal fittings at the following locations
1. in hazardous classified locations, in strict accordance with the NEC; and,
 2. in chlorine, ammonia, sulfur dioxide, and hydrofluosilicic acid areas in order to prevent passage of gases to other areas.
- Q. Provide conduit, fittings, and boxes required in hazardous classified areas that are suitably rated for the area, and provide in strict accordance with NEC requirements.
- R. Empty Conduits
1. Tag empty conduits at both ends to indicate the final destination.
 2. Where it is not possible to tag the conduit, identify the destination by means of a durable marking on an adjacent surface.

3. Install a pull-cord in each empty conduit in floors, panels, manholes, equipment, and the like.
 4. Install a removable plug on empty conduits that terminate below grade, in vaults, manholes, handholes, and junction or pullboxes.
- S. Identification of Conduits
1. Identify conduits at ends and at pulling points.
 2. Identification shall be the unique conduit number assigned in the Contract Documents.
 3. Other than 120 VAC panelboard circuits, if a conduit has not been assigned a unique number in the Contract Documents, assign a unique number following the numbering scheme used in the Contract Documents.
 4. Assign a unique number to 120 VAC panelboard circuits, similar to the cable numbering scheme used in the Contract Documents.
 5. Provide conduit identification by a stamped or engraved non-corroding metal tag attached to the conduit bushing.
 6. Provide an engraved phenolic nameplate in accordance with the requirements of Section 26 00 00 – Electrical Work, General, or a computer printed self-adhesive label attached to the equipment or enclosure inside which the conduit terminates.
 7. Markings with a pen or paint will not be accepted.
- T. Identification of Pullboxes and Junction Boxes
1. Identify pullboxes and junction boxes.
 2. Identification shall be the unique conduit number assigned in the Contract Documents, or if not assigned a unique number the Design-Builder shall assign one following the numbering scheme used in the Contract Documents.
 3. Provide box identification by a stamped or engraved non-corroding metal tag or an engraved phenolic nameplate, in accordance with the requirements of Section 26 00 00 – Electrical Work, General, and attached to the box or enclosure.
 4. Markings with a pen or paint will not be accepted.
- U. Provide conduit for data cables in accordance with the equipment supplier's recommendations, especially regarding separation from low- and medium-voltage power raceways.

3.03 CABLE TRAYS

- A. When required, provide cable trays in strict accordance with the Supplier's printed instructions.
- B. Allowable cable fill areas shall meet NEC Article 392 - Cable Trays requirements.
- C. Verify cable tray fills prior to installation based on cables and trays actually provided.
- D. Maintain continuous grounding of cable trays including bonding jumpers in accordance with the requirements of NEC Article 392.
- E. Install cable trays using hangers and supports on 8-foot centers, maximum.

- F. Install cable trays to walls as the primary method of support.
- G. If support from the ceiling is the only alternative, use hangers and supports on 6-foot centers, maximum.

END OF SECTION

SECTION 26 05 36

WIRING DEVICES

PART 1 GENERAL

1.01 SUMMARY

A. Scope

1. This Section specifies wiring devices.
2. The Contractor shall provide wiring devices, complete and operable, as indicated in accordance with the Contract Documents.
3. The requirements of Section 26 00 00 – Electrical Work, General apply to this Section.
4. Single Supplier
 - a. Like products shall be the end product of one Supplier in order to achieve standardization of appearance, operation, maintenance, spare parts, and Supplier's services.

1.02 QUALITY ASSURANCE

A. Reference Codes and Standards

1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
NEMA 250	Enclosures for Electrical Equipment (1000 volts maximum)
NEMA WD-1	General Requirements for Wiring Devices
NFPA 70	National Electrical Code (NEC)

1.03 SUBMITTALS

- A. Preconstruction/Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.
1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.
 2. Submit complete catalog cuts of switches, receptacles, enclosures, covers and appurtenances, marked to clearly identify the proposed materials.
 3. Submit documentation showing that the proposed materials comply with the requirements of NEC and U.L.
 4. Submit documentation of the Supplier's qualifications.

1.04 ENVIRONMENTAL CONDITIONS

- A. Equipment in this Section shall be subjected to environmental conditions in accordance with Section 01 11 80 – Environmental Conditions.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

- A. Suppliers
1. The Engineer and the City believe that the Suppliers indicated in this Section are capable of producing equipment and products, which will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular Supplier or product, nor shall it be construed that a named Supplier's standard product will comply with the requirements of this Section.

2.02 MATERIALS

- A. Materials specified are considered the minimum acceptable for the purposes of durability, strength, and resistance to erosion and corrosion. The Contractor may propose alternative materials for the purpose of providing greater strength or to meet required stress limitations. However, alternative materials must provide at least the same qualities as those specified for the purpose. If alternatives are proposed, the proposals shall be accompanied with documentation supporting the claimed superiority of the proposed substitutions. The Engineer shall be the sole decider in the equivalency of alternative materials of construction.
- B. Devices shall carry the U.L. label.
- C. Color
1. General purpose duplex receptacles and toggle switch handles shall be ivory everywhere unless otherwise indicated.
 2. Special purpose receptacles shall have a body color as indicated.
- D. Receptacles and switches shall be of specification grade and shall conform to NEMA WD-1, Federal Specifications W-C-596E and W-S-896E, respectively.

2.03 LIGHTING SWITCHES

- A. Toggle switches shall be AC only type switch.
1. 20 Ampere, 120/277 Volt, Ivory, Single, Double and 3-Way, Respectively

Item	Equipment Number
Leviton	1121-I, 1122-I, 1123-I
Hubbell	1121-I, 1122-I, 1123-I
G.E.	5951-2, 5952-2, 5953-2
P & S.	521-I, 522, 523

2. Lighted Handle Pilot Switch, 20A, 120/277 V

Item	Equipment Number
Bryant	4901-PLR-R277
Hubbell	1221-PL7-277
P & S	20AC1RPL

3. On/Off Motor Switches, Single Phase

Item	Equipment Number
20 Amp, 1 hp, 120 Volt	P&S #20AC2-HP
20 Amp, 2 hp, 208-240 Volt	P&S #20AC2-HP
30 Amp, 2 hp, 120-240 Volt	P&S #30AC2-HP

4. Key Switches (Lock Switched), 20 Amp, 120-277 Volt

Item	Equipment Number
P & S	#521-L, 522-L, 523-L

5. Spring Wound Interval Timer Switch, Rotary

Item	Equipment Number
20A-125 Volt/10A-277	SPST

- a. 0-15 Minute without hold Tork 515M
- b. 0-6 Hour without hold Tork 506H

B. Switches for Hazardous Areas

- 1. Switches for control of lighting and small single-phase power loads in hazardous areas shall consist of a factory assembled and sealed combination general purpose type switch in an explosion-proof housing. The switch shall be rated in accordance with NEC for the area in which it is to be installed. The external operating mechanism shall consist of a wing-type handle having the "ON" and "OFF" positions visible from the front.
- 2. Suppliers
 - a. Crouse-Hinds EDSC Type,
 - b. Appleton EDSC Type, or
 - c. Approved Equal.

C. Switches for Outdoor and Corrosive Areas

- 1. Switches shall be 20-ampere with weatherproof/corrosion-resistant neoprene plate. Switches shall be mounted in "FS" type copper-free aluminum or PVC mounting boxes with plate for outdoor and corrosive area use. All switches in outdoor areas, generator and pump rooms, utility corridors and vaults shall have weatherproof covers.
- 2. Suppliers:
 - a. Hubbell,
 - b. Arrow-Hart, or
 - c. Approved Equal.

2.04 GENERAL PURPOSE RECEPTACLES

- A. Duplex receptacles that are rated at 125V, 20 amperes, shall be of the polarized 3-wire type for use with a 3-wire cord with grounded lead, and one designated stud shall be permanently grounded to the conduit system in accordance with NEMA 5-20R. Quad receptacles (dual duplex) shall be provided in the Control Room as indicated on the Drawings.

B. Dry Areas

- 1. NEMA Configuration #5-20
 - a. Duplex Receptacle Ivory, 20 amp, 125 volt, 2-pole, 3-wire

Item	Equipment Number
Arrow Hart	#5762-I
Leviton	#5342-I
Hubbell	#5342-I
G.E.	#4108-2

Bryant	#5342-I
P& S	#5342-I
Single Receptacle Similar	#5351 Series or G.E. 4102-2

2. NEMA Configuration #5-30

- a. Single Ivory, 30 amp, 125 volt, 2-pole, 3-wire

Item	Equipment Number
Bryant	#9530-FR Receptacle and 9530 ANP Plug
General Electric	#4138-3 and 4337-9
Leviton	#5371

C. Damp/Wet Areas

1. Receptacles for damp/wet location, including pump room, generator room and all outdoor areas shall be weather-resistant-listed and GFCI protected.

D. GFCIs

1. Ground-fault circuit-interrupting receptacles (GFCIs) shall be installed at the indicated locations and as required by the NEC.
2. GFCIs shall be duplex receptacles, of specification grade, and tripping at 5 mA.
3. GFCI ratings shall be 125V, 20 amperes, NEMA WD-1, Configuration 5-20R, and capable of interrupting 5,000 amperes without damage.
4. Feed-through-type GFCIs serving standard receptacles will not be permitted.

E. Hazardous Locations

1. Receptacles for hazardous locations shall be of the single-gang type with a spring door.
2. The receptacles shall be provided with a factory-sealed chamber.
3. The receptacles shall be provided with a delayed action feature requiring the plug to be inserted into the receptacle and rotated before the electrical connection is made.
4. The receptacle shall not work with non-hazardous rated plugs.
5. One plug shall be furnished with each receptacle.
6. The receptacles shall be rated for 20 amps at 125 VAC.
7. Hazardous location receptacles shall be:
 - a. Appleton EFSB,
 - b. Crouse-Hinds ENR, or
 - c. Approved Equal.
8. Ground-Fault Protection
 - a. Where indicated, hazardous location receptacles shall be provided with ground fault protection.
 - b. Ground fault protection shall be:
 - 1) Appleton EFSR-GFI,
 - 2) Crouse-Hinds GFS-1, or

3) Approved Equal.

2.05 ENCLOSURES AND COVERS

- A. General: Device plates shall be 0.040 inch minimum, with struck-up beveled edges, void of sharp corners and multi-gang as applicable. Finish of screws shall match plates. Provide permanent ID on all plates/devices.
- B. Wall Plates: Wall plates for indoor recessed devices shall be of Ivory color with matching screws unless indicated otherwise, and of the configuration required for the devices installed. Units shall be smooth high impact type. Manufactured by:
 - 1. Leviton,
 - 2. Hubbell,
 - 3. Pass & Seymour RP, or
 - 4. Approved Equal.
- C. Cover Plates: Surface (raised) covers for 4" square boxes indoors shall be ½" deep. Surface covers shall be as manufactured by:
 - 1. Steel City,
 - 2. Appleton,
 - 3. Raco, of the configuration required. Others shall be similar.
- D. Wet Locations
 - 1. Receptacles in wet locations shall be provided with a hinged non-metallic cover/enclosure marked "Suitable for Wet Locations when in use" and "UL Listed."
 - 2. Provide a gasket between the enclosure and the mounting surface, and between the hinged cover and mounting plate/base.
 - 3. Cover plates indicated (WP) weatherproof shall be made of Polycarbonate with stainless steel springs and screws and gaskets. Hubbell Wet Location of the configuration required.
- E. In-Use Covers
 - 1. Equipment that is to be continuously fed by plug and receptacle and in areas designated NEMA-4X, CORROSIVE, or other areas specified, and in outdoor areas, provide in-use type weatherproof lift covers that maintain weatherproof rating with plug installed for equipment that is cord connected with plug and receptacle. Covers shall be cast aluminum.
 - 2. Supplier: Outdoor, NEMA 4X areas: In-use covers shall be:
 - a. Hubbell WP7, WP8, WP26; or
 - b. Approved Equal.
 - 3. CORROSIVE areas; Supplier:
 - a. TayMac Corporation 20510,
 - b. Carlon E9UXXXX,
 - c. Hubbell WP826XXX, or
 - d. Approved Equal.

2.06 480V RECEPTACLES

- A. When required, welding receptacles shall be rated 30 amperes, 600 VAC, 3-phase, 3-wire, 4-pole, heavy-duty circuit-breaking-type, complete with an outlet box and connected for 480-volt 3-phase service.
- B. Furnish a matching plug for every receptacle.
- C. The outlets shall be Crouse Hinds Arktite ARE-6424, with matching plug APJ-6485, or approved equal.

2.07 RECEPTACLE – SURGE PROTECTED

- A. Surge protected receptacles shall be of the duplex style
- B. The units shall be rated 125 volts AC, sized for installation in 2-inch by 4-inch outlet boxes.

2.08 NAMEPLATES

- A. Provide nameplates or equivalent markings on the switch enclosures to indicate the ON and OFF positions of each switch.
- B. ON and OFF for 3-way or 4-way switches will not be accepted.
- C. Provide receptacles for special purposes with nameplates indicating their use.
- D. Circuit numbers shall be provided on each cover plate for all wiring devices, in accordance with Section 26 00 00 – Electrical Work.
- E. Nameplates shall meet the requirements of Section 26 00 00 – Electrical Work, General and Section 26 05 53 – Electrical Identification.

PART 3 EXECUTION

3.01 INSTALLATION

- A. The Supplier shall provide the Contractor with detailed recommendations and instructions for installation of the product specified in this Section.
- B. The equipment shall be aligned, connected, and installed at the locations shown and in accordance with the recommendations of the Supplier.
- C. Installation shall be in accordance with the requirements of the NEC.

3.02 CONNECTION

- A. Rigidly attach wiring devices in accordance with the NEC and as indicated, avoiding interference with other equipment.
- B. Securely fasten nameplates using screws, bolts, or rivets centered under or on the device, unless otherwise indicated.

- C. Receptacles indicated to be powered by uninterruptible power supplies (UPS) shall have a nameplate installed directly above the receptacle that reads
 - 1. (first line) "UPS-Powered"
 - 2. (second line) "No Tools"
- D. Nameplates shall meet the requirements of Section 26 00 00 – Electrical Work, General and Section 26 05 53 – Electrical Identification.

3.03 GROUNDING

- A. Devices, including switches and receptacles, shall be grounded in accordance with NEC, Article 250, and Section 26 05 26 – Grounding.
- B. Switches and associated metal plates shall be grounded through the switch mounting yoke, outlet box, and raceway system.
- C. Flush Receptacles
 - 1. Flush receptacles and their metal plates shall be grounded through positive ground connections to the outlet box and grounding system.
 - 2. Maintain the ground to each receptacle by a spring-loaded grounding contact to the mounting screw, or by a grounding jumper, each making a positive connection to the outlet box and grounding system at all times.
- D. Receptacles served from an uninterruptible power supply shall be provided with an isolated grounding conductor from the serving power panel board.

3.04 CAPS

- A. Install a suitable cord and cap (male plug) on all equipment.

