Project Specifications and Contract Documents

For

Yavapai Hills #1 Lift Station Rehabilitation

CIP No. 2105-004

MAYOR AND COUNCIL:

Phil Goode, Mayor
Connie Cantelme, Council Member
Lois Fruhwirth, Council Member
Ted Gambogi, Council Member
Brandon Montoya, Council Member
Eric Moore, Council Member
Cathey Rusing, Council Member

CITY CLERK:

Sarah M. Siep

PUBLIC WORKS DIRECTOR:

Gwen Rowitsch

Notice Inviting Bids

Yavapai Hills #1 Lift Station Rehabilitation

DESCRIPTION: This project will rehabilitate the existing Yavapai Hills #1 Lift Station at 5101 Cactus Pl. in Prescott, Arizona. The project will install new wet wells and associated equipment. The existing wet wells will be kept in place to provide overflow containment capabilities. The old open pit treatment plant will be removed. The site work will include the installation of a new fence and maintenance road improvements.

MANDATORY PRE-BID CONFERENCE: April 8, 2024, at 1:00 pm, City of Prescott Public Works Department.

BID OPENING: Thursday, April 25, 2024, at 2:00pm **City Council Chambers 201 N. Montezuma Street, 3rd Floor, Prescott, Arizona 86301**

In accordance with local and State law, sealed bids with the project name on outside of envelope will be received by the Office of the **City Clerk at 201 N. Montezuma Street, Suite 302, Prescott, Arizona 86301**, until 2:00pm on the date specified above, for the services specified herein. Bids will be opened and read aloud at the above noted date, time, and location. Any bid received at or after 2:00pm on the referenced date will be returned unopened.

The City of Prescott reserves the right to accept or reject any or all bids, and/or some or all of the alternates bid, and waive any informality deemed in the best interest of the City and to reject the bids of any persons who have been delinquent or unfaithful in any contract with the City.

Copies of the Plans, Project Specifications and Contract Documents are available for inspection at the Public Works Department, or may be obtained free of charge on the City's website at https://prescott-az.gov/budget-and-finance/purchasing/.

PUBLISH: March 24th and 31st, 2024

Yavapai Hills #1 Lift Station Rehabilitation

Table of Contents

Attachments:

- City of Prescott Supplement to the Maricopa Association of Governments (MAG) Uniform Standard Specifications and Details for Public Works Construction (Technical Specifications)
- Project Engineers Technical Specifications

Special Instructions

Bids will be returned unopened if not submitted properly sealed and prior to the time set forth in the Notice Inviting Bids.

Bids shall be enclosed in a sealed envelope, addressed to the Office of the City Clerk, and marked on the outside, lower right-hand corner indicating:

1. Bidder's Name
2. Project Title
3. Bid Opening Date and Time
4. Acknowledgement of Addenda Received, if applicable

Mandatory Pre-Bid Conference

The pre-bid conference is mandatory for potential bidders. Bids will only be accepted from contractors in attendance as established on the sign-in sheet. Anything discussed, or not discussed, in the meeting shall not change the requirements of the bid documents. Any changes to the bid documents shall be in writing. The minutes of this pre-bid conference will be distributed to all attendees. The minutes shall not be considered part of any addendum and shall not be considered part of the contract documents for the project.

The mandatory pre-bid conference will be held on April 8, 2024, at 1:00 pm at this location:

City of Prescott
Public Works Division
433 N Virginia Street
Prescott, AZ 86301

Bid Submittal

All bids must contain the following completed forms, provided herein:

1. Bidding Schedule (pages 7-8)
2. Proposal (pages 9-11)
3. Subcontractors List (page 12)
4. Proposed Staging Locations (page 13)
5. Bidder's Affidavit (page 14)
6. Proposal Guarantee (certified check, cashier's check, or surety bond)
7. Addendum Acknowledgement (all pages), if applicable

Failure to complete and sign (where required) and return the above documents with your bid may render it irregular. It is not necessary to return a complete copy of the Notice Inviting Bids, Project Specifications and Contract Documents, other than the documents noted above.

DELIVERY OF SUBMITTALS

Sealed bids will be received **before 2:00 PM on Thursday, April 25, 2024**, at the **City Clerk's Office, 201 N. Montezuma Street, Suite 302, Prescott, Arizona 86301**, at which time all submittals will be publicly opened. **The City will not accept delivery of the bid at any other City location.**

Any submittals received at or after 2:00 PM on the above-stated date will be returned unopened. Firms are solely responsible for the delivery of their submittals to the above location by the time and date specified. The City is not responsible for lateness of mail, carrier, etc. The City will not accept delivery of the bid at any other city locations. The time and date stamp in the City Clerk's Office shall be the official time of receipt. Electronic or facsimile submittals will not be considered. Modifications to submittals will not be considered after the 2:00 PM deadline.

The outside of the submittal envelope shall indicate the name and address of the Respondent; shall be addressed to the City Clerk, City of Prescott, at the above address; and shall be clearly marked:

Notice of Inviting Bids:
Yavapai Hills #1 Lift Station Rehabilitation
Due before 2:00 PM on April 25, 2024

Requests for Information

Questions pertaining to this project prior to opening and award of the contract shall be directed to:

Melissa Busby
Purchasing Manager
contracts@prescott-az.gov

Requests for information must be received **by 5:00 PM on Tuesday, April 16, 2024.** Responses or addenda will be issued **no later than 12:00 PM on Monday, April 22, 2024.** It is the prospective proposer's full responsibility to check the City's website at https://prescott-az.gov/budget-and-finance/purchasing/ for Addenda related to this procurement. A signed copy with all pages of the addenda must be submitted with the proposal package.

Scope of Work

The intent of the Plans and Specifications is to prescribe a complete work for the described project which the Contractor shall perform in a manner acceptable to the City Public Works Director and in full compliance with the terms of the Contract.

Unless otherwise specified in the Engineers Technical Specifications, the Contractor shall furnish all materials, labor, tools, equipment, water, light, power, transportation, superintendence, temporary construction of every nature, and incidentals, but not limited to, dust and traffic control measures, and to perform all work involved in executing the Contract in a satisfactory and workmanlike manner within the specified time.

All standard specifications and details referenced, unless otherwise noted, shall conform to all the City of Prescott Standard Specifications and Detail Drawings, most current revisions, and to the most current editions of the Uniform Standard Specifications and Details for Public Works Construction by the Maricopa Association of Governments (MAG Specifications and Details), including revisions thereto.

Project Schedule

The Contractor shall fully complete all work under this Contract within one hundred fifty (150) calendar days beginning with the calendar day as noted in the Notice to Proceed. The Contractor shall at all times during the continuance of the Contract prosecute the work with such work force and equipment as is sufficient to complete the project within the time specified.

The following milestones are estimates of the earliest dates possible for planning purposes only and shall not represent any contractual commitment whatsoever on the part of the City. The City reserves the right to amend the project schedule as necessary.

Award of Contract	May 28, 2024
Pre-Construction Meeting	Week of June 4, 2024
Notice to Proceed	Week of June 10, 2024
Expected Completion Date	Week of November 7, 2024

City Protest Policy

Any protest against the solicitation or award must be filed with the City Clerk's Office by 4:00 PM up to ten (10) days after award. All such protests shall be in writing and contain the following: 1) Name, address, email address and telephone number of the interested party; 2) Signature of the interested party or its representative; 3) Identification of the purchasing department and Project name; 4) Detailed statement of the legal and factual grounds for protest including copies of relevant documents; and 5) Form of relief requested. Protesting parties must demonstrate as part of their protest that they made every reasonable effort within the schedule and procedures of this solicitation to resolve the basis or bases of their protest during the solicitation process, including asking questions, seeking clarifications, requesting addenda, and otherwise alerting the City to perceived problems so that corrective action could be taken prior to the selection of the successful vendors. The City will not consider any protest based on items which could have been or should have been raised prior to the deadline for submitting questions or requesting addenda. The filing of a protest shall not prevent the City from executing an agreement with any other proposer.

Bidding Schedule

Yavapai Hills Regional Lift Station #1						
CIP # 2105-004						
Line No.	**Item**	**Description**	**Qty**	**Unit**	**Unit Cost**	**Amount**
General Construction Items						
1	105.8	Construction Stakes Lines and Grades	1	LS		
2	107.16	Stormwater Pollution Prevention Plan	1	LS		
3	109.10	Mobilization/Demobilization	1	LS		
4	109.11	Contract Allowance	1	ALL	$350,000.00	$350,000.00
5	420	Permanent Fencing	650	LF		
		General Construction Items Subtotal			*$*	
Sewer Improvements						
6	2200 SP	Piping, Existing Fencing, Pumps, Concrete, Valves, Slide Gates, Manholes and ATS Demolition	1	LS		
7	03410-A SP	Splitter Box - Polymer Pre-Cast	20	CY		
8	03410-B SP	Wet Well - Polymer Pre-Cast	56	CY		
9	725	Storage Building Pad - Slab - on - Grade	10	CY		
10	03400-A SP	Meter Vault - Pre-Cast	1	EA		
11	744	Manhole - Polymer Pre-Cast	3	EA		
12	03400-B SP	Valve Vaults - Pre-Cast	3	EA		
13	08305 SP	Access Hatches	6	EA		
14	2930 SP	Fabricated Steel Gates and Operators	2	EA		
15	15010 SP	Pipe Supports	8	EA		
16	8200 SP	Storage Roll Up Door	1	EA		
17	626.3	Coatings	1	LS		
18	11000 SP	Passive Odor Scrubber	2	EA		
19	11300 SP	Flygt NP3315 HT 452	2	EA		
20	5500 SP	Misc Shelving	1	LS		
21	15100 PSDS PVC1 SP	15" SDR-35 PVC Pipe	50	LF		
22	15100 PSDS DIP SP	10" Class 350 DIP	210	LF		
23	15200.2.2.5.A SP	10" Plug Valve	3	EA		
24	15200.2.2.3.B SP	10" Check Valve	3	EA		
25	15812 SP	4" FRP Duct	200	LF		
26	11100 SP	10" Sluice Gate Manually Actuated	4	EA		
27	16050 SP	General Electrical Provisions	1	LS		
28	16496 SP	ATS	1	EA		
29	16232 SP	Genset	1	EA		
30	13305 SP	Programming	1	LS		
31	13310.2.2.4 SP	Level Indicator Transmitters	2	EA		
32	13310.2.2.5 SP	Level Switch (High, High High and Low Low)	10	EA		
33	13310.2.2.2 SP	Flow Element and Indicator Transmitter	1	EA		

Bidding Schedule

Yavapai Hills Regional Lift Station #1						
CIP # 2105-004						
Line No.	**Item**	**Description**	**Qty**	**Unit**	**Unit Cost**	**Amount**
34	MAG 343.2	Aggregate	1,010	SY		
35	MAG 215.4	Grading	9,035	SY		
				Sewer Improvements Subtotal		*$*
Total Bid Amount						

TOTAL BID AMOUNT:

_____ Dollars and _____ Cents

(In Written Words)

_____

Company Name

_____

Company Address

_____ _____

Signature of Company Official Date Signed

_____

Title

_____

Email

Proposal

Date: _____

Proposal of _____
(Name)

Corporation organized and existing under the laws of the State of Arizona; a partnership consisting of _____ or an individual trading as _____.

TO THE HONORABLE MAYOR AND COUNCIL
CITY OF PRESCOTT
PRESCOTT, ARIZONA

Ladies and Gentlemen:

The Undersigned hereby proposes and agrees to furnish any and all required labor, material, construction equipment, transportation, and services for completion of the Yavapai Hills #1 Lift Station Rehabilitation Project, in strict conformity with the plans and specifications, at the total base bid price of:

_____ Dollars

($_____).

The Undersigned hereby declares that he has visited the site and has carefully examined the Contract Documents relating to the work covered by the above bid or bids.

The Proposal Guarantee (Certified Check, Cashier's Check, or Bid Bond) attached, payable to the City of Prescott in the sum of not less than ten percent (10%) of the total bid price submitted for the complete project, to ensure that the Undersigned, if his bid is accepted, shall enter into contract and give the bonds and certificates of insurance required. In the event that the contract and bonds and certificates of insurance required are not furnished to the City within the time required, then and in that event the City may retain from the proposal guarantee an amount, not to exceed the amount of the proposal guarantee, representing the difference between the amount specified in the proposal or bid, and such larger amount that the City in good faith contracts with another party to perform the work covered by the proposal or bid.

The project shall be completed within one hundred fifty (150) calendar days after the starting date set forth in the NOTICE TO PROCEED.

The Undersigned hereby declares, as bidder, that the only persons or parties interested in this PROPOSAL as principals are those named herein; that no elected official or employee of the City is in any manner interested directly or indirectly in this PROPOSAL or in the profits to be derived

from the contract proposed to be taken, other than as permitted by law; that this bid is made without any connection with any other person or persons making a separate bid for the same purpose; that the bid is in all respects fair and without collusion or fraud; that he has read the NOTICE INVITING BIDS, CONTRACT DOCUMENTS AND PROJECT SPECIFICATIONS, and agrees to furnish the items and perform the work called for in accordance with the provisions of said form of Contract and the Specifications and to deliver the same within the time stipulated herein, and that he will accept in full payment therefore the total bid price named in this Proposal.

The bidder shall be an A-General Engineering contractor properly licensed in the State of Arizona at the time of bidding to perform construction in connection with fixed works, including streets, roads, power and utilities plants, dams, hydroelectric plants, sewage and waste disposal plants, bridges, tunnels, and overpasses and shall also be licensed to perform work within residential and commercial property lines, or shall be properly licensed to sub-contract residential or commercial work, as may be required in the Scope of Work.

Any bid submitted without the proper contracting license to perform the required work shall be considered non-responsive and rejected.

The bidder further agrees that, upon receipt of written notice of the acceptance of this PROPOSAL, he will execute the Contract in accordance with the PROPOSAL as accepted and furnish the required bonds TEN (10) days from the date of mailing of said Notice of Award to him at his address as given below, or within such additional time as may be allowed by the City; and that upon his failure or refusal to do so within said time, then the certified or cashier's check or bid bond accompanying this bid shall be cashed or enforced and the money payable pursuant thereto shall be forfeited to and become the property of the City as liquidated damages for such failure or refusal; provided that if said bidder shall execute the Contract and furnish the required bonds within the aforesaid time, his certified or cashier's check, if furnished, shall be returned to him within three (3) days thereafter, and the bid bond, if furnished, shall become void.

Bidder understands and agrees that the City reserves the right to reject any or all bids and to waive any informality in the bidding.

The bidder agrees that this bid shall be good and may not be withdrawn for a period of sixty (60) calendar days after the scheduled closing time for receiving bids.

Bidder acknowledges receipt of the following Addenda: _____

The undersigned is the holder of Arizona State Contractor's License No(s). and Classification(s):

_____

Respectfully submitted,

_____

Bidder (Authorized Signature)

Corporate Seal

By: _____

Title: _____

Bidder's Contact Information:

Physical Address: _____

Mailing Address: _____

Telephone No: _____

Email Address: _____

Names and addresses of all members of the firm or names and titles of all officers of the corporation:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Subcontractors List

Yavapai Hills #1 Lift Station Rehabilitation

Subcontractor Information	Bid Item(s)	Subcontract Amount	% of Total Bid
Name: Address: Phone #: License #:			
Name: Address: Phone #: License #:			
Name: Address: Phone #: License #:			
Name: Address: Phone #: License #:			
Name: Address: Phone #: License #:			
Total Subcontract Amount and Percentage of Bid	**$**		**%**

**Use additional forms if needed*

Proposed Staging Locations

Project Name: Yavapai Hills #1 Lift Station Rehabilitation

Bid Date: April 25, 2024

Contractor Name: _____

Proposed Location No. 1	
General Description:	Parcel No:
	Physical Address:
Legal Owner:	Zoning District:

Proposed Location No. 2	
General Description:	Parcel No:
	Physical Address:
Legal Owner:	Zoning District:

**A map of each location may be attached to this form*

If <u>no</u> staging areas are proposed, please check here and sign below: ☐ No Areas Proposed

By signing below, I ("Contractor") certify that no staging areas are required for the above-named project. If necessary, staging area(s) are later determined, I understand that any associated costs shall be furnished by the Contractor and will be considered incidental without additional compensation from the City.

_____ _____

Signature of Company Official Date Signed

CITY OF PRESCOTT
ARIZONA

Bidder's Affidavit

Yavapai Hills #1 Lift Station Rehabilitation Project

State of _____)
) ss.
County of _____)

_____, being first duly sworn, deposes and says:

That he/she is _____ of _____
(Title) (Bidder)

who submits herewith to the City of Prescott, Arizona, a Proposal:

That all statements of fact in such Proposal are true.

That said Proposal was not made in the interest of or on behalf of any undisclosed person, partnership, company, association, organization, or corporation.

That said bidder has not, directly, or indirectly by agreement, communication, or conference with anyone attempted to induce action prejudicial to the interest of the City of Prescott, Arizona, or of any bidder or anyone else interested in the proposed contract; and further,

That prior to the public opening and reading of proposal, said bidder:

1. Did not directly or indirectly, induce or solicit anyone else to submit a false or sham proposal;
2. Did not directly or indirectly collude, conspire, connive or agree with anyone else that said bidder or anyone else would submit a false or sham proposal, or that anyone should refrain from bidding or withdraw his proposals;
3. Did not in any manner, directly or indirectly, seek by agreement, communication or conference with anyone to raise or fix the proposal price of said bidder or of anyone else, or to raise or fix any overhead, profit or cost element of his proposal price, or of that of anyone else;
4. Did not, directly or indirectly, submit his proposed price or any breakdown thereof, or the contents thereof, or divulge information or data relative thereto, to any corporation, partnership, company, association organization, bid depository or to any member or agent thereof, or to any individual or group of individuals, except the City of Prescott, Arizona, or to any person or persons who have a partnership or other financial interests with said bidder in his business.

By: _____

SUBSCRIBED AND SWORN to before me by _____

this _____ day of _____, 20___.

_____ _____
Notary Public Commission Expires

Construction Contract

Yavapai Hills #1 Lift Station Rehabilitation

Contract No. 2024-***

THIS AGREEMENT made and entered into this 28th day of May, 2024, by and between ** of the city of **, county of **, state of **, hereinafter designated "Contractor", and the City of Prescott, a municipal corporation, organized and existing under and by virtue of the laws of the State of Arizona, hereinafter designated "City".

WITNESSETH: That the said Contractor, for and in consideration of the sum to be paid by the said City, and of the other covenants and agreements herein contained, and under the penalties expressed in the bonds provided, hereby agrees, for him/herself, his heir, executors, administrators, successors and assigns as follows:

ARTICLE I - SCOPE OF WORK: The Contractor shall furnish any and all labor, materials, equipment, transportation, utilities, services and facilities, required to perform all work for the construction of the project described as City of Prescott: Yavapai Hills #1 Lift Station Rehabilitation Project and install the material therein for the City, in a good and workmanlike and substantial manner and to the satisfaction of the City through its Engineers and under the direction and supervision of the Public Works Director, or his properly authorized agents and strictly pursuant to and in conformity with the Plans and Specifications prepared by the engineers for the City, and with such written modifications of the same and other documents that may be made by the City through the Public Works Director or his properly authorized agents, as provided herein.

ARTICLE II - CONTRACT DOCUMENTS: The Notice Inviting Bids, Project Plans and Specifications, MAG Specifications and Details, City Supplement to MAG, Special Provisions, Addenda, Contractor's Affidavit Regarding Settlement of Claims and Certification of Completion of Warranties, Contractor Bid Proposal as accepted by the Mayor and Council per Council Minutes of May 28, 2024, Proposal Guarantee, Performance Bond, Payment Bond, Certificates of Insurance and required Endorsements, Contract Allowance Authorizations and Contract Amendments, are by this reference made a part of this Contract to the same extent as if set forth herein in full.

ARTICLE III - TIME OF COMPLETION: The Contractor hereby agrees to commence work on or before the tenth (10th) day after written notice to do so, unless such commencement of work is mutually agreed to be extended by the parties due to material unavailability and delayed lead times. The Contractor will complete the work within one hundred fifty (150) calendar days after the date of the written notice to commence work, subject to such extensions of time as are provided by the City Supplement to MAG. The contract will close 60 days after the substantial completion date, to finalize the payment process.

ARTICLE IV - COMPENSATION: Contractor shall be paid, pursuant to the provisions as set forth in the Contract Documents, a not to exceed amount of ** dollars and ** cents ($**), plus any approved contract amendments, for the full and satisfactory completion of all work as set forth in the Project Plans, Specifications and Contract Documents. Retention shall

be in accordance with A.R.S. § 34-221. If the Contractor claims that any instructions involve additional/extra cost, it shall give the Director written notice thereof within forty-eight (48) hours after the receipt of such instructions, and in any event before proceeding to execute the services / work. No such claim shall be valid unless so made. The Contractor shall do such additional/extra services/work upon receipt of an accepted Contract Amendment or other written order of the Director. In the absence of such Contract Amendment or other written order of the Director, the Professional shall not be entitled to payment for such additional/extra services/work. In no case shall services/work be undertaken without written notice from the Director to proceed with the services/work. All Contract Amendments shall be approved by the Director, but Contract Amendments over $50,000 must also be approved by City Council.

ARTICLE V – CONFLICT OF INTEREST: Pursuant to A.R.S. § 38-511, the City may cancel this contract, without penalty or further obligation, if any person significantly involved in initiating, negotiation, securing, drafting or creating the contract on behalf of the City is, at any time while the contract or any extension of the contract is in effect, an employee or agent of any other party to the contract in any capacity or a consultant to any other party of the contract with respect to the subject matter of the contract. In the event of the foregoing, the City further elects to recoup any fee or commission paid or due to any person significantly involved in initiating, negotiation, securing, drafting or creating this contract on behalf of the City from any other party to the contract, arising as a result of this contract.

ARTICLE VI - AMBIGUITY: This Agreement is the result of negotiations by and between the parties. Although it has been drafted by the Prescott City Attorney, it is the result of the negotiations between the parties. Therefore, any ambiguity in this Agreement is not to be construed against either party.

ARTICLE VII - NONDISCRIMINATION: The Contractor, with regard to the work performed by it after award and during its performance of this contract, will not discriminate on the grounds of race, color, national origin, religion, sex, disability or familial status in the selection and retention of subcontractors, including procurement of materials and leases of equipment. The Contractor will not participate either directly or indirectly in the discrimination prohibited by or pursuant to Title VI of the Civil Rights Act of 1964, Section 504 of the Rehabilitation Act of 1973, Section 109 of the Housing and Community Development Act of 1974, the Age Discrimination Act of 1975, the Americans With Disability Act (Public Law 101-336, 42 U.S.C. 12101-12213) and all applicable federal regulations under the Act, and Arizona Governor Executive Orders 99-4, 2000-4 and 2009-09 as amended.

ARTICLE VIII - INDEPENDENT CONTRACTOR STATUS: It is expressly agreed and understood by and between the parties that the Contractor is being retained by the City as an independent contractor, and as such the Contractor shall not become a City employee and is not entitled to payment or compensation from the City or to any fringe benefits to which other City employees are entitled other than that compensation as set forth in Article IV - Compensation above. As an independent contractor, the Contractor further acknowledges that he is solely responsible for payment of any and all income taxes, FICA, withholding, unemployment insurance, or other taxes due and owing any governmental entity whatsoever as a result of this Agreement. As an independent contractor, the Contractor further agrees that he will conduct himself in a manner consistent with such status, and that he will neither hold himself out nor claim to be an officer or employee of the City by reason thereof, and that he will not make any claim, demand or application to or for any right or privilege applicable to any officer or employee of the City, including but not limited to workmen's compensation coverage, unemployment insurance benefits, social security coverage, or retirement membership or credit.

ARTICLE IX - CITY FEES: Prior to final payment to the Contractor, the City shall deduct therefrom any and all unpaid privilege, license and other taxes, fees and any and all other unpaid moneys due the City from the Contractor and shall apply to those moneys to the appropriate account. Contractor shall provide to the City any information necessary to determine the total amount(s) due.

ARTICLE X - LIQUIDATED DAMAGES: All time limits stated in the Contract Documents are of the essence and should the Contractor fail to complete the work required to be done on or before the time of completion as set forth in these Contract Documents, including any authorized extension of time, it is mutually agreed and understood by and between the parties that the public will suffer great damages; that such damages, from the nature of the project, will be extremely difficult and impractical to fix; that the parties hereto wish to fix the amount of said damages in advance; and that the sum of $**.00 per day for each and every day's delay in completion and acceptance of the work required to be done by the Contractor subsequent to the time of completion, including any authorized extensions of time, is the nearest and most exact measure of damages for such breach that can be fixed now or could be fixed at or after such breach and that, therefore, the Owner and Contractor agree to fix said sum of $**.00 per day for each and every said day's delay as liquidated damages, and not as a penalty or forfeiture for the breach of the agreement to complete the work required to be done by the Contractor on or before the time of completion and acceptance and, in the case of such breach, the Owner shall deduct said amount from the amount due the Contractor under the contract. In the event the remaining balance due the Contractor is insufficient to cover the full amount of assessed liquidated damages, then the Contractor or the surety on the bonds shall pay the difference due the Owner.

ARTICLE XI - OTHER WORK IN PROJECT AREA: The City, any other contractors, whether under contract with the City, a third party, and/or utilities, may be working within the project area while this Contract is in progress. The Contractor herein acknowledges that delays and disruptions may, and in all likelihood, will occur due to other work. The Contractor's bid shall be deemed to have recognized and included costs arising from and associated with other work in the project area disclosed by the Contract Documents or which would be apparent to an experienced contractor exercising due diligence during inspection of the project documents, the question-and-answer session in the pre-bid process or during site inspection. No payment will be made for any delays or disruptions in the work schedule that are wholly the fault of the Contractor, its agents, employees, or any of the Contractor's subcontractors. In the event the Contractor encounters delay or disruption in the project schedule due to factors not wholly the fault of the Contractor or within the Contractor's control then the Contract may be adjusted pursuant to the Delay's and Extension of Time provisions of this Contract and a timely request submitted for Contract Amendment. Failure to submit a timely request for Contract Amendment shall be deemed a waiver of any entitlement to additional compensation.

ARTICLE XII - BONDS:

A. On or before the execution of the contract, the Contractor shall obtain in an amount equal to the full contract price a performance bond pursuant to A.R.S. § 34-222, conditioned upon the faithful performance of this contract in accordance with the plans, specifications, and conditions herein. The bonds shall be solely for the protection of the City. A copy of this bond shall be filed with the Prescott City Clerk.

B. Contractor shall also obtain a payment bond, pursuant to the provisions of A.R.S. § 34-222, in an amount equal to this full contract price herein, said bond to be solely for the protection of claimants supplying labor or materials to the Contractor or his subcontractors in the prosecution of the work provided for in this contract. A copy of this bond shall be filed with the Prescott City Clerk.

C. All bonds must be written by an insurance company authorized to do business in the State of Arizona, to be evidenced by a Certificate of Authority as defined in A.R.S. § 20-217, a copy of which certificate is to be attached to the applicable bid bond, payment bond and performance bond. In addition, depending upon the nature of the contract and amount thereof, the City Manager may also require insurance companies and/or bonding companies to have an "A" rating or better with Moody's or A.M. Best Company, and/or to be included on the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (as amended) by the audit staff, Bureau of Accounts, US Treasury Department.

ARTICLE XIII – SUBCONTRACTORS:

A. During performance of this Agreement, the Contractor may engage such additional subcontractors as may be required for the timely completion of the construction. The addition of any Subcontractors shall be subject to prior written approval by the City. In the event of sub-contracting, the sole responsibility for fulfillment of all terms and conditions of this Agreement rests with the Contractor.
B. The Contract Amount includes payment for any and all Services to be rendered by the Contractor or Subcontractors which the Contractor may employ for this Agreement. It is expressly agreed by and between the parties that the Contractor is solely responsible for all payment to such any other Contractors or Subcontractors retained by the Contractor. The Contractor agrees to indemnify and save harmless the City of Prescott against any and all liens, claims of liens, suits, actions, damages, charges and expenses whatsoever, which said City may suffer arising out of the failure to pay for all labor performance and materials furnished for the performance of said project when completed.

ARTICLE XIV – INDEMNITY:

The Contractor shall defend, indemnify and hold harmless the City, its departments, officers, officials, agents, and employees (hereinafter referred to as "Indemnitee") from and against any and all claims, actions, liabilities, damages, losses, or expenses (including court costs, attorneys fees and costs of claim processing, investigation and litigation) (hereinafter referred to as "Claims") for bodily injury or personal injury (including death), or loss or damage to tangible or intangible property caused, or alleged to be caused, in whole or in part, by the negligent or willful acts or omissions of the Contractor or any of the Contractor's owners, officers, directors, agents, employees or subcontractors. This indemnity includes any claim or amount arising out of or recovered under Worker's Compensation Law or arising out of failure of such Contractor to conform to any Federal, State, or local law, statute, ordinance, rule, regulation, or court decree. It is the specific intentions of the parties that the Indemnitee shall, in all instances, except for Claims arising solely from the negligent or willful acts of Indemnitee, be indemnified by the Contractor from and against any and all claims. In consideration of the award of this contract, the Contractor agrees to waive all rights of subrogation against the City, its departments, officers, officials, agents, and employees for losses arising from the work performed by the Contractor for the City.

ARTICLE XV – RIGHT TO ASSURANCE:

If the City in good faith has reason to believe that the Contractor does not intend to or is unable to perform or continue performing under this Contract, the Public Works Director may demand in writing that the Contractor give a written assurance of intent to perform. Failure by the Contractor to provide written assurance within the number of Days specified in the demand may, at the City's option, be the basis for terminating the Contract.

ARTICLE XVI – TERMINATION FOR CONVENIENCE:
The City reserves the right to terminate the Contract, in whole or in part at any time, when in the best interests of the City without penalty or recourse. Upon receipt of the written notice, the Contractor shall stop all work, as directed in the notice, notify all subcontractors of the effective date of the termination, and minimize all further costs to the City. In the event of termination under this paragraph, all documents, data, and reports prepared by the Contractor under the Contract shall become the property of and be delivered to the City upon demand. The Contractor shall be entitled to receive just and equitable compensation for work completed, and materials accepted before the effective date of the termination.

ARTICLE XVII - MISCELLANEOUS:

A. All pay applications need to have these items contract number, pay application number, dates of service and date submitted. They need to be submitted to the project manager for review. Once they review and sign off, they will submit to our accounts payable department for payment processing.

B. The parties hereto expressly covenant and agree that in the event of a dispute arising from this Agreement, each of the parties hereto waives any right to a trial by jury. In the event of litigation, the parties hereby agree to submit to a trial before the Court. The Contractor further agrees that this provision shall be contained in all subcontracts related to the project, which is the subject of this Agreement.

C. Final Payment Acknowledgement to be signed by the contractor and sent in with the final pay application. This is to further certify that the project is completed to acceptable standards as defined in the plans and specifications per the Project Contract Agreement. Any changes to the plans have been noted on the Construction As-built Mylar Drawings certified by the Engineer of Record. The revised As-built Drawings have been delivered and approved by the Public Works department. All materials used and workmanship performed are expressly warranted to be free of defects for a period of twenty-four (24) months from the date of final acceptance by the City of Prescott.

D. Contractor's Affidavit Regarding Settlement of Claims and Certification of Completion of Warranties is to be signed and returned at the end of the two-year warranty period that is determined per the warranty letter sent out when the project has been completed.

E. The parties hereto expressly covenant and agree that in the event of litigation arising from this Agreement, neither party shall be entitled to an award of attorney fees, either pursuant to the Contract, pursuant to A.R.S. § 12-341.01 (A) and (B), A.R.S. §34-301, §34-302 & §34-321 or pursuant to any other state or federal statute, court rule, case law or common law. The Contractor further agrees that this provision shall be contained in all subcontracts related to the project that is the subject of this Agreement.

F. In the event of default, neither party shall be liable for incidental, special, or consequential damages.

G. Any notices to be given by either party to the other must be in writing, and personally delivered or mailed by prepaid postage, at the following addresses:

City of Prescott	**
201 N. Montezuma Street	**
Prescott, Arizona 86301	**
contracts@prescott-az.gov	Email

H. This Agreement shall be construed under the laws of the State of Arizona.

I. This Agreement represents the entire and integrated Agreement between the City and the Contractor and supersedes all prior negotiations, representations, or agreements, either written or oral. This Agreement may be amended only by written instrument signed by both the City and the Contractor. Written and signed amendments shall automatically become part of the Agreement, and shall supersede any inconsistent provision therein; provided, however, that any apparent inconsistency shall be resolved, if possible, by construing the provisions as mutually complementary and supplementary.

J. In the event any provision of this Agreement shall be held to be invalid and unenforceable, the remaining provisions shall be valid and binding upon the parties. One or more waivers by either party of any provision, term, condition, or covenant shall not be construed by the other party as a waiver of a subsequent breach of the same by the other party.

K. No oral order, objection, claim or notice by any party to the other shall affect or modify any of the terms or obligations contained in this Agreement, and none of the provisions of this Agreement shall be held to be waived or modified by reason of any act whatsoever, other than by a definitely agreed waiver or modification thereof in writing. No evidence of modification or waiver other than evidence of any such written notice, waiver or modification shall be introduced in any proceeding.

L. Contractor agrees that notwithstanding the existence of any dispute, the Contractor shall continue to perform the obligations required of Contractor during the negotiation and resolution of any such dispute unless specifically enjoined or prohibited by an Arizona Court of competent jurisdiction.

M. In the event of a discrepancy between this Agreement and other documents incorporated into this Agreement, this Agreement shall control over Exhibit “A”.

N. Non-Availability of Funds: Fulfillment of the obligation of the City under this Agreement is conditioned upon the availability of funds appropriated or allocated for the performance of such obligations. If funds are not allocated and available for the continuance of this Agreement, this Agreement may be terminated by the City at the end of the period for which the funds are available. No liability shall accrue to the City in the event this provision is exercised, and the City shall not be obligated or liable for any future payments as a result of termination under this paragraph.

O. Compliance with Federal and State Laws: All Services performed by the Contractor shall be performed in compliance with all applicable federal, state, county, or city laws, rules, regulations, and ordinances, including, without limitations, those set forth on the attached Exhibit C, if applicable. The Contractor, at the Contractor’s expense, shall be responsible for

obtaining all necessary licenses, permits and governmental authorizations required to perform the Services. The Contractor understands and acknowledges the applicability to it of the Immigration Reform and Control Act of 1986 and the Drug Free Workplace Act of 1989.

P. Nondiscrimination and Equal Employment Opportunity: The Contractor and any Subcontractors are required to comply with all applicable provisions of Title VII of the Civil Rights Act, Sections 501 and 505 of the Rehabilitation Act, Section 109 of the Housing and Community Development Act, the Age Discrimination Act, the Americans With Disabilities Act, the Equal Pay Act, the Genetic Information Non-Discrimination Act, the Vietnam Era Veterans Readjustment Act, and all applicable federal regulations or executive orders related to these laws. Additionally, the Contractor and any Subcontractors are required to comply with Arizona law on nondiscrimination and equal employment opportunity, including the Arizona Civil Rights Act and Arizona Governor Executive Orders 99-4, 2000-4 and 2009-09, as amended. The Contractor agrees not to discriminate on the grounds of age, race, color, national origin, religion, sex, disability, pregnancy, veteran, familial status, or any other protected status in the selection and retention of employees and subcontractors, including procurement of materials and leases of equipment.

Q. Employees on Public Works Construction Projects: E-Verify Requirements:
   1. The Contractor shall comply with A.R.S. § 34-301, "Employment of Aliens on Public Works Prohibited", and A.R.S. § 34-302, "Residence Requirements for Employees", as amended.

   2. Under the provisions of A.R.S. § 41-4401, the Contractor hereby warrants to the City that the Contractor and each of its Subcontractors will comply with, and are contractually obligated to comply with, all Federal Immigration laws and regulations that relate to their employees and A.R.S. § 23-214(A) (hereinafter referred to as "Contractor Immigration Warranty"). The Contractor further understands and acknowledges that:
      a. A breach of the Contractor Immigration Warranty shall constitute a material breach of this Agreement and shall subject the Contractor to penalties up to and including termination of this Agreement at the sole discretion of the City.
      b. The City retains the legal right to inspect the papers of any Contractor or Subcontractors' employee to ensure that the Contractor or Subcontractor is complying with the Contractor Immigration Warranty. The Contractor agrees to assist the City in regard to any such inspections.
      c. The City may, at its sole discretion, conduct random verification of the employment records of the Contractor and any of the Subcontractors to ensure compliance with the Contractor Immigration Warranty. The Contractor agrees to assist the City in regard to any random verification performed.
      d. Neither the Contractor nor any Subcontractor shall be deemed to have materially breached the Contractor Immigration Warranty if the Contractor or Subcontractor establishes that it has complied with employment verification provisions prescribed by Sections 274A and 274B of the Federal Immigration and Nationality Act and the E-Verify requirements prescribed by A.R.S. § 23-214(A).
      e. The provisions of this Article shall be included in any contract the Contractor enters with any and all of its Subcontractors who provide Services under this Agreement. "Services" are defined as furnishing labor, time, or effort in the State of Arizona by a Contractor or subcontractor. Services include construction or maintenance of any structure, building or transportation facility or improvement of real property.

R. Israel: Contractor certifies that it is not currently engaged in and agrees for the duration of this Agreement that it will not engage in a “boycott”, as that term is defined in A.R.S. § 35-393, of Israel.

S. Force Labor of Ethnic Uyghurs Certification: Pursuant to A.R.S. § 35- 394, Contractor certifies that the firm does not currently, and agrees for the duration of the contract that it will not, use:

1. The forced labor of ethnic Uyghurs in the People' s Republic of China
2. Any goods or services produced by the forced labor of ethnic Uyghurs in the People' s Republic of China; and
3. Any Contractor / subcontractors or suppliers that use the forced labor or any goods or services produced by the forced labor of ethnic Uyghurs in the People' s Republic of China.

If the Contractor becomes aware during the term of the Contract that the company is not in compliance with the written certification, the Firm shall notify the City of Prescott within five business days after becoming aware of the noncompliance. If the Contractor does not provide City of Prescott with a written certification that the Company has remedied the noncompliance within 180 days after notifying the City of Prescott of the noncompliance, this Contract terminates, except that if the Contract termination date occurs before the end of the remedy period, the Contract terminates on the Contract termination date.

T. Contracting with small and minority firms, women's business enterprise and labor surplus area firms:

1. The Company will take all necessary affirmative steps to assure that minority firms, women’s business enterprises, and labor surplus area firms are used when possible.
2. Affirmative steps shall include:
   a. Placing qualified small and minority businesses and women's business enterprises on solicitation lists
   b. Assuring that small and minority businesses, and women's business enterprises are solicited whenever they are potential sources.
   c. Dividing total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by small and minority business, and women's business enterprises.
   d. Establishing delivery schedules, where the requirement permits, which encourage participation by small and minority business, and women's business enterprises.
   e. Using the services and assistance of the Small Business Administration, and the Minority Business Development Agency of the Department of Commerce.

DATED: _____ day of _____, 2024

IN WITNESS WHEREOF, the parties hereto have executed this Agreement as of the date and year first set forth above.

** (Company Name)

_____
(Authorized Signature)

By: _____
(Printed Name)

Title: _____

Email: _____

ATTEST:

_____
Sarah M. Siep, City Clerk

City of Prescott, a municipal corporation:

_____
Philip R. Goode, Mayor

APPROVED AS TO FORM:

_____
Joseph D. Young, City Attorney

INSURANCE REQUIREMENTS

Contractor and subcontractors shall procure and maintain until all of their obligations have been discharged, including any warranty periods under this Contract are satisfied, insurance against claims for injury to persons or damage to property which may arise from or in connection with the performance of the work hereunder by the Contractor, his agents, representatives, employees or subcontractors.

The insurance requirements herein are minimum requirements for this Contract and in no way limit the indemnity covenants contained in this Contract.

The City in no way warrants that the minimum limits contained herein are sufficient to protect the Contractor from liabilities that might arise out of the performance of the work under this Contract by the Contractor, his agents, representatives, employees, or subcontractors. The Contractor is free to purchase such additional insurance as may be determined necessary.

ADDITIONAL INSURANCE REQUIREMENTS:

The policies shall include, or be endorsed to include the following provisions:

1. On insurance policies where the City of Prescott is named as an additional insured, the City of Prescott shall be an additional insured to the full limits of liability purchased by the Contractor even if those limits of liability are in excess of those required by this Contract.

   Additional Insured:
   City of Prescott
   201 N. Montezuma Street
   Prescott AZ 86301

2. The Contractor's insurance coverage shall be primary insurance and non-contributory with respect to all other available sources.

All certificates required by this Contract shall be emailed directly to coi@prescott-az.gov **AND** fandboperations@prescott-az.gov. The City contract number and project name/description shall be noted on the certificate of insurance. The City reserves the right to require complete, certified copies of all insurance policies required by this Contract at any time. Any Renewal of insurance certificates with endorsements will need to be emailed to the above emails at least two weeks prior to expiration.

NOTICE OF CANCELLATION:

With the exception of a ten (10) day notice of cancellation for non-payment of premium, and changes material to compliance with this contract in the insurance policies above shall require a thirty (30) day written notice.

ACCEPTABILITY OF INSURERS:

Insurance is to be placed with insurers with a current A.M. Best's rating of no less than A-VII, unless otherwise approved by the City of Prescott. General liability, automobile liability, and worker's compensation insurance is to be placed with an insurer admitted in the state in which operations are taking place.

VERIFICATION OF COVERAGE:

Contractor shall furnish the City with certificates of insurance (ACORD form or equivalent approved by the City) as required by this Contract. The certificates for each insurance policy are to be signed by a person authorized by that insurer to bind coverage on its behalf.

All certificates and any required endorsements are to be received and approved by the City before work commences. Each insurance policy required by this Contract must be in effect at or prior to commencement of work under this Contract and remain in effect for the duration of the project and warranty period as set forth in warranty letter. Failure to maintain the insurance policies as required by this Contract or to provide evidence of renewal is a material breach of contract.

MAG Specifications, Sections 103.1 through 103.8, including: Unless otherwise specifically required by the Special Conditions, the minimum limits of public liability and property damage liability shall be as follows:

1. Contractor shall provide coverage with limits of liability not less than those stated below. An excess liability policy or umbrella liability policy may be used to meet the minimum liability requirements provided that the coverage is written on a following form basis.

   Commercial General Liability – Occurrence Form –

   Policy shall include bodily injury, property damage, broad form, contractual liability and XCU coverage.

   - General Aggregate $ 3,000,000
   - Products – Completed Operations Aggregate $ 3,000,000
   - Personal and Advertising Injury $ 1,000,000
   - Each Occurrence $ 1,000,000
   - Fire Legal Liability (Damage to Rented Premises) (if applicable) $ 100,000

The policy shall be endorsed to include the following additional insured language:

"The Contractor agrees to endorse the City of Prescott as an Additional Insured on the Commercial General Liability with the following Additional Insured endorsement, or similar endorsement providing equal or broader Additional Insured coverage, the CG 2010 10 01 Additional Insured - Owners, Lessees, or Contractors, or CG2010 07 04 Additional Insured – Owners, Lessees, or Contractors – Scheduled Person or Organization endorsement in combination with the additional endorsement of GC2037 10 01 Additional Insured – Owners, Lessees, or Contractors – Completed Operations shall be required to provide back coverage for the contractor's "your work" as defined in the policy and liability arising out of the products-completed operations hazard."

Business Automobile Liability: Bodily Injury and Property Damage for any owned, hired, and/or non-owned vehicles used in the performance of this Contract.

Combined Single Limit (CSL) $ 1,000,000

The policy shall be endorsed to include the following additional insured language:

"The City of Prescott shall be named as additional insured with respect to liability arising out of the activities performed by or on behalf of the Contractor, involving automobiles, owned, leased, hired, or borrowed by the Contractor."

Worker's Compensation and Employer's Liability

Workers' Compensation Statutory

Employer's Liability

Each Accident - $1,000,000

Disease – each employee -	$1,000,000
Disease – policy limit -	$1,000,000

Policy shall contain a waiver of subrogation against the City of Prescott for losses arising from work performed by or on behalf of the Contractor.

Professional Liability (Errors and Omissions Liability) – *if applicable*

Each Claim	$ 1,000,000
Annual Aggregate	$ 2,000,000

1. In the event that the professional liability insurance required by this Contract is written on a claims-made basis, Contractor warrants that any retroactive date under the policy shall precede the effective date of this Contract and that either continuous coverage will be maintained, or an extended discovery period will be exercised for a period of two (2) years at the time work under this contract is completed.

2. The policy shall cover professional misconduct or lack of ordinary skill for those positions defined in the Scope of Work of this contract.

Notice of Cancellation: With the exception of a ten (10) day notice of cancellation for non-payment of premium, any changes to material to compliance with this contract in the insurance policies above shall require thirty (30) day written notice.

Such policy shall not exclude coverage for the following:

1. Injury to or destruction of any property arising out of the collapse of/or structural injury to any building or structure due to grading of land, excavation, borrowing, filling, backfilling, tunneling, pile driving, cofferdam work or caisson work.

2. Injury to or destruction of wires, conduits, pipes, mains, sewers, or other similar property or any apparatus in connection therewith, below the surface of the ground, if such injury or destruction is caused by and occurs during the use of mechanical equipment for the purpose of grading of land, paving, excavating, drilling; or injury to or destruction of any property at any time resulting there from.

3. Injury to or destruction of any property arising out of blasting or explosion.

4. Motor vehicle public liability and property damage insurance to cover each automobile, truck, and other vehicle used in the performance of the Contract in an amount of not less than $1,000,000.00 for one person, and $1,000,000.00 for more than one person, and property damage in the sum of $1,000,000.00 resulting from any one accident which may arise from the operations of the Contractor in performing the work provided for herein.

The Contractor shall carry and maintain fire and extended coverage with an endorsement for vandalism and malicious mischief in Contractor’s name and also in the name of the City in an amount of at least ONE HUNDRED PERCENT (100%) of the Contract amount (if applicable).

The Contractor shall secure "all risk"-type builder's risk insurance for work to be performed. Unless specifically authorized by the City, the amount of such insurance shall not be less than ONE HUNDRED PERCENT (100%) of the contract price. Such policy shall include coverage for

earthquake, landslide, flood, collapse, or loss due to the results of faulty workmanship, during the contract time and until final acceptance of work by the City (if applicable).

CITY OF PRESCOTT
ARIZONA

FINAL PAYMENT ACKNOWLEDGEMENT

To the City of Prescott, Arizona:

Contractor company name
Address
city, state,zip
Email

Contractor Name, has submitted the final pay application for the Yavapai Hills #1 Lift Station Rehabilitation project Contract Number 2024-*** in the consideration of:

$ _____
(Total Final Project Amount)

as full and complete payment under the terms of the Contract. All materials used and workmanship performed are expressly warranted to be free of defects for a period of twenty-four (24) months from the date of final acceptance by the City of Prescott, as stated in the warranty letter to be provided.

The Undersigned further agrees to indemnify and save harmless the City of Prescott against any and all liens, claims of liens, suits, actions, damages, charges and expenses whatsoever, which said City may suffer arising out of the failure of the undersigned to pay for all labor performance and materials furnished for the performance of said project within the next 90 days.

Signed and dated this _____ day of _____, 20____.

_____
(Authorized Signature)

By: _____

Title: _____

State of _____)
) ss.
County of _____)

SUBSCRIBED AND SWORN to before me by _____

this _____ day of _____, 20_____.

_____ _____
Notary Public Commission Expires

CONTRACTOR'S AFFIDAVIT REGARDING SETTLEMENT OF CLAIMS AND CERTIFICATION OF COMPLETION OF WARRANTIES

(Send in after 2-year Warranty)

Project: Yavapai Hills #1 Lift Station Rehabilitation
Contract Number: 2024-***

To the City of Prescott, Arizona:

1. This affidavit is to certify that all lawful claims for materials, rental of equipment and labor used in connection with the construction of the above project, whether by subcontractor or claimant in person, have been duly discharged.
2. The Undersigned, for the consideration of $ _____
   (Total project price)
   as set out in the final pay application, as full and complete payment under the terms of the Contract, hereby waives and relinquishes any and all further claims or right of lien under, in connection with, or as a result of the above-described project. The Undersigned further agrees to indemnify and save harmless the City of Prescott against any and all liens, claims of liens, suits, actions, damages, charges and expenses whatsoever, which said City may suffer arising out of the failure of the undersigned to pay for all labor performance and materials furnished for the performance of said project.

Signed and dated this _____ day of _____, 20___.

_____
(Authorized Signature)

By: _____

Title: _____

State of _____)
) ss.
County of _____)

SUBSCRIBED AND SWORN to before me by _____

this _____ day of _____, 20___.

_____ _____
Notary Public Commission Expires

SUPPLEMENT TO THE MARICOPA ASSOCIATION OF GOVERNMENTS (MAG) UNIFORM STANDARD SPECIFICATIONS AND DETAILS FOR PUBLIC WORKS CONSTRUCTION

Technical Specifications

February 14, 2019

City of Prescott Public Works
433 N. Virginia Street, Prescott, Arizona 86301
Ph: 928.777.1130 | TDD: 928.777.1100 | Fax: 928.771.5929

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- Section 103 Award and Execution of Contract
- Section 110 Notification of Changed Conditions and Dispute Resolution
- Section 703 Riprap

Specifications Rewritten, or With Major Updates:

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- Section 101 Abbreviations and Definitions
- Section 104 Scope of Work
- Section 105 Control of Work
- Section 106 Control of Materials
- Section 107 Legal Regulations and Responsibility to Public
- Section 108 Commencement, Prosecution and Progress
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Details That Have Been Updated:

- All references to COP Standard Details to correspond with updated City of Prescott General Engineering Standards

PART 100 – GENERAL CONDITIONS

ADD the following section to Part 100- General Conditions:

SECTION 100: GENERAL CONDITIONS

100.2 STANDARD SPECIFICATIONS AND DRAWINGS

(A) Standard details and specifications for the project shall be the most recent versions of the Maricopa Association of Governments Uniform Standard Specifications and Details for Public Works Construction (MAG Details/MAG Specifications), City of Prescott Supplement to MAG Standards (COP Supplement), City of Prescott General Engineering Standards (COP GES), Prescott City Code (City Code) and Arizona Revised Statutes (A.R.S.), except as modified in the project plans and specifications.

(B) Other standard specifications and details will be incorporated within the plans, project documents and specifications by reference, as necessary. These may include references to the Arizona Department of Transportation Standard Specifications for Roadway and Bridge Construction (ADOT Specifications), Arizona Department of Environmental Quality (ADEQ), Manual on Uniform Traffic Control Devices (MUTCD) (with Arizona Supplement), American Association of State Highway and Transportation Officials (AASHTO), American Society for Testing and Materials (ASTM), and others.

100.3 GENERAL NOTES

(A) All construction shall conform to the most recent versions of the MAG Standards, COP Supplement to MAG, and the COP GES, unless specifically modified on the plans.

(B) It shall be the Contractor's responsibility to obtain copies of all standards, details and specifications necessary to completely and accurately interpret the plans.

(C) All plans are null and void 1 year from date of signature if construction has not started.

(D) All quantities shown on plans are approximate, are not verified by the Engineer, and are furnished solely for the Contractor's convenience. They do not necessarily correspond to bid schedule items. Payment shall be based on bid schedule items for actual quantities provided and installed. The Contractor shall not be relieved of their responsibility for independently estimating work quantities prior to bidding. If any discrepancy in quantities is found, Contractor shall notify the Engineer of such no later than 24 hours prior to bid opening.

(E) A City right-of-way permit will be required for all off-site construction and construction within the public right-of-way.

(F) It is the sole responsibility of the Contractor to obtain, at the Contractor's own expense, such permits as are required from the appropriate agencies.

(G) The Public Works Department shall be notified a minimum of 24 hours prior to beginning any construction in the public right-of-way at (928) 777-1176.

(H) Inspection is to be done by the City Public Works Department.

(I) Any work performed without the knowledge of the City Inspector or the Inspector's authorized representative is subject to removal and replacement of same, to be done at the Contractor's expense.

(J) All work and materials, which do not conform to the specifications, are subject to removal and replacement at the Contractor's expense.

(K) Approval of a portion of the work in progress does not guarantee its final acceptance. Testing and evaluation may continue until the written final acceptance of a complete and workable unit.

(L) The City may suspend the work by written notice when, in its judgment, progress is unsatisfactory, work being done is unauthorized or defective, weather conditions are unsuitable, or there is a danger to the public health and safety.

(M) The Contractor shall provide sufficient men and equipment on the job at all times during construction to comply with specifications and to complete work.

(N) The Contractor shall be responsible for construction surveying and layout.

(O) The Contractor shall notify Arizona 811 (formerly Arizona Blue Stake) at 1-800-STAKE-IT (1-800-782-5348) between 6 a.m. and 5 p.m. Arizona time, Monday-Friday (excluding State holidays), at least 48 hours prior to construction.

(P) It is the Contractor's responsibility to locate all underground pipelines, telephone, communication and electric conduits and structures in advance of any construction and will observe all possible precautions to avoid any damage to such. The Engineer and/or City will not guarantee any locations as shown on these plans, or those omitted from it.

(Q) The Contractor is to uncover all existing lines being tied into and verify grades, pipe material, and pipe diameter before material submittals and planned construction activities.

(R) The Contractor shall comply with all ADEQ requirements.

(S) All water lines shall be provided with 12 AWG HS-CCS wire. Trace wire shall be subject to traceability test. Testing is to be by the Contractor and witnessed by the City Representative and at no extra cost to the City.

(T) Water and sewer separation shall be pursuant to Arizona Administrative Code (AAC) R18-5-502.C. and City specifications.

(U) Water mains shall be subject to a pressure and leakage test in accordance with the American Water Works Association (AWWA) C600 Standard.

(V) Water mains shall be disinfected in accordance with ADEQ Engineering Bulletin No. 8 “Disinfection of Water Systems”.

(W) Operation of valves to be done by City personnel only.

(X) All pipeline materials shall be installed per manufacturer's requirements unless superseded by City specifications.

(Y) All materials for water line construction shall meet AAC R18-4-119.

(Z) ADEQ requirements will apply when more stringent than MAG Specifications; more specifically where they pertain to maximum allowable sewer line/pressure sewer line exfiltration-infiltration rates.

(AA) Sewer line low-pressure air tests shall be done on 100 percent of all sanitary sewer lines.

(BB) Sewer manholes exfiltration tests shall be done on 100 percent of all manholes. Vacuum testing in accordance with City standards may be used in lieu of exfiltration test.

(CC) Sewer line deflection tests shall be done on 100 percent of all pipes.

(DD) Prior to project acceptance, the Contractor shall be responsible for providing the City with a video (DVD format) of the entire sewer main installed including service laterals. A City Representative shall attend the video data collection. If the City is not present during the video data collection, the City may require that the video data be redone, at the Contractor’s expense, with the City Representative present. The video will be reviewed and deemed acceptable by the City prior to project acceptance.

(EE) Acceptance of the completed work will not be given until 3 ml Mylar as-built reproducible plans and all required digital files have been submitted by the Engineer of Record and approved by the Engineer.

(FF) The Contractor shall warrant all work for a minimum of 2 years after formal acceptance of the work.

SECTION 101: ABBREVIATIONS AND DEFINITIONS

101.2 DEFINITIONS AND TERMS

REVISE and ADD the following:

Agency/City/Contracting Agency/Owner: Interchangeable to mean, the City of Prescott, a municipal corporation, organized and existing under and by virtue of the laws of the State of Arizona, unless otherwise noted; and meant as the governmental agency/legal entity for which the work is being done, either by permit or contract.

City's Representative: The authorized representative of the City, which may be an individual or a firm, or their assistants assigned to the project work, the project site, or any part thereof during the performance of the work by the Contractor and until final acceptance.

County: Yavapai County, organized and existing under and by virtue of the laws of the State of Arizona.

Director: The City of Prescott Public Works Director, or their designee, representative or assistants, unless otherwise noted.

Engineer: The duly authorized person, or their designees, employed by or contracted with the City of Prescott who is responsible for all aspects of the project and with the authority to make revisions to and approve the changes to the plans or specifications.

Engineer of Record: The Engineer of Record is a Civil Engineer registered in the State of Arizona by the Board of Technical Registration and is responsible for design, calculations and preparation of contract documents. The Engineer of Record shall provide field observation, compile, review and comment on project documentation, material testing reports and prepare as-built drawings.

Materially Unbalanced Bid: A bid that generates a reasonable doubt that award to the bidder submitting a mathematically unbalanced bid will result in the lowest ultimate cost to the City.

Mathematically Unbalanced Bid: A bid containing lump sum or unit bid prices that do not reflect reasonably anticipated actual costs plus a reasonable proportionate share of the bidder's anticipated profit, overhead costs, and other indirect costs.

Notice Inviting Bids: Refers to the standard forms inviting proposals or bids.

SECTION 102: BIDDING REQUIREMENTS AND CONDITIONS

102.2 CONTENTS OF PROPOSAL PAMPHLET

ADD the following:

All standard specifications and details referenced, unless otherwise noted, shall conform to the most current editions, including revisions thereto.

102.4 EXAMINATION OF PLANS, SPECIAL PROVISIONS AND SITE OF WORK

ADD the following:

If any person contemplating submitting a bid for the proposed contract is in doubt as to the true meaning of any part of the plans, specifications, or other proposed contract documents, or finds discrepancies in or omissions from the plans or specifications, they shall submit to the Director a written request for an interpretation or correction thereof no later than 5 working days before bid or proposal opening. The person submitting the request will be responsible for its prompt delivery. Interested bidders may call, email or visit the office of the Director with any questions up to 5:00 PM on the fifth working day prior to the bid opening date. The City will no longer address or interpret any general questions or comments after that time. Should any issue be determined significant to the project by the Director, appropriate action will be taken. Any interpretation or correction of the proposed documents will be made available to prospective bidders a minimum of 3 working days prior to the bid opening date. Any correction of the contract documents will be made only by an addendum duly issued by the City and a copy of such addendum will be available on the City's website. The City will not be responsible for any other explanations or interpretations of the documents.

102.5 PREPARATION OF PROPOSAL

ADD the following:

(D) If the proposal is made by an individual, it shall be signed and the individual's full name and address shall be given. If it is made by a partnership, it shall be signed with the partnership name and by a general partner of the firm who shall also sign their own name, and the name and address of each partner shall be given; and, if it is made by a corporation, the name of the corporation shall be signed by its duly authorized officer or officers.

All submittal forms are contained in the Notice Inviting Bid and must be submitted as part of the bid.

ADD the following subsection to 102.5 Preparation of Proposal:

102.5.1 Instructions for Preparing Proposal

Payment for all work performed under this contract shall be based on the units as shown in the bidding schedule. Payment of the bid items as stated in the Contractor's proposal for the completed work, shall be compensation in full for the furnishing of all overhead, labor, materials, devices, equipment and appurtenances included in the work as are necessary to complete the total work under this contract in a good, neat, and satisfactory manner as indicated on the plans, as described in the specifications, and as otherwise implied or required to fulfill the objective of the work.

All construction elements, as identified in the bid schedule, shown on the plans or details or described in the special provisions, are required for the construction and are to include all costs associated with earthwork, trenching, subgrade construction, valves, fittings, tapping sleeves, appurtenances, utility boxes, bedding, pavement replacements, hauling, placing, disposing of, start up, testing, certifying, or any other associated work and materials required for a complete in place and operable item of construction. All work items and materials not specifically itemized in the bid schedule and that are required for construction are to be considered incidental to the total project bid amount.

It is the intent of the contract that maximum payment shall not exceed the agreed unit price without duly authorized contract amendments. Each item, fixture, piece of equipment, work, etc., as indicated on the plans, or specified anywhere in these documents shall be completed with all necessary connections and appurtenances for the satisfactory use and operation of said item, and the total system or systems.

Any and all patents, license fees, insurance premiums, etc., for the right to use equipment or processes included in this contract shall be included in the total bid price.

Cost of testing, and other incidental operations, profit and overhead cost, including the cost of supervision, temporary field offices, move-in, move-out, insurance, taxes, equipment not a permanent part of the job, and other incidental items, shall be included in the total bid price.

The "Total Amount of Bid" must be filled out by the bidder. In case of any discrepancy between the price in figures and price in written words, as written or corrected, the price in written words shall be presumed to be correct unless obviously in error, and shall be considered as the Contractor's correct and intended bid.

Bids shall not contain any recapitulations of the work to be done. Alternative proposals will not be considered unless called for.

102.6 SUBCONTRACTORS LIST

REMOVE the first paragraph in its entirety and REPLACE with the following:

The Subcontractors List must be completed, attached and submitted along with the bidding schedule. Only 1 name shall be listed for each category.

102.7 IRREGULAR PROPOSALS

ADD the following:

(F) If the bid is mathematically unbalanced.

(G) If the bid is materially unbalanced.

102.9 SUBMISSION OF PROPOSAL

ADD the following:

Bids shall be delivered to the office of the City Clerk, City of Prescott, Arizona, before the day and hour set for the submittal of bids in the Notice Inviting Bids as published. Bids shall be enclosed in a sealed envelope bearing the title of the work and the name of the bidder. It is the sole responsibility of the bidder to ensure the bid is received in proper time.

102.13 SUCCESSFUL BIDDERS

REMOVE in its entirety and REPLACE with the following:

The successful bidder may obtain 1 set of plans and specifications for the project at no extra cost.

ADD the following subsection to Section 102- Bidding Requirements and Conditions:

102.14 ADDENDA

Any addenda issued during the time of bidding, forming a part of the documents issued to the bidder for the preparation of a bid, shall be covered in the bid and shall be made a part of the contract. Addenda may be issued until noon on the third working day prior to the bid opening date. It is the prospective bidder's responsibility to check for addenda related to this procurement. Addenda will be posted on the City's website.

SECTION 103: AWARD AND EXECUTION OF CONTRACT

ADD the following subsection to 103.1 Consideration of Proposals:

103.1.1 Confirmation of Bid

At any time after the opening of the bids, the Director may require any bidder on the project to confirm such bid in writing prior to contract award. An acknowledgement will be sent to the bidder to certify the prices bid have been reviewed and to confirm work can be completed in accordance with the requirements of the contract documents, plans and specifications in the total bid amount stated in the bidding schedule.

ADD the following subsection to 103.1 Consideration of Proposals:

103.1.2 Experience and Qualifications

When requested by the City, the bidder shall supply a list of all public projects begun within the previous 3 years prior to contract award. The project list shall contain all public projects entered into by the bidder and shall include the project name and location, original and final contract amounts, project status and a contact name and information for each project. The bidder shall provide a description and explanation for any projects that were not completed successfully. Failure to provide complete and factual information may be grounds for rejection of the bid in accordance with City Procurement Code 1-27-18(K).

ADD the following subsection to 103.1 Consideration of Proposals:

103.1.3 Pre-Award Conference

The City may require the apparent low bidder to attend a pre-award conference in order to establish that the bidder fully understands the scope, complexity and expectations of the project as described in the contract documents; to discuss issues, concerns, risk areas and how to minimize them within the bounds of the contract; and to determine that the apparent low bidder is the most responsible and/or most qualified bidder in accordance with City Procurement Code 1-27-18(K).

The purpose of the pre-award conference is to ensure that all participants are apprised of their responsibilities and obligations regarding all applicable laws, rules, regulations and ordinances contained in the contract documents prior to entering into a contract.

103.3 AWARD OF CONTRACT

REMOVE the first paragraph in its entirety and REPLACE with the following:

The contract will be awarded to the lowest qualified bidder complying with these instructions and with the Notice Inviting Bid. The City, however, reserves the right to accept or reject any or all bids if it deems it best for the public good, and to waive any informality in the bids received. The award, if made, will be within 60 calendar days after the opening of bids.

ADD the following subsection to 103.3 Award of Contract:

103.3.1 Assignment of Contract

No partial or full assignment by the Contractor of any contract to be entered into hereunder, or any part thereof, or of funds to be received there under by the Contractor, will be recognized by the City unless such assignment has had prior written approval of the City and the surety has been given due notice of such assignment in writing and has consented thereto in writing.

103.6 CONTRACTOR'S INSURANCE

ADD the following:

The Contractor and subcontractors shall procure and maintain until all of their obligations have been discharged, including any warranty periods under the contract are satisfied, insurance against claims for injury to persons or damage to property which may arise from or in connection with the performance of the work hereunder by the Contractor, the Contractor's agents, representatives, employees or subcontractors.

The insurance requirements herein are minimum requirements for a contract and in no way limit the indemnity covenants contained in the contract.

The City in no way warrants that the minimum limits contained herein are sufficient to protect the Contractor from liabilities that might arise out of the performance of the work under a contract by the Contractor, the Contractor's agents, representatives, employees, or subcontractors. The Contractor is free to purchase such additional insurance as may be determined necessary.

(A) Additional Insurance Requirements: The policies shall include, or be endorsed to include, the following provisions:

(1) On insurance policies where the City is named as an additional insured, the City shall be an additional insured to the full limits of liability purchased by the Contractor even if those limits of liability are in excess of those required by this contract.

(2) The Contractor's insurance coverage shall be primary insurance and non-contributory with respect to all other available sources.

(B) Notice of Cancellation: With the exception of a 10 day notice of cancellation for non-payment of premium, any changes material to compliance with this contract in the insurance policies above shall require a 30 day written notice.

(C) Acceptability of Insurers: Insurance is to be placed with insurers with a current A.M. Best's rating of no less than A-VII, unless otherwise approved by the City. General liability, automobile liability, and worker's compensation insurance is to be placed with an insurer admitted in the state in which operations are taking place.

(D) Verification of Coverage: The Contractor shall furnish the City with certificates of insurance (ACORD form or equivalent approved by the City) as required by this contract. The certificates for each insurance policy are to be signed by a person authorized by that insurer to bind coverage on its behalf.

All certificates and any required endorsements are to be received and approved by the City before work commences. Each insurance policy required by this contract must be in effect at or prior to commencement of

work under this contract and remain in effect for the duration of the project and warranty period as set forth in Paragraph 3 of the "Contractor's Affidavit Regarding Settlement of Claims and Certification of Completion of Warranties". Failure to maintain the insurance policies as required by this contract or to provide evidence of renewal is a material breach of contract.

All certificates required by this contract shall be sent directly to the Public Works Department, 433 N. Virginia Street, Prescott, AZ 86301. The City project/contract number and project description shall be noted on the certificate of insurance. The City reserves the right to require complete, certified copies of all insurance policies required by this contract at any time.

(E) Such policy shall not exclude coverage for the following:

(1) Injury to or destruction of any property arising out of the collapse of/or structural injury to any building or structure due to grading of land, excavation, borrowing, filling, backfilling, tunneling, pile driving, cofferdam work or caisson work.

(2) Injury to or destruction of wires, conduits, pipes, mains, sewers, or other similar property or any apparatus in connection therewith, below the surface of the ground, if such injury or destruction is caused by and occurs during the use of mechanical equipment for the purpose of grading of land, paving, excavating, drilling; or injury to or destruction of any property at any time resulting there from.

(3) Injury to or destruction of any property arising out of blasting or explosion.

(4) Motor vehicle public liability and property damage insurance to cover each automobile, truck, and other vehicle used in the performance of the contract in an amount of not less than $1,000,000.00 for one person, and $1,000,000.00 for more than one person, and property damage in the sum of $1,000,000.00 resulting from any one accident which may arise from the operations of the Contractor in performing the work provided for herein.

(F) The Contractor shall carry and maintain fire and extended coverage with an endorsement for vandalism and malicious mischief in the Contractor's name and also in the name of the City in an amount of at least 100 percent of the contract amount (if applicable).

(G) The Contractor shall secure "all risk"-type builder's risk insurance for work to be performed. Unless specifically authorized by the City, the amount of such insurance shall not be less than 100 percent of the contract price. Such policy shall include coverage for earthquake, landslide, flood, collapse, or loss due to the results of faulty workmanship, during the contract time and until final acceptance of work by the City (if applicable).

103.6.1 General

REMOVE item (A) in its entirety and REPLACE with the following:

(A) The Contractor shall provide and maintain, during the life of the contract, General Liability, Automobile Liability, and Worker's Compensation Insurance as provided herein.

Unless otherwise specifically required by the special provisions, the minimum limits of public liability and property damage liability shall be as provided herein.

The Contractor shall provide coverage with limits of liability not less than those stated below. An excess liability policy or umbrella liability policy may be used to meet the minimum liability requirements provided that the coverage is written on a following form basis.

(1) Commercial General Liability: Occurrence Form

Policy shall include bodily injury, property damage, broad form contractual liability and XCU coverage.

- General Aggregate $3,000,000
- Products – Completed Operations Aggregate $3,000,000
- Personal and Advertising Injury $1,000,000
- Each Occurrence $1,000,000
- Fire Legal Liability (Damage to Rented Premises) (if applicable) $100,000

The policy shall be endorsed to include the following additional insured language:

"The Contractor agrees to endorse the City of Prescott as an Additional Insured on the Commercial General Liability with the following Additional Insured endorsement, or similar endorsement providing equal or broader Additional Insured coverage, the CG 2010 10 01 Additional Insured - Owners, Lessees, or Contractors, or CG2010 07 04 Additional Insured – Owners, Lessees, or Contractors – Scheduled Person or Organization endorsement in combination with the additional endorsement of GC2037 10 01 Additional Insured – Owners, Lessees, or Contractors – Completed Operations shall be required to provide back coverage for the Contractor's "your work" as defined in the policy and liability arising out of the products-completed operations hazard."

(2) Business Automobile Liability: Bodily Injury and Property Damage for any owned, hired, and/or non-owned vehicles used in the performance of this Contract

- Combined Single Limit (CSL) $1,000,000

The policy shall be endorsed to include the following additional insured language:

"The City of Prescott shall be named as additional insured with respect to liability arising out of the activities performed by or on behalf of the Contractor, involving automobiles, owned, leased, hired, or borrowed by the Contractor."

(3) Worker's Compensation and Employer's Liability:

Worker's Compensation Statutory

Employer's Liability

- Each Accident $1,000,000
- Disease- each employee $1,000,000
- Disease- policy limit $1,000,000

The policy shall contain a waiver of subrogation against the City for losses arising from work performed by or on behalf of the Contractor.

(4) Professional Liability (Errors and Omissions Liability) (if applicable)

- Each Claim $1,000,000
- Annual Aggregate $2,000,000

(a) In the event that the professional liability insurance required by this contract is written on a claims-made basis, the Contractor warrants that any retroactive date under the policy shall precede the effective date of this contract and that either continuous coverage will be maintained or an extended discovery period will be exercised for a period of two (2) years at the time work under this contract is completed.

(b) The policy shall cover professional misconduct or lack of ordinary skill for those positions defined in the Scope of Work of this contract.

(c) Notice of Cancellation: With the exception of a 10 day notice of cancellation for non-payment of premium, any changes material to compliance with this contract in the insurance policies above shall require a 30 day written notice.

103.6.2 Indemnification of the Contracting Agency Against Liability

REMOVE in its entirety and REPLACE with the following:

The Contractor shall defend, indemnify and hold harmless the City, its departments, officers, officials, agents, and employees (hereinafter referred to as "Indemnitee") from and against any and all claims, actions, liabilities, damages, losses, or expenses (including court costs, attorneys fees and costs of claim processing, investigation and litigation) (hereinafter referred to as "Claims") for bodily injury or personal injury (including death), or loss or damage to tangible or intangible property caused, or alleged to be caused, in whole or in part, by the negligent or willful acts or omissions of the Contractor or any of the Contractor's owners, officers, directors, agents, employees or subcontractors. This indemnity includes any claim or amount arising out of or recovered under Worker's Compensation Law or arising out of failure of such Contractor to conform to any Federal, State or local law, statute, ordinance, rule, regulation or court decree. It is the specific intentions of the parties that the Indemnitee shall, in all instances, except for Claims arising solely from the negligent or willful acts of Indemnitee, be indemnified by the Contractor from and against any and all claims. In consideration of the award of this contract, the Contractor agrees to waive all rights of subrogation against the City, its departments, officers, officials, agents, and employees for losses arising from the work performed by the Contractor for the City.

ADD the following subsection to Section 103- Award and Execution of Contract:

103.9 PRECONSTRUCTION CONFERENCE

Within 15 days of the date of the Notice of Award, the Contractor is required to attend a preconstruction conference. The City will contact the Contractor to schedule a specific date, time and location for the preconstruction conference. The purpose of the meeting is to outline specific construction items and procedures and to address items, which require special attention on the part of the Contractor. The Contractor may also present proposed variations in procedures, which the Contractor believes may be of benefit to the project, reduce cost, or will reduce inconvenience to the public. Communication and coordination issues will be also addressed during the preconstruction conference. The Contractor will be required to provide 5 sets of the following information at the preconstruction conference:

- Key personnel names and emergency phone numbers involved in the project.
- Public information plan
- Project signage plan
- Stormwater Pollution Prevention Plan (SWPPP) (NOI if applicable)
- Contractor quality control plan
- Subcontractor contracts and purchase orders for each and every item of work under subcontract on the project
- Payment schedule showing the estimated dollar volume of work for each calendar month during the life of the project
- Overall construction schedule and two-week look ahead schedule (provided weekly)

- Dust abatement/street sweeping plan and construction water meter application
- Traffic control plan and access management plan providing for continuous access to residents and businesses affected by the project
- Contractor's company safety plan
- An itemized list of shop drawings, materials, mix designs, equipment submittals and a schedule indicating the dates each of these items will be transmitted to the Director for review

Each of the above items is subject to review and approval by the Director.

ADD the following subsection to Section 103- Award and Execution of Contract:

103.10 COMMENCEMENT

The Contractor shall commence work on or before the tenth calendar day after receiving the Notice to Proceed, and shall complete all work under the contract within the period of time specified in the special provisions. The City reserves the right to issue Notice to Proceed at any time between 0 and 60 days after contract award. Notice to Proceed will be issued not later than 60 calendar days after the contract has been awarded unless otherwise agreed upon in writing, or as may be specified in the special provisions. In addition, the Contractor shall not commence work until all required documents, bonds, plans and schedules have been received and approved by the City. These submittals will not affect the issuance of Notice to Proceed by the City.

ADD the following subsection to Section 103- Award and Execution of Contract:

103.11 CONTRACTOR AND SUBCONTRACTOR RECORDS

(A) The Notice Inviting Bids, Information for Bidders, special provisions, specifications, plans, and all supplementary documents are intended to be complete and complementary and to prescribe a complete work. If any omissions are made of information necessary to carry out the full intent and meaning of the contract documents, the Contractor shall immediately call the matter to the attention of the Director for furnishing of detailed instructions. In case of discrepancies, the specifications shall govern over the plans. Figured dimensions shall govern over scaled dimensions.

(B) Any drawings or plans listed anywhere in the specifications or addenda thereto shall be regarded as a part thereof and of the contract. Anything mentioned in these specifications and not indicated on the plans, or anything indicated on the plans and not mentioned in these specifications, shall be in the same force and effect as if indicated or mentioned in both.

(C) The Contractor, subcontractors and all suppliers shall keep and maintain all books, papers, records, files, accounts, reports, bid documents with back-up data, including electronic data, and all other material relating to the contract and project for 3 years following completion and acceptance of the work. All records shall be accurately maintained in accordance with generally accepted accounting principles and practices uniformly and consistently applied in a format that will permit audit. The Director or the Director's authorized representative(s) shall have access at all reasonable times to all applicable records of the Contractor and the records of the Contractor's subcontractors.

The Contractor and subcontractors shall preserve all such materials for a period of 3 years after all payments to the Contractor or subcontractors, or until the final resolution of all claims made by the Contractor or subcontractor on this contract, whichever is later. The Contractor and subcontractors shall make all of the above materials available to the Director for auditing, inspection and copying and shall produce such materials upon written request at the office of the Public Works Director located at 433 N. Virginia Street, Prescott, Arizona 86303.

The Contractor shall insert the above requirement in each subcontract, purchase order, lease agreement, or other document under which goods or services are provided for the performance of this contract and shall also include in all subcontracts a clause requiring subcontractors to include the above requirement in any lower-tier subcontract, purchase order, lease agreement or document under which goods or services are provided for the performance of this contract.

ADD the following subsection to Section 103- Award and Execution of Contract:

103.12 ERROR AND OMISSIONS

The written dimensions, calculations and quantities on the plans are presumed to be correct, but the Contractor shall be required to check carefully all dimensions, calculations and quantities before beginning work. If any errors or omissions are discovered, the Director shall be so advised in writing and will make the proper corrections. If the Contractor claims that any such errors or omissions should change the cost of any pay item or the construction as identified in the plans, the Contractor shall also submit to the Director a written proposed contract amendment. Any such adjustments made by the Contractor that are claimed to change the cost of any pay item or the construction as identified in the plans, without prior review and acceptance of a proposed contract amendment, shall be at the Contractor's own risk. The settlement of any complications or disputed expenses arising from the Contractor's adjustment shall be borne by the Contractor at the Contractor's own expense.

ADD the following subsection to Section 103- Award and Execution of Contract:

103.13 CONTINGENCIES

All loss or damage arising from obstruction or difficulties which may be encountered in the prosecution of the work, from the action of the elements, or from any act or omission on the part of the Contractor or any person or agent employed by him shall be borne by the Contractor.

ADD the following subsection to Section 103- Award and Execution of Contract:

103.14 NOTICE AND SERVICE THEREOF

Any notice to the Contractor from the City relative to any part of this contract shall be in writing and considered delivered and the service thereof completed when said Notice is posted, by first class mail to the Contractor at the Contractor's last given address, electronically delivered, or delivered in person to the Contractor or the Contractor's authorized representative on the work.

ADD the following subsection to Section 103- Award and Execution of Contract:

103.15 PROJECT CLOSEOUT

It is the intent of these specifications and contract documents that the Contractor shall deliver a complete and operable facility capable of performing its intended functions and ready for use. The City shall withhold Final Payment and release of retention until ALL of the following items have been completed:

(A) Completion of all work, including punch-list items and final acceptance of the work by the City.

(B) Submittal by the Contractor of final pay estimate, which shall show the amount of work performed according to the contract and approved by the City.

(C) Submittal by the Contractor of all project record documents, including as-built drawings, operation and maintenance manuals, and other records as referenced herein.

(D) Submittal by the Contractor of the Contractor's Affidavit Regarding Settlement of Claims and Certification of Completion and Warranties.

(E) Closeout of any and all permits issued to the Contractor by the City or any other agency for the work included in the project.

(F) Submittal by the Contractor of an Environmental Protection Agency (EPA) Stormwater Pollution Prevention Plan (SWPPP) Notice of Termination (if applicable).

SECTION 104: SCOPE OF WORK

104.1.1 General

REMOVE the last paragraph in its entirety and REPLACE with the following:

Unless otherwise specified in the special provisions, the Contractor shall furnish all materials, labor, tools, equipment, water, light, power, transportation, superintendence, temporary construction of every nature, and incidentals, including, but not limited to, dust and traffic control measures, and to perform all work involved in executing the contract in a satisfactory and workmanlike manner within the specified time.

The Contractor shall at all times during the continuance of the contract prosecute the work with such work force and equipment as is sufficient to complete the project within the time specified.

ADD the following:

The work shall conform to such other drawings relating thereto as may be furnished by the City prior to the opening of proposals, and to such drawings in the explanation of details or minor modifications as may be furnished from time to time during construction, including such minor modifications as the Director may consider necessary during the prosecution of the work.

Scaled dimensions shall not be used in the construction of the work.

All work, as identified in the contract documents, not specifically itemized in the bid schedule that are required for the construction, are to be considered incidental to the project bid amount.

104.1.3 Water Supply

ADD the following:

(A) The Contractor shall supply adequate, pure, cool drinking water with individual drinking cups for the use of employees on the project. The quality of drinking water shall meet the requirements specified by the Arizona State Department of Health.

(B) It shall be the responsibility of the Contractor to provide and maintain, at the Contractor's own expense, a supply of water sufficient for the needs of the project and to install and maintain necessary supply connections and piping for the same. Before final acceptance of the completed project, all temporary connections and piping installed by the Contractor shall be removed.

(C) The Contractor shall apply for a fire hydrant meter for all construction water used if the Contractor desires to obtain water from the City distribution system at any point. All contractors requesting construction water from the City must submit an application for a construction water meter to the Water Distribution

Department. A $1,000 deposit will be required for hydrant meters. If construction water use occurs during the months of May through September the Contractor shall also include a dust abatement program. Potable water may not be allowed for dust abatement during these months. Potable water can be used to process embankment fill and base materials year round. However, contractors are encouraged to use treated effluent for construction activities. The City has two outlets for effluent, the Sundog Wastewater Treatment Plant and the Airport Wastewater Treatment Plant. The City will provide metered standpipes for effluent at both plants. The Contractor will be required to estimate daily and total potable/effluent water usage for the project as identified on the application for a construction water meter. The Contractor will be responsible for all costs associated with obtaining and delivering construction water.

104.1.4 Cleanup and Dust Control

ADD the following:

(A) Street Sweeping: The Contractor shall be responsible for sweeping the project no less than 4 times a week, or more as deemed necessary by the Engineer, to suppress dust, pick up dirt, soil, and construction debris so it does not travel to a water body or the City's storm drain system. A street sweeping plan documenting the frequency of sweeping, time and dates, route and type of sweeper that will be utilized shall be submitted to the City at the first preconstruction conference. The street sweeper shall be a mechanical sweeper with water applying equipment. No brooms, mechanical brooms mounted on drivable construction equipment or regenerative air sweepers will be accepted without prior approval from the City.

No measurement or payment will be made for street sweeping, unless otherwise provided for in the special provisions or proposal. The cost of street sweeping will be deemed incidental and the cost included in the proposal price for the construction operation to which dust control is incidental or appurtenant.

(B) Waste Disposal, Grading and Material Storage

(1) The Contractor shall provide for the disposal of all surplus materials, waste products, debris, etc., and shall make necessary arrangements for such disposal. The Contractor shall obtain written permission from property owners(s) prior to disposing of any surplus materials, waste products, debris, etc., on private property, and shall also obtain the approval of the Director prior to such disposal.

(2) The Director will not approve the filling of ditches, washes, drainage ways, etc., which may in the Director's opinion create water control problems.

(3) The Director will not approve disposal operations, which will, in the Director's opinion, create unsightly and/or unsanitary nuisances.

(4) The Contractor shall maintain the disposal site(s) in a reasonable condition of appearance and safety during the construction period as required by the Director. Prior to final acceptance of the project, the Contractor shall have completed the leveling and cleanup of the disposal site(s) to the satisfaction of the Director.