3.05 MOUNTING

- A. Mounting Heights (to Center of Box)
 - 1. Generally mount outlets 18" above finished floor (AFF) unless noted.
 - 2. Mount switches and dimmers at 48" AFF.
 - 3. Mount outlets over mirrors 8" higher than the top of the mirror.
 - 4. Mount outlets over counters and centered in the back splash where it occurs. Receptacles in backsplash shall be horizontal.
 - 5. Gang switches and dimmers together where feasible.
- B. Adjust outlet heights in ceramic tile walls to be entirely in or entirely out of the tile.
- C. Outlets may be horizontal to meet space conditions.
- D. Test each socket of each outlet with a device intended for the purpose. Gang switches and dimmers, where feasible.

3.06 SWITCH AND PILOT LIGHTS

- A. Use on all 120-volt exhaust fans except where timers are used.

B. Exhaust fans interlocked with air handling units or supply fans do not require a pilot light.

3.07 GFCI RECEPTACLES

A. Provide GFCI duplex receptacles as shown and at all the following locations

1. Outdoors (with weatherproof covers)
2. Restrooms
3. Indoor process areas
4. Pump room (with weatherproof covers)
5. Generator room (with weatherproof covers)
6. Tunnel/corridors (with weatherproof covers)

3.08 SURGE PROTECTED RECEPTACLES (NO DOWN STREAM NON-SURGE PROTECTED UNITS ALLOWED)

A. Use surge protected duplex receptacles as shown and at all the following locations

1. Control Room
2. All desks and tables designated for computers.
3. Provide quad duplex receptacles in the Control Room

3.09 INTERVAL TIMERS

A. Use maximum 15 minute on timers for single toilet exhaust fans. Fans shall not be interlocked with air handlers.

3.10 FIELD TESTING AND COMMISSIONING

- A. Field Testing and Commissioning shall be in accordance with the requirements of Section 01 75 00 – Equipment Testing and Plant Startup.
- B. Provide checkout, field, and functional testing of wiring devices in accordance with Section 26 00 00 – Electrical Work, General.
- C. Test each receptacle for polarity and ground integrity, using a standard receptacle tester.

END OF SECTION

SECTION 26 05 43
UNDERGROUND RACEWAY SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

- A. Scope
1. This Section specifies underground raceway systems.
 2. Provide underground raceway systems, complete and in place, as indicated in accordance with the Contract Documents.
 3. Manholes, pullboxes, and fittings that are dedicated to the underground raceway system shall comply with the requirements of this Section.
 4. Precast manholes and pullboxes shall be built in accordance with the Standard Details as shown on the Drawings.

1.02 QUALITY ASSURANCE

- A. Reference Codes and Standards
1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
 2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.
 3. Applicable references listed in Section 26 05 33 - Electrical Raceway Systems shall apply to this Section.

1.03 ENVIRONMENTAL CONDITIONS

- A. Equipment in this Section shall be subjected to environmental conditions in accordance with Section 01 11 80 - Environmental Conditions.

1.04 SUBMITTALS

- A. Preconstruction/Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.
1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.
 2. Furnish submittals in accordance with Section 26 00 00 – Electrical Work, General.
 3. Submit complete catalog cuts of all raceways, fittings, pullboxes, and manholes, marked where applicable in order to show proposed materials and finishes.
- B. Informational Submittals: The following minimum informational submittals shall be submitted in accordance with the timing requirements specified in these Contract Documents, prior to Substantial Completion and in accordance with Section 01 33 00 - Submittals.
1. As-Built Documentation
 - a. Prepare As-Built Drawings of encased concealed and exposed raceways, ducts, raceways, junction boxes, pull boxes, and electrical and instrumentation equipment.
 - b. Show routings, burial depths, manhole and handhole locations and sizes, and where applicable, connections to drainage systems.
 - c. Furnish the As-Built Drawings to the Engineer in accordance with the requirements of Section 01 33 00 – Submittals.
 - d. Photograph the interior of each manhole facing each wall to document the final installation.
 - e. Permanently mark the manhole walls to identify the ducts and coordinate them with the record drawings.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

- A. Suppliers
1. The Engineer and the City believe that the Suppliers indicated in this Section are capable of producing equipment and products, which will satisfy the requirements of

this Section. This statement, however, shall not be construed as an endorsement of a particular Supplier or product, nor shall it be construed that a named Supplier's standard product will comply with the requirements of this Section.

2.02 MATERIALS

- A. Materials specified are considered the minimum acceptable for the purposes of durability, strength, and resistance to erosion and corrosion. The Contractor may propose alternative materials for the purpose of providing greater strength or to meet required stress limitations. However, alternative materials must provide at least the same qualities as those specified for the purpose. If alternatives are proposed, the proposals shall be accompanied with documentation supporting the claimed superiority of the proposed substitutions. The Engineer shall be the sole decider in the equivalency of alternative materials of construction.

2.03 PRE-CAST MANHOLES AND PULLBOXES

- A. Frames and Covers
 - 1. Provide traffic-type covers with an H-20 loading, except as otherwise indicated.
 - 2. Identify manhole with medium voltage cables as "HV ELECTRIC" and manholes and pullboxes covers with 600V rated cables as "ELECTRIC" or "CONTROL", or "SIGNAL" as required by providing raised letters cast into the covers.
 - 3. Provide frost-proof and water-tight grey iron frames and covers with solid lids and inner lids, and with 36-inch clear openings.
 - 4. Bolt the covers and lids to cast-in-place steel frames using corrosion-resistant hardware.
 - 5. Factory-prime the frames.
 - 6. Provide covers constructed of cast-iron, and provide pick holes.
 - 7. Provide frames with a 1/2-inch drilled and tapped hole and lug in order to accommodate a No. 4/0 AWG bare stranded copper conductor connected to a ground rod and the ground conductor of power cables passing through the manhole.
 - 8. Manhole frames and covers shall be:
 - a. Neenah Foundry No. NF-1755GT18; or
 - b. Approved Equal.
- B. Equip manholes and pullboxes with pulling-in irons, opposite and below each ductway entrance.
- C. Provide pre-cast manholes and pullboxes with closed bottoms; open-bottom manholes and pullboxes will not be accepted.
- D. Exterior of all concrete manholes shall receive two coats of heavy duty paint, equal to Carboline Bitumatic No. 50, applied at 30 to 36 dry mils.
- E. Provide PVC ductbank conduits with end bells.
- F. Brackets
 - 1. Provide brackets in manholes as required for racking wiring through the manholes.

- G. Cables shall be well supported on walls by heavy duty non-metallic cable racks. The cable rack consists of a stanchion that shall be attached to the manhole wall in accordance with the Supplier's recommendations and adjustable arms that lock into the stanchion. At least two stanchions shall be installed on each manhole wall. Cable rack arm lengths shall be appropriate for the amount of cables being installed. Stanchions and arms shall be made from 50 percent glass-reinforced nylon. The stanchions shall be 36 inches long and have multiple arm mounting holes and recessed bolt mounting holes spaced 4 inches apart. Holes shall be provided in the arms for cable ties. The arms shall be built in such a way that a 20 inches long arm shall have a working load of 250 pounds (load concentrated 1 inch from outer end of arm) and produce a deflection of .37 inch (measured at outer end of arm), with a safety factor of 4 to 1. All mounting hardware shall be stainless steel of the type and size recommended by the Supplier.
- H. Cable rack to be:
 - 1. Underground Devices Inc. Model CR36, RA14 and RA20; or
 - 2. Approved Equal.
- I. Precast manholes and pullboxes supplier:
 - 1. Jensen Precast,
 - 2. Mack,
 - 3. Quikset,
 - 4. U.S. Precast, or
 - 5. Approved Equal.
- J. Cast-Iron covers supplier:
 - 1. U.S. Foundry, or
 - 2. Approved Equal.
- K. The Contractor or manhole supplier shall calculate the buoyancy of each manhole based upon the depths shown on the Plans and add sufficient ballast concrete to the bottom slab of the manhole to prevent flotation with an abnormal groundwater level of flooding to rim elevation. All work on manholes shall comply with Section 33 05 16 - Precast Concrete Manholes and Vaults.

2.04 DUCTBANKS

- A. Provide underground ducts constructed of Schedule 40 PVC.
 - 1. Provide #12 AWG pull wire in all empty/spare ducts.
- B. Encase ducts in red-dyed concrete with steel reinforcing bars.
- C. Provide concrete with a 4,000-psi compressive strength conforming to the requirements of Section 03 30 00 - Cast-In-Place Concrete.
- D. Colorant
 - 1. The concrete shall be dyed red throughout the concrete bank; surface treatment shall not be accepted.
 - 2. Provide colorant consisting of an integral red-oxide coloring pigment in the proportion of 8 pounds per cubic yard of concrete.

3. The costs, if any, of cleaning coloring pigment from the concrete delivery equipment and other related cleanings shall be considered as part of the Work.
- E. Ductbanks
1. Ductbanks shall contain a No. 4/0 bare stranded copper ground wire.
 2. The ground wire shall be continuous through the ductbank and terminate at power distribution equipment and the grounding grid.
- F. Identification Tape
1. Provide continuous lengths of underground warning tapes located 8 inches above and parallel to the ductbanks.
 2. Provide tape consisting of 6-inch wide polyethylene film, imprinted with "Caution – Electric Utilities Below."
 3. Provide tape that contains a non-ferrous metal foil conductor sandwiched in the tape for detection purposes.
 4. Tape supplier:
 - a. Brady, or
 - b. Approved Equal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install underground raceways between manholes and pullboxes as indicated.
- B. Raceway systems shall be electrically and mechanically complete before conductors are installed.
- C. Provide bends and offsets that are smooth and symmetrical, and fabricated with tools designed for this purpose.
- D. Use factory elbows wherever possible.
- E. To the extent possible, follow the raceway routings as indicated on the Plans.
- F. Adjust the indicated routings as necessary in order to avoid obstructions.
- G. Coordination with Other Trades
 1. Coordinate with other trades prior to installation of raceways.
 2. The lack of coordination shall not be justification for extra compensation.
 3. Perform removal and re-installation to resolve conflicts as part of the Work.

3.02 DUCTBANKS

- A. Install ductbanks in accordance with the following criteria and as shown on the Drawings and in accordance to excavation and compaction criteria as stipulated in other Sections of these Specifications.
 1. Assemble the duct using high-impact, non-metallic spacers and saddles in order to provide conduits with vertical and horizontal separation.

2. Set the plastic spacers every 5 feet.
 3. Anchor the duct array every 5 feet in order to prevent movement during the placement of concrete.
 4. Lay the duct on a grade line of at least 3 inches per 100 feet, sloping towards pullboxes or manholes.
 5. Install the duct and adjust the pullbox and manhole depths such that the top of the concrete envelope is a minimum of 18 inches below grade and a minimum of 24 inches below roadways.
 6. Accomplish changes in direction of the duct envelope by more than 10 degrees horizontally or vertically by using bends with a minimum radius 24 times the duct diameter.
 7. Stagger duct couplings a minimum of 6 inches.
 8. Provide select backfill or sand for the bottom of the trench.
 9. Cleaning
 - a. Clean each bore of the completed ductbank by drawing through it a standard flexible mandrel, one foot long and 1/4 inch smaller than the nominal size of the duct.
 - b. After passing the mandrel, draw through a wire brush and swab.
 10. For spare raceways that are not indicated to contain conductors, provide a 1/8-inch polypropylene pull cord installed throughout the entire length of the raceway.
 11. Separate power conduits from signal conduit within the same ductbank by 12 inch or greater separation, as shown. Refer to the raceway specifications for signal to be installed in metal conduits instead of PVC ducts.
 12. Separate high voltage ductbanks from low voltage ductbanks, as shown.
- B. Grout duct entrances smooth, and terminate ducts with flush end bells.
- C. Provide watertight ductbank penetrations through walls of manholes, pullboxes, and building walls below grade.
- D. Terminate concrete-encased ductbanks at building foundations.
- E. When duct enters the building on a concrete slab on grade, do not encase the duct but transition to FRP conduits on stub-ups.
- F. Sealing
1. Where an underground conduit enters a structure through a concrete roof or a membrane-waterproofed wall or floor, provide:
 - a. Link-Seal, or
 - b. Approved Equal.
 2. Use the sealing device with rigid FRP (Fiberglass Reinforced Plastic) conduit.
 3. Transition from PVC to FRP conduit prior to building entry.
 4. The interior of all conduits shall be sealed at the termination point. Bottom entry conduits entering and terminating at electrical boxes, enclosures, motor control centers, switchgear, etc. shall be sealed with duct seal specified herein to prevent the entry of moisture into electrical and control equipment.

END OF SECTION

SECTION 26 05 53
ELECTRICAL IDENTIFICATION

PART 1 GENERAL

1.01 SUMMARY

A. Scope

1. This Section specifies electrical identification.
2. The Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install wire labels, wire color coding, terminal block labels, conduit identification, legend plates, nameplates and other identification for electrical apparatus.

B. Coordination

1. Review installation procedures under other specification sections and coordinate the installation of items that must be installed with wire labels, wire color coding, terminal block labels, conduit identification, legend plates, nameplates and other identification for electrical apparatus.

1.02 QUALITY ASSURANCE

A. Reference Codes and Standards

1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
NECA-1	National Electrical Design-Builders Association - Standard Practices for Good Workmanship in Electrical Contracting
NFPA	National Fire Protection Association
NFPA-70	National Electrical Code (NEC)
NFPA-70E	National Electrical Safety Code (NESC)

1.03 ENVIRONMENTAL CONDITIONS

- A. Equipment in this Section shall be subjected to environmental conditions in accordance with Section 01 11 80 – Environmental Conditions.

1.04 SUBMITTALS

- A. The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.
 - 1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.
 - 2. The complete description and enumeration of proposed electrical identification devices shall be shown on the Shop Drawings for the associated equipment or systems.
 - 3. Product Data
 - a. Supplier's cut sheet, specifications, dimensions and technical data for all products proposed to be furnished under this Section.
 - b. Any deviation shall be explicitly noted.
 - 4. Samples
 - a. Nameplates: Samples of nameplates shall be submitted and shall include both applied and unapplied wire and cable label samples. These samples shall be used as quality standards for the wire and cable labeling required by this Section. These samples shall be of material specified in this Section and shall include wire and cable designators meeting the requirements of this Section.
 - 5. Wiring diagrams annotated with wire numbers and terminal numbers shall be submitted prior to commissioning of associated equipment or systems.
 - 6. Project Record Documents
 - a. Refer to Section 01 77 20 – Project Record Documents.
 - b. Submittals of Record Documents required by other Sections shall show final electrical identification and electrical identification devices.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

A. Suppliers

1. The Engineer and the City believe that the Suppliers indicated in this Section are capable of producing equipment and products, which will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular Supplier or product, nor shall it be construed that a named Supplier's standard product will comply with the requirements of this Section.

2.02 MANUFACTURED UNITS

A. Engraved Identification Devices (Nameplates, and Legend)

1. Nameplates

- a. The following items shall be equipped with nameplates: All motors, motor starters, motor control centers, pushbutton stations, control panels, time switches, disconnect or relays in separate enclosures, transformers, receptacles, wall switches, high voltage boxes and cabinets. All light switches and outlets shall carry a phenolic plate with the supply circuit panel I.D. and circuit number. Electrical systems shall be identified at junction and pull boxes, terminal cabinets and equipment racks.
- b. Nameplates shall adequately describe the function of the particular equipment involved. Nameplates for panel boards and switchboards shall include the panel designation, voltage and phase of the supply. For example, Panel A, 277/480V, 3- phase, 4-wire. The name of the machine on the motor nameplates for a particular machine shall be the same as the one used on all motor starters, disconnect and P.B. station nameplates for that machine. Nameplates shall be laminated phenolic plastic, white front and back with black core, with lettering etched through the outer covering; black engraved letters on white background. Lettering shall be 3/16 inch high at pushbutton stations, thermal overload switches, receptacles, wall switches and similar devices, where the nameplate is attached to the device plate. At all other locations, lettering shall be 1/4 inch high, unless otherwise detailed on the Plans. Nameplates shall be securely fastened to the equipment with No. 4 Phillips, rough-head, cadmium-plated, steel self-tapping screws or nickel-plated brass bolts. For applications on NEMA 4X enclosures, nameplates shall be attached using an epoxy-based adhesive that is resistant to oil and moisture. Motor nameplates may be non-ferrous metal not less than 0.03 inch thick, die stamped. In lieu of separate plastic nameplates, engraving directly on device plates is acceptable. Engraved lettering shall be filled with contrasting enamel. Equipment nameplate schedule for all equipment shall be submitted with Shop Drawing submittal the Engineer's approval.
- c. All junction and splice boxes shall be labeled using permanent shipping tags attached to boxes; not covers.

B. Conduit Labels

1. Products and Suppliers:

- a. B-915 Series by Brady, or
- b. Approved Equal.

- c. Shall be pre-tensioned acrylic/vinyl construction coiled to completely encircle conduit diameters through five inches or pre-molded to conform to circumference of six-inch conduit.
- d. Strap-on style for 6-inch conduit shall be attached with stainless steel straps.
- e. Shall be blank for use with custom printed labels.
- f. Labels shall be color coded as follows
 - 1) Power Conduit (greater than 600V) - Red
 - 2) Power Conduits (600V and less) – Orange
 - 3) Control/Instrumentation – Light Blue
 - 4) Telephone/Intercom – Yellow
 - 5) Data - White

C. Custom Labels

- 1. Shall have black lettering on yellow background
- 2. Shall not contain abbreviations in legend
- 3. Shall be custom printed on continuous tape with permanent adhesive using thermal printer specified below.

D. Wire Identification

- 1. All wire and cable shall be identified at each termination point and at each pull box, splice box, junction box, or manhole. Provide permanent, waterproof, non-metallic (paper unacceptable) tags indicating the circuit number in 3/16 inch letters. Circuit numbers shall be protected with clear shrinkable tubing.
- 2. All 120 VAC and lower control circuits shall use vinyl, self-laminating, self-adhesive, wrap type labels that are heat, oil, water, and solvent resistant wire markers. Labels shall be by:
 - a. W.H. Brady Co., or
 - b. Approved Equal.
- 3. Wire numbers shall be solid machine printed, and shall not be pieced from other single or double-digit tags.
- 4. Where wire numbers change, the appropriate drawings shall include both wire numbers, clearly indicated, at the point of transition. Drawings shall also identify the insulation color for all wiring.
- 5. Wire Numbering: Unique wire numbers shall be per Section 26 05 19 – Wire And Cable.
- 6. All terminals and terminal strips and posts shall be identified with terminal block markers.
- 7. All panel wires and field wires shall be color-coded and have an alphanumeric identification tag at each point of termination.
- 8. Wire within conduits accessible by removing covers of conduit bodies, junction boxes and other devices in the conduit system shall be labeled.
- 9. All wire labels shall be clearly visible and not hidden by wire duct or other components in the enclosures.
- 10. PLC panel wire tag format and content shall be provided by the County.

2.03 FABRICATION

- A. Engraved Identification Devices (Nameplates and Legend Plates)
 - 1. All nameplate text shall remain preliminary and subject to change pending final review and acceptance of the nomenclature by the Engineer after commissioning. Temporary tags consisting of removable tape or other accepted material with the preliminary nomenclature legibly hand lettered shall be affixed to enclosures and cover plates to identify the enclosures and mounted components as required during assembly, factory testing, and start-up. Provide laminated plastic nameplates in accordance with Contract Drawings, but shall not be engraved until after commissioning of the associated system and release of final engraving requirements by the City.

PART 3 EXECUTION

3.01 SHIPMENT AND STORAGE

- A. Products shall be shipped and stored in accordance with Section 01 60 00 - Common Product Requirements.
- B. Supplier shall provide Engineer with detailed recommendations and instructions for product storage.

3.02 INSPECTION

- A. The Contractor shall examine the conditions under which the Work is to be installed and notify the Engineer in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.03 INSTALLATION

- A. Supplier's services shall be provided as specified in Section 01 60 00 - Common Product Requirements.
- B. The Supplier shall provide the Contractor with detailed recommendations and instructions for installation of the product specified in this Section.
- C. Supplier shall provide assistance during product installation as required by the Contractor.
- D. Electrical identification shall be provided as shown, specified or required. All receptacles, motor operated valves (MOV), and small motor loads shall be identified with the voltage, circuit number and source panelboard, no exceptions.
- E. Engraved Identification Devices (Nameplates and Legend Plates)
 - 1. Temporary tags shall be provided at all locations until after start-up and release of final engraving information by the Engineer.
 - 2. Unless otherwise specified, permanent nameplates shall be attached with a permanent adhesive and with stainless steel machine screws into drilled and tapped holes.

3. A nameplate with 1-1/2 inch letters shall be provided to identify each console, cabinet, panel, or enclosure as shown or specified.
 4. Nameplates with 1/2 inch letters shall be provided to identify each junction and terminal box as shown or specified.
 5. On switchgear, nameplates shall be furnished for all main and feeder circuits including control fuses and also for all indicating lights and instruments.
 - a. A nameplate with 1-inch letters shall be provided giving switchgear designation, voltage rating, ampere rating, short circuit rating, Supplier's name, general order number and item number.
 - b. The individual door for each compartment shall be identified with a nameplate giving them designation and circuit number as well as frame ampere size and appropriate trip rating.
- F. Motor Control Centers (MCC)
1. A nameplate with 1-inch letters shall be provided giving MCC designation.
 2. The individual door for each unit compartment shall be identified with a nameplate identifying the controlled equipment.
- G. Except conduit, all other electrical appurtenances including, but not limited to, lighting panels, convenience outlets, fixtures and lighting switches, shall be provided nameplates indicating the appropriate circuit breaker number(s).
- H. Safety Sign and Voltage Markers
1. Safety signs and voltage markers shall be provided on and around electrical equipment as specified and where shown.
 2. Rigid safety signs shall be installed using stainless steel fasteners.
 3. Surfaces shall be cleaned before application of pressure sensitive signs and markers.
 4. Low voltage safety signs shall be mounted on all equipment doors providing access to uninsulated 480-volt conductors (including terminal devices).
 5. Low voltage markers shall be installed on each terminal box, safety disconnect switch and panel board installed, modified or relocated and containing 120/208-volt conductors.
- I. Conduit Labels
1. All conduits shall be provided with conduit labels unless otherwise specified.
 2. Flexible conduit shall not be labeled.
 3. Exposed single conduit runs of less than 25 feet between local disconnect switches and the equipment they operate shall not be labeled.
 4. Conduit labels shall convey the following information:
 - a. Contract Number: Alphanumeric.
 - b. Conduit Number: Alphanumeric. Leftmost character shall be the uppercase letter "C", remaining characters shall be a unique combination for each conduit, as shown on the Plans and in accordance with conforming submittals.
 5. Conduit labels shall be installed at the following locations
 - a. Where conduit enters or exits walls, ceilings, floors, or slabs.

- b. Where conduit enters or exits boxes, cabinets, consoles, panels, or enclosures, except pull boxes and conduit bodies used for pull boxes.
 - c. At intervals of not more than 50 feet along the length of the conduit.
6. Conduit labels shall be oriented so as to be readable, standing on the floor near the conduit.
 7. Other than 120 VAC panel board circuits, if a conduit has not been assigned a unique number in the Contract Documents, assign a unique number following the numbering scheme used in the Contract Documents.
 8. Assign a unique number to 120 VAC panel board circuits, similar to the cable numbering scheme used in the Contract Documents.
- J. Wire and Cable Identification:
1. Color-coding of insulated conductors and identification shall comply with Section 26 05 19 – Wires and Cables.
 2. Wire and Cable Labels shall be provided as follows:
 - a. New, re-routed, or revised wire or cable shall be labeled.
 - b. All insulated conductors shall be labeled.
 - c. Bare (non-insulated) conductors shall not be labeled unless otherwise shown or specified.
 - d. Wire and cable terminations shall be labeled.
 3. Wire labels shall be applied between $\frac{1}{2}$ and 1 inch of the completed termination.
 4. Cable labels shall be applied between $\frac{1}{2}$ and 1 inch of cable breakout into individual conductors.
 - a. Individual conductors in a cable shall be labeled after the breakout as specified for wires
 5. Wire or cable exiting cabinets, consoles, panels, terminal boxes and enclosures shall be labeled.
 - a. Wires or cables shall be labeled within two inches of the entrance to the conduit.
 6. Wire or cable in junction boxes and pull boxes shall be labeled.
 - a. Wires or cables shall be labeled within two inches of the entrance to the conduit.
 7. Wire and cable installed without termination in electrical manholes shall be labeled.
 - a. Wire and cable shall have wrap-around labels applied within one foot of exiting the manhole.
 8. Wire and cable labels shall be installed when the wire or cable is pulled and prior to termination of the conductors. Installation of wire and cable labels after the conductors are terminated is not permitted.

END OF SECTION

SECTION 26 05 73
PROTECTIVE DEVICE STUDIES

PART 1 GENERAL

1.01 SUMMARY

A. Scope

1. This Section specifies protective device studies.
2. The Contractor shall perform the indicated short circuit and protective device studies for the electrical power system in accordance with the Contract Documents.
3. The Work of this Section shall include protection studies for all motors with MV or LV Variable Frequency Drives, MV generators and transformers all with overcurrent protection devices.
4. It is the responsibility of the Contractor to obtain the information required from the electric utility (FPL) and appropriate vendors.
5. All protective device studies and arc flash studies shall be performed using SKM Power System Analysis Software, no equal.

1.02 QUALITY ASSURANCE

A. Reference Codes and Standards

1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.
3. See specific references below.

1.03 ENVIRONMENTAL CONDITIONS

- A. Equipment in this Section shall be subjected to environmental conditions in accordance with Section 01 11 80 – Environmental Conditions.

1.04 SUBMITTALS

- A. Preconstruction/Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.
1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.
- B. The indicated studies shall be submitted and approved by the Engineer prior to final approval of the distribution equipment Shop Drawings and release of equipment for manufacture.
- C. An initial short circuit study shall be submitted and reviewed before the Engineer will approve the Shop Drawings for medium-voltage (MV) main switchgear, MV generator switchgear, unit substation transformers, or 480-volt distribution equipment.
- D. An initial protective device coordination study shall be submitted with 90 days after the approval of the initial short circuit study.
- E. The short circuit, arc-flash hazard analysis, and protective device coordination studies shall be updated prior to Substantial Completion; utilize characteristics of as-installed equipment and materials.
- F. The adequacy of the equipment "withstand" and interruption ratings shall be approved by the Engineer.
1. Refer to Section 01 77 20 - Project Record Documents.
 2. Submittals of record documents required by other specification sections shall show final electrical identification and electrical identification devices.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

- A. Supplier Qualifications
1. Short circuit studies, protective device evaluation studies, arc-flash hazard analysis studies, and protective device coordination studies shall be performed by a supplier

who has been regularly engaged in short circuit and protective device coordination services for a period of at least fifteen (15) years.

2. The indicated studies shall be signed by the professional electrical engineer, registered in the state of Florida, responsible for the studies.
3. The studies shall utilize computer programs with proven reliability and accuracy for performing 3-phase fault-duty calculations.

B. Coordination

1. The medium voltage switchgear supplier shall furnish the services of a qualified field technician and necessary tools and equipment in order to test, calibrate, and adjust the protective relays and circuit breaker trip devices as recommended in the protective device study.
2. The motor control center supplier shall furnish the services of a qualified field technician to calibrate the MCPs as recommended in the protective device study.

PART 3 EXECUTION

3.01 GENERAL

- A. The studies shall include development of single-line and impedance diagrams of the power system.
- B. The diagrams shall identify components considered in the study and the ratings of power devices, including transformers, circuit breakers, relays, fuses, busses, and cables.
- C. The resistances and reactances of cables shall be identified in the impedance diagram.
- D. The studies shall contain written data from the electric utility company regarding maximum available short circuit current, voltage, and X/R ratio of the utility power system.
- E. The studies shall include every protective device and feeder included or modified within the Work.
- F. The first upstream overcurrent device outside the Work shall be used as a fixed reference.
- G. The studies shall include all portions of the electrical distribution system for normal and standby power sources down to and including the 480-volt distribution system.

3.02 SHORT CIRCUIT STUDY

- A. The short circuit study shall be performed with the aid of a digital computer program, and shall be in accordance with the following Standards

Reference	Title
ANSI/IEEE 141	Recommended Practice for Electrical Power Distribution for Industrial Plants
ANSI/IEEE 242	Recommended Practice for Protection, and Coordination of Industrial, and Commercial Power Systems

Reference	Title
ANSI/IEEE C 37.010	Application Guide for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis
ANSI/IEEE C 37.13	Low-Voltage AC Power Circuit Breakers Used in Enclosures

3.03 PROTECTIVE DEVICE EVALUATION STUDY

- A. A protective device evaluation study shall be performed in order to determine the adequacy of circuit breakers, molded case switches, and fuses.
- B. Any problem areas or inadequacies in the equipment due to prospective short-circuit currents shall be promptly brought to the attention of the Design-Builder.
- C. Do not utilize series-rated circuit breakers to meet short circuit requirements for this Work.
- D. Devices shall be fully rated to withstand available fault currents.

3.04 PROTECTIVE DEVICE EVALUATION STUDY

- A. A protective device coordination study shall be performed in order to develop the necessary calculations to select power fuse ratings, protective relay characteristics and settings, ratios and characteristics of associated current transformers, and low-voltage breaker trip characteristics and settings.
- B. Any problem areas or inadequacies in the equipment due to prospective short-circuit currents shall be promptly brought to the Engineer's attention.

3.05 TIME/CURRENT COORDINATION CURVES

- A. As a minimum, the time/current coordination curves for the power distribution system shall include the following items plotted on 5-cycle log-log graph paper
 - 1. time/current curves for each protective relay, circuit breaker, or fuse demonstrating graphically that the settings will provide protection and selectivity within industry standards
 - 2. Each curve shall be identified, and tap and time dial settings shall be specified.
 - 3. Provide individual curves for each feeder unless identical to others.
 - 4. Selectivity
 - a. Time/current curves for each device shall be positioned to provide the maximum selectivity to minimize system disturbances during fault clearing.
 - b. Where selectivity cannot be achieved, the Design-Builder shall be notified as to the cause.
 - c. Recommendations shall be included for alternate methods that would improve selectivity.
 - 5. Time/current curves and points for cable and equipment damage.
 - 6. Circuit interrupting device operating and interrupting times.
 - 7. Indicate maximum fault values on the graph.
 - 8. Sketch of bus and breaker arrangement.