(5) The Contractor shall obtain a grading permit or any other permit required by the City, Yavapai County or any other county, or State or Federal rules, regulations, laws, ordinances, or any other regulatory authority for all construction operations of the project, including but not limited to the following:

(a) Areas disturbed by the Contractor, including staging areas, borrow areas, waste areas, or material storage areas, located within the City limits that are subject to any requirements of the City Code, COP Land Development Code or COP General Engineering Standards, including but not limited to Section 6.7 – Site Disturbance, Grading and Restoration Standards; and Section 9.6 – Site Disturbance and Grading Permit, of the COP Land Development Code; Chapter 16-2: Drainage Regulations of the City Code; and Articles 2 and 3 of the COP General Engineering Standards;

(b) Areas outside of the City limits that are subject to the requirements of Yavapai County, Arizona Department of Transportation (ADOT), and/or Yavapai-Prescott Indian Tribe (YPIT) for any activities described herein;

(c) The disposal of waste material on private property dependent upon site specific conditions at the waste area(s) and characteristics of the fill in accordance with this section. The fees for a permit for this activity shall not be waived; said fees are incidental to the appropriate bid item(s);

(d) The staging or material storage area(s) that:

(i) Are not City owned property on the project, or

(ii) Require clearing or grubbing in excess of 10,000 square feet

Fees for a permit(s) for this activity shall not be waived; said costs are incidental to the appropriate bid item(s).

(e) Site disturbances for infrastructure improvements on City owned property not within the right-of-way for which the disturbance is greater than 50 cubic yards of material or in excess of 10,000 square feet. The associated fees for grading permits for this activity on City owned property shall be waived.

104.1.5 Final Cleaning Up

ADD the following:

Upon completion of construction and before final acceptance can be made by the Engineer, the Contractor shall clean up each individual construction area to the satisfaction of the Engineer. Small trees, weeds, and brush, which were removed as part of construction work, shall be removed from the project site and properly disposed of. All debris including but not limited to broken pipe, concrete and other construction debris shall be removed from the project site and properly disposed.

Existing landscape improvements, drainage ditches, etc., shall be restored in "like kind" so that the improvement is put back in as close to its prior state as possible. Restoration of incidental items impacted by construction activity shall be in any and all areas utilized by the Contractor in relation to the project. The Contractor shall restore each individual work site to grades existing before construction work. No separate payment will be made for restoration of items impacted by the Contractor's construction operation and the cost of these items shall be included in the unit prices in the bid schedule.

104.2 ALTERATION OF WORK

ADD the following:

(A) Changes in the Work: The City, without invalidating the Contract, may order extra work, make changes by altering, or delete any portion of the work as specified herein, or as deemed necessary or desirable by the Director. All such work shall be executed under the conditions of the original contract except that any claim for extension of time and additional cost caused thereby shall be adjusted at the time of ordering such change or extra work.

Extra work shall be that work not indicated or detailed on the plans and not specified. Such work shall be governed by all applicable provisions on the contract document.

In giving instructions, the Director shall have authority to make minor changes in the work, not involving extra cost, and not inconsistent with the purposes of the work, but otherwise, except in an emergency endangering life or property, no extra work or change shall be made unless in pursuance of a written order by the Director, and no claim for an addition to the total amount of the contract shall be valid unless so ordered.

It is mutually understood that it is inherent in the nature of municipal construction that some changes in the plans and specifications may be necessary during the course of construction to adjust them to field conditions, and that it is of the essence of the contract to recognize a normal and expected margin of change. The Director shall have the right to make such changes, from time to time, in the plans, in the character of the work, and in the termination of the completion of the work in the most satisfactory manner without invalidating the contract.

Any change ordered by the Director which involves installation of work essential to complete the Contract, but for which no basis of payment is provided for herein, said payment therefore shall be subject to agreement prior to said work being performed.

The prices agreed upon and any agreed upon adjustment in contract time shall be incorporated in the written order issued by the Director, which shall be written so as to indicate acceptance on the part of the Contractor as evidenced by the Contractor's signature. In the event prices cannot be agreed upon, the City reserves the right to terminate the contract as it applies to the items in questions and make such arrangements as it may deem necessary to complete the work, or it may direct the Contractor to proceed with the items in question to be reimbursed pursuant to the unit prices in the Contractor's bid or on a force account basis as provided hereinafter, at the City's option.

(B) Claims for Extra Work: If the Contractor claims that any instructions involve extra cost under this contract, he shall give the Director written notice thereof within 48 hours after the receipt of such instructions, and in any event before proceeding to execute the work, except in emergency endangering life or property, and the procedure shall then be as provided for herein. No such claim shall be valid unless so made.

SECTION 105: CONTROL OF WORK

105.1 AUTHORITY OF THE ENGINEER

ADD the following:

All references to "the Engineer" shall mean the City Public Works Director.

105.2 PLANS AND SHOP DRAWINGS

ADD the following:

Drawings of minor or incidental fabricated materials and/or equipment may not be required by the Director. The Contractor shall furnish the Director tabulated lists of such fabrications, showing the names of the manufacturers and catalog numbers, together with samples of general data as may be required to permit determination by the Director as to their acceptability for incorporation in the work.

ADD the following subsection to 105.2 Plans and Shop Drawings:

105.2.1 Submittals

In ample time for each to serve its proper purpose and function, the Contractor shall submit to the Director such schedules, reports, drawings, lists, literature samples, instructions, directions, and guarantees as are specified or reasonably required for construction, operation, and maintenance of the facilities to be built and/or furnished under this contract.

Shop drawings and data shall be submitted to the Director in such number of copies as will allow him to retain 4 copies of each submittal. The submittal shall clearly indicate the specific area of the specifications or plans for which the submittal is made. The additional copies received by him will be returned to the Contractor's representative at the job site. The Director's notations of the action, which he has taken, will be noted on 1 of these returned copies.

The above drawings, lists, prints, samples, and other data shall become a part of the contract and a copy of the same shall be kept with the job site plans and the fabrications furnished shall be in conformance with the same.

ADD the following subsection to 105.3 Conformity with Plans and Specifications:

105.3.1 Order of Work

When required by the contract documents, the Contractor shall follow the sequence of operations as set forth therein. Full compensation for conforming to such requirements will be considered as included in the prices paid for contract items of work and no additional compensation will be allowed therefore.

105.4 COORDINATION OF PLANS AND SPECIFICATIONS

ADD the following:

In the event of any doubt or question arising regarding the true meaning of these specifications, special provisions, or the plans, reference shall be made to the Engineer, whose decision thereon shall be final. In the event of any discrepancy between any drawing and the figures written thereon, the figures shall be taken as correct.

The contract plans consist of general drawings. These indicate such details as are necessary to give a comprehensive idea of the construction contemplated. All authorized alterations affecting the requirements and information given on the contract plans shall be in writing. The contract plans shall be supplemented by such working or shop drawings prepared by the Contractor as are necessary to adequately control the work. No change shall be made by the Contractor in any working or shop drawing after it has been accepted by the Engineer.

The Contractor shall keep a copy of the contract documents, plans and specifications at the job site, and shall at all times give the Engineer access thereto. Any drawings or plans listed in the detailed specifications shall be regarded as a part thereof and the Engineer will furnish from time to time such additional drawings, plans, profiles and information as he may consider necessary for the Contractor's guidance.

All authorized alterations affecting the requirements and information given on the accepted plans shall be in writing. No changes shall be made of any plan or drawing after the same has been accepted by the Engineer except by consent of the Engineer in writing.

105.5 COOPERATION OF CONTRACTOR

REMOVE the first paragraph in its entirety and REPLACE with the following:

1 set of approved plans and specifications shall be kept available on the work site at all times by the Contractor.

105.6 COOPERATION WITH UTILITIES

ADD the following:

Location of Underground Utilities

(A) The Contractor shall contact Arizona 811 (formerly Arizona Blue Stake) within the time frame specified under Arizona law and request field location of underground utilities on public and private property. The Contractor shall employ private locating companies for private utilities not found by Arizona 811. At the time these locations have been marked and prior to the commencement of excavation within the affected area, the Contractor shall at the Contractor's expense manually determine the exact location of all buried facilities.

(B) The Contractor shall notify all affected utilities prior to the start of construction and shall ascertain the location of the various underground utilities either shown on the plans and/or as may be brought to the Contractor's attention.

(C) The Contractor shall perform all operations in accordance with Arizona 811.

(D) Utility locations shown on the plans are approximate and based on drawings furnished by the respective utility. It shall be the Contractor's responsibility to protect all existing utilities. Should a utility conflict occur, the Contractor shall cooperate with the said utility to resolve the conflict. No claim for extra costs shall be made against the City for delays due to any utility conflict.

(E) If performance of the Contractor's work is delayed because the utility owners fail to relocate or adjust their facilities in a timely manner, the Contractor may file for an extension of time. To receive consideration, this request shall contain specific information as to the nature of the delay and the actual loss of time involved.

(F) The Contractor shall assume full responsibility for damage to all marked utilities due to the Contractor's operations and shall repair the damaged utilities in accordance with regulatory authority requirements at the Contractor's own expense.

(G) Measurement and Payment: No separate measurement and payment shall be made for the location of underground utilities. This work shall be considered incidental and included in the unit price bid for construction or installation of the appropriate contract pay items.

105.8 CONSTRUCTION STAKES, LINES AND GRADES

ADD the following:

(A) Construction staking shall be the responsibility of the Contractor. The control for the project is provided in the contract documents. The Contractor shall be held responsible for preservation of control monumentation. If any of the control monumentation have been carelessly or willfully destroyed or disturbed by the Contractor, the cost of replacing them will be charged against him and will be deducted from the payment of work.

(B) The Contractor shall not retain the Engineer of Record for construction staking due to conflict of interest.

(C) Staking shall be performed and certified by a Registered Land Surveyor in good standing with the Arizona State Board of Technical Registration.

(D) The staking shall be performed in such a manner and frequency that the Contractor is able to construct the project in accordance with the plans and specifications. At a minimum, staking shall include:

(1) Slope or limit stakes

(2) Limits of Temporary Construction Easements (TCE)

(3) Horizontal and vertical alignment of pipeline

(4) Valves, tees, horizontal and vertical bends, blow offs, air release valves, tracer wire stations, water meters and hydrant locations

(5) Tank and appurtenances

(6) Electrical, instrumentation and control facilities, including, but not limited to, antennae pole

(7) Site improvements including, but not limited to, retaining walls, curbs, fencing, drainage, chain link fence enclosures, protection posts, gates, etc. The original grade of all retaining walls shall be surveyed and established prior to beginning any earthwork.

(8) Cross-sections will be required, at no additional expense to the City, should quantity disputes arise pertaining to the following: earthwork, subgrade, ABC or asphaltic concrete.

(9) Curb stakes at all PC's, PT's, vertical PI's (grade breaks), transitions to and from super elevated sections and at 50 foot intervals

(10) Blue tops for subgrade and ABC at intervals specified for curb. Quarter crown blue tops shall be required when the typical section is 4 lanes or more without median curb.

(11) Other staking as needed to complete the work in conformance with the plans and specifications.

(E) The Engineer and the Contractor’s superintendent shall meet monthly or as necessary to jointly measure all work items under the contract to determine pay quantities for each pay period. Quantities of work items shall be documented on the respective plan sheets and separately in tabular fashion with Station to Station measurements noted to assure there is no duplication of payment for work performed. Measurements will be for work actually completed. No projections for expected completion of work will be allowed.

(F) All survey data will be referenced to the City Coordinate System in accordance with the City Survey Datum Requirements as noted below.

CITY OF PRESCOTT SURVEY DATUM REQUIREMENTS		
Coordinate Units	International Feet	
Distance Units	International Feet	
Height Units	International Feet	
Datum		
Geodetic (Horizontal) Datum	North American Datum of 1983 (1992), (NAD83 (1992)	
Coordinate System	Arizona Coordinate System (State Plane)	
Zone	Central (0202)	
Vertical Datum	North American Vertical Datum of 1988, (NAVD88)	
Geoid Model	GEOID99 (Conus)	
City of Prescott Coordinate System (COPCS) – Conversion from State Plane		
COPCS Northing	(State Plane Northing x 1.000329975) – 701,456.0090	
COPCS Easting	(State Plane Easting x 1.000329975) + 69,457.2499	
Note: Distances computed between COPCS coordinates approximate "ground" distances		
State Plane – Conversion from City of Prescott Coordinate System		
State Plane Northing	(COPCS Northing + 701,456.0090) x 0.999670134	
State Plane Easting	(COPCS Easting – 69,457.2499) x 0.999670134	
Example – City of Prescott Mingo Base		
Latitude	34°34'29.27969" N	
Longitude	112°28'48.72638" W	
Height	5587.018'	
	State Plane Coordinates	**City of Prescott Coordinates**
Northing	1,301,026.703	600,000.0000
Easting	530,367.742	600,000.0000
Elevation	5,673.561'	5,673.955'

(G) Measurement and Payment: The quantity of construction staking measured for payment shall be the lump sum bid by the Contractor. The contract unit price per lump sum paid for construction staking shall be full compensation for all labor, materials, and equipment to perform the construction staking as described in this section.

105.9 DUTIES OF INSPECTOR

ADD the following:

An inspector is to be assigned to the project by the City to monitor the project and to keep the Engineer informed as to the progress of the work and the manner in which it is being done. Additionally, the Inspector will call the Contractor's attention to any nonconformance with the plans and specifications. Inspection will be done on an as needed or on-call basis. The Inspector will not be authorized to approve or accept any portion of the work. The Inspector will exercise such additional authority only as may from time to time be delegated to him by the Engineer.

105.10 INSPECTION OF WORK

ADD the following:

Inspection is to be done by the City Public Works Department. The Contractor shall furnish the Engineer with every reasonable facility for ascertaining whether or not the work as performed is in accordance with the requirements and intent of the specifications and contract. If the Engineer requests it, the Contractor at any time before acceptance of the work shall remove or uncover such portions of the finished work as may be directed. After examination, the Contractor shall restore said portions of the work to the standards required by the specifications. Should the work thus exposed or examined prove acceptable, the uncovering or removing and the replacing of the covering or making good of the part removed will be paid for as provided in Sections 104 and 105 of these specifications, but should the work so exposed or examined prove unacceptable, the uncovering or removing and the replacing of the covering or making good of the parts removed shall be at the Contractor's expense.

105.15 ACCEPTANCE

REMOVE item (A) in its entirety and REPLACE with the following:

(A) Partial Acceptance: Partial acceptance may be given upon substantial completion of the work at the sole discretion of the Engineer as provided herein. After completion of certain units of work under this contract, such as a structure, utility service, or a section of road or pavement, including all testing and other preparation necessary for operation of the unit by the City as herein specified, but prior to final project completion, the Contractor may request the Engineer to make final inspection of that work for partial acceptance. If the Engineer finds, upon inspection, that the work has been satisfactorily completed in compliance with the contract, the Engineer may accept the work, in writing, as being completed and the Contractor may be relieved of further responsibility for that work. Such partial acceptance shall in no way void or alter any terms of the contract.

(1) For the purpose of this section, substantial completion shall mean that stage in the progress of the work where the work or designated portion is sufficiently complete in accordance with the contract documents so that the City can occupy or utilize the work for its intended use with only minor work items or cleanup items remaining to be accomplished. Partial acceptance shall not be given for incomplete major work items nor minor work items affecting public health and safety.

(2) The units to be included for partial acceptance prior to final project completion will be noted at the time of the preconstruction conference in accordance with Contractor's schedule, or by written notice to the Contractor at the earliest possible time.

(3) The guarantee period for these units shall commence with the date of final acceptance of the entire project by the City. Full payment for these units will not be made until final acceptance of the total work is made.

(4) Acceptance of any portion of the project prior to acceptance of the whole shall not be construed as absolving the Contractor of responsibility for any item of construction or incidental work included in the original contract.

(5) Contract time accounting and/or assessment of liquidated damages shall be suspended on the date of partial acceptance and the Contractor shall complete all remaining work items necessary for final acceptance within 30 calendar days of the date of partial acceptance. The City shall withhold release of retention until all items under the contract have been completed and final acceptance has been issued.

ADD the following subsection to Section 105- Control of Work:

105.16 RECORD DRAWING PREPARATION AND COORDINATION

(A) As-built field data collection and preparation of record drawings will be performed by the Engineer. The Contractor shall notify the Engineer as required in this section, provide access to the work, and cooperate with the Engineer to gather information to accurately depict the as-built conditions. During the construction phase and prior to any backfilling or covering and subsurface improvements, the Contractor shall notify the Engineer of Record and the Engineer of Record will survey the work for the purpose of record drawing preparation. As-built measurements and surveying shall be performed and certified by a Registered Land Surveyor in good standing with the Arizona State Board of Technical Registration. The Engineer shall supply all horizontal and vertical as-built data in ASCII format, including a northing, easting, elevation and description of all work completed under this contract. The Contractor shall aid the Engineer in determining and providing this information. As-built data shall include, but not be limited to all items noted below.

(1) Grading and Drainage Plans

(a) Finished pad grades: An Average pad grade may be used if the pad is not flat. Pad elevations shall not exceed plus 0.5 feet tolerance (plus 0.2 feet if located adjacent to an existing development). Pad elevations shall not exceed minus 0.2 feet tolerance (0.1 feet if located in a floodplain or adjacent to a wash or channel).

(b) Flow line elevations of channels

(c) Hinge point elevations on all slopes and grade breaks

(d) Percentage of all slopes, flow lines and channels

(e) Catch basin grates elevation at top of grate

(f) Inverts of storm drain lines and headwalls

(g) As-built elevations shall be provided at all drainage control point (i.e. detention overflow point, tops and bottoms of detention basins, drain rims, valley gutters, curbs, curb openings, flow line elevations in swales, etc). As-built enough spot elevations to verify the design intentions are met (i.e. grade breaks, high/low points, scuppers, extreme outfall, etc). Show the direction of drainage flow to illustrate that design intent has been met.

(h) Provide calculations to verify that actual as-built volume of all detention facilities included on the as-builts, as well as a table which compares the as-built volumes with the approved, required volumes indicated on the design drawings or in the approved drainage report

(i) Detention calculations shall be revised to as-built condition by the Engineer of Record

(j) Flow line elevations and/or pipe inverts, grate elevations for catch basins, underground detention storage tanks, and all other drainage structures

(k) Top of flood walls, retaining walls, and cutoff walls

(l) Stations, offsets, and invert elevations for spillways and box culverts

(m) When storm drain lines and appurtenances are included in the grading and drainage drawings, the Contractor shall refer to the storm drain plan record drawing requirements for additional required items

(2) Water/Fire/Reclaimed Water Plans

(a) All fittings and appurtenances shall be surveyed, including but not limited to the following: valves, bends, tees, reducers blow offs, air release valves, tracer wire stations, water meters, and hydrant locations.

(i) Valves shall be measured on the nut and center of the cover. If extensions are used, the length of the extension shall be noted.

(ii) All fittings shall be measured at the middle of the fitting.

(iii) Air release valves shall be measured at the main connection, the air release box, and any major alignment changes between the two.

(b) Pipe sizes, lengths and materials

(c) Horizontal and vertical separation from existing and new utilities and drainage culverts/storm drain

(d) Street centerline station and offset dimension to:

(i) All fire hydrants and fittings (e.g. valves)

(ii) Main at all changes in alignment

(iii) All horizontal control points (e.g. centerline intersects, PC, PT)

(e) Centerline station and offset to each service tap; size of tap and meter

(f) Note centerline station, offset and elevations to all changes in vertical alignment (e.g. dips, bends, etc. required to avoid conflicts with other utilities). If the water main continues in a straight horizontal and vertical alignment for more than 100 feet, the water main will be surveyed every 100 feet. Sufficient survey measurements shall be taken on horizontal and vertical curves to establish an accurate alignment.

(g) The drawings must clearly indicate the specific points of reference. No dimensioning from points of curvature or tangency is acceptable for record drawing purposes. In all cases where the pipeline is constructed within, or parallel in close proximity with the right-of-way, all stationing and dimensioning must be from the nearest appropriate monument line and monument line intersection.

(h) When water services are not installed perpendicular to the water main, both the location of the tap at the main and the distance of the meter set from the nearest side property line of the lot must be shown.

(i) On phased projects, the phase lines must be clearly shown on the key map and on the plan and profile sheets, and their locations clearly identifiable. Actual pipe end locations relative to phasing lines must be shown by dimensioning or stationing.

(j) A complete list of all materials installed and abandoned must be shown. The specific size and material type of each pipeline installed must be shown at every construction reference to that pipe. Any changes to the record drawing must be reflected on the materials list.

(k) Water tank and appurtenances

(i) Required information for water tanks include, but are not limited to finished floor elevations, footing elevations, inlets, outlets, drains and overflow locations.

(ii) Required information for site piping and appurtenances shall follow the requirements of this section.

(iii) Manufacturer detail drawings for tanks shall be supplied and sealed by a Registered Engineer.

(3) Sewer Plans

(a) The alignments of the main(s) including all horizontal and vertical curves. If the sewer main continues in a straight horizontal and vertical alignment for more than 100 feet, the sewer main shall be surveyed every 100 feet. Sufficient survey measurements shall be taken on horizontal and vertical curves to establish an accurate alignment.

(b) All manholes, cleanouts, backwater valves, individual services, lift stations, and force main valves shall be surveyed. Structures shall have rim and invert elevations included.

(c) Pipe sizes and lengths

(d) Recalculated pipe slopes

(e) All valves at lift stations and line or isolation valves on force mains shall be measured on the nut and the center of the cover or vault lid.

(f) Separation from existing/newly installed water main and culverts

(g) Street centerline station and offset dimension from street centerline to main at manholes

(h) Sewer line stationing at centerline of each service tap at 90 degrees to main; if not installed at 90 degrees to main, station and offset to end of each service tap.

(i) New manholes built on existing lines require showing its station from the nearest existing downstream manhole and its distance to the nearest existing upstream manhole.

(j) Where construction begins with removal of an existing pipe plug or cleanout, 0+00 stationing always begins at the nearest existing downstream manhole. Pipe length measurement and stationing is always from the centerline of the downstream manhole to the centerline of the upstream manhole or cleanout. Do not give partial pipe lengths in plan or profile at match lines. Always indicate the distance between manholes or to cleanouts or pipe ends.

(k) All as-built adjustments to manhole, cleanout and pipe information shall be shown on both plan and profile, and repeated on every sheet that refers to the same information.

(l) A complete list of all materials installed and abandoned must be shown. The specific size and material type of each pipeline installed must be shown at every construction reference to that pipe. Any changes to the record drawing must be reflected on the materials list.

(m) On phased projects, the phase lines must be clearly shown on the key map and on the plan and profile sheets- and their locations clearly identifiable. Actual pipe end locations relative to phasing lines must be shown by dimensioning or stationing.

(4) Paving/Roadway Construction Plans

(a) Top of curb, flow line, and pavement centerline elevations at all grade breaks, Points of Tangency (PT), Points of Curvature (PC), Beginning Curb Return (BCR), and Ending Curb Return (ECR), valley gutters, spandrels at intersections, plus any other location necessary to adequately show drainage

(b) Percentage of slope

(c) ADA ramps including ramp slopes

(d) Edge of pavement on rural road sections

(e) Location of traffic signage, signals, poles and cabinets

(f) Station for all grade breaks

(g) Back of curb offset dimension at all changes in alignment

(h) Survey monuments - as-built installation and provide the City Northing/Easting to the hundredth of 1 foot. For street monuments, provide top of monument as-built elevation in addition.

(i) Distances from monument line to back/face of curb, edge of pavement, and sidewalk; show on plan view or typical detail for street section

(j) Beginning and ending stations and elevations for all traffic calming devices

(k) Stations, offsets, and invert elevations for spillways and box culverts

(l) Flow line elevations and/or pipe inverts, grate elevations for catch basins, underground detention storage tanks, and all other drainage structures

(5) Traffic Signal Plans

(a) Street centerline station and offset dimension to all fixture poles, cabinets, boxes, or other signal related furniture

(b) Horizontal location of conduit along with elevations to top of conduit

(6) Signing and Striping Plans

(a) Street centerline station and offset dimension to all signage, painted arrows, wording, and symbols

(b) Face of curb dimensions to all striping

(7) Storm Drain Plans

(a) Street centerline station and offset dimension to the main at all changes in alignment and/or changes in grade

(b) Street centerline station and offset dimension to all structures and changes in alignment

(c) Top and invert elevations for all structures

(d) Drainage pipe inverts

(e) Finish elevation for catch basins

(f) Invert elevations of box culverts

(g) Headwall data shall include top of wall/wingwall, footing elevations, inverts, and apron boundaries whether concrete or rip-rap

(h) Length of catch basin wings

(i) Drainage ditches, swales, and channels; the flow line and sufficient cross sections (minimum of 50 foot intervals) including grade changes, shall be provided

(8) Landscaping

(a) Revise as needed to reflect the addition, removal, relocation or change of irrigation main lines, plant materials or hardscape

(9) Street Light Plans

(a) Record drawings for street lights are required to have the Arizona Public Service (APS) ID number of each street light noted on the plan

(b) Street centerline stationing and offsets for street lights

(B) Prior to backfilling or covering any work, the Contractor shall notify the Engineer 48 hours in advance in writing for the item of work. The minimum 48 hours notice time shall not include weekends or holidays. The notification shall be via e-mail to both the City and the Engineer.

(C) The Contractor must provide access for the Engineer to verify all as-built information prior to backfilling or covering. The Contractor shall not backfill or cover an item of work until verification has been completed by the Engineer. If the Contractor backfills or covers an item of work prior to being measured or recorded by the Engineer, the Contractor at the direction of the Engineer shall uncover the item of work at no additional cost to the City.

(D) The Contractor shall maintain on site, available to the City and Engineer at all times, 1 redlined copy of all project plans and documents including drawings, specifications, addenda, approved shop drawings, and change orders which reflect all changes and modifications made during construction of the project. The redline copy shall be updated on a weekly basis in preparation for the weekly as-built field meeting. The Contractor shall maintain the plans and documents in good order and shall provide the Engineer with a redlined copy of all plans and documents upon completion of the project or upon termination of the contract.

(E) Weekly field meetings with the Contractor, Engineer and City shall occur to review as-built information for conformance with the specifications. The Contractor shall provide the Engineer with a schedule of work items to be constructed in the upcoming 30 day period, including approximate dates of installation prior to backfilling or covering. The Contractor field redlines will be reviewed for notation of changes in the work. Missing, erroneous or deficient data must be corrected by the Contractor at no additional cost to the City.

(F) Measurement and Payment: No separate measurement and payment shall be made for record drawing preparation and coordination. This work shall be considered incidental and included in the unit price bid for construction or installation of the appropriate contract pay items.

SECTION 106: CONTROL OF MATERIALS

106.1 SOURCE OF MATERIALS AND QUALITY

ADD the following:

The Contractor shall submit in writing all materials to be used in the project in accordance with ADOT Specifications 106 and 730-4.

Where equipment, materials, or articles are referred to in the specifications as “or equal”, or “equal to” any particular standard, the Director shall decide the question of equality.

Wherever any standard published specification is referred to, the latest edition or revision, including all contract amendments, shall be used unless otherwise specified. Materials of a general description shall be the best of their several kinds, free from defects, and adapted to the use for which provided. The physical characteristics of all materials not particularly specified shall conform to the latest standards published by the American Society for Testing and Materials (ASTM), where applicable. All material shall be new and of the specified quality and equal to the accepted samples, if samples have been submitted.

All work shall be done and completed in a thorough, workmanlike manner notwithstanding any omission from these specifications or from the plans; and it shall be the duty of the Contractor to call the Director's attention to apparent errors or omissions and request instructions before proceeding with the work. The

Director may, by appropriate instructions, correct errors and supply omissions, which instructions shall be binding upon the Contractor as though contained in the original specifications or plans.

Materials which will require testing and inspection at the place of origin shall not be shipped prior to such testing and inspection.

Nothing in the contract shall be construed as vesting in the Contractor any right of property in materials used after they have been attached or affixed to the work or the soil and accepted. All such materials shall become the property of the City upon being so attached or affixed and accepted.

106.2 SAMPLES AND TESTS OF MATERIALS

REMOVE the second paragraph in its entirety and REPLACE with the following:

The City will pay for the initial or normal test required by the Engineer as provided by Section 106.9 of these specifications. All Quality Control initial or normal testing will be performed by the Contractor's Quality Control subcontractor, at no cost to the City. Additional tests, required due to failure of the initial or normal test(s), shall be paid for by the Contractor for both Quality Control and Quality Assurance testing. The Engineer will designate the laboratory which will accomplish the additional test(s).

106.4 TRADE NAMES AND SUBSTITUTIONS

ADD the following:

Requests relative to substitutions for materials or equipment specifically designated on the plans or in the specifications shall be accompanied by complete data on which the Director can make determination on the merits of the proposed substitution. The written request shall state how the product proposed for a substitution compares with or differs from the designated product in composition, size, arrangement, performance, etc., and in addition, the request shall be accompanied by documentary evidence of equality in price and delivery or evidence of difference in price and delivery. Data on price shall be in the form of certified quotations from suppliers of both the designated and proposed items. All items accepted for substitution shall be subject to all applicable provisions of the specifications.

Should substitution be allowed under the foregoing provisions, and should the item subsequently prove to be defective or otherwise unsatisfactory for the service for which it was intended, the Contractor, shall without cost to the City, and without obligation on the part of the Director, replace the item with the material originally specified.

106.5 STORAGE OF MATERIALS

ADD the following:

Protection of materials and equipment stored on the site shall be the responsibility of the Contractor. The City reserves the right to direct the Contractor to provide proper means of protection for materials if such is deemed advisable by the Director; however, the exercise of or failure to exercise this right shall not be deemed to relieve the Contractor of the Contractor's primary responsibility for protecting the material and equipment. The Contractor shall provide suitable warehouses or other adequate means of protection for such if the materials and equipment require storage and protection. The Contractor shall store and care for the materials and equipment in the most suitable manner to protect them from distortion, rain, dust, or other damage. The cost of replacing any material or equipment damaged in storage shall be borne by the Contractor, and the fact that material or equipment has been damaged after partial payment has been made shall not relieve the Contractor of the Contractor's primary responsibility.

No motor shall be left uncovered or unprotected.

ADD the following subsection to Section 106- Control of Materials:

106.9 QUALITY ACCEPTANCE TESTING

(A) The Engineer may provide quality acceptance sampling and testing. The number of tests and location of each shall be determined by the Engineer.

(B) The Contractor and the Engineer's representative shall coordinate on a daily basis the following day's work schedule and any testing that may be necessary.

(C) Construction quality acceptance testing performed by the City does not relieve the Contractor or the manufacturer of materials produced for the Contractor, of the obligation to perform and document quality control testing of materials and workmanship.

(D) Measurement and Payment: No separate payment shall be made for Contractor Quality Control. This work shall be considered incidental and included in the unit price bid for construction or installation of the appropriate contract pay items. An independent geotechnical firm shall perform all quality control testing. The Contractor shall furnish copies of all test results to the City on a weekly basis.

The expense of the initial quality acceptance sampling and testing shall be paid for by the City. Additional tests, required due to failure of the initial or normal test(s), shall be paid for by the Contractor for both Quality Control and Quality Assurance testing at no expense to the City. The Engineer will designate the laboratory which will accomplish the additional test(s).

SECTION 107: LEGAL REGULATIONS AND RESPONSIBILITY TO PUBLIC

ADD the following subsection to 107.1 Compliance with Laws:

107.1.1 Compliance with Federal and State Laws

The Contractor understands and acknowledges the applicability to it of the Americans with Disabilities Act, the Immigration Reform and Control Act of 1986 and the Drug Free Workplace Act of 1989. The following is only applicable to construction contracts: The Contractor must also comply with A.R.S. § 34-301, "Employment of Aliens on Public Works Prohibited", and A.R.S. § 34-302, as amended, "Residence Requirements for Employees".

Under the provisions of A.R.S. § 41-4401, the Contractor hereby warrants to the City that the Contractor and each of its subcontractors will comply with, and are contractually obligated to comply with, all Federal Immigration Laws and regulations that relate to their employees and A.R.S. § 23-214 (A) (hereinafter "Contractor Immigration Warranty").

A breach of the Contractor Immigration Warranty Shall constitute a material breach of this contract and shall subject the Contractor to penalties up to and including termination of this contract at the sole discretion of the City.

The City retains the legal right to inspect the papers of any Contractor or subcontractor's employee who works on this contract to ensure that the Contractor or subcontractor is complying with the Contractor Immigration Warranty. The Contractor agrees to assist the City in regard to any such inspections.

The City may, at its sole discretion, conduct random verification of the employment records of the Contractor and any of the subcontractors to ensure compliance with the Contractor Immigration Warranty. The Contractor agrees to assist the City in regard to any random verification performed.

Neither the Contractor nor any of the subcontractors shall be deemed to have materially breached the Contractor Immigration Warranty if the Contractor or subcontractor establishes that it has complied with the employment verification provisions prescribed by Sections 274A and 274B of the Federal Immigration and Nationality Act and the E-Verify requirements prescribed by A.R.S. § 23-214 (A).

The provisions of this Article must be included in any contract the Contractor enters into with any and all of its subcontractors who provide services under this contract or any subcontract. "Services" are defined as furnishing labor, time or effort in the State of Arizona by building or transportation facility or improvement to real property.

ADD the following subsection to 107.1 Compliance with Laws:

107.1.2 Employment Provisions

Subject to existing law, and regulations, illegal or undocumented aliens will not be employed by the Contractor for any work or services to be performed pursuant to this contract. The Contractor will ensure that this provision is expressly incorporated into any and all Subcontracts or subordinate agreements issued in support of this contract. The Contractor agrees to comply with the provisions of Sections 274A(a)(1)(A) and 274A(a)(2) of the Immigration and Nationality Act (8 U.S.C. 1324a(a)(1)(A) and 1324a(a)(2)) (the "INA employment provisions"), and any amendments thereto, prohibiting the unlawful employment of illegal or undocumented aliens. Under the terms of this agreement, the Contractor shall not knowingly hire or employ for any work performed pursuant to this contract any workers or employees not lawfully authorized to work under the provisions of the Immigration and Nationality Act or any other applicable Federal or State laws. Violation of the provisions of this section shall be deemed a material breach of this contract.

ADD the following subsection to 107.1 Compliance with Laws:

107.1.3 Independent Contractor Status

It is expressly agreed and understood by and between the parties that the Contractor is being retained by the City as an independent contractor, and as such the Contractor shall not become a City employee, and is not entitled to payment or compensation from the City or to any fringe benefits to which other City employees are entitled. As an independent contractor, the Contractor further acknowledges that he is solely responsible for payment of any and all income taxes, FICA, withholding, unemployment insurance, or other taxes due and owing any governmental entity whatsoever as a result of this Agreement. As an independent contractor, the Contractor further agrees that he will conduct himself in a manner consistent with such status, and that he will neither hold himself out nor claim to be an officer or employee of the City by reason thereof, and that he will not make any claim, demand or application to or for any right or privilege applicable to any officer or employee of the City, including but not limited to workmen's compensation coverage, unemployment insurance benefits, social security coverage, or retirement membership or credit.

ADD the following subsection to 107.1 Compliance with Laws:

107.1.4 Nondiscrimination

The Contractor, with regard to the work performed by it after award and during its performance of this contract, will not discriminate on the grounds of race, color, national origin, religion, sex, disability or familial status in the selection and retention of subcontractors, including procurement of materials and leases of equipment. The Contractor will not participate either directly or indirectly in the discrimination prohibited

by or pursuant to Title VI of the Civil Rights Act of 1964, Section 504 of the Rehabilitation Act of 1973, Section 109 of the Housing and Community Development Act of 1974, the Age Discrimination Act of 1975, the Americans with Disabilities Act (Public Law 101-336, 42 U.S.C. 12101-12213) and all applicable Federal regulations under the Act, and Arizona Governor Executive Orders 99-4, 2000-4 and 2009-09 as amended.

ADD the following subsection to 107.1 Compliance with Laws:

107.1.5 Americans with Disabilities Act

The Contractor shall comply with all Federal, State and local nondiscrimination statutes in the operation, implementation and delivery of, including State and Federal civil rights and disabilities laws. In particular the Contractor shall ensure that the City 's obligations for program, facility and service accessibility in Title II of the Americans with Disabilities Act are complied with in all activities arising under this contract, and shall hold harmless the City for any and all loss, including but not limited to damages, costs or expenses, incurred or arising from any alleged violations of the Americans with Disabilities Act under the auspices of this contract unless resulting from an intentional or actual negligent act of the City and its employees. Failure to comply with the nondiscrimination or accessibility requirements herein shall be construed as nonperformance and may result in termination of funding, civil action or both.

ADD the following subsection to 107.2 Permits:

107.2.1 Permits, Taxes and Licenses

Except as otherwise provided in the specifications, it is the duty of the Contractor to procure all permits and licenses, pay all charges and fees, and give all notices necessary and incident to the due and lawful prosecution of the work. All applicable permits, licenses and taxes are the responsibility of the Contractor.

City permit fees are waived for contractors performing work on City capital improvement projects.

107.5 SAFETY, HEALTH AND SANITATION PROVISIONS

REMOVE the first paragraph in its entirety and REPLACE with the following;

The Contractor shall provide and maintain, in a neat and sanitary condition, suitable and adequate sanitary conveniences for the use of all persons employed on the project. All sanitary conveniences shall conform to the regulations of the public authority having jurisdiction over such matters. At the completion of the project, all such sanitary conveniences shall be removed and the premises left in a sanitary condition.

On all projects, with respect to sanitation facilities, for which Federal funds are allocated, the Contractor shall cooperate with and follow directions of representatives of the Public Health Service and the Arizona State Department of Health. Federal, State and County public health service representatives shall have access to the work wherever it is in preparation or progress, and the Contractor shall provide proper facilities for such access and inspection.

ADD the following:

The Contractor shall make adequate provision, subject to the approval of the Director, to protect the project and Contractor's facilities from fire, theft, and vandalism, and the public from unnecessary exposure to injury.

At least 1 fire extinguisher, rated at least 2A, shall be provided on the job site.

All construction hoists, elevators, scaffolds, stages, shoring, and similar temporary facilities shall be of ample size and capacity to adequately support and/or move the loads to which they will be subjected. All railings,

enclosures, safety devices, and controls required by law or for adequate protection of life and property shall be provided.

Machinery, equipment and other hazards shall be guarded or eliminated in accordance with the safety provisions of the Manual of Accident Prevention in Construction published by the Associated General Contractors of America, and the requirements of the Occupational Safety and Health Administration.

First aid facilities and information posters conforming at least to the minimum requirements of the Occupational Safety and Health Administration shall be provided in a readily accessible location or locations.

The Contractor shall provide all temporary facilities and utilities required for prosecution of the work; protection of employees and the public; protection of the work from damage by fire, weather or vandalism; and such other facilities as may be specified or required by any legally applicable law, ordinance, rule, or regulation.

The Contractor shall make all reports as are, or may be, required by the Engineer or any authority having jurisdiction, and permit all safety inspections of the work being performed under this contract. Before proceeding with any construction work, the Contractor shall take all the necessary action to comply with all provisions for safety and accident prevention. In the event the Contractor fails to comply with said safety provisions or directions of the Engineer, the Engineer without prejudice to any other rights of the City, may issue an order stopping all or any part of the work.

Thereafter, a start order for resumption of the work may be issued at the discretion of the Engineer when in the Engineer's opinion the defection from safety requirements has been corrected. The Contractor shall make no claim for an extension of time or for compensation or damages by reason of or in connection with such work stoppage.

107.6 PUBLIC CONVENIENCE AND SAFETY

ADD the following:

(A) Maintenance of Traffic

(1) Unless otherwise provided, streets and roads subjected to interference by the prosecution of work shall be kept open to all traffic and maintained by the Contractor until the work is complete. When so requested by the Contractor and approved by the Engineer, the Contractor may by-pass traffic over an approved detour route. Regardless of whether it is through or local traffic, the Contractor shall keep the portion of the project being used by traffic in such condition that traffic will be adequately accommodated. A City approved traffic control plan and right-of-way permit is required prior to the detour.

(2) The Contractor shall also provide and maintain in a safe condition temporary approaches or crossings, intersections with trails, roads, streets, businesses, parking lots, driveways residences, garages and farms. The Contractor shall also be required to remove snow as directed by the Engineer.

(3) Before any detour is opened to traffic, the Engineer shall have been satisfied that traffic is able to proceed in a safe manner.

(4) The Contractor shall bear all expense of maintaining traffic over the road being improved as well as constructing, maintaining and subsequently removing the Contractor requested detours, approaches, crossings, intersections and other features as may be necessary without any direct compensation.

(5) Except as otherwise shown or specified, off-site access roads shall be adequately maintained, graded-earth roads. Such roads shall be built only in the public right-of-way or easements obtained by the City. If the Contractor elects to build along some other alignment, he shall obtain, without additional cost to the City, the necessary right-of-ways or easements.

(6) The Contractor shall remove all unnecessary signage from the project area daily. If unnecessary signage is left, the City will contact the Contractor to remove it immediately. If the Contractor fails to remove the signage in a timely manner, the City will remove the signage at the Contractor's expense.

(7) Sidewalks shall be maintained to allow pedestrian foot traffic without obstruction. If a sidewalk must be closed, the Contractor shall maintain adequate prior warning for pedestrians to safely cross the street with as much advance notice as possible. Where sidewalk is not present, a City approved pedestrian detour shall be provided.

(B) Access to Businesses/Residences

(1) The Contractor shall provide to all residents and businesses affected by the project, access to 1 of their driveways at all times except as modified by the following: If the Contractor finds it unavoidable to temporarily close off access for any time, the residents/businesses affected shall be contacted a minimum of 48 hours in advance and an alternate procedure for access mutually agreed to. The Contractor shall provide the Engineer with signed evidence of a mutually accepted agreement between the property owner/business manager/residential manager and the Contractor prior to said closure.

(2) Direct access shall be provided at all times to fire engine houses, fire hydrants, hospitals, police stations and at all other agencies or services where emergencies may require immediate access to same.

(C) Safety

(1) The safety and convenience of the general public and the residents along the project and the protection of persons and property shall be provided for by the Contractor in accordance with the requirements of this contract.

(2) The Contractor shall submit a safety plan to the Engineer at the preconstruction conference. The plan shall detail the procedures the Contractor will implement to satisfy the Occupational Safety and Health Administration (OSHA) and the Arizona Division of Occupational Safety and Health (ADOSH) Guidelines related to the worker as well as public safety in construction of excavations, structures and confined air spaces as identified by the Engineer. The Contractor's safety plan shall include the requirement that all workers and visitors must wear hard hats while within the project limits.

(3) The safety plan submitted by the Contractor shall include proposed methods to prevent unauthorized persons from gaining access to the work areas.

(4) In conjunction with the safety plan, the Contractor shall furnish and install 72 inch temporary chain link fencing, or approved equal satisfactory to the Engineer, around any unattended excavation deeper than 4 feet with slopes steeper than 2:1. Temporary fencing shall completely enclose the referenced construction activity and shall be secured after normal working hours to prevent unauthorized access.

(5) Unless otherwise approved in writing by the Engineer, open utility trenches shall be limited to 50 feet in length except for cast-in-place pipe installations and during non-working hours shall be covered with steel plate in a manner satisfactory to the Engineer. Appropriate warning signs shall be installed when steel plates are left during non-work hours. Any traffic control signing shall be included in the traffic control line item(s) for the project.

107.6.1.1 Contractor's Marshaling Yard when the Agency is the Contracting Party:

ADD the following to item (F):

The Contractor will be fully and solely responsible for any and all adverse impacts and damages caused by the Contractor's operations on the property and the settlement of all claims pertaining thereto. The failure of the Contractor to comply with these provisions will result in the retention of some portion of the Contractor funds, payable under the contract, until such claims are resolved.

107.6.2

ADD the following:

In inhabited areas, particularly residential, operations shall be performed in a manner to minimize unnecessary noise generation. Particular consideration shall be given to noise generated by construction, repair and/or service activities during the night hours in residential areas. No construction, repair or service activities shall be conducted between the hours of 6:00 PM and 7:00 AM, without prior approval of the City.

107.7 BARRICADES AND WARNING SIGNS

ADD the following:

Excavations on project sites from which the public is to be excluded shall be marked or guarded in a manner appropriate for the hazard.

The Contractor shall protect all existing structures, trees, shrubs, and other items on the project site that are to be preserved, by substantial barricades or other devices commensurate with the hazard, from injury or destruction by vehicles, equipment, workmen, or other agents.

107.9 PROTECTION AND RESTORATION OF PROPERTY AND LANDSCAPE

ADD the following to the first paragraph:

Any land monuments and property marks displaced by the Contractor shall be replaced at the Contractor's expense in accordance with Section 405 of these specifications and to the City Surveyor's satisfaction, including filing of new record of survey if monuments could not be reestablished to pre-project conditions.

ADD the following:

The Contractor shall replace or repair any damage done to driveways and walks to not less than the condition existing prior to the Contractor's work.

Streets and roads subjected to interference by the prosecution of this work shall be kept open and maintained by the Contractor until the work is completed.

All trees and shrubbery within the right-of-way or easements shall be protected by the Contractor insofar as practicable. In the event shrubbery or trees must be trimmed, or removed, the Contractor shall notify the property owner to do so within a reasonable time prior to construction. All shrubbery or trees not removed by the property owner shall be trimmed or removed by the Contractor and hauled from the job at the Contractor's expense. All trees, shrubs, hedges, brush, etc. designated on the plans, or by the Director for removal, shall be completely removed and disposed of as indicated on the plans or as specified by the Director.

The Contractor shall contact the owners of any drainage ditches, irrigation lines, and appurtenances, which interfere with the work and shall make arrangements for dry-up or scheduling of water deliveries as necessary. The Contractor shall be liable for any damage due to irrigation facilities damaged by the Contractor's operations and shall repair such damaged facilities to an "equal or better than" original condition.

In excavation, fill, and grading operations, care shall be taken to disturb the pre-existing drainage pattern as little as possible. Particular care shall be taken not to direct drainage water onto private property or into streets or drainage ways inadequate for the increased flow.

Mailboxes and traffic signs removed during construction shall be installed in "like kind" and shall be considered incidental to the unit prices for work included in the bid schedule, provided they are not in the bid schedule.

The Contractor shall restore each individual work site to grades existing before construction work, including wheel ruts and other scarring.

Measurement and Payment: No separate payment will be made for restoration of items impacted by the Contractor's construction operation and the cost of these items shall be included in the unit bid prices in the bid schedule, unless specifically called out in the bid schedule as protection and restoration of property and landscape.

107.10 CONTRACTOR'S RESPONSIBILITY FOR WORK

ADD the following:

(A) The Director shall have the authority to suspend the work wholly or in part, for such period as he may deem necessary, due to unsuitable weather, or to such other conditions as are considered unfavorable for the suitable prosecution of the work, or for such time as he may deem necessary due to the failure on the part of the Contractor to carry out orders given, or to perform any provisions of the contract. The Contractor shall immediately comply with the written order of the Director to suspend work wholly or in part. The suspended work shall be resumed when conditions are favorable and methods are corrected, as reviewed and accepted in writing by the Director.

(B) In case of suspension of work for any cause whatsoever, the Contractor shall be responsible for all materials and shall properly store them if necessary and shall provide suitable drainage and erect temporary structures where necessary.

(C) If the performance of all or any portion of the work is suspended or delayed by the Director in writing for an unreasonable period of time (not originally anticipated, customary, or inherent to the construction industry) and the Contractor believes that additional compensation and/or contract time is due as a result of such suspension or delay, the Contractor shall submit to the Director, in writing, a request for an adjustment within 7 calendar days of receipt of the notice to resume work. The request shall set forth the reasons and support for such adjustment.

(D) Upon receipt, the Director will evaluate the Contractor's request. If the Director agrees that the cost and/or time required for the performance of the contract has increased as a result of such suspension and the suspension was caused by conditions beyond the control of and not the fault of the Contractor, its suppliers, or subcontractors at any approved tier, and not caused by weather, the Director will make an adjustment (excluding profit) and modify the contract in writing accordingly. The Contractor will be notified of the Director's determination whether or not an adjustment of the contract is warranted. In the event an adjustment of the contract is warranted a contract amendment shall be executed by both parties evidencing mutual agreement to same.

(E) No contract adjustment will be allowed unless the Contractor has submitted the request for adjustment within the time limits prescribed.

(F) No contract adjustment will be allowed under this clause to the extent that performance would have been suspended or delayed by any other cause, or for which an adjustment is provided or excluded under any other term or condition of this contract.

Add the following subsection to 107.13 Personal Liability of Public Officials:

107.13.1 Non-Responsibility of the City

Indebtedness incurred for any cause in connection with this work must be paid by the Contractor, and the City is hereby relieved at all times from any indebtedness or claim other than payments under terms of the contract.

ADD the following subsection to Section 107- Legal Regulations and Responsibility to Public:

107.15 PUBLIC RELATIONS

107.15.1 Public Notice

Unless otherwise directed, the Contractor shall issue written notification to those residents affected by the project. The notification shall contain, at a minimum: (1) Type of Work (2) Contractor Name, Phone Number and Point of Contact (3) Duration of Project (4) Date Project Commences (5) Description of the Project Site (6) Contractor's After-hours Point of Contact and Phone Number.

The Contractor is required to post public notification signs at all entrances to the project specifying the following information: (1) Project Name and Description (2) Construction Calendar (3) Contractor Name and Phone Number for both Day and Night (4) City Public Works (928) 777-1130.

The sign size and legend shall be appropriate for the intended purpose and be easily read. Sign background shall be blue with white letters. The sign size and legend content shall be approved by the Director prior to sign manufacture. All signs shall be posted prior to commencement of any work on the project. Signs will be removed by the Contractor upon final acceptance of the project. No direct payment shall be made for said signs. The cost of such signs shall be considered incidental to the project, unless otherwise noted.

107.15.2 Community Relations Organization

The Contractor shall be required to furnish a private telephone line to be used solely for receiving incoming calls from local citizens with questions or complaints concerning construction operations or procedures. The Contractor shall be required to publish this telephone number and maintain a 24 hour answering service. The answering service shall be manned by the Contractor's personnel during all hours during the course of construction that there is work being performed on the project. The Contractor shall maintain a log of incoming calls, responses, and action taken, which shall be submitted to the Engineer weekly and upon request.

The Contractor shall retain the services of a community relations organization for the project. The Contractor shall submit for approval, to the Engineer, the resume of the proposed community relations organization. Included in the resume shall be the names and credentials of the staff. The community relations organization shall be proactive and knowledgeable in the means and effectiveness of various notification techniques. The Engineer will rely on the organization's experience and suggestions in the presentation of information to the public. The Engineer will review the resume and possibly interview the organization. The Engineer will notify the Contractor within 10 calendar days of the acceptability of the community relations organization. Upon notification by the Engineer of an acceptable community relations organization, the Contractor shall hire the organization.

The community relations organization's activities shall include, but not necessarily be limited to:

- Printing and distribution of public notices
- Providing media news releases after review by the Engineer
- Planning and attending other public meetings as required by the Engineer
- Planning or otherwise participating in the dedication ceremonies as requested by the Engineer

- Possess the means for the development and fabrication of newsletters, notices, posters and demonstration boards
- Providing telephone "Hot Line" 24 hour service

The Contractor shall have a community relations organization on board prior to the preconstruction conference, a meeting in which the community relations organization will have an important participatory role.

The community relations organization shall develop a community relations program. The program shall include but not necessarily be limited to:

(A) Distributing a preconstruction information letter to all residents, businesses, schools and churches affected by the project or use of staging areas, and within an area determined by the Engineer, which shall contain, as a minimum, the following information:

- Name of contractor
- A 24 hour informational telephone number
- Brief description of project
- Names of project manager and superintendent (Contractor)
- Name of project engineer (Public Works Department)
- Construction schedule including anticipated work hours
- Traffic regulations including lane restrictions
- Time and place for the preconstruction conference. This notification shall be delivered a minimum of 5 working days prior to the meeting date.

(B) Holding a preconstruction community meeting with affected neighbors, businesses, schools, churches, etc., as directed by the Engineer.

(C) Scheduling and conducting progress meetings, as required, with the affected business tenants and property owners, as directed by the Engineer.

(D) Printing and mailing of public notices and/or newsletters, including a list of the names, addresses and receipt of postage or delivery for recipients of these newsletters and/or notifications.

(E) Holding other public meetings, as required by the Engineer.

(F) The community relations organization shall use the means (Items A through E) or others to inform the local citizens of operations which may create changes to the norm such as high noise levels, road closures, limited access, haul routes, changes to material delivery routes, unusual hours of construction, disruption of bus routes or changes to other passenger delivery/pick-up routes.

(G) Newsletters shall be distributed each month. A final draft shall be submitted to the Engineer for review and approval at least 2 days before the planned distribution. Each distribution area shall be approved by the Engineer. Each distribution shall include 1 electronic copy and 12 hard copies for the Engineer.

(H) The community relations organization shall keep daily personnel time logs which shall include the name of the employee, date of work, amount of time worked, description of work performed and project number.

Measurement and Payment: The bid schedule includes an allowance for public relations for the purpose of encumbering funds to cover the cost of public relation services. The amount of the allowance is determined

by the Engineer and is not subject to individual bid pricing. All bidders shall incorporate the amount pre-entered in the bid proposal and shall reflect the same in the total bid for the project.

It shall be understood that this allowance item is an estimate only. The allowance shall not be used without approval of the Engineer, and in no case shall exceed the allowance.

Reimbursement for public relations shall be based on the community relations organization invoice cost, plus an allowable markup to the prime Contractor of 15 percent, for those services approved by the Engineer.

107.15.3 Publicity Releases

The Contractor and the Contractor's subcontractors and suppliers, if any, shall not reveal to others through literature, brochures, or other types of publicity releases any information regarding the work or the Contractor's activities or participation on the project without prior written approval from the Director. Any and all jobsite photographs taken by the Contractor, subcontractor or others must be processed in duplicate form with copies provided to the Director. No project photographs shall be released to others without prior written approval of the Director.

ADD the following subsection to Section 107- Legal Regulations and Responsibility to Public:

107.16 STORMWATER POLLUTION PREVENTION PLAN (SWPPP)

The project is subject to the Arizona Pollutant Discharge Elimination System (AZPDES) stormwater requirements for construction sites under the Environmental Protection Agency (EPA) delegation to ADEQ for the Construction General Permit for Arizona. The following specifications shall apply:

(A) General Requirements

The Contractor shall comply with AZPDES stormwater requirements for construction sites under the ADEQ Construction General Permit for Arizona. Under provisions of that permit, the Contractor shall be designated as permittee and shall be responsible for providing the necessary labor and materials, and for taking the appropriate measures to assure compliance with the AZPDES Construction General Permit for Arizona as well as other Federal, State and local requirements pertaining to stormwater discharges. As the permittee, the Contractor is responsible for completing, in a manner acceptable to ADEQ, all documents required by this regulation including the following:

(1) The SWPPP shall be sealed by a professional engineer licensed in the State of Arizona.

(2) The SWPPP for the project including certification form. The Contractor will be required to update and revise the SWPPP as necessary throughout the construction of the project in order to assure compliance with ADEQ permit requirements. The completed SWPPP shall be kept on the project site at all times during construction of the project.

(3) Notice of Intent (NOI) to be covered by AZPDES Construction General Permit for Arizona including certification of signature.

(4) Notice of Termination (NOT) of coverage under AZPDES Construction General Permit for Arizona (upon project completion).

ADEQ's website http://www.azdeq.gov/node/524 provides guidance for NOI submittal and SWPPP templates.

(B) Submittals

(1) Preliminary copies of the NOI and SWPPP shall be submitted to the Engineer at the time of the preconstruction conference. Any necessary revisions to the SWPPP shall be subject to review by the Engineer, before submitting to ADEQ.

(2) The Contractor shall submit completed, signed NOI forms to ADEQ at least 48 hours prior to the initial start of construction on the project. The completed, signed NOI form shall be submitted to ADEQ.

(3) Failure by the Contractor (or any of its appropriate subcontractors) to submit the NOI forms within the required time frame shall result in delay of the start of construction. Any delay resulting from the Contractor failing to fulfill these requirements shall not extend the completion date of the contract unless authorized by the City. The Contractor shall submit a completed copy of the NOI prior to Notice to Proceed. A copy of the completed NOI shall be posted on the construction site and a copy of the SWPPP shall be kept on the construction site.

(C) Contractor Responsibilities

(1) It is the Contractor's responsibility to perform inspection of all stormwater pollution control devices on the project as required under the AZPDES Construction General Permit for Arizona.

The Contractor shall prepare reports on these inspections and retain these reports for a period of 3 years following project completion as required under the AZPDES Construction General Permit for Arizona. Inspection reports shall be submitted monthly to the contracting agency along with payment requests. The Contractor shall maintain all stormwater pollution control devices on the project in proper working order, including cleaning and/or repair during the duration of the project.

(2) No condition of either the AZPDES Construction General Permit for Arizona or the SWPPP shall release the Contractor from any responsibilities or requirements under other environmental statutes and regulations.

(D) Upon total project completion, acceptance, and de-mobilization, the Contractor shall submit a completed, signed NOT form to ADEQ with copies to the same agencies who received copies of the NOI, thereby terminating all AZPDES permit coverage for the project.

Measurement and Payment: Payment shall be at the lump sum unit price bid in the contract documents for all material, labor, and other incidental costs relating to the provision, installation, and maintenance of items relating to this permit during project construction. Such incidental costs shall include the Contractor's costs in order to assure proper operation of the pollution-control devices installed including all maintenance, cleaning, and disposal costs associated with clean-up and repair following storm events or other runoff or releases on the project.

SECTION 108: COMMENCEMENT, PROSECUTION AND PROGRESS

108.1 NOTICE TO PROCEED

ADD the following to item (A):

(1) The Contractor shall not work on any part of the project or incur any expenses or obligations until a Notice to Proceed has been issued by the City.

(2) The Notice to Proceed will be delivered to the Contractor by first class mail, electronically and/or delivered in person.

108.2 SUBLETTING OF CONTRACT

REMOVE item (E) in its entirety and REPLACE with the following:

(E) The Contractor shall perform more than 40 percent of the dollar value of the work (by total contract amount) involved in the project with the Contractor's own forces. Total subcontracted amounts shall be limited to less than 60 percent of the dollar value of the work (by the total contract amount). For purposes of this requirement, materials purchased directly from suppliers and installed by the Contractor's own forces shall be included in the Contractor's total and materials installed by subcontractors, regardless of who originally purchased them, will be included in the subcontractor's totals.

ADD the following:

(F) All subcontractors and purchase orders for equipment shall state and establish guaranteed delivery dates, at such times as determined by the Contractor, which will allow the Contractor to complete the project within the contract time.

(G) The Contractor shall furnish the Subcontractors List form with the Contractor's bid including the estimated amount of each subcontract. Additionally, a duplicate copy of each subcontract, including lower tier subcontracts, shall be delivered to the Director upon award of the project and prior to the issuance of the Notice to Proceed.

108.4 CONTRACTOR'S CONSTRUCTION SCHEDULE

ADD the following:

At the preconstruction conference the Contractor shall submit for review by the Engineer a complete construction schedule. The Engineer reserves the right to reject construction schedule submittals when in the Engineer's opinion the schedule lacks the proper detail. It shall be the responsibility of the Contractor to maintain overall coordination of the project. Based on the general contract construction schedule prepared in accordance with these specifications, the Contractor shall obtain from each of the Contractor's subcontractors a similar schedule and shall be responsible for all parties maintaining these schedules or for coordinating changes necessitated by unforeseen difficulties.

(A) The construction schedule shall indicate the time of starting and completing each major phase of the project and such intermediate phases as will serve for well-defined control points. The schedule shall be of sufficient detail to define the critical path for project completion. It shall also indicate the scheduled receipt of major items of equipment and the items of equipment installation dates of which is critical to the scheduled progress of the project. Two week look-ahead schedules will be provided by the Contractor at each weekly construction meeting. The comprehensive project schedule shall be updated and submitted monthly. Such updates shall include and accurately reflect additional work, changes in the work, delays to individual items of work and reasons therefore along with the extent of delay and any other items affecting the progress of the project.

(B) Failure by the Contractor to provide the weekly and monthly updates will result in the City withholding an amount equal to 5 percent of the monthly pay estimate relative to the billing period in which the schedule updates are to be provided. Said 5 percent withholding will be retained by the City until the required schedule updates are submitted by the Contractor, reviewed by the City and found to be current. When the schedule updates are determined to be in conformance with the provisions herein the 5 percent retainer will be released with the next monthly payment.

(C) The construction schedule shall serve as an index of progress prosecution as contemplated by the Contractor. In the event the actual construction progress varies substantially from the scheduled progress, the

Engineer will require and the Contractor shall be required, within 10 calendar days written notice, to provide a revised construction schedule, giving in detail the particular changes in production as estimated by the Contractor to complete the work within the specified contract time. Time is of the essence in this regard.

ADD the following subsection to 108.4 Contractor's Construction Schedule:

108.4.1 Project Meetings

(A) It shall be the responsibility of the Contractor to conduct weekly meetings to be attended by representatives of subcontractors, utilities, the City and other interested parties for the purpose of keeping the project on schedule and to provide for necessary coordination of the work of the various parties. The Contractor shall take minutes at each meeting for distribution to all attendees the following week. The minutes shall be of sufficient detail to accurately recount the meeting discussion, including but not limited to progress, work schedule, submittals and certifications, utilities, construction issues, contract changes, safety and traffic control, action items, and resolved and unresolved issues.

(B) Additionally the Contractor shall furnish the Director with written weekly project status reports at the beginning of each weekly project meeting. The report shall cover the work of the preceding work week and shall include the following for each week:

(1) A comprehensive daily list of the Contractor's men and equipment performing the work on the jobsite.

(2) A comprehensive daily list of the Contractor's subcontractor's men and equipment, if any, performing the work on the jobsite.

(3) A brief description of the work performed by the Contractor and Contractor's subcontractors, if any.

(4) The estimated percentage of each portion of the work performed for the period together with the total percentage of each portion of the work performed to the date of the report.

(5) A detailed summary of each work stoppage, if any, occasioned by the City, other contractors, or other designated reasons, which were beyond the Contractor's control.

(6) Comments or exceptions to prior weekly meeting minutes shall be addressed at each subsequent construction meeting.

108.7 DETERMINATION AND EXTENSION OF CONTRACT TIME

ADD the following:

It is the Contractor's responsibility to establish construction methods and a construction schedule, which will facilitate the completion of work required by this contract within the contract period and with full consideration for the season during which the work is scheduled. Judgment as to hazardous conditions shall be made by the Director.

To receive consideration for an extension of time, a request must be made in writing to the Director stating the reason for said request, and such request must be received by the Director as soon as reasonably practicable when the Contractor has knowledge or should have known of the delay causing event, condition or circumstances, but in no event later than immediately following the end of the delay-causing condition. The extension of time allowed shall be as determined by the Director and approved by the City. In setting the contract time, it has been assumed that up to 5 working days may be lost as a result of weather conditions which will slow down the normal progress of work; therefore no extensions in contract time will be allowed for the first 5 working days lost due to bad weather conditions. An extension of time may be granted by the City after the expiration of the time originally fixed in the contract or as previously extended, and the extension so granted shall be deemed to commence and be effective from the date of such expiration.

Any extension of time shall not release the sureties upon any bond required under the contract. Extensions of time in and of themselves will not be a basis for a request of additional compensation by the Contractor.

Any delays in the project, or extensions of time which may be granted, shall not entitle the Contractor to any additional compensation or monies whatsoever, including but not limited to compensation for loss of anticipated profits, extended overhead, unabsorbed home office overhead, or any other payments, unless expressly agreed to by the City in a duly executed and approved contract amendment.

108.8 GUARANTEE AND WARRANTY PROVISIONS

REMOVE the first paragraph in its entirety and REPLACE with the following:

The Contractor shall guarantee the work against defective workmanship and materials for a period of 2 years from the date of its final acceptance under the contract, ordinary wear and tear and unusual abuse or neglect excepted.

During the 2 year guarantee period, should the Contractor fail to remedy defective material and/or workmanship, or to make replacements within 5 calendar days after written notice by the City, it is agreed that the City may make such repairs and replacements and the actual cost of the required labor and materials shall be chargeable to and payable by the Contractor.

108.10 FORFEITURE AND DEFAULT ON CONTRACT

ADD the following:

In accordance with Section 109 of these specifications, if the Contractor fails, neglects, or refuses to perform work tasks necessary for the completion of the total job; replace defective work; to repair or resurface, in a manner that is acceptable to the City and Engineer, public right-of-ways disturbed by the Contractor's work which are a nuisance, hazard, impedes or endangers vehicular traffic and the public; the City may serve written notice upon the Contractor of its intention to have the work performed by others. Unless, within 3 calendar days after the service of such notice, the Contractor has made such arrangement and scheduled the accomplishment of said work tasks to the satisfaction of the City and Engineer, the City will proceed to have the work accomplished by others or by itself and deduct the costs thereof from amounts due to the Contractor.

The foregoing provisions are in addition to and not in limitation of any other rights or remedies available to the City.

108.11 TERMINATION OF CONTRACT

ADD the following:

The foregoing provisions are in addition to and not in limitation of any other rights or remedies available to the City.

SECTION 109: MEASUREMENTS AND PAYMENTS

109.2 SCOPE OF PAYMENT

ADD the following:

The Contractor shall maintain any and all documentation to substantiate all costs on the project, including but not limited to those items included in force account computations, computations reflecting the actual cost of work on the project and computations substantiating any claimed increases or additional costs incurred in the project by the Contractor, and shall make those records available to the City (or provide copies thereof to the City) within 24 hours of request by the City. The failure of the Contractor to maintain and produce the foregoing documentation will preclude the Contractor from being entitled to any additional payments for any additional work in question.

109.4 COMPENSATION FOR ALTERATION OF WORK

ADD the following:

New or additional work will be classed as extra work when determined by the Director that such work is not covered by the contract.

The value of such work or change shall be determined and paid for with a contract amendment in one of the following ways according to the contract amendment procedure set down by the Public Works Department, and at the option of the City:

(A) As may be mutually agreed upon by the City and the Contractor.

(B) By unit prices in accordance with the Contractor's bid.

(C) By lump sum based upon the Contractor's estimate and the Director's review and acceptance of the estimate.

(D) By force account in accordance with the requirements of that section.

(E) The Contractor shall do such extra work and furnish material and equipment therefore upon receipt of an accepted contract amendment or other written order of the Director. In no case shall work be undertaken without written notice from the Director to proceed with the work. In absence of such contract amendment or other written order of the Director, the Contractor shall not be entitled to payment for any extra work. All contract amendments must be approved by the Director. Contract amendments over $25,000.00 must be approved by City Council.

(F) In the event that the Contractor and the City cannot agree on the compensation to be paid to the Contractor prior to the issuance of a contract amendment, then and in that event the City has the option of terminating the contract with the Contractor or directing the Contractor to proceed and to receive compensation pursuant to the force account provisions herein. In the event that this contract is terminated by the City pursuant to this subsection, the Contractor shall only be paid for those services performed to date of the City's Notice of Termination, said payment to be based upon the unit prices as set forth in the Contractor's bid. In no event shall the Contractor be entitled to additional compensation for lost profits, mobilization or de-mobilization costs, loss of anticipated profits, extended overhead, unabsorbed home office overhead, or any other payments other than for work actually performed as based upon unit prices. In the event that there are no unit prices pertaining to work in question, then and in that event the Contractor's compensation for early termination pursuant to this subsection shall be based upon force account as here-in-before described.

(G) It is expressly agreed that in the event of a contract amendment, any compensation due the Contractor shall be set forth in the contract amendment, and shall be considered full and complete payment (if any) for any and all work related costs, including but not limited to labor, materials, equipment, supervision, field office overhead, extended home office overhead, unabsorbed home office overhead, taxes, bonds, insurance and profits. Additionally, the Contractor shall not be entitled to any additional compensation based upon a contract amendment (or the accumulation of contract amendments) unless specifically set forth in that contract amendment.

(H) In the event that the Contractor submits a proposed contract amendment, the Director shall have 10 days after receipt of the Contractor's written proposed contract amendment to either accept or agree to the contract amendment under the above provisions or deny such proposed contract amendment. If necessary to assess the proper purpose and function of a Contractor's proposed contract amendment, because of the proposed contract amendment's complexity or scope, the Director may either accept and agree to the contract amendment of deny such proposed contract amendment under the above provisions beyond such 10 day period and for an additional reasonable period commensurate with the nature of the proposed contract amendment. The failure of any party to take any action within the time periods or in the manner specified in the subparagraph shall be deemed a waiver of that party's right to recover for such delay in acting.

109.5 ACTUAL COST WORK

ADD the following:

The basis of payment for construction of the project shall be unit prices for all work actually performed in accordance with the specifications and scope of work, and shall include all labor and materials incorporated in the completed work.

Upon final inspection and acceptance of the work, the City will pay the Contractor the amount earned under the Contract, as provided herein.

ADD the following subsection to 109.5 Actual Cost Work:

109.5.8 Force Account

The compensation for force account work performed by the Contractor shall be approved by the Director in the following manner:

(A) Labor: The Contractor shall provide monthly certified payroll reports for all labor and for foremen in direct charge of the specific operations. The Contractor will be compensated as follows:

(1) The actual cost of wages paid by him but at rates not to exceed those for comparable labor currently employed on the project as determined by the Director.

(2) The actual cost of social security taxes and unemployment compensation insurance. There will be no payment for fringe benefits unless mandated by Federal law on federally funded projects.

(3) An amount equal to 15 percent of the actual cost of wages and other costs listed above to cover the Contractor's profit and overhead.

(4) In case work is performed by a subcontractor, the said 15 percent will be added only once to the actual cost of the work, however, the Contractor may add 5 percent to the subcontractor's price to cover the Contractor's own overhead and supervision.

(B) Tools and Equipment: For any special or heavy equipment, the use of which has been authorized by the Director, except for small tools and manual equipment, the Contractor shall be reimbursed the actual cost of rental, not to exceed the latest Rental Rate Blue Book for Construction Equipment. In the event that any of the equipment to be used is not shown in said schedule, the rental rate for such equipment shall be as agreed upon in writing before the work is started. No percentage shall be added to equipment rental rates. In the event said special or heavy equipment is owned by the Contractor, he shall be compensated only for the actual hours said equipment is required for the work under force account on the job site, at a rate not to exceed the latest Rental Rate Blue Book for Construction Equipment.

(C) Materials: For all materials accepted by the Director and used in the work the Contractor shall be paid the actual cost of such material, including transportation charges, to which cost shall be added a sum equal to 15 percent thereof.

(D) Supervision Overhead and Home Office Overhead: No allowance shall be made for general superintendence. The cost of supervision and all overhead is presumed to be included in the 15 percent added in accordance with the above.

(E) Records: The Contractor's representative and the Director shall compare the records of the work performed as ordered on a force account basis at the end of each day on which such work is performed. Copies of these records shall be made on suitable forms provide for this purpose and signed by both the Director and the Contractor's representative. All claims for work done on a force account basis shall be certified and submitted to the Director by the Contractor, and such statements shall be filed with the Director not later than the fifth day of the month following that in which the work was actually performed.

(F) Bonds and Insurance: The Contractor shall be paid the actual cost for additional bonding and insurance pertaining to force account work when the Contractor can provide evidence of additional payment for premiums on required payment and performance bonds. No duplication of payment for Contractor's costs associated with labor costs above will be allowed.

(G) The Director authorized representative is in charge of force account work and has the authority to direct which labor and equipment will be used, to suspend operations, and to refuse to pay for any labor or equipment, which he feels is not doing productive work.

109.7 PAYMENT FOR BOND ISSUE AND BUDGET PROJECTS

ADD the following:

For and in consideration of the faithful performance of the work, the City will pay to the Contractor the amount earned less retention as computed from the actual quantities of work performed under the contract and to make such payment in the manner and at the time(s) specified herein.

ADD the following to the third paragraph of item (A):

The Contractor shall obtain approval from the City prior to reducing the percentage of funds retained and prior to requesting the release of one-half the previous retained amount.

ADD the following to item (A) (1):

(a) Once each month, the Inspector and the Contractor's Superintendent shall meet, or as necessary, to jointly measure all work items under the contract to determine pay quantities for each pay period. Quantities of work items shall be documented on the respective plan sheets and separately in tabular fashion with station to station measurements noted to assure there is no duplication of payment for work performed. Measurements will be for work actually completed. No projections for expected completion of work will be allowed.

(b) The Contractor shall submit partial payment requests in a format approved by Public Works together with the City's Pay Request Application and Certification for Payment (form provided by Public Works) or equal, subject to approval by the Director.

(c) The Contractor shall furnish a detailed breakdown showing unit prices and quantities for use in preparing the monthly estimate. No partial payment will be made until this breakdown is presented by the Contractor and has been reviewed and accepted by the Director. Green-lined plan sheets shall be submitted with each monthly pay request illustrating the line item quantities constructed for the period. The green-lined plan sheets and pay estimate spreadsheets must reconcile with one another**.**

(d) Partial payments for stored materials may be considered by the Director, if it is determined to be in the best interest of the City. The Contractor shall not rely on payment for stored materials being approved in the preparation of the project bid.

REMOVE the first paragraph of item (B) in its entirety and REPLACE with the following:

(B) Final Payment: When the project has been accepted as provided in Section 105 of these specifications, and within 30 calendar days after final inspection of the work completed under the contract, the Contractor shall render to the City a final estimate, which shall show the amount of work performed and accepted under the contract. All prior estimates and partial payments will be subject to correction in the final estimate for payment.

ADD the following to the second paragraph of item (B):

(See the Contractor's Affidavit Regarding Settlement of Claims and Certification of Completion of Warranties within the contract documents.) Additionally, the Contractor shall furnish lien waivers for all completed labor and materials consumed during the project.

Prior to the final payment to the Contractor, the City shall deduct therefrom any and all unpaid privilege, license and other taxes, fees and any and all other unpaid moneys due the City from the Contractor, and shall apply to those moneys to the appropriate account. The Contractor shall provide to the City any information necessary to determine the total amount(s) due. The quantities appearing in the bidding schedule are approximate only, and are prepared for the comparison of bids. Payment to the Contractor will be made only by actual quantities of work performed and accepted in accordance with the requirements of the contract. Only the items listed in the bidding schedule are pay items. The scheduled quantities of work to be done and materials to be furnished may each be increased, decreased or omitted.

Final project as-built plans shall verify line item quantities constructed for the project by individual plan sheet. The Contractor shall submit final payment request in a format approved by the City.

109.10 PAYMENT FOR MOBILIZATION/DEMOBILIZATION

REMOVE in its entirety and REPLACE with the following:

The Agency will compensate the Contractor for a single round trip mobilization/demobilization of the Contractor's personnel, equipment, supplies and incidentals, including establishment of offices, buildings and other facilities required for the performance of the work on the project, as well as preparatory work and operations prior to the commencement of the work on the project site.

Measurement and Payment: Mobilization will be measured for payment by the lump sum bid as a single complete unit of work. Payment for mobilization will be made as provided herein which shall be full compensation for supplying and furnishing all materials, facilities, and services and performing all the work involved as specified above. The total amount allowed for mobilization during the life of the contract shall not exceed 9 percent of the original contract amount. If the bid price exceeds this percentage the excess amount will be paid to the Contractor upon completion of the contract and 9 percent of the contract amount shall be used to determine partial payments. Partial payments under this item will be made in accordance with the following provisions:

(1) The first payment of 1/3 of the lump sum price for mobilization may be made provided that all submissions required under this section and as otherwise noted in the contract documents are submitted by the Contractor at the preconstruction conference to the satisfaction of the Engineer and when the Engineer has determined that a significant amount of equipment has been mobilized to the project site which will be used to perform portions of the project work.

(2) The second payment of 1/3 of the lump sum price for mobilization shall be made on the first estimate following completion of 13 percent of the contract.

(3) The third payment of 1/3 of the lump sum price for mobilization will be made on the first estimate following completion of 26 percent of the contract.

ADD the following subsection to Section 109- Measurements and Payments:

109.11 CONTRACT ALLOWANCE

(A) Contract allowance items are provided for the purpose of encumbering funds to cover the costs of possible contract amendment work. The amount of the allowance item is determined by the Engineer and is not subject to individual bid pricing. All bidders shall incorporate the amount pre-entered in the bid proposal and shall reflect the same in the total amount bid for the project.

(B) This allowance item provides an estimated funding to cover unforeseen changes that may be encountered and corresponding extra work needed to complete the contract per plan. Unforeseen extra work, if any, shall be in accordance with MAG Specification and COP Supplement 109.4.

(C) It shall be understood that this allowance item is an estimate only and is based on contract amendment history of similar projects. It shall not be utilized without an approved contract amendment. It is further understood that authorized extra work, if any, may be less than the allowance item. The Contractor, by submittal of a bid, acknowledges that the total bid and individual bid items were prepared without anticipation of use of the contract allowance.

SECTION 110: NOTIFICATION OF CHANGED CONDITIONS AND DISPUTE RESOLUTION

110.2.2 Dispute Resolution

REMOVE the first paragraph of item (A) and REPLACE with the following:

(A) The Contractor shall provide in writing the following information to the Engineer. In providing the information required by this section, the Contractor shall provide specific factual detail as to each item and show the methods of calculating each item.

110.3.1 General

ADD the following:

Level I shall mean the Public Works Project Manager as appointed by the Public Works Director

Level II shall mean the Public Works City Engineer as appointed by the Public Works Director

Level III shall mean the Public Works Director

In the event of litigation, the parties hereby agree to submit to a trial before the court. The Contractor further agrees that this provision shall be contained in all subcontracts related to the project, which is the subject of this agreement.

The parties hereto expressly covenant and agree that in the event of litigation arising from this agreement, neither party shall be entitled to an award of attorney fees, either pursuant to the contract, pursuant to A.R.S. §

12-341.01 (A) and (B), or pursuant to any other State or Federal statute. The Contractor further agrees that this provision shall be contained in all subcontracts related to the project that is the subject of this agreement.

110.4 ARBITRATION

REMOVE the last sentence of the first paragraph in its entirety and REPLACE with the following:

The arbitration of claims shall be conducted either in Prescott or Phoenix, Arizona as agreed to by the parties, or if the parties cannot agree, to be determined by the arbitrator, taking into consideration the convenience and costs to the parties and their witnesses.

REMOVE the last paragraph in its entirety and REPLACE with the following:

The decision or award of the arbitrator shall be supported by substantial evidence and, in writing, contain the basis for the decision or award and findings of fact. The decision or award of the arbitrator shall be nonbinding.

Any resolution of a dispute in accordance with MAG Specification and COP Supplement 110 and the contract which causes the contract amount to be exceeded by $25,000.00 or more shall not be final until approved by the City Council.

PART 200 – EARTHWORK

ADD the following section to Part 200- Earthwork:

SECTION 200: DEWATERING AND BYPASS PUMPING

200.1 DEWATERING

(A) All water encountered during the work shall be disposed of by the Contractor in a manner such that it will not damage public or private property or create a public nuisance or health problem. The Contractor shall submit drawings and complete design data showing methods and equipment he proposes to utilize in dewatering prior to completing any dewatering work. This work shall consist of obtaining permits, furnishing equipment, materials, and labor necessary for the control and removal of water, the construction or installation of all facilities necessary to accomplish the work, and the subsequent removal of such facilities except when designated on the project plans or in the special provisions to remain in place.

(B) The Contractor shall keep, where appropriate, the rehabilitated pipe section free from water during rehabilitation. If groundwater is present in any excavation, the static groundwater level shall be drawn down a minimum of 1 foot below the bottom of excavations to maintain the undisturbed state of natural soils and allow the placement of any fill to the specified density. Disposal of water shall not damage property or create a public nuisance. The Contractor shall have on hand pumping equipment and machinery in good working condition for emergencies and shall have workmen available for its operation. Dewatering systems shall operate continuously until backfill has been completed to 1 foot above the normal static groundwater level.

Groundwater shall be controlled to prevent softening of the bottom of excavations, or formation of "quick" conditions. Dewatering systems shall not remove natural soils. The Contractor shall control surface runoff to prevent entry or collection of water in excavations.

Release of groundwater to its static level shall be controlled to prevent disturbance of the natural foundation soils or compacted fill and to prevent flotation or movement of structures or pipelines.

Measurement and Payment: No separate measurement or payment shall be made for dewatering. This work shall be considered incidental and included in the unit price bid for construction or installation of the appropriate contract pay items.

200.2 BYPASS PUMPING

(A) Description

(1) Scope: This section specifies the requirements for temporary bypass pumping of sewers

(2) Requirements

(a) The Contractor shall provide labor, materials, and supervision to temporarily bypass flow around the Contractor's work.

(b) The Contractor shall have the entire bypassing system in place and tested before bypassing any sewage.

(3) At the preconstruction conference, the Contractor shall submit drawings and complete design data showing methods and equipment he proposes to utilize in sewer bypassing for approval by the Engineer. The submittal shall include the following information:

(a) Drawings indicating the location of temporary sewer plugs and bypass discharge lines

(b) Capacities of pumps, prime movers, and standby equipment

(c) Design calculations providing adequacy of the system and selected equipment

(d) Standby power source

(e) Staffing plan

(f) Traffic control plan

(4) Flow Data: It is the responsibility of the Contractor for design, construction, and operation of an adequate and properly functioning bypass. It is also the responsibility of the Contractor to coordinate with the City to gather flow data.

(5) Protection: In areas where flows are bypassed, all bypass flow shall be discharged as approved by the Engineer. No bypassing to the ground surface, receiving waters, storm drains or bypassing which results in groundwater contamination or potential health hazards shall be permitted.

(6) Scheduling: The bypass system shall not be shut down between shifts, on holidays or weekends, or during work stoppages without written permission from the Engineer. Public advisory services will be required to notify all parties whose service laterals will be out of service and to advise against water usage until the main line is back in service.

(B) Materials

(1) The Contractor shall provide temporary pumps, conduits and other equipment to bypass the sewer flow. The Contractor shall furnish the necessary labor and supervision to set up and operate the pumping and bypass system. Engines shall be equipped with mufflers and/or enclosed to keep the noise level less than 50dB or 10dB above ambient noise levels when measured at the property line closest to the noise source. Pumps and bypass lines shall be of adequate capacity and size to handle the flows.

(2) The Contractor shall maintain on site sufficient equipment and materials to ensure continuous and successful operation of the bypass systems. Standby pumps shall be fueled and operational at all times. The Contractor shall maintain on site a sufficient number of valves, tees, elbows, connections, tools, sewer plugs, piping and other parts or system hardware to ensure immediate repair or modification to any part of the system as necessary.

(3) All piping, joints and accessories shall be designed to withstand at least twice the maximum system pressure, or 50 psi, whichever is greater. All hoses/pipes used for bypass pumping shall be ramped to allow for the ease of vehicular and pedestrian traffic. All hoses/pipes shall be color-coded for identification to prevent cross contamination of water and wastewater lines. Hose/pipes used for wastewater conveyance shall not be used for water conveyance.