9. Magnetizing inrush points of transformers.
10. Thermal limits of dry-type and liquid-insulated transformers (ANSI damage curve).
11. Every restriction of the ANSI and National Electrical Code shall be followed, and proper coordination intervals and separation of characteristics curves shall be maintained.

3.06 ARC FLASH STUDY

- A. An arc flash study shall be performed with the aid of a digital computer program in order to determine the “Arc Flash Protection Boundary” and “Personal Protective Equipment” (PPE) levels for applicable electrical distribution equipment, stand-alone disconnects, starters, and VFDs in the power distribution system.
- B. The arc flash study shall be performed in conjunction with short circuit calculations and protective device coordination.
- C. The arc flash study shall be in accordance with the latest version of the following Standards

Reference	Title
NFPA 70E	Standard for Electrical Safety Requirements for Employee Workplaces
IEEE 1584	IEEE guide for performing Arc Flash Hazard Calculations
OSHA (29 CFR PART 1910)	Occupational Safety and Health Standards for General Industry
ANSI Z535.4	Product Safety Signs and Labels

- D. Arc Flash Protection Boundary” and PPE levels, based on the arc flash study results, shall be tabulated in the study.
- E. Labeling
 1. The digital computer program shall provide the “Arc Flash Protection Boundary” and PPE values in a format that can be directly printed on to labels.
 2. The Contractor shall provide these labels in accordance with Section 26 00 00 – Electrical Work, General.

3.07 FINAL SUMMARY REPORT

- A. Summarize the results of the indicated protective device studies in a final report.
- B. The report shall include the following items
 1. Single-line diagram.
 2. Impedance diagram.
 3. Tabulation of all protective devices identified on the single line diagram.
 4. Tabulation of short circuit ratings (AIC) of panelboards and main protective device (main circuit breakers) of major equipment if the short circuit rating is “PASS” or “FAIL”.
 5. Time/current coordination curves.

6. Specific recommendations, if any.
 7. Test instrumentation, condition, and connections, as applicable, for each study.
 8. Computerized fault current calculations.
 9. Any suggested changes to the protection scheme or equipment selection that will result in improved system reliability and safety.
 10. Recommendations to minimize the arc flash energy.
- C. The report shall include information concerning the computer program used for the study, as well as a general discussion of the procedure, items, and data considered in the preparation of the study.
 - D. Submit 8 bound copies and one (1) digital copy of the report to the Engineer.
 - E. All software model files shall also be included as a part of the final report.

3.08 PROTECTIVE DEVICE TESTING, CALIBRATION, AND ADJUSTMENT

- A. Test, calibrate, and adjust the protective relays and circuit breaker trip devices in accordance with the recommendations in the protective device study.
- B. Calibrate the MCPs as in accordance with the recommendations in the protective device study.
- C. Adjustments shall be made prior to energizing any electrical equipment.

END OF SECTION

SECTION 26 08 00
COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. Scope

1. This Section specifies the acceptance testing or commissioning of electrical materials, power distribution and utilization equipment and circuits. The Contractor shall provide all labor, tools, material, power, and other services necessary to provide the specified tests.

1.02 QUALITY ASSURANCE

A. Reference Codes and Standards

1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
ANSI/NETA ATS	International Electrical Testing Association (NETA) - Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems
NFPA-70	National Electrical Code (NEC)

1.03 ENVIRONMENTAL CONDITIONS

- A. Equipment in this Section shall be subjected to environmental conditions in accordance with Section 01 11 80 – Environmental Conditions.

1.04 SUBMITTALS

- A. Preconstruction/Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.
1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.
 2. Functional testing and checkout procedures and schedule shall be provided in accordance with Section 01 33 00 - Submittals.
- B. Informational Submittals: The following minimum informational submittals shall be submitted in accordance with the timing requirements specified in these Contract Documents, prior to Substantial Completion and in accordance with Section 01 33 00 - Submittals.
1. The Contractor shall submit the completed test report as specified in Part 3 herein.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT AND MATERIALS

- A. Test instruments shall be calibrated to references traceable to the National Institute of Standards and Technology and shall have a current sticker showing date of calibration, deviation from standard, name of calibration laboratory and technician, and date recalibration is required.

Form No.	Title
26 05 00-A	Wire and Cable Resistance Test Data Form
26 05 00-B	Installed Motor Test Data Form
26 05 00-C	Dry Transformer Test Data Form
26 05 00-D	Motor Control Center Test Form
26 05 00-E	Medium Voltage Motor Starter Test Form
26 05 00-F	Medium Voltage Switchgear Test Form
26 05 00-G	Protective Relay Test Form
26 05 00-H	Low Voltage Switchgear Test Form
26 05 00-I	Medium Voltage Load Interrupter Switch Test Form
26 05 00-J	Liquid-Filled Transformer Test Form
26 05 00-K	Automatic Transfer Switch Test Form
26 05 00-L	Neutral Grounding Resistor Test
40 61 13-A	Loop Wiring and Insulation Resistance Test Data Form
40 61 13-B	Control Circuit Piping Leak Test Form
40 61 13-C	Controller Calibration Test Data Form
40 61 13-D	Panel Indicator Calibration Test Data Form
40 61 13-E	Recorder Calibration Test Data Form
40 61 13-F	Signal Trip Calibration Test Data Form
40 61 13-G	Field Switch Calibration Test Data Form
40 61 13-H	Transmitter Calibration Test Data Form
40 61 13-I	Miscellaneous Instrument Calibration Test Data Form
40 61 13-J	Individual Loop Test Data Form
40 61 13-K	Loop Commissioning Test Data Form

PART 3 EXECUTION

3.01 TESTING

- A. The following specified tests, including correction of defects where found and the subsequent re-testing, shall be completed prior to energization of the equipment or systems. Submit all completed test report forms in a 3-ring binder type notebook at the project Substantial Completion date.
- B. A megohmmeter shall be used for insulation resistance measurements.
 1. Insulation Resistance Measurements
 - a. Insulation resistance measurements shall be made on conductors and electrical equipment that will carry current. Minimum acceptable values of insulation resistance shall be in accordance with the applicable NETA-ATS, ICEA, NEMA, or ANSI standards for the equipment or material being tested. The ambient temperature at which insulation resistance is measured shall be recorded on the test form.
 2. Conductor and Cable Tests
 - a. The phase-to-ground insulation resistance shall be measured for all circuits 120 volts and above except lighting circuits. Measurements may be made with motors and other load equipment connected. Insulation resistance measurements shall be recorded in a format similar to Form 26 05 00-A contained in Section 01 99

- 00 – Reference Forms and submitted for acceptance. Insulation with resistance of less than 10 megohms is not acceptable.
3. Motor Tests
 - a. The Installed Motor Test Form, Form 26 05 00-B contained in Section 01 99 00 – Reference Forms shall be completed for each motor after installation and submitted for acceptance. All motors shall have their insulation resistance measured before they are connected.
 4. Motors 50 HP and larger that are not part of a package equipment shall have their insulation resistance measured at the time of delivery and when they are connected. Insulation resistance values less than 50 megohms are not acceptable.
 5. Verify that motors are connected to rotate in the correct direction. Verification may be accomplished by momentarily energizing the motor, provided the Contractor confirms that neither the motor nor the driven equipment will be damaged by reverse operation.
 6. Power Distribution Equipment
 - a. Transformers, panelboards, and other power distribution equipment shall have their insulation resistance measured phase-to-phase and phase-to-ground.
 7. Power Utilization Equipment: Every restriction of the ANSI and National Electrical Code shall be followed, and proper coordination intervals and separation of characteristics curves shall be maintained.
 - a. Test receptacles and power outlets using a device to verify polarity, grounding, and the correct wiring connections.
 8. Functional Testing
 - a. The Contractor shall submit a description of proposed functional test and checkout procedures conforming to the following requirements, including a schedule for conducting these procedures, not less than 30 days prior to the performance of functional testing.
 - b. Prior to functional testing, all protective devices shall be adjusted and made operative.
 - c. Prior to energization of associated equipment, perform a functional checkout of all electrical and instrumentation control circuits as specified in the following and in Division 40 - Process Integration. Checkout shall consist of energizing each control circuit and operating each control, alarm, safety device, and each interlock, in turn, to verify that the specified action occurs.

END OF SECTION

SECTION 26 09 13
ELECTRICAL POWER MONITORING

PART 1 GENERAL

1.01 DESCRIPTION

- A. This section specifies Power System Reporting Software for electrical distribution equipment assemblies.

1.02 SUBMITTALS

The following information shall be provided in accordance with Section 01 33 00:

1. Catalog and technical data.
2. Elementary connection and interconnection diagrams..

PART 2 PRODUCTS

2.01 ETHERNET SWITCH

- A. Rack Mount Ethernet Switch to provide connectivity between the power monitoring network components. Provide the switch with the following minimum features:
1. One RU Rack Mount Enclosure
 2. Minimum of twenty four (24) RJ-45 ports with auto-negotiation and auto-MDI/MDIX
 3. Rapid Spanning Tree Protocol (RSTP) ring management capability
 4. Link Standby redundancy
 5. Bandwidth control
 6. Virtual cable test (VCT) utility
 7. Dual firmware, software management
 8. 10/100/1000 Mbps operation
 9. Four (4) SFP type ports with auto speed detection
 10. SNMP monitoring
 11. 512 MB DRAM
 12. Power Supply of 115 VAC, 60 Hz with redundant sources
 13. Switch shall have a minimum of 2 spare ports after connection of all network components
- B. Manufacturer and Model:
1. Fortinet FortiSwitch 224E
 2. Or Approved Equal

2.02 INDUSTRIAL SERVER/PC

- A. Rack or Industrial Panel Mount Style PC Hardware:

1. Intel or AMD Processor with at least 4 cores, 2 GHz
 2. 16 GB of DDR4 RAM
 3. On Board Graphics, multi-monitor capable
 4. HDMI video connection capable of 1920 x 1080 resolution or higher
 5. One (1) 1TB hard disk drive for data storage and One (1) 256GB Solid State Drive for OS and programs.
 6. One (1) 10/100/1000 Mbps integrated network interface card
 7. Six (6) USB 3.0 ports
 8. Integrated Audio Codecs
 9. Microsoft Windows 10 Professional 64-bit latest version
- B. Manufacturer:
1. Advantech ARK-3000 Series
 2. OnLogic Helix Series
 3. Or Approved Equal

2.03 RACK-MOUNT CONSOLE KVM SWITCH WITH DISPLAY

- A. Rack Mount Console HDMI KVM Switch:
1. 8-port KVM Switch
 2. 17-inch LCD screen, supporting HD resolution
 3. Keyboard and touchpad
 4. USB and HDMI connectivity to each device.
 5. HDMI video connection capable of 1920 x 1080 resolution or higher
 6. Power Supply – 115 Vac, 60Hz
 7. One (1) 10/100/1000 Mbps integrated network interface card
 8. Provide cabling for connectivity to Industrial PC and Ethernet Switch
- B. Manufacturer:
1. Tripp Lite NetDirector B030-008-17-IP
 2. Or Approved Equal

2.04 RACK-MOUNT ENCLOSURES

- A. Provide a 19" floor mount rack enclosure meeting the requirements of Sections 40 67 00, Control System Equipment Panels and Racks, and 40 66 33, Metallic and Fiber Optic Communication Cabling and Connectors. Rack shall provide power distribution to components described below, cable housing and organizational closet features.
1. For installation in Injection Well Electrical Service Center:
 - a. Ethernet Switch
 - b. Fiber Optic Transceivers meeting the requirements of 40 66 13
 - c. Industrial Server/PC, with installation of Power System Reporting Software (described below)

- d. Rack-Mount Console KVM Switch with Display
- B. Provide a 19" wall mount rack enclosure meeting the requirements of Sections 40 67 00, Control System Equipment Panels and Racks, and 40 66 33, Metallic and Fiber Optic Communication Cabling and Connectors. Rack shall provide power distribution to components described below, cable housing and organizational closet features.
 - 1. For installation in Injection Well Pump Station No. 2:
 - a. Ethernet Switch
 - b. Fiber Optic Transceivers meeting the requirements of 40 66 13

2.05 POWER SYSTEM REPORTING SOFTWARE

- A. System Requirements
 - 1. Power System Reporting Software components shall functionally integrated with the intelligent electronic device (IDE) configuration software, providing the ability to view and change relay operation settings and reporting settings through the use of the same tool from the same location.
 - 2. The PSRS components shall be compatible with Microsoft® Windows® 10 and Windows Server® 2016.
 - 3. The PSRS system shall operate on a single physical computer or be configurable for distributed operation on a networked collection of computers.
 - 4. The PSRS components that communicate with and retrieve data from IEDs, parse and store IED reports, and supervise report naming and storage locations shall operate as Windows services with user-defined passwords.
 - 5. The system shall be capable of sharing Sequence of Events (SOE) records and oscillographic event reports between networked servers via a PSRS component operating as a Windows service. The scheduling of service operation and data synchronization shall be configurable by the user.
 - 6. The PSRS components shall be licensed individually for customized system configuration and shall operate in a fully integrated manner. The installable components shall include event reports, profile reports, transmission fault location, security, and data synchronizing.
 - 7. Automatic data collection tasks shall be customizable and individually scheduled. The system shall include a library of common tasks and IEDs that users can apply and alter as needed. The PSRS shall also support user-created templates.
 - 8. The PSRS shall provide a configurable view of all IEDs in the network. The view shall display a hierarchy of devices and allow the user to expand and collapse the visible nodes. The device view shall support user drag-and-drop functionality for moving devices within the list. It shall support copy-and-paste keyboard and mouse commands. IED properties in the view shall include network routing and connection information for each IED.
 - 9. The PSRS shall support communication via modem, direct serial, and Ethernet communication. Secure Shell (SSH), Telnet, and Raw Transmission Control Protocol (TCP) shall be supported for outgoing Ethernet connections.
 - 10. The PSRS shall include a scripting language for the creation of custom data-collection tasks

B. Regulatory Compliance

1. The PSRS shall provide a means to export reports in a Common Format for Transient Data Exchange (COMTRADE) format.
2. The PSRS shall validate that reports are successfully retrieved from IEDs.

C. Report Collection

1. The PSRS shall be configurable to either poll IEDs to discover new reports or listen for unsolicited receipt of new IED reports. Both methods shall operate simultaneously in the same system.
2. The PSRS shall support collection of SEL CEV, COMTRADE, and COMTRADE event reports sent from GE devices via the Modbus® protocol.
3. The PSRS shall support the retrieval of SOE records from relays, meters, and the Real-Time Automation Controller (RTAC) family of IEDs.
4. The PSRS shall retrieve the following types of profile data: energy, demand, voltage, current, harmonics, and frequency.
5. The PSRS shall retrieve voltage sag, swell, and interruption reports from meters.
6. The PSRS shall retrieve security logs from the RTAC family of controllers and security gateways.
7. All retrieved reports shall either be stored in a user-defined location and indexed in an ODBC-compliant database or directly stored in an ODBC-compliant database.

D. PSRS Output Reporting

1. The PSRS shall have a function for sending email notifications to subscribed users that can be configured to include either oscillographic event report summaries or full oscillographic event reports, as well as the results of a transmission fault location solution.
2. Summaries of all PSRS data shall be viewable in a list and grid format. These summaries shall be exportable in spreadsheet format.
3. All metering data and SOE reports shall be available for use in configurable Microsoft® Excel® templates. The metering Excel templates shall be included in the metering component. These shall support profile reporting for single or multiple metering points and both summary and detailed VSSI reporting for a single metering point.

E. Analytics

1. Users shall be able to search and filter PSRS data based on all summary and device attributes. These include (but are not limited to) data type, device type or ID, location, fault type, or data record time.
2. Users shall be able to analyze SOE records from a single device or any custom selection of devices in a single view. The view shall either display the originating time stamp or offset from a user-selected reference record.
3. The PSRS shall support tagging of any record as belonging to a user-defined collection of records that are associated to one another. Users shall be able to use a single query to retrieve all records associated with a given tag. The PSRS shall not limit the number of incident tags available.
4. The PSRS shall include a graphical timeline view that iconographically presents oscillographic event reports in a scrolling timeline window. A unique color shall represent each type of event. The user shall be able to adjust the time span in the

window dynamically. The window shall display event summary data when a mouse is hovered over the event icon. The PSRS shall open a graphical waveform analysis tool automatically when an event icon is selected.

5. The PSRS shall include a graphical waveform analysis tool suitable for use with oscillographic event reports. The tool shall display analog and digital values from an event report.
6. The PSRS shall include a component that uses event reports from two transmission line terminals to perform two-terminal fault location analysis. Results of the fault location calculation shall be available directly within the user interface or shall be emailed to subscribed users.

F. Service and Support

1. The software shall include no-charge technical support for the life of the product.

G. Manufacturer and Model

1. SEL-5045 ACCELERATOR TEAM
2. Or Approved Equal

2.06 PRODUCT DATA

A. The following information shall be provided in accordance with Section 01 33 00:

1. Operation and maintenance items as specified in Section 01 78 23.
2. Manufacturer's product data with features and dimensions of devices.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Accessories and devices shall be installed per the electrical distribution equipment manufacturer's instructions.
- B. Functional testing, commissioning, and first parameter adjusting shall be carried out by a factory trained manufacturer's representative field service engineer. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment. Report to the Engineer any discrepancies or issues with the installation.

3.02 TRAINING

- A. Training requirements are specified in Sections 01 79 00. Provide one training session, eight hours for use of equipment and software.

END OF SECTION

SECTION 26 11 16

LOW-VOLTAGE, ARC-RESISTANT, DRAWOUT SWITCHGEAR

PART 1 GENERAL

1.01 SUMMARY

A. Scope

1. This Section specifies low-voltage (480V), arc-resistant, drawout switchgear.
2. The Contractor shall provide the low voltage, arc-resistant, drawout switchgear, complete and operable, in accordance with the Contract Documents.
3. Low-Voltage (LV) Switchgear shall be designed for continuous duty service in the environmental conditions in Section 26 00 00 – Electrical Work, General.
4. The requirements of Section 26 00 00 – Electrical Work, General, apply to the Work of this Section.
5. The LV arc resistant drawout switchgear shall be a single responsibility of the supplier of the integrated double-ended LV unit substations with dry-type power transformers and MV load break switches lineups.

1.02 QUALITY ASSURANCE

A. Reference Codes and Standards

1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
NFPA 70	National Electrical Code
UL 1558	Low Voltage Switchgear Assemblies
ANSI/IEEE C37.20	Switchgear Assemblies Including Metal Enclosed Bus
ANSI Z55.1	Gray Finishes for Industrial Apparatus, and Equipment
ANSI C57.13	Requirements for Instrument Transformers

3. Reference Codes: Work shall conform to or exceed the applicable requirements of the National Electric Code (NEC); provided, that where a local code or ordinance is in conflict with the NEC, the provisions of said local code or ordinance shall take precedence.
- B. Factory Tests, Low-Voltage Switchgear
1. Design Testing
 - a. Submit a certificate of design tests previously conducted on one air-break circuit breaker, and switchgear assembly of each rating essentially similar to that indicated.
 - b. The design testing program shall conform to ANSI Standard C37.20.1 and C37.20.7, and shall include at least the following tests
 - 1) Dielectric
 - 2) Continuous current
 - 3) Withstand
 - 4) Endurance
 2. The low-voltage switchgear sections, including the transition section, shall be completely assembled, wired, adjusted, and tested at the factory.
 3. After assembly, the complete switchgear shall be tested for operation under simulated service conditions to assure the accuracy of the wiring and the functioning of equipment.
 4. Production tests shall be conducted on each low-voltage switchgear assembly, and a certificate of each test shall be submitted.
 5. The production testing program shall conform to ANSI Standard C37.20.1 and C37.20.7, and shall include at least the following tests
 - a. Contact resistance measurement of all 3 phases.
 - b. Operation of each electrically operated breaker with the control power supply voltage adjusted to the indicated limits.
 - c. Check of safety interlocks.
 - d. Interchangeability of circuit breakers of the same ratings in various cubicles.
 - e. Arc-resistant testing in accordance with C37.20.7.
- C. Warranty
1. A warranty for the equipment specified under this Section shall be provided in accordance with the General Conditions. The Warranty shall be for three (3) years from the date of the Notice of Substantial Completion certificate issued for the Work. If extended warranties are required, a special paragraph calling for an extended warranty will be included in this Section.
 2. The Contractor shall guarantee that the equipment shall meet the requirements herein and Section 26 00 00 – Electrical Work, General.
 3. The Contractor shall submit a recommended spare part list.

1.03 ENVIRONMENTAL CONDITIONS

- A. Equipment in this Section shall be subjected to environmental conditions in accordance with Section 01 11 80 – Environmental Conditions.

1.04 SUBMITTALS

- A. Preconstruction/Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.
1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.
 2. Provide the following:
 - a. Certified outline drawings complete with dimensions, weights, space for conduits, plans and sections for arc-blast plenums, cable terminations, and bus terminations.
 - b. Engineering data to include voltage, continuous current, withstand interrupting kVA, and temperature.
 - c. Material list and catalog data for all components.
 3. Certifications
 - a. Certified factory design test report.
 - b. Certification of arc-resistant construction meeting ANSI C37.20.7
 4. Spare Parts, Tools and Maintenance Data
 - a. Submit spare parts data listing source and current prices of recommended replacement parts and supplies.
 - b. Operation and maintenance information in accordance with Section 01 77 30 - Operating and Maintenance Instructions, including recommended maintenance procedures and intervals.
 - c. Submit a complete list of tools for the operation and maintenance of the unit.
 5. Special shipping, storage and protection, and handling instructions.
 6. Installation instructions.
- B. Informational Submittals: The following minimum informational submittals shall be submitted in accordance with the timing requirements specified in these Contract Documents, prior to Substantial Completion and in accordance with Section 01 33 00 - Submittals.
1. Operations and Maintenance Manuals (including Warranty) in accordance with Section 01 77 30 - Operating and Maintenance Instructions

2. Factory Test Reports
3. Field Testing Plan
4. Certificate of Proper Installation
5. Field Test Reports
6. Certificate of Field Testing and Commissioning
7. Certificate of Training Completion

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

A. Suppliers

1. The Engineer and the City believe that the following Suppliers are capable of producing equipment and products, which will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular Supplier or product, nor shall it be construed that a named Supplier's standard product will comply with the requirements of this Section.
2. Candidate Suppliers include the following:
 - a. Eaton, Arc-Resistant Magnum DS;
 - b. Schneider, Power-Zone 4 Arc Resistant;
 - c. ABB/GE Type WL, or
 - d. Approved Equal.

2.02 DESIGN REQUIREMENTS

- A. The Low-Voltage, Arc-Resistant, Drawout Switchgear shall be designed for indoor use, configured as indicated on the Drawings, and shall be fully integrated, and meeting the requirements of NEMA.
- B. Assembly
 1. The phase-sequence of the assembled 3-phase busses, and primary conductors shall be A, B, C starting from front-to-back, top-to-bottom, or left-to-right as viewed from the front of the switchgear.
- C. Switchgear assemblies shall include the following equipment:
 1. The low-voltage switchgear lineups shall be of the main-tie-main configuration and shall include outgoing feeder breakers as indicated.
 2. The tie breakers shall be in their own compartments, and shall not include any main or feeder breakers.
 3. Lineups shall be as indicated on the Drawings. Bus duct ratings shall match the horizontal bus ratings of the switchgear for voltage, current, number of wires, etc. Bus ducts shall have aluminum housings.
 4. The arc resistant features of the switchgear shall be provided even if not specifically shown on the Drawings.

2.03 CONSTRUCTION FEATURES

- A. The incoming line and outgoing switchgear sections shall consist of one or more groups of vertical sections containing the switchgear equipment, circuit breakers, busses, instrumentation/metering, solid state trip units, controls, and other devices as indicated.
- B. Fabrication
 - 1. Vertical sections shall be fabricated, rigidly braced, structural steel framework, with interior barriers, and breaker module side sheets of not less than 11-gauge sheet steel, and external panels and covers of not less than 14-gauge sheet steel.
 - 2. Compartment doors shall be hinged flanged dead-front panels.
 - 3. Hinged flanged doors shall also be provided on the rear of all compartments. Lift-off or bolted panels (non-hinged) will not be acceptable.
 - 4. Panels shall be reinforced with stiffening members to minimize vibration.
 - 5. Steel shall be of select quality, free of dents, and true to level after forming.
- C. Space Heaters
 - 1. Space heaters shall have mechanical guards and be provided in each vertical section.
 - 2. Heaters shall be of the low-temperature type, rated (nominally) at 120 volts, and with a single-pole circuit breaker.
 - 3. The heaters shall be sized to keep the air inside the enclosure above the dew point.
 - 4. Heaters shall be thermostatically controlled.
 - 5. Power source for the space heaters shall be from integral control power transformers (CPT) in the switchgear.
- D. Bus compartments shall be provided to fully enclose the incoming line and main bus from the cable termination area.
- E. Isolation
 - 1. Provide isolating barriers between the incoming line and main bus systems in order to prevent fault communication.
 - 2. Provide insulating sleeves in the feeder run-back conductor in the bus compartment in order to prevent fault communication in that area.
- F. Busses
 - 1. The incoming and main bus shall be welded or bolted, tin-plated copper.
 - 2. Bolted or pressure joints for busses, interconnections, disconnecting devices, and external connections to the equipment shall be copper with tin-plated, torqued contacts.
 - 3. Insulated bus supports shall be flame-retardant polyester glass, designed and tested to withstand the mechanical stress produced by fault currents, as required.
- G. Cable compartments shall be isolated from the bus compartments and have ample space for cable or busway entry from above or below, and shall be easily accessible from the hinged rear door.
- H. Switchgear

1. Switchgear shall be provided with removable steel plates on the top and sides. Provide arc-resistant plenum(s) as required by the Drawings and this Specifications. Plenums shall discharge up and into the Electrical Room ceiling that has sufficient ceiling space to dissipate the arc. Plenum(s) shall not be required to discharge outdoors. Plenum(s) shall be provided loose, for field installations.
 2. Provide a hinged rear door for each compartment.
 3. Provide a front hinged panel for each breaker and metering compartment.
- I. Low-Voltage Circuit Breaker Compartments
1. Each low-voltage circuit breaker compartment shall have a drawout mechanism consisting of an integral racking device in order to lock the removable element in the connected position and to overcome the mechanical resistance of making and breaking the contacts of the disconnecting devices.
 2. Positive mechanical interlocks of rugged design shall prevent the breaker from being racked in or out unless the breaker is tripped and shall prevent the breaker from being closed while it is being racked in or out.
 3. The breaker drawout mechanism shall be of a design that permits the breaker to be racked from the connected to the test and disconnected positions with the door closed or a metal breaker cover in place.
 4. Provide a manual release in order to hold the breaker in the test and disconnected positions.
 5. Provide a limit stop in the fully withdrawn position, and in this position, there shall be provisions for easy maintenance, inspection or removal.
- J. External Connections
1. Primary cable compartments shall include connector and cable supports.
 2. Where connections are to be made to bus ducts, provide necessary bus adapters, bolting, insulating supports, and metal flanges.
 3. Ground sensing current transformers, if required, shall be mounted in the respective cable compartments or at the breakers cell.
- K. Primary and secondary cables or bus duct shall enter the equipment from above or below as indicated.
- L. Control Wiring
1. Control wiring shall be provided to auxiliary relays and devices indicated to be furnished with the equipment.
 2. Control busses and wiring for each vertical section shall be enclosed in conduit or in compartments isolated from the primary circuits.
 3. Control wiring shall be brought to identified terminal blocks.
 4. Connections made on terminal blocks and on internal devices shall be by means of locking-spade type, pre-insulated terminals.
 5. Terminal blocks wired to outgoing control circuits shall be mounted inside each compartment. Wiring identified for connection to the plant SCADA system shall be terminated to terminal blocks and a nameplate shall be installed stating: "Connections Dedicated for Scada".
 6. Control and secondary wiring shall be 600 volt flame-retardant switchboard type, minimum size No. 14 AWG, stranded tinned copper.

7. Hinge wiring shall be extra-flexible stranding.
8. Wire shall be SIS.
9. Both ends of the wire shall be identified with labels approved by the County.