(C) General

(1) During bypass pumping, sewage shall not be leaked, dumped or spilled outside the sewer system. When bypass pumping operations are complete, all piping shall be drained into the sanitary sewer prior to disassembly. In the event that sewage accidentally drains into the storm drainage system or the street, the Contractor shall immediately stop the overflow, notify the City and take the necessary action to clean up and disinfect the spillage to the satisfaction of the City. The Contractor shall submit an emergency spillage and cleanup action plan for all sewage spills to the Engineer for approval prior to beginning construction. It shall include but not be limited to a remediation plan that indicates what labor, equipment and resources will be used to restore the site to the condition prior to the spillage.

(2) The Contractor shall repair without cost to the City any damage that may result from this negligence, inadequate or improper installation, maintenance and operation of bypassing system including mechanical or electrical failures, regulatory infractions and penalties resulting from sewer spillage.

(D) Flow Control

(1) Complete stoppage or bypassing of flow is required during sewer line and manhole rehabilitation work.

(2) When the depth of flow at the upstream manhole of the sewer line section being worked is above the maximum allowable for television inspection, the flow shall be reduced to the level shown below by plugging or blocking of the flow, or by pumping and bypassing of the flow as specified.

(3) Plugging or Blocking: A sewer line plug shall be inserted into the line upstream of the section being worked. The plug shall be so designed that all or any portion of the sewage can be released. During TV inspection, flow shall be reduced to within the limits specified above. After the work has been completed, flow shall be restored to normal. Precautions shall be taken to prevent flooding damage. See flow precautions below.

(4) Pumping and Bypassing: When pumping and bypassing is required the Contractor shall supply the pumps, conduits and other equipment to divert the flow of sewage around the manhole section in which work is to be performed. The bypass system shall be of sufficient capacity to handle existing flow plus additional flow that may occur during peak flow periods or from precipitation and shall be constructed of such material that will prevent leakage during the pumping operation. The Contractor will be responsible for furnishing the necessary labor and supervision to set up and operate the pumping and bypassing systems. All pump drivers shall have noise suppressor exhaust systems to reduce noise levels to less than 50dB, or 10dB above ambient noise levels, when measured at the closest property line.

(5) Flow Control Precautions: When flow in a sewer line is plugged, blocked or bypassed; sufficient precautions must be taken to protect the sewer lines from damage that might result from sewer surcharging. Further, precautions must be taken to ensure that sewer flow control operations

do not cause flooding or damage to public or private property being served by the sewer involved. All piping(s), joints and accessories shall be designed to withstand at least twice the maximum system pressure or a minimum of 50 psi whichever is greater. During by-pass pumping sewage shall not be leaked, dumped or spilled onto any area outside the sewer system. When bypass pumping operations are complete all piping shall be drained into the sanitary sewer prior to disassembly. In the event sewage accidentally drains into the drainage system or street, the Contractor shall immediately stop the overflow, notify the Engineer and take the necessary action to clean up and disinfect the spillage to the satisfaction of the Engineer. If sewage is spilled onto public or private property, the Contractor shall wash down, clean up and disinfect the spillage to the satisfaction of the City. The Contractor shall report any and all overflows to the City.

(E) Measurement and Payment: Payment for bypass pumping shall be made at the lump sum bid by the Contractor.

SECTION 201: CLEARING AND GRUBBING

201.1 DESCRIPTION

REMOVE in its entirety and REPLACE with the following:

This work shall consist of removing objectionable material from the right-of-way, easements, all areas to be graded, and such other areas as may be specified in the special provisions. Clearing and grubbing shall be performed in advance of grading operations.

201.3 CONSTRUCTION METHODS

REMOVE the second paragraph in its entirety and REPLACE with the following:

All trees and shrubs found suitable for improvement and beautification, which will not interfere with excavation or embankment or cause disintegration of the improvements shall not be disturbed. In any event, the Contractor shall avoid injury to shrubbery, vines, plants, grasses and other vegetation growing outside of the clearing limits. The dragging and the piling of materials of various kinds and the performing of other work which may be injurious to vegetation shall be confined to areas which have no vegetation or which will be covered by embankment or disturbed by excavation during grading operations.

REMOVE the fourth paragraph in its entirety and REPLACE with the following:

From excavated areas, all stumps, roots and other obstructions 3 inches or over in diameter shall be grubbed to a depth of not less than 24 inches below finish grade.

REMOVE Table 201-1 in its entirety and REPLACE with the following:

TABLE 201-1	
EMBANKMENT CLEARING AND GRUBBING	
Height of Embankment Over Stump	**Height of Clearing and Grubbing**
0 Feet to 2 Feet	All stumps or roots 6 inches or over in diameter shall be grubbed to 24 inches below original grade. All others shall be cut flush with the ground.
2 Feet to 3 Feet	All stumps 1 foot and over in diameter shall be grubbed to 24 inches below original grade. All others shall be cut flush with the ground.
Over 3 Feet	All stumps shall be cut flush with the ground.

REMOVE the last paragraph in its entirety and REPLACE with the following:

All tree trunks, stumps, brush, limbs, roots, vegetation and other debris removed in clearing and grubbing shall be completely removed from the project and properly disposed of.

SECTION 205: ROADWAY EXCAVATION

ADD the following subsection to 205.1 Description:

205.1.1 General

The bidding schedule quantities for this item of work will be considered to be the final quantities for payment. Adjustments in the bidding schedule quantities for roadway excavation as contained in these specifications may be initiated by the Contractor or the Engineer if evidence indicates that the required quantity varies by an amount greater than 5 percent of the bidding schedule quantity. The Contractor shall advise the Engineer, in writing, submitting evidence in the form of a construction survey or photogrammetric survey with measurement for the proposed adjustment and requesting an adjustment in quantities. The Engineer will determine the amount of adjustment, if any. The quantity upon which payment will be based will be the bidding schedule quantity plus or minus only that portion of the adjustment that exceeds 5 percent of the bidding schedule quantity.

Variations caused by shrink/swell of materials shall not be considered for quantity adjustments.

Adjustments in roadway excavation quantities due to revisions ordered by the Engineer will be isolated by measurement or calculations. The bidding schedule quantities will be adjusted by the amount either measured or calculated, regardless of the 5 percent variation requirement above.

205.2 UNSUITABLE MATERIAL

REMOVE the third paragraph in its entirety and REPLACE with the following:

If material is encountered during excavation that the Engineer determines to be unsuitable, the following shall apply:

(1) Any unsuitable material which is located in a cut section at an elevation above finished subgrade shall not be utilized in construction but shall be removed and disposed of at a site secured by the Contractor. The cost of excavation, hauling and disposal are incidental to roadway excavation. No additional compensation will be allowed for any unsuitable materials found in a cut section at an elevation above finished subgrade.

(2) Material which is located below the finished subgrade elevation in excavation areas shall be removed to the limits as determined by the Engineer and the resultant cavity backfilled with aggregate base course (ABC) in accordance with Section 310 of these specifications. The costs of the removal, hauling, disposal, backfill material, placement and any related process, shall be included in the payment for this bid item.

205.6 SURPLUS MATERIAL

REMOVE the first paragraph in its entirety and REPLACE with the following:

Unless otherwise shown on the plans, addressed in the special provisions, or approved by the Engineer, no surplus excavated material shall be disposed of within the right-of-way. The Contractor shall make all arrangements for disposal of the material at off-site locations as may be approved by the Engineer. The Contractor shall provide to the Engineer copies of the written consent of the owner of the property upon which he intends to dispose of such material, and any permits that may be required by a governing agency for said disposal.

205.7 MEASUREMENT

REMOVE the first two paragraphs in their entirety and REPLACE with the following:

The following earthwork operations will be measured as roadway excavation for the quantities of material involved.

Excavating the roadway prism including public and private roadway approaches; excavating slides and slip-outs not resulting from overshooting; excavating excess material; excavating selected material and topsoil from within the limits of the project and removing such materials from stockpiles when stockpiling is ordered; and excavating ditches.

ADD the following:

Measurement for unsuitable material shall be to the nearest cubic yard as calculated in the field.

205.8 PAYMENT

ADD the following:

Payment for unsuitable material shall be at the contract unit price and shall include any and all processes associated with the removal and backfill of the unsuitable materials, all excavation, hauling and disposal at a site secured by the Contractor, and backfilling with aggregate base course (ABC).

SECTION 206: STRUCTURE EXCAVATION AND BACKFILL

206.4.2 Structure Backfill for Earth Retaining Structures

REMOVE item (A) in its entirety and REPLACE with the following:

(A) Shall conform to the material and the graduation requirements for Select Material, Type B in Table 702-1, unless otherwise approved by the Engineer.

206.4.4 Structure Backfill for Structures within Paved Areas

REMOVE in its entirety and REPLACE with the following:

Where a structure is located within an existing street, proposed street, or paved area:

All backfill material with the exception of controlled low strength material (CLSM) shall be compacted to 95 percent maximum dry density per ASTM D698. Controlled low strength material shall be 1 sack material as specified in MAG Specifications 604 and 728.

SECTION 211: FILL CONSTRUCTION

211.1 DESCRIPTION

REMOVE in its entirety and REPLACE with the following:

Fill construction shall consist of constructing embankments except as may otherwise be specified, including the preparation of the areas upon which they are to be placed; including the construction of dikes.

The bidding schedule quantities for this item of work will be considered to be the final quantities for payment. Adjustments in the bidding schedule quantities for Fill Construction as contained in these specifications may be initiated by the Contractor or the Engineer if evidence indicates that the required quantity varies by an amount greater than 5 percent of the bidding schedule quantity. The Contractor shall advise the Engineer, in writing, submitting evidence in the form of a construction survey or photogrammetric survey with measurement for the proposed adjustment and requesting an adjustment in quantities. The Engineer will determine the amount of adjustment, if any. The quantity upon which payment will be based will be the bidding schedule quantity plus or minus only that portion of the adjustment that exceeds 5 percent of the bidding schedule quantity.

Variations caused by shrink/swell of materials shall not be considered for quantity adjustments.

Adjustments in Fill Construction quantities due to revisions ordered by the Engineer will be isolated by measurement or calculations. The bidding schedule quantities will be adjusted by the amount either measured or calculated, regardless of the 5 percent variation requirement above.

211.2 PLACING

REMOVE the first paragraph in its entirety and REPLACE with the following:

Rocks or other solid material which are larger than 4 inches in greatest dimension shall not be placed in fill areas. Broken concrete or asphalt shall not be placed in the fill.

211.3 COMPACTING

REMOVE the seventh paragraph in its entirety and REPLACE with the following:

The interstices around the rock in each layer shall be filled with earth or other fine material and compacted. Broken Portland cement concrete and bituminous pavement shall not be permitted in the fill.

211.4 TESTS

ADD the following:

Quality Control testing frequency shall be 1 per soil type for proctor density testing and 1 per 500 feet per 8 inch lift for compaction testing.

211.5 MEASUREMENT

REMOVE the first paragraph in its entirety and REPLACE with the following:

The quantities of fill construction used to construct embankments or dikes will be those of the complete bid item within the limits of dimensions shown on the plans.

PART 300 – STREETS AND RELATED WORK

ADD the following section to Part 300- Streets and Related Work:

SECTION 300: SAW CUT

300.1 DESCRIPTION

(A) The work under this item shall consist of saw cutting the existing pavement where new asphalt concrete is to match existing bituminous surfaces with no provisions for overlaying the entire section. This item shall also include saw cutting of existing Portland cement concrete pavement, sidewalks, driveways and parking lots where new construction shall match the grade of existing surfaces that are to remain where called for on the project plans or where designated by the Engineer.

(B) Saw cuts shall be made to a full depth of the material to ensure a neat vertical joint. Portland cement concrete designated to remain that is damaged by the saw cutting shall be replaced in kind at the Contractor's expense.

(C) No separate measurement or payment will be made for saw cutting, being considered incidental to the cost for work for which saw cutting is required.

SECTION 301: SUBGRADE PREPARATION

301.1 DESCRIPTION

ADD the following:

The work under this item shall consist of furnishing all materials, equipment, and labor necessary for preparation of natural or excavated areas prior to the placement of any sub-base material, pavement, curbs and gutters, driveways, sidewalks or other structures. Unless provided for in another bid item, this work shall include the removal and disposal of all unsuitable material including existing pavement and other obstructions in accordance with Section 301 of these specifications. The Contractor shall be required to provide and pay for all Quality Control geotechnical testing in accordance with the MAG Specifications and the COP Supplement.

301.2.1

REMOVE in its entirety and REPLACE with the following:

The Contractor shall not use asphalt concrete or other bituminous roadway surfacing materials as embankment fill.

Project earthwork quantities, when included as separate contract pay items, will include removed asphalt/bituminous material volumes, unless there is a pay item for asphalt removal or asphalt milling in the bid schedule or otherwise specified in the special provisions.

All unsuitable material and all excess material shall be disposed of in accordance with the requirements of Sections 205.2 and 205.6 of these specifications, respectively. When additional material is required for fill, it shall conform to MAG Specification 210.

301.3 RELATIVE COMPACTION

REMOVE item (B) in its entirety and REPLACE with the following:

The subgrade shall be scarified and loosened to a depth of 8 inches.

(B) Below detached sidewalk not subject to vehicular traffic 95 percent

Subgrade Quality Control testing shall be 1 per 500 linear feet per lane for compaction testing.

301.7 MEASUREMENT

REMOVE in its entirety and REPLACE with the following:

Measurement for subgrade preparation will be by the square yard, measured by the total accepted area of new pavements, including paved shoulders, tapers, turnouts and driveways that are paved or surfaced with an aggregate base material. The areas under concrete curb and gutter, sidewalk and concrete driveway entrances will not be included. Unless provided for in other separate bid items or unless otherwise specified; Clearing and Grubbing, Roadway Excavation, Rock Excavation, Borrow Excavation, and Fill Construction shall not be measured, in which case payment for these earthwork items, if required, shall be included in the unit price for subgrade preparation.

SECTION 306: MECHANICALLY STABILIZED SUBGRADE – GEOGRID REINFORCEMENT

306.2 MATERIALS

ADD the following

Reinforcement Geogrid shall be Tensar BX1200 or approved equal.

306.8 PAYMENT

REMOVE in its entirety and REPLACE with the following:

Measurement of geogrid reinforcement shall be the surface area of accepted geogrid to the nearest square yard. No additional measurement or payment shall be made for geogrid overlap as required by the manufacturer.

Payment for geogrid reinforcement shall be per square yard installed complete and in place.

SECTION 310: PLACEMENT AND CONSTRUCTION OF AGGREGATE BASE COURSE

310.1 DESCRIPTION

REMOVE in its entirety and REPLACE with the following:

The work under this item shall consist of furnishing all materials, equipment, and labor necessary for the placement of an approved, imported aggregate base course material on top of a prepared subgrade per the required design thickness, grade, cross-section and compaction as specified on the project plan documents and in accordance with Sections 310 and 701 of these specifications, and MAG Specification 702. Aggregate base course shall not be placed on a prepared subgrade until the Engineer or the Engineer's authorized representative has inspected and accepted the underlying subgrade. The Contractor shall be required to provide and pay for all Quality Control geotechnical testing in accordance with MAG Specifications and COP Supplement. Use of Reclaimed Concrete Material (RCM) is not allowed per COP Supplement 701.4.

ADD the following subsection to 310.1 Description:

310.1.1 Reclaimed Asphalt Pavement (RAP)

Use of reclaimed asphalt pavement (RAP) aggregates or "millings" produced on-site, imported or stockpiled for the intended use in the underlying base or subgrade material must be approved by the Engineer or the Engineer's authorized representative; and shall be screened and meet MAG Sections 310, 701 and 702, and here within. RAP millings must be uniformly mixed with an imported virgin aggregate base course material.

310.2 PLACEMENT AND CONSTRUCTION

ADD the following:

Aggregate base course shall not be placed on excessively wet or frozen subgrade materials as determined by the Engineer.

ADD the following subsection to 310.2 Placement and Construction:

310.2.1 Quality Control Testing

Aggregate base course Quality Control testing frequency shall be as follows:

(A) Resistance to Degradation and Abrasion: 1 at the start of production and again if source changes.

(B) Fractured Faces, One Face, PI, and Gradation: 1 per shift.

310.3 COMPACTION

REMOVE the fifth paragraph in its entirety and REPLACE with the following:

For roadway construction, a minimum of 1 field density test shall be performed per 6 inch lift per 500 feet per lane. For other aggregate base course applications, a minimum of 1 field density test shall be performed for each 800 square yards.

REMOVE items (A), (B) and (C) in their entirety and REPLACE with the following:

Aggregate base course shall be compacted to 98 percent in all instances.

310.5 PAYMENT

REMOVE in its entirety and REPLACE with the following:

Measurement for aggregate base course material will be per cubic yard furnished and placed. Copies of material delivery tickets will be required for quantity verification purposes. Payment shall be made at the unit price bid and shall be considered full compensation for this work item.

SECTION 317: ASPHALT MILLING

317.2 CONSTRUCTION REQUIREMENTS

REMOVE in its entirety and REPLACE with the following:

When milling is specified, the existing asphaltic concrete shall be removed in accordance with the details shown on the project plans with equipment specifically designed to remove such material by means of grinding or chipping to a controlled line and grade. The equipment used shall be capable of removing the existing asphaltic concrete within 0.01 feet of the specified removal depth. The removal shall be accomplished in a manner which does not destroy the integrity of any asphaltic concrete pavement that remains and which does not result in a contamination of the milled asphaltic concrete with the underlying base material.

Pavement to be removed by milling, adjacent to manholes, valve boxes, small radius curbs and other fixed objects that produce confined areas shall be removed with milling equipment specifically designed to operate in restricted areas and capable of removing asphaltic concrete of the specified thickness without damage or displacement of the adjacent object. The removal of asphalt concrete pavement at the approaches to structures shall be accomplished in a manner approved by the City.

On projects with existing curb and gutter, any asphaltic concrete buildup in the gutter designated to be removed, shall be removed prior to the pavement removal operation by equipment and methods approved by the Engineer. The equipment and methods used shall be capable of removing the asphaltic concrete buildup without causing damage to the curb and gutter

Upon removal, all milled materials shall become the property of the Contractor. The City will not accept millings. The Contractor shall properly dispose of the millings away from the site. No additional compensation will be made for the disposal of millings.

Prior to milling and roadway excavation, all existing manholes, valve boxes, etc. shall be lowered and protected. All City facilities shall be protected from debris that may result from any adjustments and the Contractor shall be responsible for any maintenance activity resulting from debris related to the construction. No separate payment shall be made for lowering and protecting existing manholes, valve boxes, etc.

Under no circumstance shall the removal of existing asphaltic concrete begin until the mix design for replacement asphaltic concrete has been approved by the Engineer.

The extent of removal of existing asphaltic concrete must be in keeping with the Contractor's ability to produce, haul, place and compact replacement asphaltic concrete so that at all times the length of open "trench" is at a minimum. If the Contractor's production of replacement asphaltic concrete is stopped for any reason, the removal of asphaltic concrete shall either cease or shall be reduced. The Engineer will be the sole judge as to whether the removal shall cease or be reduced. The Engineer's decision will be based on the reason for the stoppage in asphaltic concrete production, the expected length of the stoppage, the type and depth of the material being removed, and the time of day.

ADD the following subsection to 317.2 Construction Requirements:

317.2.1 Quality Control

All milling shall be inspected and approved prior to paving. High spots in excess of the tolerances noted shall be milled until in conformance.

Low spots in excess of ½ inch shall have a leveling course placed prior to paving at no additional cost to the City.

ADD the following subsection to 317.2 Construction Requirements:

317.2.2 Paving

For mill and overlay areas, replacement asphaltic concrete shall be placed as soon as possible after milling has occurred and been approved. The surface on which the material is to be placed shall be uniform and free of loose material. Any exposed base material shall be compacted to the extent required by the Engineer.

The "trench" in which asphaltic concrete is being placed shall be filled before the end of each day's work and the lane shall be opened to traffic. The length of open "trench" at any one time shall not exceed 2 miles or ½ the length of the work, whichever is the lesser.

In the event of circumstances beyond the control of the Contractor, such as equipment breakdown, or if the production of the replacement asphaltic concrete has been stopped by the Engineer and the Contractor is unable to comply with the requirements in the preceding paragraph, the Contractor shall provide and maintain such traffic control devices that the Engineer deems necessary under the circumstances in order to provide safe and efficient passage through the work zone.

If the Engineer deems it to be warranted, the Contractor shall provide for the surface drainage of areas where the pavement surface has temporarily been removed.

ADD the following subsection to 317.2 Construction Requirements:

317.2.3 Macrotexture Milling

Macrotexture asphalt milling when included as a separate contract pay item shall be performed in accordance with the following:

Existing asphaltic concrete shall be removed by milling in accordance with the details shown on the project plans and as specified herein. The milling equipment shall be specifically designed to remove material to a controlled line and grade by means of grinding or chipping. The equipment used shall be capable of removing the existing asphaltic concrete uniformly throughout the milled area at the required cross-slope and within 1/8 inch of the specified removal depth. The specified removal depth of the existing bituminous pavement shall be as noted on the plans. The removal shall be accomplished in a manner which does not destroy the integrity of any pavement that remains. During production milling, the Contractor shall verify the actual depth of milling required to remove the desired underlying pavement surface. If it is determined by the Engineer that the required milling depth is greater than the specified milling depth, the additional material shall be completely removed to the desired underlying pavement surface, as approved, in accordance with COP Supplement 109.4. The milled material shall be removed and disposed of as specified by the City.

The milled surface shall have a maximum mean macrotexture depth of 4.50 millimeters, as determined in accordance with Arizona Test Method 742- Mean Macrotexture Depth of Milled Pavement.

At the start of the milling operation, the Contractor shall mill a 500 foot test section. The milled surface of the test section shall be evaluated by the Engineer for compliance with the maximum mean macrotexture depth requirement. If the milled surface is in compliance with the macrotexture requirement, the Contractor may begin production milling. If the milled surface is not in compliance with the macrotexture requirement, the Contractor shall make adjustments to the milling operation and then mill another test section.

During production milling, the mean macrotexture depth shall be determined at a minimum frequency of 1 test per ½ mile per lane. If, at any time, during the milling operation the Engineer determines that the macrotexture requirement is not being achieved, the Contractor shall stop milling. Milling shall not resume until the Engineer is satisfied that the macrotexture requirement can be met or until successful completion of another test section. The forward speed of the milling machine during production milling shall not exceed the speed used for the test section. The forward speed of the milling machine shall be checked throughout each production day, or at the discretion of the Engineer.

The profile of the milled surface, in both the longitudinal and transverse directions, shall not vary by more than 1/8 inch over a distance of 10 feet.

Under no circumstance shall the removal of existing asphaltic concrete begin until the mix design for replacement asphaltic concrete has been approved by the Engineer.

The extent of removal of existing asphaltic concrete must be in keeping with the Contractor's ability to produce, haul, place and compact replacement asphaltic concrete so that at all times the length of milled surface is at a minimum. If the Contractor's production of replacement asphaltic concrete is stopped for any reason, the removal of asphaltic concrete shall either cease of shall be reduced. The Engineer will be the sole judge as to whether the removal shall cease or be reduced. The Engineer's decision will be based on the reason for the stoppage in asphaltic concrete production, the expected length of the stoppage, the type and depth of the material being removed, and the time of day.

Asphaltic concrete shall be placed as soon as possible after the milling. The surface on which the material is to be placed shall be uniform and free of loose material.

The length of milled surface at any one time shall not exceed 2 miles, or ½ the length of the work, whichever is less. Asphaltic concrete shall be placed on the milled surface before the end of each day's work. The lane shall be opened to traffic at the end of each day's work.

In the event of circumstances beyond the control of the Contractor, such as equipment breakdown, or if the production of the replacement asphaltic concrete has been stopped by the Engineer and the Contractor is unable to comply with the requirements in the preceding paragraph, the Contractor shall provide and maintain

such traffic control devices that the Engineer deems necessary under the circumstances in order to provide safe and efficient passage through the work zone.

If the Engineer deems it to be warranted, the Engineer will require that the Contractor provide for the surface drainage of areas where the pavement surface has temporarily been removed.

Pavement, to be removed by milling, adjacent to manholes, valve boxes, small radius curbs and other fixed objects that produce confined areas shall be removed with milling equipment specifically designed to operate in restricted areas and capable of removing asphaltic concrete of the specified thickness without damage or displacement of the adjacent object. Such areas may be excluded from macrotexture testing at the discretion of the Engineer.

On projects with existing curb and gutter, any asphaltic concrete buildup in the gutter designated to be removed, shall be removed prior to the pavement removal operation by equipment and methods approved by the Engineer. The equipment and methods used shall be capable of removing the asphaltic concrete buildup without causing damage to the curb and gutter.

317.3 MEASUREMENT AND PAYMENT

REMOVE in its entirety and REPLACE with the following:

Payment for milling shall be based on plan quantities at the unit bid price in the bid schedule to include milling and proper disposal of the millings away from the site.

SECTION 321: PLACEMENT AND CONSTRUCTION OF ASPHALT CONCRETE PAVEMENT

321.2 MATERIALS AND MANUFACTURE

REMOVE in its entirety and REPLACE with the following:

The materials shall conform to Section 710 of these specifications for the type specified. Warm Mix Asphalt (WMA) technologies shall not be used. The specific required mix type shall be called out in the contract documents or as directed by the Engineer.

321.3 WEATHER AND MOISTURE CONDITIONS

REMOVE in its entirety and REPLACE with the following:

Asphalt concrete shall be placed only when the surface on which the material is to be placed is dry, unfrozen, the atmospheric temperature in the shade is at 40 degrees F and rising, and the temperature of the road surface or subsurface is at 50 degrees F and rising as measured in the shade. No asphalt concrete shall be placed when the weather is foggy or rainy, when precipitation is eminent, or when the base or sub base on which the material is to be placed is unstable. Asphalt concrete shall be placed only when the Engineer or the Engineer's authorized representative determines that weather conditions are suitable and sub base conditions on which the material is to be placed are acceptable.

321.4 APPLICATION OF TACK COAT

REMOVE the first and second paragraphs in their entirety and REPLACE with the following:

A tack coat shall be applied to all existing and to each new course of asphalt concrete prior to the placing of a succeeding lift of asphalt concrete.

The application of the tack coat shall comply with Section 329 of these specifications. The grade of emulsified asphalt shall be SS-1h as specified in MAG Specification 713.

321.6 MIX PRODUCTION

ADD the following:

(A) Stockpiling

(1) Sufficient virgin mineral aggregate material shall be stockpiled at the site of the hot plant to produce the quantity of asphalt concrete required for a minimum of two successive 8 hour shifts; however, this requirement will be modified during the last 2 days production, or under special conditions with the Engineer's approval.

(2) Mineral aggregate shall be stockpiled so that segregation is minimized. An approved divider of sufficient size to prevent intermingling of stockpiles shall be provided.

(B) Proportioning

(1) No fine material which has been collected in the dust collection system shall be returned to the mixture unless the Engineer, on the basis of tests, determines that all or a portion of the collected fines can be utilized. If the Engineer so determines, he will authorize in writing the utilization of a specific proportion of the fines; however, authorization will not be granted unless the collected fines are accurately and uniformly metered into the mixture.

(2) Mineral aggregate and bituminous material shall be proportioned by volume, by weight, or by a combination of volume and weight.

(3) When mineral aggregate and bituminous material are proportioned by weight, all boxes, hopper buckets or similar receptacles used for weighing materials, together with scales of any kind used in batching materials, shall be insulated against the vibration or movement of the rest of the plant due to the operation of any equipment so that the error in weighting with the entire plant operating shall not exceed 2 percent for any setting nor 1½ percent for any batch. Bituminous material shall be weighed in a heated, insulated bucket suspended from a springless dial scale system.

(4) When mineral aggregate and bituminous material are proportioned by volume, the correct portion of each mineral aggregate size introduced into the mixture shall be drawn from the storage bins by an approved type of continuous feeder which will supply bituminous material and so arranged that the proportion of each mineral aggregate size can be separately adjusted. The continuous feeder for the mineral aggregate shall be mechanically or electrically actuated.

(C) Drying and Heating

(1) A recording pyrometer or other approved recording thermometric instrument sensitive to a rate of temperature change of not less than 10 degrees F per minute shall be so placed at the discharge chute of the drier in order to record mineral aggregate and to facilitate reading the recorded temperature. A copy of the recording shall be given to the Engineer. The moisture content of the asphalt concrete immediately behind the paver shall not exceed 1 percent.

(D) Mixing

(1) The production of the plant shall be governed by the rate required to obtain a thorough and uniform mixture of the materials. Mixing shall continue until the uniformity of coating, when tested

in accordance with the requirements of the American Association of State Highway and Transportation Officials (AASHTO) T 195, is at least 95 percent.

(2) A positive signal system shall be provided to indicate the low level of mineral aggregate in the bins. The plant will not be permitted to operate unless this signal system is in good working condition. Each bin shall have an overflow chute or a divider to prevent material from spilling into adjacent bins.

(3) The temperature of asphalt concrete upon discharge from the mixer shall not exceed 325 degrees F. If the asphalt concrete is discharged from the mixer into a hopper, the hopper shall be constructed so that segregation of asphalt concrete will be minimized.

321.8 PLACEMENT

ADD the following:

(A) The Contractor shall stringline finish ABC grade in the presence of the Engineer or the Engineer's authorized representative to verify compliance to specified tolerances prior to the placement of asphalt concrete. Placement of asphalt concrete shall not begin until adjacent Portland cement concrete items have obtained 75 percent of design strength.

(B) The handling of asphalt concrete shall at all times be such as to minimize segregation. Any asphalt concrete which displays segregation shall be removed and replaced.

(C) All wheels and tires of compactors and other equipment shall be wiped when necessary with an approved product in order to prevent the picking up of the asphalt concrete.

(D) Before asphalt concrete is placed, the surface to be paved shall be cleaned of objectionable material.

(E) The base or subgrade upon which the asphalt concrete is to be placed shall be prepared in accordance with the applicable requirements for the material involved and maintained in a smooth and firm condition until placement.

(F) At any time, the Engineer or the Engineer's authorized representative may require that the work cease or that the work day be reduced in the event of weather conditions either existing or expected which would have an adverse effect upon the asphalt concrete.

(G) The temperature of asphalt concrete just prior to compaction shall be at least 250 degrees F but shall not exceed 300 degrees F, unless permitted by the Engineer.

(H) The asphalt concrete shall be placed as a surfacing course. Surfacing courses are defined as courses placed to serve either as a traffic surface or as a surface upon which a finishing course or seal coat is to be placed. The thickness of surfacing courses will be shown on the project plans.

(I) In order to achieve, as far as practicable, a continuous operation, the speed of the paving machine shall be coordinated with the production of the plant.

(J) Tapered sections exceeding 8 feet in width or widened sections not exceeding 4 feet in width may be placed and finished by other means approved by the Engineer.

321.8.5 Smoothness

REMOVE the second sentence in its entirety and REPLACE with the following:

Surfacing course surfaces shall not vary more than 1/8 inch from the lower edge of a 10 foot long straightedge when the straightedge is placed parallel to the center of the roadway.

321.9 QUALITY CONTROL

ADD the following:

Contractor Quality Control

(A) General Requirements

(1) It shall be the responsibility of the Contractor to administer a Quality Control Plan (hereinafter, within this section, referred to as "Plan") sufficient to assure a product meeting the requirements of these specifications. The Plan may be operated wholly or in part by a subcontractor or an independent organization; however, the Plan's administration, including compliance with the Plan and its modification, shall remain the responsibility of the Contractor.

(2) The Contractor is required to provide and maintain a Quality Control Plan, along with all the personnel, equipment, supplies and facilities necessary to obtain samples, perform tests, and otherwise assure the quality of the project.

(3) The Contractor shall submit the Plan to the Engineer or the Engineer's authorized representative at the preconstruction conference.

(4) The Contractor shall perform process control sampling, testing and inspection during all phases of the work and shall perform the process control sampling, testing, and inspection at a rate sufficient to assure that the work conforms to the contract requirements. The Contractor shall provide the Engineer a certification stating that all of the testing equipment to be used is properly calibrated and will meet the specifications applicable for the specified test procedures.

(B) Elements of the Plan

(1) The Plan shall address all elements which affect the quality of the asphalt concrete including, but not limited to the following: Mix Design, Aggregate Production, Quality of Components, Stockpile Management, Proportioning, Mixing (including addition of Mineral Admixture, if required), Placing and Finishing, Joints, and Compaction.

321.12 MEASUREMENT

ADD the following:

(A) Measurement under this item shall be to the nearest square yard.

(B) No separate measurement shall be given for the thickened edge, COP GES Detail 201Q and as detailed on project drawings. This work shall be considered incidental and included in the unit price bid in the contract documents. Payment shall be made at the unit price bid in the contract documents for the items complete in place, adjusted for compaction and thickness deficiencies as herein provided.

SECTION 329: TACK COAT

329.3 APPLICATION

REMOVE in its entirety and REPLACE with the following:

(A) The application rate shall be between 0.04 to 0.06 gallons per square yard of diluted material, 50 percent water and 50 percent emulsion, using SS-1h.

(B) The tack coat shall be applied only as far in advance of placing the asphalt concrete as ordered by the Engineer; however, in no event shall the tack coat be applied and not covered by the asphalt concrete in the same day.

329.6 MEASUREMENT

REMOVE in its entirety and REPLACE with the following:

Measurement shall be per ton diluted as placed, based on weight tickets.

SECTION 336: PAVEMENT MATCHING AND SURFACING REPLACEMENT

336.1 DESCRIPTION

REMOVE the second paragraph in its entirety and REPLACE with the following:

Asphalt concrete roadway pavement replacement shall be constructed in accordance with COP GES Detail 200Q-1 and as indicated on the plans.

REMOVE the fourth paragraph in its entirety and REPLACE with the following:

All other surface replacement in the right-of-way but not in paved roadways shall be constructed in accordance with COP GES Detail 200Q-1 and as indicated on the plans.

336.2.1 Pavement Widening or Extensions

REMOVE the second paragraph in its entirety and REPLACE with the following:

The existing pavement shall be cut and trimmed after placement of required ABC and just prior to placement of asphalt concrete for pavement widening or extension, and the trimmed edges shall be painted with a light coating of emulsified asphalt immediately prior to constructing the new abutting asphalt concrete pavements. No extra payment shall be provided for these items and all costs incurred in performing this work shall be incidental to the widening or pavement extension.

336.2.3 Temporary Pavement Replacement

REMOVE the first and second paragraphs in their entirety and REPLACE with the following:

Temporary pavement replacement with UPM in accordance with COP GES Detail 200Q-1 shall be required in right-of-way until permanent hot mix trench pavement replacement can be performed. The Contractor shall install temporary asphalt pavement or the first course of permanent pavement replacement in accordance with Section 336 of these specifications immediately following backfilling and compaction of trenches that have been cut through existing pavement. Except as otherwise provided in Section 336, this preliminary pavement shall be maintained in a safe and reasonably smooth condition until required backfill compaction is

obtained and final pavement replacement is completed. Temporary paving removed shall be hauled from the job site and disposed of by the Contractor at no additional cost to the Agency.

Permanent pavement replacement shall replace temporary repairs within 5 working days after completion of temporary work.

336.2.4.1 Permanent Asphalt Pavement Replacement

ADD the following:

(H) Asphalt concrete trench pavement replacement shall be a minimum 4 inch thickness compacted to 95 percent of laboratory density in accordance with COP GES Details 200P-2, 200Q-1 and MAG Specification 601.6.

(I) Permanent hot mix asphalt concrete pavement replacement shall be required for all trench cuts. Installation of UPM or other high performance cold mix shall not be permitted for permanent installation. The Contractor shall be required to maintain pavement trench cuts to the satisfaction of the Engineer.

(J) The Contractor shall coordinate with the Engineer a minimum of 2 working days in advance of trench paving.

REMOVE the last paragraph in its entirety.

336.3 TYPES AND LOCATIONS OF TRENCH SURFACE REPLACEMENT

REMOVE the first five paragraphs in their entirety and REPLACE with the following:

Normally, the type of pavement replacement and backfill required will be noted on the plans or specified in other portions of the contract documents and construction shall be in accordance with COP GES Detail 200Q-1. If a type is not noted on the plans or specified in the special provisions, the following criteria will govern:

T-Top trench repair will be utilized on all streets per COP GES Detail 200Q-1.

COP GES Detail 200Q-1 trench repair shall be utilized to repair surfaces other than asphalt concrete or Portland cement concrete pavement. It may also be used when the condition of the existing pavement does not justify construction of T-Top trench repair. Prior written approval of the Engineer is required for this condition.

336.4 MEASUREMENT

REMOVE items (A) and (B) in their entirety and REPLACE with the following:

(A) In computing pay quantities for replacement using COP GES Detail 200Q-1, pay widths shall not exceed the maximum widths as depicted on Table 601-1, plus 24-inches for the T-Top.

(B) In computing pay quantities for replacement using COP GES Detail 200Q-1, pay widths shall not exceed the maximum widths as depicted on Table 601-1.

336.5 PAYMENT

ADD the following:

Pavement matching and surfacing replacement shall include all saw cutting, removal and disposal of existing pavement, plus all labor and material for complete installation of permanent pavement replacement. No extra payment will be made for temporary pavement required for maintenance of utility trench cuts or for trench widths in excess of Section 336.4 of these specifications.

SECTION 340: CONCRETE CURB, GUTTER, SIDEWALK, CURB RAMPS, DRIVEWAY AND ALLEY ENTRANCE

340.2 MATERIALS

REMOVE the first sentence in its entirety and REPLACE with the following:

Concrete shall be Class AA unless otherwise noted.

340.2.1 Detectable Warnings

ADD the following:

Detectable warnings shall be Masco Detectable Warning Panels, or approved equal, and in the color Salem Red.

340.3.1 Subgrade Preparation

REMOVE the second paragraph in its entirety and REPLACE with the following:

The subgrade shall be constructed and compacted true to grades and lines shown on the plans and as specified in Section 301 of these specifications. All soft or unsuitable material shall be removed to a depth of not less than 6 inches below subgrade elevation and replaced as directed by the Engineer. Unsuitable material shall be measured and paid in accordance with Section 205.2 of these specifications. The subgrade shall be compacted to not less than 95 percent of the maximum dry density.

All concrete items in this section shall be constructed on a minimum of 4-inches of aggregate base course unless noted otherwise, whether shown on the standard details or not. Aggregate base course shall be compacted to not less than 98 percent of maximum dry density.

ADD the following subsection to 340.3.3 Concrete Placement:

340.3.3.1 Concrete Curb, Gutter, and Curb Terminations

The pavement section (base and sub-base) shall extend to the back of curb.

ADD the following subsection to 340.3.3 Concrete Placement:

340.3.3.1a Single Curb

All single curb shall be constructed to MAG Detail 222.

ADD the following subsection to 340.3.3 Concrete Placement:

340.3.3.2 Concrete Sidewalk, Sidewalk Landing, and Ramp

Concrete sidewalk, sidewalk landings, and ramps shall be in accordance with COP GES Details or as otherwise modified on the plans.

ADD the following subsection to 340.3.3 Concrete Placement:

340.3.3.3 Concrete Driveway Entrances and 6 Inch Concrete Slabs

Portland cement concrete pavement shall contain 6 percent ±1 percent entrained air. Slump shall be a maximum of 3½ inches.

Construction Joints shall be a maximum of 15 feet apart. The Contractor shall submit a jointing pattern for review and approval prior to construction.

Driveways shall include the curb returns to the existing grades as shown on MAG Detail 251 and modified by the driveway details in the plans. All concrete used in the driveways and adjacent sidewalk crossings shall be 6 inches thick.

Match up construction shall include 10 feet of replacement driveway surfacing from the new top of sidewalk to the existing driveway elevations behind the sidewalk unless otherwise shown on the plans.

ADD the following subsection to 340.3.3 Concrete Placement:

340.3.3.4 Concrete Valley Gutter

All concrete valley gutter shall be constructed on a minimum 8 inch thick aggregate base course, whether shown on the standard details or not.

340.3.10 Deficiencies

REMOVE in its entirety and REPLACE with the following:

Any section of the work deficient in depth or not conforming to the plans or specifications shall be removed and replaced by the Contractor at no additional cost to the City. Replacement or reconstruction shall be from joint to joint.

Concrete work that does not comply with tolerance requirements of MAG Specification 340.3.9 shall be removed and replaced. Remove and replace gutters that exceed the ponding tolerance. Grinding shall only be allowed if approved by the Engineer.

No placement of asphalt shall occur unless the Contractor receives acceptance from the Engineer for all concrete work, such as, but not limited to: curb and gutter, gutter, raised median, concrete sidewalks and ramps, and valley gutter.

It shall be the Contractor's responsibility to submit for approval in advance of any paving operations such that concrete work can be inspected, and deficient work can be removed and replaced by the Contractor. The Contractor shall make necessary removals, replacements and corrections at no additional cost to the City. The Contractor shall not receive any time extension for removal, replacements and corrections of deficient work unless approved by the Engineer. The Contractor shall not receive any time extension for failure to notify the City in a timely manner for inspection before paving operations.

Approval shall be a written document from the Engineer. Verbal approval shall not be accepted.

340.5.2 Concrete Flat Work

REMOVE in its entirety and REPLACE with the following:

Sidewalks, driveways, alley intersections, valley gutters, curb ramps and aprons, to include spandrels, will be measured to the nearest square foot complete in place. When concrete sidewalks, sidewalk ramps, driveways, alley intersections, valley gutters, curb ramps, aprons and/or spandrels are cut during trenching operations, the square foot measurement for payment will be in accordance with Section 336 of these specifications.

340.5.3 Curb Ramp Installation

REMOVE in its entirety and REPLACE with the following:

Curb ramp installation shall be measured in accordance with Section 340.5.2 of these specifications. Detectable warnings are an integral part of curb ramp installations and shall not be measured or paid separately.

Perpendicular curb ramps shall include the area from the back of curb between the outer edges of the ramp wings to the top of the curb ramp, ending prior to and excluding the top landing. The top landing area shall be measured as sidewalk in accordance with Section 340.5.2. Ramp curbs area an integral part of the perpendicular curb ramp installation and shall not be measured or paid separately.

Parallel and combination curb ramps shall include the ramp area between the ramp curb and the back edge of the roadway curbing. Ramp curbs are an integral part of parallel curb ramp and combination curb ramp installations and shall not be measured or paid separately.

ADD the following subsection to 340.5 Measurement:

340.5.4 Aggregate Base Course

Aggregate base course shall be considered incidental to all items in this section.

340.6 PAYMENT

ADD the following:

Aggregate base course shall be considered incidental to all items in the section.

No separate measurement or payment for the curb returns and transition curbs for driveways shall be made.

SECTION 345: ADJUSTING FRAMES, COVERS AND VALVE BOXES

345.1 DESCRIPTION

REMOVE the second paragraph in its entirety and REPLACE with the following:

All frames, covers, valve boxes, manholes, etc., shall be adjusted to finished grade after placement of asphalt concrete surface course by the Contractor in accordance with the standard details. Adjustments shall be completed within 15 working days of completion of paving.

The Contractor shall remove old frames and covers and install new frames and covers in accordance with the contract documents.

345.3 ADJUSTING FRAMES

REMOVE the second paragraph in its entirety and REPLACE with the following:

Frames shall be set to the elevations and slopes established by the Engineer and shall be firmly blocked in place in accordance with COP GES Detail 422Q. Spaces between the frame and the old seat shall be sealed on the inside to prevent any concrete from entering the hand hole or manhole. Class AA concrete shall be placed around and under the frames to provide a seal and properly seat the frame at the required elevation and slope.

A single No. 4 rebar hoop will be placed in each concrete collar in accordance with the respective detail. The hoop diameter shall be such that its placement is centered between the edge of the manhole frame or valve box, and the outer edge of the concrete collar, the depth of the hoop shall be centered in the thickness of the collar. Each concrete ring shall be scored radially at quarter-circle points. Score lines shall be ¼ -inch wide by ½ - inch deep. The concrete collar surface shall be rough broom finished. (See COP GES Details 270Q and 422Q)

Existing frames and covers shall be salvaged to the City. All salvaged items shall be delivered to the City Wastewater Collections facility, located at 1505 Sundog Ranch Road, and placed as directed by the Engineer.

REMOVE the fourth paragraph in its entirety and REPLACE with the following:

After removal of the temporary asphalt pavement in the area of adjustment, and prior to placement of the final concrete collar ring (as shown on COP GES Details 270Q and 422Q) the asphalt pavement in proximity of the adjustment shall be rolled with a self-propelled steel wheel roller if requested by the Engineer.

Traffic shall not be allowed on the concrete collars until the concrete has reached a minimum compressive strength of 2,500 psi on residential and 3,000 psi on collector and major streets. On major streets the Contractor shall use "high-early" in the concrete mix, approved by the Engineer, to minimize delay in reopening the street(s) to traffic.

345.4 ADJUSTING VALVE BOXES

REMOVE in its entirety and REPLACE with the following:

Valve boxes shall be adjusted to the new elevations indicated on the plans, or as established by the Engineer.

New valve box top risers and caps shall be furnished by the Contractor at existing water valve locations and placed as directed by the Engineer. New valve box top risers and caps shall be considered incidental to the cost of adjustment.

Existing valve box risers and caps shall be salvaged to the City. All salvaged items shall be delivered to the City Water Operations facility, located at 1481 Sundog Ranch Road, and placed as directed by the Engineer.

A single No. 4 rebar hoop will be placed in each concrete collar in accordance with the respective detail. The hoop diameter shall be such that its placement is centered between the edge of the manhole frame or valve box, and the outer edge of the concrete collar, the depth of the hoop shall be centered in the thickness of the collar. Each concrete ring shall be scored radially at quarter-circle points. Score lines shall be ¼ inch wide by ½ inch deep. The concrete collar surface shall be rough broom finished. (See COP GES Detail 391Q)

Traffic shall not be allowed on the concrete collars until the concrete had reached a minimum compressive strength of 2,500 psi on residential and 3,000 psi on collector and major streets. On major streets the Contractor shall use "high-early" in the concrete mix, approved by the Engineer, to minimize delay in reopening the street(s) to traffic.

Add the following subsection to 345.4 Adjusting Valve Boxes:

345.4.1 Adjusting Meter Boxes

Meter boxes shall be adjusted to the new elevations indicated on the plans, or as established by the Engineer.

Additional meter box sections, concrete, and miscellaneous items required to protect the utility in accordance with the respective standard detail shall be considered incidental to adjusting the meter box.

345.5 ADJUSTING MANHOLE AND VALVE COVERS WITH ADJUSTMENT RINGS

REMOVE in its entirety and REPLACE with the following:

Existing sanitary sewer manhole and covers shall be salvaged to the City. All salvaged items shall be delivered to the City Wastewater Collections facility, located at 1505 Sundog Ranch Road, and placed as directed by the Engineer.

Adjusting rings may be used to raise manhole covers in conformance to the dimensions noted on COP GES Detail 420Q-1. The amount of adjustment, thickness of seal or overlay, and cross slope will be considered when using adjusting rings. Each location where an adjusting ring is used must have a sufficient depth of asphalt to assure the proper installation and operation of the ring. The rings shall be made of concrete and installed per the manufacturer's specifications. The rings shall be approved by the Engineer.

The concrete collar ring around the frame or valve box shall be circular, shall be a minimum of 8 inches thick, struck off and finished ¼ inch below with the adjacent new pavement surface. Concrete shall be a minimum of Class AA. All concrete shall be obtained from plants approved by the Engineer.

A single No. 4 rebar hoop will be placed in each concrete collar in accordance with the respective detail. The hoop diameter shall be such that its placement is centered between the edge of the manhole frame or valve box, and the outer edge of the concrete collar, the depth of the hoop shall be centered in the thickness of the collar. Each concrete ring shall be scored radially at quarter-circle points. Score lines shall be ¼ inch wide by ½ inch deep. The concrete collar surface shall be rough broom finished. (See COP GES Detail 270Q)

Traffic shall not be allowed on the concrete collars until the concrete has reached a minimum compressive strength of 2,500 psi on residential and 3,000 psi on collector and major streets. On major streets the Contractor shall use "high-early" in the concrete mix, approved by the Engineer, to minimize delay in reopening the street(s) to traffic.

All machined surfaces on the frame and cover shall be such that the cover will lie flat in any position in the frame and have a uniform bearing through its entire circumference. Any frame and cover which creates any noise when passed over by automobiles shall be replaced by the Contractor at the Contractor's expense.

345.6 MEASUREMENT

ADD the following:

Measurement for adjusting existing frames, covers, valve boxes, and water meter boxes to finished grade shall be the actual number of each type adjusted and accepted.

Measurement for adjusting new frames, covers, valve boxes, and water meter boxes shall not be measured as adjustment to finished grade is considered incidental to installation of the respective item.

SECTION 350: REMOVAL OF EXISTING IMPROVEMENTS

REMOVE the section in its entirety and REPLACE with the following:

350.1 DESCRIPTION

The work under this section shall consist of the removal, wholly or in part, and satisfactory disposal of all structures and obstructions within the right-of-way which have not been designated on the project plans or specified in the special provisions to remain, except for those structures and obstructions which are to be removed and disposed of under other items of work in the contract. The work shall also include salvaging of designated materials and backfilling the resulting cavities.

Existing structures, pavement, sidewalks, curbs, gutters and other existing improvements which are to become an integral part of the planned improvements shall remain even though not specifically noted.

Materials removed and not designated to be salvaged or incorporated into the work shall become the property of the Contractor.

All existing utilities not designated for removal shall remain in place and be protected against damage.

The removal of existing improvements shall be conducted in such a manner as not to damage active utilities or any portion of the improvement that is to remain in place.

350.2 CONSTRUCTION REQUIREMENTS

Bridges, culverts and other structures in use by traffic shall not be removed until l satisfactory arrangements have been made to accommodate the traffic. Blasting or other operations necessary for the removal of an existing structure or obstruction, which may damage new construction, shall be completed prior to commencing the new work.

Items designated to be salvaged shall be carefully stockpiled or stored by the Contractor at locations designated in the special provisions or as directed by the Engineer.

Items which are to be salvaged or reused in the new construction and are damaged or destroyed as a result of the Contractor's operations shall be repaired or replaced by the Contractor at no additional cost to the City.

Holes, cavities, trenches and depressions resulting from the removal of structures or obstructions, except in areas to be excavated, shall be backfilled with suitable material which shall be compacted to a density of not less than 95 percent of the maximum density as determined in accordance with the requirements of Section 601 or Section 211 of these specifications. Backfill of all excavated areas below structures shall be in accordance with MAG Specification and COP Supplement 206.4.

350.3 REMOVAL OF PAVEMENT

(A) Portland Cement Concrete Pavement: Unless otherwise specified in the special provisions, concrete pavement designated on the project plans to be removed shall be removed from the job site and disposed of at a site secured by the Contractor.

Where new construction is to join the existing concrete pavement, the pavement shall be saw cut to a true line perpendicular to the centerline of the pavement with straight vertical edges free from irregularities.

(B) Bituminous Pavement: Unless milling is noted on the plans or is a bid item, all bituminous pavement designated on the project plans to be removed, shall be completely removed down to the underlying base course or subgrade. The pavement material shall be removed and disposed of at a site secured by the Contractor.

Where new construction is to join existing bituminous pavement, the existing pavement shall be cut to a true line perpendicular to the centerline of the pavement with straight vertical edges free from irregularities. The removal of asphaltic concrete at the approaches to structures shall be accomplished in a manner approved by the Engineer.

350.4 REMOVAL OF STORM PIPE AND CULVERTS

All removed pipe which is to be salvaged or re-laid shall be cleaned of all earth and other material inside and outside prior to being stockpiled or reused. Pipe to be reused shall be stored when necessary to avoid damage or loss before relaying.

Existing pipe to be partially removed shall be cut with straight and smooth edges on a plane perpendicular to the center line of the pipe.

Pipe that is not salvaged shall become property of the Contractor, removed from the project, and disposed of properly.

350.5 REMOVAL OF MISCELLANEOUS CONCRETE

Miscellaneous concrete shall be defined as all or portions of mortared rubble masonry, curbs, gutters, sidewalks, driveways, aprons, slope paving, island paving, retaining walls, spillways, drainage structures, concrete box culverts, foundations, footings and all other Portland cement concrete or masonry construction, except bridges and pavement. All existing miscellaneous concrete shall be removed to a depth of at least 5 feet below finished subgrade elevation unless otherwise noted on the project plans or special provisions. Other specification sections that discuss removal of concrete items shall supersede the provisions in this section.

Where new concrete is to join existing concrete, the existing concrete shall be saw cut to a true line with straight vertical edges free from irregularities.

Concrete removal operations shall be performed without damage to any portion that is to remain in place. All damage to the existing concrete, which is to remain in place, shall be repaired to a condition equal to that existing prior to the beginning of removal operations. The repairing of existing concrete damaged by the Contractor's operations shall be at no additional cost to the City.

Existing reinforcement that is to be incorporated in new work shall be protected from damage and shall be thoroughly cleaned of all adhering material before being embedded in new concrete.

Concrete shall be disposed of as provided in 350.3(A).

The floors of concrete basements, pits and structures that are located within the right-of-way shall be completely removed.

350.6 REMOVAL OF UTILITIES

Removal of water mains, sewer mains, and related appurtenances shall be in accordance with COP Supplement 650 and 651, respectively.

All existing utilities not designated for removal shall remain in place and be protected against damage.

A utility may be abandoned in place below a new major structure that is part of the work only if approved by the Agency and solidly filled with grout using methods approved by the Agency. All abandoned utilities to remain and the approved abandonment method shall be noted on the installation record drawings.

Utilities to be removed by the Contractor shall be disconnected and taken out in accordance with the requirements of the utility owner to the limits shown on the plans. Utility removal shall not be performed until a release has been obtained from the utility stating that their respective service connection and appurtenant equipment have been disconnected, removed or sealed and plugged in a safe manner.

The Engineer shall be notified when utilities are encountered that are not shown on the plans.

350.6.1 Removal and Disposal of Asbestos Cement Pipe

(A) Background

Asbestos Cement Pipe (ACP) is a mixture of Portland cement and asbestos fibers. It was introduced into North America in 1931 and by 1953 the American Water Works Association (AWWA) had established standards for ACP. Along with many other cities, ACP water mains were installed in the city of Prescott and as a consequence, we have a considerable quantity of this material in service. Some of these mains are old and need to be replaced; some are undersized and need to be upsized; and others are in conflict with new utility installations and need to be relocated. These actions require all or part of the existing ACP system to be removed and disposed. Subsequent to ACP's introduction into the United States, the EPA determined that asbestos, in an airborne condition, is a hazardous material and established laws/guidelines for the handling and disposal of the material. The Asbestos National Emission Standards for Hazardous Air Pollutants (NESHAP) establishes requirements for the removal and disposal of regulated asbestos containing materials. This policy statement establishes procedures and identifies responsibilities for the proper handling of asbestos-cement pipe in conformance with the Asbestos NESHAP requirements in effect as of November 1990.

NOTE: As used herein, the term “Excavator” shall refer to that entity (individual or contractor) which actually excavates and exposes the pipe. The term “Generator” means any owner or operator of a source (covered by the regulation) whose act or process produces asbestos containing waste material. The term “extra cost” shall refer to the cost over and above the removal and disposal of the pipe in a non-friable state.

(B) Policy

(1) It is the intent of the City to comply with the requirements of the Asbestos NESHAPS found at 40 CFR Part 61, Subpart M. This Policy Statement will establish procedures to be used by all Excavators in the removal and disposal of ACP in compliance with NESHAPS. Nothing in this Policy Statement shall be construed to void any provision of a contract or other law, ordinance, regulation or policy whose requirements are more stringent.

(2) ACP is defined under NESHAPS as a Category II, non-friable, non-regulated material in its intact state but which may become friable upon removal, demolition, and/or disposal. Consequently, if the removal/disposal process renders the ACP friable, it is regulated under the disposal requirements of 40 CFR 61.150. If more than 260 linear feet of ACP is removed which on removal will become friable, a NESHAPS notification must be filed with the Yavapai County Environmental Services Department. The notification must be filed at least 10 days prior to removal of the material. If it remains in its non-friable state, as defined by the NESHAPS, it can be disposed as a conventional

construction waste. EPA defines friable as material, when dry, which may be crumbled, pulverized or reduced to powder by hand pressures.

(3) The Generator of the hazardous material is responsible for the identification and proper handling, transportation, and disposal of the material. Therefore, it is the policy of the City that if the actions of the Excavator cause the material to become friable, and therefore subject to the regulations, that the Excavator becomes the Generator.

(4) The requirements of A.R.S. § 40-360.21 through 40-360.32 (Blue Stake Law) are important with respect to implementation of this policy statement. The Blue Stake Law mandates the owner of the facility (in this case the City) to maintain installation records and, upon request, to properly locate the underground facility. The law also places requirements on the Excavator to:

(a) Call Arizona 811 at least 2 working days prior to the start of excavation.

(b) Mark the boundaries of the location to be excavated.

(c) Excavate in a careful and prudent manner, including hand digging within 24 inches of the underground facility.

(d) Notify the City if the Excavator encounters an underground facility that has not been located and marked or has been marked in the wrong location.

If the Excavator does not comply in full with Arizona 811 requirements and therefore causes non-friable ACP to become friable, any and all extra costs incurred to handle, containerize, transport, and dispose of the asbestos containing waste shall not be paid or reimbursable by the City. If Arizona 811 requirements are met and ACP is accidentally or unknowingly disturbed thereby causing it to become friable, the Excavator may seek reimbursement from the City for additional costs to handle, containerize, transport and dispose of the material following the procedures described herein.

(5) The Contractor shall retain the services of an independent, qualified, licensed asbestos abatement Consultant. All removal and disposal of ACP shall be under the cognizance of the Consultant. The Excavator is responsible to contact the Consultant a minimum of 2 working days prior to the initiation of removal/disposal operations.

The Consultant will monitor the Excavator's work. If the ACP was not planned for removal and the Excavator accidentally disturbs the pipe, the Excavator will cease all work and notify the Engineer immediately for further instructions.

(6) It is the intent of the City that all ACP shall be removed in such careful and prudent manner that it remains intact and non-friable. The Excavator is responsible to deploy the means, methods, techniques, and sequences to ensure this result. When it is a practical impossibility, as determined by the Engineer, to remove the ACP without creating a friable material, the City will pay the Excavator for the removal of friable material in accordance with the measurement and payment section. The Excavator shall take steps to minimize the amount of the friable waste and abide with all asbestos regulatory requirements. The Consultant shall be available to provide recommendations or suggestions, which the Excavator may or may not choose to deploy. The Consultant shall measure or otherwise assess and recommend to the Engineer the amount or percentage of friable waste for which the City should pay for removal and disposal with the remainder being the responsibility of the Excavator. If the ACP is caused to become friable, the Consultant shall conduct perimeter air monitoring upon request by the City. If the Excavator fails to notify the Consultant, fails to excavate and remove the ACP in a careful and prudent manner creating friable material or fails to abide with all asbestos regulatory requirement, the Excavator shall be deemed to be the Generator responsible to handle, transport and dispose of the ACP in accordance with the NESHAPS requirements and will not be reimbursed for any cost incurred. This will include all penalties and associated legal fees of the Generator as well as any penalties assessed against the City, and any associated legal fees incurred by the City for violation of any of the asbestos regulatory requirements that are caused by the Excavator.

(7) ACP shall NOT be crushed and left in place.

(8) Compliance with all aspects of worker safety and health regulations including but not limited to the OSHA Asbestos Standard is the responsibility of the Excavator. The City assumes no responsibility for compliance programs which are the responsibility of the Excavator.

(9) Payment for removal of non-friable existing asbestos cement pipe shall be at the unit bid price shown in the bidding schedule for complete removal, proper disposal and trench backfill in accordance with the specifications.

(10) Payment for removal of friable existing asbestos cement pipe shall be a contingent item at the unit bid price shown in the bidding schedule for complete removal, proper disposal and trench backfill as determined by the Engineer in accordance with this section and other provisions of the specifications.

350.7 REMOVAL OF SIGNS AND DELINEATORS

Street signs, traffic control signs, traffic signal material and control devices shall be removed as designated on project drawings, salvaged and delivered to the City at the site designated by the Engineer. The Contractor shall dismantle the sign panels and delineators and remove the sign posts from the ground in such a manner as to prevent damage to the posts. The Contractor shall not remove the existing signs prior to the completion of the new sign installation, but shall remove them within 5 working days after the installation of the new signs or as directed by the Engineer.

350.8 REMOVAL OF FENCE

All fence to be removed, shall become the property of the Contractor unless designated for salvage on the project plans. If fence is designated to be removed and salvaged, all fence, including gates shall be salvaged in accordance with the requirements of 202-3.01.

When designated for salvage, fence and gates shall be carefully dismantled and neatly rolled or coiled. Posts shall be cleaned of all concrete and dirt.

In areas where new fence or relocated fence is to be installed, the Contractor shall perform the removals in such a manner as to prevent the escape of any livestock and/or domestic pets, including the placement and removal of temporary fence when necessary.

350.9 REMOVAL OF GUARDRAIL

All guardrail to be removed shall become the property of the Contractor unless otherwise specified on the project plans.

If guardrail is designated to be removed and salvaged, the Contractor shall carefully dismantle the guardrail and remove the blocks and posts in such a manner as to prevent any damage to the removed items. The guardrail, including panels, end sections, posts and all hardware shall be salvaged in accordance with the requirements of 350.2.

350.10 MEASUREMENT AND PAYMENT

No separate measurement or payment shall be made for removal of existing improvements unless otherwise noted on the plans or there being removal bid items. This work shall be considered incidental and included in the unit price bid for construction of the appropriate contract pay items.

Measurement for non-friable and friable asbestos cement pipe shall be by the linear foot of pipe removed.

Payment for removal of non-friable existing asbestos cement pipe shall be at the unit bid price shown in the bidding schedule for complete removal, proper disposal and trench backfill in accordance with the specifications.

Payment for removal of friable existing asbestos cement pipe shall be a contingent item at the unit bid price shown in the bidding schedule for complete removal, proper disposal and trench backfill as determined by the Engineer in accordance with paragraphs E and F and other provisions of the specifications.

PART 400 – RIGHT-OF-WAY AND TRAFFIC CONTROL

SECTION 401: TRAFFIC CONTROL

401.1 DESCRIPTION

REMOVE in its entirety and REPLACE with the following:

Traffic control is the responsibility of the Contractor and shall be performed in accordance with this section and the US Department of Transportation Federal Highway Administration's Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD), latest edition with the latest revisions, Prescott Traffic Barricade Manual, and the project plans.

(A) Prior to beginning the project, the Contractor shall submit to the City, for approval, a traffic control plan for all activities connected with the proposed work. He must obtain approval from the Engineer for the traffic control plan and schedule prior to any construction. The Contractor shall submit the traffic control plan to the Engineer at or before the project preconstruction conference.

(B) Written notice shall be given to the Engineer or the Engineer's authorized representative on the job 48 hours prior to any changes in detours or routes of access. The notice shall give specific details with maps showing the access to all residences and businesses affected by the project.

(C) The City Police and Fire Departments shall be continually updated on access routes along and through the site during construction.

401.2 TRAFFIC CONTROL DEVICES

ADD the following:

(C) All traffic control devices required for the project shall be the responsibility of the Contractor.

(D) When required to cross, obstruct, or close a street, traffic way, or sidewalk for a short duration that is approved by the Director, the Contractor shall provide and maintain suitable bridges, detours or other approved temporary means for the accommodation of vehicular and pedestrian traffic.

(E) When traffic conditions at the construction site warrant the use of certified police personnel to direct traffic, arrangements shall be made with the City Police Department, Yavapai County Sheriff's Office, or Department of Public Safety for off-duty officers.

401.3 FLAGMEN OR PILOT CARS

REMOVE in its entirety and REPLACE with the following:

The Contractor shall provide sufficient certified flagmen, uniformed off-duty law enforcement officers and pilot cars to expedite the safe passage of traffic through the work zone as determined by the Engineer.

Any individual who is stationed in a work zone to provide temporary traffic control (flagmen) or to drive a pilot car shall have completed training and be certified in flagging through a program that meets the training and certification standards of the National Safety Council flagger training program, the American Traffic Safety Services Association (ATSSA) flagger program or an equivalent program that meets the same objectives. An equivalent program must be approved by the Director and meet the US Department of Transportation Federal Highway Administration's Standards for the control of traffic through highway work zones as defined in the manual on uniform traffic control devices for streets and highways. This training and certification shall be renewed at least once every 4 years. It is the Contractor's responsibility to provide the certifications to the Engineer before flagmen engage in the traffic control and/or temporary traffic control. This section does not apply to law enforcement personnel who are employed by governmental entities. Should appropriately trained flaggers not be present, the City, at its discretion may cease operations until appropriately trained flaggers can be provided on-site.

401.6 MEASUREMENT

REMOVE in its entirety.

401.7 PAYMENT

REMOVE in its entirety.

ADD the following subsection to Section 401- Traffic Control:

401.8 MEASUREMENT AND PAYMENT

Payment for traffic control shall be at the applicable unit price bid in the contract documents.

(A) Preparation of traffic control plan shall be inclusive of all submittals, reviews and if needed, re-submittals.

(B) Flaggers shall be per hour for actual time directing traffic. It does not include travel time or time spent setting up or taking down devices.

(C) In the event off-duty police personnel are required to direct traffic, the bid schedule includes an allowance for certified police personnel for the purpose of encumbering funds to cover the cost of certified police personnel. The amount of the allowance is determined by the Engineer and is not subject to individual bid pricing. All bidders shall incorporate the amount in the bid proposal and shall reflect the same in the total bid for the project.

It shall be understood that this allowance is an estimate only. The allowance shall be not used without approval of the Engineer.

Reimbursement for certified police personnel shall be based on actual cost, plus an allowable markup to the prime Contractor of 15 percent, for use of certified police personnel approved by the Engineer.

Flagmen, uniformed off-duty law enforcement officers or pilot cars, with driver, will be measured by the hour for each individual, including vehicle and equipment, required to perform traffic control. When an officer is

used less than 3 hours, a minimum of 3 hours will be charged. Anything over 3 hours will be measured by the hour.

Payment will be made at the contract bid price in the proposal for uniformed, off-duty law enforcement officer. If the officer is utilized in excess of 8 hours in any calendar day or in excess of 40 hours in any calendar work week, payment shall be at the rate of 1½ times the contract bid price for all hours worked in excess in either of the above time periods.

(D) Barricades and storage shall be at the lump sum bid and shall be inclusive of all temporary signs and devices in the traffic control plan and as required by the MUTCD, COP Traffic Barricade Manual and the Engineer.

(E) Message boards shall be measured by each per day as determined necessary by the approved traffic control plan and the Engineer.

(F) Pilot car and driver shall be per hour for actual time used as required by the approved traffic control plan and the Engineer. It does not include travel time or time spent setting up or taking down devices.

(G) Incidental traffic related items shall include all other pertinent tools, equipment, devices and or work required to provide safe and effective traffic control in accordance with the approved traffic control plan, the MUTCD and the Engineer.

ADD the following section to Part 400- Right-of-Way and Traffic Control:

SECTION 402: PAVEMENT MARKINGS AND STRIPING

402.1 THERMOPLASTIC PAVEMENT MARKINGS

Work under this item shall be performed per ADOT Specification 704.

(A) Stop Bars and Crosswalks: Work under this item shall consist of the application of thermoplastic striping material at the locations noted on the project plans. All stop bars shall be 18 inches in width unless otherwise specified. Crosswalks shall be 12 inches in width.

(B) Measurement shall be in accordance with ADOT Specification 704-5 (width times length divided by 4 inches equals LF as shown in bid schedule).

(C) Pavement Markings: Pavement markings shall be in accordance with ADOT Specifications 704-4, ADOT 4-M 1.12 through 4-M 1.17, and as modified herein. Work under this item shall consist of the application of thermoplastic striping material at the locations noted on the project plans.

402.2 TEMPORARY STRIPING

Work under this item, temporary striping (paint) where required, shall be performed per ADOT Specification 701-3.05.

402.3 PERMANENT PAVEMENT MARKINGS

Work under this item shall be performed per ADOT Specification 708.

402.4 MEASUREMENT AND PAYMENT

Measurement and payment for pavement markings shall be at the per each basis for each legend or marking installed in accordance with ADOT Specification 704-5.

Measurement and payment for temporary striping shall be per ADOT Specifications 708-4 and 708-5.

Measurement for permanent pavement markings shall be in accordance with ADOT Specification 708-4 (width times length divided by 4 inches equals LF as shown in bid schedule). Payment for permanent pavement markings shall be in accordance with ADOT Specification 708-5.

ADD the following section to Part 400- Right-of-Way and Traffic Control:

SECTION 403: PERMANENT SIGNING, SIGN POSTS AND DELINEATORS

403.1 DESCRIPTION

Work under this item shall be done in accordance with the project drawings and requirements of the Manual MUTCD, MAG Detail 131, and ADOT Signing and Marking Standards.

403.2 GENERAL SIGNING GUIDELINES

(A) All signing shall conform to the most recent editions of the publications shown above with regard to size, color, shape and placement.

(B) All signs shall be new (other than those shown to be relocated). All new and relocated signs shall be mounted on new posts with new hardware. Signs designed for installation on existing street light poles shall be mounted with new hardware.

(C) Traffic sign dimensions, colors and lettering shall conform to the latest MUTCD Specifications. Traffic sign size shall be standard unless otherwise specified here or on the plans.

(D) All non mountable curb section signs shall be located at least 2 feet from the curb face to the nearest edge of the sign. All other roadways signs shall be mounted from 6 feet to 12 feet from the edge of the pavement to the nearest edge of the sign, unless otherwise noted in the sign summary table or on the plans.

(E) Roadways with guardrail signs shall be located at least 6 feet from the face of the guard rail to the nearest edge of the sign, unless otherwise noted in the sign summary table or on the plans.

(F) Sign location shall be coordinated with landscaping plans to ensure sign visibility per AASHTO Standards.

(G) Signs shall be mounted on street light poles whenever feasible.

(H) All signs installed in areas where parking or pedestrian movements occur shall typically be erected at a height of 7 feet above the normal edge of pavement or sidewalk to the bottom of the sign or to the lowest sign in a multiple sign installation assembly with the following exceptions:

(1) The height to the bottom of a secondary sign mounted below another sign may be up to 2 feet less than the height specified above.

(2) If the bottom of a secondary sign that is mounted below another sign is mounted lower than 7 feet above a pedestrian sidewalk or pathway, the secondary sign shall not project more than 4 inches into the pedestrian facility.

(3) Object markers shall be installed at least 4 feet above the normal edge of pavement.

(I) All R1-1 "STOP" signs and pedestrian warning signs shall be reflective with all reflective sheeting material to be diamond grade.

(J) All other signs are to be reflective with all reflective sheeting material to be high intensity prismatic meeting or exceeding ASTM D4956-04.

(K) Sign blanks shall be 5052-H38 alloy treated aluminum with Alodine 1200 conversion coating, 0.080 inch thick with rounded corners.

(L) Stop signs are to be shown at all local street intersections within a subdivision unless an engineering study shows that no control or yield control is warranted. Stop signs shall be designed and shown at all collector and non signalized arterial street intersections.

(M) Stop signs and Yield signs shall be a minimum of 30 inches in width. When specified by the City Traffic Engineer 36 inch and/or 48 inch signs may be required on major collectors and arterial streets.

403.3 SIGN POSTS

(A) Sign posts shall conform to the COP GES Detail 131Q.

(B) For new construction the Telspar, Uni-strut or approved equal 12 gauge, galvanized steel, 4 sided perforated square tubing is required. Two inch tubing shall be used for smaller signs while 2½ inch tubing shall be used for the larger signs.

(C) The post shall be tall enough to provide the minimum clearances specified in COP GES Detail 131Q.

(D) The base and sleeve system for the sign shall be anchored in a minimum of a 24 inch deep, 12 inch diameter foundation of concrete. The base shall have a breakaway slip base system. The exposed post from the base shall be 4 inches to 6 inches high.

(E) Signs over 48 inches wide shall be mounted on two, 2½ inch posts with a horizontal support frame.

(F) All station locations are approximate. The Contractor shall verify actual sign locations with the Engineer prior to the installation of all signs.

(G) The Contractor shall verify post lengths and elevations prior to installation.

403.4 MEASUREMENT AND PAYMENT

Measurement and payment shall be the unit price per each for posts and delineators and per square foot for sign panels, complete and in place.

ADD the following section to Part 400- Right-of-Way and Traffic Control:

SECTION 404: LOOP DETECTORS

404.1 QUADRUPOLE LOOP DETECTORS

(A) Loop detectors shall be installed in base course of asphalt concrete pavement and conform to ADOT Specifications 735 and 732-2.01, ADOT Traffic Signals and Lighting Standard Drawings (2010) 7-1. All

loop detectors shall be installed per ADOT Signals and Lighting Standard Drawing T.S. 7-1, Sheet 2. Installation shall include the home runs and installation of loop wiring into the existing signal cabinet. The hardwiring in the cabinet will be accomplished by City forces unless otherwise specified.

(B) Prior to bidding, the Contractor shall verify the location and layout of the existing detector loops and appurtenant home runs to ensure that home runs are re-established in their original configuration. Loop detectors shall be centered in lanes. The Contractor shall verify loop layout with the Inspector prior to installation.

404.2 MEASUREMENT AND PAYMENT

Measurement shall be a complete quadrupole loop installation. Payment shall be made on a per each installed basis.

SECTION 405: SURVEY MONUMENTS

405.1 DESCRIPTION

ADD the following:

All efforts shall be made to protect survey monuments from being disturbed or damaged. Monuments shall be: 1) re-established by a Registered Land Surveyor at the Contractor's expense if disturbed, damaged or covered, and 2) located by a Registered Land Surveyor where noted on plans.

All survey monuments, including but not limited to street centerline monuments, benchmarks, control points, and property corner monuments shall not be moved or otherwise disturbed by the Contractor until an authorized agent of the agency having jurisdiction over the survey monuments has witnessed or otherwise referenced their location, and only then in accordance with the requirements of the agency having jurisdiction. Any survey monuments uncovered, found, damaged, defaced, disturbed, removed, or displaced by the Contractor shall be replaced at the Contractor's expense.

405.2 MATERIALS

REMOVE the first paragraph in its entirety and REPLACE with the following:

The concrete portion of monuments shall be constructed in accordance with the provisions in Sections 725 and 505 of these specifications. Concrete shall be Class AA.

405.3 CONSTRUCTION

REMOVE the fourth paragraph in its entirety.

ADD the following:

Frames, covers and concrete shall be installed per COP GES Detail 120Q.

405.5 PAYMENT

ADD the following:

No separate payment shall be made for resetting property monuments. This work shall be considered incidental and included in the unit price bid for construction or installation of the appropriate contract pay items.

Payment for survey monuments shall be based on a per each unit complete in place.

SECTION 430: LANDSCAPING AND PLANTING

430.3.2 Seeding

REMOVE in its entirety and REPLACE with the following:

430.3.2 Seeding (Hydraulic)

(A) Seeding consists of furnishing and applying chemical fertilizer; furnishing and planting seed and furnishing, applying and affixing mulch. The areas to be seeded are disturbed or un-vegetated areas. Slopes are required to be seeded immediately upon completion; coordination with grading operations will be required.

Application rates of seed as specified are for Pure Live Seed (PLS). PLS is determined by multiplying the sum of the germination and hard or dormant seed by purity. Weed content of seed shall not exceed 0.5 percent. No substitution of species, strain or origin of seed will be allowed unless evidence is submitted in writing by the Contractor to the Engineer showing that the specified materials are not reasonably available during the contract period. The substitution of species, strains or origins shall be made only with the written approval of the Engineer, prior to making said substitution.

The seed shall be delivered to the project site in standard, sealed, undamaged containers. Each container shall be labeled in accordance with A.R.S. § 3-231 through 3-243 and the US Department of Agriculture rules and regulations under the Federal Seed Act. Labels shall indicate the variety or strain of seed, the percentage of germination, purity and weed content, and the date of analysis, which shall not be more than 9 months prior to the delivery date.

(B) Seed Mix

Botanical Name	Common Name	Seed/lb	Rate/Acre- PLS (Pure Live Seed)
Agropyron dasystachym	Thickspike Wheatgrass	154,000	3.0
Bouteloua gracilis	Blue Gramma	825,000	2.0
Koeleria crisata	Prairie Junegrass	825,000	1.0
Mulenbergia wrightii	Spike Muhly	1,000,000	1.5
Festuca arizonica	Arizona Fescue	500,000	2.0
Elymus elymoides	Squirrel Tail	192,000	4.0
Sporobolus cryptandrus	Sand Dropseed	5,298,000	0.75

(C) Seed Supply Agreement: The required species may be in short supply during the project. Therefore, the Contractor shall enter a contractual agreement with a seed collector/supplier that verifies that sufficient supply of specified plant materials will be available on or immediately prior to the seeding dates. This requirement shall be fulfilled within 45 days following the preconstruction conference in order to allow sufficient time for seed collection. The Contractor shall provide written notification to the Engineer verifying that the required species are available and secured for the project. The collection contractor shall test the seed for purity and viability and hold the seed in a manner which maintains its viability. The Contractor shall submit purity and viability test results to the Engineer for approval prior to the initiation of seeding operations. If it is required to be held for more than a year from initial testing the seed shall be tested again for viability. The Contractor shall compensate the seed supplier a percentage of the seed cost to hold seed material and for the seed tests as identified in Basis for Payment.

(D) General

The slurry for the hydroseed process shall be as follows:

Slurry Mix	Rate
Hydrofiber: Silva, Conwed or Spray mulch x-100 wood fiber or equivalent	800 lbs/acre
Tackifier	80 lbs active ingredient/acre
Starter fertilizer: Ammonium Phosphate	16-20-0 200 lbs/acre
Seed mix	As specified
Soil conditioner	1000 lbs/acre

The seed shall be applied within 30 minutes after being combined with the slurry mix.

Ingredients for Slurry Application	Percentages (Minimum)
Nitrogen	5
Phosphoric Acid	3
Water Soluble Potash	1
Humas	50
Humic Acids	15
Soluble Metallic Iron	1

(E) Wood Cellulose Fibers: Wood fiber mulch shall consist of a specially prepared wood fiber processed to contain no growth germination inhibiting factors. The mulch shall be virgin wood and be manufactured and processed so the fibers will remain in uniform suspension in water under agitation to form a homogenous slurry. The mulch shall have a pH range between 4.5 to 6.5.

When hydraulically sprayed on the ground, the material will form a blotter-like cover impregnated uniformly with seed. The cover will allow the absorption of moisture and allow rainfall to percolate to the underlying area.

(F) Tacking Agent: Binder shall be free flowing, non-corrosive powder produced from natural plant gum marketed under M-Binder, M145 Binder, AZ-TAC or approved equal. It shall have gelling properties to inhibit the tendency of water and fiber to move downhill as they are sprayed on steep slopes.

(G) Construction Requirements

(1) General: The Engineer will regularly observe the weighing of seed, mixing of slurry mix and application of seed.

(2) Seeding: Seeding shall be done immediately following the final grading or disking of each cut slope and each fill slope. The soil surface shall be loose. The Contractor will be required to mobilize frequently to accomplish this goal. No seeding shall be carried out under wind conditions exceeding 5 mph Scheduling of seeding mobilization will be coordinated with the Engineer at the weekly construction meetings. In no case shall a decision by the Engineer relieve the Contractor from the requirement of seeding prior to measurable rainfall. If measurable rain falls prior to seeding, or if the surface of the graded area has formed a crust or slightly hardened surface, the Contractor shall be responsible for ripping, blading or loosening the ground surface, or otherwise repairing and/or preparing the affected areas for seed, after they adequately dry out and prior to seeding, at no cost to the City. The use of specialized equipment or manual methods may be required to prepare the surface for seeding, if seeding is not accomplished immediately after grading or disking.

Seed is to be accomplished during the window of June 1 to July 15 and November 1 to January 30. These windows are to allow expected seasonal rains to start germination process.

All areas disturbed by construction are to be seeded. This may be more area than shown on the plans. All areas are to be approved by the Engineer. The Contractor shall coordinate seeding operations with slope construction so that the tops of cuts and toes of fills can be reached with hydroseed equipment.

Hoses may be used where heavy equipment cannot access.

(3) Tillage: All slopes steeper than 3:1 shall either have a loose, friable soil depth of 2 inches or more or be tilled a minimum of 4 inches in depth as they are constructed.

Tillage shall be accomplished with a ripper bar, chisel plow or harrow tool or with other equipment which will provide thorough soil cultivation.

Tillage shall be performed along the contour. The slopes behind guardrail and in the ditch line in cut shall be left with roughened surface to aid in water absorption. Seeded areas which are not behind guardrail or between the ditch line and the roadway on a cut shall be left in a firm surface free of foreign material that would interfere in the seeding operation.

No work shall be done when the moisture content of the soil is unfavorable or the ground is otherwise in a condition not conducive to tillage.

(4) Planting: The Contractor shall submit a batch (tank) mix for the Engineer's approval prior to mixing any seed/mulch slurry. Batch mixing and coverage will be monitored throughout seeding operations. The Contractor is to coordinate monitoring with the Engineer in advance of mixing.

After the tillage is complete and accepted by the Engineer, seed shall be planted by slurry mix (cut slopes steeper than 3:1).

All areas to be seeded shall have a starter fertilizer of ammonium phosphate 16-20-0 applied at a rate of 200 pounds per acre and soil condition at the rate of 1,000 pounds per acre.

Any material sprayed on non-designated areas shall be immediately removed by the Contractor at the Contractor's expense. Non-designated areas include pavement, guardrails, signs, plants and existing vegetation.

(5) Anchorage by Tacking: Mulch shall be anchored by tacking using a slurry consisting of a minimum of 150 pounds of binder, 400 pounds of wood fiber mulch and 700 gallons of water per acre.

(6) Preservation of Seeded Areas: Any material sprayed on non-designated areas shall be immediately removed by the Contractor at the Contractor's expense. Non-designated areas include pavement, guard rails, signs, plants, and existing vegetation.

(7) Warranty: The Contractor shall guarantee that 75 percent of the applied tackifier remains in place for a period of 30 days after acceptance of the seeding application. Any areas that have less than 75 percent of the tackifier remaining shall be reseeded, re-mulched and re-tacked at the Contractor's expense.

Areas that require reseeding and re-mulching under the warranty shall be done at no additional cost to the City. The 30 day period(s) shall be within the allotted contract time.

Measurement and Payment: Seeding will be measured by the acre, to the nearest tenth acre, measured along the ground surface for the areas which have been planted and mulched, as determined by the Engineer. The Contractor may be reimbursed a partial payment based on the invoice amount for the cost to hold and test the seed in conformance with the Seed Supply Agreement.

The accepted quantities of seeding, measured as provided above, will be paid for at the contract price per acre for the full performance of the work herein described, which price shall be full compensation for the work completed including all equipment, labor and materials required.

ADD the following section to Part 400- Right-of-Way and Traffic Control:

SECTION 431: LANDSCAPE ROCK

431.1 REMOVE AND REPLACE LANDSCAPE ROCK

Landscaping shall be protected and restored in accordance with Section 107.9 of these specifications. Existing landscaping rock shall be removed, stockpiled, and replaced in its original position as closely as possible.

Measurement and Payment: Payment shall be per lump sum amount.

PART 500 – STRUCTURES

SECTION 505: CONCRETE STRUCTURES

505.1.1 Minor Structures

REMOVE in its entirety and REPLACE with the following:

Concrete structures such as manholes, catch basins, median barriers, headwalls, cattle guards, and other miscellaneous structures as defined by the Engineer are hereby defined as minor structures. Minor structures

shall be precast units. MAG Type D Catch Basins shall be cast-in-place. Cattle guards, median barriers, and headwalls, at the option of the Engineer, may be either constructed of cast-in-place concrete, or furnished as precast units. Precast units shall be fabricated in accordance with shop drawings submitted by the Contractor and approved by the Engineer, in accordance with the requirements of MAG Specification and COP Supplement 105.2. All structures not defined as minor structures shall be classified as major structures.

(A) Concrete Drainage Outlet/Structure: The work consists of constructing a concrete drainage outlet(s) and structure(s) as designated on the project drawings in accordance with Sections 505 and 725 of these specifications, and as modified herein. All cast-in-place concrete shall be Class AA, 4,000 psi. Subgrade and base materials under the structure shall be compacted to not less than 95 percent of the maximum dry density as determined by AASHTO T 99. No additional payment will be made for aggregate base materials required under concrete structures. The base material shall be considered incidental to the construction of this item and provided for in the unit price for the work. Measurement and payment under this item shall be to the nearest square foot complete in place in accordance with the respective detail for flat work, and per each unit installed for structures.

(B) Concrete Headwall: Work under this item shall be in accordance with COP Supplement 505 and 725, MAG Specifications 726 and 727; MAG Details 501-1 and 501-2; and the project drawings. Concrete shall be Class AA, 4,000 psi. Payment shall be made per each headwall installed complete in accordance with the respective detail.

(C) Concrete Catch Basin: Work under this item shall be in accordance with MAG Details 530 through 540-2; COP Supplement 505 and 725; and above mentioned specifications for Portland Cement Concrete. All grates shall be bicycle safe type. Measurement and payment under this item shall be per each catch basin complete in place in accordance with the respective detail, to include grates.

(D) Scupper: Work under this item shall be in accordance with MAG Details 203 and 206. Concrete shall be Class AA, 4,000 psi. Measurement and payment under this item shall be per each scupper installed complete in place in accordance with the respective detail.

(E) Concrete Retaining Wall: Work under this item shall be in accordance with the project drawings. Measurement and payment under this item shall be to the nearest square foot of the retaining wall measured from the top of the footing to the top of the wall complete in place in accordance with the respective detail.

505.6.2 Adverse Weather Concreting

REMOVE in its entirety and REPLACE with the following:

Adverse weather concreting shall be in accordance with COP Supplement 725.

PART 600 – WATER, SEWER, STORM DRAIN AND IRRIGATION

SECTION 601: TRENCH EXCAVATION, BACKFILLING AND COMPACTION

601.1 DESCRIPTION

ADD the following:

(A) Unless specifically identified, no investigation of subsurface soil conditions for water or sewer main installation has been made for project limits.

(B) Excavation, backfilling and compaction shall be in accordance with this section and standard details as noted.

(C) All water encountered during the work shall be disposed of by the Contractor in a manner such that it will not damage public or private property or create a public nuisance or health problem. The costs of furnishing pumps, pipes, special bedding, and over excavation as required to provide a stable foundation, and other equipment and materials shall be incidental to the work in accordance with COP Supplement 200.1.

601.2.3 Trench Grade

REMOVE in its entirety and REPLACE with the following:

All construction staking shall be in accordance with Section 105.8 of these specifications.

For all pipe, the Contractor shall excavate for and provide an initial granular bedding at least 6 inches thick. This bedding material shall be placed at a uniform density with minimum compaction and fine graded as specified below.

601.2.5 Over-excavation

REMOVE the second paragraph in its entirety and REPLACE with the following:

Unauthorized excavation below the specified grade line shall be refilled at the Contractor's expense with bedding material compacted to a uniform density of not less than 95 percent of the maximum density as determined by AASHTO T 99 and T 191 or ASTM D6938. When AASHTO T 99, method A or B, and T 191 are used for density determination, ADOT Procedure ARIZ 227c will be used for rock correction.

ADD the following subsection to 601.2 Excavation:

601.2.11 Rock Excavation for Utility and/or Drainage Construction

(A) Definition of Rock: When rock is encountered, it shall be stripped of earth and shale, and the Engineer notified in order that he may measure or cross-section the same. In lieu of stripping the earth overburden prior to excavation/blasting, the Engineer and the Contractor may mutually agree on a method to define the vertical limits of rock. Any rock excavated before such measurement or agreement is made, will not be estimated, allowed, or paid for. Rock excavation shall be defined to include: all hard, solid rock in ledges; bedded deposits and unstratified masses; all natural conglomerate deposits so firmly cemented as to present all the characteristics of solid rock; and masonry or concrete structures not shown on the plans. Shales, hard pan, masonry and concrete rubble boulders less than 1 cubic yard which are not a part of or attached to substrata of rock, shall not be considered rock excavation. Additionally, material to be considered "rock" shall be of such hardness that it cannot be excavated using hydraulic backhoe with combined breakout force, for bucket and stick cylinders, of at least 100,000 pounds.

(B) Blasting

(1) It is the Contractor's responsibility to determine the type of material he will encounter and whether blasting will be necessary.

(2) Blasting shall be done only by experienced, qualified blasters. Blasting shall be done in accordance with the recommendations for best practice in Section 9 of the Associated General Contractors of America (AGC) Manual of Accident Prevention in Construction and in accordance with the recommendations for best practices of the Institute of Makers of Explosives. Also, all blasting must comply with the requirements of the Division of Industrial Safety and OSHA and all other Federal, State and local ordinances.

(3) When work requires blasting or explosive conditions, precautions shall be taken to protect life and property, and give proper warning to persons who may be in vicinity of work before blast is set off.

(4) Blasting shall be performed in such a manner that no damage will result to any building, structure, pipeline, or facility on or off the site of work, above or below ground. Any damage suffered as a result of blasting shall be immediately settled, including repair or replacement.

(5) Blasting shall be done in such a manner that the earth is not loosened or disturbed below the footing or foundation of any proposed structure. Loosened material below footings or foundations shall be replaced with Class C concrete.

(6) The stemming of each hole or cover over explosive shall be sufficient to prevent surface blast wave, but in no case less than 3 feet, 6 inches. Multiple holes shall be shot using millisecond delays.

(7) The Contractor shall enlist the services of an experienced explosives engineer for advice on blasting methods and for the protection of existing structures or facilities.

(8) Blasting procedures shall comply with all rules and regulations as specified and determined by the City Fire Marshall or the Director.

601.4.2 Bedding

REMOVE in its entirety and REPLACE with the following:

Bedding shall be a minimum of 6 inches and shall be in accordance with COP GES Detail 200Q-1 for paved and unpaved areas. Bedding/shade material shall be of granular consistency such as sand or crushed aggregates conforming to the following gradation and plasticity requirements:

Sieve Size	Percentage Passing By Weight
1 in	100
No. 200	< 25
PI	10 Max.

Volcanic cinders or glass materials are not acceptable.

Use of open graded rock (i.e. 3/8 inch pea gravel or ¾ inch rock) must be approved by the Engineer prior to placement and will be considered only in special circumstances.

Water consolidation by any means shall not be permitted.

Bedding and shading material shall not be considered “corrosive” or “aggressive” soil per the definitions in AWWA (including C105), Ductile Iron Pipe Research Association (DIPRA) and other similar standards and industry accepted documents. The Contractor shall submit material certification documents from the bedding and shading material supplier indicating that the bedding and shading material to be provided is not considered “corrosive” or “aggressive” soil to ferrous metals, and shall include the pH, resistivity, oxidation/reduction, and sulfide values of the material within the certification package. Upon delivery of the material, the Contractor’s geotechnical engineer shall provide Quality Control testing by testing samples of the bedding/shading material for corrosivity. The Contractor’s geotechnical engineer shall provide a letter

sealed by a registered professional engineer, licensed in the State of Arizona, that the bedding/shading material is not corrosive to ferrous metals as defined by AWWA C105. If the material is found to be corrosive, the Contractor must install polyethylene encasement per MAG Specification 610.6 at no additional cost to the City. Testing shall occur a minimum of every 1,000 linear feet of pipe installed.

601.4.4 Initial Backfill

REMOVE in its entirety.

601.4.5 Final Backfill

REMOVE in its entirety and REPLACE with the following:

601.4.5 Backfill

Backfill material shall be in accordance with COP GES Detail 200Q-1 for paved areas and COP GES Detail 200Q-1 for unpaved areas. In paved areas, backfill from 1 foot above the pipe to the bottom of the base course shall be non-shrink CLSM backfill. In unpaved areas, backfill from 12 inches above the pipe to 6 inches below existing grade shall be minus 3 inch native material similar in nature to material existing prior to excavation.

Trench backfill Quality Control testing frequency shall be 1 per soil type for Proctor Density testing and 1 per 1 foot vertical lift per 200 linear feet of trench.

601.4.6 Compaction Densities

REMOVE in its entirety and REPLACE with the following:

All backfill material with the exception of non-shrink slurry backfill shall be compacted to 95 percent maximum dry density per ASTM D698.

601.4.7 Water Consolidation

REMOVE in its entirety and REPLACE with the following:

Water consolidation by any means shall not be permitted.

601.7 PAYMENT

REMOVE in its entirety.

ADD the following subsection to Section 601- Trench Excavation, Backfilling and Compaction:

601.8 MEASUREMENT AND PAYMENT

No separate measurement or payment shall be made for trench excavation, backfilling, compaction, or placement of temporary pavement. This work shall be included in the respective unit bid price for water, sewer, or storm main and lateral construction.

Rock excavation within the roadway excavation limits shall not be measured separately. It will be included in roadway excavation. No separate payment will be made for roadway rock excavation. It shall be combined as one item under roadway excavation.

Rock excavation within structural excavation limits shall not be measured separately. It will be considered incidental and shall be included in the appropriate bid item.

Rock excavation within trenches shall be measured in accordance with the following:

(1) Width of trench for rock excavation shall be based on pipe outside diameter plus 24 inches.

(2) Depth for rock excavation shall be actual depth from top of rock to bottom of rock, or to bottom of normal bedding section, whichever depth occurs first.

Payment for rock trenching shall be at the unit price bid per cubic yard which shall include the cost of blasting, excavation, removal, hauling and disposal.

SECTION 610: WATER LINE CONSTRUCTION

610.1 DESCRIPTION

REMOVE in its entirety and REPLACE with the following:

Water main construction shall be in accordance with all applicable standard specifications and standard details.

610.3 MATERIALS

REMOVE item (A) in its entirety and REPLACE with the following:

(A) Water Main piping shall be bell and spigot Class 350 ductile iron unless otherwise noted on the project plans, in accordance with COP Supplement 610 and MAG Specification 750. Trace wire per COP GES Detail 319Q-1 shall be required for all water main installations. Water main piping shall be furnished new in full lengths with manufacturer, class rating, and all other applicable information clearly marked on the barrel. Water main piping for 2 inch shall be copper in accordance with MAG Specification 754 and encased in polyethylene protective wrapping in accordance with Section 610.6 of these specifications.

REMOVE the fourth paragraph in its entirety and REPLACE with the following:

Ductile iron water pipe and fittings per: MAG Specification 750. Concrete pressure pipe-steel/cylinder type per: MAG Specification 758.

ADD the following:

(C) All ductile iron water main and fittings shall be encased in polyethylene protective wrapping in accordance with Section 610.6 of these specifications where called for on the plans or after the Contractor's testing of bedding and shading material is found to be corrosive in accordance with AWWA C105.

All copper and brass water main and fittings shall be encased in polyethylene protective wrapping in accordance with Section 610.6.

(D) All water mains shall have "NSF-PW" seal clearly marked on each barrel and installed with trace wire in accordance with COP GES Detail 319Q-1.

(E) Thrust restraint shall generally be accomplished through the use of restrained joints in lieu of thrust blocking. The preferred joint restraint system shall be "Field-Lok" gasket or approved equal except that vertical deflections, tees, valves and bends shall be restrained utilizing Mega-Lug, as manufactured by Ebba Iron, or equal.

(F) Joint restraint shall be required at piping configurations as show on COP GES Detail 303Q-1. Required minimum lengths of joint restraint shall be per COP GES Detail 303Q-2, or as noted on the plans. In "Tee" locations where perpendicular branch mains are shown as restrained, the main line run (LRN) shall be restrained for a minimum of 10 feet or 1 joint, whichever is greater, each side of the "Tee".

Concrete thrust blocking will be required at connections to existing lines at the locations noted on the plans. Thrust blocks placed at these connections shall be in conformance with MAG Specification 610.14 and MAG Detail 380, and shall be adequately braced to allow system operation during curing of the concrete thrust blocks. Fittings to be restrained with thrust blocks shall be wrapped and taped with heavy polyethylene sheeting per Section 610.6 to prevent covering with concrete on nuts and threading on fittings.

(G) All lateral water main connecting piping, valves and fittings shall be constructed using restrained joints from the main line "Tee" to the connection point at the existing water main at the locations shown on the plans.

(H) Prior to ordering of materials and scheduling connections to existing water mains and services, the Contractor shall complete investigations to verify the size, type and location of the existing water mains and services.

(I) The technical specification for "Air Release Valves" is expanded to include Combination Air Release-Vacuum Breaker valves at the locations shown on the plans constructed as shown in COP GES Detail 317Q-1.

(J) Payment for water main shall be at the unit price in the bidding schedule and shall include all connections, fittings, joints, flanges, thrust restraint and incidentals unless specifically itemized in the bidding schedule.

610.4.1 Trenching/Cover

REMOVE in its entirety and REPLACE with the following:

All water mains shall have a minimum cover of 48 inches over the top of the pipe.

Cover for water mains will be measured from existing or proposed finished grade of pavement or from natural ground, whichever is deeper.

No water main shall be deflected, either vertically or horizontally, in excess of 50 percent of the manufacturer's recommendation for the pipe or coupling, without the appropriate use of bends or offsets.

Except as otherwise required in this specification, the special provisions, or by the Engineer, trench excavation, backfilling and compaction shall be in accordance with the requirements of Section 601 of these specifications. Backfilling may be accomplished as soon as the pipe line has been installed to the satisfaction of the Engineer, subject to the requirements for testing per Section 611 of these specifications.

610.4.3 Blocking and Restraints

REMOVE the first four paragraphs in their entirety and REPLACE with the following:

All pipe lines, valves and fittings shall be restrained using mechanical joints, mechanical joint restraints, or gasket joint restraints in accordance with COP GES Details 303Q-1 through 303Q-4.

If irregular soil or pressure conditions are encountered, a thrust block design revision or an alternate joint restraint system may be required. Thrust block installation or alternate joint restraint will require approval from the City.

610.4.5 Testing

REMOVE the last sentence of this section and REPLACE with the following:

All corporation stops used for testing and chlorination shall be removed and a stainless steel full circle repair clamp shall be installed.

610.5 SEPARATION

REMOVE all references to the Maricopa County Environmental Services Department.

610.5.1 General

ADD the following:

Concrete encased water mains that cross storm drains and/or other dry utilities which clear the crossed line by less than 12 inches shall incorporate a 6 inch sand pad to break the frictional contact.

610.9 FIRE HYDRANTS

ADD the following:

(A) Hydrant installation shall be in accordance with COP GES Details 360Q, 362Q, 363Q and 364Q, and as specified on the project plans. Hydrants shall be Waterous, Mueller, East Jordan, or as approved by the Engineer.

(B) All ductile iron water pipe used in fire hydrant installation shall be Class 350.

(C) All new fire hydrants and connecting piping shall be constructed using restrained joints from the main line "Tee" to the hydrant.

(D) Payment for hydrant installation shall be at the unit price in the bidding schedule and shall include the hydrant, piping, valve, box and cover, and all appurtenant fittings, as noted for a complete assembly.

610.11 CONNECTION TO EXISTING MAINS

ADD the following:

The existing water main shall not be taken out of service prior to completion and ADEQ Approval to Operate the replacement water main and connection of all water services and fire hydrants to the replacement system.

The existing water system shall not be taken out of service at any time without the approval of the Engineer. With the approval of the Engineer, the existing water main may be taken out of service for limited periods to facilitate project construction. City Water Operations shall be contacted a minimum of 48 hours prior to a planned water service disruption.

The Contractor shall prepare and submit to the Engineer a plan for each connection to the existing system which demonstrates the ability to complete all work within the allowed period.

All temporary connections and/or elements which must be placed in service prior to full system disinfection, testing and approval shall be disinfected in accordance with Section 4.7 of AWWA C651 after approval of the Engineer.

All existing water service connections shall be replaced in accordance with the provisions of the COP General Engineering Standards.

610.13 METER SERVICE CONNECTIONS

REMOVE items (A) and (B) in their entirety and REPLACE with the following:

(A) Type K soft copper pipe or tubing shall be used except as otherwise called for on the plans.

(B) When the existing main is not abandoned and the existing meter is to be connected to the new line, the corporation stop and saddle shall be removed and a stainless steel full circle repair clamp shall be installed.

ADD the following:

(E) Water Service Connection

(1) New Water Service shall be in accordance with COP GES Detail 316P. All service piping and fittings from main tap to meter box shall be encased in polyethylene protective wrapping in accordance with Section 610.6 of these specifications. Existing water service shall be abandoned in place and existing meter box and cover shall be salvaged and delivered to the City's Maintenance Yard and placed as directed by the Engineer. The Contractor shall supply all necessary materials for new water service including service saddle, corporation stops, piping, meter yoke, boxes and covers, plus all appurtenant fittings to connect to customers existing service line. The Contractor shall maintain a minimum 4 feet of cover material over water service and set new box and yoke as indicated on plans.

(2) The Contractor shall take all necessary steps to maintain water service. Customers affected by water disruption due to water service installation/connection shall be notified by written flyer delivered by the Contractor a minimum of 24 hours in advance of scheduled water service disruption. The Contractor shall not disconnect or disrupt water service until new water main and services pass hydrostatic and disinfection tests and is accepted by the Engineer. Customers shall not be without water service for a total time period greater than 4 hours. The Contractor shall supply bottled potable water and temporary water service meeting all State health requirements for periods of water service disruption exceeding 4 hours. No separate payment will be made for water service maintenance or Contractor written notification of water service disruption.

(3) No separate measurement or payment will be made for adjustment of new water meter boxes to finished grade. This work is considered as incidental to the construction of the water service replacement.

(4) The Contractor shall install water service line from the main to the new water meter location and continue to a point after the existing water meter location. This point of connection shall be a maximum of 10 feet from the existing meter location. The Contractor shall remove existing valves, pressure regulators, nipples, connectors, etc. and replace per specifications. All private service lines shall be Type "K" copper in accordance with MAG Specification 754 and encased in polyethylene protective wrapping in accordance with Section 610.6. The Contractor shall maintain a minimum of 4 feet of cover material, including ditch inverts, over new private water service line and utilize

existing in-situ material for backfill. The Contractor shall supply all necessary material for new private water service installation including a curb stop, plus an approved type pressure regulator, in an accessible box per COP GES Detail 316P at the new meter box location and all appurtenant fittings to connect to existing service line.

(5) The Contractor shall remove the existing water meter and reinstall in the new yoke at the new meter box location with all appurtenant fittings and adapters. The City shall supply the Contractor with new meters for use in new locations that were not previously served or there is no existing meter to remove.

(6) The Customer Box called out in COP GES Detail 316P for the curb stop and pressure regulator on the customer side of the meter box shall be minimum #1 box, and the curb stop, regulator, box and lid shall be provided and installed by the Contractor.

(7) The Contractor shall be required to distribute written notices approved by the Engineer to all customers 24 hours in advance of proposed private service line reconnection work.

(8) Existing improvements disturbed by the Contractor shall be restored in "like kind" to the satisfaction of the Engineer. No extra payment will be made for restoring existing improvements in "like kind" to include concrete walkways, retaining walls, landscape improvements, etc.

(9) It shall be the Contractor's responsibility to review existing water meter location and points of private service line reconnection locations and ascertain all work including existing improvement restoration costs to perform the private service line reconnection work as specified. Costs associated for private service line reconnection work shall be at the appropriate unit bid price in the bidding schedule and shall include private service line piping, curb stop and pressure regulator, plus all appurtenant fittings and existing improvement restoration work as specified.

(10) The pressure regulators shall be set at 65 psi. The Contractor shall bench-test or otherwise provide written verification from the supplier prior to installation that the pressure regulators have been set at the required psi.

(11) Payment for new water service and reconnection shall be at the appropriate unit bid price shown in the bidding schedule and shall include service saddle, corporation stops, curb stops, piping, meter yoke, adapters, boxes, pressure regulator, plus all appurtenant fittings for complete assembly for connection to existing service line. The Contractor shall supply and install all fittings necessary to install meter into new yoke.

(F) Commercial Water Service (Greater than 2 inches)

(1) The Contractor shall install water service line from the main to the new water meter location and continue to a point after the existing water meter location. This point of connection shall be a maximum of 10 feet from the existing meter location. The Contractor is to furnish and install gate valve and Pressure Regulating Valve (PRV) after meter vault. PRV shall be installed in accordance with the International Building Code as adopted by the City. All commercial service lines shall be a minimum of 4 inch Class 350 Ductile Iron Pipe in accordance with Section 610 of these specifications. The Contractor shall maintain a minimum of 4 feet of cover material over new water service line and may utilize existing in-situ material for backfill provided it meets the project specification. The Contractor shall supply all necessary material for commercial water service installation including a customer shutoff valve and PRV, in an accessible vault per COP GES Detail 321Q at the new meter vault location and include all appurtenant fittings to connect to existing service line.

(2) The Contractor shall be required to distribute written notices approved by the Engineer to all customers 24 hours in advance of proposed private service line reconnection work.

(3) Existing improvements disturbed by the Contractor shall be restored in "like kind" to the satisfaction of the Engineer. No extra payment will be made for restoring existing improvements in

"like kind" to include concrete walkways, retaining walls, landscape improvements, etc. It shall be the Contractor's responsibility to review existing water meter location and points of service line connection locations and ascertain all work including existing improvement restoration costs to perform the service line connection work as specified.

(4) Measurement and Payment for commercial water service shall be at the applicable unit bid price in the bidding schedule and shall include piping, customer shutoff valve, PRV and vault, including all appurtenant fittings and existing improvement restoration work as required.

(G) Traffic Rated Concrete Meter Box

(1) Meter boxes located within traffic areas shall be Christy model B1324 by Christy Concrete Products or approved equal.

(2) Pre-cast concrete meter boxes shall have H-20 loading and be constructed of high density reinforced concrete with a minimum compressive strength of 4,000 psi. Covers to be furnished with the boxes shall be a steel checker plate, H-20 loading, and lid.

610.16 MEASUREMENT AND PAYMENT

REMOVE item (E) in its entirety.

SECTION 611: WATER, SEWER AND STORM DRAIN TESTING

611.2 FLUSHING AND HYDROSTATIC TESTING

REMOVE the first and second paragraphs and REPLACE with the following:

Water lines, fire lines and force mains, including all fittings and connections to the water mains shall be tested for water tightness by subjecting each section to hydrostatic testing in accordance with applicable provisions of AWWA C600, except as modified below, and the City Water Line Testing and Acceptance Procedures, and shall consist of pressure testing and allowance testing.

Testing shall be performed by the Contractor and shall be witnessed by the Engineer for approval.

Payment for testing of water mains shall be included in the unit bid price for water main construction.

611.3 DISINFECTING WATER MAINS

ADD the following:

Water main and services shall be disinfected in accordance with Section 611 of these specifications and the City Water Line Testing and Acceptance Procedures. The City shall perform the sampling for bacteriological and residual chlorine testing. The Contractor shall notify the City 24 hours in advance to coordinate disinfection testing.

All valves in the lines being disinfected shall be opened and closed several times during the 24 hour period of disinfection.

Payment for disinfection of water mains shall be included in the unit bid price for water main construction.

611.4 SEWER LINE TESTING

ADD the following to the first paragraph:

Force mains shall be pressure tested at a minimum of 50 psi above the maximum design working pressure for 2 hours in accordance with AAC R18-9-E301, 4.01.

ADD the following to (A) Low Pressure Air Test:

Sanitary sewers shall be low pressure air tested in accordance with ADEQ Engineering Bulletin 11, Chapter IV and in accordance with the Arizona Administrative Code, Title 18, Chapter 9, Part E301(D)(2)(j)(i). 100 percent of the total length of pipe shall be tested.

ADD the following to (C) Deflection Test for HDPE and PVC Pipe:

100 percent of new sewer main construction, regardless of pipe material shall be deflection tested in accordance with the following:

(1) The pipe section to be tested shall be cleaned free of dirt, sand, water, or other foreign materials.

(2) Backfill and compaction will have been completed prior to testing. Initial tests may be done immediately upon completion of the first reach of pipe for each diameter to ascertain if the Contractor's means, materials and methods are producing the desired quality within permissible tolerances.

(3) Final acceptance mandrel pull shall be no sooner than 30 days after backfill and compaction unless authorized by the City.

(4) Test mandrels shall be solid sleeve or cage type with outside diameter and type of pipe permanently and clearly identified on the mandrel body. Worn, damaged or deformed mandrels will not be allowed. The mandrel shall have a cable attached at each end to enable removal if it becomes stuck.

(5) For acceptance, the mandrel must pass through the entire section between manholes or other structures in one pass when pulled by hand, without the use of excessive force. All testing shall be witnessed by the Engineer or the Engineer's authorized representative and the Engineer reserves the right to order additional tests in excess of 20 percent of new main installed.

(6) Any section of the installation which fails to pass the deflection test will be repaired and retested.

REMOVE item (D) in its entirety and REPLACE with the following:

(D) Closed Circuit Television Inspection

(1) Description

This section defines the requirements for internal television inspection of the sewer main and service laterals after they have been installed for all new construction and shall include the connection point to the existing system. The Contractor shall inspect the sewer interior using a color Closed Circuit Television (CCTV) camera and document the inspection on video with audio location and date information, video title information and hard copy inspection logs.

Upon completion of sewer main rehabilitation, the Contractor shall perform CCTV inspection for 100 percent of the newly rehabilitated sewer main to provide a video record and associated written report to become the property of the Engineer. The Engineer shall be notified a minimum of 48 hours in advance of proposed scheduled sewer camera inspection, so the Engineer may witness the video recording. Any inspection completed without the Engineer witnessing will not be accepted.

(2) Submittals

(a) The Contractor shall submit samples of main and lateral (if separate) inspection logs and reports for approval in accordance with MAG Specification and COP Supplement 105.2.

(i) The Contractor shall be responsible for modifications to the Contractor's equipment and/or inspection procedures to achieve report material of acceptable quality. No work shall commence prior to approval of the material by the Engineer. Once accepted, the report material shall serve as a standard for the remaining work.

(ii) The Contractor shall maintain a copy of all inspection documentation (reports, DVD, etc) for the duration of the work and warranty period.

(iii) Mainline inspection reports shall be provided by the Contractor and shall show all observations, at a minimum: project title, name of owner, time of day, manhole-to-manhole pipe section, pipe segment length, pipe material, line size, compass direction of viewing, lateral identification and clock position, direction of camera's travel, pipe depth, name of operator and footage counter reading at the beginning and end of each manhole-to-manhole pipe segment. Report shall identify any deficiencies observed.

(iv) Video of sewer mainlines shall at a minimum include the following information: project title, time of day, pipe material, line size, compass direction of viewing, direction of camera's travel, and footage counter reading continuously through-out each manhole-to-manhole pipe section. The video shall pause at and identify all observations.

(v) Service lateral inspection reports shall be provided by the Contractor and shall show all observations, at a minimum: project title, time and date, property address of service, manhole-to-manhole pipe section, pipe segment length, pipe material, line size, direction of camera's travel, name of operator and footage counter reading at the beginning and end of each service. Report shall identify any deficiencies observed.

(vi) Video of sewer lateral shall show, at a minimum: project title, street address, time and date, pipe material, line size, direction of camera's travel, and counter reading at the beginning and end of each service. The video shall pause at and identify all observations including the connection point to the existing service line.

(b) The Contractor shall supply finished video recordings upon completion of sewer construction. 4 sets of the videos (DVD) and reports shall be submitted to the City.

(3) Equipment

(a) Cameras: For inspection of sewer, the camera shall be equipped with a rotating head, capable of 90 degree rotation from the horizontal and 360 degree rotation about its centerline. Minimum camera resolution shall be 400 vertical lines and 460 horizontal lines. The camera lens shall not have less than 140 degree viewing angle and shall have automatic or remote focus and iris controls. The focal distance shall be adjustable through a range of from 2 inches to infinity. Camera(s) shall be intrinsically safe and shall be operative in 100 percent humidity conditions. Lighting intensity shall be remote controlled and shall be adjusted to

minimize reflective glare. Lighting and camera quality shall provide a clear, in-focus picture of the entire inside periphery of the sewer.

(b) Recording Media: Video recordings of all sewer line inspections shall be made on DVD. The audio portion of the composite video shall be sufficiently free from electrical interference and background noise to provide complete intelligibility of the oral report. Each video shall be identified with labels showing the Owner's name, Contractor's name, Engineer's name and each manhole-to-manhole pipe segment of sewer line represented on the video. Each video shall be submitted at the completion of the project for records.

(c) Footage Counter: A footage counter device which measures the distance traveled by the camera in the sewer device shall be accurate to plus or minus 2 feet in 1,000 feet.

(d) Depth Gauge: The camera shall be fitted with a depth gauge to identify sags present in the main lines. The gauge shall have ¼ inch increment markings to measure the depth of the pipe sag. The depth of the sag and location shall be noted as an observation and recorded on the report.

(e) Video Titling: Video recording equipment shall include genlocking capabilities to the extent that computer generated data, (i.e. footage, date, size, etc) as determined by the City can be overlaid onto video, and both indicated on the television monitor and permanently recorded on the inspection video recording.

(4) Flow Control

(a) Flow control is required for TV inspection and for sewer line rehabilitation. Limited sewage flow, as defined below, is acceptable for TV inspection.

(b) Depth of flow shall not exceed 40 percent of pipe diameter as measured in the manhole when performing television inspection.

(c) Bypass pumping, if required, shall conform to the requirements of COP Supplement 200.2 and shall be incidental to CCTV Inspection.

(5) Inspection Methods

(a) The Engineer and the City's Wastewater Collection Representative shall have access to observe the video monitor and all other operations at all times. The system of cabling employed to transport the camera and transmit its signal shall not obstruct the camera's view.

(b) The Contractor shall physically measure and record on the inspection log, the length of each sewer reach from the centerline of its terminal manholes.

(c) The camera may travel through the sewer in either direction. Maximum rate of travel shall be 30 feet per minute when recording.

(d) The camera image shall be down the center axis of the pipe when the camera is in motion. The Contractor is required to provide a 360 degree sweep of the pipe interior, at points of interest, in order to more fully document the existing condition of the sewer. Points of interest may include, but are not limited to, defects, encrustations, mineral deposits, debris, sediment and any location determined not to be clean or part of a proper line installation and defects in the liner including, but not limited to, bumps, folds, tears, dimples, etc.

(e) The video and all inspection documentation should include the sewer line and manhole identifiers shown on the plans. After the rehabilitation of the sewer main is complete, the Contractor shall use the upstream manhole as the identifier in conjunction with the distance meter.

(f) The City will review videos and logs to ensure compliance with the requirements listed in this specification and contract documents. If the sewer line, in the sole opinion of the City, is not adequately clean, it shall be cleaned and re-inspected by the Contractor at no additional cost to the City. If the construction work, in the sole opinion of the City, has not been properly installed, it shall be reinstalled and re-inspected by the Contractor at no additional cost to the City.

Final acceptance of the project will not be granted until sewer line video results, including any re-inspection of deficient sewer main, meet the satisfaction of the Engineer and are in accordance with this section.

611.5 POST INSTALLATION INSPECTION OF NEW MAINLINE STORM DRAINS

REMOVE the first sentence of item (A) in its entirety and REPLACE with the following:

The Contractor shall provide the Engineer with an annotated video inspection record (DVD format only) of the new mainline storm drain pipeline.

REMOVE the last sentence of item (A) in its entirety and REPLACE with the following:

This video shall be provided to the Engineer for review and approval prior to the Contractor being allowed to place the first lift of pavement over the storm drain line.

611.6 PAYMENT

REMOVE the second paragraph in its entirety and REPLACE with the following:

All low pressure air, hydrostatic, and deflection testing shall be considered incidental to the unit price bid for sewer main installation and no additional payment shall be made for these items.

Measurement and payment shall be for the complete work of Sewer CCTV inspection at the unit price in the bid schedule. All cleaning and bypass pumping required for a clear and complete CCTV inspection shall be incidental to the cost of video inspection.

ADD the following section to Part 600- Water, Sewer, Storm Drain and Irrigation:

SECTION 612: TEMPORARY WATER MAINS (FLY LINES)

612.1 DESCRIPTION

This section describes the requirements and procedures for the installation, testing and maintenance of temporary water main systems where required to maintain service to customers during the shutdown or removal of existing City water mains for new construction. *All* existing water services shall be moved to the temporary main so that customer service interruptions are avoided.

(A) Materials: All pipe valves, fittings, hose and connections furnished by the Contractor shall be of good quality, clean, meet National Sanitation Foundation (NSF) Standard 61 requirements for potable water. The City shall be the final arbiter if any questions arise regarding the suitability of any materials to meet these criteria. Previously used pipe that has been used in sanitary sewer, force main or effluent applications is specifically NOT allowed, regardless of any disinfection procedures or results submitted.

Temporary mains 6 inches or greater shall be constructed of HDPE solid wall pipe conforming to AWWA C906 with a minimum DR ration based on 150 psi. Higher rated pipe may be required based on analysis of the City water system for the construction area.

Temporary mains less than 4 inches may be constructed of either HDPE or PVC with the appropriate pressure rating for system and testing pressures.

(B) Installation and Protection: The temporary line may be installed above grade as necessary to facilitate the construction of new waterline. The temporary pipe shall be installed in such a manner that it will not present a hazard to vehicle traffic or pedestrians and will not interfere with access to homes, businesses and driveways along its route. Cover plates shall be installed as necessary. Where installed at driveway or street crossings the line shall be protected from traffic loads and displacement. During seasons with potential for freezing the lines shall be insulated to the degree necessary to prevent damage to the line or fittings and to maintain service.

Valves shall be installed at the beginning and end of the temporary line and at 300 foot intervals, or as directed by the City. The use of pressure reducing valves for individual service connections may be required as directed by the City.

All temporary piping, fittings and service connections shall be furnished, installed and maintained by the Contractor for the duration of the construction. The Contractor shall make connections to a water source designated by the City or as shown on the plans. Alternative connection points may be considered by the City.

(C) Testing

(1) Disinfection and Testing: The Contractor shall be responsible to disinfect all pipe, connections and fittings in accordance with MAG Specification 611.3. Disinfection of the line, if not connected to the City's existing system at either end, may be treated as a closed vessel for purposes of the disinfection period and combined with the pressure test. If the temporary line is connected to the City's existing system the line shall be disinfected, flushed and then pressure tested after a bacteriological sample is obtained and tested.

(2) Pressure Testing: All temporary water mains shall be pressure tested to ensure integrity of the system supplying water to the City's customers. Test pressure shall be a minimum of 50 psi over normal system operating pressure for the area served by the temporary line and shall be maintained for 2 hours. Pressure test results should be provided to the Inspector responsible for the project. A single length of HDPE line with no joints will not require a pressure test.

(3) Bacteriological Testing: Following disinfection, pressure testing and flushing of the temporary line, the Contractor shall obtain water samples from the line and submit to a certified laboratory for bacteriological testing. Results shall be provided to the Inspector responsible for the project. The City's Utility Engineer will review test results prior to connection of existing customers to the temporary line.

(D) Maintenance and Repairs

(1) Maintenance: Following acceptance of the temporary system as a potable system by the City, the Contractor shall maintain continuous service through the temporary piping to all customers normally served both directly and indirectly by the pipe line. Once the temporary pipe has been accepted, the Contractor shall request the City to shut down the existing system piping and the Contractor shall remove the existing system piping in conflict with the new mains or as shown on the project plans.

Upon completion of the work, the Contractor shall remove the temporary piping and appurtenances and shall restore all ground surfaces and water service connections to the satisfaction of the City.

(2) Repairs: If repairs to temporary piping are necessary the Contractor shall make such repairs in a timely manner as directed by the City. If progress in making repairs is inadequate, as determined

by the City, or in the event of an emergency, the City may take immediate corrective measures, which may include the performance of repair work by City forces or another contractor. All costs for corrective measures shall be borne by the Contractor.

(3) Fire Hydrants: Fire hydrants not on the temporary main that are taken out of service shall be covered with a bag to be easily recognized as being out of service until they are removed or until they are brought back into service. The Contractor shall notify the City Fire Marshal and the Water Operations Division of any fire hydrants that will be taken out of service.

(E) Measurement and Payment: Measurement for the installation, testing and maintenance of temporary water mains shall be for each separate main installation.

Payment shall be made at the unit price contained in the bid schedule. Such payment shall be full compensation for furnishing and installing the pipe, fittings valves, adaptors, service connections, and all miscellaneous fittings, complete in place, standard details, and/or Temporary Water Main Plan submittal and approval, and shall include all costs of excavation, removal of obstructions, shoring, bracing, bedding, backfilling, compaction, maintenance of traffic, testing, disinfection, connections to existing mains and services, disposal of existing pipes and materials. Disposal of asbestos cement pipe, lead joints and other potential hazardous materials shall be disposed of in accordance with applicable Federal, State and local regulations and shall be considered incidental to the payment for Temporary Mains unless specifically identified in other bid items.

SECTION 615: SANITARY SEWER LINE CONSTRUCTION

615.2 MATERIALS

REMOVE in its entirety and REPLACE with the following:

Pipe used for sewer line construction, including specials, joints, and gaskets, shall be according to the following sections, or as modified by the special provisions.

HDPE pipe shall conform to MAG Specification 738. Vitrified clay pipe shall conform to MAG Specification 743. Polyvinylchloride (PVC) pipe and fittings shall conform to MAG Specification 745. Ductile iron pipe shall conform to MAG Specification 750.

(A) Sanitary sewer main construction shall be in accordance with all applicable standard details and MAG Specification 750. All sanitary sewer piping and fittings shall be ASTM D3034 SDR 35 PVC or AWWA C151 Ductile Iron, Class 350, with an epoxy coating (Protecto Coat 401, Series 431 Perma-Shield, or approved equal). Sewer pipe shall be furnished new in full lengths with manufacturer, class, rating and other pertinent information clearly marked on the barrel. All ductile iron sewer main shall be encased in polyethylene protective wrapping in accordance with MAG Specification 610.6 where called for on the plans or after the Contractor's testing of bedding and shading material is found to be corrosive in accordance with AWWA C105.

(B) Field cuts and taps of ductile iron pipe shall be re-coated with Protecto Coat 401, Series 431 Perma-Shield, (or approved equal) field kit in accordance with the manufacturer's recommendations.

(C) Where noted on project plans, mechanical joint or restrained joint, Class 350, ductile iron sewer main shall be installed 10 feet (minimum) each direction from water/sewer interface where vertical separation is less than 2 feet or until 6 feet of horizontal separation is attained per MAG Detail 404.

(D) The method of construction of manhole and sewer main replacements is of prime importance to the City. Maintenance of sewage flows is critical and shall be the responsibility of the Contractor. The

Contractor's construction schedule shall be phased as to allow for minimal pumping of sewage flows for manholes and sewer main under construction.

(E) Payment for sanitary sewer main will be at the applicable unit bid prices for sewer main, as shown in the bidding schedule and shall include all excavation, backfill and compaction in accordance with trench details and all materials necessary for installation of the new sewer main.

615.8 SANITARY SEWER SERVICE TAPS

REMOVE the last sentence of the fourth paragraph in its entirety.

ADD the following:

All new or replacement sewer services, and any existing sewer services disturbed during construction, shall be replaced to the location indicated on project plans with a new minimum 4 inch ASTM D3034 SDR 35 PVC or AWWA C151 Ductile Iron, Class 350, with an epoxy coating (Protecto Coat 401, Series 431 Perma-Shield, or approved equal) sewer pipe, backwater valve, manufactured wye, and appurtenances in accordance with COP GES Details 405Q, 414P, 440P-1, 440P-2 and 440P-3, except as modified herein.

If individual sewer service disruption is anticipated, the Contractor shall notify the property owner 24 hours in advance. Sewer service must be restored within 4 hours or some alternate means of sewage disposal provided to allow for the resumption of individual sewer service.

Payment for sanitary sewer service shall be at the unit price indicated on the bidding schedule for the sewer service installation, and shall include connecting each existing sewer service including all labor, material, equipment, removal of existing pipe, new pipe, coupling concrete reinforcement, new concrete encasement, fittings, by-pass pumping and other work required to connect the existing yard line service to the new sewer main.

615.10 MANHOLES

ADD the following:

(A) The Contractor is to provide to the Engineer a detailed written description of the method of construction for manhole and sewer replacement for each individual area of work. This should include, but is not limited to the following:

(1) Maintenance of sewage flows during construction and curing of concrete.

(2) Type of concrete for manhole bases (i.e. pre-cast, "high-early", etc.)

(3) Method of curing concrete (i.e. protection against freezing, development strength before barrels and cones are set, etc.)

(4) What steps will be taken to ensure the grade around the manholes will not sink when complete (i.e. compaction testing, special base preparation, etc.)

Sanitary sewer manholes shall be constructed per COP Supplement 625.

SECTION 618: STORM DRAIN CONSTRUCTION

618.1 DESCRIPTION

ADD the following:

Work under this item shall be in accordance with COP Supplement 601 and as modified herein.

REMOVE the second paragraph in its entirety.

618.2 MATERIALS

REMOVE the first paragraph in its entirety and REPLACE with the following:

Pipe used for storm drain construction, including specials, joints, and gaskets, shall be according to the following sections, or as modified by special provisions.

The concrete pipe, HDPE pipe, corrugated metal pipe (CMP), specials, joints, gaskets, and testing shall be according with MAG Specifications 621, 735, 736 and 738, except as specified below or as modified by special provisions.

ADD the following:

All CMP shall have $2^{2}/_{3}$ inch x ½ inch corrugations with a minimum gauge of 14. Steel lined or paved CMP will not be allowed.

(1) Rubber Gasket Joints

All joints for CMP shall conform to MAG Specification 621.3.1 and shall be watertight.

618.3 CONSTRUCTION METHODS

REMOVE the first paragraph in its entirety and REPLACE with the following:

Excavation, bedding, backfilling, and compaction of backfill and bedding of trenches shall be accomplished in accordance with COP Supplement 601 and MAG Specification 603 for HDPE pipe, or as modified by special provisions.

SECTION 625: MANHOLE CONSTRUCTION AND DROP SEWER CONNECTIONS

625.1.1 Manholes

ADD the following:

Sanitary sewer manhole construction shall be in accordance with COP GES Details 420Q-1, 420Q-2, 421Q, 422Q, 423P-1, 423P-2, 426Q-1, 426Q-2 and 427Q.

625.1.2 Sanitary Drop Sewer Connections

ADD the following:

Sanitary sewer drop connections shall be constructed per COP GES Detail 426Q-1.

625.2 MATERIALS

REMOVE the second paragraph in its entirety and REPLACE with the following:

Brick shall not be used for maintenance and adjustment of the existing sanitary sewer manhole or ring and cover.

REMOVE the seventh paragraph in its entirety and REPLACE with the following:

Manhole steps, where approved by the City shall be in accordance with COP GES Detail 412Q. Plastic manhole steps shall conform to OSHA and ASTM C487 requirements. The manufacturer shall furnish a written certification indicating conformance.

625.3 CONSTRUCTION METHODS

REMOVE in its entirety and REPLACE with the following:

625.3.1 Manholes

Manholes shall be constructed of precast concrete sections, frames and covers, in accordance with the standard details. The invert channels shall be smooth and semi-circular in shape, conforming to the inside of the adjacent sewer sections. Changes in direction of flow shall be made with a smooth curve, having a radius as large as the manhole will permit. Changes in size and grade of the channels shall be made gradually and evenly.

Invert channels may be formed of concrete having a smooth mortared surface, or may be constructed by laying a full section of sewer pipe through the manhole and cutting out the portion of pipe above the floor after the surrounding concrete has hardened. The floor of the manhole outside the channels shall be smoothed and shall slope towards the channels.

Existing manholes shall be totally removed, including the bases, and disposed of by the Contractor. Existing rings and covers shall be salvaged and delivered to the City Wastewater Collection Yard located at 1505 Sundog Ranch Road. No separate payment will be made for removing manholes or salvaging manhole rings and covers. The cost of this item of work shall be included in the cost of manhole construction.

The excavation shall be made cylindrical to a diameter sufficient in size to permit sheeting if necessary and leave room that the precast concrete sections may be properly assembled.

Concrete foundations shall be Class A concrete and in accordance with the standard details and COP Supplement 505 for both poured-in-place and pre-cast bases. Cast-in-place concrete bases and inverts shall cure for a minimum of 72 hours, depending on concrete development strength before barrels and cones can be placed and before sewage flows across the inverts.

Frame and Cover: All machined surfaces on the frame and cover shall be such that the cover will lie flat in any position in the frame and have a uniform bearing through its entire circumference. Any frame and cover which creates any noise when passed over by automobiles shall be replaced. Frames shall be set in accordance with COP GES Detail 420Q-1.

Watertight Ring and Cover: Installation of watertight ring and cover shall be in accordance with COP GES Detail 420Q-1 as indicated on the plans. Watertight rings and covers shall be approved by the City prior to installation and cost shall be incidental to the manhole construction.

All water encountered during the work shall be disposed of by the Contractor in a manner such that it will not damage public or private property or create a public nuisance or health problem in accordance with MAG Specification 220.1. The costs of special bedding and over excavation as required to provide a stable foundation, and other equipment and materials shall be incidental to the work.

Backfilling shall be done in accordance with the requirements for trench backfilling as stated in COP Supplement 601. Quality Control density testing shall be 1 test per 16 inches of fill, beginning at 2 feet above the crown of the pipe. A minimum of 2 density tests are required for each manhole. Each density test taken shall be in a different quadrant of the manhole as the previous test. If 4 tests are required, each quadrant shall have a density test.

625.3.2 Sanitary Sewer Drop Connections

Drop manholes that intercept existing mains (upper invert) shall not have a block-out for the pipe during the casting process. Said manholes shall be core drilled in place once the appropriate invert elevation has been verified in the field.

Core drilling shall not commence without approval from the Engineer.

The pipe shall be sealed at the penetration using a Link-Seal Modular Seal or approved equal.

(A) Internal Drop

(1) Internal drop systems shall be installed in drop manholes where indicated on the plan sheets and accordance with COP GES Detail 426Q-1.

(2) Internal drop systems shall be constructed using Reliner Inside Drop System as manufactured by Reliner/Duran Inc., or approved equal.

(3) Manholes with internal drop systems require Internal Manhole Coating, and shall have the protective coating installed and tested prior to the installation of the drop system. Manhole coating shall be in accordance with COP Supplement 626.1.

625.3.3 Sanitary Sewer Manhole Testing

All manholes installed shall be tested by exfiltration or by vacuum testing as determined by the City. Testing shall be per ASTM C1244-3 and in accordance with Arizona Administrative Code, Title 18, Chapter 9, Part E301(D)(3)(e).

Testing of sanitary sewer manholes is considered incidental to the price bid for manhole installation and no additional payment shall be made.

625.4 MEASUREMENT

REMOVE in its entirety and REPLACE with the following:

Measurement of manholes shall be per manhole installed, complete in place regardless of depth.

Measurement of drop manholes shall be per manhole installed, complete in place regardless of depth.

Measurement for internal drops shall be per drop installed, complete in place regardless of depth.

625.5 PAYMENT

REMOVE in its entirety and REPLACE with the following:

Payment for each accepted manhole installation shall be at the contract unit bid price in the bidding schedule and shall include all excavation, backfill, installation, grade ring adjustment, all necessary materials and testing for a complete manhole installation.

Payment for each accepted drop manhole installation shall be at the contract unit bid price and shall include all excavation, backfill, installation, internal coating, internal drop assembly, core drilling, grade ring adjustment, all necessary materials, and testing for a complete manhole installation

Payment for internal drop systems installed in existing manholes shall be at the bid unit price and shall include complete installation of the internal drop assembly, and internal coating in accordance with COP GES Detail 426Q-1 and all materials necessary for installation of the new drop sewer connections.

ADD the following section to Part 600- Water, Sewer, Storm Drain and Irrigation:

SECTION 626: MANHOLE COATINGS

626.1 DESCRIPTION

This section specifies the coating system used for the lining of the manholes as indicated on the drawings. The Contractor shall furnish all labor, materials and equipment required to clean, modify and coat the manholes. The Contractor shall comply with the local authority and all OSHA requirements for confined space entry. The coating shall yield a hard, durable chemical resistant coating and shall be specifically designed to be applied on a dry surface. The finish coating shall provide a watertight seal and shall adhere to all components of pipeline liner systems.

(A) Specific coating terminology used in this section is in accordance with definitions contained in ASTM D16, ASTM D3960 and the following definitions:

(1) Dry Film Thickness (DFT): The thickness of one fully cured continuous application of coating.

(2) Field Coat: The application or the completion of application of the coating system after installation of the surface at the site of the work.

(3) Shop Coat: One or more coats applied in a shop or plant prior to shipment to the site of erection or fabrication, where the field or finishing coat is applied.

(4) Tie Coat: An intermediate coat used to bond different types of paint coats. Coatings used to improve the adhesion of a succeeding coat.

(5) Photochemically Reactive Organic Material: Any organic material that will react with oxygen, excited oxygen, ozone or other free radicals generated by the action of sunlight on components in the atmosphere giving rise to secondary contaminants and reaction intermediates in the atmosphere which can have detrimental effects.

(6) 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 or pounds per gallon.

(7) Touch-Up Painting: The application of a 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.

(B) Quality Assurance

(1) References: This section contains references to the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

- ASTM D16-93 Standard Terminology Relating to Paint, Varnish, Lacquer and Related Products
- ASTM D3359 A-92 Standard Test Methods for Rating Adhesion by Tape Test
- ASTM D3960-92 Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings

(2) Standardization: Materials and supplies provided shall be the standard products of manufacturers. Materials in each coating system shall be the products of a single manufacturer.

(C) Delivery and Storage

(1) Materials shall be delivered to the job site in their original, unopened containers. Each container shall bear the manufacturer's name, coating type, batch number, date of manufacture, storage life and special directions.

(2) Materials shall be stored in enclosed structures and shall be protected from weather and excessive heat or cold. Flammable materials shall be stored in accordance with State and local codes. Materials exceeding storage life recommended by the manufacturer shall be removed from the site.

626.2 MATERIALS

(A) The pre-approved coatings for the lining of manholes include: Sewer Shield Liner 150 as manufactured by Environmental Coatings, Mesa, Arizona; Sauereisen No. 210 as manufactured by Sauereisen, Inc., Pittsburgh, Pennsylvania; or Raven 405 as manufactured by Raven Lining Systems, Broken Arrow, Oklahoma. The coating color shall be approved by the owner.

(B) Primer shall be as recommended by the manufacturer for each application.

(C) Defect filler shall be as recommended by the manufacturer for each application. The coating shall contain no more than 20 percent filler, sand; no fiberglass fillers.

(D) Applicator Experience and Qualifications: The coating applicator must have a minimum of 2 years experience in applying either the specified coating or an equivalent coating and shall be certified as an applicator by the manufacturer. They shall submit a successful performance history for the application of either the specified coating or a similar coating in the wastewater industry:

(1) The coating applicator shall submit 3 references relating to the quality of workmanship performed on other projects using the same coating being proposed or an equivalent coating.

(2) The coating applicator shall be an Arizona licensed contractor with an AE License or equivalent.

(3) The coating contractor shall submit a manufacturer's certification to apply the coating specified herein for each applicator involved in the coating process.

(E) Product Data: Before materials are delivered to the job site, the Contractor shall provide the following information in accordance with these specifications.

(1) For the filler, primer and finish coating, the Contractor shall furnish a Material Safety Data Sheet (MSDS).

(2) For the filler and finish coating, the Contractor shall provide the manufacturer's application instructions, which shall include the following:

(a) Surface preparation recommendations

(b) Primer type, where required

(c) Maximum dry and wet mil thickness per coat

(d) Minimum and maximum curing time between coats, including atmospheric conditions for each

(e) Curing time before submergence in liquid

(f) Thinner to be used with coating material

(g) Ventilation requirements

(h) Minimum atmospheric conditions during which the coating shall be applied

(i) Allowable application methods

(j) Maximum allowable moisture content

(k) Maximum storage life

(3) List of materials proposed to be used under this section and manufacturer's data for each material.

626.3 COATING

(A) Coating products shall not be used until the City has inspected the materials and the coating manufacturer's technical representative has instructed the Contractor and the City in the surface preparation, mixing and application of the coating. The coating manufacturer's technical representative must be a factory representative, not a local representative or an affiliate of the Contractor.

(B) Field coats shall consist of 1 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 all previous coats have been inspected.

(C) All items of equipment, or parts and surfaces of equipment, which are immersed when in service, with the exception of pumps and valves shall have all surface preparation and coating work, performed in the field.

(D) Preparations

(1) 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 except as specified. 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 of contaminants, which might interfere with the adhesion of the coatings. The air used for blast cleaning shall be sufficiently free of oil and moisture to not cause detrimental

contamination of the surfaces to be coated. The Contractor shall examine all surfaces to be coated and shall correct all surface defects as required by manufacture before application of any coating.

(2) The Contractor shall protect the sewer from debris, overspray or any detrimental activity due to restoration of the manholes.

(3) Holes shall be filled using a grout as recommended by the coating manufacturer, and approved by the Engineer. The grout filler shall be used to bring all areas of holes and pitting up to the nominal surface of the manhole so that there is an even interior surface in the manhole without waves, pits or holes. Any exposed rebar shall be cleaned, and all areas of corrosion removed, prior to application of the grout as recommended by the coating manufacturer and approved by the Engineer.

(4) After surface preparation is complete, all loose material shall be removed from the sewer and manholes.

(5) The Contractor shall repair all defects in the coating system where directed by the Engineer.

(6) Surface preparations for each type of surface shall be in accordance with the specific requirements of the coating system specification sheet (COATSPEC). The COATSPEC shall be supplied by the manufacturer.

(E) Application

(1) The surface of the installed coating will be cleaned and prepared to permit visual inspection by the Engineer. Any areas of the coating showing poor adhesion, excessive air inclusion or edge or seam defects shall be properly repaired and re-inspected.

(2) Coated surfaces shall be free from runs, drops, ridges, waves, laps and brush marks. Coats shall be applied so as to produce an even film of uniform thickness completely coating corners and crevices. Painting shall be done in accordance with the requirements of SSPC: The Society for Protective Coatings, Paint Application Specification No. 1. The SSPC Paint Application Specification shall be supplied by the manufacturer.

(3) The Contractor's equipment shall be designed for application of the materials specified. The coating shall be obtained with the proper thickness and surface characteristics as recommended by the coating manufacturer.

(4) Each coat shall be applied evenly and sharply cut to line. Care shall be exercised to avoid over-coating or spattering on surfaces not to be coated.

(5) Film Thickness and Continuity: Coating system thickness is the total thickness of the finished coats. The surface area covered for various types of surfaces shall not exceed those recommended by the manufacturer. Coatings shall be applied to the thickness specified, and in accordance with these specifications. In testing for continuity of coating about welds, projections (such as bolts and nuts), and crevices, the City will determine the minimum conductivity for smooth areas of like coating where the dry mil thickness has been accepted. This conductivity shall then be taken as the minimum required for these rough or irregular areas. Pinholes and holidays shall be repainted to the required coverage.

(6) Safety and Ventilation: Requirements for safety and ventilation shall be in accordance with SSPC Paint Application Guide No. 3. The SSPC Paint Application Guide shall be supplied by the manufacturer.

(7) Cleanup: Upon completion of coating, the Contractor shall remove surplus materials, protective coverings and accumulated rubbish and thoroughly clean all surfaces and repair any over spray or other paint-related damage.

(F) Testing

(1) Spark Testing: All coated surfaces shall be spark tested for holes. The spark tester used shall provide 14,000 volts. If pinholes are found, the Contractor shall repair the coating as recommended by the manufacturer and retest. All testing and repair work shall be at the Contractor's expense.

(2) Adhesion Testing: The Contractor shall perform an adhesion test after proper cure in accordance with ASTM D3359 to demonstrate that the specified field coatings adhere to the substrate. Test results showing an adhesion rating of 5A on immersed surfaces and 4A or better on all other surfaces shall be considered acceptable.

626.4 DEFECT REPAIR

The Contractor shall repair all defects in the coating system where directed by the Engineer.

Where unacceptable adhesion test results are obtained, the Contractor shall be responsible for removing and reapplying the specified coatings at no expense to the City.

626.5 WARRANTY

The coating applicator shall supply a minimum 5 year warranty, for the coating that has been approved through the submittal process. The coating applicator shall also supply a warranty from the coating manufacturer addressed to the City. The warranty shall state, at a minimum, that the coating is applied in accordance with the manufacturer's instruction and that the coating will not fail for a period of 5 years. The definition of coating failure is that blistering, cracking, embrittlement or softening of the coating is starting to occur.

All structural rehabilitation work performed by the Contractor shall be guaranteed against faulty workmanship and/or materials for a period of 2 years after final acceptance of work.

626.6 MEASUREMENT AND PAYMENT

Payment for manhole coating shall be per square foot as measured from the invert to the ring and cover. The unit price shall include by-pass pumping and all materials necessary for internal coating of manholes specified on the plan sheets.

SECTION 630: TAPPING SLEEVES, VALVES AND VALVE BOXES ON WATER LINES

630.3.1 General

ADD the following:

Valves shall be resilient wedge gate valves, Waterous 2500 series, Clow, Mueller, or equal, suitable for use in line and in wet tapping water mains in conjunction with tapping sleeves. Gate valves shall be mechanical joint except where flange joints are specifically detailed in project plans or where required for tapping sleeves and hydrant installation.

Valve blocking shall be provided on all valves in accordance with Quad City Detail 301Q. No separate payment will be made for valve blocking and the cost shall be included in the water main unit price.

Valve boxes shall be in accordance with COP GES Detail 391Q.

Debris caps shall be installed on all valves within project limits according to MAG Detail 392 and shall be color-coded according to COP GES Detail 391Q. Debris caps shall be SW Services DC600 or approved equal.

The Contractor shall notify customers of scheduled water service disruption a minimum of 24 hours in advance of construction. Customers shall coordinate water shut-down with City Water Operations in accordance with Quad City Detail 103P.

630.3.2 Specific Valve Size Requirements

REPLACE item (A) with the following:

(A) Valves 2 inches through 12 inches:

REMOVE item (B) in its entirety and REPLACE with the following:

(B) Valves 14 inches and larger:

Valves shall be iron body resilient-seated gate valves in accordance with the latest revision of AWWA C515.

Valves shall be for operation in a horizontal position. The valve shall have bevel gears. The gears and stuffing box shall be enclosed in a watertight iron case, for operation in a buried location. The case shall be filled with grease at the factory.

By-pass valves shall be furnished and installed on each valve unless otherwise indicated on the approved plans. See Table 630-1 for by-pass valve sizes.

630.4 TAPPING SLEEVES AND VALVES

ADD the following:

The City Utility Operations shall be notified 48 hours in advance to schedule water main tap. If the Contractor is not ready for the tap at the scheduled time, the tap will be rescheduled. City crews will not remain on standby until the Contractor is ready for the tap. The rescheduled tap shall include a new 48 hour notification.

630.4.1 Tapping Valves

REMOVE the third paragraph in its entirety and REPLACE with the following:

Once the tap has been installed, the Contractor shall not operate the valve.

ADD the following:

Debris caps shall be installed on tapping sleeve valve according to MAG Detail 392 and shall be color-coded according to COP GES Detail 391Q. Debris caps shall be SW Services DC600 or approved equal.

630.5 BUTTERFLY VALVES

REMOVE item (A) and REPLACE with the following:

(A) 18 inches and larger:

REMOVE item (A) (1) in its entirety and REPLACE with the following:

(1) Valve body shall be of cast iron or ductile iron with connecting ends one of or a combination of flanged (short body) or mechanical joint.

REMOVE item (B) in its entirety and REPLACE with the following:

(B) 3 inches through 16 inches:

Butterfly valves shall not be used.

630.6 AIR RELEASE AND VACUUM VALVES

ADD the following:

(C) Air/vacuum release valves shall be in accordance with COP GES Detail 317Q-1 or 317Q-2.

(D) Combination Air Valves

(1) Air valves shall be standard combination style. Cast iron air valves shall comply with AWWA C512 except as modified herein. Valves shall be of the size shown and shall have threaded or flanged ends to match piping. Bodies shall be of high-strength cast iron, conforming to ASTM A126, Class B, or NSF 61 certified reinforced nylon. Floats of cast iron air valves shall be heavy stainless steel, suitable to withstand 1,000 psi external pressure. Seats of cast iron air valves shall be Buna-N. Other internal components of cast iron air valves shall be constructed of stainless steel, bronze, delrin, or cast iron as appropriate. Internal components for reinforced nylon valves shall be NSF 61 certified nylon, polypropylene, EPDM or NBR 70. Inlet and outlet ports for large orifice valves shall be baffled to prevent the action of high volume airflows from interfering with valve operations. Interior and exterior carbon steel surfaces shall be epoxy coated. Valves shall be designed for a minimum of 300 psi water working pressure, unless otherwise shown.

(2) Internal protective coatings shall be provided in accordance with AWWA C550.

(a) Liquid epoxy lining and coating materials shall be listed in the NSF Listing for Drinking Water Additives, Standard 61, certified for use in contact with potable water.

(b) The minimum dry film thickness for epoxy linings shall be 0.203 mm (0.008-inch or 8 mils). Liquid epoxy lining shall be applied in 2 coats in accordance with AWWA C210.

(3) Combination air valves shall be in accordance with COP GES Detail 317Q-1 or 317Q-2, unless shown otherwise. They shall have both large and small orifices in a single body. The large orifice shall serve to vent large quantities of air during filling operations and shall automatically open to relieve vacuum conditions. The small orifice shall vent small quantities of air under full line pressure that may become entrained in the system and collect at high points. Valves shall be APCO Series 140, Val-Matic Corp. Series 200, or equivalent

ADD the following subsection to 630.6 Air Release and Vacuum Valves:

630.6.1 Blow Off Installation

Blow off installation shall be in accordance with Quad City Detail 318P. The Contractor shall be required to provide Mega-Lug restraint for all joints for a distance specified per Quad City Detail 303Q-1 and 303Q-2.

630.8 MEASUREMENT

REMOVE in its entirety and REPLACE with the following:

Measurement will be by the unit each of the various kinds and sizes of valves, manholes, vaults, or tapping sleeves and valves, including valve boxes and covers, retrofit debris covers, air release valve assemblies, combination valve assemblies, and blow off assemblies.

630.9 PAYMENT

ADD the following:

Payment for valves, box and cover shall be per each at the unit bid price shown in the bidding schedule. Valves on tapping sleeves and hydrant installations shall be included in the appropriate bid item in the bidding schedule.

Debris cap specified on existing valves shall be incidental to the project work.

Payment for tapping sleeves shall be at the unit price bid in the bidding schedule and include the tapping sleeve, valve, box and cover, and all appurtenant fittings for complete assembly.

Payment for air release and vacuum valve installation shall be at the unit price bid in the bidding schedule and shall include all materials and appurtenant fittings as noted for a complete installation.

Payment for combination air valve assembly shall be at the unit price bid in the bidding schedule and shall include all materials and appurtenant fittings as noted for a complete installation.

Payment for blow off installation shall be at the unit price bid in the bidding schedule and shall include all materials and appurtenant fittings as noted for complete installation. No extra payment shall be made for Mega-Lug restraint.

ADD the following section to Part 600- Water, Sewer, Storm Drain and Irrigation:

SECTION 650: ABANDONMENT AND REMOVAL OF WATER MAIN

650.1 WATER MAIN ABANDONMENT

(A) Abandonment of existing water main shall not commence until hydrostatic and disinfection test results for the new main have been accepted by the Engineer. The Contractor shall contact the Engineer a minimum of 48 hours in advance of abandonment activities to schedule City water crews to coordinate valve operation. Water customers affected by water service disruption due to water main abandonment shall be notified by written flyer delivered by the Contractor a minimum of 24 hours in advance of scheduled water service disruption. Scheduled water service disruptions are limited to a maximum of 4 hours.

(B) Abandonment of existing main shall include the removal of all valves, hydrants, and appurtenances within the reach to be abandoned. All valves and hydrants to be abandoned shall be salvaged to the City unless otherwise noted on the plans or special provisions. All salvaged items shall be delivered to the City

Water Operations facility, located at 1481 Sundog Ranch Road, and placed as directed by the Engineer. Removed materials not identified to be salvaged shall become the property of the Contractor and properly disposed of. Removed or salvaged materials shall not be used in new main installation.

At all locations indicated on the plans, a minimum of 4 feet of water main shall be removed capped and the appropriate thrust restraint installed.

Existing valves to be abandoned shall include removing the valve, valve box, and cover in its entirety. Abandonment of appurtenances located in any structure (manhole, vault, etc.) shall include the complete removal and proper disposal of the appurtenance and the structure.

Abandonment of valves, hydrants, and appurtenances shall include the installation of the requisite number of mechanical joint caps as necessary to seal all pipe remaining in place.

(C) Restoration for water main abandonment shall include excavation, backfilling, compaction and re-surfacing in accordance with COP Supplement 601.

(D) Pavement matching and surface replacement shall be incidental to water main abandonment.

650.2 WATER MAIN REMOVAL

(A) Removal of water main shall not commence prior to authorization from the Engineer.

(B) Water main removal shall include the complete removal of all existing water main, valves, hydrants, structures, and appurtenances within the reach as indicated on the plans. All valves and hydrants to be removed shall be salvaged to the City unless otherwise noted on the plans or special provisions. All salvaged items shall be delivered to the City Water Operations facility, located at 1481 Sundog Ranch Road, and placed as directed by the Engineer. Materials not otherwise identified to be salvaged shall become the property of the Contractor and properly disposed of. Removed or salvaged materials shall not be used in new main installation.

(C) Removal of water main shall include excavation, backfilling, compaction, disposal and salvage in accordance with COP Supplement 601.

(D) Pavement matching and surface replacement shall be measured and paid accordance with COP Supplement 336. Any other restoration shall be considered incidental.

650.3 MEASUREMENT

Measurement for abandonment of water main and laterals shall be by the linear foot of pipe abandoned, measured horizontally through valves and fittings. Hydrants, valves, fittings, vaults, services, and other appurtenances shall be considered incidental to water main abandonment.

Measurement for removal of water mains and laterals shall be by the linear foot of pipe removed, measured horizontally through valves and fittings. Hydrants, valves, fittings, vaults, services, and other appurtenances shall be considered incidental to water main abandonment.

650.4 PAYMENT

Payment for water main abandonment shall be at the applicable unit bid price and shall include all work and appurtenant fittings necessary for complete abandonment. Pavement matching and surface replacement shall be incidental to water main abandonment.

Payment for water main removal shall be at the applicable unit bid price and shall include all work and appurtenant fittings necessary for complete removal. Pavement matching and surface replacement shall be

measured and paid accordance with COP Supplement 336. Any other restoration shall be considered incidental.

ADD the following section to Part 600- Water, Sewer, Storm Drain and Irrigation:

SECTION 651: ABANDONMENT AND REMOVAL OF SANITARY SEWER

651.1 SANITARY SEWER ABANDONMENT

(A) Abandonment of sanitary sewer shall not occur until all existing sanitary sewer services have been transferred to another main or lateral, and abandonment is approved by the Engineer.

(B) Abandonment of sanitary sewer shall include gravity and/or force mains, manholes, vaults, wet wells, and other appurtenances within the reach noted on the plans to be abandoned.

(C) Manhole frames, covers, vault access hatches, and clean-out frame and covers shall be salvaged to the City unless otherwise noted on the plans or special provisions. All salvaged items shall be delivered to the City Wastewater Collections facility, located at 1505 Sundog Ranch Road, and placed as directed by the Engineer. Materials not otherwise identified to be salvaged shall become the property of the Contractor and properly disposed of. Removed or salvaged materials shall not be used in new sewer installation.

(D) Restoration for sanitary sewer abandonment shall include all excavation, backfilling, compaction, and resurfacing in accordance with COP Supplement 601.

651.1.1 Sanitary Sewer Mains

(A) Abandonment of sanitary sewer mains shall include all gravity mains, laterals, and force mains, and shall be accomplished by pipe bursting or grout filling as indicated on the plans.

(1) Pipe bursting shall be performed using industry standard methods and equipment.

A pipe bursting plan including equipment used, means and methods shall be submitted and approved in accordance with Section 105.2 of these specifications prior to beginning bursting operations.

Valves shall be removed and disposed of prior to pipe bursting, and shall become property of the Contractor. All valves shall be properly disposed of in accordance with these specifications.

(2) Grouting shall be accomplished following industry standard methods, using a cement based grout to fill the void of the existing sanitary sewer main. The grouting material must have a minimum compressive strength of 100 psi and shall have flow characteristics appropriate for filling a sanitary sewer.

Injection of the grout material shall be done with sufficient pressure and injection locations to fill the existing sanitary sewer line. The method shall adequately provide for the removal and legal disposal of existing sewage in the lines and any pipe materials removed, and release of air from the system to facilitate proper abandonment.

A grouting plan including equipment used injection locations, grout mix design, and means and methods shall be submitted and approved in accordance with Section 105.2 prior to beginning grouting operations.

651.1.2 Manholes, Vaults and Wet Wells

(A) Abandonment of manholes, vaults, wet wells and other structural appurtenances shall include the complete removal of each structure within the reach to be abandoned as indicated on the plans.

(B) All items removed and not salvaged shall become property of the Contractor and properly disposed of in accordance with these specifications.

(C) Backfilling after removal shall be in accordance with COP Supplement 601.

(D) Pavement matching and surface replacement shall be incidental to sewer abandonment.

651.2 SANITARY SEWER REMOVAL

(A) Removal of sanitary sewer shall not commence prior to authorization from the Engineer.

(B) Removal of sanitary sewer shall include the complete removal of gravity and/or force mains, manholes, vaults, wet wells, and other appurtenances within the reach noted on the plans to be removed.

Existing sanitary sewer that is removed coincident with the installation of new sanitary sewer shall be considered incidental to the installation and shall not be measured or paid for under this section.

(C) Manhole frames, covers, vault access hatches, and clean-out frame and covers shall be salvaged to the City unless otherwise noted on the plans or special provisions. All salvaged items shall be delivered to the City Wastewater Collections facility, located at 1505 Sundog Ranch Road, and placed as directed by the Engineer. Materials not otherwise identified to be salvaged shall become the property of the Contractor and properly disposed of. Removed or salvaged materials shall not be used in new sewer installation.

(D) Removal of sewer main, laterals, or force main that tie into an existing manhole that is to remain in service shall include complete removal of the penetrating pipe and grouting the hole with lean, non-shrink grout. A water stop shall be used to ensure the integrity of the manhole.

The water stop proposed shall be submitted for review and approval prior to removal activities in accordance with Section 105.2 of these specifications.

(E) Removal of sanitary sewer shall include excavation, backfilling and compaction in accordance with COP Supplement 601. Disposal, salvage, and bypass pumping shall be considered incidental to sewer removal.

(F) Pavement matching and surface replacement shall be measured and paid in accordance with Section 336 of these specifications. Any other restoration shall be considered incidental.

651.3 MEASUREMENT

Measurement for abandonment of sewer main, laterals, and force main shall be by the linear foot of pipe abandoned, measured horizontally through manholes, vaults, valves, and fittings. Valves, fittings, services, cleanouts, and other appurtenances shall be considered incidental to sewer abandonment.

Abandonment of manholes and wet wells shall be the number of each abandoned. Vaults shall be considered incidental to sewer abandonment unless otherwise noted in the special provisions.

Measurement for removal of sewer main, laterals, and force main shall be by the linear foot of pipe abandoned, measured horizontally through manholes, vaults, valves, and fittings. Valves, fittings, services, cleanouts, and other appurtenances shall be considered incidental to sewer removal.

Measurement for manholes and wet wells shall be the number of each removed. Vaults shall be considered incidental to sewer abandonment unless otherwise noted in the special provisions.

651.4 PAYMENT

Payment for abandoning sewer mains, laterals, and force main shall be made at the contract unit price. Said price shall be full compensation for furnishing all materials, labor, equipment, tools and incidentals necessary to complete the work. Pavement matching and surface replacement shall be incidental to sewer abandonment.

Payment for abandoning manholes and wet wells shall be made at the contract unit price. Said price shall be full compensation for furnishing all materials, labor, equipment, tools and incidentals necessary to complete the work. Pavement matching and surface replacement shall be incidental to sewer abandonment.

Payment for removing sanitary sewer shall be made at the contract unit price. Said price shall be full compensation for furnishing all materials, labor, equipment, tools and incidentals necessary to complete the work. Pavement matching and surface replacement shall be measured and paid in accordance with Section 336 of these specifications. Any other restoration shall be considered incidental.

Payment for removing manholes and wet wells shall be made at the contract unit price. Said price shall be full compensation for furnishing all materials, labor, equipment, tools and incidentals necessary to complete the work. Pavement matching and surface replacement shall be measured and paid in accordance with Section 336. Any other restoration shall be considered incidental.

PART 700 – MATERIALS

SECTION 701: AGGREGATE

701.4 RECLAIMED CONCRETE MATERIAL (RCM)

REMOVE in its entirety and REPLACE with the following:

Use of Reclaimed Concrete Material (RCM) is not allowed.

701.5 RECLAIMED ASPHALT PAVEMENT (RAP)

REMOVE in its entirety and REPLACE with the following:

Reclaimed asphalt pavement (RAP) shall not be allowed.

SECTION 703: RIPRAP

703.1 GENERAL

REMOVE the second paragraph in its entirety and REPLACE with the following:

Aggregate shall be color-matched with adjacent landscape aggregate or as specified on the plans or in the special provisions, and approved by the Engineer. Payment for riprap shall include all work associated with providing color samples.

SECTION 710: ASPHALT CONCRETE

710.2.1 Asphalt Binder

REMOVE in its entirety and REPLACE with the following:

(A) The approved asphalt binder shall be either Performance Grade (PG) 64-22, PG 70-22, PG 70-22TR, or PG70-22TR+ asphalt conforming to the requirements of AASHTO M 320-09 Performance-Graded Asphalt Binder. The binder grade shall be as specified in the contract documents or as directed by the Engineer.

(B) The Engineer may review a request by the Contractor to change from the approved binder grade.

710.2.3 Reclaimed Asphalt Pavement (RAP):

REMOVE in its entirety and REPLACE with the following:

Reclaimed asphalt pavement (RAP) shall not be allowed.

710.3.1 General

REMOVE item (11) in its entirety.

710.3.2 Mix Design Criteria

ADD the following:

(A) The intent of this supplement is to use only ½ inch or ¾ inch Marshall or Gyratory Mix Designs within the specification unless specifically called out in the project specifications.

(B) The asphalt mix design shall be for high traffic volume, unless otherwise specified.

710.3.2.1 Marshall Mix Design

REMOVE item (5) in Table 710-3 Marshall Mix Design Criteria and REPLACE with the following:

(5) Tensile Strength Ratio: % Min.

Minimum percent requirement is changed to 75. A tensile strength ratio of 75 percent may require more than 1 percent mineral admixture.

REMOVE item (7) in Table 710-3 Marshall Mix Design Criteria and REPLACE with the following:

(7) Stability: pounds, Minimum

Minimum requirement is changed to 3500 for ½ inch mix and ¾ inch mix.

SECTION 725: PORTLAND CEMENT CONCRETE

725.1 GENERAL

ADD the following:

All Portland cement concrete placed under this contract shall be Class AA with a maximum water/cement ratio of 0.45.

ADD the following subsection to 725.1 General:

725.1.1 Adverse Weather Concreting

(A) Hot Weather Concreting: Hot weather is defined as any combination of high ambient temperature, low relative humidity, and wind velocity which would tend to impair the quality of fresh concrete. These effects become more pronounced as wind velocity increases. Since last minute improvisations are rarely successful, preplanning and coordination of all phases of the work are required to minimize these adverse effects.

(1) Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:

(a) Cool ingredients before mixing to maintain concrete temperature below 90 degrees F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is the Contractor's option.

(b) Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.

(c) Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

(2) As an absolute minimum, the Contractor shall ensure that the following measures are taken:

(a) An ample supply of water, hoses, and fog nozzles are available at the site.

(b) Spare vibrators are on hand in the ratio of 1 spare vibrator for each 3 in use.

(c) Pre-planning has been accomplished to ensure prompt placement, consolidation, finishing, and curing of the concrete.

(d) Concrete temperature on arrival should be approximately 60 degrees F and in any event shall not exceed 90 degrees F. The use of cold water and ice is recommended.

(e) The subgrade is moist, but free of standing water.

(f) Fog spray is utilized to cool the forms and steel. Under extreme conditions of high ambient temperature, exposure to the direct rays of the sun, low relative humidity, and wind, even strict adherence to these measures may not produce the quality desired and it may be necessary to restrict concrete placement to early morning only. If this decision is made, then particular attention must be directed to the curing process since the concrete will be exposed

to severe thermal stresses due to temperature variation; heat of hydration plus midday sun radiation versus nighttime cooling.

(B) Cold Weather Concreting: Comply with ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

(1) When air temperature has fallen to or is expected to fall below 40 degrees F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 degrees F and not more than 80 degrees F at point of placement.

(2) Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

(3) Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.

(C) Wet Weather Concreting: Placing of concrete shall be discontinued when the quantity of rainfall is such as to cause a flow or wash to the surface. Any concrete already placed and partially cured shall be covered to prevent dimpling. A construction joint will be installed prior to shut down.

(D) Replacement of Damaged or Defective Concrete: Upon written notice from the Engineer, all concrete which has been damaged or is defective, shall be replaced by the Contractor at no cost to the Contracting Agency.

(E) References

(1) ACI-305 Hot Weather Concreting

(2) ACI-306 Cold Weather Concreting

(3) ACI-308 Recommended Practices for Curing Concrete

(F) No separate payment shall be made for adverse weather concreting. The work shall be considered incidental and included in the unit price bid for construction or installation of the appropriate contract pay item.

725.5 ADMIXTURES AND ADDITIVES

REMOVE the third paragraph in its entirety and REPLACE with the following:

Air entraining admixtures incorporated into the approved concrete mix design shall meet the requirements of ASTM C260. All Portland cement concrete shall contain 6 percent, plus or minus 1 percent, entrained air of evenly dispersed air bubbles at the time of placement. The air-entraining agent shall contain no chlorides. The air-entraining agent shall be added to the batch in a portion of the mixing water. The solution shall be batched by means of a mechanical batcher capable of accurate measurement. Air entrainment in the concrete shall be tested in accordance with AASHTO T 152. Air entrainment shall be tested at time of sampling in accordance with ASTM C143 and C231 respectively. The cost of this testing shall be the responsibility of the Contractor.

725.8.1 Field Sampling and Tests

REMOVE the fourth paragraph in its entirety and REPLACE with the following:

The slump of Portland cement concrete shall be tested in accordance with the requirements of AASHTO T 119, ASTM C143 and ASTM C231 respectively. Concrete that does not meet the specification requirements as to slump shall not be used, but shall be removed from the job at no cost to the City. Slump tests shall be

taken in the field by a representative of the Contractor's Quality Control firm. The cost of this testing shall be the responsibility of the Contractor.

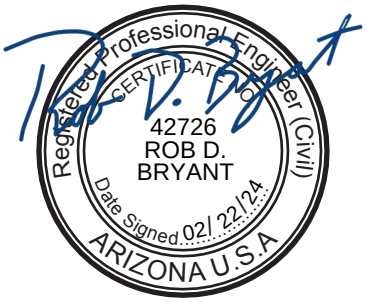
725.8.2 Concrete Cylinder Test:

ADD the following:

Concrete cylindrical specimens for compression tests shall be taken in the field by a representative of the Contractor's Quality Control firm in accordance with AASHTO T 141 and T 23. These samples will be tested for compressive strength in accordance to AASHTO T 22. Concrete samples will be taken in accordance with this section and MAG Specification 725.8.3, except as noted hereinafter. 1 set of not less than 4 cylinders per 50 cubic yards or ½ days pour shall be prepared and retained to verify compressive strength of the mixture. 1 cylinder shall be tested at 7 days and 2 at 28 days. The fourth cylinder shall be retained for up to 60 days. If the 28 day test does not meet the minimum strength requirement, cores shall be taken as provided herein and the cost of such will be the responsibility of the Contractor. Acceptance shall be based on minimum 28 day strength requirements. The cost of testing shall be the responsibility of the Contractor.

CITY OF PRESCOTT, YAVAPAI HILLS LIFT STATION # 1 TECHNICAL SPECIFICATIONS

FOR CONSTRUCTION VOLUME 2 OF 4



CITY OF PRESCOTT
ARIZONA
Everybody's Hometown

February 2024

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Scottsdale, AZ 85256
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WATERWORKS ENGINEERS

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DIVISION 01

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SECTION 01110

SUMMARY OF WORK

PART 1 - GENERAL

1.1 LOCATION AND DESCRIPTION OF WORK

A. The Work covers the demolition, new construction and rehabilitation of portions of the Yavapai Hills Lift Station #1 and performing related required work, located as shown on these Drawings and Specifications.

B. The Work is located at Yavapai Hills Lift Station, 5101 Cactus Place, Prescott, Arizona 86301.

C. The Work will be constructed under one contract. The Contract Documents include the following:
   1. Volume 1 – Drawings
   2. Volume 2 – Technical Specifications
   3. Volume 3 – Standard Details
   4. Volume 4 – Technical Memorandum

D. Interference with work on utilities:
   1. The CONTRACTOR shall cooperate fully with all utility forces of the OWNER or forces of other public or private agencies engaged in the relocation, altering, or otherwise rearranging of any facilities which interfere with the progress of the work.
   2. The CONTRACTOR shall schedule the work so as to minimize interference with said relocation, altering, or other rearranging of facilities.