M. Equipment Enclosure

1. Enclosures shall be indoor, NEMA Type 1.

2.04 COMPONENTS

- A. The low-voltage switchgear lineups shall include air breakers, metering, and associated standard and optional accessories as indicated.
- B. The BIL rating shall be NEMA standard for the service.
- C. Equipment shall be for indoor service as indicated.
- D. Low-Voltage Switchgear
 1. Components for separate switchgear sections shall conform to the following requirements for low-voltage main, tie, and feeder power circuit breakers
 - a. Breakers shall conform to ANSI, UL, and NEMA Standards.
 - b. Circuit Breakers
 - 1) Low-voltage power circuit breakers shall be of the 5-cycle oil less type, 3-pole, single-throw, draw-out with frame size and trip setting as indicated.
 - 2) Circuit breakers shall be 100 percent rated.
 - 3) Circuit breakers shall have mechanically trip-free operating mechanisms of the stored energy type, and shall be provided with self-aligning primary and secondary disconnecting devices, trip button, position indicator, mechanically operated devices as indicated, and other indicated accessories.
 - 4) Electrically Operated Circuit Breakers
 - a) Electrically operated circuit breakers shall be equipped with electrically trip-free operating mechanisms.
 - b) Provide bell alarm and form "C" auxiliary contacts wired to an identified terminal strip.
 - 5) Manually operated circuit breakers shall be charged from the handle.
 - c. Trip Units
 - 1) Trip units shall be of the RMS microprocessor based type, providing adjustable long-time, short-time, instantaneous, and ground fault protection.
 - 2) Provide zone selective interlocking and "maintenance mode" protection for each switchgear lineup.
 - 3) Short-time and ground fault trip functions shall include I₂t slopes as part of the trip unit programming functions.
 - 4) Provide trip indicators for long-time, short-time, instantaneous, and ground fault trip indication.
 - 5) Provide dry contacts rated for 120 VAC/24VDC for remote SCADA monitoring of breaker open/closed status, trip status, maintenance mode, withdrawn status, and other contacts as indicated.
 - d. Breaker Rating

- 1) Short circuit interrupting rating of the breakers shall be not less than 65,000 amperes symmetrical, but no less than required by Section 26 05 73 – Protective Devices Studies.
- e. Tie breakers shall be supplied with trip units.
- f. Mechanical interlocks shall be provided in order to prevent the removable element from being moved to or from the operating position with the circuit breaker closed, and in order to prevent the circuit breaker being closed unless primary disconnecting devices are fully engaged or separated a safe distance.
- g. The breaker shall be equipped for mounting on the draw-out mechanism in the breaker compartment.
- h. Breaker elements of the same size, rating, and type shall be completely interchangeable within and between switchgear lineups.
- i. Test Unit
 - 1) Furnish one static trip calibration and portable test unit per switchgear.
 - 2) The unit shall be as designed and built specifically for the type of circuit breakers being furnished and shall contain necessary cables, plugs, and instruction manuals required for its operation.
 - 3) Test sets will not be necessary when the circuit breakers trip units include internal test capabilities by an operator.
- j. Each cubicle shall have protection shutters to automatically cover primary line and secondary load studs when the circuit breaker is withdrawn from the cubicle.
- k. Main, tie and feeder circuit breakers shall be electrically operated, controlled from a Remote Operating Panel (ROP). The ROP shall be provided by the switchgear supplier. The ROP enclosure shall be stainless steel, and shall include a breaker control switch and indicating lights for each breaker. Interconnection conduit and wiring shall be provided by the Contractor as required for a completely operable system. The ROP shall be located to allow operation of the switchgear by an operator without standing directly in front of the switchgear.
- l. Charging or energy storage springs shall be capable of being manually charged from an operating handle.
- m. Provide key interlocking and electrical interlocking which allows 3 of the 4 main-tie-main breakers to be closed at any one time. It shall not be possible to parallel the two incoming lines.

E. Control Power Transformers

1. Provide control power transformers in each main circuit breaker section in order to supply power for switchgear space heaters and other accessories not powered by the station battery.
2. The transformer shall be protected by current limiting fuses in a dead front holder on both the primary and secondary.
3. Distribution control power shall be through use of panel mounted fusible type switches or circuit breakers, properly coordinated.

F. Busses and Bus Duct Ties

1. Busses shall be constructed of high conductivity tin-plated copper, sized for the rated continuous and momentary currents within allowable temperature rise, and shall not be tapered.

2. Busses shall be braced to withstand a short circuit current of 65,000 amperes symmetrical minimum, and shall be insulated.
 3. Joints
 - a. Bus joints shall be welded, brazed, or bolted.
 - b. Bolted joints shall have tin-plated surfaces.
 - c. Bolts and associated hardware shall be corrosion-resistant and shall be rear accessible.
 4. Insulating barriers shall be provided where primary busses pass from one compartment to another.
 5. Ground Bus
 - a. Provide a tin-plated copper ground bus, extending the entire length of each unit substation switchgear assembly and incoming line compartment, and having clamp-type terminal lugs adjustable between 4/0 AWG, and 500 KCMIL at each end for external cable connections.
 - b. Metal parts of the structure shall be effectively connected to this bus.
 - c. The ground bus shall be of rectangular cross-section, not less than 1/4-inch by 1-1/2-inch.
- G. Terminal Blocks
1. Terminal blocks for external control connections shall be of the 600-volt, barrier type, having a minimum rating of 20 amperes, and with marker strips identifying all internal and external wiring.
 2. Terminal blocks shall have at least 20 percent unused spare connections after completion of wiring.
 3. Terminal blocks for current transformer secondary connections shall be of the short-circuiting type.
 4. One 4-pole block shall be used for each current transformer set.
- H. Meters and Instruments
1. Power Meters and instruments shall be provided as indicated, and installed and wired on the hinged front panels.
 2. Arrangement of these devices on the hinged panels is subject to approval by the Engineer.
 3. Provide multi-function microprocessor based electronic power metering units on main circuit breakers.
 4. Instruments and meters shall be suitable for operating from instrument transformers with nominal 5-ampere and 120-volt secondaries.
 5. Power Meters shall be fully programmed and the Contractor shall verify that ranges and indicated values are appropriate for each switchgear lineup. Corrections to improperly programmed meters shall be performed at no extra cost to the City.
- I. Instrument Transformers
1. Potential Transformers
 - a. Provide the quantity, ratio, and connection of potential transformers as indicated.
 - b. Potential transformers shall be provided with current-limiting high-interrupting capacity primary fuses in dead front-holders on both the primary and secondary, which shall be mounted in the auxiliary section.

2. Current Transformers
 - a. The quantity and ratio of current transformers shall be as indicated.
 - b. Current transformers shall have thermal and mechanical ratings, and insulation class not less than those of their associated circuit breakers.
 - c. Current transformers shall be mounted in such a way as to provide easy access for inspection and maintenance.
 3. Provide test blocks and plugs for current and potential circuits for the main breakers.
- J. Spare and Space Cubicles
1. When indicated as "future," circuit breaker compartments shall be completely equipped with draw-out rails for future additional circuit breakers, including electrical connections.
 2. Provide insulating sleeves over the main stationary disconnect studs.
 3. Where indicated as spares, circuit breaker compartments shall have a spare circuit breaker of the indicated rating, installed and wired.
- K. Lifting Device
1. Provide a top-of-switchgear, rail-mounted overhead lifting device and transport dolly for removing the circuit breakers.

2.05 NAMEPLATES

- A. Provide nameplates for the front and rear face of each cubicle for each mounted major device, such as meters, instruments, control switches, and relays.
- B. Nameplates shall be provided for major internal devices such as relays, instrument, and control power transformers, fuse blocks, switches, and SCADA connections.
- C. Nameplates shall be 3-layer laminated phenolic plastic, with a black front and back, white case, and engraved to show white lettering.
- D. Lettering shall be upper case of the follow heights
 1. Switchgear Identification: one inch
 2. Compartment Identification: 7/16 inch
 3. Component Nameplate: 1/8 inch
- E. Nameplates which are 1-1/2 inches tall and smaller shall be 1/16 inch thick.
- F. Nameplates larger than 1-1/2-inches tall shall be 1/8 inch thick.
- G. Nameplates shall be securely fastened by black anodized screws.

2.06 SPARE PARTS

- A. The following spare parts and special tools shall be provided in accordance with Section 01 60 00 – Common Product Requirements.
- B. Provide one (1) set of any special tools required to perform operation and maintenance activities and perform installation.

PART 3 EXECUTION

3.01 SHIPMENT AND STORAGE

- A. Equipment shall be shipped and stored in accordance with Section 01 60 00 - Common Product Requirements.
- B. Supplier shall provide Contractor with detailed recommendations and instructions for equipment storage.
- C. Low voltage switchgear shall be stored in a clean, dry, non-corrosive space.
- D. Factory wrapping shall be maintained, or a heavy plastic cover shall be provided to protect units from dirt, water, construction debris, and traffic.
- E. The storage space shall be heated, or space heaters shall be energized.

3.02 SUPPLIER'S FIELD SERVICES

- A. Supplier shall provide field services in accordance with Section 01 60 00 – Common Product Requirements and as further required within this Section.
- B. Supplier shall provide assistance during equipment installation as required by the Contractor.
- C. The equipment provided under this Section shall be started and tested only under the direction of personnel provided by the Supplier. Field services by the Supplier shall be provided as required to support the receipt upon shipment, installation, field testing and commissioning, and training of the equipment supplied in order to provide a fully functioning system in accordance with the Contract Documents.
- D. The Contractor shall arrange for a technical representative of the Supplier for pre-commissioning checkout of the equipment and to instruct the operating personnel in the operation, shutdown, startup, and maintenance of the equipment, in accordance with Section 01 79 00 – Demonstration and Training.

3.03 INSTALLATION

- A. Supplier's services shall be provided as specified in Section 01 60 00 – Common Product Requirements.
- B. The Supplier shall provide the Contractor with detailed recommendations and instructions for installation of the equipment specified in this Section.
- C. Supplier shall provide assistance during product installation as required by the Contractor.
- D. The equipment shall be installed at the locations shown and in accordance with the recommendations of the Supplier.

- E. Surface Preparation, Painting and Cleanliness
 - 1. Metal surfaces shall be smooth and free of foreign matter such as scale, sand, blisters, weld splatter, metal chips and shavings, oil, grease, organic matter, and rust, and shall be chemically cleaned and treated in a process which provides a phosphate coating.
 - 2. Immediately after the treatment process, the surfaces shall be sprayed with coatings of primer and finish paint, and both shall be baked.
 - 3. Provide an electrostatically deposited powder-coated epoxy finish, oven baked, of one-mil minimum thickness indoor and 2-mils minimum thickness outdoor, and as follows
 - a. Paint surfaces light gray ANSI 61 according to ANSI Z55.1 standard.
 - b. The Supplier's standard practice of double-tone finish on the low-voltage switchgear section is acceptable.
 - 4. Furnish two (2) spray cans of air-drying paint of each color tone for field use.
- F. Install the low voltage drawout switchgear in accordance with the Supplier's installation instructions and as indicated. Field install the arc-blast plenum(s) after the switchgear is mounted in place.
- G. The Contractor shall provide the floor channels and shall secure the unit substation elements to the channels by bolting or tack welding at the front and the rest.
- H. Prior to energizing, equipment shall be cleaned, inspected for loose connections, checked for electrical and mechanical operations and phase-sequence, and all circuits made free of any shorts or ground connections following field testing.
- I. The Contractor shall anchor the switchgear in conformance with the anchoring criteria in Section 26 00 00 – Electrical Work, General.
- J. Following installation, Supplier shall provide Certificate of Proper Installation.

3.04 FIELD TESTING AND COMMISSIONING

- A. Field Testing and Commissioning shall be in accordance with the requirements of Section 01 75 00 – Equipment Testing and Plant Startup.
- B. The Supplier shall provide detailed procedures for Field Testing and Commissioning for the equipment specified in this Section.
- C. Field Testing and Commissioning shall be performed under the direction of experienced and qualified personnel provided by the Supplier.
- D. The Contractor shall perform all testing required herein and by Section 26 00 00 – Electrical Work, General.
- E. Following successful Field Testing and Commissioning, Supplier shall provide Certificate of Proper Field Testing and Commissioning.

3.05 TRAINING

- A. Training shall be provided as specified in Section 01 79 00 – Demonstration and Training.
- B. Upon completion of the training activities, the Supplier shall provide a Certification of Training Completion.

END OF SECTION

SECTION 26 11 16.13

PRIMARY UNIT SUBSTATION TRANSFORMERS – LIQUID FILLED

PART 1 GENERAL

1.01 DESCRIPTION

- A. This section specifies the requirements for two (2) primary unit substation transformers, liquid cooled with 13200V (13.2kV) primary voltage, delta, and 4160V (4.16kV) secondary, wye connection with neutral grounding resistors as indicated on the Drawings.
- B. Each primary unit substation transformer shall be complete with 15kV rated arc resistant metal enclosed switchgear with vacuum fault interrupter circuit breaker (VFI) for primary protection and 5kV rated air terminal compartment (ATC) for secondary feeder termination.
- C. The primary unit substation manufacturer/supplier shall establish one source of responsibility for the equipment supply to ensure high standards for quality, reliability and service.

1.02 QUALITY ASSURANCE

- A. References:
 - 1. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.
 - 2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ANSI C57.12.00	General Requirements for Distribution, Power, and Regulating Transformers
ANSI C57.12.10	Requirements for Transformers 230,000 Volts and Below, 833/958 through 8,383/10,417 KVA, Single Phase and 750/862 through 60,000/ 80,000/100,000, KVA, Three Phases
ANSI C57.12.90	Test Code for Distribution, Power, and Regulating Transformers
IEEE C37.6	Standards for AC High Voltage Circuit Breakers
IEEE C37.20.2	Standards for Metal-Clad Switchgear
ANSI C57.98	IEEE Guide for Impulse Tests

Reference	Title
FM	Factory Mutual
UL	UL Label Required

3. Warranty: Equipment furnished under this Specification shall be guaranteed against defective parts and workmanship for an extended warranty period of no less than three (3) years from the date of startup and acceptance of the units and shall include labor, parts, materials, and travel costs for the necessary repair at the job site during the warranty period.

B. Factory Tests:

1. The transformers shall be factory tested in accordance with ANSI C57.12.90. The manufacturer shall certify that the tests have been performed and that the results comply with ANSI C57.12.90.
2. Factory witness acceptance testing for the primary unit substation transformers shall be provided and scheduled before shipment to the job site.

C. Transformer Manufacturing:

1. The transformers shall be built in accordance with NEMA 210, ANSI C57.12.00, and ANSI C57.12.10, modified to meet specified requirements.
2. The transformers shall have FM (Factory Mutual) approval and applicable UL label.

1.03 SUBMITTALS

- A. The following submittals shall be provided in accordance with Section 01 33 00, including a copy of this Specification:

1. Stainless steel nameplate with pertinent transformer data in accordance with ANSI 57.12.00.
2. Certified outline drawings showing outline dimensions, arrangement showing locations of primary and secondary equipment, elevation drawings, weight, control devices and control panel, and anchoring methods.
3. Engineering data including but not be limited to: kVA rating, forced air cooling ratings, impedance, primary and secondary voltages, primary and secondary current ratings sound level, connection diagrams, and coolant classification.
4. Winding basic impulse level (BIL) ratings for both primary and secondary windings.
5. Load tap changer data, above and under normal voltage.
6. Product data sheets.
7. Certified production test reports for the specified transformers.
8. A copy of this Specification including corresponding Addenda if any, shall be included in the submittals, indicating compliance and/or deviation to each paragraph, no exceptions.