E. Responsibility for Damage:
   1. The CONTRACTOR shall not be responsible for damage done by CONTRACTORs not under their jurisdiction.
   2. The CONTRACTOR will not be liable for any such loss or damage, unless it is through the negligence of the CONTRACTOR.

1.2 WORK BY OTHERS

A. OWNER will perform the following work:
   1. Operation of all existing system valves and equipment, unless specified otherwise.

1.3 SITE CONDITIONS

A. Site Investigation and Representation
   1. The CONTRACTOR acknowledges that it has satisfied itself as to the nature and location of the work, the general and local conditions, particularly those bearing upon availability of transportation, disposal, handling and storage of materials, availability of labor, water, electric power, roads, and uncertainties of weather, tide stages, or similar physical conditions at the site, the conformation and conditions of the ground, the character of equipment and facilities needed preliminary to and during the

prosecution of the work and all other matters which can in any way affect the work or the cost thereof under this Contract.

2. The CONTRACTOR further acknowledges that it has satisfied itself as to the character, quality, and quantity of surface and subsurface materials to be encountered from inspecting the site and from evaluating information derived from exploratory work that may have been done by the OWNER or included in these Contract Documents. Any failure by the CONTRACTOR to become acquainted with all the available information will not relieve the CONTRACTOR from responsibility for properly estimating the difficulty or cost of successfully performing the work.
3. Field Verification:
    a. Before undertaking each part of the work, the CONTRACTOR shall carefully study and compare the Contract Documents and check and verify pertinent figures shown thereon and all applicable field measurements.
    b. As the work proceeds, the CONTRACTOR shall field verify the depth and location of all buried utilities, and existing systems, and location of hazardous waste and contaminants.
    c. The CONTRACTOR shall promptly report in writing to the ENGINEER any conflict, error, or discrepancy which the CONTRACTOR may discover and shall obtain a written interpretation or clarification from the ENGINEER before proceeding with any work affected thereby.

B. Existing Utilities and Improvements
    1. Location of Underground Utilities:
        a. Known existing underground conduits, pipelines and other utilities have been shown on the contract drawings in their approximate locations (within 3 feet of actual location). However, the accuracy or completeness of utilities indicated on the drawings is not guaranteed.
        b. It shall be the responsibility of the CONTRACTOR to determine the exact location of all utilities and their service connections.
        c. All potholing or other procedures for verifying utility location shall be performed by the CONTRACTOR as necessary to prepare for excavation at least 4 working days in advance of scheduled excavation.
        d. The CONTRACTOR shall immediately notify the ENGINEER as to any utility located by him which has been incorrectly shown or omitted from the drawings.
        e. If the CONTRACTOR cannot locate an underground utility whose presence is indicated on the Drawings, the ENGINEER shall be notified in writing.
        f. The CONTRACTOR shall ascertain the exact locations of underground utilities whose presence is indicated on the Drawings, the locations of their service laterals work and of service laterals or appurtenances of any other underground utilities which can be inferred from the presence of visible facilities such as buildings, meters and junction boxes prior to doing work that may damage such utilities or interfere with their service.
        g. Utilities Not Shown on Drawings:
            1) Attention is directed to the possible existence of underground utilities not indicated on the Drawings and to the possibility that underground utilities may be in a location different from that indicated on the Drawings.
            2) If the ENGINEER determines that the underground utility for which such notice has been given has not been depicted on the Drawings with reasonable accuracy (within 3 feet of actual location), the additional cost incurred in locating the utility will be paid for as extra work as provided in the General Conditions.

3) If the CONTRACTOR discovers underground an utility not indicated on the Drawings, the CONTRACTOR shall immediately give the ENGINEER and the Utility Company written notification of the existence of such utility.
4) Such utilities shall be located and protected from damages as directed by the ENGINEER and the cost of such work will be paid for as extra work as provided in the General Conditions.

2. Utility Coordination:
   a. The CONTRACTOR shall notify Arizona 811 at least 2 working days prior to excavation, telephone (602) 659-7500.
   b. The CONTRACTOR shall also contact all utility owners not registered with Arizona 811 but known to have utilities in the project area to field locate underground utilities at least 4 days prior to excavation.
   c. The CONTRACTOR shall notify all owners of utilities when the Work is in progress and shall make arrangements as are necessary to make any emergency repairs.
   d. Existing utilities that are shown or that are made known and located to the CONTRACTOR prior to excavation, and that are to be retained; and all utilities that are constructed during excavation operations shall be properly supported and protected from damage during the progress of the work.
3. Utility Protection and Damage:
   a. Existing utilities that are shown or that are made known and located to the CONTRACTOR prior to excavation, and that are to be retained, and all utilities that are constructed during excavation operations shall be properly supported and protected from damage during the progress of the work.
   b. Should any damage to a utility occur during the progress of the work, the CONTRACTOR shall notify the OWNER or the utility at once and render all assistance possible to repair the damage and restore the service.
   c. No extra compensation will be made for the repair of any services or utility damaged by the CONTRACTOR nor for any damage incurred through neglect or failure to provide adequate protection to existing utilities.
   d. 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.
   e. Damaged water pipelines will be repaired by the OWNER at the CONTRACTOR's expense. If the CONTRACTOR fails to pay the cost of repairs to water pipelines within thirty days of receipt of the invoice, the OWNER reserves the right to withhold the amount owed from the CONTRACTOR's Progress Payment.
   f. Damage Report:
      1) In the event that the CONTRACTOR damages any underground utilities not shown on the Drawings or not depicted on the Drawings with reasonable accuracy (within 3 feet of actual location) or any lateral service the location of which could not be inferred by the CONTRACTOR, a written report thereof shall be made immediately to the ENGINEER.
      2) The CONTRACTOR's report shall also advise the ENGINEER of any schedule delays. Compensation for such delays will be determined in accordance with the General Conditions. The CONTRACTOR shall be entitled to no other compensation for any such damage.
4. All utilities encountered along the line of the work shall remain continuously in service during all work under the Contract, unless otherwise shown on the drawings, or unless other arrangements satisfactory to the ENGINEER are made with the owner of said utilities.

C. CONTRACTOR's Responsibility for Utility Facilities and Service

1. Where the CONTRACTOR's operations could cause damage or inconvenience to railway, telephone, television, power, oil, gas, water, sewer, or irrigation systems, the CONTRACTOR shall make all arrangements necessary for the protection of these utilities and services.
2. The CONTRACTOR shall be solely and directly responsible to the owner and operators of such properties for any damage, injury, expense, loss, inconvenience, delay, suits, actions, or claims of any character brought because of any injuries or damage which may result from the construction operations under this Contract.
3. Neither the OWNER nor its officers or agents shall be responsible to the CONTRACTOR for damages as a result of the CONTRACTOR's failure to protect utilities encountered in the work.
4. In no event shall interruption of any utility service be allowed outside working hours unless granted by the owner of the utility.
5. No sand, mud, rocks or other construction debris shall be disposed of in the sanitary sewers or storm sewers.
6. Where bypassing of sewage is required to perform sewer repairs or service relocations and where temporary pumps are required to bypass any sewage across traffic lanes, the discharge lines crossing the traffic lanes shall be buried a minimum of 4 inches below the pavement surface and backfilled with temporary asphalt concrete surfacing. The CONTRACTOR shall take all necessary steps to assure continuous flow of sewage. Bypassing of untreated wastewater to surface waters or courses will not be permitted.
7. The CONTRACTOR shall replace, at its own expense, any and all existing utilities or structures removed or damaged during construction, to their existing condition unless otherwise provided for in these Contract Documents.
8. The CONTRACTOR shall repair or replace, at its own expense, all pavement damaged during the construction, to its existing condition unless otherwise provided for in these Contract Documents.

D. Names of Known Utilities Serving the Area
   1. The following is a list of the known public utilities serving the area:
      a. Sewer – City of Prescott
      b. Telecommunications – Century Link, Sparklight
      c. Electric – Arizona Public Service
      d. Gas – UniSource Energy Solutions

E. Railroads
   1. The CONTRACTOR shall not perform work or occupy any part of railroad property without a permit authorizing the same.

F. Interfering Structures
   1. The CONTRACTOR shall take necessary precautions to prevent damage to existing structures whether on the surface, aboveground, or underground. An attempt has been made to show major structures on the Drawings. While the information has been compiled from the best available sources, its completeness and accuracy cannot be guaranteed, and it is presented as a guide to avoid possible difficulties.
   2. The CONTRACTOR shall protect all existing structures, trees, shrubs, and other items on the project site that are to be preserved, by substantial barricades or other devices commensurate with the hazard, from injury or destruction by vehicles, equipment, workmen, or other agents.

3. Where existing fences, gates, buildings, or any other structure must be removed to properly carry out the work, or are damaged during the work, they shall be restored at the CONTRACTOR's expense to their original condition or better.
4. Without additional compensation, the CONTRACTOR may remove and replace in a condition as good as or better than original, any small structures such as fences, and signposts that interfere with the CONTRACTOR's operations.

G. Field Relocation
1. During the progress of construction, it is expected that minor relocations of the work will be necessary.
2. Such relocations shall be made only by direction of the ENGINEER.
3. If existing structures are encountered that will prevent construction as shown, notify the ENGINEER before continuing with the work in order that the ENGINEER may make such field revisions as necessary to avoid conflict with the existing structures.
4. If the CONTRACTOR shall fail to notify the ENGINEER when an existing structure is encountered, and shall proceed with the work despite this interference, CONTACTOR shall do so at their own risk.
5. Any CONTRACTOR request(s) for additional compensation or contract time resulting from necessary field relocations will be considered as set forth in the General Conditions.
6. If the CONTRACTOR fails to notify the ENGINEER when a structure which interferes with construction is encountered, and proceeds with the work despite this obstruction, the CONTRACTOR shall do so at their own risk and at no additional cost to the OWNER.

1.4 REFERENCE POINTS AND SURVEYS

A. Location and elevation of benchmarks are shown on Drawings.

B. Dimensions for lines and elevations for grades of structures, appurtenances, and utilities are indicated on Drawings, together with other pertinent information required for laying out Work. If conditions vary from those indicated, notify OWNER immediately, who will make minor adjustments required.

C. OWNER may perform checks to verify accuracy of CONTRACTOR's layout Work and that completed Work complies with Contract Documents.

D. Any existing survey points or other control markers destroyed without proper authorization will be replaced by owner of the survey points or control markers at CONTRACTOR's expense.

E. CONTRACTOR's Responsibilities:
1. Provide all survey and layout required.
2. Locate and protect reference points prior to starting site preparation.
3. Notify OWNER at least 3 working days in advance of time when grade and line to be provided by others will be needed.
4. Check and establish exact location of existing facilities prior to construction of new facilities and any connections thereto.
5. In event of discrepancy in data provided by OWNER, request clarification before proceeding with Work.
6. Provide cut sheets for all staking.

7. Preserve and leave undisturbed control staking until ENGINEER has completed checks it deems necessary.
8. Re-establish reference points resulting from destruction by CONTRACTOR's operations.
9. Cooperate with ENGINEER so that checking and measuring may be accomplished with least interference to CONTRACTOR's operations.

1.5 SEQUENCE AND PROGRESS OF WORK

A. The CONTRACTOR shall submit a Construction Schedule covering the entire Work in accordance with Section 01320, Progress Schedule.

B. The CONTRACTOR shall incorporate the requirements of Section 01130, Special Project Constraints, into the Construction Schedule.

C. Alternate Sequence:
   1. The CONTRACTOR's schedule may use a different sequence from that shown or specified, if techniques and methods known to the CONTRACTOR will result in cost and time savings to the OWNER, still achieve the required objective and maintain the same or greater level of treatment.
   2. The ENGINEER's determination on the acceptability of any alternative sequence from that shown or specified shall be final.

1.6 CONTRACTOR'S USE OF PREMISES

A. Restriction of Work Area:
   1. The full use of the premises for storage, the operations of workmen and for all other construction activities will not be available to the CONTRACTOR.
   2. The CONTRACTOR must operate entirely within the space allowed to the CONTRACTOR.
   3. The Drawings defines the area allocated to the CONTRACTOR.

B. The CONTRACTOR shall be solely responsible for obtaining and paying all costs in connection with any additional work area, storage sites, access to the site or temporary right-of-way, which may be required for proper completion of the Work.

C. Limitations on Use of Work Area:
   1. It shall be understood that responsibility for protection and safe-keeping of equipment and materials on or near the site will be entirely that of the CONTRACTOR and that no claim shall be made against the OWNER or their authorized representatives by reason of any act.
   2. It shall be further understood that should any occasion arise necessitating access to the sites occupied by these stored materials or equipment, the ENGINEER shall direct the CONTRACTOR owning or responsible for the stored materials and equipment to immediately move the same.
   3. No materials or equipment may be placed upon the property of the OWNER, other than in the designated areas as shown on the Drawings, unless the ENGINEER has agreed to the location contemplated by the CONTRACTOR to be used for storage.
   4. All stored materials shall be labeled according to the appropriate contractor or Subcontractor with the manufacturer's label as well.
   5. Appropriate material safety data sheets (e.g., MSDS) shall be provided.

D. The CONTRACTOR shall be required to share use of the premises with other Contractors whose services the OWNER has obtained or will obtain for construction of other facilities on the site.

1.7 USE OF OWNER'S FACILITIES

A. The CONTRACTOR may use existing facilities or equipment in the Work for construction purposes, only if the OWNER's written permission is obtained.

B. Restore existing facilities and equipment used for temporary purposes to original condition in a manner satisfactory to OWNER.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01130

SPECIAL PROJECT CONSTRAINTS

PART 1 - GENERAL

1.1 LIMIT OF CONSTRUCTION ACTIVITIES ON WORK SITE

A. Traffic Control:
   1. During non-work hours, the CONTRACTOR shall keep all lanes of traffic open and clear. All trenches shall be backfilled or covered with suitable steel plates and open to traffic.
   2. No equipment, construction material or excavated material that will interfere with traffic shall be stored on streets or roadways at any time.

1.2 SEQUENCE OF WORK

A. General:
   1. The CONTRACTOR shall schedule and sequence their work in order to complete the Work by the specified completion date.
   2. The OWNER's wastewater collection system must remain operational at all times.
   3. Re-vegetation of graded areas shall take place as quickly as possible as weather permits.

B. Delivery of OWNER-Furnished Equipment:
   1. The OWNER-furnished equipment is currently onsite within the South Wet Well. The CONTRACTOR shall be prepared to inspect, remove and store the equipment during that period, in accordance with the requirements of Section 01630, Owner-Furnished Equipment.
      a. Existing Submersible Pump: Flygt NP 3315 HT 3 ~ 453

1.3 PROJECT CONSTRAINTS

A. Maintenance of OWNER's Operations:
   1. Constraints listed herein involve limits on activities during construction. These limits relate to the critical nature of the existing water system.
   2. Continuous operation of OWNER's facilities is of critical importance. Schedule and conduct activities to enable existing facilities to operate continuously, unless otherwise specified.
   3. Work Plan:
      a. The CONTRACTOR shall submit a detailed Work Plan and time schedule for all construction activities that will make it necessary to remove a tank, pipeline, electrical circuit, equipment, structure, road or other facilities from service, including the critical outages identified herein.
      b. The Work Plan shall, at a minimum, identifying:
         1) the date and time when each activity will occur;
         2) what equipment will be present including standby equipment;
         3) what assistance will be required by OWNER's operating personnel;
         4) an emergency backup plan identifying what action will be taken if Work cannot be completed within the allotted time; and
         5) what individual will be in charge of the activity.

c. Submit Work Plan 10 days prior to the scheduled activity.
4. Perform Work continuously during critical connections and changeovers, and as required to prevent interruption of OWNER's operations.
5. Shutdowns:
   a. Coordinate proposed Work with OWNER and facility operations personnel before affecting unit shutdowns. The CONTRACTOR shall provide written confirmation of the shutdown date and time two (2) working days prior to the actual shutdown.
   b. Under no circumstances shall the CONTRACTOR cease Work at the end of a normal working day or at the end of a working week if such actions may inadvertently cause a cessation of any facility operating process, in which case, remain onsite until necessary repairs are complete.
6. Do not close lines, open valves or gates, shut down equipment, or take other action which would affect the operation of existing systems, except as specifically required by the Contract Documents and after approval of OWNER.
7. Do not proceed with Work affecting a facility's operation without obtaining OWNER's advance approval of the need for and duration of such Work.

B. Relocation of Existing Facilities:
1. During construction, it is expected that minor relocations of Work will be necessary.
2. Provide complete relocation of existing structures and Underground Facilities, including piping, utilities, equipment, structures, electrical conduit wiring, electrical duct bank, and other necessary items.
3. Use only new materials for relocated facility. Match materials of existing facility, unless otherwise shown or specified.
4. Perform relocations to minimize downtime of existing facilities.
5. Install new portions of existing facilities in their relocated position prior to removal of existing facilities, unless otherwise accepted by OWNER.

C. Overtime:
1. Conduct Work outside regular working hours on prior written consent of OWNER to meet Project schedule and avoid undesirable conditions.
2. All overtime Work by the CONTRACTOR necessary to conform to the requirements of this Section and related Sections shall be performed by the CONTRACTOR, at no cost to the OWNER and shall be performed in accordance with the General Conditions. The CONTRACTOR shall make no claims for extra compensation as a result thereof.

1.4 SCHEDULED SHUTDOWNS AND CONSTRUCTION SEQUENCING CONSTRAINTS

A. Scheduled Shutdowns:
1. The scheduled shutdowns during the period of the CONTRACTOR'S Work will be as shown in Table 01130-A
2. All Work requiring the OWNER's facilities to be out-of-service shall be performed during the scheduled shutdowns shown.
3. The OWNER's staff will continue to perform administrative, operation and maintenance functions during shutdowns.

B. Critical work sequencing constraints are described in this paragraph. Work not specifically covered in this Section may, in general, be done anytime during the contract period.

C. Key work sequencing constraints are as follows:
1. Flow cannot be stopped.

2. Electrical outages should be minimized as necessary and shall occur during low flows.
3. See Drawings for sequencing.

TABLE 01130-A
SCHEDULED SHUTDOWNS

AREA/ITEMS	SHUT-DOWN	FACILITY	SUBSTANTIAL/ FINAL COMPLETION & CONSTRAINTS
Existing Generator	0.5 hr max primary and backup power outage	Power outage is necessary to disconnect the existing generator and ATS,	**Coordinate sequencing and outage with OWNER. Make provisions for temporary backup generator to run single 160HP Flygt pump if longer outage is needed.**
New Generator and ATS	0.5 hr max primary and backup power outage	Power outage is necessary to complete new ATS connections and connect the new generator.	**Coordinate sequencing and outage with OWNER. Make provisions for temporary backup generator to run single 160HP Flygt pump if longer outage is needed.**
Existing WWTP Structures	None	Plug/Cap existing overflow piping.	**No constraint anticipated.**

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

+ + END OF SECTION + +

O&M MANUAL REVIEW CHECKLIST

SUBMITTAL NO. _____ **DATED** _____

SPEC. SECTION. _____ **REVIEW DATE** _____

SUBJECT _____ **REVIEWER** _____

EQUIP. ITEM _____ **SUPPLIER** _____

_____ **MANUFACTURER** _____

ACCEPTABLE _____ **PROJECT TITLE:** _____

UNACCEPTABLE _____ **PROJECT NO.** CIP No. 2105-004

DISPOSITION	ACCEPTABLE? YES	NO	NA	COMMENTS
HARD-COPY O&M MANUALS				
▪ Minimum five (5) copies				
▪ Three-ring binder with hard-back cover				
▪ Cover Label and Title Page:				
Project title and Project number				
Specification section				
System/Equipment names				
Facility				
Equipment number				
▪ Typed table of contents				
▪ Heavy section dividers w/numbered plastic index tabs				
▪ Sections parallel equipment specifications				
▪ Pages punched for 3 ring binder (punching does not obliterate data)				
▪ Info larger than 8-1/2"x11" folded showing title block, or included in binder pockets				
▪ Multiple volumes labeled "Vol. 1", "Vol. 2", etc.				
▪ Table of contents for entire set in each binder				
ELECTRONIC O&M MANUALS				
▪ Minimum one (1) copy delivered by sharepoint				
▪ Full version of O&M manual in PDF format				
▪ Separate text and drawing files used to create PDF O&M manual				
TECHNICAL CONTENT				
▪ Diagrams and illustrations, including pump curves				
▪ Detailed description of function of principal components				
▪ Performance and nameplate data				
▪ Installation instructions				
▪ Starting procedure				
▪ Proper adjustment procedure				

DISPOSITION	ACCEPTABLE? YES	NO	NA	COMMENTS
▪ Test procedures				
▪ Operating procedure				
▪ Shutdown instructions				
▪ Emergency operating instructions & troubleshooting				
▪ Safety instructions				
▪ Maintenance and overhaul instructions				
▪ Lubrication instructions				
▪ List of electrical relay settings and control and alarm contact settings				
▪ Electrical interconnection wiring diagrams, including control and lighting systems				
▪ Recommended spare parts and special tools				
▪ Project specific warranty statement				

SECTION 01400

QUALITY CONTROL

PART 1 - GENERAL

1.1 OBSERVATION AND SUPERVISION

A. The ENGINEER or ENGINEER's appointed representative will review the Work and the CONTRACTOR shall provide facilities and access to the Work at all times as required to facilitate this review.

B. Responsibility:
   1. The CONTRACTOR shall be solely responsible to supervise and direct the entire Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to complete the Work in accordance with the Contract Documents.
   2. The CONTRACTOR shall be solely responsible for the means, methods, techniques, sequences, quality control, and procedures of construction and safety precautions and programs incidental thereto.
   3. The foregoing includes work performed by the CONTRACTOR's Subcontractors.
   4. The CONTRACTOR shall be responsible to see that the finished Work complies accurately with the Contract Documents.

C. Superintendent:
   1. The CONTRACTOR shall designate in writing and keep on the work site at all times during its progress a technically qualified, English-speaking superintendent, who shall not be replaced without written acceptance of the ENGINEER.
   2. The superintendent shall be the CONTRACTOR's representative at the job site and shall have authority to act on behalf of the CONTRACTOR.
   3. All communications given to the superintendent shall be as binding as if given to the CONTRACTOR.
   4. The CONTRACTOR's superintendent shall be present at the site of the Work at all times while work is in progress. Failure to observe this requirement shall be considered as suspension of the Work by the CONTRACTOR until such time as such superintendent is again present at the site.

1.2 RESPONSIBILITY

A. The CONTRACTOR is responsible for conducting all testing and inspection specifically required by the Specifications and otherwise necessary to ensure compliance with the Contract Documents.
   1. Approval of Testing Laboratories:
      a. All laboratory work under this contract shall be performed by a laboratory approved by the ENGINEER, whether the laboratory is employed by the CONTRACTOR, or is owned and operated by the CONTRACTOR.
      b. The basis of approval includes the following:
         1) Testing laboratories performing work in connection with concrete, steel, and bituminous materials shall comply with ASTM E 329 and ASTM D 3666, respectively.

2) Testing laboratories performing work not in connection with concrete, steel, bituminous materials, soils and non-destructive testing shall comply with ASTM E 548.

B. The ENGINEER may conduct periodic independent testing and inspection to verify compliance with the Contract Documents.

C. Retesting:
   1. The OWNER reserves the right to back-charge the CONTRACTOR for retesting of deficient or defective work or products upon written notification.
   2. Compensation for retesting on behalf of the OWNER will be made through deductions from the Progress Payments.

D. The CONTRACTOR is responsible for correcting all defective work discovered prior to final acceptance of the Contract, despite the failure of the Inspector(s) to discover it.

1.3 TESTS AND INSPECTIONS

A. The CONTRACTOR shall be responsible for scheduling all inspections and tests required.
   1. The ENGINEER shall be given a minimum 48 business hours notice prior to any inspections or tests.

B. The CONTRACTOR shall pay for all tests including, but not limited to:
   1. Inspections and tests necessary to comply with laws, ordinances, rules, regulations and orders of public authorities pursuant to General Conditions.
   2. Mix designs, including tests of trial batches, on concrete mixes.
   3. Tests of materials, inspections, and certifications required by the Specifications.
   4. Testing, adjusting, and balancing of equipment and systems required by the Specifications.
   5. One tension and elongation test for each 5 tons of steel or fractional part thereof for each size will be required, unless the steel can be identified by heat or melt numbers and is accompanied by mill analysis and test reports. Commercial stock may be used, subject to approval of the ENGINEER.
   6. Any testing performed by the CONTRACTOR for their own quality control (e.g., compaction tests).
   7. Retests or re-inspections by the OWNER, if required, and tests or inspections required due to CONTRACTOR error or lack of required identifications of material.
   8. Any and all water used by the CONTRACTOR in any testing.

C. Two copies of the agency or laboratory report of each test or inspection shall be provided to the ENGINEER. All tests of materials shall be made in accordance with the commonly recognized standards of national technical organizations, and such other special methods and tests as are prescribed in the Contract Documents.

D. Purchase Orders:
   1. One copy of each of the CONTRACTOR's purchase orders for materials forming a portion of the work shall be furnished to the ENGINEER, if requested.
   2. Each such purchase order shall contain a statement that the materials included in the order are subject to inspection by the OWNER.
   3. Materials purchased locally will be inspected at the point of manufacture or supply, and materials supplied from points more than 50 miles from the job site will be

inspected upon arrival at the job, except when other inspection requirements are provided for specific materials in other Sections of this Specification.

E. Samples:
   1. The CONTRACTOR shall furnish samples of materials as are required by the ENGINEER, without charge.
   2. No material shall be used until the ENGINEER has had the opportunity to test or examine such materials.
   3. Samples will be secured and tested whenever necessary to determine the quality of the material.
   4. Samples and test specimens prepared at the job site, such as concrete test cylinders, shall be taken or prepared by the ENGINEER in the presence and with the assistance of the CONTRACTOR.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

+ + END OF SECTION + +

SECTION 01500

TEMPORARY CONSTRUCTION FACILITIES AND UTILITIES

PART 1 - GENERAL

1.1 STORAGE - GENERAL

A. The CONTRACTOR shall provide any temporary storage required for the protection of equipment and materials as recommended by manufacturers of such materials.

1.2 STORAGE BUILDINGS

A. The CONTRACTOR shall erect or provide temporary storage buildings of the various sizes as required for the protection of mechanical and electrical equipment and materials as recommended by manufacturers of such equipment and materials.

B. The buildings shall be provided with such environmental control systems that meet recommendations of manufacturers of all equipment and materials stored in the buildings.

C. The buildings shall be of sufficient size and so arranged or partitioned to provide security for their contents and provide ready access for inspection and inventory.

D. At or near the completion of the work, and as directed by the ENGINEER, the temporary storage buildings shall be dismantled, removed from the site, and remain the property of the CONTRACTOR.

E. Combustible materials (paints, solvents, fuels, etc.) shall be safely stored and separated in accordance with the manufacturer's requirements and in compliance with hazardous material storage requirements. CONTRACTOR shall be responsible for providing proper storage buildings for combustible materials.

1.3 STORAGE YARDS

A. The CONTRACTOR shall provide temporary storage yards as required for the storage of materials that are not subject to damage by weather conditions.

B. Materials such as pipe, reinforcing and structural steel, shall be stored on pallets or racks, off the ground, and stored in a manner to allow ready access for inspection and inventory.

C. Temporary gravel surfacing of the storage yards shall meet with the approval of the ENGINEER.

1.4 PARKING AREAS

A. Control vehicular parking to preclude interference with public traffic or parking, access by emergency vehicles, OWNER's operations, or construction operations.

1.5 VEHICULAR TRAFFIC

A. Comply with Laws and Regulations regarding closing or restricting use of public streets or highways. No public or private road shall be closed, except by written permission of proper authority. Assure the least possible obstruction to traffic and normal commercial pursuits.

B. Conduct the Work to interfere as little as possible with public travel, whether vehicular or pedestrian.

C. Whenever it is necessary to cross, close, or obstruct roads, driveways, and walks, whether public or private, provide and maintain suitable and safe bridges, detours, or other temporary expedients for accommodation of public and private travel.

1.6 DELIVERY-STORAGE-HANDLING

A. General:
   1. The CONTRACTOR shall deliver, handle, and store materials and equipment in accordance with supplier's written recommendations and by methods and means which will prevent damage, deterioration, and loss including theft.
   2. Delivery schedules shall be controlled to minimize long-term storage at the site and overcrowding of construction spaces.
   3. In particular, the CONTRACTOR shall provide delivery/ installation coordination to ensure minimum holding or storage for material or equipment recognized to be flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other sources of loss.

B. Transportation and Handling:
   1. Materials and equipment shall be transported by methods to avoid damage and shall be delivered in dry, undamaged condition in supplier's unopened containers or packaging.
   2. The CONTRACTOR shall provide equipment and personnel to handle the materials, and equipment by methods that will prevent soiling and damage.
   3. The CONTRACTOR shall provide additional protection during handling to prevent marring and otherwise damaging packaging, and surrounding surfaces.

C. Storage and Protection:
   1. Materials and equipment shall be stored in accordance with supplier's written instructions, with seals and labels intact and legible. Exposed metal surfaces of valves, fittings and similar materials shall be coated with grease in accordance with manufacturer's recommendations to prevent corrosion. Sensitive materials and equipment shall be stored in weather-tight enclosures and temperature and humidity ranges shall be maintained within tolerances required by supplier's written instructions.
   2. For exterior storage of fabricated materials, they shall be placed on sloped support above ground. Materials or equipment subject to deterioration shall be covered with impervious sheet covering; ventilation shall be provided to avoid condensation.
   3. Loose granular materials shall be stored on solid surfaces in a well-drained area and shall be prevented from mixing with foreign matter.
   4. Inspection:
      a. Storage shall be arranged to provide access for inspection.

b. The CONTRACTOR shall periodically inspect to assure materials and equipment are undamaged and are maintained under required conditions.

5. Storage shall be arranged in a manner to provide access for maintenance of stored items.

1.7 PROJECT SECURITY

A. The CONTRACTOR shall make adequate provision for the protection of the work area against fire, theft and vandalism, and for the protection of the public and OWNER personnel against exposure to injury, and for the security of any off-site storage areas.

B. All costs for this protection shall be included within the CONTRACTOR's bid.

1.8 TEMPORARY UTILITIES

A. The CONTRACTOR shall provide and pay for all necessary temporary telephones, fuel, power, potable water, sanitary, and proper toilet accommodations. CONTRACTOR shall not use OWNER-owned utilities.

B. The temporary facilities to be provided by the CONTRACTOR as described above shall conform to all requirements in regard to operation, safety, and fire hazards of State and local authorities and of Underwriters.

C. CONTRACTOR shall return the site and facilities to their original "as-found" condition, unless otherwise specified in the Contract Documents, at the completion of the project.

1.9 SOUND CONTROL

A. The CONTRACTOR shall comply with all local sound control and noise level rules, regulations and ordinances which apply to any work performed pursuant to the contract.

B. Each internal combustion engine, used for any purpose on the job or related to the job, shall be equipped with a muffler of a type recommended by the manufacturer, so as to produce a maximum noise level of 85 dBA at 5 feet.

C. No internal combustion engine shall be operated on the project without said muffler.

D. Special Precautions for Inhabited Areas:
1. In inhabited areas, particularly residential, operations shall be performed in a manner to minimize unnecessary noise generation.
2. In residential areas, special measures shall be taken to suppress noise generated by repair and service activities during the night hours.

1.10 DUST/AIR POLLUTION CONTROL

A. The CONTRACTOR shall take whatever steps, procedures, or means as are required to prevent dust conditions being caused by operations in connection with the execution of the Work; and on any road which the CONTRACTOR or any of their Subcontractors are using, excavation or fill areas, demolition operations, or other activities.

B. Control shall be by sprinkling, use of dust palliatives, modification of operations, or any other means acceptable to agencies having jurisdiction.

C. Damage to personal property, etc., resulting from the CONTRACTOR's construction operations shall be borne by the CONTRACTOR at no cost to the OWNER.

D. The CONTRACTOR shall keep the streets and work area clean at all times by means of mechanical sweepers or hand sweeping. Water will be used for dust control only, and not for cleaning streets.

E. Burning of waste, rubbish, or other debris will not be permitted on or adjacent to site.

1.11 WASTE DISPOSAL

A. The CONTRACTOR shall dispose of surplus materials, waste products, and debris and shall make necessary arrangements for such disposal. The CONTRACTOR shall obtain written permission from property owner prior to disposing surplus materials, waste products, or debris on private property.

B. All waste disposal shall be done in accordance with applicable laws and regulations.

C. Landfill Disposal:
   1. If the CONTRACTOR proposes to dispose of construction debris, trench spoils, excavation spoils, etc., at a landfill, the CONTRACTOR shall be responsible to provide and pay for all permits and analyses required by the landfill.
   2. If the analyses determine that the material is hazardous, then an equitable adjustment of the Contract for the cost of hazardous waste disposal will be made in accordance with the General Conditions, and the following:
      a. Time extension or contract costs will not be granted for delays that could have been avoided by the CONTRACTOR redirecting their forces and equipment to perform other work on the contract.

D. Ditches, washes, or drainageways shall not be filled.

E. Disposal operations shall not create unsightly or unsanitary nuisances.

F. The CONTRACTOR shall maintain the disposal site in a condition of good appearance and safety during the construction period.

G. Prior to final acceptance of the work, the CONTRACTOR shall have completed the leveling and cleanup of the disposal site.

1.12 CLEAN UP

A. Throughout the period of construction, the CONTRACTOR shall keep the work site free and clean of all rubbish and debris, and shall promptly remove from the site, or from property adjacent to the site of the work, all unused and rejected materials, surplus earth, concrete, plaster, and debris.

B. Upon completion of the work, and prior to final acceptance, the CONTRACTOR shall remove from the vicinity of the work all plant, surplus material, and equipment belonging to the CONTRACTOR or used under their direction during construction.

1.13 TEMPORARY ENCLOSURES

A. When sandblasting, spray painting, spraying of insulation, or other activities inconveniencing or dangerous to property or the health of employees, the public or construction workers, are in progress, the area of activity shall be enclosed adequately to contain the dust, over spray, or other hazard.

B. In the event there are no permanent enclosures of the area, or such enclosures are incomplete or inadequate, the CONTRACTOR shall provide suitable temporary enclosures as required by the ENGINEER to meet field conditions in accordance with the recommendations of the owner-furnished equipment supplier (if applicable) and the CONTRACTOR's equipment supplier requirements.

C. Said temporary or permanent enclosures shall be adequately ventilated to ensure the safety of the workers.

1.14 DRAINAGE

A. The CONTRACTOR shall take all necessary actions as required to meet discharge requirements of the Arizona Dept. of Environmental Quality and other pertinent local ordinances and regulations pertaining to dewatering and/or site drainage discharged into storm drains and creeks. This may include, but may not be limited to, the use of retention basins and silt basins to settle most of the solids prior to discharge.

B. In excavation, fill, and grading operations, care shall be taken to disturb the pre-existing drainage pattern as little as possible.

C. Particular care shall be taken not to direct drainage water onto private property or into streets or drainageways inadequate for the increased flow.

D. Drainage means shall be provided to protect the work.

1.15 TEMPORARY LIGHTING

A. The CONTRACTOR shall provide temporary lighting in all work areas sufficient to maintain a lighting level during working hours not less than the lighting level required by OSHA standards.

1.16 CONSTRUCTION FACILITIES

A. Construction hoists, elevators, scaffolds, stages, shoring, and similar temporary facilities shall be of ample size and capacity to adequately support and move the loads to which they will be subjected. Railings, enclosures, safety devices, and controls required by law or for adequate protection of life and property shall be provided.

B. Temporary supports shall be designed with an adequate safety factor to assure adequate load bearing capability. Whenever required by safety regulations, the CONTRACTOR shall submit design calculations for staging and shoring prior to application of loads.

1.17 REMOVAL OF TEMPORARY FACILITIES AND UTILITIES

A. At such time or times as any temporary construction facilities and utilities are no longer required for the work, the CONTRACTOR shall notify the ENGINEER of their intent and schedule for removal of the temporary facilities and utilities, and obtain the ENGINEER's approval before removing the same.

B. As approved, the CONTRACTOR shall remove the temporary facilities and utilities from the site as CONTRACTOR's property and leave the site in such condition as specified, as directed by the ENGINEER, and/or as shown on the Drawings.

C. In unfinished areas, such as planted medians, the condition of the site shall be left in a condition that will restore original drainage, evenly graded, seeded or planted as necessary, and left with an appearance equal to, or better than original.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

+ + END OF SECTION + +

SECTION 01610

GENERAL PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SCOPE

A. All products furnished and installed under this contract shall conform to the general stipulations set forth in this Section except as otherwise specified in other Sections.

1.2 COORDINATION

A. The CONTRACTOR shall coordinate all details of the products and equipment with other related parts of the work, including verification that all structures, piping, wiring, and equipment components are compatible. The CONTRACTOR shall be responsible for all structural and other alterations in the work required to accommodate products or equipment differing in dimensions or other characteristics from that contemplated in the Contract Drawings or Specifications.

1.3 DESIGN REQUIREMENTS

A. Where CONTRACTOR design is specified, design and installation of systems, equipment, and components, including supports and anchorage, shall be in accordance with provisions of 2018 edition of the International Building Code (IBC).
   1. Basic Wind Speed: 115 mph, Exposure C.
   2. Snow: 30-psf, non-reducible.
   3. Seismic:
      a. S_S (maximum short-term spectral response acceleration) = 0.343
      b. S_1 (maximum 1-second spectral response acceleration) = 0.105
      c. S_{DS} (design short-term spectral response acceleration) = 0.297
      d. S_{D1} (design 1-second spectral response acceleration) = 0.105
      e. I_e (Seismic Importance Factor) = 1.25
      f. Risk Category = III
      g. Seismic Design Category = B
   4. Maximum Rain Intensity: 3-inches/hour

B. Proof of Compliance:
   1. Structural integrity and anchorage shall be certified by an approved calculation that demonstrates the adequacy of the anchorage system for seismic forces. This calculation may be based on principles of structural analysis and engineering mechanics, or based on similarity to approved shake-table tests.
   2. The CONTRACTOR shall submit for review and approval test data or calculations certified by a Civil or Structural Engineer registered in the State of Arizona to show compliance with the above requirements.

1.4 ENVIRONMENTAL REQUIREMENTS

A. Altitude: Provide materials and equipment suitable for installation and operation under rated conditions at 5350 feet above sea level.

B. Provide equipment and devices installed outdoors or in unheated enclosures capable of continuous operation within an ambient temperature range of -10 degrees F to 110 degrees F.

1.5 WORKMANSHIP AND MATERIALS

A. The CONTRACTOR shall guarantee all equipment against faulty or inadequate design, improper assembly or erection, defective workmanship or materials, and leakage, breakage, or other failure. Materials shall be suitable for service conditions.

B. All equipment shall be designed, fabricated, and assembled in accordance with recognized and acceptable engineering and shop practice. Individual parts shall be manufactured to standard sizes and gages so that repair parts, furnished at any time, can be installed in the field. Like parts of duplicate units shall be interchangeable. Equipment shall not have been in service at any time prior to delivery, except as required by tests.

C. Except where otherwise specified, structural and miscellaneous fabricated steel used in equipment shall conform to AISC standards. All structural members shall be designed for shock or vibratory loads. Unless otherwise specified, all steel which will be submerged, all or in part, during normal operation of the equipment shall be at least 1/4 inch thick.

D. Except where otherwise specified, all metal which will be exposed to weather, submerged or otherwise exposed to moisture shall be either non-ferrous or stainless steel, as the application may require.

1.6 LUBRICATION

A. Equipment shall be adequately lubricated by systems which require attention no more frequently than weekly during continuous operation. Lubrication systems shall not require attention during startup or shutdown and shall not waste lubricants.

B. Lubricants of the type recommended by the equipment manufacturer shall be provided in sufficient quantity to fill all lubricant reservoirs and to replace all consumption during testing, startup, and operation prior to acceptance of equipment by OWNER. Unless otherwise specified or permitted, the use of synthetic lubricants will not be acceptable.

C. Lubrication facilities shall be convenient and accessible. Oil drains and fill openings shall be easily accessible from the normal operating area or platform. Drains shall allow for convenient collection of waste oil in containers from the normal operating area or platform without removing the unit from its normal installed position.

1.7 ELECTRIC MOTORS

A. Unless otherwise specified, motors furnished with equipment shall meet the following requirements:
   1. Designed and applied in accordance with NEMA, ANSI, IEEE, AFBMA, and NEC for the duty service imposed by the driven equipment, such as frequent starting, intermittent overload, high inertia, mounting configuration, or service environment.
   2. Rated for continuous duty at 40oC ambient, unless the application is well recognized for intermittent duty service as a standard industry practice.

3. Insulated with Class F insulation and designed for a service factor of 1.15, or greater.
4. Three phase motors used in conjunction with variable speed drives shall have Class F insulation with a Class B temperature rise at rated nameplate horsepower, and 1.15 service factor.
5. When operating at service factor load, maximum observable temperature rise of insulation and motor parts, as determined by resistance or thermometer methods, shall not exceed the NEMA allowable limits for the type of motor, the type of enclosure, and the particular application with regard to continuous or intermittent duty.
6. To ensure long motor life, nameplate horsepower, regardless of service factor, shall be at least 115 percent of the maximum load imposed by the driven equipment.
7. Designed for full voltage starting.
8. Designed to operate from an electrical system that may have a maximum of 5 percent voltage distortion per IEEE Standard 519.
9. Derated, if required, for the altitude at which the equipment is installed.
10. Clamp-type grounding terminal shall be inside motor conduit box.
11. External conduit boxes shall be oversized at least one size larger than NEMA standard.
12. Totally enclosed motors shall have a continuous moisture drain which also excludes insects.
13. Bearings shall be either oil or grease lubricated.
14. Manufacturer's standard motor may be supplied on integrally constructed, packaged assemblies such as appliances, tools, unit heaters, and similar equipment specified by model number, in which case a redesign of the unit would be required to furnish motors of other than the manufacturer's standard design. However, in all cases, totally enclosed motors are preferred and shall be furnished if offered by the manufacturer as a standard option.
15. Totally enclosed motors shall be furnished on:
    a. Equipment for installation below grade.
    b. Equipment operating in wet or dust-laden locations.
16. Drip-proof motors, or totally enclosed motors at the supplier's option, shall be furnished on equipment in indoor, above-grade, clean, and dry locations.
17. Explosion-proof or submersible motors shall be furnished as required by applicable codes, as specified in other Sections, or at the supplier's option.
18. Motors shall be rated and constructed as follows:
    a. Below 1/2 hp:
        1) 115 volts, 60 Hz, single phase.
        2) Built-in manual-reset thermal protector, or integrally mounted stainless steel enclosed manual motor starter.
    b. 1/2 hp and above:
        1) 460 volts, 60 Hz, 3 phase.
        2) Where specified or required by the drawings, motors used on 240 volt systems shall be 230 volts, 60 Hz, 3 phase.

1.8 DRIVE UNITS

A. The nominal input horsepower rating of each gear or speed reducer shall be at least equal to the nameplate horsepower of the drive motor. Drive units shall be designed for 24 hours continuous service.

B. Unless otherwise specified, the use of gearmotors will not be acceptable.

C. Gear reducers:
   1. Each gear reducer shall be a totally enclosed unit with oil or grease lubricated antifriction, rolling element bearings throughout.
   2. Helical, spiral bevel, combination bevel-helical, and worm gear reducers shall have a service factor of at least 1.50 based on the nameplate horsepower of the drive motor. Shaft-mounted and flange-mounted gear reducers shall be rated AGMA Class II. Helical gear reducers shall have a gear strength rating to catalog rating of 1.5. Each gear reducer shall bear an AGMA nameplate.
   3. The thermal horsepower rating of each unit shall equal or exceed the nameplate horsepower of the drive motor. During continuous operation, the maximum sump oil temperature shall not rise more than 100°F above the ambient air temperature in the vicinity of the unit and shall not exceed 200°F.
   4. Bearings:
      a. Each grease lubricated bearing shall be installed in a bearing housing designed to facilitate periodic regreasing of the bearing by means of a manually operated grease gun.
      b. Each bearing housing shall be designed to evenly distribute new grease, to properly dispose of old grease, and to prevent over greasing of the bearing.
      c. The use of permanently sealed, grease lubricated bearings will not be acceptable.
      d. An internal or external oil pump and appurtenances shall be provided if required to properly lubricate oil lubricated bearings.
      e. A dipstick or sight glass arranged to permit visual inspection of lubricant level shall be provided on each unit.
   5. Gear reducers that require the removal of parts or periodic disassembly of the unit for cleaning and manual regreasing of bearings will not be acceptable.
   6. Certification shall be furnished by the gear reducer manufacturer indicating that the intended application of each unit has been reviewed in detail by the manufacturer and that the unit provided is fully compatible with the conditions of installation and service.

D. V-belt drives:
   1. Each V-belt drive shall include a sliding base or other suitable tension adjustment. V-belt drives shall have a service factor of at least 1.6 at maximum speed based on the nameplate horsepower of the drive motor.

1.9 SAFETY GUARDS

A. All belt or chain drives, fan blades, couplings, and other moving or rotating parts shall be covered on all sides by a safety guard.

B. Safety guards shall be fabricated from 16 USS gauge or heavier galvanized or aluminum-clad sheet steel or 1/2-inch mesh galvanized expanded metal.

C. Each guard shall be designed for easy installation and removal.

D. All necessary supports and accessories shall be provided for each guard. Supports and accessories, including bolts, shall be galvanized.

E. All safety guards in outdoor locations shall be designed to prevent the entrance of rain and dripping water.

1.10 ANCHOR BOLTS

A. Equipment suppliers shall furnish suitable anchor bolts for each item of equipment.

B. Anchor bolts, together with templates or setting drawings, shall be delivered sufficiently early to permit setting the anchor bolts when the structural concrete is placed.

C. Anchor bolts shall comply with Section 05051, Anchors, Inserts and Epoxy Dowels and, unless otherwise specified, shall have a minimum diameter of 1/2-inch.

D. Unless otherwise indicated or specified, anchor bolts for items of equipment mounted on baseplates shall be long enough to permit 1-1/2 inches of grout beneath the baseplate and to provide adequate anchorage into structural concrete.

1.11 EQUIPMENT BASES

A. Unless otherwise indicated or specified, all equipment shall be installed on concrete bases at least 6 inches high.

B. Cast iron or welded steel baseplates shall be provided for pumps, compressors, and other equipment.

C. Each unit and its drive assembly shall be supported on a single baseplate of neat design.

D. Baseplates shall have pads for anchoring all components and adequate grout holes.

E. Baseplates for pumps shall have a means for collecting leakage and a threaded drain connection.

F. Baseplates shall be anchored to the concrete base with suitable anchor bolts and the space beneath filled with grout as specified in Section 03600, Grout.

1.12 SPECIAL TOOLS AND ACCESSORIES

A. Equipment requiring periodic repair and adjustment shall be furnished complete with all special tools, instruments, and accessories required for proper maintenance. Equipment requiring special devices for lifting or handling shall be furnished complete with those devices.

1.13 SHOP PAINTING

A. Surface Protection:
   1. All steel and iron surfaces shall be protected by suitable paint or coatings applied in the shop.
   2. Surfaces that will be inaccessible after assembly shall be protected for the life of the equipment.
   3. Exposed surfaces shall be finished smooth, thoroughly cleaned, and filled as necessary to provide a smooth uniform base for painting.
   4. Electric motors, speed reducers, starters, and other self-contained or enclosed components shall be shop primed or finished with a high-grade oil-resistant enamel suitable for coating in the field with an alkyd enamel.
   5. Coatings shall be suitable for the environment where the equipment is installed.

B. Shop Primer:
   1. Surfaces to be painted after installation shall be prepared for painting as recommended by the paint manufacturer for the intended service, and then shop painted with one or more coats of the specified primer.
   2. Unless otherwise specified, the shop primer for steel and iron surfaces shall be:
      a. Cook "391-N-167 Barrier Coat",
      b. Koppers "No. 10 Inhibitive Primer",
      c. Tnemec "37H Chem-Prime HS",
      d. Valspar "13-R-28 Chromox Primer",
      e. Or equal.

C. Machined, polished, and nonferrous surfaces which are not to be painted shall be coated with rust-preventive compound, Houghton "Rust Veto 344", Rust-Oleum "R-9", or equal.

1.14 PREPARATION FOR SHIPMENT

A. All equipment shall be suitably packaged to facilitate handling and protect against damage during transit and storage. All equipment shall be boxed, crated, or otherwise completely enclosed and protected during shipment, handling, and storage. All equipment shall be protected from exposure to the elements and shall be kept thoroughly dry at all times.

B. Painted surfaces shall be protected against impact, abrasion, discoloration, and other damage. All painted surfaces which are damaged prior to acceptance of equipment shall be repainted to the satisfaction of ENGINEER.

C. Grease and lubricating oil shall be applied to all bearings and similar items.

D. Each item of equipment shall be tagged or marked as identified in the delivery schedule or on the Shop Drawings. Complete packing lists and bills of material shall be included with each shipment.

1.15 STORAGE

A. Upon delivery, all equipment and material shall immediately be stored and protected until installed in the work.

B. Pumps, motors, electrical equipment, and all equipment with antifriction or sleeve bearings shall be stored in weathertight structures maintained at a temperature above 60° F. Equipment, controls, and insulation shall be protected against moisture and water damage. All space heaters furnished in equipment shall be connected and operated continuously.

C. Equipment and materials shall not show any pitting, rust, decay, or other deleterious effects of storage when installed in the work.

1.16 INSTALLATION AND OPERATION

A. Equipment shall not be installed or operated except by, or with the guidance of, qualified personnel having the knowledge and experience necessary for proper results. When so specified, or when employees of the CONTRACTOR or their subcontractors are not

qualified, such personnel shall be field representatives of the manufacturer of the equipment or materials being installed.

B. Qualified field representatives shall be provided by the equipment manufacturers as required by Section 01750, Testing, Training and Startup.

C. All equipment installed under this Contract, including that furnished by OWNER shall be placed into successful operation according to the written instructions of the manufacturer or the instructions of the manufacturer's field representative. All required adjustments, tests, operation checks, and other startup activity shall be provided.

D. Acceptance of work in connection with the installation of equipment furnished by others will be subject to approval of the field representative. The CONTRACTOR shall be responsible for planning, supervising, and executing the installation of work, and the approval or acceptance of ENGINEER or the field representative will not relieve the CONTRACTOR of responsibility for defective work.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

+ + END OF SECTION + +

SECTION 01630

OWNER-FURNISHED EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. The work specified in this Section includes the unloading, handling, installation, connection, and testing of OWNER-furnished equipment as indicated on the Plans and as specified herein.

B. OWNER-furnished equipment:
   1. Existing Submersible Pump:
      a. Equipment Manufacturer: Flygt
      b. Contact Person:
      c. Components: Submersible Pump, Cable and Base Elbow

C. Definitions: As used in this Section, the following terms have the meaning indicated:
   1. Equipment Manufacturer:
      a. The Company with whom the OWNER has a contract to procure the equipment items.
   2. Defective:
      a. An adjective which when modifying the word "equipment" refers to OWNER-furnished equipment and indicates that such equipment is unsatisfactory, faulty or deficient; that such equipment does not conform to the provisions of the Equipment Specifications; that such equipment does not meet the requirements of any inspection, test, or approval referred to in the Equipment Specifications; or that such equipment is damaged.
   3. Equipment specifications:
      a. The specifications and other Contract Documents covering the purchase and delivery of OWNER-furnished equipment are included in the separate agreement between the OWNER and the Equipment Manufacturer.
   4. Approved shop drawings:
      a. The drawings and data supplied by the Equipment Manufacturer for OWNER-furnished equipment, as approved by the ENGINEER.

1.2 CONTRACTOR COORDINATION WITH EQUIPMENT MANUFACTURER

A. CONTRACTOR shall be in close coordination with service representatives of the manufacturer of the OWNER-furnished equipment in every phase of installation.

B. Both the CONTRACTOR and the Equipment Manufacturer have separate responsibilities, both of which must necessarily be interwoven as regards the installation, testing and acceptance of the equipment.

C. The Agreement between the OWNER and the Equipment Manufacturer, plus approved Shop Drawings, are available for inspection at the Engineer’s Office. All prospective Contractors shall review said Agreement and Shop Drawings.

1.3 QUALITY ASSURANCE

A. Equipment specifications and approved shop drawings:
   1. The CONTRACTOR will be presumed cognizant, prior to entering into the Contract, of the provisions of the Equipment Specifications and approved Shop Drawings.
   2. One copy of the approved Shop Drawings will be made available to the CONTRACTOR to whom the Contract is awarded.

B. Installation:
   1. OWNER-furnished equipment shall be installed as specified in Article 3.1.

C. Operation:
   1. OWNER-furnished equipment shall be operated in accordance with the written instructions furnished with the equipment, and with the instructions issued by representatives of equipment manufacturers.

D. Testing:
   1. After installation, and following certification in writing by Equipment Manufacturer that the installation is ready for electrical testing, the CONTRACTOR shall make electrical tests on OWNER-furnished equipment.
   2. The tests shall prove that the equipment has been properly installed; that power, control, instrumentation, and alarms are properly connected and wired from the equipment to points of supply or receipt of signals and are properly calibrated; and that all other work performed by the CONTRACTOR renders the equipment operational as intended.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery of OWNER-furnished equipment:
   1. Equipment will be delivered to the CONTRACTOR at the site of the work as specified in the Equipment Specifications and identified in Section 01100, Summary of Work.
   2. Changes to the delivery procedure and schedule may be made if mutually agreed between the CONTRACTOR and the OWNER, and if approved by the Equipment Manufacturer.
   3. Inspection and Acceptance:
      a. Upon delivery, conduct with OWNER or ENGINEER a joint inspection for the purpose of identifying product, general verification of quantities, and observation of apparent condition.
      b. Such inspection will not be construed as final or as receipt of any product that, as a result of subsequent inspections and tests, are determined to be nonconforming.
      c. Damaged or incomplete products to be returned for replacement will not be unloaded, except as necessary to expedite return shipment.
      d. OWNER will submit claims for transportation damage and expedite replacement of damaged, defective, or deficient items.
      e. Indicate signed acceptance of delivery on a copy of the invoice.
      f. Upon CONTRACTOR's acceptance of OWNER-furnished equipment, it shall be understood that the CONTRACTOR assumes the responsibilities assigned to him in these Specifications in relation to the installation, testing and operation of OWNER furnished equipment.
   4. Defective Equipment Notice:

a. The CONTRACTOR shall verify the conditions of OWNER-furnished equipment and shall submit to the ENGINEER within 7 days after delivery date a statement listing all defective equipment items.
b. The list shall include the cost and extension to the Contract Time that the CONTRACTOR estimates for the correction and repair of each defective equipment item and a statement of the CONTRACTOR's opinion as to the cause of the defective equipment items.
c. If the CONTRACTOR makes no submittal within the time period specified, it shall be understood that the OWNER-furnished equipment is in satisfactory condition and that the CONTRACTOR's acceptance has occurred as of the date of delivery.
d. If the CONTRACTOR makes a submittal listing defective equipment items within the time period specified, the ENGINEER will decide on the course of action to be taken. The possible courses of action by the ENGINEER include:
    1) Correction By Change Order:
        a) To authorize the CONTRACTOR to proceed with the correction and repair of defective equipment items through the issuance of a Change Order.
        b) The CONTRACTOR's consent to perform such repair and correction shall be construed as CONTRACTOR's acceptance for the items included in the Change Order.
    2) Correction By Force Account:
        a) To direct the CONTRACTOR to proceed with the correction and repair of defective equipment items through the procedures specified for force account work.
        b) It shall be understood that CONTRACTOR's acceptance has occurred for the items covered under force account work on the date of the issuance of the ENGINEER's directive.
    3) Correction By Others:
        a) To have others perform the correction and repair of defective equipment items.
        b) The CONTRACTOR shall observe the work done by others and notify the ENGINEER in writing of all irregularities, faulty workmanship, or unsatisfactory work done by others.
        c) The CONTRACTOR observations shall be carried out without obstruction or interference to others performing work.
        d) Upon completion of the correction and repair, the ENGINEER will notify the CONTRACTOR and it shall be understood that CONTRACTOR's acceptance has occurred for items repaired by others upon receipt of the ENGINEER's notification.
    4) Modify the Installation Contract:
        a) To modify the Plans and Specifications in order to meet changing conditions.
        b) It shall be understood that CONTRACTOR's acceptance has occurred upon receipt of the ENGINEER's modifications to Plans and Specifications.
    5) Reject the Characterization:
        a) To state to the CONTRACTOR that an item listed by the CONTRACTOR is not a defective equipment item.
e. Regarding such items, it shall be understood that CONTRACTOR's acceptance has occurred on the delivery date.

5. If CONTRACTOR is not prepared to accept delivery of OWNER-furnished equipment by either the specified Estimated Date of Arrival or such OWNER-confirmed delivery date, as specified herein, associated costs incurred by OWNER shall be borne by CONTRACTOR. Such costs may include, but not be limited to, demurrage, interest,

insurance costs, additional administrative and engineering costs, additional factory and field technical support, additional storage and reshipping costs, cost escalation, and extended warranty costs due.

6. The CONTRACTOR shall unload the equipment from the delivery vehicle within 24 hours after arrival of the vehicle transporting such equipment to the site. The equipment shall be unloaded in accordance with manufacturers' instructions, or as specified.
7. The CONTRACTOR shall assume responsibility for storage and handling of equipment after the delivery has been accepted.

B. Protection of OWNER-furnished equipment:
   1. The CONTRACTOR shall protect the equipment in accordance with the Equipment Manufacturer's recommendations against weather conditions, including construction of a temporary cover, and periodic lubrication, if required.
   2. From the time of receipt until the equipment is energized for operations, unless such equipment is being worked on, equipment shall be considered in storage.
   3. While in storage, a 120V, 1 phase source of power shall be provided and connected to space heaters in all items of equipment so equipped. Equipment not provided with space heaters shall be provided with a light bulb or electric heater while in storage to prevent moisture condensation.

1.5 SCHEDULING:

A. It shall be understood that the CONTRACTOR's review of the Equipment Specifications has allowed the scheduling of their operations in accordance with the dates for the delivery of OWNER-furnished equipment anticipated in said Equipment Specifications.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. The CONTRACTOR shall install OWNER-furnished equipment in accordance with the instructions and recommendations furnished with the equipment, approved shop drawings, instructions of the representatives of equipment manufacturers and installation manuals, and as indicated on the Plans.

B. The CONTRACTOR shall be responsible to include in their bid all labor, materials, and equipment required to install the OWNER-furnished equipment and make the complete system operate satisfactorily.

C. Equipment shall not be installed or operated except by, or with the guidance of, qualified personnel having the knowledge and experience necessary to obtain proper results. Such personnel shall be field representatives of the Equipment Manufacturer.

D. Factory Service Representatives:
   1. Qualified factory service representatives will be provided by the Equipment Manufacturer as required to perform all manufacturers' field services called for in these Specifications.

2. Equipment Manufacturer will submit resumes of the proposed factory service representatives to the ENGINEER for review and acceptance not less than 21 days prior to the factory services representative's first site visit.
3. Factory service representatives will observe, instruct, guide, and direct CONTRACTOR's erection or installation procedures, and perform an installation check, as required herein or as requested by the ENGINEER.
4. Each factory service representative will revisit the site as often as necessary to attain installation satisfactory to ENGINEER.

E. The CONTRACTOR shall furnish and install all piping, electrical and instrumentation work, interconnections, finish painting and accessories as required to make the OWNER-furnished equipment and system complete and functional.

F. Provide foundation pads for OWNER-furnished products as shown. Verify exact dimensions and configuration of all pads, including penetrations, with OWNER-furnished product shop drawings.

G. Anchor Bolts:
1. Where required, provide anchor bolts, fasteners, washers, and templates needed for installation of OWNER-furnished equipment.
2. Size and locate anchor bolts in accordance with OWNER-furnished product shop drawings and installation instructions.

H. Mechanical and electrical equipment shall be properly aligned, plumb and level, with no stresses on connecting piping or conduit.

3.2 FIELD FINISHING

A. Products will be delivered with prime coat(s) applied.

B. Finish coat as specified in Section 09900, PAINTING.

C. Touch up or repair damage to coatings resulting from unloading, storage, installation, testing, and startup.

D. If finish coats are damaged extensively after transfer, completely repaint.

E. Touch up, repair, or complete repainting shall match color of original paint, and shall be fully compatible with applied primers and finish.

3.3 EQUIPMENT FIELD TESTING

A. General:
1. Field Testing shall consist of Functional Testing performed by the CONTRACTOR, and Performance Testing performed by the Equipment Manufacturer with OWNER assistance.
2. Minimum Functional Testing requirements are specified in Section 01750, Testing, Training and Startup.
3. The CONTRACTOR shall schedule, coordinate, and perform all Functional Tests required to prove that the equipment has been properly installed and is in satisfactory operating condition.

4. The Equipment Manufacturer will furnish a factory trained representative to provide technical guidance to assist the OWNER's CONTRACTOR during Functional Testing.
5. Addition Functional Testing requirements for the Owner-Supplied Equipment are listed in the Technical Specifications.

B. The CONTRACTOR shall repair, replace or correct to the satisfaction of the ENGINEER all defective equipment items caused by the CONTRACTOR's improper placement and handling of OWNER-furnished equipment.

C. After testing, the CONTRACTOR shall repair, replace, or correct faulty work.

3.4 SERVICES OF EQUIPMENT MANUFACTURER'S REPRESENTATIVES

A. The Equipment Manufacturers (through the OWNER) will provide services of skilled representatives of equipment manufacturer's for inspecting the installation, adjustments, start-up and testing of OWNER-furnished equipment.

B. The extent of services provided by manufacturer's representatives is specified in the Equipment Specifications.

C. The services will be provided as requested by the ENGINEER.

D. The CONTRACTOR and their employees shall fully cooperate with the manufacturer's representatives.

E. The CONTRACTOR shall notify the ENGINEER in writing 15 calendar days before the equipment manufacturer's representative needs to be present at the site.

+ + END OF SECTION + +

SECTION 01750

TESTING, TRAINING AND STARTUP

PART 1 - GENERAL

1.1 GENERAL

A. Scope:
   1. This Section covers general equipment and system testing and startup requirements, services of the manufacturer's representatives and special coordinating services required of the CONTRACTOR that shall apply during construction and training of the OWNER's personnel for facilities operation.
   2. Specific testing and tracking procedures and requirements found in the Technical Specifications shall also apply.

B. The CONTRACTOR shall inform all Subcontractors and manufacturers of the requirements herein and include the required services in their costs for the work specified in these Contract Documents. Where a minimum amount of time is stated in the Technical Specifications for manufacturers' services, any additional time required to perform the specified services shall be provided at no additional cost to the OWNER.

C. Scheduling:
   1. Equipment testing and plant startup are requisite to satisfactory completion of the Contract and, therefore, shall be completed within the contract time.
   2. All equipment testing and plant startup activities shall be realistically allowed for and shown on the CONTRACTOR's Construction Schedule, in accordance with Section 01320, Progress Schedule.
   3. All equipment testing and plant startup activities shall be scheduled in conformance with the restrictions specified in Section 01130, Special Project Constraints.

D. Equipment testing shall be satisfactorily completed prior to commencing plant startup associated with the particular equipment item or equipment package. The equipment shall not be considered ready for testing until the following conditions are satisfied:
   1. Manufacturer's certification of equipment installation has been accepted by the ENGINEER.
   2. Electrical and/or instrumentation Subcontractor certification of motor control logic has been accepted by the ENGINEER.
   3. Related Technical Submittals, O&M Manual and Final Shop Drawings have been accepted by the ENGINEER.
   4. Operator training services have been furnished by the CONTRACTOR (operational testing only).
   5. Testing procedures have been submitted in writing and accepted by the ENGINEER in accordance with Section 01330, Submittal Procedures. All testing procedures and results shall be submitted in writing.

E. The requirements of plant startup specified herein shall also apply to the startup of individual treatment plant processes and facilities.

F. Startup Plan:

1. Not less than 3 months prior to initial equipment or system startup, the CONTRACTOR shall submit to the ENGINEER for review, a detailed Facilities Startup Plan for the associated items of equipment and/or systems.
2. The Startup Plan shall include:
    a. A detailed sub-network of the CONTRACTOR's Construction Progress Schedule including the following activities:
        1) Manufacturer's Services;
        2) Installation Certifications;
        3) Operator Training;
        4) O&M Manual;
        5) Functional Testing;
        6) Performance Testing;
        7) Operational Testing;
        8) All other activities necessary to affect a coordinated and successful Testing, Training and Startup.
    b. Written testing plan with proposed data logs for each item of equipment to be tested.
    c. A discussion of any coordination required with the Owners staff and/or any system or equipment outage requirements.
    d. The Plan shall be updated and/or revised as necessary prior to subsequent Construction Progress Meetings.
    e. Testing shall not be scheduled earlier than 30 days after approval of the Plan.

1.2 SERVICES DURING CONSTRUCTION

A. General:
1. Manufacturer’s Representative:
    a. The CONTRACTOR shall provide the services of competent and experienced technical representatives of the manufacturers of all equipment and systems furnished under the contract, for as many days as may be necessary for assembly, installation, testing assistance and operator training.
    b. Manufacturer's field representatives shall observe, instruct, guide, and direct CONTRACTOR's erection or installation procedures, or perform an installation check, as required.
    c. In each case, the CONTRACTOR shall arrange to have the manufacturer's representative revisit the job site as often as necessary until operator training is complete and testing and startup problems have been resolved to the satisfaction of the ENGINEER.
    d. This requirement applies to manufacturers of all equipment furnished (excluding manually operated valves smaller than 24 inches in size, and any other items of equipment specifically exempted by the ENGINEER in writing), whether or not specifically set forth in the Technical Specifications.
    e. The CONTRACTOR shall maintain a service record on each item of equipment and shall deliver these service records to the ENGINEER prior to acceptance of operational testing.

B. Fulfillment of Specified Minimum Services:
1. The CONTRACTOR shall obtain prior written approval from the ENGINEER for providing manufacturers' services.
2. All requests to the ENGINEER for prior approval shall (1) be in writing, (2) be submitted not less than 10 calendar days prior to the providing of the subject

services, (3) state the service to be provided, and (4) state the reason(s) why the timing of the service is appropriate.

3. Request made to the ENGINEER less than 10 calendar days prior to the manufacturers' services may not receive consideration and response prior to the times the services are provided.
4. Visits of manufacturers and their representatives to the jobsite or training classroom without prior approval as provided herein may not act to fulfill the specified minimum man-day requirements.

C. Certificate of Proper Installation:
   1. Equipment requiring factory tests shall not be delivered to the jobsite until the CONTRACTOR submits acceptable certified test results to the ENGINEER.
   2. Equipment shall not be considered ready for functional testing until after the following certifications have been submitted and accepted by the ENGINEER.
      a. Manufacturer Representatives:
         1) The CONTRACTOR shall require that each manufacturer's representative furnish to the ENGINEER a written and signed report addressed to the OWNER certifying that the equipment has been properly installed, adjusted, lubricated, is in accurate alignment, is free from any undue stress imposed by connecting piping or anchor bolts, has been operated satisfactorily under full-load conditions and is ready for full-time operation.
         2) For pumps, compressors, blowers, engines, motors, and other rotating or reciprocating equipment, the report shall certify that the equipment operates within the manufacturer's allowable limits for vibration.
         3) The report shall also certify that all controls, protective devices, \instrumentation, and control panels furnished as part of the manufacturer's equipment package are properly installed and calibrated; and that the control logic for equipment startup, shutdown, sequencing, interlocks, and emergency shutdown has been tested and is properly operating.
         4) The CONTRACTOR shall also sign said certification.
         5) The CONTRACTOR shall submit "Manufacturer's Certification of Proper Installation" on the OWNER form.
      b. Electrical and Instrumentation Subcontractor:
         1) The CONTRACTOR shall require that the electrical and/or instrumentation Subcontractor shall furnish a written and signed report to the ENGINEER certifying that the motor control logic for the equipment item that resides in motor control centers, control panels, control boards, microprocessors, distributed processing units, computers, and the like furnished by the electrical and/or instrumentation Subcontractor has been properly tested and calibrated.
         2) The report shall certify that the control logic for equipment startup, shutdown, sequencing, interlocks, and emergency shutdown has been tested and is properly operating.
         3) The CONTRACTOR shall also sign said certification.

1.3 STARTUP AND TESTING

A. General:
   1. The CONTRACTOR shall provide the effective coordination of all parties necessary for the successful project startup.

2. The ENGINEER shall not be responsible to instruct the CONTRACTOR in the startup of the project, however, the ENGINEER will be available prior to and during startup to provide operational and technical support to the CONTRACTOR.
3. The CONTRACTOR shall furnish all labor, consumables (power, water, chemicals, air, etc.) tools, equipment, instruments, and services required and incidental to completing all functional, performance and operational testing of installed equipment.
4. The CONTRACTOR shall submit the proposed test procedures to the ENGINEER for review at least 30 days prior to testing.
5. The CONTRACTOR shall give the ENGINEER written notice confirming the date of testing at least five working days before the time the equipment is scheduled to be tested.
6. All testing shall be witnessed by the ENGINEER to be considered valid.
7. Test Reports:
    a. CONTRACTOR shall submit written detailed results of all functional, performance and operational testing.
    b. Upon successful completion of Operational testing all equipment installation, testing and maintenance records shall be submitted to the ENGINEER.
    c. Said records shall be bound separately for each piece of equipment or system and shall be collected by type of record.
8. For factory tests, written test results shall be submitted to the ENGINEER at least 10 days prior to shipment.

B. Functional testing:
1. All items of mechanical and electrical equipment shall be functionally tested by the CONTRACTOR after installation for proper operation.
2. A minimum of ten (10) days prior to the start of functional testing, the CONTRACTOR shall submit interconnection diagrams for the equipment and for the alarms, controls and instruments associated with the equipment. This requirement shall not relieve the CONTRACTOR of meeting any requirements in the technical specifications for earlier submittal of the interconnection diagrams.
3. Minimum Test Requirements
    a. The functional test of each piece of mechanical equipment shall continue for not less than eight (8) continuous hours without interruption.
    b. The functional test shall include checking for proper rotation, alignment, speed, flows, pressure, vibration, sound level, etc. Initial equipment and system adjustment and calibrations shall be performed in the presence of and with the assistance of the manufacturer's representative.
    c. The functional test shall include a demonstration of the proper performance of all alarms, local and remote controls, instrumentation, equipment functions, and all other electrical, mechanical and piping systems.
    d. All parts shall operate satisfactorily in all respects, under continuous full load, and in accordance with the specified requirements, for the full duration of the eight-hour test period.
    e. If any part of a unit shows evidence of unsatisfactory or improper operation during the eight-hour test period, correction or repairs shall be made and the full eight-hour test operation, as specified herein, shall be repeated after all parts operate satisfactorily.

C. Performance testing:
1. Where performance testing is required by the Technical Specifications, the testing shall be supervised by the manufacturer's representative. These services shall continue until such times as the applicable equipment or system has been

successfully tested for performance and has been accepted by the ENGINEER for operational testing.
2. Performance testing shall take place after functional testing is successfully completed in accordance with Article 1.3 B.
3. Performance testing shall demonstrate that the equipment meets all performance requirements specified.

D. Startup/operational testing:
1. Upon successful completion of operator training and the functional, performance and leakage testing, the CONTRACTOR shall startup the plant facilities and test the equipment operation and performance by conducting a seven (7) day, continuous operational test of the completed facilities as an operational process unit to demonstrate to the ENGINEER's satisfaction that all equipment and systems required by these specifications will operate in the manner in which they are intended to perform.
2. The OWNER will provide CONTRACTOR-trained operating personnel for the duration of the operational test. Said operation shall be conducted and under the supervision and direction of the CONTRACTOR and/or manufacturer's representative.
3. Operational Defects:
   a. All defects in materials or workmanship which appear during the operational test shall be immediately corrected by the CONTRACTOR.
   b. In the event of a malfunction or deficiency that results in shutdown or partial operation of a system or process unit or results in performance that is less than that specified, the startup duration shall be repeated for that corresponding system or process unit and any other affected equipment so its proper operation and performance as required by the Contract Documents is demonstrated for a minimum of seven (7) continuous and trouble free days.
4. If the operational test is interrupted through no fault of the CONTRACTOR the test may resume at the earliest mutually agreeable time.
5. No unit process or part thereof shall be placed in service until it has successfully completed operational testing.
6. During plant startup, the CONTRACTOR shall provide the appropriate construction trades and the services of authorized Manufacturer's representatives for operational testing and as necessary, to correct faulty equipment operation.
7. After completion of all startup/operational testing, the CONTRACTOR shall repaint, hose, scrub, clean up and otherwise return the work to a "like new" condition, prior to OWNER acceptance.

1.4 TRAINING OF OWNER PERSONNEL

A. General:
1. Operation and maintenance training of OWNER's personnel shall be provided for mechanical, electrical, instrumentation and control equipment as listed in this Section or elsewhere in the Specifications.
2. For the purposes of this requirement, operations training is considered to be separate from maintenance training. Instructions are to be tailored to the needs of each group.
3. These training services shall be conducted by the manufacturer's representative and shall ensure measurable and observable means that OWNER personnel are qualified to perform equipment task requirements, including essential knowledge, skills and abilities.

4. Training shall be conducted by competent representatives who are certified by the manufacturer to be thoroughly familiar with the subject matter as well as instructional methods.
5. Training materials shall be submitted to the OWNER (see Paragraph 1.4 C below) for review. Acceptance of training materials is required prior to start of training.
6. All training shall be completed prior to beginning operational testing.
7. The OWNER shall have the right to videotape any or all training sessions, or may designate separate sessions or portions thereof for the sole purpose of videotaping.

B. Training coordinator:
1. The CONTRACTOR shall designate and provide one or more persons to be responsible for coordinating and expediting training duties.
2. The person or persons so designated shall be present at all training coordination meetings with the OWNER.

C. Training schedule:
1. The CONTRACTOR's coordinator shall coordinate the training periods with OWNER's personnel and manufacturer's representatives, and shall submit a training schedule and the training materials for each piece of equipment or system for which training is to be provided.
2. The training schedule shall be submitted not less than 21 calendar days prior to the time that the associated training is to be provided and shall be based on the then current Plan of Operation.
3. Equipment and/or systems shall be deemed suitable for use in training upon satisfactory completion of functional testing.
4. All training with regards to a unit process or part thereof shall be completed prior to the start of operational testing.
5. As a minimum, training shall be provided on the following equipment and systems:
   a. Submersible Pumps
   b. All Valves
   c. All Instrumentation
   d. Control Panel
   e. Generator and ATS
   f. Odor Control
6. The CONTRACTOR shall provide distinct and separate training sessions for both operations and maintenance personnel, meeting the following criteria:
   a. Maintenance Training:
      1) Maintenance training shall be provided for all items in 1.4.C.5 above.
      2) The CONTRACTOR shall provide two (2) separate training sessions on a day agreed to by the ENGINEER.
      3) Training shall emphasize theory of operations, troubleshooting, and preventative maintenance and repair procedures.
      4) The discussion shall encompass issues relating to instrumentation, electrical, and mechanical systems.
   b. Operations training:
      1) Operations training shall be provided for each piece of equipment listed in Paragraph 1.4.C.5 above.
      2) The CONTRACTOR shall provide two (2) separate training sessions for each three (3) operating shifts.
      3) Sessions are to be provided for each shift within the following time periods.
         a) Day Shift: 8:00 a.m. - 2:00 p.m.
   c. Training session schedules shall be approved by the ENGINEER.

d. Training shall emphasize theory of operations, startup instructions, emergency and normal shutdown instructions, lockout procedures, troubleshooting, preventative maintenance, and alarm and control logic.

7. The CONTRACTOR shall confirm each training period a minimum of three working days prior to the schedule time.
8. If a manufacturer's representative fails to conduct a scheduled training class, the CONTRACTOR hereby agrees to compensate the OWNER for labor costs, including overhead, for all OWNER personnel in attendance for the entire scheduled training period.
9. If the CONTRACTOR or the manufacturer's representative fails to provide training that qualifies the OWNER personnel to perform equipment task requirements, the CONTRACTOR hereby agrees to provide remedial training to ensure OWNER personnel proficiency at no additional cost to the OWNER.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 RECORD KEEPING

A. The CONTRACTOR shall maintain as a minimum, the following records:
   1. Equipment manufacturer's shop drawings.
   2. Daily logs indicating all equipment testing and startup activities.
   3. Log and time sheets of all manufacturer's representatives performing services on the jobsite.
   4. Updated equipment testing and startup schedules.
   5. Records of system cleaning.
   6. Hydrostatic and pressure test records.
   7. Equipment alignment and vibration measurements and corrective actions.
   8. Equipment lubrication records.
   9. Insulation resistance measurements.
   10. Electrical phase, voltage and amperage measurements.
   11. Electrical breaker inspection, test, and adjustment records.
   12. Logs of abnormal circuits and lifted wires.
   13. Testing and validation of all central and alarm functions.
   14. Data sheets of all testing and calibration of instrumentation devices and control loops including documentation of set points.
   15. Equipment and system release logs (from construction to startup).
   16. Daily work reports.

3.2 GENERAL PROCEDURES

A. The general work procedures listed below outline the work to be performed by the CONTRACTOR. Additional procedures applicable to specific equipment items are specified elsewhere.

B. Technical assistance and support:
   1. Obtain the assistance of the appropriate construction trades and the manufacturer or vendor, as required for technical assistance during equipment installation, testing,

and startup by the CONTRACTOR and for training of the OWNER's Operation and Maintenance personnel.
2. Furnish names and telephone numbers of manufacturer's and vendor's current technical service representatives for use by the ENGINEER.

C. Instructions:
1. Maintain an adequate manufacturer's instruction file so that the information will be readily available during equipment testing and startup.
2. Prior to equipment testing, finalize, and transmit to the ENGINEER the applicable technical manuals as required under Section 01330, Submittal Procedures of the Contract Specifications.

D. Removal of rust preventives:
1. Prior to equipment testing, remove all rust preventives and oils used to protect the equipment during the construction period whenever these protective materials will be detrimental to operation or equipment maintenance.

E. Lubricants:
1. At least 60 days prior to startup, provide a list of the manufacturer's recommended lubricants for use in the plant. All equipment lubrication shall be listed with the lubricant types and quantities recommended and approved by the equipment manufacturers.
2. Provide the necessary lubricants for startup and the initial 60 days of operation.
3. Flush systems and install the initial charge of all lubricants. Dispose of flushing oil in accordance with applicable regulations.
4. The CONTRACTOR shall lubricate the equipment in accordance with the manufacturer's recommendations until the equipment is accepted by the OWNER.
5. Maintain a lubrication record for each item of equipment. The CONTRACTOR shall submit the lubrication records to the ENGINEER prior to equipment testing.

F. Packing and seals:
1. Install, adjust, and replace packing, mechanical seals, and accessories, as necessary, during the equipment testing and startup period.
2. Adjust seal water and flushing water flow rates in accordance with the equipment manufacturer's recommendations.

G. Removal of temporary bracing:
1. Prior to equipment testing, remove all temporary supports, bracing, or other foreign objects that were installed in vessels, transformers, rotating machinery, or other equipment to prevent damage during shipping, storage, and erection, and repair any damage sustained.

H. Rotation, alignment, and vibration:
1. Prior to equipment testing, check rotating machinery for correct direction of rotation and for freedom of moving parts before connecting the driver.
2. Prior to equipment testing, perform the cold alignment and hot alignment to the manufacturer's tolerances.
3. Prior to equipment testing, test equipment vibration and correct any vibration in excess of the manufacturer's recommendation.

I. Tie-ins at the contract limits:

1. Provide proper notification, preparation, and coordination for safe tie-ins and minimal interference with the plant operation.
2. Obtain approval and make the necessary tie-ins at the unit limits as required by the Contract Documents and as approved by the ENGINEER.
3. Prior to startup, remove the temporary blind flanges, plugs, bulkheads, seals, etc.

J. Leak and pressure tests:
1. Provide the ENGINEER with 3-day advance notification in writing of the schedule for non-operating field leak tests or field pressure tests on piping and field fabricated equipment, unless otherwise directed by the ENGINEER.
2. Provide the water, air and any special media required for the test purposes.
3. Prior to startup, conduct all leak and pressure tests in accordance with applicable codes, regulations, and the Contract Documents, and as approved by the ENGINEER. The CONTRACTOR is advised that the tests shall be witnessed by the ENGINEER, to be considered valid.
4. Maintain a record of the leak and pressure test data and work completed.
5. Dispose of the test media in a manner that is acceptable to and approved by the OWNER and applicable regulatory agencies.
6. Isolate in-line equipment as necessary for protection against test pressure.

K. Pressure/vacuum safety relief devices:
1. Prior to equipment testing, test and adjust all safety devices as recommended by the equipment manufacturer.
2. Prior to plant startup, provide the ENGINEER with a list of all field or factory equipment settings.

L. Flushing and chemical/mechanical cleaning:
1. Prior to equipment operation, conduct all flushing, blowing, and chemical/mechanical cleaning operations without using the permanently installed equipment.
2. Provide any special media needed for flushing and/or cleaning purposes.
3. Dispose of all media in a manner that is acceptable to and approved by the OWNER and the applicable regulatory agencies.
4. All systems shall be free of trash and construction debris before initiating startup.
5. Maintain a record of the work completed.

M. Screens, strainers, and blind flanges:
1. Provide and install temporary strainers, screens, and blind flanges as necessary to protect the equipment and to test the equipment and pipelines.
2. Prior to startup, remove all of the temporary blinds and temporary appurtenances.
3. Clean the screens and strainers as required during startup.
4. At the end of startup, clean all of the permanently installed screens and strainers.

N. Purging/inerting:
1. Prior to startup, purge and/or passivate the facilities as specified.
2. Install purge/inerting connections in accordance with the manufacturer's recommendations.
3. Provide purge or inerting materials and conduct the necessary operations as recommended by the equipment manufacturer.

O. Drying out:

1. Prior to startup, dry out the facilities as specified or recommended by the equipment manufacturer to prevent contamination of catalysts, operating materials, and/or product.
2. Dry out systems, protective coatings, refractories, and linings as specified or recommended by the equipment manufacturers.

3.3 SPECIFIC PROCEDURES

A. In addition to the work responsibilities described in Subsection 3.2, the procedures outlined below further define the work responsibilities of the CONTRACTOR for specific systems and items of equipment.