- B. The submittal shall include this Specification with check marks on the line items that are in compliance with the Specifications, and/or deviation with the Specifications.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. The City and Engineer believe the following candidate manufacturers are capable of producing equipment and/or products that will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular manufacturer's products, nor shall it be construed that named manufacturers' standard equipment or products will comply with the requirements of this Section. Candidate manufacturers include:
1. Eaton/Cooper Power Systems
 2. General Electric/ABB
 3. Square D/Schneider Electric
 4. Siemens
 5. No other equal

2.02 TRANSFORMER CHARACTERISTICS

- A. Rating:
1. The primary unit substation transformers shall be three phase, 60 Hertz, with voltage, impedance, temperature rise, and KVA ratings as indicated on the Drawings or as specified herein.
- B. Temperature Rise:
1. The forced air-cooled transformers shall have multiple ratings with a combination temperature rise of 55/65 degrees C. The transformers shall deliver the specified KVA rating at the 55 degree C temperature rise and 12 percent additional capacity at the 65 degree C rise.
- C. Coolant:
1. The transformer shall have biodegradable (Envirotemp FR-3) oil coolant with forced air cooling (KNAF), or equal.
- D. Windings:
1. The transformers shall have winding configurations as specified. The transformer primary and secondary windings shall be copper, no exceptions. The primary winding shall be provided with two 2-1/2 percent taps above and below the specified voltage. Basic impulse insulation levels (BIL) shall be as specified herein:

2.03 DESIGN REQUIREMENTS

- A. The primary unit substations shall be suitable for indoor installation. It shall be an integrated assembly of 15kV drawout vacuum fault interrupter (VFI) metal enclosed switchgear with differential relay protection, and liquid filled unit substation transformer with low voltage (5kV) air terminal compartment.
- B. Transformer schedule shall be as follows (refer to Contract Drawings Sheets E-10-2401 and E-10-2402 for substation orientation):

Primary Unit Substation Transformer Schedule

Transformer Designation	KVA Rating	Primary Voltage (NOTE 1)	Secondary Voltage	Temperature Rise °C	Cooling Methods	Liquid Fill
MV-UST-1A	5000/5600/7000	13.2 kV, 3-Phase Delta	4.16/2.4 kV Wye, 4W Resistance Grounded	55/65	KNAF	Envirotemp FR-13
MV-UST-1B	5000/5600/7000	13.2 kV, 3-Phase Delta	4.16/2.4 kV Wye, 4W Resistance Grounded	55/65	KNAF	Envirotemp FR-13

C. Primary Voltage Taps:

1. Primary winding shall have multiple taps at 13.8kV, 13.2 kV and 12.47kV.

D. Additional transformer ratings shall be as follows:

Impedance	6.5% ± 7-½%
HV BIL	95kV
HV De-energized Taps	±2 - 2½% full capacity
LV BIL	60kV

2.04 TRANSFORMER CONSTRUCTION:

- A. The transformer shall carry its continuous rating with average winding temperature rise by resistance that shall not exceed 55 degrees C, based on average ambient of 30 degrees C over 24 hours with a maximum of 40 degrees C. The insulation system shall allow an additional 12% kVA output at 65 degrees C average winding temperature rise by resistance, on a continuous basis, without any decrease in normal transformer life.
- B. The transformer shall be designed to carry short-time emergency overloads in accordance with ANSI C57.12.92 as applicable. Duration and magnitude of designed withstand capability shall be as outlined in ANSI C57.12.90 and the latest edition of the IEEE short-circuit test code.
- C. The transformer shall be designed to meet the sound level standards for liquid transformers as defined in NEMA TR1. The measurement procedure shall be as specified in ANSI C57.12.90.
- D. High-voltage and low-voltage windings shall be copper. Insulation between layers of the windings shall be by Insuldur paper, or equal.
- E. The transformer core shall be vertical, and shall be constructed of high permeable, grain-oriented, laminated silicon steel. The lamination shall be flat and without burr and sharp edges. The laminations shall be insulated, and insulating material shall be resistant to effect of hot oil.

- F. The main transformer tank and attached components shall be designed to withstand pressure 25% greater than the required operating design value without permanent deformation. Construction shall consist of carbon steel plate reinforced with external sidewall braces. All seams and joints shall be continuously welded.
- G. Each radiator assembly shall be removable with valves and receive a quality control pressurized check for leaks. The entire tank assembly shall receive a similar leak test before core and coil are tanked. A final six-hour leak test shall be performed after the transformer is tanked, welded and completed to ensure that there are no leaks before shipment.

2.05 TRANSFORMER ACCESORIES

- A. Transformer features and accessories shall include:
 - 1. De-energized tap changer with externally operated, padlockable handle.
 - 2. Combination drain and filter valve and sampling device.
 - 3. Manual gas pressure test connection.
 - 4. Filling plug and filter press connection in cover.
 - 5. Dial-type top liquid thermometer.
 - 6. Magnetic liquid level gauge.
 - 7. Provisions for lifting, provisions for jacking, base designed for skidding or rolling in two directions.
 - 8. Ground pad – stainless steel.
 - 9. Instruction nameplate – stainless steel.
 - 10. Pressure vacuum gauge.
 - 11. Welded-on main tank cover and handhole in cover.
 - 12. Automatic pressure relief device that automatically reseals after operation, with semaphore operation indicator, for FR3 filled transformers.
 - 13. Alarm contacts shall be provided on the following devices: pressure, over temperature, low vacuum, or low coolant level.
 - 14. Each transformer shall include all controls, devices, wiring, cooling fans and auxiliary equipment necessary for automatic temperature-controlled forced air cooling to obtain an additional capacity as indicated on the Contract Drawings and as specified herein. Control power for cooling fans shall be 230 VAC, single-phased obtained from a control transformer in the secondary of the transformer.
 - 15. Each liquid filled transformer shall be provided with oil leak or spill containment pan that has the capacity to hold 110 percent of the oil contained in the transformer. The secondary oil containment shall be integral part of the transformer sub-base structure and shall be leak-proof and painted gauge steel similar to the transformer tank enclosures. ADDENDUM 8
- B. Neutral Grounding Resistors
 - 1. The neutral grounding resistors shall have stainless steel wound resistance elements, double insulated and shall be manufactured in accordance with IEEE 32-1972 with 10 seconds rating. Indoor unit shall be for floor mounting with grounded safety screen enclosures. The ground CT shall be furnished with the neutral grounding resistors. Manufacturer: Post Glover, Eaton, or equal.

2.06 TERMINAL COMPARTMENTS/FLANGE CONNECTIONS

- A. The transformer unit supplied shall include a HV close-coupled flange for connection to 15kV metal enclosed switchgear and a LV cable air terminal compartment for connections to outgoing 5kV cables.

2.07 METAL CLAD SWITCHGEAR (15kV)

- A. The 15kV Vacuum Fault Interrupter (VFI) switchgear assembly ratings shall be as follows:

Maximum Design Voltage	15kV
Basic Impulse Level	95kV
Nominal System Voltage	13.2 kV three-phase four wire
System Grounding	low resistance grounding
Main Cross Bus Continuous Current Rating	600 Amperes

- B. The 15kV breaker assembly ratings shall be as follows:

Circuit Breaker Frame Rating	1200 Amperes
Circuit Breaker Nominal 3-Phase MVA Class	500 MVA
Circuit Breaker Rated Short-Circuit Current at Rated Maximum kV	18 kA Symmetrical RMS
Short-Time (2-second) Current	23 kA Asymmetrical RMS
Circuit Breaker Closing and Latching Capability (and assembly momentary)	62 kA Asymmetrical RMS

2.08 SWITCHGEAR CONSTRUCTION (15kV)

- A. The indoor type VFI switchgear assembly shall consist of deadfront, completely metal-enclosed vertical sections each containing drawout vacuum circuit breakers with miscellaneous auxiliary devices of the number, rating and type noted on the Drawings or specified herein.
- B. High voltage parts within circuit breaker compartments shall be isolated with grounded metal barriers. Vertical section construction shall be isolated with grounded metal barriers. Vertical section construction shall be of the universal frame type using die-forme and bolted parts. All enclosing cover and doors shall be fabricated from gage steel. Heavy-duty hot dipped galvanized anchor clips shall be provided to anchor the switchgear to the concrete pad.

- C. Each vertical section shall be ventilated at the top and bottom, both front and rear, to allow airflow to help prevent buildup of moisture within the structure. Each vertical section containing a switch shall have a single, full-length, flanged front door and shall be equipped with two rotary latch-type padlockable handles. A nameplate shall be mounted on the front door of each vertical section.

2.09 SWITCHGEAR BUS (15kV)

- A. All buses shall be silver-plated copper.
- B. Ground bus shall be silver-plated copper and be directly fastened to a galvanized metal surface of each vertical section, can be of a size sufficient to carry the rated current of the switchgear assembly.
- C. A neutral bus shall be provided when indicated on the drawings. It shall be insulated for 1000 VAC to ground. The current rating of the neutral bus shall be 600 amperes.

2.10 VACUUM CIRCUIT BREAKER (15kV)

- A. Each vacuum circuit breaker shall be operated by a motor-charged spring stored energy mechanism. The spring may be charged manually in an emergency or during maintenance procedures.
- B. Each circuit breaker shall have three (3) vacuum interrupter assemblies that are separately mounted on glass polyester insulators. Each vacuum interrupter shall have a contact wear indicator which does not require any tools to indicate the contact wear. The current transfer from the vacuum interrupter moving stem to the breaker main conductor shall be a non-sliding design. The breaker front panel shall be removable when the compartment door is open for ease of inspection and maintenance of the mechanism.
- C. The breaker shall be electrically operated by 125 VDC close, and 125 VDC Trip coil. Each breaker shall be completed with control switch and red and green indicating lights to indicate breaker contact position.

2.11 SWITCHGEAR PROTECTIVE RELAYS

- A. The switchgear manufacturer shall furnish and install in the metal-clad switchgear the quantity, type and rating of protection relays and required instrument transformers as required herein.
- B. Furnish and install microprocessor based transformer primary protective relay for over-current and fault protection. The transformer protective relay shall be SEL 787, no equal.

2.12 SWITCHGEAR ACCESSORIES

- A. Provide station class surge arresters with ratings as indicated on the Drawings or as recommended by the manufacturer.

2.13 SWITCHGEAR ENCLOSURES AND FINISH

- A. Enclosures shall be constructed per IEEE/ANSI C37.20.3 indoor specifications (meets or exceeds NEMA 1). Each vertical section shall be ventilated at the top and bottom, both front and rear, to allow airflow to provide cooling and to help prevent buildup of moisture within the structure.
- B. Final finish shall be ANSI 61. Thickness of coating shall be 5 mils minimum.

2.14 SPARE PARTS

- A. Provide two (2) fully functional spare 15kV vacuum circuit breakers with 1200A ratings of the same manufacturer of the circuit breakers being used for the project. The circuit breakers shall be delivered in crates to the job site.

2.15 MANUFACTURER

- A. Eaton
- B. Cooper Power Systems
- C. Siemens
- D. Square D
- E. General Electric
- F. No other equal

PART 3 - EXECUTION

3.01 FACTORY TEST

- A. Factory Tests: The Manufacturer shall perform the standard factory tests and quality control assurance on each section of the primary unit substations prior to customer witness test. All factory tests data shall be recorded and certified by the factory test Engineer.
- B. Customer Witness Test: Prior to shipment the units shall be tested at the manufacturer's testing facility to verify that the equipment is free of any defects; to verify guaranteed performance, and to stimulate operation of protective relays in conjunction with other equipment related to the operation of this unit as specified herein.
 - 1. The Engineer and the City shall witness all transformer factory tests. All costs for transportation, lodging, substance and other incidental costs for one (1) Engineer's representative during the witness testing shall be borne by the Contractor at no additional cost to the City. (Note: The City shall provide their own travel cost and incidentals). The Manufacturer shall give the Engineer and the City a minimum of four (4) weeks notice prior to the tests.

3.02 TRANSFORMER FACTORY TEST

- A. The following standard factory tests shall be performed on all equipment provided under this section. All tests shall be in accordance with the latest version of ANSI and NEMA standards.
 - 1. Resistance measurements of all windings on the rated voltage connection of each unit and at the tap extremes of one unit only of a given rating on this project.
 - 2. Ratio tests on the rated voltage connection and on all tap connections.
 - 3. Polarity and phase-relation tests on the rated voltage connections.
 - 4. No-loads loss at rated voltage on the rated voltage connection.
 - 5. Exciting current at rated voltage on the rated voltage connection.
 - 6. Impedance and load loss at rated current on the rated voltage connection of each unit and on the tap extremes of one unit only of a given rating on this project.
 - 7. Applied potential test.
 - 8. Induced potential tests.
- B. The Manufacturer shall provide three (3) copies of factory test reports.
- C. The following special factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest revision on ANSI and NEMA standards.
 - 1. Temperature test(s) shall be performed on all units. When a transformer is supplied with auxiliary cooling equipment to provide more than one rating, temperature tests as listed above shall be made on the lowest kVA KNAN rating and the highest kVA KNAF rating.
 - 2. ANSI impulse test (BIL) on both primary and secondary windings.

3.03 SWITCHGEAR FACTORY TEST

- A. The following standard factory tests shall be performed on circuit breaker provided under this section. All tests shall be in accordance with the latest version of ANSI and NEMA standards.
 - 1. Circuit breaker operated over the range of minimum to maximum control voltage.
 - 2. Factory setting of contact gap.
 - 3. One (1) minute dielectric test per ANSI standards.
 - 4. Final inspections and quality checks.
- B. The following production test shall be performed on the circuit breaker housing:
 - 1. One (1) minute dielectric test per ANSI standards on primary and secondary circuits.
 - 2. Operation of wiring, relays and other devices verified by an operational sequence test.
 - 3. Final inspection and quality check.

3.04 INSTALLATION

- A. The primary unit substations shall be installed in accordance with the manufacturer's printed recommendations.

- B. The complete lineup shall be anchored in place on a concrete pad with leveling channels as indicated on the Drawings.

3.05 FIELD TEST

- A. General: All field tests shall be conducted in accordance with NETA and Specification Section 26 01 26 – Electrical Tests. The third party testing shall be performed prior to any commissioning tests. The third party testing shall be under the supervision of the transformer manufacturer’s representative.
- B. Pre-Commissioning Test: The Contractor shall submit the procedures for the pre- and commissioning test for review and acceptance by the Engineer.
- C. Field Test: Field test shall be conducted by the Manufacturer’s authorized Field Service technician after installation to assure compliance with all operating requirements of these specifications. Test shall include, but not be limited to, actual design loads as shown on the Drawings.

3.06 START-UP, OPERATIONAL INSTRUCTIONS

- A. Upon completion of the installation and all field tests, start-up shall be performed in accordance with the manufacturers written recommended start-up procedures. These procedures shall be submitted to the Engineer for review and acceptance. Step by step, detailed instructions of the operation of the system shall be provided by the switchgear manufacturer.
- B. The primary unit substation operational instructions shall include, as a minimum but not limited to the following procedures:
 - 1. Start-up of the system
 - 2. Normal shutdown of the system
 - 3. Emergency shutdown of the system
 - 4. Manual operation of the system
- C. The Manufacturers Field Service Technician shall conduct a minimum of two (2) four hour training sessions after System start-up and acceptance by the Engineer and the City.
- D. Training shall include Operations and Maintenance of the System.

3.07 FIELD QUALITY CONTROL

- A. The Contractor shall provide the service of a qualified factory-trained manufacturers technician to assist in installation and startup of the equipment specified under this section. The manufacturer’s technician shall provide technical direction and assistance in general assembly of the equipment, connections and adjustments, and testing of the assembly and components contained therein.

3.08 FIELD ADJUSTMENTS

- A. Adjust voltage (voltage tap changer) taps to install the correct 4160 V secondary voltage per nameplate data.