B. Mechanical equipment:
   1. Level baseplates and soleplates and grout under all load bearing surfaces.
   2. Install suitable supports and flexible connections to alleviate any piping stresses that may be imposed on pumps, compressors, and drivers.
   3. In accordance with the manufacturer's recommendations, chemically clean lube oil, seal oil, and cooling systems. Dispose of waste and cleaning media in a manner that is acceptable to and approved by the OWNER and applicable regulatory agencies.
   4. In accordance with the manufacturer's recommendations, charge the lube oil, seal oil, and cooling systems with flushing media and circulate for cleaning purposes. Dispose of any flushing media in a manner that is acceptable to and approved by the OWNER and applicable regulatory agencies.
   5. Charge the lube oil systems, seal oil systems, and cooling systems with the amount and type of operating oil or coolant recommended by the manufacturer.
   6. Operate the equipment and check for excessive vibration, abnormal operating noises, overheating and lubricant leakage, etc., and test any safety shutdown/alarm devices for proper operation, and make any operating tests required by the ENGINEER. The adjustments required for proper operation shall be made prior to operational testing.
   7. Utilize manufacturer's representative for technical assistance during installation and startup.
   8. Prior to startup, all sidewalks, gratings, handrails, safety chains, safety shields, etc., shall be installed.
   9. Prior to startup, demonstrate to the ENGINEER's satisfaction that all chemical solution pipelines are connected to the intended tank(s), feeder(s), pump(s), and application points, and that the pipes, appurtenances contained therein and diffusers will operate at the intended flow rates.
   10. Prior to startup, the applicable safety equipment, emergency shower and eyewash units, fire extinguishers, fire suppression equipment, self-contained breathing apparatus, toxic and/or combustible gas detectors (including the respective personnel warning system), protective clothing, emergency repair kits, etc., shall be installed in an acceptable manner-subject to the ENGINEER's approval, and be fully ready for operation.
   11. All safety hazards, e.g., exposed drive shafts or rotating equipment members, exposed electrical circuitry, open electrical junction boxes and panels, improperly supported piping and conduits, missing safety devices, etc., shall be corrected prior to supplier training of the OWNER's personnel.
   12. The CONTRACTOR shall perform a comprehensive safety inspection and correct any safety deficiencies found before implementing plant startup.
   13. Roadways that are required for ambulance service, fire fighting access, delivery of treatment chemicals and supplies, and disposal of the treatment byproducts shall be completed prior to startup.

14. Prior to startup, install all warning and safety signs, labels, and devices.

C. Tanks:
   1. Test all tanks and internals, as required to demonstrate conformance to the Contract Documents. Dispose of test media in a manner that is acceptable to and approved by the OWNER and the applicable regulatory agencies.
   2. Prior to startup, conduct chemical cleaning or flushing operations as specified. Dispose of wastes and cleaning media in a manner that is acceptable to and approved by the OWNER and the applicable regulatory agencies.
   3. Prior to startup, install all chemical identification, warning, and safety signs and labels.

D. Electrical power and lighting systems:
   1. Provide the ENGINEER with 3-day advance notification in writing of the test schedule. The CONTRACTOR is advised that the tests shall be witnessed by the ENGINEER.
   2. Perform insulation resistance tests on all wiring 120 volt and larger. Do not meggar instruments or solid-state devices.
   3. Perform insulation resistance tests on all motor and transformer windings from phase to phase and phase to ground.
   4. Perform grounding system tests to determine the continuity of connections and the value of resistance to ground.
   5. Fill electrical gear with oil and/or other media as recommended by the equipment manufacturer.
   6. Prior to substantial completion and startup, test and set switchgear and circuit breaker relays for proper coordination and operation.
   7. The CONTRACTOR shall obtain the services of a qualified "independent testing service", member of the National Electric Testing Association, to perform a thermographic survey on all switchgear buses, insulators and power connections when energized and under at least 20 percent load. Significant hot spots shall be further checked by infrared pyrometer for exact temperature rise. The CONTRACTOR shall troubleshoot and correct the thermographic hot spots. Correction shall be verified by repeating the thermographic survey at no additional cost to the OWNER.
   8. The CONTRACTOR shall obtain the services of a qualified "independent testing service", member of the National Electric Testing Association, to inspect and test the protective relays and the 800-ampere and larger drawout breakers for proper installation, adjustment, and operation in accordance with the manufacturer recommendations.
   9. The CONTRACTOR shall obtain the services of a qualified "independent testing service", member of the National Electrical Testing Association, to perform DC high potential tests on all cables that will operate at more than 2,000 volts to ground.
   10. Obtain local electrical inspector's approval where required.
   11. Energize all substations, with approval of the Utility Company and the ENGINEER after completion of all electrical testing.
   12. Prior to startup, perform tests and adjustments on all switchgear and motor control equipment to demonstrate proper operation and conformance to the Contract Documents and manufacturer's recommended settings.
   13. Prior to startup, test installation of emergency power and lighting systems for proper operation, including light intensity.
   14. Prior to startup, provide the ENGINEER with a record of all test data and the work completed.
   15. Vacuum clean all electrical equipment prior to startup and acceptance.

E. Piping systems:
   1. Provide the ENGINEER with 3-day advance notification in writing of test schedule.
   2. Hydrostatically or pneumatically test all piping as required by the codes and contract documents.
   3. After successful testing of the piping, slowly drain the system and then flush the system. Orifice plates shall be installed after testing. If installed with the piping, they will be removed and replaced with spacers or pipe spools of equal length prior to the pressure test.
   4. Dewater the system, remove blind flanges, and perform tightness tests, as required by the ENGINEER.
   5. Insulate or paint piping, flanges, threaded joints, or field welds after the specified testing of each item has been completed unless instructed otherwise by the ENGINEER.
   6. Leave exposed all welded joints (longitudinal, girth, and nozzle) in underground piping that have not been shop tested until the specified testing has been completed. After final testing of these joints, cover the system.
   7. Prior to substantial completion and startup, check pipe hangers, supports, guides, and pipe specialties for the removal of all shipping and erection stops and for the correctness of the cold and hot settings for the design service, make adjustments as necessary to obtain proper installation. Provide the ENGINEER with instructions for the hot settings.
   8. As necessary during equipment testing and at the end of substantial completion and startup, clean or replace the screens and filter elements as appropriate for the filter type and service.
   9. Prior to startup, verify, to the extent required by the ENGINEER, that specified valve packing has been provided on valves installed in the plant.
   10. Prior to startup, install all of the valve and piping system identification labels.
   11. Prior to startup, check and record the position of all process system valves.
   12. Prior to startup, correct support, vibration, and thermal expansion problems detected during the preliminary equipment testing.
   13. Prior to the startup, retorque all hot and cold service bolting as required to ensure a permanent and proper installation.
   14. Prior to startup, demonstrate to the ENGINEER's satisfaction that each piping system (e.g., chemical, sample, utility, irrigation process, etc.) functions as designed and required by the Contract Documents.

+ + END OF SECTION + +

SECTION 01800

OPERATIONAL COMPLETION AND PROJECT CLOSEOUT

PART 1 - GENERAL

1.1 GENERAL

A. The Work will be considered operationally complete when all technical and administrative submittals, testing, training and startup are completed satisfactorily in accordance with the Contract Documents.

B. Operational completion shall apply to the project in its entirety.

1.2 CERTIFICATION OF OPERATIONAL COMPLETION

A. Prior to requesting the ENGINEER's inspection for certification of each phase as operationally complete, the CONTRACTOR shall certify in writing that each phase of the Work is operationally complete and shall submit a list of known items still to be completed or corrected (punchlist) prior to Contract Completion.

B. The following items shall be completed:
   1. OWNER has been advised of any pending insurance changeover requirements.
   2. Specific warranties, maintenance agreements, final certifications and similar documents have been submitted.
   3. All tools, spare parts, extra stocks of materials, and similar physical items have been delivered to OWNER.
   4. Instruction of OWNER's operation/maintenance personnel, and start up testing has been completed.
   5. Submittal and acceptance of all O&M manuals.
   6. Changeover of locks to OWNER's cores/keys.

C. Punchlist:
   1. When the CONTRACTOR considers that the Work, or a portion or phase thereof which the OWNER agrees to accept separately, is operationally complete, the CONTRACTOR shall certify in writing that the work is operationally complete and shall prepare and submit to the ENGINEER a comprehensive list of items to be completed or corrected prior to Contract Completion (punchlist).
   2. The ENGINEER may add additional work items to the punchlist.
   3. Failure to include an item on the punchlist does not alter the responsibility of the CONTRACTOR to complete all Work in accordance with the Contract Documents.
   4. Upon receipt of the CONTRACTOR's punchlist, the ENGINEER will make an inspection to determine whether the Work or designated portion thereof is operationally complete.
   5. If the ENGINEER's inspection discloses any item, whether or not included on the CONTRACTOR's list, that is not in accordance with the requirements of the Contract Documents, the CONTRACTOR shall, upon notification by the ENGINEER and before an issuance of the Certificate of Operational Completion is provided, complete or correct such item.
   6. The CONTRACTOR shall then submit a request for another inspection by the ENGINEER.

7. When the Work or designated portion thereof is accepted by the ENGINEER to be operationally complete, the ENGINEER will prepare a Certificate of Operational Completion.
8. The date of Operational Completion shall be the date of the ENGINEER's inspection and acceptance.

1.3 DESCRIPTION OF PROJECT CLOSEOUT

A. Closeout is hereby defined to include general requirements near the end of the Contract Time, in preparation for Final Acceptance, Final Payment, normal termination of Contract, occupancy by OWNER and similar actions evidencing completion of the Work.

B. Specific requirements for individual units of Work are specified in Sections of Divisions 2 through 16.

1.4 FINAL CLEANUP

A. At completion, leave project clean and ready for use.
   1. Legally dispose of waste materials, debris and rubbish off the site.
   2. Remove grease, dust, dirt, stains, labels, fingerprints and other foreign materials from exposed and enclosed surfaces.
   3. Repair, patch and touch up all affected curbs, gutters, and sidewalks to match adjacent surfaces.
   4. Broom clean paved surfaces, rake clean other surfaces of grounds. Vacuum clean all interior surfaces, rake clean other surfaces of grounds.

1.5 RECORD DRAWINGS

A. The CONTRACTOR shall prepare and submit Contract Record Drawings for the OWNER.
   1. The CONTRACTOR shall make a record of changes during construction on prints of the Drawings provided by the OWNER for this purpose (Contract Record Drawings) as described in Section 01330, Submittal Procedures.
   2. The reproducible drawings on which changed conditions are recorded shall be returned to the ENGINEER prior to project completion.

1.6 GUARANTEES

A. The General Conditions cover the CONTRACTOR's responsibility to remedy defects due to faulty workmanship and materials which appear within one year from the date of Final Acceptance.

B. Special guarantees are required by various Sections of the Specifications. Assemble written guarantees, label and submit to the ENGINEER.
   1. Provide the "Warranty Form" included in the General Conditions.
   2. Equipment guarantees shall be written in the manufacturer's standard form and shall be countersigned by the Subcontractor or supplier and the CONTRACTOR.
   3. All other guarantees shall be written on the Subcontractor's or supplier's letterhead and shall be countersigned by the CONTRACTOR.

1.7 SPARE PARTS AND MAINTENANCE MATERIALS

A. Spare parts and maintenance materials are required by various Sections of the Specifications.
   1. Parts and materials shall be packaged so as to preclude damage in normal handling and storage.
   2. Packages shall be labeled with full description of contents and project name and clearly identified as to which item of equipment they belong to. CONTRACTOR shall maintain a spare parts inventory list which shall be provided to the OWNER prior to Final Acceptance.
   3. Submit packaged parts and materials to ENGINEER.
   4. Submit the value of all spare parts.

1.8 FINAL INSPECTION

A. Prior to requesting ENGINEER's final inspection for certification of Final Acceptance and Final Payment, complete the following and list known exceptions (if any):
   1. Submit Final Payment request with final releases and supporting documentation not previously submitted and accepted.
   2. Submit copy of final punchlist of itemized work to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, endorsed and dated by ENGINEER.
   3. Submit Consent of Surety.
   4. Revise and submit evidence of final, continuing insurance coverage complying with insurance requirements.

B. Certify in writing that the work has been completed in accordance with the Contract Documents, and request ENGINEER's final inspection.

C. Reinspection:
   1. Within seven (7) days after receipt of the CONTRACTOR's notice that the work has been completed, including punchlist items resulting from earlier inspections, and excepting incomplete items delayed because of acceptable circumstance, the ENGINEER will reinspect the work.
   2. Upon completion of reinspection, ENGINEER will either prepare a certificate of Final Acceptance or advise the CONTRACTOR of work not complete or obligations not fulfilled as required for Final Acceptance.
   3. If necessary, inspection procedure will be repeated.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

+ + END OF SECTION + +

DIVISION 02

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SECTION 02220

DEMOLITION

PART 1 - GENERAL

1.1 DEFINITIONS

A. "Demolish": CONTRACTOR shall remove from the site as property of CONTRACTOR. Demolition includes disconnecting, removal, loading, repairs, cleanup, transportation, unloading, disposal permits and fees, disposal, and all other items required to remove the material from the site.

B. "Salvage": CONTRACTOR shall remove from area of Work and place in location designated by ENGINEER. Equipment is property of OWNER. Salvage includes disconnecting, removal, repairs, cleanup, loading, transportation, unloading, and all other items required to remove and relocate the material.

C. "OWNER to Remove": OWNER will remove from area of Work prior to CONTRACTOR commencing demolition Work for this area.

D. "Relocate": CONTRACTOR shall relocate material shown to new locations shown on Drawings or stated herein. Relocation includes disconnecting, removal, reconnecting, attaching, repairs, and all other items required to relocate material to new location.

E. "Abandon": CONTRACTOR shall disconnect and leave in place as specified.

F. "Materials": Any and all items and objects that are scheduled, specified, or shown to be demolished, salvaged, removed, relocated, or abandoned.

1.2 SUBMITTALS

A. Action Submittals:
   1. Product Information: Grout, sealants, and bonding agents to be used for patching.

B. Informational Submittals:
   1. Plan and schedule phased demolition, including limits of demolition, as part of and consistent with the progress schedule specified in Section 01320, PROGRESS SCHEDULE.
   2. Methods of demolition and equipment proposed to demolish materials.
   3. Copies of any authorizations and permits required to perform Work.
   4. Copies of Hazardous Materials Inspection Reports.
   5. Repair procedures for demolition of materials beyond limits shown on Drawings.

PART 2 - PRODUCTS

2.1 GENERAL

A. CONTRACTOR shall provide all materials and equipment in suitable and adequate quantity as required to accomplish the Work shown, specified herein, and as required to complete the Project.

PART 3 - EXECUTION

3.1 GENERAL

A. Drawings are based on available information. The Work may differ slightly from what is shown. CONTRACTOR shall be responsible for determining the work required by inspecting the site.

3.2 SAFETY REQUIREMENTS

A. All Work shall be done in conformance with all applicable rules and regulations pertaining to safety.

B. Hazardous Materials:
   1. See General Conditions.
   2. Existing facilities, or portions thereof, to be demolished may contain hazardous materials such as asbestos cement piping, residual chemicals in existing or abandoned piping, lead-based paint, mercury seals, or other unknown hazardous materials.

3.3 SEQUENCE

A. Be responsible for the sequence of Work.

B. Conform to constraints as specified in Section 01130, SPECIAL PROJECT CONSTRAINTS.

3.4 COORDINATION

A. Coordination with ENGINEER:
   1. Only materials specified herein, shown on the Demolition Photographs or the Drawings, or approved by ENGINEER in the field shall be demolished, salvaged, removed, relocated, or abandoned.
   2. Verify materials scheduled to be demolished, salvaged, removed, relocated, or abandoned with ENGINEER prior to performing Work.
   3. Do not remove materials without prior approval of ENGINEER.
   4. Provide at least 3 working days' notice to ENGINEER prior to start of Work.
   5. Notify ENGINEER to turn off affected services or facilities before starting Work.
   6. Provide temporary services during interruptions to affected services or facilities as acceptable to ENGINEER.
   7. ENGINEER will indicate limits of Work if not clearly shown.

B. Coordination with Utility Owners:
   1. Notify utility owners to turn off affected services or facilities before starting Work.

2. Provide not less than 72 hours notice to utility owners prior to shutdown, unless otherwise directed by utility owners.
3. Provide temporary services during interruptions to affected services or facilities as acceptable to utility owners.

3.5 LIMITS

A. Drawings define minimum portions of materials to be demolished. Unless otherwise shown, rough cuts or breaks may be made to limits of demolition shown. If rough cuts or breaks are made exceeding limits shown, CONTRACTOR shall repair the cuts or breaks back to the dimensions shown on Drawings at CONTRACTOR's expense.

B. If limits are not clear on the Drawings or Demolition Photographs, limits shall be as directed by ENGINEER.

C. All areas not within the limits of demolition Work shown on the Drawings, or as specified herein, shall be left undisturbed, unless necessary for demolition of materials.

3.6 DEMOLITION

A. General:
   1. Inspect condition of materials to be demolished prior to bidding to assess potential for salvage value.
   2. Remove all materials associated with existing equipment that is to be demolished.
   3. Materials within limits of demolition will become the property of CONTRACTOR.
   4. All materials from the demolition process shall be removed safely from the project site as soon as possible. They shall be disposed of in accordance with applicable federal, state, and city regulations. CONTRACTOR is responsible for determining these regulations and shall bear all costs associated with disposal of the materials.

B. Pavement and Curbs:
   1. Provide saw cut at all concrete and pavement surfaces and curb removal limits and where neat connection lines are required.
   2. Surfaces exposed by demolition activities shall be repaired and finished to provide a uniform, smooth, level transition between adjacent surfaces.

C. Concrete, CMU, and Reinforcing:
   1. In areas where concrete or CMU portions are to be removed from a structure, the edge of removal shall be cut with a concrete saw to leave a perpendicular edge or by core-drilling where a circular hole is required.
   2. Damaged concrete shall be removed to solid concrete. Damaged concrete shall include concrete that is soft, spalled, cracked, or otherwise damaged as determined by ENGINEER.
   3. Depth of removal shall be as determined by ENGINEER unless otherwise shown or specified.
   4. Reinforcing shall be cut and removed unless otherwise shown or instructed by ENGINEER.
   5. Spalled edges may be required to be resawn at the discretion of the ENGINEER.
   6. Protect adjacent structures and equipment from damage during Work.
   7. Exposed surfaces following demolition activities shall be repaired and finished to provide a uniform, smooth, and level transition between adjacent surfaces.

8. Remove and repair designated cracked and damaged concrete areas shown in accordance with this section and Section 03300, CAST-IN-PLACE CONCRETE.

D. Concrete Embedded Items:
   1. Except for core drills, demolish anchor bolts, reinforcing steel, conduit, and other materials that are concrete embedded to a minimum of 1 inch below final finished surface. For core drills, coat rebar exposed by core drilling with System No. 304 in accordance with Section 09900, PAINTING.
   2. Plug empty pipes and conduits with fireproof sealant to maintain fire ratings for floors or walls.
   3. Patching:
      a. Demolish damaged concrete. Damaged concrete shall be removed to solid concrete. Damaged concrete shall include concrete that is soft, spalled, cracked, or otherwise damaged as determined by ENGINEER.
      b. Coat with approved bonding agent.
      c. Patch with nonshrink, nonmetallic grout.

E. Piping:
   1. Pressurized Services: Install restrained caps or plugs at the demolished ends, unless otherwise shown.
   2. Gravity Services: Install concrete plugs, 5-foot minimum length.

F. Utilities:
   1. Excavate utility lines serving structures to be demolished.
   2. Demolish electrical, sanitary, and storm drainage lines serving structures to be demolished.
   3. Support or relocate utility lines exposed by Work.
   4. For water and gas lines to be demolished or capped and terminated, provide a permanent leakproof closure. Closure type shall be as recommended by utility owner.

G. Electrical:
   1. Remove conduits and wiring from materials to be demolished back to nearest junction box.
   2. For existing circuits to remain operational, intercept existing conduit at the most convenient location, or as shown, and splice and extend conduit to new location. Install new conductors as required to accomplish intended results. New conductors shall be continuous without splices between junction boxes.
   3. For existing circuits no longer needed, demolish conductors from conduits and add pull tapes.
   4. Demolish all surface-mounted conduit which is no longer needed.
   5. For conduit below grade or concealed within walls, cap and abandon in place.

3.7 SALVAGE

A. Salvage materials for OWNER's own use where shown.

B. Remove materials with extreme care so as not to damage.

C. Promptly remove materials from Work area.

D. Store materials in location designated by ENGINEER.

E. Clean and protect materials from dust, dirt, natural elements, and store as directed.

3.8 RELOCATION

A. ENGINEER will determine condition of materials prior to removal.

B. Remove all materials associated with items to be relocated.

C. Existing materials shall not be damaged during removal.

D. Properly store and maintain materials in same condition as when removed.

E. Clean and protect materials from dust, dirt, natural elements, and store as directed.

3.9 ABANDONMENT

A. Structures: Break holes into or core drill floor slabs, catch basins, and other below-grade concrete structures to be abandoned in place to allow water to freely migrate through.

B. Piping and Conduits:
   1. General: Piping and conduits to be abandoned shall be capped with a watertight plug at demolished end in a manner that will prevent entrance of soil, groundwater, or moisture.
   2. Pressurized Services: Install restrained caps or plugs at the demolished ends, unless otherwise shown.
   3. Gravity Services: Install concrete plugs, 5-foot minimum length.

3.10 REPAIR AND REPLACEMENT

A. Any damaged materials scheduled to be salvaged or relocated shall be repaired by the CONTRACTOR to the satisfaction of ENGINEER or replaced at the CONTRACTOR's expense.

B. Any damage to areas not within the limits of demolition Work shown on the Demolition Photographs, Drawings, or as specified herein shall be repaired or replaced to original precontract conditions at the CONTRACTOR's sole expense.

3.11 DISPOSAL

A. Dispose of materials offsite in licensed landfills and in accordance with all local, state, and federal regulations. CONTRACTOR is responsible for obtaining any and all necessary permits for disposal.

+ + END OF SECTION + +

SECTION 02930

FABRICATED STEEL GATES AND OPERATORS

PART 1 - GENERAL

1.1 SUBMITTALS

A. Shop Drawings: Detailed drawings, information and specifications for materials, finishes, and dimensions.

B. Quality Control Submittals:
   1. Manufacturer's recommended installation instructions.
   2. Evidence of Supplier and installer qualifications.

1.2 SCHEDULING AND SEQUENCING

A. Complete necessary site preparation and grading before installing fabricates steel gates and operators.

PART 2 - PRODUCTS

2.1 FABRICATED STEEL GATES

A. Fabricate steel access gates and person gates as shown on the Drawings.

B. Shop fabricate steel gates and deliver to site completely finished and painted.
   1. Clean all weld residue and grind welds smooth prior to painting.
   2. Paint with System 300, as described in Section 09900 PAINTING.

C. Steel Frame: Provide steel fabricated in accordance with Section 05500 MISCELLANEOUS METALS.

D. Metal Panel:
   1. Galvanized steel sheet meeting ASTM A653, G-60. Provide profile and thickness shown on the Drawings.

2.2 GATE OPERATORS

A. Provide gate operators as shown on the Drawings, suitable for operation of the gates, as shown on the drawings.

B. Features:
   1. Drive Unit A/C Power: 230VAC, single phase, 60 Hz.
   2. Drive Motor: 1/2 HP, 24VDC, brushless, variable speed, operating temperature: -25°C to 70°C. Provide size "O" contactor type magnetic starter, reversing, prewired with overcurrent and overload protection.
   3. Speed Reduction: Heavy duty sprockets, belt and drive chain, permanently lubricated.

4. Housing: Heavy gage, weather-resistant, lockable, galvanized steel, NEMA 3R enclosure.
5. Drive Chain: No. 50 minimum. Provide all mounting hardware required to connect to gate.
6. Safety Clutch: Adjustable friction type, designed to slip if gate meets obstruction.
7. Magnetic Brake: Solenoid activated disc type, designed to reduce gate coasting.
8. Emergency Operation: Manual no tool disconnect in case of power failure.
9. Limit Switches: Adjustable rotary type, full-open and full-closed limit switches.
10. Audible Warning: Provide audible warning signal during gate operation, suitable for outdoor installation.
11. Capable of operating 1500 pound gate.

C. Controls:
1. All controls shall be suitable for operation of a 230 volt, single phase, 60 hertz power supply. Provide a fused 230/115 volt transformer, 125 percent sized, to provide power to all controls and devices. Provide all controls, transformers, relays and other equipment as necessary for a complete and functional system installed in a NEMA 3R enclosure.
2. Gate operators shall be controlled as follows:
   a. Local Operation Station: Provide keypad operated local operation station, Linear AK-11 or approved equal, mounted on a gooseneck pedestal located on the public side of gate location.
   b. Fire Department Knox Box: Provide a single gate and key switch Knox Box in accordance with the local Authority Having Jurisdiction (AHJ) requirements, Knoxbox #3502 or approved equal. Switch shall have at minimum the following functionality: SPDT or DPDT, 7A Resistive, 4A inductive, 2-position removable key recessed with Stainless Steel, Dust/Tamper proof cover. The box shall include a highly reflective operation decal, RED label indicating "FIRE DEPARTMENT".
   c. Time Delay System: Close on entry after set time delay.
   d. Embedded Magnetic Vehicle Detection Loop: Automatic open on vehicle exit, Reno A&E, Type PLH or approved equal.
   e. Radio remote controls: Provide remote receiver antenna wired directly to gate drive controller for each gate drive unit, HySecurity MX001179 or approved equal. Provide (2) 2-button (Open/Close), DIP switch programmable radio transmitter remotes for each gate drive unit, HySecurity MX001203 or approved equal.
   f. Photobeam Detectors (Thru-Beam Type): Provide (2) pairs of photobeam detectors for each gate drive unit. (1) pair of photobeam detectors will monitor the gate obstruction zone while closing and (1) pair will monitor the gate entrapment zone while opening, Seco-Larm Enforcer E-960-D90GQ or approved equal.
3. Manufacturer of the automatic gate operators and controls shall provide a "total system" with all accessories required to operate according to the following:
   a. Embedded 'Free Exit' Magnetic detection loop shall automatically open the gate when a vehicle is detected. After the Free Exit loop triggers gate opening, gate control will defer to the photobeam sensor inputs and timer settings described below.
   b. Obstruction Zone Photobeam Detectors shall prevent premature gate closure. The photobeam detection system shall hold the gate in an open position until the vehicle or any obstruction such as a pedestrian clears the gate area. When the vehicle or obstruction clears the gate area, the gate operator shall automatically close the gate, after a pre-set period, adjustable from 3 to 90 seconds. Should the gate be closing as a vehicle or obstruction reaches the gate area, the gate

shall automatically reverse to the open position and the timer shall reset for a full time cycle.

c. Entrapment Zone Photobeam detectors shall prevent premature gate opening if an obstruction is detected in the gate entrapment zone. A detected obstruction in the gate entrapment zone will attempt to close the gate. While closing, the Obstruction Zone photobeam control description will govern gate operation. If both the Entrapment Zone and Obstruction Zone photobeams detect obstructions, the gate will stop operation and audibly alarm.
d. Provide maximum run timer to limit time of operation in any one direction to a maximum of 90 seconds and to delay reversal of gate 1.5 seconds when signaled from magnetic vehicle detection system.

D. Product and Manufacturer:
1. SlideSmart DC 15
2. Or Approved Equal

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all gates level, plumb and in-line for smooth operation.

B. Install gate operators to provide smooth operation of gate, as described above.

C. Provide all miscellaneous fittings and accessories required for a complete installation of all gates.

D. Provide padlock hasps for all gates, attached to adjacent fencing to provide for a secure gate system utilizing OWNER's padlocks.

E. Touch up all damaged paint after installation.

3.2 FIELD QUALITY CONTROL

A. Gate Tests: Prior to acceptance of installed gates and gate operator systems, demonstrate proper operation of gates under each possible open and close condition specified.

+ + END OF SECTION + +

DIVISION 03

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SECTION 03400

PRECAST CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section includes all plant-precast products including valve and meter vaults.

B. Manholes, influent junction structure and pump station shall be Armorock per 03410.

C. Include lifting lugs and provisions for removal of the lid on the following structures (valve vaults and meter vault).

1.2 SYSTEM DESCRIPTION

A. Precast products shall be designed for the indicated service, the loadings specified in the Contract Documents, and all transportation, handling, and erection loads, in accordance with requirements and recommendations of the references.
   1. Precast products not subjected to traffic loads shall be designed to meet and exceed the requirements of ACI 318-14.
   2. Precast products subjected to traffic loads shall be designed to meet and exceed the requirements of the current AASHTO LRFD Bridge Design Specifications.
   3. Liquid containing precast products shall be designed for the additional requirements of ACI 350-06.

B. If precast products are proposed as substitutes for cast-in-place designed structures, such precast products shall meet the above requirements and any other requirements for which the cast-in-place structures were designed by the ENGINEER. Such products shall be designed by an engineer licensed to practice in the State where the project is performed.

C. Items located in or adjacent to traffic areas shall be designed to resist AASHTO HL93 loading, unless otherwise indicated.

D. Lifting inserts shall have a minimum safety factor of 4.

1.3 QUALIFICATIONS

A. Manufacturer:
   1. Manufacturer shall have at least 5 years experience in the design and manufacture of precast concrete products substantially similar to those required for this project.

B. Installer:
   1. Precast Items shall be in stalled by the Manufacturer or by an installer regularly engaged for at least 5 years in erection of precast products similar to those required on this project.

1.4 SUBMITTALS

A. Shop Drawings:
   1. Submit to the Engineer for review, shop drawings of the proposed details, and design calculations; all calculations and shop drawings shall be stamped and signed by a Civil or Structural Engineer registered in the State of Arizona.
   2. Material specifications.
   3. All dead, live and other applicable loads used in the design.
   4. Applicable standards (from "References") met by the item(s).
   5. Setting plans locating and designating all items furnished by the manufacturer, with all major openings shown and located.
   6. Details to indicate quantities, location and type of reinforcing and prestressing steel.
   7. Sections and details showing connections, edge conditions, support conditions, and connections of the items.
   8. Description of all embeds, including stripping, lifting and erection inserts, with piece mark and location, including those cast into products or sent loose to the job site.
   9. Description and drawings of all frames and covers.
   10. Dimensions and special finishes.

B. Mix Designs: Submit all precast mix designs for approval. Mix designs shall be prepared by an independent testing facility or qualified employee of the Precast Manufacturer.

C. Design Modifications:
   1. Submit design modifications necessary to meet performance requirements and field conditions. Refer to the Project Geotech Report for soil conditions. Whenever there is a conflict between the Geotech Report and this specification, the most stringent requirement applies.
   2. Variations in details or materials shall not adversely affect the appearance, durability or strength of products.
   3. Maintain general design concept without altering size of members, profiles and alignment unless otherwise approved by the Architect/Engineer.

1.5 QUALITY ASSURANCE

A. In-Plant Quality Control
   1. The Manufacturer shall have an established PCI quality control program in effect prior to bidding. If requested, a copy of this program shall be submitted to the ENGINEER.
   2. Testing of materials and inspection of production techniques shall be the responsibility of the Manufacturer's Quality Control Department.
   3. Keep quality control records available for two years after final acceptance.
   4. Keep certificates of compliance available for five (5) years after final acceptance.

B. All other testing and inspection, if any, to be provided by OWNER.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Handle and transport products in a position consistent with their shape and design in order to avoid excessive stresses or damage.

B. Lift or support products only at the points shown on the Shop Drawings.

C. Installer shall be responsible for the repair of damage to items except that caused by others.

D. After items are installed in their final positions, the CONTRACTOR shall be responsible for their protection. The CONTRACTOR shall be responsible for the repair of any damage to the items caused by someone other than the Manufacturer/Installer.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. Portland Cement ASTM C150 Type I, II or III cement. Use best type for soil condition present.

B. Aggregates:
   1. Fine and coarse aggregate for mix shall conform to ASTM C33 or C330.
   2. Aggregates shall be clean, hard, strong, durable, inert, and free of staining and deleterious materials.

C. Water Potable, free from deleterious material.

D. Admixtures:
   1. Conforming to ASTM C260 and/or ASTM C494.
   2. Calcium chloride or admixtures containing chlorides shall not be used.

E. Concrete Strength: Concrete strength shall be determined by design with a minimum 28 day design strength of 4,000 psi.

2.2 STEEL MATERIALS

A. Products:
   1. Structural Shapes, Bars & Plates (1.6mm and thicker): ASTM A36
   2. Pipe: ASTM A53 Grades A or B
   3. Tube Steel: ASTM A500 Grades A or B
   4. Reinforcing Steel: ASTM A615 Grades 300 & 420 or ASTM A706
   5. Prestressing Strand: ASTM A416 Grade 270, low relaxation
   6. Deformed Steel Bar Mats: ASTM A184
   7. Deformed Bar Anchors: ASTM A496
   8. Deformed Welded Wire Fabric: ASTMA497
   9. Plain Welded Wire Fabric: ASTM A185
   10. Welded Headed Studs: AWS D1.1 Type B
   11. Standard Machine Bolts: ASTM A307 Grade A or SAE J429 Grade 2
   12. Standard Studs/Threaded Round Stock: ASTM A307 Grade C, ASTM A572 Grade 345
   13. Nuts for Standard Machine Bolts and Threaded Studs: ASTM A563 Grade A Hex Nuts
   14. High Strength Bolts: ASTM A325 Type 1, ASTM A449 Type 1, or SAE J429 Grade 5
   15. Nuts for High-Strength Bolts and Threaded Studs: ASTM A563 Grade DH Heavy Hex Nuts
   16. Coil Rods and Bolts: ASTM A108 - SAE 1016 to 1026, F_u/F_Y = 480/380 MPa minimum
   17. Coil Nuts for Coil Rods and Bolts: Nuts passing a proof load stress of 80 ksi, based on the tensile stress area of the matching coil rods and bolts.
   18. Carbon Steel Castings: ASTM A27 Grade 415-205

B. Protective Coatings:
   1. All connection hardware permanently exposed to weather after completion shall be protected. All connection hardware not exposed to weather after completion may be uncoated, except as otherwise explicitly required by the contract drawings. Fasteners can have either an electroplated zinc or cadmium coating.
   2. Alkyd Rust Inhibitive Primers (shop primers such as red iron oxide) :
      a. Tnemec Series FD88 Azeron Primer
      b. Ameron 5105
      c. Weld-Thru Primer, Red, 2-0101 & Gray, 2-0102
   3. Zinc Coatings:
      a. Hot-Dip Galvanizing: ASTM A123, or ASTM A153
      b. Electroplated Zinc for Steel Products and Steel Hardware: ASTM B633
      c. Zinc Rich Paints: DOD-P-21035
   4. Cadmium Coatings:
      a. Electrodeposited Coatings of Cadmium: ASTM B766

2.3 MISCELLANEOUS PRODUCTS

A. Grout:
   1. Cement Grout: Portland cement, sand and water sufficient for placement and hydration.
   2. Non-Shrink Grout: Premixed, packaged non-ferrous aggregate shrink resistant.
   3. Epoxy Resin Grout: Two-component mineral-filled resin: ASTM C881.

B. Joint Sealing Compound: The joint sealing compound shall be a permanently flexible plastic material complying in every detail to Federal Specification SS S-00210 (GSA-FSS) dated July 26, 1965. "Quickseal", or approved equal.

C. Frames and Covers: Catch basins, manholes, and vaults shall be provided with fabricated aluminum or steel frames and covers as specified or shown on the drawings and shall be built up so that the cover is flush with the surrounding surface unless otherwise specified.

2.4 FABRICATION

A. Unless otherwise noted, precast concrete structure dimensions called out on the Drawings are interior dimensions.

B. Manufacturing procedures shall be in general compliance with PCI MNL-116.

C. Manufacturer shall provide for those openings 10 in. or larger, round or square as shown on the drawings. Other openings shall be located and field drilled or cut by the trade requiring them after the units have been erected. Openings and/or cutting of prestressing strand shall be approved by ENGINEER and manufacturer before drilling or cutting.

D. Forms:
   1. Forms for precast products shall be rigid and constructed of materials that will result in finished products conforming to the profiles, dimensions and tolerances indicated by this Section, the Contract Documents and the reviewed Shop Drawings.
   2. Construct forms to withstand vibration method selected.
   3. Release agents shall be applied and used according to manufacturer’s instructions.

E. Plastic Liner:
   1. Where called for on the Drawings, provide cast-in-place plastic liner system.
   2. Install liner system per manufacturer's instructions.
   3. Follow all requirements of Specification Section 06640, Plastic Liner for Concrete Pipe and Structures.

F. Concreting:
   1. Batching of Concrete shall be in accordance with approved Mix Design(s).
   2. Convey concrete by methods which will prevent separation, segregation or loss of material.
   3. Consolidate all concrete in the form to minimize honeycombing or entrapped air.

G. Curing: Procedures sufficient to insure specified concrete strength of all products must be employed. Stripping of a panel shall not occur until concrete strength is sufficient to prevent cracking or damage of the panel.

H. Manufacturing Tolerances:
   1. Cross Sectional Dimensions:
      a. Less than 24 inches: ±1/4"
      b. 24 to 36 inches: ±3/8"
      c. Over 36 inches: ±1/2"
   2. Length:
      a. Less than 25 ft: ±1/2"
      b. 25 to 50 ft: ±3/4"
      c. Over 50 ft: ±1"
   3. Variation from square or designed skew (difference in length of two diagonal measurements): Max. ±3/4"

I. Identification: Mark each precast item to correspond to identification mark on Shop Drawings for product location, and with casting date.

PART 3 - EXECUTION

3.1 PREPARATION

A. Access: Clear unloading areas and access roadways to point of component placement shall be provided and maintained by the CONTRACTOR. The CONTRACTOR shall provide all required traffic controls, barricades, warning lights and/or signs to insure a safe installation.

B. Sitework: The CONTRACTOR shall excavate and prepare the subgrade, including 2 inches of clean sand, graded level and to the proper elevation.

C. Installer Responsibility: Prior to installation of the precast products, notify the CONTRACTOR of any discrepancies discovered which affect the work under this contract.

3.2 INSTALLATION

A. General: Precast products shall be lifted with suitable lifting devices at points provided by the Manufacturer to prevent excessive stresses or damage to the products. Brace and secure items before unhooking.

B. Sitework:
   1. Openings or "knockouts" shall be located as shown on the drawings and shall be sized sufficiently to permit passage of the largest dimension of pipe and/or coupling flange. Upon completion of installation, all voids or openings in the vault walls around pipes shall be filled with 4,000-psi concrete or mortar, using an approved epoxy for bonding concrete surfaces.
   2. All joints between precast sections shall be made watertight using preformed mastic material. The sealing compound shall be installed according to the manufacturer's recommendations to provide a watertight joint which remains impermeable throughout the design life of the structure. All joints shall be filled with dry-pack non-shrink grout. If plastic liner system is used, after the joint has been made and is cured, install plastic liner weld strip at all joints and seams.
   3. Frames and covers shall be built up so that the cover is flush with the surrounding surface unless otherwise specified. The CONTRACTOR is responsible for placing the cover at the proper elevation where paving is to be installed and shall make all necessary adjustments so that the cover meets these requirements.
   4. After the structure and all appurtenances are in place and approved, and after any required disinfection or testing, backfill shall be placed to the original ground line or to the limits designated on the plans.

3.3 FIELD QUALITY CONTROL

A. Hydrostatic Testing:
   1. All Manholes, Wetwells, Junction Boxes, or other water bearing structures shall be hydrostatically tested prior to acceptance.
   2. Test Procedure:
      a. Plug all inlets and outlets with temporary plugs
      b. Fill water bearing structure with clean, potable water
      c. Let stand for 24 hours, if desired, to allow for "soaking-in"
      d. Fill to rim elevation
      e. Let stand for a minimum of 2 hours
      f. Check distance from rim to water surface
      g. Calculate water loss. Leakage in each manhole may not exceed 0.1-gallon per hour per foot of water depth during the test.
   3. Repair all manholes which do not meet the above test requirements with a method approved by the ENGINEER and re-test until passing.

3.4 PATCHES AND REPAIRS:

A. Patching of products, when required, shall be performed to industry standards for structural concrete. Repairs shall be sound, permanent and flush with adjacent surface.

3.5 WARRANTY:

A. All labor and materials under the Precast Manufacturers contract shall be warranted by the Precast Manufacturer for a period of two (2) years after substantial completion.

+ + END OF SECTION + +

SECTION 03410

POLYMER CONCRETE STRUCTURES

PART 1 - GENERAL

1.1 SCOPE

A. This specification covers polymer concrete manholes intended for use in sanitary sewers, storm sewers and water lines where corrosion resistance is required

1.2 REFERENCES

A. This specification covers polymer concrete manholes intended for use in sanitary sewers, storm sewers and water lines where corrosion resistance is required

B. ASTM C 478 (most current) Standard Specification for Precast Reinforced Concrete Manhole Sections

C. ASTM C 579 (most current) Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic, Surfacing, and Polymer Concretes

D. ASTM C 443 (most current) Standard Specification for Joints for Concrete Pipe and Manholes Using Rubber Gaskets

E. ASTM C 580 (most current) Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes

F. ASTM C 857 (most current) Standard Practice for Minimum Structural Design Loading for Underground Utility Structures

G. ACI 350-06 Code Requirements for Environmental Engineering Concrete Structures & Commentary

H. ACI 440.1R-15 Guide for the Design and Construction of Structural Concrete Reinforced with Fiber-Reinforced Polymer (FRP) Bars

I. ACI 548.6R-96 Polymer Concrete-Structural Applications State-of-the-Art Report

J. ASTM D 648 (most current) Test Method for Deflection Temperature of Plastics Under Flexural Load in Edgewise Position

K. ASTM D 6783 (most current) Standard Specification for Polymer Concrete Pipe

L. ASTM D 2584 (most current) Test Method for Ignition Loss of Cured Reinforced Resins

M. ASTM C 923 (most current) Standard Specifications for Resilient Connectors between Concrete Manholes Structures and Pipe

N. ASTM C 990 (most current) Standard Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections using Preformed Flexible Joint Sealants

O. ASTM C 497 (most current) Test Methods for Concrete Pipe, Manhole Sections, or Tile

1.3 SUBMITTALS

A. Conform to bid document requirements

B. Submit manufacturer's data and details of following items for approval:
   1. Shop drawings of manhole sections, base units and construction details, jointing methods, materials, and dimensions
   2. Summary of criteria used in manhole design including, as minimum, material properties, loading criteria, and dimensions assumed. Include certification from manufacturer that polymer concrete manhole design meets or exceeds the load and strength requirements of ASTM C 478 and ASTM C 857, reinforced in accordance with ACI 440.1R-15. Include current ISO 9001:2008 certification
   3. Frames, grates, rings, and covers
   4. Materials to be used in fabricating pipe drop connections
   5. Materials to be used for pipe connections
   6. Materials to be used for stubs and stub plugs, if required

C. Submitted sealed drawings by a registered Professional Engineer

PART 2 - PRODUCTS

2.1 POLYMER CONCRETE MANHOLES AND STRUCTURES

A. Provide polymer concrete manhole sections, monolithic base sections and related components referencing to ASTM C 478. ASTM C 478 material and manufacturing is allowed compositional and dimensional differences required by a polymer concrete product

B. Provide base riser section with monolithic floors, unless shown otherwise

C. Provide riser sections joined with bell and spigot / ship-lap design seamed with butyl mastic and or rubber gaskets (ASTM C 990) so that on assembly, manhole base, riser and top section make a continuous and uniform manhole structure

D. Construct riser sections for polymer concrete manholes from standard polymer concrete manhole sections of the diameter indicated on drawings. Use various lengths of polymer concrete manhole sections in combination to provide correct height with the fewest joints

E. Design wall sections for depth and loading conditions with wall thickness as designed by polymer concrete manufacturer

F. Provide tops to support AASHTO HS-20 or HL-93 or vehicle loading or loads as required and receiving cast iron frame covers or hatches, as indicated on drawings

G. DESIGN CRITERIA:

1. Polymer Concrete Manhole risers, cones, flat lids, grade rings and manhole base sections shall be designed by manufacturer to meet the intent of ASTM C 478 with allowable compositional and sizing differences as designed by the polymer concrete manufacturer.
    a. AASHTO HS-20 or HL-93 design or as required loading applied to manhole cover and transition and base slabs
    b. Polymer manholes will be designed based upon live and dead load criteria in ASTM C 857 and ACI 350-06
    c. Unit soil weight of 120 pcf located above portions of manhole, including base slab projections
    d. Internal liquid pressure based on unit weight of 63 pcf
    e. Dead load of manhole sections fully supported by polymer concrete manhole base

H. DESIGN:
1. Polymer Concrete Manhole risers, cones, flat lids, grade rings and manhole base sections shall be designed by manufacturer to meet loading requirements of ASTM C 478, ASTM C 857 and ACI 350-06 as modified for polymer concrete manhole design as follows:
    a. Polymer Concrete Mix Design shall consist of thermosetting resin, sand, and aggregate. No Portland cement shall be allowed as part of the mix design matrix. All sand and aggregate shall be inert in an acidic environment
    b. Reinforcement – Shall use acid resistant reinforcement (FRP Bar) in accordance with ACI 440.1R-06 as applicable for polymer concrete design. No steel rebar or matting may be used or substituted.
    c. The wall thickness of polymer concrete structures shall not be less than that prescribed by the manufacturer's design by less than 95% of stated design thickness
    d. Thermosetting Resin - The resin shall have a minimum deflection temperature of 158° F when tested at 264 psi (1.820 mPa) following Test Method D 648. The resin content shall not be less than 7% of the weight of the sample as determined by test method D 2584. Resin selection shall be suitable for applications in the corrosive conditions to which the polymer concrete manhole structures will be exposed
    e. Each polymer concrete manhole component shall be free of all defects, including indentations, cracks, foreign inclusions and resin starved areas that, due to their nature and degree or extent, detrimentally affect the strength and serviceability of the component part. Cosmetic defect shall not be cause for rejection. The nominal internal diameter of manhole components shall not vary more than 2%. Variations in height of two opposite sides of risers and cones shall not be more the 5/8 inch. The under run in height of a riser or cone shall not be more than ¼ in/ft of height with a maximum of ½ inch in any one section
    f. Marking and Identification - Each manhole shall be marked with the following information - Manufacturer's name or trademark, Manufacturer's location and Production Date
    g. Manhole joints shall be assembled with a bell/spigot or shiplap butyl mastic and/or gasketed joint so that on assembly, manhole base, riser and top section make a continuous and uniform manhole. Joint sealing surfaces shall be free of dents, gouges and other surface irregularities that would affect joint integrity
    h. Minimum clearance between wall penetrations and joints shall be per manufacturer's design

i. Construct invert channels to provide smooth flow transition with minimal disruption of flow at pipe-manhole connections. Invert slope through manhole is as indicated on drawings. All precast base sections to be cast monolithically. Polymer bench and channel are to be constructed with all polymer concrete material. Extended ballast slab requirements for buoyancy concerns can be addressed with cementitious concrete material if needed

j. Provide resilient connectors conforming to requirements of ASTM C 923 or other options as available. All connectors are to be water tight. Install approved resilient connectors at each pipe entering and exiting manholes in accordance with manufacturer's instructions

I. QUALITY CONTROL

1. Facility Quality Control should be maintained by adhering to ISO 9001:2008 for manufacturing. All fabricators will be ISO 9001:2008 Certified. All fabrication will take place in an all polymer concrete fabrication facility. At no time will the polymer concrete fabrication facility share the facility with a cementitious precast product production facility. Fabricator is also to provide references of 5 previous projects in the last 5 years performed with both owner and contractor for reference and review by owner. Polymer concrete shall be cast in a polymer only facility and shall not be manufactured in a cementitious concrete facility

J. GROUTING

1. All materials needed for grouting and patching will be a polyester mortar compound provided by the manufacturer or an approved equal by the manufacturer

K. MANUFACTURER

1. Armorock LLC

PART 3 - MANHOLE VENT WITH DAMPER ASSEMBLY ACCESSORY

A. Provide manhole vent assembly per detail 2125.

B. Materials

1. All piping shall be stainless steel per SECTION 15100 PSDS WSSTP unless noted.
2. Valves shall be per SECTION 15200 VS unless noted.

PART 4 - EXECUTION

4.1 PREPARATION

A. Access: Clear unloading areas and access roadways to point of component placement shall be provided and maintained by the CONTRACTOR. The CONTRACTOR shall provide all required traffic controls, barricades, warning lights and/or signs to insure a safe installation.

B. Sitework: The CONTRACTOR shall excavate and prepare the subgrade, including 2 inches of clean sand, graded level and to the proper elevation.

C. Installer Responsibility: Prior to installation of the precast products, notify the CONTRACTOR of any discrepancies discovered which affect the work under this contract.

4.2 INSTALLATION

A. General: Precast products shall be lifted with suitable lifting devices at points provided by the Manufacturer to prevent excessive stresses or damage to the products. Brace and secure items before unhooking.

B. Sitework:
   1. Openings or "knockouts" shall be located as shown on the drawings and shall be sized sufficiently to permit passage of the largest dimension of pipe and/or coupling flange. Upon completion of installation, all voids or openings in the vault walls around pipes shall be booted or sealed with polymer concrete grout as supplied or recommended by the manufacturer.
   2. All joints between precast sections shall be made watertight using preformed mastic material. The sealing compound shall be installed according to the manufacturer's recommendations to provide a watertight joint which remains impermeable throughout the design life of the structure. All joints shall be filled with dry-pack non-shrink grout. If plastic liner system is used, after the joint has been made and is cured, install plastic liner weld strip at all joints and seams.
   3. Frames and covers shall be built up so that the cover is flush with the surrounding surface unless otherwise specified. The CONTRACTOR is responsible for placing the cover at the proper elevation where paving is to be installed and shall make all necessary adjustments so that the cover meets these requirements.
   4. After the structure and all appurtenances are in place and approved, and after any required disinfection or testing, backfill shall be placed to the original ground line or to the limits designated on the plans.

4.3 FIELD QUALITY CONTROL

A. Vacuum Testing
   1. All Manholes, Wet wells, Junction Boxes or other water bearing structures shall be negative pressure vacuum tested prior to acceptance.
   2. Test procedure:
      a. Plug all inlets and outlets with temporary plugs
      b. Determine test time based on diameter and depth of structure
      c. Pull vacuum on structure to 10 bar
      d. Commence test time upon reaching 10 bar.
      e. 1 Bar of vacuum loss is acceptable within the prescribed amount of time for the structure
   3. Repair structures which do not meet the above requirement with a method approved by the manufacturer and ENGINEER and re-test until passing.

4.4 PATCHES AND REPAIRS:

A. Patching of products, when required, shall be performed to industry standards for structural concrete with polymer concrete. Repairs shall be sound, permanent and flush with adjacent surface.

4.5 WARRANTY:

A. All labor and materials under the Precast Manufacturers contract shall be warranted by the Precast Manufacturer for a period of two (2) years after substantial completion.

B. A 50 year Warranty against corrosion shall be issued.

+ + END OF SECTION + +

SECTION 03740

CRACK REPAIR BY EPOXY INJECTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall furnish all material, tools, equipment, appliances, transportation, labor and supervision required to repair cracks by the injection of an epoxy resin adhesive.

1.2 QUALITY ASSURANCE

A. Qualifications for Epoxy Injection Staff:
   1. Manufacturer's Site Representative:
      a. Capable of instructing successful methods for restoring concrete structures utilizing epoxy injection process.
      b. Understands and is capable of explaining technical aspects of correct material selection and use.
      c. Experienced in the operation, maintenance, and troubleshooting of application equipment.
   2. Injection crew and job foreman shall provide written and verifiable evidence showing compliance with the following requirements:
      a. Licensed and certified by epoxy manufacturer.
      b. Minimum 3 years' experience in successful epoxy injection for at least 10,000 linear feet of successful crack injection including 2,000 linear feet of wet crack injection to stop water leakage.
   3. CONTRACTOR shall retain the services of a qualified and authorized technical representative of the materials manufacturer to provide a site visit to specifically address the parameters of the repair and provide recommendations at the beginning of the installation and to make periodic visits to ensure that the work is performed in accordance with the manufacturer's recommendations and achieves the repair objectives.

1.3 SUBMITTALS

A. Product Data: Submit copies of manufacturer's specifications and installation instructions for all materials and accessories including:
   1. Manufacturer's recommended surface preparation procedures and application instruction for epoxy adhesives.
   2. Installation instructions for repairing core holes with epoxy grout.
   3. Manufacturer's Certificate of Compliance: Certified test results for each batch of epoxy adhesive.
   4. Statements of Qualification for Epoxy Adhesive:
      a. Manufacturer's site representative.
      b. Injection applicator.
      c. Injection pump operating technician.
   5. Epoxy adhesive two component ratio and injection pressure test records for concrete crack repair work.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: Package adhesive material in new sealed containers and label with the following information:
   1. Manufacturer's name.
   2. Product name and lot number.
   3. Material Safety and Data Sheet, MSDS.
   4. Mix ratio by volume.

B. Store adhesive containers at ambient temperatures below 100°F and above 45°F. Condition adhesive before use as recommended by the manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Materials, equipment and accessories specified in this section shall be products of one of the following:
   1. Concresive Series, as manufactured by BASF Building Systems.
   2. Sikadur Series, as manufactured by Sika Corporation.
   3. Euco Series, as manufactured by Euclid Chemical Company.

2.2 EPOXY ADHESIVE

A. Epoxy adhesive grout shall be a 100% solids 2-part water insensitive low-viscosity epoxy resin system.

B. Epoxy shall be suitable for grouting both dry and damp cracks.

C. Adhesive Properties:

7-day, Tensile Strength, psi	ASTM D638	5,000 min.
Tensile Elongation @ Break, percent	ASTM D638	1.0% min.
Compressive Yield Strength, 7 days @ 73°F, psi	ASTM D695	8,000 min.
Compressive Modulus, psi	ASTM D695	$1.5x10^5$ min.
Heat Deflection Temperature, °F	ASTM D648	120 min.
Water Absorption @ 24 hours, percent	ASTM D570	1.0% max.
Bond Strength @ 2 days, psi	ASTM C882	1,000 min.
Bond Strength @ 14 days, psi	ASTM C882	1,500 min.

2.3 SURFACE SEAL

A. The surface seal material is that material used to confine the injection adhesive in the fissure during injection and cure.

B. The surface seal material shall have adequate strength to hold injection fittings firmly in place and to resist injection pressures adequately to prevent leakage during injection.

C. Capable of removal after injection adhesive has cured.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean cracks in accordance with epoxy adhesive manufacturer's instructions.

B. Surface adjacent to cracks or other areas of application shall be cleaned of dirt, dust, grease, oil, efflorescence or other foreign matter which may be detrimental to the integrity of the bond between the epoxy and the injection surface. Acids and corrosives used for cleaning shall not be permitted.

C. Entry ports shall be provided along the crack at intervals of not less than the thickness of the concrete at that location, unless otherwise specified by the adhesive manufacturer.

D. Unless the crack is in submerged concrete, remove any water that can be seen by visual inspection from the crack before the injection process, and remove water that appears during the injection process.

E. Do not inject cracks when the temperature of the concrete is below freezing and moisture conditions indicate the possibility of ice on the internal surfaces of the crack.

F. Do not inject adhesive if the temperature of the concrete is not within the range of application temperatures recommended by the manufacturer of the adhesive.

3.2 INSTALLATION

A. Sealing: Apply surface seal in accordance with manufacturer's instructions to designated crack face prior to injection. Seal surface of crack to prevent escape of injection epoxy.

B. Entry Ports:
   1. Establish openings for epoxy entry in surface seal along crack.
   2. Determine space between entry ports equal to thickness of concrete member to allow epoxy to penetrate the full thickness of the wall.
   3. Provide a means to prevent concrete dusts and fines from contaminating the crack or ports when drilling.
   4. Space entry ports closer together to allow adjustment of injection pressure to obtain minimum loss of epoxy to soil at locations where:
      a. Cracks extend entirely through wall.
      b. Backfill of walls on one side.
      c. Difficult to excavate behind wall to seal both crack surfaces.
      d. Core drill to verify epoxy depth where only one side of wall is exposed.

C. Epoxy Injection:
   1. Condition epoxy at a minimum of 70°F, or as recommended by the manufacturer.
   2. Start injection into each crack at lowest elevation entry port.
   3. Continue injection at first port until adhesive begins to flow out of port at next highest elevation.
   4. Plug first port and start injection at second port until adhesive flows from next port.
   5. Inject entire crack with same sequence.

D. Finishing:
   1. Cure epoxy adhesive after cracks have been completely filled to allow surface seal removal without draining or runback of epoxy material from cracks.
   2. Remove surface seal from cured injection adhesive.
   3. Finish crack face flush with adjacent concrete.
   4. Indentations or protrusions caused by placement of entry ports are not acceptable.
   5. Remove surface seal material and injection adhesive runs and spills from concrete surfaces.

E. Equipment:
   1. The equipment used to meter and mix the two injection adhesive components and inject the mixed adhesive into the crack shall be portable, positive displacement type pumps with interlock to provide positive ratio control of exact proportions of the two components at the nozzle. The pumps shall be electric or air powered and shall provide in-line metering and mixing.
   2. The injection equipment shall have automatic pressure control capable of discharging the mixed adhesive at any pre-set pressure up to 200 psi plus or minus 5 psi and shall be equipped with a manual pressure control override.
   3. The injection equipment shall have the capability of maintaining the volume ratio for the injection adhesive prescribed by the manufacturer of the adhesive within a tolerance of plus or minus 5 percent by volume at any discharge pressure up to 160 psi.
   4. Do not use batch mix pumps.

3.3 FIELD QUALITY CONTROL

A. Injection Pressure Test:
   1. The mixing head of the injection equipment shall be connected and the equipment run until clear uniformly mixed material flows into the purge pail. The Operator shall engage the equipment shut-off nozzle valve and subsequently bump the on-off switch while monitoring pressure on psi gauge until the pressure reaches 200 psi. Pressure gauge shall be monitored for one minute. If pressure is maintained between 190 – 200 psi, check valves shall be considered to be functioning properly and the injection may proceed. If pressure drops below 190 psi, CONTRACTOR shall be required to have new seals installed on the check valves and the equipment shall be subsequently retested.
   2. The pressure test shall be run for each injection unit at the beginning and after meal break of every shift that the unit is used in the work of crack repair.
   3. The adequacy and accuracy of the equipment shall be solely the responsibility of CONTRACTOR.

B. Metering Accuracy Ratio Test:
   1. The epoxy mixture ratio shall be monitored continuously while injecting by placing a strip of masking tape on the sides of the A & B reservoirs full height. After filling reservoirs, the A & B levels shall be marked and monitored while running injection machine into purge pail for a period of one minute at 160 psi discharge pressure.
   2. The ratio test shall be run for each injection unit at the beginning of every shift that the unit is used in the work of crack repair and when injection work has stopped for more than 1 hour.

C. Proof of Ratio and Pressure Test:

1. At all times during the course of the work CONTRACTOR shall keep complete and accurate records available to ENGINEER of the pressure and ratio tests specified above.
2. In addition, ENGINEER at any time without prior notification of CONTRACTOR, may request CONTRACTOR to conduct the tests specified above in the presence of ENGINEER.

D. Daily Log
   1. Maintain a written daily log for each day of injection work that includes:
      a. Ambient temperatures at the start and end of the workday and 4 hours after the end of the workday.
      b. Weather conditions, such as rain, snow, and wind, including changes during the shift.
      c. Crack cleaning methods, if any, including locations.
      d. Record of injection adhesive, including manufacturer, product and batch number, and amount used each day.
      e. Signature and printed name of person responsible for record keeping.

E. Core Testing
   1. Initial Cores:
      a. Obtain 4-inch diameter cores for the full crack depth taken from ENGINEER selected locations.
      b. Visual inspection for depth of penetration:
         1) Three cores from the first 100-feet and one core for each 100-feet thereafter.
         2) It is permitted to obtain 2-inch cores if they are only used to verify adhesive penetration.
      c. Splitting tensile strength per ASTM C496:
         1) One core for the first 100-feet and once core for each 75-feet thereafter.
      d. Mark each of the cores with a "T" for top or "B" for bottom for cores taken vertically, or "H" for cores taken horizontally.
      e. Mark the respective end of the core with the letters "IS" (injection side) to indicate the side from which the injection was performed.
   2. Test Requirements:
      a. Adhesive Penetration: Minimum of 90% of the crack shall be full of epoxy adhesive.
      b. Splitting tensile strength / Compression Test: Concrete failure before adhesive failure, or 6,500 psi with no failure of either concrete or adhesive.
   3. Acceptance Criteria:
      a. If initial cores pass the tests as specified, epoxy adhesive injection Work at the area represented by cores will be accepted.
      b. If adhesive penetration or bond strength are not acceptable, stop injection Work until the areas represented by the testing are accepted, and changes in procedures or materials for continued injection Work have been accepted. Reinject adhesive in the locations where injection has not been acceptable. If partial injection has blocked all access to the cracks on surfaces that can be reinjected, drill injection holes into the concrete to intersect the crack in their void areas.

F. Core Hole Repair:
   1. Fill core holes with epoxy grout as required by the Project Specifications. Finish surface shall blend with adjacent concrete.

+ + END OF SECTION + +

DIVISION 05

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SECTION 05051

ANCHORS, INSERTS, AND DOWELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes all post-installed anchors and inserts required to anchor parts of the Work to supporting concrete or masonry construction, and plaster. This Section also includes adhesives for anchoring reinforcing dowels into existing concrete.

1.2 REFERENCES

A. American Society for Testing and Materials
   1. ASTM A36, Standard Specification for Carbon Structural Steel.
   2. ASTM A320, Standard Specification for Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service.
   3. ASTM D746, Standard Test Method for Brittleness of Temperature of Plastics and Elastomers by Impact
   4. ASTM D1505, Standard Test Method for Density of Plastics by the Density-Gradient Technique
   5. ASTM D1525, Standard Test Method for Vicat Softening Temperature of Plastics

B. 2018 International Building Code (IBC)

C. American Concrete Institute (ACI)
   1. ACI 355.2, Qualification of Post-Installed Mechanical Anchors in Concrete
   2. ACI 355.4, Qualification of Post-installed Adhesive Anchors in Concrete

1.3 SYSTEM DESCRIPTION

A. Provide the size, type, and length of anchor shown on the drawings or, if not shown, as specified in the detailed sections of these specifications.

B. When the size, length or load carrying capacity of an anchor bolt, expansion anchor, toggle bolt, or concrete insert is not shown or specified, provide the size, length and capacity required to carry the design load times a minimum safety factor of 4.

C. For equipment anchors, if the design load is not specified by the manufacturer, provide anchors of diameter no less than the diameter of the hole minus 3/16 inch. When the design load is not specified by the manufacturer, provide structural calculations in accordance with Section 01610.

1.4 SUBMITTALS

A. Product Data: Submit for approval copies of material certification, manufacturer's specifications, load tables, dimension diagrams and installation instructions for the devices.

B. Installer's Qualifications: When installing adhesive anchors subject to sustained tension loading or when specifically noted in the Drawings, submit for approval copies of the installer's qualifications certified by the ACI/CRSI Adhesive Anchor Installer Certification program.

1.5 QUALITY ASSURANCE

A. Post-installed concrete anchors shall be ICC approved for seismic applications in cracked concrete and prequalified in accordance with ACI 355.2 or ACI 355.4.

PART 2 - PRODUCTS

2.1 ANCHOR BOLTS

A. Nonsubmerged Use in areas of wet use, washdown areas, or areas outside heated buildings:
   1. Stainless steel Type 316, unless otherwise shown.
   2. Diameter, Length and Bend Dimensions: As required by equipment or machinery manufacturer. Unless otherwise required, provide 3/4–inch minimum diameter by 12-inches long and other geometry as shown.
   3. Furnish A320 nuts and washers of same material for each bolt, unless otherwise shown.
   4. Provide sleeves as required or as shown for location adjustment.

B. Submerged Use:
   1. Submerged use is defined as any connection 1 foot 6 inches below the normal water surface elevation in a water holding basin.
   2. As specified for nonsubmerged use, for equipment, machinery or other connections except as follows:
      a. Coating of anchor bolt threads is not required.
      b. Where threads are covered with fusion bonded coating, provide nut of proper size to fit and provide connection of equal strength to embedded bolt.

C. For anchoring fabricated metalwork, structural steel, or other components where connections will be protected or dry:
   1. Galvanized Steel, 36 ksi, minimum.
   2. Minimum Size: ¾-inch diameter by 12-inch long, unless otherwise shown.
   3. At base plates with grout pads, furnish two nuts and two washers per bolt of same material as bolt, unless otherwise shown.

2.2 ANCHOR BOLT SLEEVE

A. High Density Polyethylene Plastic:
   1. 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 blot projection.
   3. Material requirements shall conform to the following:
      a. Plastic: High density polyethylene.
      b. Density: 0.956, ASTM D1505.
      c. Vicant Softening Point: 256°F, ASTM D1525

d. Brittleness Temperature: -180°F, ASTM D746

B. Fabricated Steel Sleeve:
   1. Material: A36 steel.
   2. Dimensions, welding, and sizes as shown.

2.3 STAINLESS STEEL FASTENERS LUBRICANT (ANTISEIZING)

A. Provide for stainless steel nuts and machined bolts, anchor bolts, concrete anchors, and all other threaded fasteners.

B. Lubricant shall contain substantial amounts of molybdenum disulfide, graphite, mica, talc, or copper as manufactured by:
   1. Loc Tite Co., Permatex.
   2. Or equal

2.4 CONCRETE INSERTS

A. For vertical support of grating or floor plate, provide cast-in metal fabrications as shown.

B. Except as permitted below, or as otherwise shown, provide malleable iron inserts for hanging piping and conduit from concrete ceilings and soffits. Comply with Federal Specification WW-H-171-E (Type 18). Provide those recommended by the manufacturer for the required loading.

C. Obtain inserts in sufficient time so as not to delay concrete or masonry work.

D. Product and Manufacturer: Provide inserts of one of the following:
   1. Figure 282, as manufactured by Anvil/Grinnell.
   2. Sharktooth Insert, as manufactured by Hohmann and Barnard, Incorporated.
   3. Or equal.

2.5 ADHESIVE (EPOXY) ANCHORS AND DOWELS

A. Provide adhesive anchors where specifically shown and where adhesive anchors are allowed. Unless otherwise shown, adhesive anchors are allowed for anchoring:
   1. Supports for pipe, conduit, and electrical boxes, devices, and panels, on floors and walls
   2. Handrails, guardrails, sunshades, stairs,
   3. Fixtures and equipment on floors and walls, and
   4. Single pipes and conduits <2 inch in diameter to ceilings and soffits.

B. Adhesive shall be epoxy resin. Vinylester resin anchors are NOT allowed.

C. Product and Manufacturer: Provide one of the following:
   1. Installation to Concrete:
      a. HIT-HY 200 as manufactured by Hilti, Inc.
      b. SET-3G as manufactured by Simpson Strong-Tie, Inc.
      c. Or approved equal meeting ACI 355.4.
   2. Installation to solid-grouted Masonry:
      a. HIT-HY 270 as manufactured by Hilti, Inc.
      b. SET as manufactured by Simpson Strong-Tie, Inc.

c. Or approved equal.

2.6 EXPANSION ANCHORS

A. Provide expansion anchors only where specifically shown and where expansion anchors are allowed. Unless otherwise shown, and except as noted below, expansion anchors are allowed for anchoring:
   1. Supports for pipe, conduit, and electrical boxes, devices, and panels, to floors and walls.
   2. Handrails, guardrails, and sunshades.
   3. Fixtures and equipment which have no moving parts, to floors and walls.

B. Expansion anchors are NOT allowed in any submerged or chemical containment areas.

C. Leveling nuts shall not be used with expansion anchors. If leveling nuts are required, provide adhesive anchors, unless otherwise shown.

D. Wedge anchors: Provide one of the following:
   1. Installation to Concrete:
      a. Hilti Kwik Bolt TZ by Hilti, Inc.
      b. Strong-Bolt 2 by Simpson Strong-Tie, Inc.
      c. Or approved equal meeting ACI 355.2.
   2. Installation to solid-grouted Masonry:
      a. Hilti Kwik Bolt-3 by Hilti, Inc.
      b. Wedge-All by Simpson Strong-Tie, Inc.
      c. Or approved equal.

E. Drop-in anchors, only where specific shown on the drawings: Provide one of the following:
   1. HDI by Hilti, Inc.
   2. Drop-In by Simpson Strong-Tie, Inc.
   3. Or equal.

2.7 SCREW ANCHORS

A. Provide screw anchors only where specifically shown. Provide ICC approved screw anchors suited for seismic and cracked concrete applications.

B. Installation to Concrete or Masonry:
   1. KH-EZ by Hilti, Inc.
   2. Titen HD by Simpson Strong-Tie, Inc.
   3. Or approved equal.

2.8 TOGGLE BOLTS

A. Provide toggle bolts only where specifically shown, to fasten single pipes and conduits <1 inch and equipment weighing less than 50 lbs (4-bolts required) to hollow walls.

B. Provide spring-wing toggle bolts, with two-piece wings, carbon steel bolts with zinc coating in accordance with Federal Specification FF-S-325.

C. Product and Manufacturer: Provide toggle bolts of one of the following:

1. The Rawlplug Company, Incorporated.
2. Haydon Bolts, Incorporated.
3. Or equal.

2.9 OTHERS

A. Powder actuated fasteners and other types of anchors not specified herein shall not be used, unless approved by ENGINEER.

2.10 ACCESSORIES

A. Provide Belleville washers, or approved equal, at anchorage connections used to transfer anchorage loads at sheet metal equipment housings.

PART 3 - EXECUTION

3.1 INSTALLATION OF ANCHORS

A. Obtain anchor bolts in sufficient time so as not to delay concrete or masonry work.

B. Adhesives shall be stored and installed at the service temperature ranges recommended by the manufacturer.

C. Locate and accurately set the anchor bolts using templates or other devices as necessary.

D. Protect threads and shank from damage during installation of equipment and structural steel.

E. Post-installed anchors are NOT acceptable substitutes for cast-in-place anchor bolts.

F. Assure that embedded items are protected from damage and are not filled in with concrete.

G. Unless otherwise shown, the minimum diameter of anchor bolts for structural steel is ¾ inch, and for other applications, 3/8 inch.

H. Unless otherwise shown, provide the following minimum embedment, where "d" is the nominal anchor diameter:
   1. Cast-in-place anchors: 12d.
   2. Adhesive anchors: 12d.
   3. Expansion anchors: 8d.

I. Unless otherwise shown, provide a minimum edge distance equal to six times the bolt diameter for adhesive anchors, eight times the bolt diameter for expansion anchors and a bolt spacing equal to twelve times the bolt diameter.

J. Concrete shall have a minimum age of 21 days at the time of post-installed anchor installation.
   1. Concrete temperature at the time of adhesive anchor installation shall be at least 50°F.

K. Existing reinforcing bars in the concrete structure may conflict with specific anchor locations. Unless noted on the Drawings that the bars can be cut, the contractor shall review the existing structural drawings and shall undertake to locate the position of the reinforcing bars at the locations of the concrete anchors by ferroscan, ground penetrating rebar (GPR), x-ray, chipping or other means.

L. Drilling equipment used and installation of post-installed anchors shall be in accordance with the manufacturer's printed instructions.

M. For the adhesive and expansion anchors, CONTRACTOR shall comply with the manufacturer's printed installation instructions on the drilled hole diameter and depth.

N. CONTRACTOR shall properly clean out the hole utilizing a wire brush and compressed air in accordance with the manufacturer's printed installation instructions to remove all loose material from the hole, prior to installing adhesive or expansion anchors. Drilled and cleaned anchor holes shall be protected from contamination until the anchor is installed. A drilled anchor hole shall be re-cleaned assuming the hole was just drilled, if in the opinion of ENGINEER or Inspector that the hole has become contaminated after initial cleaning.

O. Unless otherwise indicated by the manufacturer, adhesive shall be dispensed through a tube or cartridge extension, beginning at the maximum depth of the hole and withdrawn as adhesive is injected, followed by insertion and rotating the anchor to the specified depth. Where necessary, spaces around anchors at the surface shall be sealed at horizontal to vertically overhead locations to prevent loss of the adhesive during curing.

P. Anchors to be installed in the adhesive shall be clean, oil-free, and free of loose rust, paint, or other coatings.

Q. Installed anchors shall be securely fixed in-place to prevent displacement. Unless shown otherwise on the Drawings, anchors shall be installed perpendicular to the concrete surface.

R. Reinforcing adhesive dowel bars or all-threaded adhesive bars shall not be bent after being adhesively embedded in hardened, sound concrete.

S. In lieu of the use of stacked standard washers, if threads of an anchor bolt protrude beyond the attachment, the installers shall use a fabricated filler plate of equal or greater size of the washer. Hole on the filler plate shall be 1/16" (or 2 to 3 mm) greater than the bolt size. Coat as appropriate in accordance with the material and installation location requirements.

3.2 FIELD QUALITY CONTROL

A. Anchors shall be installed by qualified personnel in accordance with the manufacturer's printed installation instructions. Installation of adhesive anchors shall be performed by personnel trained to install adhesive anchors.

B. Installation of adhesive anchors horizontally or upwardly inclined to support sustained tension loads shall be performed by personnel certified by the ACI/CRSI Adhesive Anchor Installer Certification program.

C. CONTRACTOR shall employ a special inspector to perform field inspection services in accordance with Chapter 17 of the IBC for all post-installed anchors.
   1. The special inspector must be periodically on the jobsite during post-installed anchor installation.
   2. Adhesive anchors installed to resist sustained tension loads shall be continuously inspected during installation by an inspector specially approved for that purpose by the building official.

D. CONTRACTOR shall employ a testing laboratory to perform field quality testing of installed adhesive anchors. A minimum of 10% of randomly selected adhesive anchors and reinforcing dowel bars greater than 3/8 inch diameter are to be tension tested to the least of 50 percent of expected adhesive ultimate bond strength or 80 percent of steel yield strength of the anchor rod. Maintain the proof load at the required load level for a minimum of 10 seconds.
   1. Tension testing shall be performed in accordance with ASTM E488.
   2. The independent testing laboratory shall submit an anchorage testing plan for approval to ensure the testing requirements are fulfilled.
   3. If failure of more than 5 percent of the tested anchors or reinforcing dowel bars occurs, CONTRACTOR will be required to pay for the costs involved in testing the remaining 90%.
      a. Concrete cracking in the vicinity of the anchor after loading shall be considered a failure.

E. CONTRACTOR shall correct improper workmanship, remove and replace, or correct as instructed by the ENGINEER, all anchors or bars found unacceptable or deficient, at no additional cost to the OWNER.

F. The independent testing and inspection agency shall complete a report on each area. The report should summarize the observations made by the inspector and be submitted to ENGINEER.

G. Provide access for the testing agency to places where Work is being produced so that required inspection and testing can be accomplished.

+ + END OF SECTION + +

SECTION 05500

MISCELLANEOUS METALS

PART 1 - GENERAL

1.1 SUMMARY

A. Work necessary to furnish and install, complete, fabricated metalwork and castings as shown or as required to secure various parts together and provide a complete installation.

1.2 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings for the fabrication and erection of the miscellaneous metal Work. Include plans, elevations and details of sections and connections. Clearly show all field connections. Show anchorage and accessory items.

B. Product Data: Submit copies of manufacturer's specifications, load tables, dimensions, diagrams, anchor details, and installation instructions for manufactured products.

C. Samples: Submit representative samples of manufactured products.

1.3 QUALITY ASSURANCE

A. Field Measurements: Take field measurements prior to preparation of Shop Drawings and fabrication to ensure proper fitting of the Work.

B. Shop Assembly: Preassemble items in the shop to the greatest extent possible, so as to minimize field splicing and assembly of units at the project site. Disassemble units to the extent necessary for shipping limitations. Clearly mark units for reassembly and coordinated installation.

C. Qualifications: Qualify welding operators in accordance with requirements of current AWS Standard Performance Qualification Procedures in the applicable structural welding code.
   1. Qualification Tests: Performed by a recognized testing laboratory.

D. Certification: Certify welders of structural and reinforcing steel for all positions of welding in accordance with such procedure.

PART 2 - PRODUCTS

2.1 GENERAL

A. Like Items of Materials: Provide end products of one manufacturer in order to achieve standardization for appearance, operation, maintenance, replacement, and manufacturer’s service.

B. Lifting Lugs: Provide on equipment and equipment components weighing over 100 pounds.

C. Furnish miscellaneous items:
   1. Miscellaneous metalwork and castings as shown, or as required to secure various parts together and provide a complete installation.
   2. Items specified herein are not intended to be all-inclusive. Provide metalwork and castings shown, specified, or which can reasonably be inferred as necessary to complete the project.

2.2 MATERIALS

A. Carbon steel structural shapes:
   1. Wide flange sections: ASTM A992 Grade 50.
   2. Steel pipe columns: ASTM A53 Grade B.
   3. Hollow Structural Sections (HSS): ASTM A500 Grade B.
   4. Plates, Angles, Channels, and S Shapes: ASTM A36.

B. Stainless Steel:
   1. Plates and Sheets: ASTM A240, Type 304L or 316
   2. Structural shapes: ASTM A276, A479 or A1069, Type 304L or 316.
   3. Fasteners and fittings: ASTM A320, Type 316
      a. Where stainless steel bolts are in contact with dissimilar metals provide insulating sleeves and phenolic washers to electrically isolate the bolts and nuts.

C. Aluminum, Structural Shapes and Plates: Alloy 6061-T6, meeting Aluminum Assoc. Specification for Aluminum Structures

D. Cast Iron: A48, Class 30

E. Light Gauge Steel Framing:
   1. Manufactured by SSMA ICC ESR-3064P, or equivalent, to meet the requirements of AISI S100.
   2. ASTM A570 or A446 with a minimum yield strength of 33 ksi for 18 gauge and 20 gauge, 50 ksi for 14 gauge and 16 gauge.
   3. Framing members shall have the section properties as listed on the Drawings.

F. High-Strength Threaded Fasteners: Heavy hexagonal structural bolts, heavy hexagon nuts, and hardened washers, as follows:
   1. Quenched and tempered medium carbon steel bolts, nuts and washers, complying with ASTM A325 or:
   2. Quenched and tempered alloy steel bolts, nuts and washers, complying with ASTM A490.
   3. Provide two ASTM F436 washers for all bolts.
   4. Provide beveled washers at connections of sloped/tapered sections.
   5. Unless noted otherwise, high-strength fasteners shall be used for all non-stainless steel fasteners.

G. Cast-in-Place Anchor Rods:
   1. ASTM F1554, Grade 36 with weldability supplement S1, galvanized, unless shown otherwise.
   2. Provide ASTM F436 washers at all nuts unless shown otherwise.
   3. Provide anchor bolt sleeves as required or as shown for location adjustment.
   4. Provide stainless steel anchors where shown on the Drawings or listed in another specific specification section.

H. Galvanizing:
   1. Zinc coated hardware: ASTM A153.
   2. Fabrications: ASTM A123.
   3. Members designated as galvanized on the drawings or as directed by ENGINEER shall be galvanized after fabrication in accordance with ASTM A385. Weight of zinc coating shall not be less than 2.5 ounces per square foot of actual surface and have a coating thickness of 0.0042 inch. Coating weight will be subject to verification by ENGINEER. Thickness of coating will be measured by means of a magnetic thickness gauge.
   4. Each fabricated assembly shall be totally immersed in the galvanizing bath. The galvanizing procedure shall be such as to avoid distortion of the assembly. Straightening of members after galvanizing will not be permitted. Assemblies shall be held in the galvanizing bath until the temperature of the assembly is equal to the temperature of the bath. All deviations shall require approval by ENGINEER.
   5. Any galvanized surface which has the coating removed for any cause shall be touched up with a zinc-rich cold galvanizing compound so that the entire surface has a uniform coating of 2.5 ounces of zinc per square foot.
   6. Galvanized work shall be subject to inspection by ENGINEER at any time to ensure strict compliance with this specification. Any areas found to show defects or signs of improper galvanizing application will be rejected. Repairs shall be made by CONTRACTOR without additional cost to OWNER.

I. Surface preparation and Finish:
   1. Steel: Where not indicated to be galvanized, steel shall be primed in the shop. Comply with Section 09900, Painting.

2.3 ALUMINUM STAIR TREAD

A. Extruded bearing bars positioned and locked by cross bars. Treads shall be manufactured with a defined visible abrasive nosing and end plates capable of welding or bolting to stair stringers.

B. Material:
   1. All supports, cross members, etc. shall be aluminum
   2. Bearing bars: Alloy 6061-T6 or Alloy 6063-T6, conforming to ASTM B221.
   3. Fasteners and fittings: ASTM A320, Type 316
      a. Where stainless steel bolts are in contact with dissimilar metals provide insulating sleeves and phenolic washers to electrically isolate the bolts and nuts.

C. Manufacturer:
   1. Grating Pacific.
   2. Borden Metal Products.
   3. Ohio Grating.

2.4 ANCHOR BOLT SLEEVE

A. High Density Polyethylene Plastic:
   1. 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 blot projection.
   3. Material requirements shall conform to the following:
      a. Plastic: High density polyethylene.

b. Density: 0.956, ASTM D1505.
c. Vicant Softening Point: 256°F, ASTM D1525
d. Brittleness Temperature: -180°F, ASTM D746

B. Fabricated Steel Sleeve:
1. Material: A36 steel.
2. Dimensions, welding, and sizes as shown.

2.5 FABRICATIONS

A. Miscellaneous Framings and Supports:
1. Fabricate units to the sizes, shapes, and profiles shown, or if not shown, of the required dimensions to receive the adjacent gratings, plates, tanks, doors, or other work to be retained by the framing.
2. Except as otherwise shown, fabricate from structural shapes, plates, and bars of compatible material, all-welded construction, using mitered corners, welded brackets and splice plates, and a minimum number of joints for field connection. Cut, drill, and tap units to receive hardware and other items to be anchored to the work.
3. Equip units with integrally welded anchors for casting into concrete or integrating into masonry. Furnish inserts for casting in, if units must be installed after concrete or grout is placed. Anchor spacing shall be 24" on-center, unless otherwise shown.
4. Galvanize where shown.

B. Miscellaneous Fabricated Metals:
1. The following additional items are listed as a guide. Some items on list may not be required, and list may not be all-inclusive. Submittal data for materials and products must be approved before they are incorporated in the work.
a. Access Walkway
b. Aluminum Stairways.
c. Float Switch Supports
d. Lifting Eyes.
e. Pipe Supports.
f. Steel Bases and Anchors.
g. Weir Plates.

C. Stainless Steel Fabrication: Following welding fabrication all stainless steel assemblies shall be cleaned, descaled and passivated in accordance with ASTM A380.