- B. Measure primary and secondary voltages for proper tap settings.

3.09 MANUFACTURER'S CERTIFICATION

- A. A qualified factory-trained manufacturer's representative shall certify in writing that the equipment has been installed, adjusted and tested in accordance with the manufacturer's recommendations.
- B. The Contractor shall provide three (3) copies of the manufacturer's representative's certification.

END OF SECTION

SECTION 26 12 16
MEDIUM-VOLTAGE TRANSFORMERS – DRY TYPE

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section specifies medium voltage (MV) dry-type (DT) unit substation transformers with primary windings rated for 4160 volts (4.16kV) and 480 volts secondary, used for power distribution systems as specified or indicted on the Drawings.
- B. The MV dry-type unit substation transformers shall be installed in a double-ended configuration in a single lineups with the low voltage draw-out switchgear specified under Section 26 11 16 and as indicated on the Drawings.
- C. Coordination: The Contractor shall coordinate the work under this specification and the work under the equipment sections of these Specifications, specifically Section 26 00 00 – Electrical Work, General Section 26 01 26 – Electrical Tests and Section 26 11 16 – Low Voltage, ARC Resistant Draw-out Switchgear.
- D. Responsibility: The Contractor through the MV Dry Type Substation transformer and the LV arc resistant switchgear manufacturer/vendor shall establish one source of responsibility for the equipment to ensure high standards for quality, coordination reliability and service.

1.02 REFERENCES

- A. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.
- B. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ANSI C57.00	General Requirements for Liquid Immersed Distribution, Power, and Regulating Transformers
ANSI/IEEE C57.12.01	General Requirements for Dry-Type Distribution and Power Transformers
ANSI C57.12.50	Distribution Transformers 1 to 500 KVA, Single-Phase; 15 to 500 KVA, Three Phase with High-Voltage 2400-34,500 Volts, Ventilated Dry-Type

Reference	Title
ANSI C57.12.51	Ventilated Dry-Type Power Transformers 501 KVA and Lower, Three Phase, with High Voltage 601 to 34,500 Volts, Low Voltage 208Y/120 to 4160 Volts
ANSI/IEEE C57.12.91	Test Code for Dry-Type Distribution and Power Transformers

1.03 RATINGS AND STANDARDS

- A. Transformers shall conform to ANSI/IEEE C57.12.01, ANSI C57.12.50, ANSI C57.12.51, and ANSI/IEEE C57.12.91.
- B. Transformer voltage, frequency, number of phases, and KVA rating shall be as specified herein, or indicated on the Drawings.
- C. UL label required for all equipment.

1.04 SUBMITTALS

- A. The following information shall be provided in accordance with Section 01 33 00:
 - 1. Catalog data of the major components and accessories.
 - 2. Written descriptions explaining ladder diagram operation, system operation and analog block diagram.
 - 3. Enclosure outline.
 - 4. Factory test data certifying compliance of similar equipment of this manufacturer with this Specification.
 - 5. System schematic diagrams.
 - 6. Interconnection diagrams.
 - 7. Winding BIL rating.
 - 8. All equipment and work shall comply with the latest applicable ANSI, NEMA and IEEE Standards, and the National Electric Code.
 - 9. The shop drawing submittal shall include the following specific information:
 - a. Name of manufacturer.
 - b. Type and model number.
 - c. Assembly drawing and nomenclature.
 - d. Temperature limitations/temperature rise.
 - e. Maximum heat dissipation in watts or BTU/min. Cooling and ventilation requirements.
 - f. Efficiency considerations.
 - g. Altitude considerations.
- B. The submittals shall include this Specification with check marks on the line items that are in compliance with the Specifications and/or deviations with the Specifications.

1.05 QUALITY ASSURANCE

- A. Factory Tests: Prior to delivery at the job site, the MV unit substation DT transformers and appurtenant equipment shall be tested at the manufacturer's testing facility to verify that the equipment is free of any defects and to verify guaranteed performance.
 - 1. A certificate of design tests previously conducted on each rating essentially similar to that specified herein shall be submitted. The design testing program shall conform to ANSI Standard and shall include, but not limited to the following tests: basic impulse level and mechanical life.
 - 2. Step-Down Transformer: A certificate of design tests previously conducted on one step-down transformer of similar rating to that specified herein shall be submitted. Production tests on the rated voltage shall be conducted on each step-down transformer supplied herein. Certificates for each test shall be submitted. The production testing program shall conform to ANSI Test Code C57.12.00 and NEMA and shall include, but not limited to, the following tests:
 - a. Sound level measurements
 - b. Resistance measurements
 - c. Ratio tests on all tap connections
 - d. Polarity and phase relation check
 - e. No-load loss/core loss
 - f. Exciting current measurement
 - g. Impedance, and load loss measurements
 - h. Applied potential test
 - i. Induced potential test
 - j. Temperature tests

1.06 MANUFACTURER'S SERVICES

- A. The Contractor shall provide the services of a qualified manufacturer's technical representative who shall adequately supervise the installation, testing, and startup of all equipment and accessories furnished under this Section of the Specifications, and instruct the City's personnel in the operation and maintenance of the units.
- B. All costs for transportation, lodging, subsistence, and other incidental costs for the manufacturer's representative during the installation, testing and personnel training shall be borne by the Contractor at no additional cost to the City.

1.07 WARRANTY

- A. Warranty: Equipment furnished under this Section shall be guaranteed against defective parts and workmanship under the terms of the manufacturer's and supplier's standard warranty. In no event shall it be for a period of no less than three (3) years from date of final acceptance of the units and shall include labor, materials and travel costs for necessary repairs at the job site.

PART 2 PRODUCTS

2.01 DESIGN REQUIREMENTS

- A. All MV unit substation dry-type transformers shall conform to ANSI C57.12 and shall have applicable standard accessories. The transformers shall bear a UL label.
- B. Transformer Construction:
1. Ventilated MV DT unit substation transformer shall have cast coil windings with 185 degree C-class insulation and 80 degree C temperature rise over 40 degree C ambient. The transformer shall be suitable for indoor installation.
 2. The transformer ratings shall be as shown in the schedule. The transformer shall be three-phase, 60 hertz, and shall have a minimum of four (4) 2-1/2 percent full-capacity primary taps – two (2) above and two (2) rated primary voltage.

MV Unit Substation Dry-Type Transformer Schedule

Transformer Designation	KVA Rating	Primary Voltage	Secondary Voltage	Application
LV-UST-1A	1000/1333	4160 V Delta	480/277V Wye, 4W	Step-down
LV-UST-1B	1000/1333	4160 V Delta	480/277V Wye, 4W	Step-down
LV-UST-2A	1000/1333	4160 V Delta	480/277V Wye, 4W	Step-down
LV-UST-2B	1000/1333	4160 V Delta	480/277V Wye, 4W	Step-down

3. The transformers shall be explosion resistant, fire resistant and non-polluting to the environment. Enclosure shall be NEMA 1.
4. The transformer shall have coils of the continuous wound construction type. The coils shall have copper windings and shall be impregnated with a non-hygroscopic thermosetting varnish.
5. The transformer core shall be constructed of high grade, non-aging silicon steel with high magnetic permeability and with low hysteresis and eddy current losses. Magnetic flux densities shall be kept well below the saturation point.
6. The enclosures shall have removable panels for access to taps and for core and coil inspection. The transformer enclosure shall be fabricated of heavy gauge sheet steel.
7. The transformer core shall be grounded to the transformer and closure by means of a flexible grounding conductor which shall be sized in accordance with the applicable NEMA, IEEE, and ANSI Standards.
8. The transformer impedance shall be 5.75 percent for per NEMA standard. High voltage BIL shall be 75kV, low voltage BIL shall be 30kV.
9. Transformer winding temperature shall be monitored electronically similar to Qualitrol Model 118 IT, or equal.

2.02 MANUFACTURERS

- A. The Engineer and the City believe the following candidate manufacturers are capable of producing equipment and/or products that will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular manufacturer's products, nor shall it be construed that named manufacturers' standard

equipment or products will comply with the requirements of this Section. Candidate manufacturers include:

1. Eaton
2. ABB/GE
3. Siemens
4. Square D
5. or approved equal

B. Terminal Compartments:

1. Primary Terminals: Full height, incoming bus terminal compartments with removable doors and shall be located side by side, for connection to incoming 4.16kV metal enclosed switchgear with drawout vacuum breaker in one lineup arrangement as indicated on the Drawings.
2. Secondary Terminals: Terminal compartment shall be suitable for connection to a double-ended low voltage draw-out switchgear in one lineup arrangement. A grounding pad shall be furnished in each compartment.

2.03 ENCLOSURES

A. Enclosures shall be ventilated type for indoor installations.

1. Provide the following:
 - a. Fan cooling with up to six cooling fans under the coils.
 - b. Thermistor or temperature devices in the three coils for hot spot temperature monitoring.
 - c. Lifting devices bolted or welded to the base of the structure.
 - d. Jacking pads flush with the enclosure.

2.04 FINISH AND COLOR

A. The exterior finish and color shall be the manufacturer's standard finish but shall match the LV switchgear finish, no exceptions.

2.05 NAMEPLATES

A. Nameplates shall be provided in accordance with the requirements of Section 26 05 00.

2.06 PRODUCT DATA

- A. The following information shall be provided in accordance with Section 01 33 00:**
1. Manufacturer's certification that the unit has been built and tested in accordance with the specified ANSI standards and is in compliance with this section.
 2. Layout drawing of the transformers, indicating equipment arrangement, dimensions and weights.
 3. Applicable operation and maintenance information as specified in Section 01 78 23.
 4. Manufacturer's product information and wiring diagrams.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. The transformer shall be mounted on a reinforced concrete pad with 4-inch minimum thickness, located as shown on the Drawings.
- B. Steel channels shall be imbedded in the pad. The channels, which shall be furnished under this Section of the Specifications, shall be set flush with finished pad surface and shall be level in all directions.
- C. The transformer shall be fastened to the steel channels using bolts with a minimum diameter of ½ inch.

3.02 FIELD TESTS

- A. Field test shall be in accordance with NETA, as applicable.
- B. Before energizing the transformer, but after disconnecting any devices which may be sensitive to the megger voltage, the Contractor shall megger the transformer windings and the terminal connections to check for shorts or open circuits conditions.
- C. After energizing the transformer but before applying any load the Contractor shall measure both the primary and secondary voltages and make any tap changes required to attain rated voltage levels.
- D. After applying load to the transformers, the Contractor shall again measure both the primary and secondary voltages and make any tap changes required to maintain rated voltage levels under load.
- E. An authorize representative of the City and Engineer shall witness all field tests. The City shall be notified, in writing at least two (2) days in advance of any field tests.

3.03 MANUFACTURER'S REPRESENTATIVE

- A. The Contractor shall arrange for a technical representative of the manufacturer for pre-commissioning checkout of the equipment and to instruct the operating personnel in the operation, shutdown, startup, and maintenance of the equipment.

END OF SECTION

SECTION 26 12 17

PANELBOARDS AND GENERAL PURPOSE DRY-TYPE TRANSFORMERS

PART 1 GENERAL

1.01 SUMMARY

A. Scope

1. This Section specifies panelboards and general purpose dry type transformers.
2. The Contractor shall provide panel boards and general purpose dry-type transformers, complete and operable, in accordance with the Contract Documents.

1.02 QUALITY ASSURANCE

A. Reference Codes and Standards

1. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the Florida Building Code (FBC) at the time of Advertisement for Bids or Invitation to Bid shall be considered the building code in effect.

Reference	Title
IEEE	Institute of Electrical and Electronic Engineers
NEMA	National Electrical Manufacturing Association
NFPA 70	National Electrical Code (NEC)
UL 50	Cabinets and Boxes
UL 67	Underwriters Laboratories, Electric Panelboards
UL 489	Molded-Case Circuit Breakers and Circuit Breaker Enclosures
UL 1449	Surge Suppression Devices
UL 1561	Dry-type General Purpose and Power Transformers
ANSI/IEEE C57.12.01	General Requirements for Dry-Type Distribution and Power Transformers
ANSI/UL 506	Specialty Transformers

Reference	Title
NEMA ST20	Dry-Type Transformers for General Application

1.03 ENVIRONMENTAL CONDITIONS

- A. Equipment in this Section shall be subjected to environmental conditions in accordance with Section 01 11 80 – Environmental Conditions.

1.04 SUBMITTALS

- A. Preconstruction/Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittals.

1. A copy of this Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements or those parts which are to be provided by the Contractor or others shall be provided. Check marks (✓) shall denote full compliance with a paragraph as a whole.

If deviations from the Specifications are indicated, and therefore requested, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations.

The remaining portions of the paragraph not underlined shall signify compliance with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the requirements of the Specification shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.

2. Submittal data shall include the following information as part of the Shop Drawings:
 - a. Transformers
 - 1) Dimension drawings
 - 2) Technical certification sheets
 - 3) Drawing of conduit entry/exit locations
 - 4) Transformer ratings, including:
 - a) Voltage
 - b) Phase
 - c) Continuous current
 - d) Taps
 - e) Basic impulse level for equipment over 600 volts
 - f) KVA
 - g) Sound Levels
 - h) Temperature Rise
 - i) Losses at $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$ and full load
 - 5) Descriptive bulletins including materials of construction

- 6) Product sheets
- b. Panel boards
 - 1) Breaker layout drawings with dimensions and nameplate designations
 - 2) Component list
 - 3) Drawings of conduit entry/exit locations
 - 4) Assembly ratings including:
 - a) Short circuit rating
 - b) Voltage
 - c) Continuous current
 - 5) Cable terminal sizes
 - 6) Descriptive bulletins
 - 7) Product sheets
 - 8) Materials of construction and installation information
 - 9) Equipment anchorage details

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

A. Suppliers

1. The Engineer and the City believe that the Suppliers indicated in this Section are capable of producing equipment and products, which will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular Supplier or product, nor shall it be construed that a named Supplier's standard product will comply with the requirements of this Section.

2.02 PRODUCTS

- #### **A. Products and materials specified are considered the minimum acceptable for the purposes of durability, strength, and resistance to erosion and corrosion. The Contractor may propose alternative materials for the purpose of providing greater strength or to meet required stress limitations. However, alternative materials must provide at least the same qualities as those specified for the purpose. If alternatives are proposed, the proposals shall be accompanied with documentation supporting the claimed superiority of the proposed substitutions. The Engineer shall be the sole decider in the equivalency of alternative materials of construction.**
- #### **B. Transformers**
1. The transformers shall be dry-type, designed, manufactured, and tested in accordance with the latest applicable standards of ANSI and NEMA.
 2. Transformers shall be UL-listed and bear the UL label.
- #### **C. Panel boards**
1. Panel boards shall be dead front factory assembled. Panel boards shall comply with NEMA PB-1-Panelboards, as well as the provisions of UL 50 - Safety Enclosures for Electrical Equipment and UL 67 - Safety Panel boards. Panel boards used for service equipment shall be UL labeled for such use. Lighting panel boards shall be rated for 120/208 volt, 3 phase operation or 120/240 volt for single phase operation as