D. Anchors, Fasteners, and Fittings: Provide zinc-coated carbon steel for steel fabrications, and stainless steel for aluminum and stainless steel fabrications, unless shown otherwise.

E. Pipe Sleeves
1. Provide as follows:
a. Hot-dip galvanized, Schedule 40 steel pipe sleeves where shown for piping passing through concrete or masonry.
b. Holes drilled with rotary drill may be provided in lieu of sleeves in existing walls.
c. Provide a center flange for water stoppage on sleeves in exterior or water-bearing walls.
d. Provide a rubber caulking sealant or a modular mechanical unit to form a watertight seal in the annular space between pipes and sleeves.

PART 3 - EXECUTION

3.1 FABRICATION

A. General:
   1. Exposed Surfaces Finish: Smooth, sharp, well-defined lines.
   2. Provide necessary rabbets, lugs, and brackets so work can be assembled in neat, substantial manner.
   3. Conceal fastenings where practical.
   4. Drill metalwork and countersink holes as required for attaching hardware or other materials.
   5. Fabricate materials as specified.
   6. Weld connections, except where bolting is directed.
   7. Methods of fabrication not otherwise specified or shown shall be adequate for stress and as approved.
   8. Grind exposed edges of welds smooth on walkways, guardrails, handrails, stairways, channel door frames, steel column bases and where shown.
   9. Round sharp edges to 1/8-inch minimum radius. Grind burrs, jagged edges, and surface defects smooth.

B. Aluminum:
   1. Fabricate as shown, and in accordance with the Aluminum Association Standards and manufacturer's recommendations as approved.
   2. Grind smooth sheared edges exposed in finished work.

3.2 WELDING

A. General
   1. Meet codes for Arc and Gas Welding in Building Construction of the AWS and AISC for techniques of welding employed, appearance, quality of welds made, and the methods of correcting defective work.
   2. Welding Surfaces: Free from loose scale, rust, grease, paint, and other foreign material, except mill scale which will withstand vigorous wire brushing may remain.
   3. A light film of linseed oil may likewise be disregarded.
   4. Do not weld when temperature of base metal is lower than zero degrees F.
   5. Finished members shall be true to line and free from twists.
   6. Prepare welds and adjacent areas such that there is:
      a. No undercutting or reverse ridges on the weld bead.
      b. No weld spatter on or adjacent to the weld or any other area to be painted.
      c. No sharp peaks or ridges along the weld bead.
   7. Grind embedded pieces of electrode or wire flush with adjacent surface of weld bead.

B. Welding Operators: As specified in PART 1, Article 1.3 QUALITY ASSURANCE.

3.3 INSTALLATION

A. Set units accurately in location, alignment, and elevation, level, plumb, true, and square, measured from established lines and levels. Brace or anchor temporarily in formwork where units are to be built into concrete, masonry, or similar construction.

B. Anchor securely as shown or as required for the intended use, using concealed anchors wherever possible.

C. Fit exposed edges accurately together to form tight, hairline joints. Do not weld, cut, or abrade the surfaces of galvanized or anodized units which are intended for bolted or screwed connections.

D. Field Welding: Where field welding is necessary, grind joints smooth and touch-up the shop paint. Comply with the applicable provisions of AWS D1.1 for the procedures of manual shielded metal-arc welding, the appearance and quality of welds made, and the methods used in correcting welding.

E. Field Coat all miscellaneous ferrous and steel metals per Specification Section 09900 - Painting, System 300.

F. Where aluminum is in contact with dissimilar metals, or embedded in masonry or concrete, protect surfaces as specified in Section 09900 - Painting, System 305.

+ + END OF SECTION + +

DIVISION 08

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SECTION 08200

METAL SECTIONAL OVERHEAD DOORS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope: Provide and install interior face-mounted, insulated overhead sectional steel service door assemblies, completely weather sealed and provided with all necessary accessories and components for a complete installation.

1.2 SUBMITTALS

A. Product Data:
   1. Manufacturer's data sheets on each product to be used, including:
      a. Preparation instructions and recommendations.
      b. Storage and handling requirements and recommendations.
      c. Installation methods.

B. Shop Drawings: Indicate plans and elevations including opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.

C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

D. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

E. Quality Control:
   1. Installer's factory authorization.
   2. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.3 QUALITY ASSURANCE

A. Qualifications: Experienced, factory authorized installer.

1.4 DELIVERY, STORAGE AND HANDLING

A. Store products in manufacturer's unopened labeled packaging until ready for installation.

B. Protect materials from exposure to moisture until ready for installation.

C. Store materials in a dry, ventilated weathertight location.

1.5 DESIGN/PERFORMANCE REQUIREMENTS

A. Wind Loads: Design and size components to withstand loads caused by pressure and suction of wind acting normal to plane of wall as calculated in accordance with applicable code.

1. Design pressure of 20 lb/sq ft.

B. Single-Source Responsibility: Provide doors, tracks, motors (where required), and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.

PART 2 - PRODUCTS

2.1 METAL COILING OVERHEAD DOOR

A. Features:
   1. Door Assembly: Metal/foam/metal sandwich panel construction, with EPDM thermal break and ship-lap design.
      a. Panel Thickness: 2 inches (5 mm).
      b. Exterior Surface: Ribbed, textured.
      c. Exterior Steel: .015 inch (4 mm), hot-dipped galvanized.
      d. End Stiles: 16 gauge with thermal break.
      e. Standard Springs: 10,000 cycles. (High cycles.)
      f. Insulation: CFC-free and HCFC-free polyurethane, fully encapsulated.
      g. Thermal Values: R-value of 17.50; U-value of 0.057.
      h. Air Infiltration: 0.08 cfm at 15 mph; 0.08 cfm at 25 mph.
      i. High-Usage Package: Provide with optional high-usage package.
   2. Finish and Color: Two coat baked-on polyester
      a. Interior: By OWNER
      b. Exterior: By OWNER
   3. Windload Design: ANSI/DASMA 102 standards to meet applicable code.
   4. Hardware: Galvanized steel hinges and fixtures. Ball bearing rollers with hardened steel races.
   5. Lock:
      a. Interior mounted slide lock.
   6. Weatherstripping: EPDM rubber bulb-type strip at bottom. (Header seal and jamb weatherstripping.)
      a. EPDM rubber bulb-type strip at bottom.
      b. Flexible Jamb seals.
      c. Flexible Header seal.
   7. Track: Provide track as recommended by manufacturer to suit loading required and clearances available.
   8. Manual Operation: Chain hoist.

B. Manufacturers and Products:
   1. Overhead Door Corp.; 591 Series Thermacore Insulated Steel Door.
   2. Or equal.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine the substrates and conditions under which the Work 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 any unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

A. Install overhead doors and track in accordance with approved shop drawings and the manufacturer's printed instructions.

B. Coordinate installation with adjacent work to ensure proper clearances and allow for maintenance.

C. Anchor assembly to wall construction and building framing without distortion or stress.

D. Securely brace door tracks suspended from structure. Secure tracks to structural members only.

E. Fit and align door assembly including hardware.

F. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.

3.3 TESTING AND ADJUSTING

A. Upon completion of installation including the work by other trades, test and adjust doors to operate easily, free from warp, twist or distortion.

B. Test the door in presence of ENGINEER to demonstrate proper operation.

3.4 ADJUSTING AND CLEANING

A. Adjust doors and operators for smooth, easy operation.

B. Repair any damage to paint or finishes.

C. Leave door assemblies clean and remove all debris from work area.

+ + END OF SECTION + +

SECTION 08305

ACCESS HATCHES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope: Provide all materials, equipment, and accessories to furnish and install the following access hatches:
   1. Flush floor hatches for all structures.

1.2 QUALITY ASSURANCE

A. Warranty: Provide a 2-yrs warranty on all hatches from date of installation. Warranty shall cover defects in workmanship, design, and materials. If any component should fail during the warranty period, it shall be corrected and the unit restored to service at no expense to the OWNER.

1.3 DESIGN REQUIREMENTS

A. In Rights-of-way, service roads, and driveways, and where designated on the drawings, hatches shall be designed for H20 wheel loading.

B. In other locations and where designated as "Standard" hatches shall be designed for a live load of 300 pounds per square foot.

1.4 SUBMITTALS

A. Shop Drawings:
   1. Detailed drawings showing component and assembly dimensions, location of connections, weights of all equipment, installation details, and accessory details.

B. Product Data:
   1. Descriptive literature, specifications, and engineering data.
   2. Materials of construction for all components and accessories.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. All equipment and accessories shall be properly protected during shipment such that no damage or deterioration shall occur between shipment and installation.
   1. Finished surfaces shall be protected by wooden blanks.
   2. Finished ferrous metal surfaces not painted shall be protected from corrosion.
   3. Each box and package shall be clearly marked with the contents and total weight.

B. Manufacturer shall provide any special storage and handling instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. General: Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.
   1. Aluminum hatches:
      a. USF
      b. Or Approved Equal.

2.2 MATERIALS

A. Unless otherwise noted, all access hatches shall be constructed of aluminum.

B. Aluminum hatches shall be provided with aluminum frames and stainless-steel hardware.

2.3 FLUSH FLOOR HATCHES

A. General
   1. Doors shall be pre-assembled from the manufacturer.
   2. Covers shall open 90 to 180 degrees and be equipped with a hold open arm which automatically locks the cover in the open position with recessed padlock/HASP assembly.
   3. Covers shall be fitted with the required number and size of compression spring or torsion operators. Springs shall have an electrocoated acrylic finish. Spring tubes shall be constructed of a reinforced nylon 6/6-based engineered composite material.
   4. Hardware:
      a. Hinges shall pivot so that the cover does not protrude into the channel frame.
      b. A Type 316 stainless steel snap lock with fixed handle shall be mounted to the underside of the cover.
   5. Entire door and all hardware components shall be highly corrosion resistant.
   6. Doors shall be sealed with an EPDM gasket for odor control purposes.
   7. Doors shall all drain into the below structure.
   8. Doors shall be 300 PSF rated unless otherwise specified.

B. **H-100**: Single leaf flush floor hatch for walking areas (up to 42-inch by 42-inch)
   1. Furnish and install where indicated on drawings flush floor access hatch. The hatch shall be single leaf.
   2. Service: Floor hatch for use in areas of foot traffic.
   3. Features:
      a. Material:
         1) Cover: ¼-in aluminum diamond pattern plate or ¼-in steel diamond pattern plate
         2) Frame: ¼-in extruded aluminum or ¼-in steel
      b. The cover shall be reinforced to support a minimum live load of 300 lb/ft^2 with a maximum deflection of 1/150th of the span.
      c. Integral safety grating (epoxy coated steel)
      d. Hinges:
         1) Aluminum cover: Provide heavy forged aluminum hinges with a minimum ¼-in diameter Type 316 stainless steel pin.
         2) Steel cover: Provide heavy forged brass hinges with a minimum 3/8-in diameter Type 316 stainless steel pin

C. **H-101**: Double leaf flush floor hatch for walking areas (over 42-inch by 42-inch)
   1. Furnish and install where indicated on drawings flush floor access hatch. The hatch shall be double leaf.
   2. Service: Floor hatch for use in areas of foot traffic.
   3. Features:
      a. Material:
         1) Cover: ¼-in aluminum diamond pattern plate or ¼-in steel diamond pattern plate
         2) Frame: ¼-in extruded aluminum or ¼-in steel
      b. The cover shall be reinforced to support a minimum live load of 300 lb/ft^2 with a maximum deflection of 1/150th of the span.
      c. Integral safety grating (epoxy coated steel)
      d. Hinges:
         1) Aluminum cover: Provide heavy forged aluminum hinges with a minimum ¼-in diameter Type 316 stainless steel pin.
         2) Steel cover: Provide heavy forged brass hinges with a minimum 3/8-in diameter Type 316 stainless steel pin

2.4 HATCH SCHEDULE

A. Hatches shall be installed based on the following schedule

B.

Hatch No.	H-101	H-100		
Location	Wetwells	Valve Vault	Flowmeter Vault	Influent Splitter Structure
Hatch Type	Double Leaf	Single Leaf	Single Leaf	Single Leaf
Dimensions	6′ x 4′	5′ x 5′	5′ x 5′	3′ x 4′
No. of Leaf Door	2	3	1	
Loading	300 lb/ft^2			
Fall Protection	Fall protection grating (aluminum).			
Drain	Trough frame with drain outlet			
Spring Assist	Compression spring operators for lift assist			
Slamlock	Yes			

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install in accordance with the manufacturer's recommendations and approved shop drawings. Install level and square with other construction, without warp or rack.

B. Unless otherwise shown, hatches shall be cast integrally with concrete decks, and shall not be grouted in later.

C. Coordinate precise location with equipment to be accessed thereby.

D. Aluminum surfaces shall be protected with two heavy coats of asphaltic or zinc chromate paint, where they are in contact with concrete or masonry.

+ + END OF SECTION + +

DIVISION 09

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SECTION 09875

CONCRETE COATINGS FOR WASTEWATER STRUCTURES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope: Provide and install coatings on all interior concrete surfaces, as indicated herein, in the Specifications and on the Drawings.

B. System shall be a multi-component resin-based mortar lining system specifically designed to protect the concrete surfaces of municipal wastewater structures from chemical attack. The main purpose of this membrane is to offer protection of the substrate from chemicals or gases that might cause deterioration.

1.2 QUALITY ASSURANCE

A. Experience: Both coatings manufacturer and coatings installer shall have a minimum 5 years' experience in production and application, respectively, of specified products. Coatings installer shall be approved and endorsed, in writing, by coatings manufacturer.

B. Regulations: Meet federal, state, and local requirements which apply to the work, including, but not limited to those regulations limiting the emission of volatile organic compounds.

C. Coatings Manufacturer Recommendations: Coatings installer shall follow all recommendations of the coatings manufacturer regarding storage, handling, surface preparation, application of coatings, re-coat times, environmental conditions during storage, preparation and application of coatings, and all other coatings manufacturer recommendations.

D. Warranty: Both Coatings Manufacturer and Coatings Installer shall provide a 2-years complete replacement warranty for all coatings. Manufacturer shall provide 5-year warranty for long-term performance of coatings in addition to 2-years warranty.

1.3 SUBMITTALS

A. Shop Drawings: Coatings Manufacturer shall submit for approval the following:
   1. Copies of manufacturer's technical information and application instructions for each material proposed for use. Specify exactly which product is being proposed for each coating type (as specified below). This may be accomplished through a reference table along with information on the various products, or by a separate, tabbed section with information on products being submitted for each system in a separate tab of a binder. Submittal of general manufacturer's literature without detailing which product is proposed for each paint system will be unacceptable.
   2. Letter from the Coatings Manufacturer certifying the Coatings Installer as factory trained and qualified.
   3. Furnish copies of the final, approved submittal to the coatings installer so that it is clear which product is to be used for which each system.

4. Test reports from an independent testing laboratory confirming chemical resistance of coating for chemicals common to municipal wastewater treatment facilities.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Protection: Protect all pre-coated items from coating damage during shipping.

B. Store products in accordance with manufacturer's directions.

C. Store products in a neat, orderly fashion. Protect products from damage. Protect storage area from damage from stored products.

PART 2 - PRODUCTS

2.1 PRODUCT AND MANUFACTURER:

A. Sauereisen SewerGard
   1. Sewer Shield 150
   2. Sewergard 210XHB
   3. Raven 405

B. Or approved equal.

2.2 SERVICE CONDITIONS AND PERFORMANCE

A. Provide a 100% solids, VOC-free resin based coating system specifically formulated for wastewater applications.
   1. The lining system shall be a non-sagging application permitting repair of vertical, horizontal, and overhead surfaces.
   2. The lining system shall provide an impermeable, high-strength, corrosion-resistant, monolithic lining for manholes, grit chambers, wetwells, wastewater channels, and related structures subject to attack from hydrogen sulfide and acid generated by microbiological sources.

B. The lining system, including underlayment, primer and surface materials, shall be from a single manufacturer.

C. Chemical Resistance (ASTM D 1308):
   a. Reagent: 6% sulfuric acid solution.
   b. Film Integrity: Unaffected.

D. Coating Thickness: 125 mils thick, minimum.

E. Texture: Semi-smooth for all surfaces.

2.3 PROPERTIES

A. Either trowel or spray application is acceptable provided the Installer follow all Manufacturer recommendations.

B. Physical Properties

1. Bond strength to dry or damp concrete: Failure in concrete per ASTM C4541
2. Compressive strength: >6,700 psi per ASTM C579
3. Flexural strength: >4,600 psi per ASTM C580
4. Tensile strength: >2,400 psi per ASTM C580
5. Moisture absorption: <0.2% per ASTM C413

PART 3 - EXECUTION

3.1 STORAGE, MIXING, AND THINNING OF MATERIALS

A. Manufacturer's Recommendations: Unless otherwise specified herein, the coating manufacturer's printed recommendations and instructions for thinning, mixing, handling, applying, and protecting its coating materials, for preparation of surfaces for coating, and for all other procedures relative to coating shall be strictly observed.

B. All protective coating materials shall be used within the manufacturer's recommended shelf life.

C. Storage: Coating materials shall be protected from exposure to inclement weather, and shall be thoroughly stirred, strained, and kept at a uniform consistency during application.

D. Mixing:
   1. Coatings of different manufacturers shall not be mixed together.
   2. Mixing of multi-component coating systems shall be performed in accordance with Manufacturer’s recommendations. Components must be mixed in complete batches only and used immediately.

3.2 INSPECTION

A. Contractor and his installer shall examine the areas and conditions under which concrete coatings are to be placed and notify Engineer, in writing, of any conditions which could be detrimental to the proper and timely installation of the Work. Do not proceed with the Work until any unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.

3.3 SURFACE PREPARATION

A. Surface preparation shall not begin until at least 7 days after new concrete has been placed. Chemical resistant coatings shall not be applied until at least 28 days after new concrete has been placed.

B. All oil, grease, and form release and curing compounds shall be removed by detergent cleaning in accordance with SSPC-SP1 before abrasive blast cleaning. Surface preparation shall be performed in accordance with the latest editions of the following standards:
   1. ASTM D-4258: Standard Practice for Surface Cleaning Concrete for Coating
   2. ASTM D-4259: Standard Practice for Abrading Concrete

C. Concrete surfaces and deteriorated concrete surfaces to be coated or lined shall be abrasive blast cleaned in accordance with SSPC SP13 to remove existing coatings,

laitance, deteriorated concrete, and to roughen the surface equivalent to the surface of the No. 60 grit flint sandpaper (surface profile of 2.5 to 4 mils).

1. Evaluation of blast cleaned surface preparation work will be based upon comparison of the blasted surfaces with the standard samples available from the NACE, using NACE Standard TM-01-70.
2. The air compressor must be equipped with efficient oil and water traps to ensure that the compressed air is clean and free of oil particles. Refer to NACE procedure for "Blotter Testing" of compressed air.

D. Concrete surfaces requiring repairs in excess of one-quarter inch (¼") depth shall be restored with underlayment, and brought flush with the surface, in accordance with the coating manufacturers' recommendations to provide a continuously smooth and even surface for application of top coat.

E. Surfaces shall be clean and as recommended by the coating manufacturer before coating or lining is started.

F. Unless required for proper adhesion, surfaces shall be dry prior to coating. The presence of moisture shall be determined with a moisture detection device such as Delmhorst Model DB, or equal.

G. All surfaces to be coated shall be completely dry, clean, and contaminant-free prior to application. For polyurethane lining system, after completing surface preparation, surface dryness shall be verified according to ASTM D4263. Any indication of moisture will require an appropriate corrective measure. The surface shall be re-tested after taking the corrective measure.

H. The concrete surface shall be notched to a depth equal to the total lining thickness with a power grinding tool on the perimeter of all lining termination points. The notch shall be clean and neat.

3.4 APPLICATION

A. Coatings shall be installed on all surfaces described in Paragraph 1.1.A of this Section, with the systems indicated.

B. Contractor shall give the Engineer a minimum of 3 days advance notice of the start of any field surface preparation work or coating application Work. All such Work shall be performed only in the presence of the Engineer.

C. All concrete surfaces shall be coated before installation of any equipment in the area to be protected, including chemical storage tanks, pumps, pipe supports and stands, etc.

D. Contractor shall supply all temporary heating, cooling or night-time work, if required, and provide protection from the sun, heat, or other environmental conditions which may adversely affect the coatings. Moisture content of concrete, air temperature, relative humidity, and all other conditions shall be within limits recommended by coatings manufacturers.

E. Contractor shall fill all "bug holes" and other defects in the concrete to which the chemical resistant coatings are applied prior to application of the chemical resistant coatings system in accordance with the recommendations of the coatings manufacturer

approved for use in each area. Filler shall be allowed to cure in accordance with manufacturers recommendation.

F. All surfaces receiving the polyurethane membrane lining shall be visually dry and at least 5°F (3°C.) above the Dew Point prior to starting the installation to prevent moisture entrapment. The Relative Humidity must be below 85%.

G. Contractor shall apply coating to prepared concrete surface. Contractor shall repeat coating application as recommended by manufacturer for complete coverage. Application and mixing shall be by the method recommended by the coatings manufacturer with the equipment recommended as the best for installing the coating system supplied. Apply the materials in the recommended quantities to provide the dimensional requirements and chemical resistance specified for the system. Successive topcoats shall be applied within 24 hours so as to not exceed the recoat window.

H. Contractor shall apply termination and expansion joint strips at the junction of the chemical resistant coating with other surfaces and at expansion joints as recommended by the coatings manufacturers.

I. Wet film thickness shall be monitored throughout the installation by means of frequent measurements with a high-range wet film thickness gage.

J. Whether spray or trowel application is used, the application shall be according to the principles of good workmanship outlined in SSPC-PA1-82 and shall provide a finish which is continuous, uniform in thickness, and verified free of pores or other defects using electrical discontinuity testing (high voltage spark testing).

3.5 CURING OF COATINGS

A. Contractor shall provide curing conditions in accordance with the conditions recommended by the coating material manufacturer or by this Section, whichever is the highest requirement, prior to placing the completed coating system into service.

B. In the case of enclosed hydraulic structures, forced air ventilation, using heated or cooled air if necessary, is required for the application and curing of coatings on the interior surfaces.
   1. During curing periods continuously exhaust air from the lowest level of the structure using portable ducting. After all interior coating operations have been completed provide a final curing period for a minimum of 10 days, unless a shorter period is recommended by the coating manufacturer, during which the forced ventilation system shall operate continuously.

3.6 FIELD TESTING

A. Inspection by the Engineer, or the waiver of inspection of any particular portion of the work, shall not relieve Contractor of its responsibility to perform the Work in accordance with this Specification.

B. Proper, safe access shall be provided in locations where requested by the Engineer to facilitate inspection. Additional illumination shall be furnished when the Engineer requests. Proper ventilation and atmospheric monitoring shall be provided as well as all

other safety equipment and precautions required by OSHA for a safe inspection in all areas.

C. The Engineer will conduct wet-film thickness testing. Contractor shall recoat any areas found deficient in thickness.

D. Holiday Testing:
   1. Engineer will visually inspect coverage for blisters, sags, and holidays. Contractor shall repair areas identified by this inspection prior to conducting holiday test.
   2. Contractor shall holiday test, in the presence of the Engineer, all coated surfaces which will be submerged in water or other liquids, or surfaces which are enclosed in a vapor space in such structures and surfaces coated with any of the submerged and severe service coating systems.
      a. Holiday testing equipment and procedures shall be done in strict accordance with the latest edition of the NACE "Standard Recommended Practice Discontinuity (Holiday) Testing of Protective Coatings."
      b. Areas that contain holidays shall be marked and repaired or recoated in accordance with the coating manufacturer's printed instructions and then retested.
   3. Holiday detectors shall be of the following type:
      a. High voltage pulse-type holiday detector such as Tinker & Rasor Model AP-W, D.E. Stearns Co. Model 14/20, or equal shall be used. The unit shall be adjusted to operate at a voltage of at least 110 volts/mil desired thickness.

E. Any damaged areas, faulty areas, or discontinuities (pinholes) found during quality control inspection shall be repaired in accordance with the Manufacturer's recommendations.

3.7 ADJUSTMENT AND CLEANING

A. At the completion of the Work, Contractor shall remove all material and debris associated with the Work of this Section.

B. At the completion of the Work, Contractor shall clean all surfaces to which coatings were applied, as well as all adjacent, uncoated surfaces in a manner acceptable to the Engineer.

C. Coatings shall be protected from damage until Final Acceptance of all Work in the area that was coated. Coatings damaged in any manner by Contractor prior to Final Acceptance of all Work in that area shall be repaired or replaced in a manner acceptable to the Engineer at no additional cost to the Owner.

D. Just prior to Final Acceptance of all Work in the area that was coated, Contractor shall clean all coatings, as recommended by the manufacturer, to provide a finished product acceptable to the Owner.

+ + END OF SECTION + +

SECTION 09900

PAINTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope: Provide and install coatings on all exposed surfaces as indicated herein, in other Specification Sections, and on the Drawings.

1.2 QUALITY ASSURANCE

A. Experience: Both Coatings Manufacturer and Coatings Installer shall have a minimum 5 years' experience in production and application, respectively, of specified products. Coatings Installer shall be approved and endorsed, in writing, by Coatings Manufacturer.

B. Regulations: Meet federal, state, and local requirements which apply to the work, including, but not limited to those regulations limiting the emission of volatile organic compounds.

C. Coatings Manufacturer Recommendations: Coatings Installer shall follow all recommendations of the Coatings Manufacturer regarding storage, handling, surface preparation, application of coatings, recoat times, environmental conditions during storage, preparation and application of coatings, and all other Coatings Manufacturer recommendations.

D. Warranty: Both Coatings Manufacturer and Coatings Installer shall provide a 2-years complete replacement warranty for all coatings. Manufacturer shall provide 5-year warranty for long-term performance of coatings in addition to 2-years warranty.

1.3 SUBMITTALS

A. Shop Drawings: Coatings Manufacturer shall submit for approval the following:
   1. Copies of Manufacturer's technical information and application instructions for each material proposed for use. Specify exactly which product is being proposed for each coating type (as specified below). This may be accomplished through a reference table along with information on the various products, or by a separate, tabbed section with information on products being submitted for each system in a separate tab of a binder. Submittal of general Manufacturer's literature without detailing which product is proposed for each paint system will be unacceptable.
   2. Copies of Manufacturer's complete color charts for each coating system.
   3. Letter from the Coatings Manufacturer approving and endorsing Coatings Installer.
   4. Letter from Coatings Manufacturer stating that volatile organic compounds (VOCs) meet all Federal, State and Local requirements.
   5. Furnish copies of the final, approved submittal to the Coatings Installer so that it is clear which product is to be used for which each system.

B. Reference Samples:
   1. Provide reference samples of paint colors and textures as required by the ENGINEER. Reference samples will show the color and texture of the final paint to be applied and

shall be approved by the ENGINEER prior to painting. Reference samples should be applied to similar substrates to the final surfaces to be painted. If ENGINEER chooses to forego reference samples, CONTRACTOR must receive the allowance to forego reference samples before painting begins or all painted surfaces will be re-painted at the ENGINEER's discretion and at no additional cost to the OWNER.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Protection: Protect all pre-coated items from coating damage during shipping.

B. Store products in accordance with Manufacturer's directions.

C. Store products in a neat, orderly fashion. Protect products from damage. Protect storage area from damage from stored products.

PART 2 - PRODUCTS

2.1 PRODUCT AND MANUFACTURER:

A. Provide coating types as listed in the following table. The systems referenced in the table are those provided by TNEMEC and Sherwin-Williams. If manufacturers other than TNEMEC or Sherwin Williams are desired, the CONTRACTOR shall submit equivalent paint systems.

COATING TYPE	DESCRIPTION	Sherwin Williams Series	TNEMEC SERIES
Clear Polyamine Epoxy	Clear Polyamine Epoxy, high solids, moisture resistant, designed as a one-coat wood sealer.	GP3477	Series 201, Epoxoprime
Acrylic Filler	Waterborne Cementitious Acrylic designed for application on porous surfaces such as rough-faced concrete masonry units	CementPlex 875	Series 130, Envirofill
Interior Acrylic Latex	Single component, finish as required	ProMar 200	N/A
Industrial Acrylic	Single component, high density acrylic finish for interior, exterior surfaces	Pro Industrial High Performance Acrylic	Series 1029
Interior Latex Primer/ Sealer	Waterborne vinyl acrylic primer/sealer for interior gypsum wallboard/plaster. Capable of providing uniform seal and suitable for use with specified finish coats.	ProMar 200 Primer	Series 115
Exterior Acrylic Latex Primer/Sealer	Capable of providing uniform seal and suitable for use with specified finish coats.	Extreme Bond Latex Primer	Series 1028
Polyamine Epoxy	Waterborne Polyamine Epoxy,	Multi-	Series 151,

Sealer	penetrating, flexible and low-odor primer designed for sealing porous substrates.	Purpose Acrylic Primer	Elasto-Grip FC
Acrylate	Modified Waterborne Acrylate designed for application on porous surfaces such as rough-faced concrete masonry units or wood surfaces. Flexible and breathable, moisture and UV resistant. Matte Finish	Loxon XP	Series 156, Enviro-crete
Polyamidoamine Epoxy	Polyamidoamine Epoxy designed for use on steel or other ferrous metals not in contact with potable water but submerged or immersed in wastewater or non-potable water.	Sher-glass FF	Series N69, V69 or L69 (type per local VOC regulations), Hi-Build Epoxoline II
	Polyamidoamine Epoxy designed for use on steel or other ferrous metals in contact with potable water.	Macropoxy 5500	Series N140, L140 or V140 (type per local VOC regulations), Pota-Pox Plus
Polyurethane	Aliphatic Acrylic Polyurethane designed for exterior weathering, abrasion and corrosion resistance	HS Polyurethane 250 or Waterbased Acrolon	Series 1095, Endura-Shield
Silane Water Repellent Sealant	Silane/Siloxane penetrating water repellent blend designed for application on above-grade concrete, stucco, block, masonry and stone surfaces	Loxon 7% Siloxane	Series 636, Dur A Pell 20
Wood Sealer / Stain	Single component, 250 g/l wood stain in clear or standard colors	Minwax 250	
Wood Varnish Finish	Single component polyurethane varnish	Minwax	

B. All coatings used shall comply with Federal, State and local VOC limits based on application location.

2.2 COLOR

A. Color Pigments: Pure, nonfading, lead-free applicable types to suit the substrates and service indicated.

B. Provide colors as described in the drawings or specifications, or as selected by ENGINEER from standard color palette. For piping system colors, reference pipe schedule.

C. Where existing colors are to be matched or satisfactory color is not available from standard color palette, provide custom-mixed colors.

D. Provide samples of each color on the substrate to be coated for approval by the ENGINEER prior to beginning coating application.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. Coatings Installer shall prepare all surfaces to be painted in strict accordance with Coatings Manufacturer's recommendations.

B. Coatings Manufacturer representative shall observe Coatings Installer's methods of preparing surfaces and approve of the work prior to Coatings Installer beginning coating installation. If, after a period of time, Coatings Manufacturer is satisfied with Coatings Installers methods, Coatings Manufacturer can allow Coatings Installer to proceed without inspection following surface preparation. Coatings Manufacturer and installer will still both be held equally accountable for any coatings failure.

C. Wood surface preparation
   1. Coatings Installer shall clean and prepare all wood surfaces in accordance with the Coating Manufacturer's recommendations. Patching may be required where approved by the Engineer. All joints in wood members including trim, siding, soffits, and joints between wood and dissimilar materials shall be filled with joint sealant prior to coating.

3.2 PROTECTION

A. Protect all adjacent surfaces from overspray, dripping or other transfer of coatings not intended for those surfaces. Use masking, tape, drop cloths, plastic and other protective materials as appropriate.
   1. Remove, mask, or otherwise protect hardware, lighting fixtures, switchplates, aluminum surfaces, stainless steel surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not intended to be painted.
   2. Protect working parts of mechanical and electrical equipment from damage during surface preparation and painting process. Mask openings in motors, fan housings, etc. to prevent coatings from falling inside.
   3. Correct all damages by cleaning, repairing or replacing, and repainting, as acceptable to ENGINEER.

B. Completely remove all masking, tape, drop cloths, plastic and other protective materials within 48 hours of completion of application of finish coat. Take special care to remove masking and plastic which cover tank vent openings, HVAC registers, vents, motor vents, and other areas where airflow is critical to proper operation.

3.3 APPLICATION

A. Paint all exposed surfaces not specifically excluded in 3.3.C, below. Provide and install Coatings in accordance with the following Table, unless otherwise specified in other Sections:

COATING SYSTEM NO.	SURFACE TO BE COATED	PRIMER COATING	NO OF PRIMER COATS	PRIME COAT THICKNESS (EACH COAT)	FINISH COATING	NO OF FINISH COATS	FINISH COAT THICKNESS (EACH COAT)
100	Concrete Masonry Units (Interior)	Acrylic Filler	1	70 SF/Gal Application Rate	Acrylate	2	135 SF/Gal Application Rate

COATING SYSTEM NO.	SURFACE TO BE COATED	PRIMER COATING	NO OF PRIMER COATS	PRIME COAT THICKNESS (EACH COAT)	FINISH COATING	NO OF FINISH COATS	FINISH COAT THICKNESS (EACH COAT)
101	Concrete Masonry Units (Exterior)	Silane Waterproofing Sealant	1	250 SF / Gal Application Rate	None		
102	Concrete Roof Slab (Exterior)	Silane Waterproofing Sealant	1	250 SF/Gal Application Rate	None		
200	Wood (Interior and Exterior)	Polyamine Epoxy	1	250 SF/Gal Application Rate	Acrylate	2	135 SF/Gal Application Rate
201	Wood (Interior, where noted)	Wood Sealer	1	250 SF/Gal Application Rate	Wood Finish	1	350 SF/Gal Application Rate
202	Gypsum Board (Interior)	Interior Latex Primer/Sealer	1	350 SF/Gal Application Rate	Interior Acrylic Latex (Semigloss)	2	400 SF/Gal Application Rate
300	Exposed Ferrous Pipe Systems and Exposed Steel Items	Polyamidoamine Epoxy	2	4-6 MDFT	Polyurethane	2	2-3 MDFT
301	Exposed, Non-metallic Pipe Systems	Exterior Latex Primer/Sealer	1	3-5 MDFT	Industrial Acrylic (Semigloss)	2	3-5 MDFT
302	Immersed Ferrous Pipe Systems and Steel Items	Polyamidoamine Epoxy*	1	6-10 MDFT	Polyamidoamine Epoxy*	1	6-10 MDFT
303	Immersed Non-metallic Pipe Systems	Exterior Latex Primer/Sealer*	1	4-6 MDFT	Industrial Acrylic Acrylic Latex (Semigloss)*	1	4-6 MDFT
304	Buried Ferrous and Steel Items	Polyamidoamine Epoxy	1	8-10 MDFT	Polyamidoamine Epoxy	1	8-10 MDFT
305	Aluminum Surfaces in Contact with Concrete	Polyamidoamine Epoxy	1	4-6 MDFT	None		
	Steel Tank	Per 09871, Coating of Steel Water Storage Tank					
	Pumps	Touch up factory applied coatings, per Pump Specifications					

* Where in contact with potable water, coating shall be NSF-61 certified.

B. Items Delivered with Factory Applied Primer:
   1. For items delivered with a factory applied primer and requiring painting under this Section, the factory applied primer may be used in lieu of field applied primer only under the following conditions:
      a. The ENGINEER approves the use of the factory applied primer in lieu of field applied primer.
      b. The factory applied primer is certified by the Coatings Manufacturer as compatible with the field applied finish coat.
      c. The Coatings Manufacturer's recommended recoat time for the factory applied primer has not been exceeded.
   2. If all of the above conditions are not met, the Coatings Installer shall re-prepare all surfaces to be painted in strict accordance with Coatings Manufacturer's recommendations and primer applied, in accordance with this Section.

C. Table Definitions:
   1. SF/Gal: Square foot of coverage per gallon of coating used.
   2. MDFT: mil dry film thickness
   3. mil: 1/1000 of an inch paint thickness
   4. Ferrous Pipe: Includes Ductile Iron, Cast Iron, Steel, and Galvanized Steel piping
   5. Steel Items: Includes steel and galvanized steel items such as structural steel, doors, window frames, overhead coiling doors, bollard posts, steel gates, steel fences, and all other steel and galvanized steel items.
   6. Non-Metallic Pipe: Polyvinyl Chloride, Chlorinated Polyvinyl Chloride, Fiberglass Reinforced Plastic, High Density Polyethylene
   7. Exposed: Located above grade, exposed to the atmosphere not submerged. Includes surfaces inside and outside of buildings.
   8. Submerged: In an area which normally is under water or other liquid or is intermittently under water or other liquid.
   9. Buried: Located below grade, surrounded by backfill.

D. Surfaces Not Requiring Painting:
   1. Unless otherwise stated or shown below or in other sections, the following areas or items will not require painting or coating:
      a. Concrete surfaces.
      b. Reinforcing steel.
      c. Copper, bronze, brass, Monel, aluminum, chromium plate, and stainless-steel surfaces, except where:
         1) Required for electrical insulation between dissimilar metals.
         2) Aluminum and stainless steel are embedded in concrete or masonry, or aluminum is in contact with concrete or masonry.
         3) Color coding of equipment and piping is required.
      d. Existing piping, fittings and pipe supports.
      e. Pipe unions or portions of piping systems where painting would make disassembly difficult or impossible.
      f. Prefinished electrical, mechanical and architectural items such as motor control centers, switchboards, switchgear, panelboards, transformers, disconnect switches, HVAC equipment enclosures, ductwork, acoustical tile, cabinets, louvers, and wall panels.
      g. Electrical conduits.
      h. Cathodic protection anodes.

i. Insulated piping and insulated piping with jacket will require prime coat only.
j. Fiberglass reinforced plastic (FRP) surfaces with an integral ultra-violet resistant colored gel coat do not require painting, provided the color is as selected.
k. Glass, plexiglass or other transparent or translucent material intended to allow passage of light.
l. Civil/site materials such as asphalt, gravel, rock, chain-link fence, and plantings.

3.4 RECOAT TIMES:

A. Coatings Installer shall observe all requirements of the Coatings Manufacturer regarding recoat times.

3.5 PAINT LOG

A. Coatings Installer shall keep a paint log
   1. Specific details of the contents and format paint log shall be determined by the Coatings Installer and approved by the ENGINEER.
   2. At a minimum, paint log shall record, on a daily basis for any day when coating work is performed:
      a. Weather conditions, including 3-day forecast
      b. Which surfaces were prepared for coating
      c. Approval of surface preparation by the Coatings Manufacturer representative
      d. Which surfaces or systems were coated that day
      e. Who the installer was (specific names of persons on crew)
      f. Which coating type was used
      g. Which coat was installed
      h. What the application rate or MDFT was (as approved by ENGINEER)
   3. Paint log shall be kept on-site. Paint log shall be signed on a daily basis, for any day when coating work is performed, by the supervisor of the coatings installer field crew and by the ENGINEER.
   4. Any painted surface which was not recorded in the paint log shall be stripped, re-prepared, and recoated at the ENGINEER’s discretion.

3.6 WARRANTY INSPECTION

A. Warranty inspection shall be conducted during the eleventh month following completion of the Work. All defective Work shall be repaired by the CONTRACTOR in accordance with this Specification and to the satisfaction of the ENGINEER and at the CONTRACTOR'S expense.

B. Any location where paint has peeled, bubbled, or cracked and any location where rusting is evident shall be considered to be a failure of the system. The CONTRACTOR shall make repair at all points where failures are observed by removing the deteriorated paint, cleaning the surface, and recoating or repainting with the same system. If the area of failure exceeds 25 percent of the total coated or painted surface, the entire coating or paint system may be required to be removed and repainted in accordance with this specification as determined by the ENGINEER.

C. All costs for CONTRACTOR'S inspection, Manufacturer's inspection and all costs for repair shall be borne by the CONTRACTOR.

+ + END OF SECTION + +

DIVISION 10

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SECTION 10340

ARCHITECTURAL SUNSHADES AND CANOPIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope: Work in this section includes furnishing and installation of roll-formed aluminum overhead hanger rod style canopies as shown on the Drawings.

1.2 QUALITY ASSURANCE

A. Qualifications:
   1. Designer: Professional Civil or Structural Engineer registered in the same state as the Project.
   2. Erector: Approved by the manufacturer.

B. Warranty: Furnish manufacturer's extended guarantee or warranty, with OWNER named as beneficiary, in writing. Warranty shall provide for correction, or at the option of OWNER, removal and replacement of Work specified in this Section found defective during a minimum period of 5 years after date of Substantial Completion. Finish will not chalk, crack, check, blister, peel, flake, chip or lose adhesion for 5 years.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Drawings stamped by manufacturer's Designer:
      a. Drawings shall be specifically prepared for this Project.
      b. Show structural component locations and positions, dimensions, and details of construction and assembly.
   2. Structural Calculations stamped by manufacturer's Designer:
      a. Complete analysis and design of structural components and connections in accordance with the design requirements indicated.
   3. Samples: Minimum 2-inch by 3-inch metal components requiring color selection.

B. Product Data:
   1. Manufacturer's literature and technical data.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Protect components and accessories from corrosion, deformation and other damage during delivery, storage and handling.

B. Store on wood blocking or pallets, flat and off ground, to keep clean and to prevent damage or permanent distortion. Support bundles so there is no danger of tipping, sliding, rolling, shifting, or material damage. Cover with tarpaulins or other suitable weathertight ventilated covering.

PART 2 - PRODUCTS

2.1 PRODUCT AND MANUFACTURER

A. Products manufactured or supplied by the following, and meeting these Specifications, may be used on this Project:
   1. Mapes Architectural Canopies
      a. Canopy: Lumishade
   2. Or equal.

2.2 SERVICE CONDITIONS AND DESIGN CRITERIA

A. Dead Load:
   1. As calculated.

B. Live Load:
   1. 0 psf.

C. Snow Load:
   1. 30 psf.

D. Wind Load:
   1. Basic Wind Speed: 85 mph
   2. Exposure Category: C.
   3. Importance Factor: 1.15

E. Seismic:
   1. Seismic Design Category: D.
   2. Importance Factor: 1.0.
   3. Site Class: D.
   4. Design Spectral Acceleration Parameters:
      a. S_{DS} = 0.491.
      b. S_{D1} = 0.326.

2.3 COMPONENTS

A. Materials:
   1. Decking at sunshades shall consist of louvered blades (.110 inch extruded aluminum).
   2. Decking at canopies shall consist of 2-1/2 inches interlocking, role formed .032-inch decking.
   3. Intermediate framing members shall be extruded aluminum, alloy 6063-T6, in profile and thickness as required by manufacturer.
   4. Hanger rods to be powder coated finish to match the canopy.
   5. Fascia shall be standard 8-inch extruded, minimum .125 aluminum, flat face (Mapes style 'J').

B. Finishes:
   1. Finish: Two-Coat Kynar Finish.
   2. Color: Selected by OWNER.

2.4 FABRICATION

A. All sunshades and canopies shall be factory preassembled to the greatest extent possible.

B. All connections shall be mechanically assembled utilizing 3/16-inch fasteners with a minimum shear stress of 350 pounds. Pre-welded or factory-welded connections are not acceptable.

C. Concealed drainage at canopies: Water shall drain from covered surfaces into intermediate trough and be directed to downspouts.

PART 3 - EXECUTION

3.1 INSPECTION

A. Confirm that surrounding area is ready for the canopy installation.

B. Installer shall field confirm dimensions and elevations to be as shown on shop drawings provided by the manufacturer and the Drawings.

C. Erection shall be performed by an approved installer and scheduled after all concrete, masonry and roofing in the area is completed.

3.2 INSTALLATION

A. Installation shall be in strict accordance with manufacturer's shop drawings and written instructions. Particular attention should be given to protecting the finish during handling and erection.

3.3 REPAIR AND CLEANING

A. Immediately following erection, remove unused material, screws, fasteners, and other debris from completed installation. Use caution in removing metal cuttings from surface of prefinished metal panels.

B. Replace damaged, dented, buckled, or discolored metal panels.

+ + END OF SECTION + +

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SECTION 10400

IDENTIFICATION DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope: Furnish and install signs, placards, and labels for safety equipment, hazards, and equipment and piping identification.

1.2 SUBMITTALS

A. Shop Drawings:
   1. Provide manufacturer's literature showing available letter sizes and styles, standard and custom colors, and standard mounting details.
   2. Provide drawings showing layouts, actual letter sizes and styles, colors, and project-specific mounting details.

PART 2 - PRODUCTS

2.1 FIRE EXTINGUISHER LOCATION SIGNS

A. Material:
   1. Subsurface silkscreened graphics on a transparent acrylic sheet, 0.08" thick with Helvetica Medium alphabet and matching arrows type face.
   2. Provide 2" high upper case letters and 1" high lower case letters.

B. Fire Extinguisher Identification Sign:
   1. Provide 15"x 15" with 1" radiused corners, unframed.
   2. Provide one for each surface mounted fire extinguisher.
   3. Background color shall be red with white lettering.
   4. Signs shall incorporate a white directional arrow as located by ENGINEER.

C. Product and Manufacturer: Provide one of the following:
   1. ASI/SPE MH (Four Corners) Plaque by ASI Sign Systems, Incorporated.
   2. Or equal.

2.2 FIRE PROTECTION PLACARDS

A. Fire Protection Placards:
   1. Provide diamond-shaped placards: 15" square of 0.125" rigid polyethylene.
   2. The placard shall meet NFPA 704.

B. Product and Manufacturer: Provide one of the following:
   1. W.H. Brady Company
   2. Seton Name Plate Company
   3. Or Equal

C. Provide fire protection placards in accordance with the following schedule:

LOCATION	MATERIAL	HEALTH	FLAMMABILITY	REACTIVITY	SPECIAL
Diesel Tank	Diesel	1	2	0	

2.3 MISCELLANEOUS SAFETY SIGNAGE

A. Safety signs shall comply with the following standards:
   1. Occupational Safety and Health Administration (OSHA), Standards for General Industry, Subparts 1910.200 Hazard Communication (July, 1986).
   2. National Fire Protection Association (NFPA) Standard No. 704 - Label System.
   3. Uniform Fire Code, Latest Edition.
   4. Uniform Fire Code Standard 79-3.

B. Safety signs shall be of height and width required by layout and shall be formed from semi-rigid butyrate, polyethylene or fiberglass. Lettering shall be 3-inches high and 1/2-inch in stroke.

C. Provide the following safety signs:

LOCATION	TEXT	BACKGROUND COLOR	LETTERING COLOR
All Hatches	CONFINED SPACE – ENTER UNDER PERMIT ONLY	White	Red
Each Pump Hatch	CAUTION: EQUIPMENT STARTS AUTOMATICALLY	White	Red
All Electrical Gear	DANGER: HIGH VOLTAGE	Yellow	Black

2.4 EXIT SIGNS

A. Material: Plastic, 1/8-inch minimum thickness.

B. Lettering: 6 inches high, 3/4-inch stroke, white letters on red background.

2.5 IDENTIFICATION LABELS

A. Pipe Labels and Flow Direction Arrows:
   1. Label, Lettering Color, Size and Placement: In accordance with ANSI A13.1, and as listed below.
   2. Label Colors:

Fluid Service	**Background Color**	**Letter Color**
Fire quenching fluids	Safety red	White
Toxic and corrosive fluids	Safety orange	Black
Flammable fluids	Safety yellow	Black
Combustible fluids	Safety brown	White
Potable, cooling, boiler feed, and other water	Safety green	White
Compressed air	Safety blue	White

3. Label Size:

Outside Diameter of Pipe Covering, inches	Length of Color Field, inches	Size of Letters, inches
3/4 to 1-1/4	8	½
1-1/2 to 2	8	3/4
2-1/2 to 6	12	1-1/4
8 to 10	24	2-1/2
Over 10	32	3-1/2

4. Label Placement:
   a. Labels shall be positioned on the pipes so they can be easily read. Proper label placement is on the lower side of the pipe if the employee has to look up to the pipe, on the upper side of the pipe if the employee has to look down towards the pipe, or directly facing the employee if on the same level as the pipe. Labels should be located near valves, branches, where a change in direction occurs, on entry/re-entry points through walls or floors, and on straight segments with spacing between labels that allows for easy identification.
5. Material: Manufacture from or encase in outdoor grade plastic or vinyl that will resist damage or fading from washdown, sunlight, mildly corrosive atmosphere, dirt, grease, and abrasion.
6. Message: Matching "Description" per Piping Schedule.
7. Labels:
   a. Snap-Around Type: Size for finished outside diameter of pipe and insulation.
   b. For 6 Inches and Over Diameter Pipe: May furnish strap-on type fastened without use of tools with plastic or stainless steel straps.
   c. Firmly grip pipe so labels remain fixed in vertical pipe runs.
8. Manufacturers and Products:
   a. T & B/Westline, Rariton, NJ, Model WSS Snap-Around.
   b. Seton Name Plate Corp., New Haven, CT, Setmark Series.
   c. Or equal.

B. Valve and Equipment Labels:
1. Applies to valves and equipment with assigned tag numbers wherever specified.
2. Lettering: Black bold face, 3/4-inch minimum high.
3. Background: OSHA safety yellow.
4. Materials: Either of the following:
   a. Aluminum or stainless steel base with a baked-on finish that is suitable for use on wet, oily, exposed, abrasive, and corrosive areas.
   b. Fiberglass with fiberglass-encased lettering.
5. Furnish 1-inch margin on each end of label for mounting. On fiberglass labels furnish grommets at each end for mounting.
6. Size:
   a. As appropriate for lettering provided.
   b. Provide same-size labels for equipment series which are adjacent.
7. Message: Equipment names and tag numbers as used in Sections where equipment is specified and/or on Drawings.
8. Manufacturers and Products:
   a. T & B/Westline Co., Rariton, NJ; Type KQ.
   b. Seton Name Plate Corp., New Haven, CT; Style EB.
   c. Or equal.

PART 3 - EXECUTION

3.1 INSTALLATION OF SIGNS

A. Install Fire Extinguisher location signs at all fire extinguisher locations, approximately 12" above fire extinguisher mounting bracket.

B. Install Exit Signs mounted to each door which leads to the outside of the building, on the panic bar side of the door, mounted to the door approximately 5'-6" above finished floor.

C. Install all other signs at locations as shown on the drawings. Signs should be installed approximately 5'-6" off of finished floor, attached to doors where appropriate. Where two signs are indicated in the same location, signs should be mounted side-by-side, where possible.

D. Install all signs plumb and level. They shall be attached with four stainless steel screws or anchor bolts as required for substrate. Provide theft/tamper-resistant fasteners on all signs.

3.2 INSTALLATION OF PIPE IDENTIFICATION LABELS

A. Provide pipe identification label with flow arrows on all exposed piping systems as follows:
   1. At all connections to equipment, valves, tees or wall penetrations.
   2. At intervals along piping not greater than 18 feet on center with at least one label applied to each exposed horizontal and vertical run of pipe.

B. Install pipe identification labels after all painting has been completed.

3.3 INSTALLATION OF EQUIPMENT IDENTIFICATION LABELS

A. Install equipment identification labels on all equipment and valves which have been given a tagnumber in the Drawings or Specifications. Provide identification label which includes equipment name and tag number.

B. Where no damage will be caused to equipment, mount equipment identification label directly to equipment. Otherwise, mount equipment identification labels to concrete equipment base or wall space. Install equipment identification label such that it is clear which piece of equipment is being labeled.

C. Anchor to equipment or base for easy removal and replacement with ordinary hand tools.

+ + END OF SECTION + +

SECTION 10520

SAFETY EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. The following safety equipment is to be provided and installed by CONTRACTOR so that it may be integrated into OWNER's safety program for operation of the facility into which it is installed.
   2. The following safety equipment does not represent a complete package of safety equipment required to operate the facility. Refer to OWNER's safety program for all required safety equipment and procedures.

1.2 SUBMITTALS

A. Shop Drawings: Provide manufacturer's product data for each item including sizes, ratings, UL listings, OSHA certifications or other certifications, and mounting/installation information.

B. Warranty: Provide manufacturer's 5-year warranty on all products provided.

1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Protect all equipment provided from all damage until such time as it is turned over to the OWNER.

B. Safety equipment provided under this specification shall not be used by the CONTRACTOR in the construction of the facility. Safety equipment shall be turned over to the OWNER in new condition.

PART 2 - PRODUCTS

2.1 FIRE EXTINGUISHERS

A. Provide at both doors.

B. Provide Fire Extinguishers which Conform to NFPA-10 and as follows:
   1. Tri-class dry chemical extinguishing agent.
   2. Pressurized, red enameled steel shell cylinder.
   3. Activated by top squeeze handle.
   4. Agent propelled through hose or opening at top of unit.
   5. For use on A, B, and C class fires.
   6. Minimum UL Rating: 4A:60B:C, 10-pound capacity.

C. Mounting Hardware:
   1. Furnish heavy-duty brackets with clip-together strap for wall mounting.
   2. Use all stainless steel fasteners for attaching brackets to wall.

D. Manufacturers:
   1. Walter Kidde
   2. Master Protection Enterprises
   3. Or Equal

2.2 FALL PROTECTION EQUIPMENT

A. Fall Protection Grating:
   1. Standards:
      a. Comply with all applicable OSHA, UL, ANSI and other applicable standards including, but not limited to, OSHA 29 CFR 1910.23.
   2. General Purpose:
      a. Designed to allow visual inspection and wash down of confined space through grating while preventing falls into open hatches.
      b. Designed as a factory installed option to be easily opened for confined space entry once entrant is properly harnessed and utilizing proper retrieval system.
   3. Features:
      a. Materials:
         1) Metallic parts shall be Aluminum and/or stainless steel.
         2) Fiberglass grating panel.
      b. Fiberglass grating panel shall be equipped with lift assistance and automatic hold-open arm for ease of operation and user safety.
      c. Fiberglass grating panel shall operate independently of the access cover.
      d. Fall protection grating shall be rated for 300 psf.
   4. Manufacturer and Product:
      a. The Bilco Co
      b. Or equal

B. Portable Davit Arm Retrieval System:
   1. Standards:
      a. Comply with all applicable OSHA, UL, ANSI and other applicable standards.
   2. General Purpose:
      a. Designed to retrieve an entrant into a confined space using a standard personnel harness system.
   3. Features:
      a. 60-inch high center post with winch mounting assembly
      b. Allows for either 18” or 24” reach on offset arm
      c. Weight rating of 350 lbs
      d. Safety factor of 10:1
   4. Accessories:
      a. Winch
         1) Designed to attach to a person that is entering or exiting from a confined space.
         2) Built with an internal braking system to prevent the accidental pay out of line, as well as a back-up locking pawl system to prevent “free-wheeling” of the winch.
         3) Cable extension (payout) should occur ONLY when the handle is turned counterclockwise AND a force of AT LEAST 10 lbs. (4.5 kg.) is applied to the line.
         4) The winch frame back plate attaches to a mounting plate which can then be mated to the Portable Davit Arm Retrieval System. Coordinate winch and Portable David Arm Retrieval System.

5) Weight rated to 350 lbs.
6) 10:1 safety factor
7) 5.5:1 gear ratio single speed drive
8) Retrieval rate of 23 feet per minute
9) Continuous braking drive prevents free wheeling
10) Double pawls on friction brake provide back up safety
11) Low wear, high temperature brake pads
12) Anti-friction drive bearings
13) Three permanent wraps of cable on the drum
14) Level wind springs to prevent loosening of cable lays
15) Slip clutch drive to prevent back-winding of cable drum
16) Galvanic zinc coating of all metal parts
17) Double action locking swivel snap hook
18) Provide with 70 feet of stainless steel cable

5. Flush Floor Mounted Davit Sleeve:
   a. Provide flush floor mounted davit sleeve by same manufacturer as davit crane.
      1) Sleeve shall be designed specifically for davit crane and shall allow for full functionality and load rating of crane
      2) Sleeve and anchor bolts shall be stainless steel
      3) Sleeve to be designed for installation in concrete after concrete placement by core drilling a hole in the concrete and bolting sleeve to concrete floor using stainless steel chemical anchors, per manufacturers instructions.
      4) Provide stainless steel debris cap with sleeve.
6. Manufacturer and Product:
   a. Davit Crane: T.A. Pelsue Company, Model PNUH1824, or equal
   b. Winch: T.A. Pelsue Company, Model PLPS806MR-70, or equal
   c. Davit Sleeve: T.A. Pelsue Company, Model PNUS102B-SS, or equal
   d. Debris Cap: T.A. Pelsue Company, Model PNUS106-SS, or equal

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all safety equipment per manufacturers written instructions.

B. Install fire extinguishers where "FEXT" is called out on the drawings, 48" above finished floor or adjacent grade.

+ + END OF SECTION + +

DIVISION 11

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SECTION 11100

FABRICATED SLIDE GATES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope: This Section describes the design, fabrication, and supply of fabricated slide gates, including wall thimbles (if applicable), pipe adapters (if applicable), discs, guide frames, stem guides, seats, operating stem, operator, and anchorage. Gate supplier shall provide all materials, equipment, and accessories necessary to furnish and install slide gates as described herein and as shown on Drawings.

1.2 QUALITY ASSURANCE

A. Reference Standards: Comply with requirements and recommendations of the following references, except as otherwise specified:
   1. American Water Works Association (AWWA)
   2. American Gear Manufacturers Association (AGMA)
   3. American National Standards Institute (ANSI)
   4. ASTM International (ASTM)
   5. Anti-Friction Bearing Manufacturers Association (ABMA)

B. Unit Responsibility: All equipment specified herein shall be coordinated and provided by a single gate manufacturer. Manufacturer assumes full responsibility for coordination of all components.

C. Warranty: Provide a 2-years warranty on all equipment from date of start-up. Warranty shall cover defects in workmanship, design, and materials. If any component should fail during the warranty period, it shall be corrected and the unit restored to service at no expense to the OWNER.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Detailed drawings showing component and assembly dimensions, location of mechanical connections, weights of all equipment, installation details, and accessory details.
   2. Drawings, templates and directions for installation of anchor bolts and stem couplings.

B. Product Data:
   1. Descriptive literature, specifications, and engineering data.
   2. Materials of construction for all components and accessories.
   3. Force calculations for gate operator and stem, including seismic loading calculations.
   4. Shipping, storage, protection and handling instructions.
   5. Installation directions.
   6. Operation and Maintenance Manual.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Gate manufacturer shall provide any special unloading, storage and handling instructions.

PART 2 - PRODUCTS

2.1 PRODUCT AND MANUFACTURER:

A. Golden Harvest

B. Fontaine

C. Or equal

2.2 GOVERNING STANDARD

A. Except as modified or supplemented herein, fabricated slide gates and their appurtenances shall conform to the applicable requirements of AWWA C561.

2.3 SERVICE CONDITIONS AND PERFORMANCE

A. Gate Schedule:

Tag	SLG-101	SLG-201	SLG-301	SLG-302
Location	Splitter Box		Lift Station	
Material	316SS			
Operation	Open-Close			
Size (W x H)	24" x 24"	24" x 24"	36" x 36"	36" x 36"
Self-Contained	Yes			
Seating Head	12'	12'	16'	16'
Unseating Head	12'	12'	16'	16'
Inv. Elevation	5328.71	5328.71	5323.20	5328.00
Operating Floor Elevation	5339.00	5339.00	5339.00	5339.00
Mounting	Wall			
Top Seal	Yes			
Actuator	Removable Handwheel and Electric Drill Adapter			
Gate Opening Direction	Upward			
Stem Movement	Rising			
Limit Switches	No			
Service	Raw Wastewater			

B. Performance:
1. Closed leakage shall not exceed 0.1 gallons per minute (GPM) per foot of gate periphery under seating or unseating head conditions.

2.4 COMPONENTS

A. General:
   1. Slide gates and all appurtenances shall be provided by one manufacturer.
   2. All components of the gates shall have a minimum thickness of ¼-inch.
      The gates for this project will be wall mounted over plain-end wall fittings provided by the CONTRACTOR or over openings in concrete walls, as shown on the Drawings. No wall thimbles or pipe adaptors are required.

B. Guide Frame:
   1. Material: ASTM A-276 Type 316 SS.
   2. Designed for maximum rigidity.
   3. If applicable, machine back flange to mount directly to machined face of pipe adapter.
      ASTM D4020 Ultra high molecular weight polyethylene seats shall be provided in a retainer slot in sides of frame, on the unseating head side of the gate.
      Neoprene seals shall be utilized as necessary to achieve specified closed leakage performance.
   4. Guide frame corners shall be factory welded.
      Provide bolt holes in upper portion of sides of frame for connection to supporting angle.
   5. Weight of guide frame shall not be less than 9.0 pounds per linear foot. Frame:

C. Disc:
   1. Material: ASTM A-240 Type 316L SS.
   2. Disc shall be reinforced as necessary to limit deflection under the design operating head to less than 1/360 of the gate span.
   3. Reinforcing members shall be 316L SS angle or channels welded to the plate.

D. Stem:
   1. Material: ASTM A-276 Type 316 SS.
      Diameter shall 1-1/4 inch minimum, and be sized as necessary to withstand two times the compressive force when 40 pounds of force are applied at the operator. Stem shall be supported such that the L/r ratio for unsupported lengths does not exceed 200.
      Threaded portions of the stem shall be ACME type cold rolled threads with a maximum surface roughness of 0.000016 inches. Machine cut threads will not be accepted.
      Stem connections shall be threaded with bolt fastening to both stem segments. Gates having a width equal to or greater than two times their height shall be provided with two geared lifting mechanisms interconnected by a tandem shaft so that all stems move at the same rate. The tandem shaft shall be protected by a full length, removable aluminum or stainless steel cover attached to the actuator.

E. Stem Guides:
   1. Provide cast steel, cast iron or fabricated stainless steel stem guides for installation at 120-inch intervals.
      Guides shall consist of collar with UHMWPE bushings, and bracket with slotted holes for adjustment in two directions.
   2. Inside diameter of the collar and bushings shall be slightly larger than the gate stem to prevent binding.

F. Manual Actuator:
   1. Type: Provide nut, crank arm or handwheel type, as indicated in the schedule.
      a. Crank Type:
         1) Each crank-operated manual actuator shall be provided with a removable crank having a revolving grip.
         2) Crank handles shall have an overall length of not less than 6 inches and not more than 15 inches.
         3) Crank handles shall be made of corrosion resistant material.
         4) Crank shall have fully enclosed single or double gear reducer as required for lifting capacity.
            a) Gears shall be machine cut.
            b) Lubrication fitting shall be provided in gear housing to permit housing to permit lubrication of all gears and bearings.
            c) Arrow marked "open" shall be cast on the housing to indicate direction of rotation to open the gate.
      b. Handwheel Type:
         1) Direct Drive without reduction gearing
         2) Maximum handwheel diameter shall be 30 inches.
   2. Maximum effort required to open the gate shall not be more than 40 pounds.
   3. Furnish threaded bronze lift nut to engage threaded portion of stem.
      a. Lift nut shall be flanged and supported on roller bearings.
      b. Lift nut shall be capable of thrust developed during opening and closing of the gate without damage.
   4. Provide cast steel housing for bearings and lift nut.
      a. Housing shall be supported by the terminal stem guide support.
   5. Provide adjustable bronze stop collar for OPEN and CLOSED position limitation.
   6. Provide clear butyrate stem guide cover and cap.
      a. Indicate OPEN/CLOSED position with 1-inch marking on clear mylar pressure sensitive adhesive scale for field application.
   7. Distance from center of radius of crank arm or center of handwheel to ground shall be less than 48 inches.

G. Fasteners:
   1. All fasteners necessary for installation and operation shall be furnished by the gate manufacturer.
   2. Fasteners shall be Type 316 SS
   3. Fasteners shall be ½-inch diameter minimum, and adequately sized to withstand all operational stresses.

H. Portable Operator:
   1. Manufacturer to provide one portable operator with 2 inch adaptor to open/close gates utilizing available 115V outlet.
   2. Portable operator to be complete with stand and adjustable height to allow for alignment with varying operator nuts.

I. Spare Parts: Provide the following spare parts:
   1. Two bronze stop collars
   2. Bronze lift nut
   3. Special tools required for servicing operator

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be as shown on the Drawings and in accordance with gate manufacturer's written instructions.

3.2 FIELD QUALITY CONTROL

A. Conduct functional and performance tests under approved simulated operating conditions.

B. If any portion of the installation does not function properly, adjust, realign, or modify the installation and retest.

C. Manufacturer's Services:
   1. 1 person-day for installation assistance, inspection, testing and alignment.

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SECTION 11300

SUBMERSIBLE SEWAGE PUMPS

PART 1 - GENERAL

1.1 EQUIPMENT TAG NUMBERS

A. Provide all labor, materials, equipment, and incidentals required to furnish and install Submersible Sewer Pumps complete and operational with motors, base plate, safety guard and accessories as shown on the Drawings and specified.

B. This specification section refers to pump numbers:
   1. PMP-101 (CONTRACTOR to procure new)
   2. PMP-201 (CONTRACTOR to procure new)

C. Use of American Iron and Steel (AIS) applies to this project.

1.2 SUBMITTALS

A. Product Data:
   1. Make, model, weight, and horsepower of each equipment assembly.
   2. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
   3. Dimensional outline and installation drawing. Full installation instructions.
   4. Performance data curves showing head, capacity, horsepower demand, pump efficiency, and net positive suction head required over the entire operating range of the pump, from shutoff to maximum capacity. Indicate separately the head, capacity, horsepower demand, overall efficiency, and minimum submergence required at the guarantee point.
   5. Power and control wiring diagrams, including terminals and numbers.
   6. Data on the moisture/temperature protective relay
   7. Complete motor nameplate data, as defined by NEMA, motor manufacturer, and including any motor modifications.
   8. Factory finish system.
   9. Complete catalog information for the davit crane, including make, model, lifting capacity, materials of construction, and installation drawing with dimensions.

B. Unit Responsibility: All equipment specified herein shall be coordinated and provided by the pump manufacturer. Manufacturer assumes full responsibility for coordination of all components.

C. Pump Tests and Data:
   1. Pump casings shall be hydrostatically tested to twice the discharge head or 1-1/2 times the shutoff head whichever is greater.
   2. Running Test: Pump assembly shall be operated from zero to maximum capacity as shown on the approved curve. Results of the test shall be shown in a plot of test curves showing head, flow, horsepower, efficiency, and current. Readings shall be taken at a minimum of five evenly spaced capacity points including shut-off, design point and minimum head for which pump is designed to operate.

3. Each test shall be witnessed by a Registered Professional Engineer, who may be an employee of the manufacturer. The Registered Professional Engineer shall sign and seal all copies of curves and shall certify that hydrostatic tests were performed. Tests shall be conducted in conformance with the methods described in Section A6 of AWWA E101.

D. Motor Tests and Data:
   1. For each motor furnish an inspection report for the motor or for a previously manufactured electrically duplicate motor that has been tested. Provide the following minimum data:
      a. Running current.
      b. Locked rotor current.
      c. Winding resistance measurement.
      d. High potential test.
      e. Bearing inspection.

E. Operation and Maintenance Manuals: Submit complete manuals including: copies of all approved Shop Drawings, test reports, maintenance data and schedules, description of operation, and spare parts information.

F. Warranty: Provide a 2-yrs warranty on all equipment from date of start-up. Warranty shall cover defects in workmanship, design, and materials. If any component shall fail during the warranty period, it shall be corrected, and the unit restored to service at no expense to the OWNER.

G. Test Data: Pumps shall not be shipped until the ENGINEER has approved the test reports. Submit:
   1. Four copies of certified pump tests.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Pump equipment shall consist of pump(s) complete with motor(s), cooling jacket(s), guide rails and supports, base elbow(s), anchoring brackets, power cable(s), pump lifting cable(s), and protective control system. Pump metal parts that come into contact with guide rail or cable system shall be made of non-sparking materials.

B. Pumps shall have capacity no less than 98% and no greater than 103% of the specified capacity at each of the total dynamic head operating conditions shown.

C. Pumps and Motors:
   1. Pumps PMP 101 and PMP 102:
      a. Minimum Shutoff Head: 355 feet
      b. Primary Design Point Flow/Head
         1) 1,075 gpm at 303 feet of TDH at 100% speed
         2) Min Efficiency = 55%
      c. Runout Point
         1) 1550 gpm at 280 feet of TDH at 100% speed
      d. Horsepower: 160 hp
      e. Voltage: 480V, 3 Phase, 60 Hertz

f. 100% Motor speed: 1780 rpm

D. Pump Features:
1. Service: Raw Sewage
2. Site Altitude: 5330 feet
3. Type: Non-clog centrifugal submersible sewage pump
4. Capacity: Passing 2” ball, minimum
5. Volute: ASTM A48 CL35B Cast Iron
6. Impeller: Hard Iron (ASTM A-532 (Alloy III A) 25% chrome cast iron)
7. Impeller Insert Ring: (ASTM A-532 (Alloy III A) 25% chrome cast iron)
8. Each unit shall be provided with an integral motor cooling system. A stainless steel motor cooling jacket shall encircle the stator housing, providing for dissipation of motor heat regardless of the type of pump installation. An impeller, integral to the cooling system and driven by the pump shaft, shall provide the necessary circulation of the cooling liquid through the jacket. The cooling liquid shall pass about the stator housing in the closed loop system in turbulent flow providing for uninterrupted heat transfer. The cooling system shall have one fill port and one drain port integral to the cooling jacket. The cooling system shall provide for continuous pump operation in liquid or ambient temperatures of up to 104°F (40°C). Operational restrictions at temperatures below 104°F are not acceptable. Fans, blowers or auxiliary cooling systems that are mounted external to the pump motor are not acceptable.
9. Mechanical Seal: Each pump shall be provided with a positively driven dual, tandem mechanical shaft seal system consisting of two seal sets, each having an independent spring. The lower primary seal, located between the pump and seal chamber, shall contain one stationary and one positively driven rotating corrosion and abrasion resistant tungsten-carbide ring. The upper secondary seal, located between the seal chamber and the seal inspection chamber shall be a leakage-free seal. The upper seal shall contain one stationary and one positively driven rotating corrosion and abrasion resistant tungsten-carbide seal ring. The rotating seal ring shall have small back-swept grooves laser inscribed upon its face to act as a pump as it rotates, returning any fluid that should enter the dry motor chamber back into the lubricant chamber. All seal rings shall be individual solid sintered rings. Each seal interface shall be held in place by its own spring system. The seals shall not depend upon direction of rotation for sealing. Mounting of the lower seal on the impeller hub is not acceptable. Shaft seals without positively driven rotating members or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces are not acceptable. The seal springs shall be isolated from the pumped media to prevent materials from packing around them, limiting their performance.

E. Accessories:
1. Base Elbow: ASTM A48, CL35B Cast Iron, one per pump, coated to match pump/service conditions.
2. Guide Rails: Type 316 Stainless Steel, coordinate length with drawings, 3-inch diameter minimum, two guide rails per pump (guide cables are not acceptable).
3. Upper Guide Rail Brackets (one per pump):
   a. Type 316 Stainless Steel
   b. Mount to wetwell hatch opening
4. Intermediate Guide Rail Brackets (one per pump):
   a. Type 316 Stainless Steel
   b. Provide if guide rails are longer than 20-feet
   c. Brackets shall mount to discharge piping

5. Pump Lift System:
    a. Pumps will be hoisted from the wet-well utilizing City boom truck.
    b. Lifting Chain: approximately 18" long 316 Stainless Steel, provide one chain per pump.
    c. 30 feet of nylon line connected to the lifting chain, provide one rope per pump.
    d. Forged steel grip eye for connecting/disconnecting hook and cable to pump chain, provide one grip eye per pump.
6. Safety Hooks and Cable Holders: 316 Stainless Steel, provide one of each per pump
7. Wetwell hatch:
    a. Hatch dimensions per drawings
    b. See specification section 08305 for hatch requirements

F. Motors:
1. Connected load shall not exceed 90 percent of motor nameplate horsepower
2. Motor shall be non-overloading for the entire pump operating curve.
3. Furnish motors suited for operation in a Class 1, Division 1, Groups C & D explosion-proof atmosphere and certified as such by Factory Mutual.
4. Vertical mounting
5. Solid shaft
    a. Shaft seal: Tandem mechanical seals
6. Service factor: 1.15
7. Thermal Protection: Normally closed thermal switch in stator housing
8. Moisture Protection: Leakage Sensor in stator housing
9. Motor capable of 15 starts per hour
10. Motor capable of continuous full-load operation while unsubmerged without overheating or voiding Class 1, Division 1, Group D compliance
11. Class H insulation rated for 180°C (356°F) with Trickle Impregnation method.
12. Provide motor lifting lug
13. Provide motor power and control cables with connections made at the motor inside a junction chamber. Cable entry shall be sealed and provided with means of strain relief. Cables shall comply with applicable code requirements. Coordinate pump cable length with distance between pump and control panel, per drawings and field installation.
14. Motor shall be compatible with VFD.

G. Controls:
1. Provide moisture protection/thermal protection relay for connection to leakage sensor and thermal switch on each motor for installation in an external control panel by others.
2. Coordinate with programming during pump commissioning to initially run pump at 100% speed to clear the impeller before reducing speed to desired set-point. This was a request of the manufacturer during design.

H. Manufacturers/Models:
1. Flygt Model NP3315 HT 453
2. No Approved Equal

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in complete accordance with manufacturer's instructions.

B. Installation shall include furnishing and applying an initial supply of grease and oil, recommended by manufacturer.

C. Check and align all pumps, motors, etc. after pump assemblies have been installed to ensure alignment and assembly has been unchanged from factory assembly conditions. Make adjustments required to place system in proper operating condition. Pump installation shall place no strain on adjacent piping systems.

3.2 FIELD QUALITY CONTROL

A. Functional Test: Conduct on each pump.
   1. Alignment: Test complete assemblies for correct rotation, proper alignment and connection, and quiet operation.

3.3 MANUFACTURER'S FIELD SERVICES

A. A factory trained representative shall be provided for start-up and test services and operation and maintenance personnel training services. The representative shall make one one-day visit to the site for performing these services.

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DIVISION 13

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SECTION 13100

ODOR CONTROL UNIT
(ADSORBENT MEDIA FOUL AIR SCRUBBER)

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, equipment, materials, and incidentals as required to furnish, install, check, calibrate, test, document, start-up, and place in satisfactory operation the Odor Control Unit as shown on the Drawings and as specified.
   2. The Odor Control Unit shall include, but not be limited to the following:
      a. Adsorber Canister
      b. Media
      c. Drain Line

B. General:
   1. Descriptions contained hereinafter are for guidance and to show the functions desired. They do not describe or specify all components to interface equipment. All parts and equipment necessary to meet functional requirements shall be provided and fit within the dimensions and configuration shown on the Drawings.
   2. The mechanical, structural, instrumentation and electrical design have been based on an odor control unit manufactured by Bay Products, Inc. The cost of any changes and modifications to mechanical, structural, instrumentation or electrical facilities necessary to adapt alternate equipment to the layout and design shown shall be borne by CONTRACTOR. Clearances shown on the Drawings shall be maintained. Any such proposed changes or modifications are subject to review and acceptance by the ENGINEER in accordance with the Special Provisions.
   3. Complete responsibility for the proper operation and functions of the Odor control unit herein specified, belongs to CONTRACTOR. Responsibility for coordination of all interfaces with other contractors to achieve the required Odor control unit operation belongs to CONTRACTOR.
   4. Odor control equipment outdoor areas are considered corrosive areas. All mechanical and electrical equipment and material shall conform to NEMA 4X, non-metallic requirements.

C. Related Divisions and Sections:
   1. Section 01610 – General Equipment Requirements
   2. Section 01750 – Training, Testing and Start-up
   3. Section 16010 – Electrical

1.2 REFERENCES

A. American Society of testing and Materials (ASTM):
   1. ASTM D-3299-88 Standard Specification for Filament Wound Glass Fiber Reinforced Thermosetting Resin Chemically Resistant Tanks.
   2. Voluntary Product Standard
      a. PS 15-69

1.3 QUALITY ASSURANCE

A. Odor control unit Manufacturer's Qualifications:
   1. Manufacturer shall have minimum of five years experience of producing substantially similar equipment, and shall be able to show evidence of at least ten installations.

B. When two or more units of equipment for the same purpose are required they shall be the product of one manufacturer.

C. Inspection and Testing Requirements: The visual inspection of the equipment shall comply with ASTM D 2563, Visual Acceptance Level II.

D. Requirements of Regulatory Agencies: Meet federal, state, and local requirements which apply to the work.

E. Products used in the Work of this Section shall be produced by manufacturers regularly engaged in the production of such items and have a successful history of product acceptability, as interpreted by ENGINEER.

F. Listing, labeling or marking, as conforming to the Standards of Underwriters Laboratories, Inc., American National Standards Institute, Inc., United States Bureau of Mines, or other nationally recognized testing organization.

1.4 SUBMITTALS

A. Shop Drawings: Submit for approval the following:
   1. Submit for review to ENGINEER, sufficient literature, detailed specifications, and drawings to show dimensions, make, style, speed, size, type, horsepower, service factors, efficiency, materials used, design features, internal construction, weights, and any other information required by ENGINEER for review of all odor control equipment.

B. Operation and Maintenance Manuals:
   1. Submit complete installation, operation and maintenance manuals, including, test reports, maintenance data and schedules, description of operation and spare parts information.

C. Documentation to demonstrate that the manufacturer has been regularly engaged in fabricating odor control units for at least 5 years and provide documentation of at least 10 installations.

D. Field Assembly Instructions: Provide instructions on proper assembly of odor control unit.

E. Manufacturer shall provide laboratory analysis from certified laboratory for the high capacity carbon verifying the hydrogen sulfide capacity. The analysis shall be performed within six months of the date of submittal.

1.5 GUARANTEE

A. Manufacturer shall provide a guarantee stating that the hydrogen sulfide (H_2S) removal efficiency (with an average inlet of 25 ppmv H_2S) will be greater than 99% prior to carbon media being spent.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Odor Control Unit
   1. The purpose of the odor control unit shall be to remove H_2S and odors or VOCs emanating from ambient sewage emission. Each odor control unit shall include the following:
      a. Adsorber Canister
      b. Media
      c. Mist eliminator
   2. Design of the odor control unit has been based on CalgonCarbon Ventsorb PE System.
   3. Design and Performance Criteria:
      a. Each odor control unit shall be designed for the following operating conditions and shall meet the following performance criteria when put in service with fresh carbon media:
      b. Air Flow Rate, cfm: 200.
      c. Average Inlet H_2S Concentration, ppmv: 25.
      d. H_2S Removal Efficiency, (With an average inlet of 25 ppmv H_2S): Greater than 99% prior to Carbon media being spent.

B. Adsorber Canister
   1. The self-contained, adsorber canister shall be a Ventsorb PE Canister, as supplied by CalgonCarbon
   2. There will be 2 adsorber canister required.
   3. The 55-gallon adsorber canister shall be manufactured of HMW-high density polyurethane. The canister shall have no moving parts.
   4. The adsorber canister shall support the carbon bed on FRP grating and screen. Adsorber design shall utilize "Plug Flow" air distribution (influent air shall enter below the carbon bed support grating, this area shall pressurize equally, and the air passes through the media bed uniformly, exiting through the outlet nozzle at the top of the vessel). The inlet plenum shall be void of packing, gravel or any other material and shall be open without air flow restriction.
   5. The canister shall have the following features:
      a. Inlet: 4" plain end connection
      b. Cover: Removable HMW-HDPE cover with closure and polyurethane gasket.
      c. Drain: ¾" drain with PVC ball valve
   6. The canister shall be rated at +/- 7 psig
   7. The canister shall be capable of operating at a maximum airflow rate of up to 200 CFM with a maximum headloss of 6 inches W.C.
   8. Anchor bolts shall be Type 316L stainless steel and conform to the requirements of Section 05051, Anchor Bolts, Inserts and Epoxy Dowels.
   9. Equipment Tags: From the factory, vessel shall be provided with Type 316L stainless steel equipment tags with the following minimum information:
      a. Media Type.
      b. Vessel Dimensions.
      c. Date of Manufacture.
      d. Design Conditions.

C. Media
   1. The media utilized by the reactor vessel shall be provided by the system supplier and supplied pre-installed in the vessel before shipping.
   2. Media: Virgin Grade Vapor Phase Carbon – 4mm Pellet
   3. 300 cfm @ 6 inches w.c.

D. Manufacturers/Models:
   1. Odor Control Canister: CalgonCarbon Ventsorb PE
   2. No equal allowed

2.2 SPARE PARTS AND MAINTENANCE MATERIALS

A. Each odor control unit shall be furnished with a manufacturer's repair kit which shall include as a minimum the following:
   1. Replacement media for two (2) complete media replacement.
   2. Special tools required for maintenance and operation.

B. Spare parts shall be packed in sturdy containers with clear indelible identification markings and shall be stored in a dry, warm location until transferred to the OWNER at the conclusion of the Project.

2.3 SURFACE PREPARATION AND PAINTING

A. Motors, drives and appurtenances shall receive shop primer and shop coating conforming to requirements of Section 09900, Painting. If any damage to the paint system occurs, the equipment shall be repainted as directed by the ENGINEER.

B. Surface preparation and painting shall conform to the requirements of Section 09900, Painting.

C. All gears, bearing surfaces, machined surfaces and other surfaces which are to remain unpainted shall receive a heavy application of grease or other rust-resistant coating. This coating shall be maintained during storage and until the equipment is placed into operation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Equipment shall be installed as specified herein, as indicated on the Drawings, and in accordance with the manufacturer's recommendations and instructions.

B. All equipment shall be installed with Type 316L stainless steel anchor bolts as specified in Section 05051, Anchors, Inserts and Epoxy Dowels.

3.2 MANUFACTURER'S FIELD SERVICES

A. The manufacturer shall provide one (1) person-day for installation inspection, system start up, flow balancing, air testing and training. Manufacturer shall be provide a written report on the results, air sample results and expected media life.

+ + END OF SECTION + +

SECTION 13305

SPECIFIC CONTROL STRATEGIES

PART 1 - GENERAL

1.1 SUMMARY

A. Coordination:
   1. Equipment manufacturer to provide screen shots for the PLC controls at the HMI screen for review and approval. Controls terminology mentioned in this section may differ from the existing plant naming convention. Once PLC and control panel drawings are received and reviewed, these terminologies will be commented upon and will be updated.

B. Section includes:
   1. Loop descriptions:
      a. Specific control requirements and functional descriptions for individual control loops.

C. Related sections:
   1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
   2. It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

D. Trending is to be provided for all instruments provided in this project. Programming and transmitters shall be selected accordingly.

1.2 REFERENCES

A. See Division 1, Division 16 and Division 13.

1.3 DEFINITIONS

A. List of Terms

HMI	human machine interface
LCP	local control panel
LOR	local-off-remote
MCC	motor control center
P&IDs	process and instrumentation diagrams
PLC	programmable logic controller
SCADA	supervisory control and data acquisition
VFD	variable frequency drive

1.4 SUBMITTALS

A. Develop detailed loop descriptions based on the information in the Contract Documents, and submit as specified in Division 1 and Division 17.

1. For each control loop, provide a detailed functional description of the operation of the equipment, signals, and controls shown on the P&IDs:
    a. Include all functions depicted or described in the Contract Documents.
    b. Include the following within each loop description:
        1) All requirements specific to that loop.
        2) Common control requirements applicable to that loop.
        3) List of all ranges, setpoints, timers, values, counters, etc.
2. Where there are similar loops with identical control, such as multiple loops for individual raw water pumps, only 1 loop description need be developed and the remaining loops may reference that loop description.

B. Loop description format:
    1. Loop number and title.
    2. References:
        a. List P&IDs that are specifically referenced.
    3. Abstract:
        a. General description of how the loop works, what devices are involved, and how the process will be controlled.
        b. Process values, setpoints, and limits, including units and ranges:
            1) Show span and range values for analog inputs and outputs, and operating point and deadband for discrete inputs.
    4. Hardwired control:
        a. Detailed description of the control functions at the local level.
        b. Function of local operator interfaces.
        c. Operation of hardwired field pilot controls:
            1) Pushbuttons.
            2) Selector switches.
            3) Potentiometers.
            4) Pilot lights, indicators, and other displays.
    5. Hardwired interlocks:
        a. Explanation of the operation of system interlocks and hardwired permissive conditions.
    6. PLC control:
        a. Detailed description of the control functions that are under control of the PLC.
        b. Operator controls and automatic controls.
        c. Setpoints, alarms, etc.:
            1) Include units and ranges for analog values.
            2) Include span and range for analog inputs and outputs.
            3) Include operating point and deadband for discrete inputs, and identify conditions where contacts are open, and when they close.
        d. Control sequences.
    7. Software interlocks:
        a. Operation of system software interlocks.
    8. HMI control:
        a. Detailed description of the operator controls.
    9. SCADA control:
        a. Detailed description of the operator controls.
        b. Setpoints, alarms, etc.
    10. Indicators and alarms:
        a. List any indicators and alarms specific to the loop that are not covered in the common control strategies.
    11. Failure modes:

a. List any failure modes specific to the loop that are not covered in the common control strategies.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.1 INSTALLATION, APPLICATION, CONSTRUCTION

A. Lift Station:
   1. References:
      a. P&ID: N-601.
   2. The description below is typical for loops 101 and 201.
   3. Abstract:
      a. The Lift Station is designed to lift and convey wastewater from Yavapai Hills to Ranch #1 Lift Station.
      b. The Pumps are VFD operated and interlocked to allow only one pump running at a time.
      c. A magnetic flow meter is provided on the lift station discharge to monitor flow.
      d. The Pumps can be controlled locally by the operator via the local control panel (LCS-101/LCS-201).
      e. In automatic mode the pump is controlled by the PLC to maintain constant level.
   4. Hardwired control:
      a. When the Local-Off-Remote (LOR) switch (HS-101A/HS-201A) at LCS-101/LCS-201 is in LOCAL position, the pump is controlled by the start/stop hand momentary switches on the respective LCS.
      b. When the LCS Start button for the pump is pushed by the operator, the pump operates at the speed setpoint set by the operator at the LCS.
      c. When the Stop button for the pump is pushed by the operator, the pump stops.
      d. After an alarm condition has cleared the RESET button located on the VFD will release the alarm.
   5. Hardwired interlocks:
      a. The pump is stopped and prohibited from starting if:
         1) Motor high temperature switch (TSH-101/201) is activated.
         2) Motor leak switch (MSH-101/201) is activated.
         3) Low Lift Station level switch (LSL-101/201) is activated.
         4) Pumps are hardwired interlocked so that only one pump can run at a time.
   6. SCADA/PLC Pump control:
      a. When the LOR switch at the LCP-VFD is in the REMOTE position, the pump is controlled by the PLC. SCADA will have a software Manual-Off-Auto selector switch for the pump.
      b. Pumps shall be fully controlled via remote offsite connection at Sundog WRF.
      c. When the software selector is in the MANUAL setting, the pump is started and stopped using Start-Stop (MN-101 AND MS-101) controls displayed on the SCADA graphic screen. Speed of the pump is varied by changing the set-point (SC-101) on the SCADA graphic screen.

d. When the software selector is in the AUTO setting, the pump will be operated in Lead/Lag based on the selected mode of operation.
    1) Level Mode:
        a) The operator sets level setpoint inside the wet well (initially set at 4.2 feet from bottom).
        b) When pump is called to start, pump speed shall ramp up to 86% (Operator adjustable).
        c) VFD speed will vary based on PID controller to maintain this level setpoint.
        d) Pump turns off when one or more of following criteria are met:
            1. Operator turns off the pump.
            2. Based on Low Level in Lift Station (Operator Adjustable).
    2) The pumps shall rotate lead/lag based on an operator adjustable setpoint (initially set at 7 days).
e. If connection to SCADA/PLC is interrupted, then the pump shall operate based on the floats within the well described as follows:
    1) LSHH: 5329'
    2) LSH: 5328.5'
    3) Pump Start: 5326.33'
    4) Pump Stop: 5325.33'
    5) LSLL: 5323.8'

7. Software interlocks:
    a. Prohibit the pump from running when:
        1) Lift station low level from LIT-101, (Operator Adjustable).
8. Indicators and alarms:
    a. As indicated on the Drawings and Specifications.
    b. At a minimum provide the following:
        1) VFD:
            a) Amber - High motor temperature alarm (TSH-101)
            b) Amber - Motor leak alarm (MSH-101)
            c) White – Power On
            d) Green – Motor On/Running (YL-101)
            e) Amber – Motor Fault (YA-101)
            f) VFD Speed (HMI)
            g) Motor run elapsed time
        2) SCADA:
            a) Pump Status
                1. Red – On/Running (YL1-101)
                2. Amber – Failed (YA-101)
            b) Pump remote status (YR-101)
            c) VFD speed (SI-101)
            d) Motor run time (K1-101)
            e) Flow (FI-103)
            f) Low flow alarm (FAL-103)

B. Existing Wet Well Pumps (Overflow)
    1. References:
        a. P&ID N-602
    2. The description below is typical for loop 601 and 602
    3. Abstract:
        a. The overflow is designed to allow for the accumulation of flow volume in the event of a 100-year 2 hour event.

b. The overflow pumps are to discharge into the proposed manhole labeled as Manhole No. 2 while having the ability to pass 2 inch solids.
c. The pumps are operated on a single frequency of 60 Hz.
d. The pumps can be controlled locally at the vendor provided LCP (LCP-601).
e. The pumps are to operate based upon level switch indicating floats, and shall feature an LSHH, LSH, LEAD and STOP floats.

4. Hardwired control:
   a. As indicated on the drawings.
   b. To be provided by VENDOR, but will at a minimum provide:
      1) Hand-Off-Auto (HM)
      2) Reset (HMS)
      3) Fault light – Red
      4) Running light – Green
      5) Power light – White
      6) Silence (HMS) – to silence audible alarm
      7) Test (HMS) – to test that alarms are functioning properly
5. SCADA/PLC Pump Control
   a. When the HOA (Hand-Off-Auto) is in the Hand position, the pump shall be controlled at the LCP using the hardwired controls.
   b. When the HOA (Hand-Off-Auto) is in the Off position, the pump shall be off.
   c. When the HOA (Hand-Off-Auto) is in the Auto position, the pump shall be operated based on the vendor provided floats.
      1) Floats to be set at the following levels:
         a) LSHH: 4’
         b) LSH: 3.5’
         c) LEAD: 3’
         d) STOP: 2.5’
6. Hardwired interlocks:
   a. Per manufacturer.
7. Software interlocks:
   a. Per manufacturer.
8. Indicators and alarms:
   a. As indicated on the drawings.
   b. At a minimum provide the following
      1) SCADA:
         a) Well high high level alarm.
         b) Transfer pump general alarm.
         c) Transfer pump fault.
         d) Transfer pump running indicator.

++ End of Section ++

DIVISION 15

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SECTION 15010

PIPING SUPPORT SYSTEMS

PART 1 - GENERAL

1.1 SUBMITTALS

A. Shop Drawings:
   1. Details of each pipe support type used.

PART 2 - PRODUCTS

2.1 SUPPORT SYSTEMS:

A. Channel-type support systems
   1. 316 Stainless Steel
      a. Unistrut
      b. B-Line
      c. Or Equal.
   2. Non-metallic
      a. Aikenstrut
      b. CLIC
      c. Or Equal.

B. Hanger- and Clevis-type support systems
   1. B-line
   2. Anvil
   3. Or Equal

C. Stanchion-type support systems
   1. B-Line
   2. Anvil
   3. Or Equal

D. Adjustable Pipe Saddle Support
   1. B-Line, Figure B-3092
   2. Or Equal

E. Wall Bracket (14-inch to 24-inch pipe)
   1. B-Line Figure B-3067 Heavy Duty Angle Bracket
   2. Or Equal

F. Wall Bracket (8-inch to 12-inch pipe)
   1. B-Line Figure B-3066 Medium Duty Angle Bracket
   2. Or Equal

G. Wall Bracket (4-inch to 6-inch pipe)
   1. B-Line Figure B-3068 Light Duty Angle Bracket
   2. Or Equal

PART 3 - EXECUTION

3.1 INSTALLATION

A. In addition to the pipe supports specifically called for on the drawings, CONTRACTOR shall provide pipe supports as required to fully support all piping systems.

B. CONTRACTOR shall design, supply and install pipe support system using manufacturer's standard available pipe support hardware.

C. Pipe supports shall, at a minimum, be installed at the following locations:
   1. On both sides of each valve, piece of equipment or other appurtenance, such that allowance is made for removal of the valve, piece of equipment, or other appurtenance while leaving the pipe system fully supported. Support piping connections to equipment by pipe support and not by the equipment.
   2. Along straight runs of pipe, the maximum distance between supports shall be as listed below:

Pipe Diameter	Maximum Distance Between Supports	Minimum Hanger Rod Diameter (if Hanger Rods are used)
2" and smaller	6-feet	½"
2-1/2" to 6"	8-feet	¾"
8" to 12"	10-feet	2 @ ¾"
14" to 18"	10-feet	2 @ 1"
Over 18"	Custom Design	

   3. Directly supporting valves 8-inch in diameter and larger.
   4. At least two supports on each side of flexible couplings or flanged coupling adapters to provide that no load is applied to the flexible coupling.
   5. On the pipe within two pipe diameters of each side of elbows and each branch of tees and crosses.
   6. Where piping passes through walls, such that no load is transferred to the wall.

D. Install support systems in accordance with MSS SP 69, Pipe Hangers and Supports-Selection and Application and MSS SP 89, Pipe Hangers and Supports-Fabrication and Installation, unless shown otherwise.
   1. Support no pipe from the pipe above it.
   2. Do not install pipe supports and hangers in equipment access areas or bridge crane runs.

E. Bracing and lateral support:
   1. Provide lateral sway bracing on 10-foot maximum centers
      a. Brace hanging pipes against horizontal movement by both longitudinal and lateral sway bracing.
   2. Install lateral supports for seismic loads at all changes in direction.

F. Thermal expansion and thrust restraint
   1. Install pipe anchors where required to withstand expansion thrust loads and to direct and control thermal expansion.

G. Support types:
   1. Horizontal Suspended Piping:
      a. Single Pipes: Adjustable swivel-ring, splint-ring or clevis hangers.

b. Grouped Pipes: Trapeze hanger systems.
c. For insulated piping, furnish galvanized steel protection shields, welding insulation saddles, or precut sections of rigid insulation (with vapor barrier) at all hanger locations.

2. Horizontal Piping Supported From Walls:
   a. Single Pipes: Wall brackets or wall clips attached to wall with anchors. Clips attached to wall-mounted framing also acceptable.
   b. Stacked Piping:
      1) Wall-mounted framing system and clips acceptable for piping smaller than 3-inch minimal diameter.
      2) Piping clamps that resist axial movement of pipe through support not acceptable.
   c. Insulated piping shall have the insulation removed in the vicinity of wall brackets and piping clips to allow only direct pipe wall contact with the support system.
3. Horizontal Piping Supported From Floors:
   a. Stanchion Type:
      1) Pedestal type; adjustable with stanchion, saddle, and anchoring flange.
      2) Use yoked saddles for piping whose centerline elevation is 18 inches or greater above the floor and for all exterior installations.
      3) Provide neoprene waffle isolation pad under anchoring flanges, adjacent to equipment or where otherwise required to provide vibration isolation.
   b. Floor-Mounted Channel Supports:
      1) Use for piping smaller than 3-inch nominal diameter running along floors and in trenches at piping elevations lower than can be accommodated using pedestal pipe supports.
      2) Attach channel framing to floors with anchor bolts.
      3) Attach pipe to channel with clips or pipe clamps.
   c. Concrete Cradles:
      1) Use for piping larger than 3-inch along floor and in trenches at piping elevations lower than can be accommodated using stanchion type.
4. Vertical Pipe:
   a. Support with wall brackets and base elbow or riser clamps on floor penetrations.
   b. Insulated piping shall have the insulation removed in the vicinity of wall brackets and riser clamps, to allow only direct wall contact with the support system.

H. Standard Attachments:
1. To Concrete Ceilings: Concrete inserts.
2. To Steel Beams: I-beam clamp or welded attachments.
3. To Wooden Beams: Lag screws and angle clips to members not less than 2-1/2 inches thick.
4. To Concrete Walls: Concrete inserts or brackets or clip angles with anchor bolts.
5. Existing Walls and Ceilings: Install as specified for new construction, unless shown otherwise.
6. Repair mounting surfaces to original condition after attachments are made.

I. Isolation:
1. Install elastomeric inserts designed to isolate piping from pipe supports where copper pipe is run in stainless steel supports, or where other dissimilar metals are in contact with pipe supports.

J. Materials:

1. Channel-type, hanger-type and trapeze-type support systems and pipe racks constructed of channel systems:
   a. Provide non-metallic support systems in all chemical storage and feed areas or as otherwise noted on the Drawings. Provide type 316 stainless steel fasteners.
   b. Provide type 304 stainless steel support systems and fasteners in all other areas.
2. Stanchion-type support systems
   a. Provide steel and ductile iron stanchion components
   b. Coat stanchions after assembly per specification Section 09900, Painting.

+ + END OF SECTION + +

SECTION 15080

PIPING INSULATION

PART 1 - GENERAL

1.1 SUBMITTALS

A. Shop Drawings:
   1. Manufacturer's data on materials, construction, end connections, ratings, overall lengths, etc.

PART 2 - PRODUCTS

2.1 PIPE INSULATON

A. **INS-01:** Flexible Elastomeric Pipe Insulation (up to 6" diameter)
   1. Material: Flexible elastomeric pipe insulation, closed cell structure
   2. Provide a minimum of ¾-inch thickness
   3. Temperature Rating: -40 degrees to 200 degrees Fahrenheit
   4. Nominal Density: 6 pcf
   5. Conductivity in accordance with ASHRAE 90.1 and minimum of 0.27 BTU-in/hr-ft2 degrees F at 75 degrees F per ASTM C177 or ASTM C518.
   6. Minimum water vapor transmission of 0.10 perm-inch per ASTM E96
   7. Flame Spread Rating: Less than 25 per ASTM E84
   8. Joint sealant and tape per manufacturer
   9. Manufacturers and Products:
      a. Rubatex: R-180-FS
      b. Armstrong: Armaflex AP
      c. Or Equal

B. **INS-02:** Rigid Fiberglass with PVC Cover
   1. Material:
      a. Insulation: UL rated, preformed, sectional rigid fiberglass
      b. Vapor Barrier Jacket: Kraft paper with aluminum foil with pressure sensitive adhesive lap
      c. Cover: Preformed PVC Cover
         1) UV resistant
         2) Joints designed to shed water
         3) Color: White.
         4) Provide Identification Labels per the requirements of 10400 – Identification Devices
   2. Temperature Rating: 0 degrees to 850 degrees Fahrenheit
   3. Conductivity in accordance with ASHRAE 90.1 and minimum of 0.27 BTU-in/hr-ft2 degrees F at 75 degrees F per ASTM C177 or ASTM C518.
   4. Minimum water vapor transmission of 0.02 perm-inch per ASTM E96
   5. Flame Spread Rating: Less than 25 per ASTM E84
   6. Fittings and valves:
      a. Insulate with fabricated sections of insulation
      b. Wrap with vapor barrier jacket

c. Provide preformed PVC fitting cover specifically designed for fitting or valve
7. Manufacturers and Products:
   a. Owens-Corning Fiberglass; ASJ/SSL-II with PVC Cover
   b. Johns Manville Corp; Micro-Lok with Zeston 2000 PVC Cover
   c. Or Equal.

2.2 HEAT TRACING

A. Parallel resistance, low watt density, self limiting output electrical cable heaters. Designed for use on metallic or non-metallic piping, under insulation, for freeze protection.

B. Features:
1. Two 16 AWG multistrand copper buss wire
2. Extruded in a self-regulating conductive polymer core with polyolefin inner jacket
3. Tinned copper braid for mechanical protection and ground path
4. Covered with a thermoplastic elastomer overjacket for chemical protection. Suitable for use in chemical areas.
5. Designed to be field-cut and spliced
6. 120VAC
7. 8 watts/foot
8. Allowable circuit length up to 880 feet
9. Approximately 3/8 inch by 1/8 inch
10. Approved for use in Class I, Div 2 hazardous locations

C. Provide all connectors, cables, termination box, thermostat and other appurtenances required for a complete installation.

D. Manufacturers and Products:
1. Chromalox; Model SRL
2. Tempco; Style SL
3. Raychem; Model BTV
4. Or Equal

2.3 HEATED FIBERGLASS ENCLOSURES

A. General:
1. Equipment ID: **HE-01**
2. Provide electrically-heated flip-top fiberglass heater enclosures where indicated on the Drawings.
3. Enclosure shall be specifically designed and thermostatically controlled for protection of piping and equipment from exterior temperatures to -30°F.

B. Enclosure:
1. The enclosure shall be constructed from minimum 1/8-in thixotropic polyester resin reinforced with fiberglass strands and shall be ASSE 1060 certified.
2. The enclosure shall have smooth molded exterior and shall be provided with a UV-inhibited isophthalic polyester gel coat.
3. Enclosure shall utilize a lockable flip-top design and shall not require removal of the entire unit for maintenance access.
4. Enclosure shall be provided with a continuous hinge and overlapping lid seam design.

C. Insulation: Minimum 1.25-in. (R8) thick unicellular, non-wicking polyisocyanate foam

D. Drain Ports:
   1. Enclosure shall be provided with two drain ports sized for full port backflow discharge, one at each end of the enclosure.
   2. Drains shall be designed for "one way" flow to limit intrusion of debris and/or vermin.

E. Anchorage:
   1. Enclosure shall be anchored to a reinforced concrete pad by means of steel anchors.
   2. Enclosure shall be provided with minimum four internal brackets for anchorage.

F. Heating:
   1. Minimum rated capacity: 1,000 W
   2. Power: 120V, single phase
   3. Controlled by integral thermostat and sized to maintain the interior at a minimum of +40°F.

G. Manufacturers and Products:
   1. Hubbell Power Systems, Inc. Hot Box Model HF026070045
   2. Or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Where called for in the drawings or pipe schedule, provide heat tracing between pipe and insulation.
   1. Install heat tracing per manufacturer's instructions
   2. Provide electrical service to heat tracing from nearest 120V panelboard or receptacle, whether shown on the electrical drawings or not. Electrical service shall be in accordance with all codes and regulations for the installation.

B. Insulate all piping, valves and fittings for the piping systems (Flow Stream IDs) where insulation is called for in 15100 PS - Piping Schedule

C. Install insulation according to manufacturer's instructions
   1. Install insulation only after piping system has passed pressure testing.
   2. Requirement for insulation does not negate the requirement for coating of the piping system. Apply piping coating system as called for in 15100 PS – Piping Schedule. Allow coating system to completely cure prior to installation of pipe insulation.
   3. If heat tracing is required on piping system, do not install pipe insulation until after heat tracing has been installed and successfully tested.
   4. Do not "gap" insulation at pipe supports. Trim insulation to allow for pipe support while providing continuous insulation of piping in those parts of the pipe not in contact with pipe support.
   5. Install removable/replaceable insulation sections and cover panels over fittings or valves which require maintenance access.
   6. Use accessories, adhesives and tapes per manufacturer's recommendations.

D. Finishing

1. Overall installation shall result in smooth, straight, neat and clean piping insulation system. No frayed ends, irregular lumps or other unsightly installation result will be acceptable.

+ + END OF SECTION + +

SECTION 15100

PIPE AND FITTINGS

PART 1 - GENERAL

1.1 SUBMITTALS

A. Shop Drawings:
   1. Product data sheets for each piping system.
      a. Include information on pipe, fittings and joint systems.
   2. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
   3. Complete descriptions and data for all coatings and linings.
   4. Tests and inspection data for pipe and coatings/linings.
   5. Qualifications for welders and/or technicians performing joining processes that requires specialized equipment to perform the work or as specifically identified herein.

B. Operation and Maintenance Data as specified in Section 01330, SUBMITTAL PROCEDURES.

1.2 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. In accordance with manufacturer's directions.

PART 2 - PRODUCTS

2.1 PIPING SYSTEM DATA SHEETS

A. Piping system data sheets (PSDS) have been attached to this Specification and are incorporated herein by reference. Provide piping systems in accordance with piping system data sheets.

2.2 THRUST RESTRAINT

A. Provide rigid or restrained joints and fittings for all piping systems specified with a test pressure in the Pipe Schedule.

B. Unless otherwise specified in the Pipe Schedule or shown on the Drawings, thrust blocks shall not be used.

PART 3 - EXECUTION

3.1 PIPE SCHEDULE

A. A Pipe Schedule has been attached to this Specification and is incorporated herein by reference. Install piping systems in accordance with Pipe Schedule.

B. For pipe which is shown on the Drawings, but not referenced in the Pipe Schedule, CONTRACTOR to provide pipe material and fittings which are appropriate for the intended service and acceptable to the ENGINEER.

3.2 PREPARATION

A. Inspect pipe and fittings before installation, clean ends thoroughly, and remove foreign matter and dirt from inside.

B. Repair any coatings or linings which were damaged during shipping and handling using manufacturer-approved coating and lining repair materials in accordance with manufacturer's instructions.

3.3 INSTALLATION

A. General:
   1. Join pipe and fittings in accordance with manufacturer's instructions, unless otherwise shown or specified.

B. Joint Assembly:
   1. Flanged Joints (FLG):
      a. Bolt Holes: Straddle vertical centerlines, aligned with connecting equipment flanges or as shown.
      b. Follow a bolt tightening pattern which produces uniform bearing pressure.
      c. Do not over-tighten bolts. Follow manufacturer's recommendation for bolt torque.
      d. Provide gasket at every flanged joint.
      e. Provide insulating flange kit where indicated on Drawings and required in this Specification.
   2. Threaded and Coupled Joints (THR):
      a. Conform to ANSI B1.20.1.
      b. Produce sufficient thread length to ensure full engagement when screwed home in fittings.
      c. Ream pipe ends and clean chips and burrs after threading.
      d. Make connections with not more than three threads exposed.
      e. Lubricate male threads only with thread lubricant or tape as specified on Piping Data Sheets.
      f. PVC Threaded Joints:
         1) Provide Schedule 80 threaded nipple where necessary to connect to threaded valve or fitting.
         2) Use strap wrench for tightening threaded plastic joints. Do not overtighten fittings.
      g. HDPE Threaded Joints:
         1) Joining HDPE pipe with threaded connections is not allowed unless specifically approved by the ENGINEER
      h. Provide dielectric union or insulating coupling where indicated on Drawings and required in this Specification.
   3. Grooved-End Joints (GRV):
      a. Type: Rigid, except where joints are used to correct misalignment, to provide flexibility, and where shown otherwise, in which case provide flexible type.
      b. Grooved end joints are not allowed for plastic pipes unless approved by the ENGINEER.
   4. Soldered Joints (SLD):

a. Before soldering, remove stems and washers from solder joint valves.
b. Use only solder specified for particular service.
c. Cut pipe ends square and remove fins and burrs.
d. Protect adjacent surfaces from damage during soldering.
    1) Protect from high temperatures due to flame
    2) Protect from damage due to dripping flux or solder
e. After thoroughly cleaning pipe and fitting of oil and grease using solvent and emery cloth, apply noncorrosive flux to the male end only.
f. Solder Joint
g. Wipe excess solder from exterior of joint before hardened.

5. Solvent Welded Joints (SLV):
    a. Use only solvent cement which is rated for use in the service intended. Check compatibility of solvent cement with service, especially in pipelines which carry chemicals.
    b. Observe all manufacturer's requirements for environmental conditions for use of solvent cement.
    c. Cut pipe ends square and remove fins and burrs.
    d. Apply appropriate primer.
    e. Apply solvent cement and assemble joint.
        1) Hold in place long enough for solvent cement to set-up and hold joint, as assembled, until solvent cement has cured.
    f. Wipe excess solvent cement from exterior of joint before hardened.
6. Proprietary Restrained Mechanical Joints (PRJ):
    a. PRJ piping shall be furnished with factory-fabricated retainer weldment on spigot end.
    b. If PRJ piping is field cut, the pipe joint shall be restrained using Restrained Mechanical Joint (RMJ) Glands as specified in Section 15120, Piping Specialties. Field welding of retainer weldment will not be allowed.

C. Exposed Piping Installation:
1. Piping Runs:
    a. Parallel to building or column lines and perpendicular to floor, unless shown otherwise.
    b. Piping upstream and downstream of flow measuring devices shall provide straight lengths as required for accurate flow measurement.
2. Supports: As specified in Section 15010, PIPING SUPPORT SYSTEMS.
3. Group piping wherever practical at common elevations; install to conserve building space and not interfere with use of space and other work.
4. Provide unions or flanges at each piping connection to equipment or instrumentation on equipment side of each block valve to facilitate installation and removal.
5. Install piping so that no load or movement in excess of that stipulated by equipment manufacturer will be imposed upon equipment connection;
6. Install piping to allow for contraction and expansion without stressing pipe, joints, or connected equipment.
7. Piping clearance, unless otherwise shown:
    a. Over Walkway and Stairs: Minimum of 7 feet 6 inches, measured from walking surface or stair tread to lowest extremity of piping system including flanges, valve bodies or mechanisms, insulation, or hanger/support systems.
    b. Between Equipment or Equipment Piping and Adjacent Piping: Minimum 3 feet 0 inch, measured from equipment extremity and extremity of piping system including flanges, valve bodies or mechanisms, insulation, or hanger/support systems.

c. From Adjacent Work: Minimum 1 inch from nearest extremity of completed piping system including flanges, valve bodies or mechanisms, insulation, or hanger/support systems.
d. Do not route piping in front of or to interfere with access ways, ladders, stairs, platforms, walkways, openings, doors, or windows.
e. Headroom in front of openings, doors, and windows shall not be less than the top of the opening.
f. Do not install piping containing liquids or liquid vapors in transformer vaults or electrical equipment rooms.
g. Do not route piping over, around, in front of, in back of, or below electrical equipment including controls, panels, switches, terminals, boxes, or other similar electrical work.

D. Buried Pipe Installation:
1. Pipe Placement:
a. Keep trench dry until pipe laying and joining are completed.
b. Exercise care when lowering pipe into trench to prevent twisting or damage to pipe.
c. Prevent foreign material from entering pipe during placement.
1) Close and block open end of last laid pipe section when placement operations are not in progress and at close of day's work.
d. Lay pipe upgrade with bell ends pointing in direction of laying.
e. Deflect pipe at joints for pipelines laid on a curve using unsymmetrical closure of spigot into bell. Utilize a maximum of 75 percent of manufacturer's recommended allowable joint deflection.
1) If joint deflection of standard pipe lengths will not accommodate horizontal or vertical curves in alignment, provide:
a) Shorter pipe lengths.
b) Fittings/bends.
f. Secure pipe which has been placed from movement or damage while placing the next section of pipe.
g. Prevent uplift and floating of pipe prior to backfilling.

E. Cleaning:
1. Following assembly and testing, and prior to disinfection and final acceptance, flush pipelines with water at 2.5 fps minimum flushing velocity until foreign matter is removed. At a minimum, flush for a period of time which will flush the entire pipeline volume three times.
a. If impractical to flush large diameter pipe at 2.5 fps, clean in-place from inside by brushing and sweeping, then flush line at lower velocity. If lower velocity is used, flush the entire pipeline volume five times.
2. Provide temporary means of removing flushing water from pipeline during flushing.
3. Provide means for removal/screening of debris from the flushing water, disposal of debris and disposal of flushing water.

3.4 TESTING

A. Pressure test piping in accordance with the Pipe Schedule, and Section 15990, Pressure Testing of Piping Systems.

3.5 SUPPLEMENTS

A. The following supplements are attached to this Specification section and incorporated herein by reference:
   1. 15100 PS – Pipe Schedule
   2. 15100 PSDS CPVC – Solvent Welded CPVC Pipe
   3. 15100 PSDS DIP – Ductile Iron Pipe
   4. 15100 PSDS PVC1 – Solvent Welded Polyvinyl Chloride Pipe
   5. 15100 PSDS PVC4 – PVC Sewer Pipe
   6. 15100 PSDS SSTP – Stainless Steel Pipe

+ + END OF SECTION + +

SECTION 15100 PS

PIPE SCHEDULE

1.1 DESCRIPTION

A. General:
   1. This schedule is provided for the convenience of the CONTRACTOR. Some flow streams may be shown on the drawings, but not listed here.

B. Flow Stream IDs:
   1. DRN – Drain
   2. DR – Air Relief Drain
   3. FA – Foul Air
   4. OVF – Overflow
   5. FM – Forcemain
   6. SS – Sanitary Sewer
   7. V – Vent

C. Pipe Materials:
   1. CPVC – Solvent Weld CPVC Pipe
   2. DIP – Ductile Iron Pipe
   3. PVC1 – Solvent Welded Polyvinyl Chloride Pipe
   4. PVC4 – PVC Sewer Pipe
   5. SSP – Stainless Steel Pipe

D. Joint Types:
   1. MJ – Mechanical Joint
   2. RMJ – Restrained Mechanical Joint
   3. SLV – Solvent Welded Socket
   4. THR – Threaded

E. Lining Systems:
   1. CE – Ceramic Epoxy

F. Coating Systems: As described in Section 09900

1.2 PIPE SCHEDULE

Contractor shall install piping systems in accordance with the following pipe schedule:

FLOW STREAM I.D.	DESCRIPTION	SERVICE	EXPOSURE	SIZE RANGE	MATERIAL	JOINT TYPE	TEST PRESSURE	LINING	COATING SYSTEM/ COLOR	NOTES
DR	Air Relief Drain	Air	Exposed	2″	SSP	THR	None	None	300	
DRN	Drain	Sewer	Buried	All	PVC1	SLV	5 psi	None	None	
FA	Foul Air	Air	Exposed	All	CPVC	SLV	None	None	301	
FM	Forcemain	Sewer	Buried	2″	PVC1	SLV	30 psi	None	None	
			Exposed	10″	DIP	RMJ	400 psi	Ceramic Epoxy	None	
			Exposed	10″	DIP	FLG	400 psi	Ceramic-Epoxy	None	
OVF	Overflow	Sewer	Buried	15″	PVC4	SLV	20 psi	None	None	1., 2.
SS	Sanitary Sewer	Sewer	Buried	15″	PVC4	SLV	20 psi	None	None	1., 2.
V	Vent	Air	Exposed	4″	CPVC	SLV	None	None	301	

1. Sanitary sewer shall be low pressure air tested per Specification Section 15990.

2. PVC pipe shall be deflection tested in accordance with Section 611 of City of Prescott Technical Specification.

SECTION 15100 PSDS CPVC

PIPING SYSTEM DATA SHEET – SOLVENT WELDED CHLORINATED POLYVINYL CHLORIDE PIPE

ITEM	DESCRIPTION
Pipe	Schedule 80 CPVC: Type IV, Grade I or Class 23447-B conforming to ASTM D1784 and ASTM F441. Manufactured with 2 percent titanium dioxide for ultraviolet protection. Threaded nipples shall be schedule 80.
Fittings	Schedule 80 CPVC as Specified Under Pipe Above: Conforming to the requirements of ASTM F439 Rev A for socket-weld type and ASTM F437 for threaded type. Manufactured with 2 percent titanium dioxide for ultraviolet protection.
Joints	Solvent socket-weld except where connection to valves and equipment may require future disassembly.
Flanges	One piece, molded hub Type CPVC flat face flange in accordance with Fittings above; 125-pound ANSI B16.1 drilling.
Bolting	Flat Face Mating Flange or In Corrosive Areas: ASTM A193/A193M Rev A Type 316 stainless steel Grade B8M hex head bolts and ASTM A194/A194M Grade 8M hex head nuts. Raised Face Mating Flange: Carbon steel ASTM A307 Grade B square head bolts and ASTM A563 Grade A heavy hex head nuts.
Gaskets	Flat-Face Mating Flange: Full faced 1/8-inch thick EPDM rubber. Raised-Face Mating Flange: Flat ring 1/8-inch EPDM rubber, with filler gasket between OD of raised face and flange OD to protect the flange from bolting moment.
Solvent Cement	As recommended by the pipe and fitting manufacturer conforming to ASTM F493 Rev A.
Thread Lubricant	Teflon tape.

SECTION 15100 PSDS DIP

PIPING SYSTEM DATA SHEET – DUCTILE IRON PIPE

ITEM	DESCRIPTION
Pipe	**Buried Piping:** Pressure class as indicated in the pipe schedule. If not indicated: • All pipe 12" diameter and smaller shall be pressure class 350. • All pipe 14" through 20" shall be pressure class 250. • All pipe larger than 20" shall be pressure class 200. **Flanged Piping:** Special Thickness Class 53 Pressure class shall be per AWWA C150/A21.50 and AWWA C151/A21.51 All buried pipes designed to carry recycled water shall be distinctively wrapped in purple tape.
Lining	**Wastewater:** Ceramic epoxy as follows: 1. Amine cured novalac epoxy containing at least 20% by volume of ceramic quartz pigment. 2. Permeability rating of 0.00 when tested per Method A of ASTM E 96, Procedure A with a test duration of 30 days. 3. Minimum lining thickness: 40 mils nominal dry film thickness. 4. The following tests must be run on coupons from factory lined Ductile Iron pipe: a. ASTM B 117 Salt Spray (scribed panel). Results to equal 0.0 undercutting after two years. b. ASTM G 95 Cathodic Disbondment (1.5 volts at 77ºF). Results to equal no more than 0.5 mm undercutting after 30 days. c. Immersion Testing rated using ASTM D 714. i. 20% Sulfuric Acid: No effect after two years. ii. 140ºF 25% Sodium Hydroxide: No effect after two years. iii. 160ºF Distilled Water (scribed panel): No effect after two years. iv. 120ºF Tap Water (scribed panel): 0.0 undercutting after two years with no effect. v. Abrasion Resistance: Less than .075 mm (3 mils) loss after one million cycles on a ±22.5º sliding aggregate slurry abrasion tester using a sharp natural siliceous gravel with a particle size between 2mm and 10 mm (European Standard SN598). 5. Manufacturer and Product: a. Protecto 401 Ceramic Epoxy Lining; Or Equal. b.

ITEM	DESCRIPTION
Coating	Unless otherwise specified in the Pipe Schedule, piping shall be coated as follows: **Buried Piping:** • AWWA C105/A21.5: Polyethylene encasement, 4-mil high-density cross laminated or 8-mil linear-low density, color as required by local/state regulations. **Exposed/Immersed Piping:** • Primer Coating: Where shop primer is applied to protect pipe during shipping, storage and handling, primer shall be compatible with pipe coating requirements of Section 09900, Painting.
Fittings	Lined and coated same as pipe. **Flange (FLG):** AWWA C110/A21.10 ductile iron, faced and drilled, 125-pound flat face. Gray cast iron will not be allowed.
Joints	**Mechanical (MJ):** 250 psi minimum working pressure. **Restrained Mechanical Joint (RMJ):** Standard MJ Joint with RMJ gland conforming to requirements of Section 15120, PIPING SPECIALTIES. Branch connections 3 inches and smaller, shall be made with service saddles as specified in Section 15120, PIPING SPECIALTIES.
Couplings	**Grooved End:** 250 psi minimum working pressure, malleable iron per ASTM A47 or ductile iron per ASTM A536. Victaulic. **Grooved End Adapter Flanges:** 250 psi minimum working pressure, malleable iron per ASTM A47 or ductile iron per ASTM A536. Victaulic.
Bolting	**T-Bolts and other specialty bolts:** Manufacturer's standard. **Hex Bolts:** ASTM A307, Grade B carbon steel hex head bolts. ASTM A320 B8 Type 304 stainless steel, if exposed. **Nuts:** ASTM A563, Grade A carbon steel hex head nuts. **T-Bolts and other specialty bolts:** Type 304 stainless steel **Hex Bolts:** ASTM A193 B8, Type 304 stainless steel **Nuts:** ASTM A194 Grade 8, Type 304 stainless steel
Gaskets	**Push-On, Mechanical, and Proprietary Restrained Joints:** Red Rubber (SBR) conforming to ANSI/AWWA C111/A21.11. **Flanged**, Water and Sewage Service: 1/8 inch-thick, red rubber (SBR), hardness 80 (Shore A), rated to 200 degrees F, conforming to ANSI B16.21, AWWA C207, and ASTM D1330, Grades 1 and 2. Full face for 125-pound flat-faced flanges, flat-ring type for 250-pound raised-face flanges. Blind flanges shall be gasketed covering the entire inside face with the gasket cemented to the blind flange. Gasket pressure rating to equal or exceed the system hydrostatic test pressure.
Joint	Manufacturer's standard.

ITEM	DESCRIPTION
Lubricant	

SECTION 15100 PSDS PVC1

PIPING SYSTEM DATA SHEET – SOLVENT WELDED POLYVINYL CHLORIDE PIPE

ITEM	DESCRIPTION
Pipe	Schedule 80 Polyvinyl Chloride (PVC), unless indicated otherwise. Type I, Grade I or Class 12454-B conforming to ASTM D1784 and ASTM D1785. Pipe shall be manufactured with 1% titanium dioxide for ultraviolet protection. All pipes designed to carry recycled water shall be colored purple or distinctively wrapped in purple tape.
Fittings	Schedule to match pipe above, ASTM D2466 and ASTM D2467 for socket weld type and Schedule 80 ASTM D2464 for threaded type. Fittings shall be manufactured with 1% titanium dioxide for ultraviolet protection.
Joints	Solvent socket weld except where connection to threaded valves and equipment may require future disassembly.
Flanges	One piece, molded hub type PVC flat face flange in accordance with Fittings above, 125-pound ANSI B16.1 drilling
Bolting	**Hex Bolts:** ASTM A193 B8, Type 304 stainless steel **Nuts:** ASTM A194 Grade 8, Type 304 stainless steel
Gaskets	Flat-Face Mating Flange: Full-faced 1/8-inch thick EPDM rubber.
Solvent Cement	As recommended by the pipe and fitting manufacturer conforming to ASTM D2564, except solvent weld cement for PVC pipe joints in sodium hypochlorite service shall be free of silica filler and shall be certified by the manufacturer to be suitable for that service. Certification shall be submitted.
Thread Sealant	Teflon Tape.

SECTION 15100 PSDS PVC4

PIPING SYSTEM DATA SHEET – POLYVINYL CHLORIDE GRAVITY SEWER PIPE

ITEM	DESCRIPTION
Pipe*	Conform to the requirements of ASTM D3034 (4 to 15-inch) and ASTM F679 (18 to 24-inch). Provide minimum SDR-35 sewer pipe with a minimum pipe stiffness of 115 PSI. PWEagle, or Equal.
Fittings	Conform to the requirements of ASTM D3034 (4 to 15-inch) and ASTM F679 (18 to 24-inch). GPK, or Equal.
Joints	Rubber-gasketed bell and spigot or rubber-gasketed couplings conforming to ASTM D3212.
Gaskets	Conforming to the requirements of ASTM F477.
Joint Lubricant	Manufacturer's standard.

*: Refer to City of Prescott Specifications

SECTION 15100 PSDS SSTP

PIPING SYSTEM DATA SHEET – STAINLESS STEEL PIPE

ITEM	SIZE	DESCRIPTION
Pipe		Austenitic stainless steel, ASTM A312, Grade TP 316 seamless, or welded
	2 inch & smaller	Schedule 80
	2-1/2 thru 6 inch	Schedule 40
Joints	3 inch & smaller	Threaded or flanged at valves and equipment.
	4 inch & larger	Flanged at valves and equipment.
Couplings		Threaded, Type 316 Stainless Steel, Class 3000: LF2 ASME B16.11, SA182
Flanges		Class 150, F316/316L, ASTM A102, ANSI B16.5 Class 150 or Class 300, threaded, 1/16-inch raised face.
Unions		Threaded Type 316 Stainless Steel, Class 3000: MSS SP83 ,SA182
Plugs		Threaded Type 316 Stainless Steel, Class 3000: Threads conform to ASME B1.20.1 NPT; Materials conform to ASTM A182, Dimension conform to ASME B16.11
Bolting		Hex Bolts: ASTM A320/A320M, Type 316 stainless steel, grade 5 Nuts: ASTM F594, Type 316 stainless steel, grade 5
Gaskets	All Flanges	Flanged, Water and Sewage Service: 1/8-inch thick, red rubber (SBR), hardness 80 (Shore A), rated to 200 degrees F., conforming to ANSI B16.21, AWWA C207, and ASTM D1330, Grades 1 and 2. Blind flanges shall be gasketed covering the entire inside face with the gasket cemented to the blind flange.
Thread Lubricant	2 inch & smaller	Heavy duty anti-seize joint lubricant for stainless steel threads that is insoluble in water.

SECTION 15120

PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUBMITTALS

A. Shop Drawings:
   1. Manufacturer's data on materials, construction, end connections, ratings, overall lengths, etc.

PART 2 - PRODUCTS

2.1 SERVICE SADDLES

A. Double-Strap Iron:
   1. Pressure Rating: Capable of withstanding 150 psi internal pressure without leakage or over stressing.
   2. Run Diameter: Compatible with outside diameter of pipe on which saddle is installed.
   3. Taps: Iron pipe threads.
   4. Materials:
      a. Body: Malleable or ductile iron.
      b. Straps: Galvanized steel.
      c. Hex Nuts and Washers: Steel.
      d. Seal: Rubber.
   5. Manufacturers and Products:
      a. Smith-Blair; Series 313 or 366.
      b. Dresser; Style 91.
      c. Or Equal

2.2 FLEXIBLE COUPLINGS

A. Flexible Couplings (FC)
   1. Features:
      a. Description: Sleeve-type flexible couplings
      b. Pressure and Service: Same as connected piping.
      c. Sleeve material: Carbon steel for carbon steel and ductile iron piping systems, or stainless steel for stainless steel piping systems.
      d. Coating and Lining: All cast and carbon steel components shall be epoxy lined and coated, minimum 16 mils thickness. For potable water service, lining shall be NSF-61 certified.
      e. Gasket: EPDM
      f. Bolts and Nuts: Alloy steel, corrosion-resistant, prime coated. Buried couplings shall have Type 316 stainless steel bolts and nuts.
   2. Manufacturers and Products:
      a. Ductile Iron Pipe:
         1) Smith-Blair, Inc.; Style 411.
         2) Or Equal.

B. Flanged Coupling Adapters (FCA)
   1. Features:
      a. Description: One end of adapter shall be flanged and the other end shall have a sleeve type flexible coupling.
      b. Pressure and Service: Same as connected piping.
      c. Adapter body material: Cast iron or steel.
      d. Gasket: EPDM
      e. Bolts and Nuts: Alloy steel, corrosion-resistant, prime coated. Buried couplings shall have Type 316 stainless steel bolts and nuts.
   2. Manufacturers and Products:
      a. Ductile Iron Pipe:
         1) Dresser Piping Specialties; Style 227.
         2) Smith-Blair, Inc.; Style 127.
         3) Or Equal.

C. Restrained Flanged Coupling Adapters (RFCA)
   1. Features:
      a. Description: One end of adapter shall be flanged and the other end shall have a sleeve type flexible coupling.
      b. Pressure and Service: Same as connected piping.
      c. Adapter body material: Cast iron or steel.
      d. Gasket: EPDM
      e. Bolts and Nuts: Alloy steel, corrosion-resistant, prime coated. Buried couplings shall have Type 316 stainless steel bolts and nuts.
      f. Restraining lug.
   2. Manufacturers and Products:
      a. Ductile Iron Pipe:
         1) Romac Industries; RFCA
         2) Or Equal.

D. Restraint Rods for Flexible Couplings: As shown on the Drawings

2.3 RESTRAINED COUPLINGS

A. Restrained Mechanical Joint Glands (RMJ)
   1. Pressure Rating:
      a. Minimum Working Pressure Rating: Not less than 150 psi.
      b. Safety Factor: Not less than two times working pressure and shall be supported by manufacturer's proof testing.
   2. RMJ gland shall be designed for use with standard mechanical joint pipe. Pipe restraint products designed for use with push-on joints will not be acceptable.
   3. Thrust Restraint:
      a. Provide hardened steel wedges that bear against and engage outer pipe surface, and allow articulation of pipe joint after assembly while wedges remain in their original setting position on pipe surface.
      b. Products employing set screws that bear directly on pipe will not be acceptable.
   4. Manufacturer and Product:
      a. Ductile Iron Pipe Only
         1) EBAA Iron Sales Co.; Megalug.
         2) Romac Industries Inc.: RomaGrip
         3) Or Equal.

B. Dismantling Joint
   1. Pressure Rating
      a. Minimum Working Pressure Rating: Not less than 150 psi
      b. Pressure rating to be no less than test pressure for piping system in which the Restrained Dismantling Joint is used.
      c. Safety Factor: Not less than two times working pressure and shall be supported by manufacturer's proof testing.
   2. Thrust Restraint
      a. Provide steel tie rods, ASTM A 193 GR B7
      b. Number and arrangement of tie rods to provide dismantling joint assembly which meets pressure rating requirement.
   3. Materials of Construction
      a. Flanged Adapter Body: Steel
      b. Follower Flange: Ductile Iron
      c. Gasket: Buna-N, NSF-61 approved
      d. Flange: Steel, per AWWA C207
      e. Spigot: Steel
      f. Studs: Type 304 stainless steel
      g. Coating: NSF-61 approved epoxy
   4. Manufacturer and Product
      a. Smith-Blair, Model 975 or 972, as required for pressure rating
      b. Romac Industries, Style DJ400
      c. Or Equal.

2.4 ELASTOMER BELLOWS:

A. Type: Reinforced, molded wide-arch elastomer bellows

B. Features:
   1. End Connections: Flanged, drilled 125# ANSI B16.1 standard with split hot-dip galvanized steel retaining rings.
   2. Washers: Use with retaining rings to provide leak-proof joint at twice the rated pressure.
   3. Thrust Protection: Control rods with gusset connection shall prevent over-extension.
   4. Bellows Arch lining shall be Buna-N, nitrile, or butyl.
   5. Rated Temperature: 250 deg F.
   6. Rated Deflection and Pressure:
      a. Lateral deflection shall be ¾-inch minimum.
      b. Burst Pressure: Four times the working pressure.
      c. Compression deflection and minimum working pressure as follows:

Size (inch)	Deflection (inch)	Pressure (psig)
2-1/2 to 12	1.06	150
14	1.65	130
16 to 20	1.65	110

C. Manufacturers and Products:
   1. General Rubber Corp.; Style 1015 Maxijoint.
   2. Mercer; Flexmore Style 450.
   3. Goodall Rubber Co.; Specification E-711.
   4. Or equal.

2.5 MODULAR MECHANICAL SEAL

A. Type: Interconnecting synthetic rubber links shaped and sized to continuously fill annular space between pipe and sleeve, blockout, or core-drilled opening in concrete slabs or walls.

B. Features:
   1. Links: EPDM
   2. Bolts and nuts: Type 316 stainless steel
   3. Pressure plates: composite
   4. Temperature range: -40 to 250 degrees Fahrenheit
   5. Pressure rating: guaranteed by the manufacturer to provide a water-tight seal with a differential hydrostatic head of 40-feet of water

C. Manufacturers and Products:
   1. PSI-Thunderline; Link-seal, Type S-316
   2. Or equal

2.6 PIPE TO MANHOLE CONNECTORS

A. Type: Resilient rubber male-to-female wedge-style flexible connector between a circular gravity pipe and a circular opening core-drilled into a precast or cast-in-place concrete structure.

B. Performance Requirements:
   1. Able to hold 10 psi head pressure for 10 minutes with no leakage
   2. Load Rating: 150 lbs per inch pipe diameter

C. Materials:
   1. Body: resilient rubber material conforming to ASTM C923
   2. Hardware: 300 Series Stainless Steel conforming to ASTM C923, ASTM A666 and ASTM A240

D. Manufacturer and Products
   1. Trelleborg Pipe Seals Milford, Inc., Model Kor-N-Seal I – 106 Series for pipes up to 18” diameter and Kor-N-Seal II – 206 Series for pipes from 20” to 54” in diameter.
   2. Or Equal

2.7 CHEMICAL CONNECTION

A. Type: Lockable Male Cam-lock
   1. Materials:
      a. Adapter and Cap: Glass-reinforced polypropylene
      b. Gaskets and O-rings: Viton
      c. Handles, Rings, and Pins: Stainless Steel
   2. Temperature Rating: 0 to 150 deg F
   3. Pressure Rating:
      a. 0 deg F: 100 psi
      b. 70 deg F: 125 psi
      c. 150 deg F: 70 psi
   4. Adapter:
      a. 2” FNPT x Male quick connect adapter

5. Cap
    a. 2” Lockable Type

B. Manufacturers and Products:
    1. Banjo
        a. Adapter: 200A with Viton gasket
        b. Cap: 200CAP with Viton gasket
    2. Or equal

2.8 NON-METALLIC CORPORATION STOP WITH INJECTION QUILL

A. Type: Complete assembly of corporation stop, injection quill, and safety chain, designed for use on process pipes 4” or larger. Construction shall be fully compatible with service conditions.

B. Corporation Stop:
    1. Process Connection: 3/4” Male NPT.
    2. Rated 150 psi at 195 degrees F.
    3. ASTM D1784, Type I, Grade 1 chlorinated polyvinyl chloride body, ball, and stem, end entry.
    4. Threaded ends.
    5. Viton or Teflon seat.
    6. Viton O-rings and stem seals.

C. Injection Quill:
    1. Process Connection: 1/2” female NPT.
    2. Dimensions:
        a. Minimum 1/4” inside diameter.
        b. Tapered injector tip, oriented to maximize chemical dispersion.
        c. Select injection quill length such that tip of quill extends into process pipe between one-third and one-half of process pipe diameter. Minimum distance from pipe wall to injector tip shall be 2-inches.
    3. Materials:
        a. Solution Tube Assembly: CPVC.
        b. Ring, Sleeve and Capture Nut: PVDF.
    4. Minimum Pressure Rating: 150 psi.

D. Safety Chain:
    1. Designed to prevent injection quill withdrawal before corporation stop is closed.

E. Manufacturers and Products:
    1. Hydro Instruments, CS-075-CPVC.
    2. Neptune, CS2-75-PVC.
    3. Or Equal

2.9 STRAINERS

A. PVC Y-STRAINER, 4” diameter and smaller
    1. Materials:
        a. Body: PVC
        b. Hex Cleanout Cap: PVC
        c. Screen: PVC

d. O-rings and gaskets: EPDM
2. 1/32" perforated screen
3. Minimum Pressure Rating: 150 psi
4. Size and connection as shown on the Drawings
5. Manufacturer:
   a. Hayward Flow Control Systems
   b. Or Equal

2.10 PRESSURE GAGES

A. Type: Direct mounted, dial type pressure gage.
   1. Construction: Weatherproof,
      a. Case:
         1) 4-inch diameter
         2) Material: cast aluminum with black finish or 304 stainless steel
         3) Flangeless
         4) Bottom 1/4-inch N.P.T. connection.
      b. Ring: Chrome plated or stainless steel, close type.
      c. Dial: White face, black numbers and graduations.
      d. Window: Laminated safety glass or clear acrylic plastic.
      e. Pointer: Micrometer type, black finish, red tip.
      f. Movement: Stainless steel, rotary type, delrin sector and bushings.
      g. Bourdon Tube: Seamless phosphor bronze, Grade A over-pressured and stress-relieved.
      h. Socket and Tip: Forged brass, alloy steel and Type 316 stainless steel.
   2. Accuracy: 1 percent minimum.
   3. Range: Unless noted otherwise, provide gages with a range from 0 to 150 psi.
   4. Gage Cocks: Provide brass tee handle cock before each gage.
   5. Diaphragm Seals:
      a. Provide diaphragm seals on all installations where called for on the Drawings, Details or Specifications
      b. Diaphragm seals shall be thread-attached type with removable cleanout AISI Type 316 stainless steel diaphragm, zinc or cadmium plated carbon steel upper housing and stainless steel lower housing.
      c. The diaphragm shall be of continuous design to safely contain the process fluid in the event of gauge breakage or removal with the system under pressure.
      d. The lower housing shall be provided with a tapped ¼-inch NPT flushing connection and an M x F stainless steel needle valve.
   6. Provide snubber or pulsation dampener to protect gage.
   7. Reference ANSI B40.1 for Grade 1A gages.

B. Product and Manufacturer: Provide one of the following:
   1. Weksler Instrument Company, Regal Gauges.
   2. H.O. Trerice Company, 700 Series.
   3. Or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General
   1. Follow all manufacturer's directions

B. Flexible Couplings (FC)
   1. Follow all manufacturer's directions
   2. No more than 1-inch gap between pipe ends
   3. Center flexible coupling in joint
   4. Tighten bolts in an alternating pattern to provide even tension around the coupling
   5. Tighten bolts to specified torque
   6. In buried installations, wrap coupling with plastic fastened to pipe to protect bolts and coupling from backfill material

C. Flanged Coupling Adapters (FCA)
   1. Follow all manufacturer's directions
   2. No more than 1-inch gap between pipe plain end and flange face
   3. Tighten flange bolts prior to tightening coupling bolts
   4. Tighten bolts in an alternating pattern to provide even tension around the coupling
   5. Tighten bolts to specified torque
   6. In buried installations, wrap coupling with plastic fastened to pipe to protect bolts and coupling from backfill material

D. Restrained Mechanical Joint Glands (RMJ)
   1. Follow all manufacturer's directions
   2. Tighten mechanical joint gland bolts before tightening restraint lugs
   3. Tighten restraint lugs until torque head breaks off
   4. In buried installations, wrap joint with plastic fastened to pipe to protect bolts and coupling from backfill material

E. Pressure Gages
   1. Follow all manufacturer's directions
   2. Install diaphragm seals where process liquid would be detrimental to gage life (wastewater, chemical service, etc.)
   3. Check gage accuracy

F. Orifice Plate
   1. Follow all manufacturer's directions.
   2. The unit shall be "self centering" within the bolt circle of the flanges. No alignment of the orifice shall be necessary.
   3. Lubricate & tighten bolts diametrically alternating to recommend flange torque.
   4. If the plate is not bi-directional, insure plate is installed with the arrow facing in the same direction as flow.

+ + END OF SECTION + +

SECTION 15200

VALVES AND OPERATORS

PART 1 - GENERAL

1.1 SUBMITTALS

A. Shop Drawings:
   1. Product data sheets for make and model.
   2. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
   3. Certificate of Compliance for: Butterfly valves; full compliance with AWWA C504.

B. Tests and inspection data.

C. Operation and Maintenance Data as specified in Section 01330, SUBMITTAL PROCEDURES.

1.2 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. In accordance with manufacturer's directions.

PART 2 - PRODUCTS

2.1 GENERAL

A. All valves shall be the same size as the pipe in which they are installed, unless specifically noted otherwise on the Drawings.

B. All valves shall include all appurtenant parts (operators, chainwheels, handwheels, valve stems, floor stands, gear boxes, operating nut, etc.) for a complete operating valve.
   1. Valve shall be, as much as practical, fully factory assembled.

C. All valves shall open by turning counter-clockwise. Maximum force required for operation shall be 40 lbs.

D. Coatings and Linings:
   1. Provide factory-applied coatings as described herein.
   2. Where liquid epoxy coatings are specified, coatings shall conform to AWWA C550.
   3. Field coat the exterior of all valve bodies with the same coating as is required for the adjacent pipe in Section 09900, PAINTING and Section 15100, PIPE AND FITTINGS, unless otherwise specified.

E. Nuts, Bolts and Washers
   1. Hex Bolts: ASTM A320/A320M, Type 316 stainless steel, Grade B8, Class 2
   2. Nuts: ASTM F594, Type 316 stainless steel, Grade B8, Class 2
   3. Washers: Type 316 stainless steel

2.2 BALL VALVES

A. **BAV-03:** Stainless Steel Ball Valve, 3 Inches and Smaller
   1. Service: Water, air.
   2. Features:
      a. Threaded ends
      b. Rated minimum 800 psig WOG (Water-Oil-Gas)
      c. Stainless steel body
      d. Polished stainless steel ball
      e. Teflon seat
      f. Stainless steel lever-type handle
   3. Manufacturers and Products:
      a. Apollo, Type 76
      b. Watts Type S-FBV-1
      c. Or Equal

2.3 CHECK VALVES

A. **CKV-15:** Slanting Disc Check Valve, 2 Inches to 24 Inches:
   1. Service: Wastewater.
   2. Features:
      a. Slanting or tilting disc design
      b. Off-center pivot
      c. Body: ductile iron
      d. Two-piece design
      e. Disc: buna-n
      f. Pivot pin and bushing: stainless steel,
      g. ANSI B16.1, Class 250 flange
      h. 300 psi working pressure rating,
      i. Bottom mounted plunger,
      j. Coatings and Linings:
         1) Fusion bonded epoxy, 12 mil minimum, for valve interior and exterior.
   3. Manufacturers and Products:
      a. Val Matic; Surgebuster.

B. **CKV-10:** Swing Check Valve (2" to 24")
   1. Service: Water, Sewage, Sludge and General Service.
   2. Style: Swing Check, Outside lever and weight type, Flanged-End Connections
   3. General: Valves shall comply with AWWA C508.
   4. Body: Valve body and cover shall be fabricated with cast iron conforming to ASTM A 126 with flanged ends conforming to ANSI B16.1.
   5. Disc: The valve disc shall be fabricated of cast iron or ductile iron and rubber faced.
   6. Seat and Rings: The valve seat and rings shall be fabricated of bronze conforming to ASTM B62 or B148 or of Buna-N.
   7. Disc Bolt: A307 Steel
   8. Hinge: Ductile Iron
   9. Hinge Pin: The hinge pin shall be fabricated of stainless steel.
   10. Coatings and Linings:
      a. Liquid epoxy, 12 mil minimum, for valve interior and exterior.
      b. For potable water applications, epoxy lining shall be NSF 61 approved.
   11. Manufacturer:
      a. M&H; Style 159, Lever and Weight

b. Milliken; Figure 8001, Lever and Weight
c. Or equal.

C.

2.4 GATE VALVES

A. **GAV-10:** Resilient-Seated Gate Valve, 2 Inches to 24 Inches:
1. Service: Water.
2. Features:
a. Conforms to AWWA C509 (2") or AWWA C515 (3" to 24")
b. Iron body
c. Resilient seat, bronze mounted
d. Full port
e. Valve Ends:
1) Mechanical joint ends for buried service, unless shown otherwise on drawings or valve schedule
2) Flanged ends for exposed service
f. Non-rising stem
g. Actuator for Buried Service:
1) Stem extension, as required, to bring operating nut to within 12" of ground surface.
2) 2-inch operating nut
h. Actuator for Exposed Service:
1) Handwheel
i. Design working water pressure: 250 psig
j. Coatings and Linings:
1) Liquid epoxy, 12 mil minimum, for valve interior and exterior.
2) For potable water applications, epoxy lining shall be NSF 61 approved.
3. Manufacturers and Products:
a. Mueller 2360 (2") or 2361 (3" to 24")
b. M&H Valve; AWWA C509 (2") or AWWA C515 (3" to 24").
c. Or Equal.

2.5 PLUG VALVES

A. **PLV-10:** Eccentric Plug Valve, 3 Inches to 20 Inches:
1. Service: Water, sewage.
2. Features:
a. Non-lubricated type.
b. Drip-tight shutoff with pressure from either direction.
c. Features:
1) Body: Cast iron Type ASTM A126 Class B.
2) Plug:
a) Cast iron or 316 stainless steel.
b) Round or rectangular port of no less than 80 percent of connecting pipe area.
c) Coated with Buna-N, Chloroprene, or Hycar.
3) Seats: Type 316 stainless steel or nickel.
4) Stem:
a) Bearing: Self-lubricating stainless steel or reinforced Teflon.
b) Seal:

1. Multiple V-rings, U-cups, or O-rings of nitrile rubber.
2. Externally adjustable and re-packable without removing the bonnet or actuator from the valve under pressure.

c) Provide upper and lower grit seals on stem.

5) Ends:
   a) Exposed service: Flanged per ANSI B16.1 or grooved, as shown on Drawings or indicated on Valve Schedule.
   b) Buried service: Mechanical joint per ANSI A21.11.
6) Actuators:
   a) Exposed:
      1. Valves 3 Inches through 6 Inches: Wrench lever manual actuator.
      2. Valves 8 Inches through 20 Inches: Totally enclosed, geared, manual actuator with handwheel
   b) Buried: 2-inch nut per Valve Schedule.
7) Coatings and Linings:
   a) Liquid epoxy, 12 mil minimum, for valve interior and exterior.
   b) For potable water applications, epoxy lining shall be NSF 61 approved.

d. Pressure Rating:
   1) Valves 3 Inches through 12 Inches: 175 psi.
   2) Valves 14 Inches through 20 Inches: 150 psi.

3. Manufacturers and Products:
   a. DeZurik; Style PEC.
   b. Pratt; Ballcentric.
   c. Milliken; Millcentric.
   d. Or Equal.

2.6 AIR RELIEF AND VACUUM VALVES

A. **CARV-02:** Combination Air Release and Vacuum Valve, Sewer Service up to 150 psi:
   1. Service: Sewage.
   2. Features:
      a. Combines the operating features of both an air vacuum valve and air release valve, allowing to vent or re-enter system freely in either direction.
      b. Once air has been exhausted, uses sewer pressure to close valve. In CLOSED position, seat against resilient seat to prevent water leakage.
      c. Single-body type
      d. Rated 150 psi working pressure, orifice size by manufacturer (minimum orifice size 1/8-inch).
      e. Cast iron, ductile iron, or semi-steel body, cover with stainless steel float and trim.
      f. 2-inch inlet, 1-inch outlet.
      g. Suitable for use with sewage.
      h. Provide flushing connections for maintenance.
      i. Maximum Valve Height: 20-inches
      j. Provide vent hose or piping and route discharge line to nearest drain/structure.
      k. Coatings and Linings:
         1) Liquid epoxy, 12 mil minimum, for valve interior and exterior.
   3. Manufacturers:
      a. ARI D-025

2.7 OPERATORS:

A. General:
   1. Operator force not to exceed 40 pounds under any operating condition, including initial breakaway. Gear reduction operator when force exceeds 40 pounds.
   2. Operator self-locking type or equipped with self-locking device.
   3. Provide position indicator on all valves.
   4. Worm and gear operators one-piece design worm-gears of gear bronze material. Worm hardened alloy steel with thread ground and polished. Traveling nut type operators threaded steel reach rods with internally threaded bronze or ductile iron nut.
   5. Valve handles, wheels, etc. to be designed to accommodate a padlock.

B. Manual Operator:
   1. Galvanized and painted handwheels.
   2. Lever operators allowed on quarter-turn valves 8 inches and smaller.
   3. Cranks on gear type operators.
   4. For all valves above 5'-0" above adjacent working surface (finished floor or finished grade), provide chain wheel operator with tiebacks
   5. For all exposed valves below adjacent working surface (finished floor or walkway), provide extension stem, floor stands, and other accessories to permit operation from 2'-6" above adjacent working surface.
   6. For all buried valves 3" and larger, provide stem extension, valve bonnet, valve box and 2" AWWA operating nut such that operating nut is within 12" of adjacent finished grade.
      a. For small-diameter buried valves, provide cross-shaped handle for operating with forked key.

2.8 VALVE SCHEDULE

A. A Valve Schedule has been attached to this Specification and is incorporated herein by reference. Provide valves in accordance with Valve Schedule.

B. For valves that are not referenced in Valve Schedule, provide the valve type called for on the Drawings.

2.9 PREPARATION

A. Cleaning:
   1. Clean all mating faces of valve (threads, flange faces, etc.) prior to assembly.
   2. Remove all debris from valve body prior to assembly.
   3. Take extra care to clean mating faces of existing pipe and fittings which may have corrosion, dirt, debris and mineral build-up which should be removed for a proper fit.

B. Apply joint compound, lubricant, etc. as recommended by valve manufacturer for proper installation prior to installation.

C. Install valves in accordance with the following schedule and as noted on the Drawings:

2.10 INSTALLATION

A. Install valves per manufacturer's recommendations.

B. Install valves so handles operate from fully open to fully closed without encountering obstructions.

C. Install valves in location and orientation for easy access for routine operation and maintenance. Access should be such that an operator can operate the valve by reaching a handle, chain, etc. at a height between 2'-6" and 5'-0" above adjacent work surface (for buried valves, this is accomplished with a t-handle wrench and the operating nut being within 12" of finished grade).

D. Install plug valves with the seat side as indicated on the drawings. If manufacturer's recommendations differ from indicated seat direction on the drawings, or if no seat side is indicated, install plug valves with seat side as recommended by the manufacturer after obtaining approval from the ENGINEER.

2.11 TESTS AND INSPECTION

A. Valve may be either tested while testing pipelines, or as a separate step.

B. Test that valves open and close smoothly under operating pressure conditions. Test that two-way valves open and close smoothly under operating pressure conditions from both directions.

C. Inspect air release and vacuum valves as pipe is being filled to verify venting and seating is fully functional.

D. Count and record number of turns to open and close valve; account for any discrepancies with manufacturer's data.

E. Set, verify, and record set pressures for all relief and regulating valves.

F. Automatic valves to be tested in conjunction with control system testing. Set all opening and closing speeds, limit switches, as required or recommended by the ENGINEER.

2.12 SUPPLEMENTS

A. The following supplements are attached to this Specification section and incorporated herein by reference:
   1. 15200 VS – Valve Schedule

+ + END OF SECTION + +

SECTION 15200 VS

VALVE SCHEDULE

1.1 DESCRIPTION

A. General:
   1. This schedule is provided for the convenience of the CONTRACTOR. Some valves may be shown on the drawings, but not listed here.
   2. Valve specifications are given in Section 15200, Valves and Operators.

B. Valve Tag Number:
   1. Tag numbers are as noted in the Drawings.

C. Valve Type:
   1. Valve types are as described in 15200, Valves and Operators

D. Valve Ends:
   1. FLG – Flanged
   2. GRV – Grooved End
   3. LUG - Lugged
   4. MJ – Mechanical Joint
      a. Where the surrounding piping system is installed with restrained joints, MJ valves shall be installed using RMJ (restrained mechanical joint) glands per 15120, Piping Specialties.
   5. SLV – Solvent Welded Socket
   6. SLD – Soldered Socket
   7. THR – Threaded
   8. W – Wafer

E. Installation Codes
   1. Ex – Exposed
   2. Un – Underground

F. Valve Actuators, as described in 15200, Valves and Operators
   1. HW – Handwheel
   2. L – Lever
   3. N – 2” Nut
   4. N/A – Not Applicable

1.2 VALVE SCHEDULE

VALVE TAG NUMBER	VALVE TYPE	ENDS	DIAMETER	INSTALLATION	ACTUATOR
BAV-111	BAV-03	THR	2	Ex	L
ARV-111	CARV-02	THR	2	Ex	N/A
CKV-111	CKV-15	FLG	10	Ex	N/A
PLV-111	PLV-10	FLG	10	Ex	HW
BAV-112	BAV-03	THR	1/2	Ex	L

VALVE TAG NUMBER	VALVE TYPE	ENDS	DIAMETER	INSTALLATION	ACTUATOR
BAV-113	BAV-03	THR	1/2	Ex	L
BAV-211	BAV-03	THR	2	Ex	L
ARV-211	CARV-02	THR	2	Ex	N/A
CKV-211	CKV-10	FLG	10	Ex	N/A
PLV-211	PLV-10	FLG	10	Ex	HW
BAV-212	BAV-03	THR	1/2	Ex	L
BAV-213	BAV-03	THR	1/2	Ex	L
BAV-331	BAV-03	THR	2	Ex	L
ARV-311	CARV-02	THR	2	Ex	N/A
CKV-311	CKV-10	FLG	10	Ex	N/A
PLV-311	PLV-10	FLG	10	Ex	HW

+ + END OF SECTION + +

SECTION 15812

CORROSION RESISTANT DUCTWORK AND ACCESSORIES

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NTS: This is from a City of Redding Project in 2014 and hasn't been updated to be a master but it's a good starting point. Contact Joe Riess for more info until this gets cleaned up.

++

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment and incidentals as shown on the Drawings, specified, and required to furnish and install a complete corrosion resistant duct system with all appurtenances required for proper operation.
   2. Field verify locations, sizes and elevations for all connections, supports, dampers, test ports, and flexible connections.
   3. Items to be furnished and installed under this Section include, but are not limited to the following:
      a. Fiberglass Reinforced Plastic (FRP) duct, fittings, supports and accessories.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications:
   1. Engage a single firm, with undivided responsibility for performance and other requirements and components of the corrosion resistant ductwork and accessories.
   2. Engage a firm which can demonstrate successful experience in the fabrication and erection of corrosion resistant ductwork systems of at least five systems of the scope and type similar to the required Work.

B. Installer's Qualifications:
   1. Engage a single installer regularly engaged in FRP ductwork installation and who agrees to employ only tradesmen with specific skill and experience in this type of Work. Submit name and qualifications of installers to ENGINEER.
   2. Engage a single installer for the entire corrosion resistant ductwork system with undivided responsibility for performance and other requirements.

C. Requirements of Regulatory Agencies: Comply with the applicable provisions of regulatory agencies below and others having jurisdiction.
   1. Underwriters' Laboratories, Incorporated (UL).
   2. National Fire Protection Association (NFPA).

D. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
   1. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
   2. Sheet Metal and Air Conditioning Contractors National Association (SMACNA).
      a. HVAC Duct Construction Standards.
      b. Thermoset FRP Duct Construction Manual.
      c. Fire Damper Guide for Air Handling Systems.

3. ASTM A 774, Specification for As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures.
4. ASTM A 778, Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products.
5. ASTM C 581-655 Practice for Determining Chemical Resistance of Thermosetting Resins Used in Glass Fiber Reinforced Structures.
6. ASTM D 2310, Classification for Machine-Made Reinforced Thermosetting Resin Pipe.
7. ASTM D 2563, Practice for Classifying Visual Defects In Glass Reinforced Plastic Laminate Parts.
8. ASTM D 2583, Test Method for Indentation Hardness of Plastics by Means of a Barcol Impressor.
9. ASTM D 2996, Specification for Filament-Wound Reinforced Thermosetting Resin Pipe.
10. ASTM D 4024, Specification for Machine Made Fiberglass (Glass Fiber Reinforced Thermosetting Resin) Flanges.
11. ASTM D 4097, Specification for Contact Molded Glass Fiber Reinforced Thermoset Chemical Resistant Tank.
12. Standards of Society of the Plastic Industry, PS15-69, Custom Contact Molded Reinforced-Polyester Chemical Resistant Process Equipment.
13. NFPA 91, Blowers and Exhaust Systems for Dust, Stock and Vapor Removal or Conveying.
14. ANSI B16.1, Cast Iron Pipe Flanges and Flanged Fittings.
15. ANSI B16.5, Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and Other Special Alloys.
16. Gilbert Building Code.

E. Field Measurements: Take field measurements where required prior to installation to ensure proper fitting of Work.

F. Provide certification that all hardware and appurtenances including screws, bolts, nuts and other support and expansion joint hardware shall be Type 316L stainless steel.

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval the following:
1. 1/4-inch scale duct layouts, dimensioned to show length of duct runs, duct sizes, support design and spacing and expansion provisions.
2. Details of construction, including condensate sumps and condensate eductor stations.
3. Details of installation, including tie-in of support systems to building.
4. Manufacturer's literature, illustrations, specifications and engineering data.
5. Flexible connections.
6. Other technical data related to the specified material and equipment as requested by ENGINEER.
7. Duct sealants.
8. Specifications for FRP resins and reinforcing material used.
9. Submit color samples of pigmented gel coat to ENGINEER for selection.
10. Specifications for fire-retardant epoxy FRP ductwork coating and reinforcing material used.
11. Submit FRP round duct schedule with laminate construction, sizes, thickness, vacuum pressure, weight per foot pressure, spans, joint type and flange data.
12. Submit FRP rectangular duct schedule with laminate construction, sizes, thickness, vacuum pressure, weight per foot pressure, spans, joint type and flange data.

13. Gasket material.
14. Deviations from Contract Documents.

B. Test Reports: Submit volume damper leakage tests from an AMCA approved testing laboratory.

C. Submit a letter stating that the proposed resins proposed in the fabrication of the FRP ductwork will provide satisfactory performance under the specified service conditions or a corrosion resistance chart indicating same.

D. Manufacturer's calculations indicating the laminate sequence meets the proposed pressure and vacuum classification and deflection criteria indicated below.

E. Tabulation in check list forms to indicate compliance with ASTM D 2563 Table I, Level II visual acceptance levels.

F. Calculations for structural support loading and design, and dimensions or materials related to the specified product as requested by ENGINEER.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Store equipment and materials so as to keep free from moisture, damage, and deterioration.

B. Manufacturer shall protect all flange faces and the more fragile appurtenances of the sub-assemblies, with padding between pieces in order to prevent one piece from impacting with another, and by crating or other means for shipment.

C. Duct sub-assemblies shall be unloaded with care and stored in a location where they will be free from damage. Impact of a tool or other heavy object may result in a fracture of the inner lining and affect the service life of the duct or equipment.

D. Large sub-assemblies shall be supported during unloading to prevent excessive deflection and overstressing.

E. Corrosion resistant ductwork shall be protected, by padding or bracing, from banding or ropes used in shipment. No chains are to be used to secure any corrosion resistant ductwork during transportation.

1.5 GENERAL REQUIREMENTS

A. The Drawings show general arrangement and extent of Work to be done, but the exact location and arrangement of all connections, fittings, dampers, supports and expansion joints shall be determined as the Work progresses, to conform in the best possible manner with its surroundings. The exact location of all parts of the Work must be governed by the general building plans and the actual building conditions. Piping, equipment, ducts, etc. found to interfere with the construction of the building, plumbing apparatus and piping, electrical wiring or other obstructions, etc. shall be located to clear such obstructions. Connections shown on the Drawings to the various units are intended as an indication only. The actual connections shall be made and to best suit each particular case, provide for expansion, circulation and minimize the amount of space required.

B. Drawings do not show all offsets, fittings, accessories and details which may be required. Examine all the Contract Documents for conditions which may affect the installation of the Work, and shall arrange the Work accordingly. Provide all required items to complete the systems to the extent required by the Contract Documents.

C. If piping or ductwork can be run to better advantage, CONTRACTOR, before proceeding with the Work, shall prepare and submit complete drawings showing all details of the proposed rearrangement for written approval by the ENGINEER.

D. Resin cure for all FRP ductwork shall be checked by Barcol hardness and acetone tests. Hardness shall be within 90 percent of resin manufacturer's specification. Barcol test shall be required for inside and outside surfaces of all fiberglass fabrications in accordance with ASTM D 2583. Acetone test shall be conducted on interior surfaces of ducts.

E. Prior to final inspection, all surfaces shall be made clean by brushing, wiping, or with a compressed-air blast to remove all loose foreign materials.

F. A thorough inspection of each piece of ductwork will be conducted upon arrival at construction site to inspect for damage incurred in transit. Any damage shall be immediately repaired by respective equipment fabricator's personnel (not a sales representative).

1.6 DUCTWORK FABRICATION

A. FRP ductwork and accessories shall be fabricated in a heated and well ventilated structure protected from weather and temperature extremes. Entire fabrication, curing and assembly process of any piece of FRP equipment shall occur under appropriate temperature and humidity conditions as recommended by the FRP fabricator and resin provider. Submit an affidavit certifying that all FRP equipment shall be fabricated, cured and assembled as described in this Section.

PART 2 - PRODUCTS

2.1 DESIGN CONDITIONS

A. Maximum allowable deflection for any size of corrosion resistant ductwork shall be 1/4-inch between supports and for any side of duct under worse case operating conditions.

B. Tolerances:
   1. Out-of-roundness of duct shall be limited to ±1/8-inch or ± one percent of duct inside diameter, whichever is greater for duct sizes 8-inch diameter and greater.
   2. Length of all flange pipe sections shall not vary more than ±1/8-inch at 70°F.
   3. All unflanged duct shall be square on the ends in relation to the pipe axis and ±1/8-inch up to and including 24-inch diameter and ±3/16-inch for all diameters greater than 24-inch.
   4. Fittings:
      a. The tolerance on angles of all fittings shall be ± one degree, up to and including 24-inch diameter and ±1/2 degree for 30-inch diameter and above.
   5. Flanges:

a. Flange faces shall be perpendicular to the axis of the duct within 1/2 degree.
b. Flange faces shall be flat to within ±1/32-inch, up to and including 18-inch diameter and flat within ±1/16-inch for 20-inch diameter and larger.
c. Provide custom filler pieces as required to mate flanges squarely.

2.2 FIBERGLASS REINFORCED PLASTIC (FRP) DUCTWORK AND ACCESSORIES

A. The fiberglass reinforced plastic duct system shall be specifically designed, constructed, and installed as shown on the Drawings for the following minimum conditions.
1. Ambient Air Temperature: 20°F to 125°F.
2. Corrosion resistance to hydrogen sulfide, chlorine, mercaptans and other gases commonly encountered in wastewater treatment plants.
3. Vacuum Service: Minimum 10-inch water gage.
4. Pressure Service: 60-inch water gage.

B. Fiberglass reinforced plastic (FRP) ductwork shall be of filament wound or hand lay-up construction.
1. FRP ductwork shall be of flame retardant material inside and outside in accordance with NFPA-91.
2. Flame spread rating shall be 25 or less.
3. All ducts shall be installed in accordance with manufacturer's recommendations.

C. FRP Duct Construction:
1. Duct shall meet the applicable requirements of ASTM D 2310, Type 1, Grade 1 or 2, with Class "E" liner, 20 mils minimum thickness, and be manufactured in accordance with ASTM D 2996.
2. Flanges and bolt drilling circles and diameters shall conform to NBS PS 15-69, except that flanges shall be a minimum of 0.75-inches thick. Ductwork shall be fabricated of vinylester resin as specified herein.
3. All interior and exterior surfaces of ducts, dampers and FRP accessories shall be coated with a minimum 90 percent resin, five percent antimony trioxide and nexus veil reinforcement.
4. Exterior surfaces shall have a factory applied paraffinated pigmented gel coat finish with ultra-violet inhibitors.
5. Ductwork shall be in accordance with SMACNA Thermoset FRP Duct Construction Manual.

D. Laminates shall consist of a 20 mil chemical resistant liner with a synthetic surfacing veil embedded in a resin rich surface. The corrosion barrier shall be a minimum of 100 mils and include no less than two layers of 1-1/2 ounce mat with 25 percent glass and 75 percent resin content. The structural layer shall be of sufficient thickness to meet the minimum thickness requirements specified. The exposed exterior surface layer shall be resin rich appertured nexus veil not less than 20 mils thick. Exposed outside finish shall have a parrafinated pigmented gel coat finish with an ultra violet inhibitor. Provide standard and custom color chart for color selection. The composition specified for the inner surface and interior layer is intended to achieve optimum chemical resistance.

E. Resins used in the laminate shall be premium corrosion resistant and fire retardant brominated biphenol-A vinylester resins such as Dow Chemical Company, Derakane 510A with five percent antimony trioxide, Reichhold Dion 9300 FR with five percent Antimony Trioxide or Ashland Chemical Company, Hetron FR 992 with three percent antimony

trioxide or equal. The synthetic surfacing veil shall be Veil-Nexus 1012 (apertured) as manufactured by Burlington Industries.

F. All cut edges shall be sealed with a resin coating of the same resin as used in the fabrication. The resin shall contain paraffin.

G. Product and Manufacturer: Provide one of the following:
   1. Ershigs Incorporated.
   2. Spunstrand.
   3. Belco Manufacturing Co.
   4. Smith Fibercast
   5. Daniel Mechanical
   6. Or equal.

H. Fittings and Joints: All fittings such as elbows, laterals, tees, and reducers shall be of the same resin and equal or superior in strength to the adjacent duct section and shall have the same internal diameter as the adjacent duct. Exposed round duct joints shall be flanged, butt wrapped or bell and spigot joints. Exposed bell and spigot joints shall be sealed with a standard butt joint overlay in accordance with PS 15 69. Buried round duct joints shall be bell and spigot joints with a single EPDM or Isoprene o-ring. All interior surfaces of joint to be coated with a paraffinated resin-rich gel coat.

I. Total width of overlay for butt-wrap joints shall be not less than 6-inches for diameters from 8-inches up to and including 30-inches, 36-inch and larger shall be not less than 10-inches.

J. Standard Elbows:
   1. Standard elbow centerline radius shall be equal to a minimum of 1-1/2 times the diameter.
   2. Standard elbows up to 24-inch diameter shall be smooth radius molded elbows. Standard elbows 30-inch diameter and greater may be mitered sections as specified below.
   3. 0 to 44 degree elbows shall contain one mitered joint and two sections. 45 to 80 degree elbows shall have a minimum of two mitered joints and three sections. Elbows greater than 80 degrees shall have a minimum of four mitered joints and five sections.

K. Maximum allowable deflection for any size ductwork shall be 1/2-inch between supports and for any side of duct under worse case operating conditions. Ductwork supports shown on the Drawings are a minimum number required. Additional sup-ports shall be provided as required to meet the specifications. Additional supports shall be the same as adjacent support details.

L. Tolerances:
   1. Out-of-roundness of duct shall be limited to ±1/8-inch or ± one percent of duct inside diameter; whichever is greater for duct sizes 8-inch diameter and greater.
   2. Length of all flange pipe sections shall not vary more than ±1/8-inch at 70°F.
   3. All unflanged duct shall be square on the ends in relation to the pipe axis and ±1/8-inch up to and including 24-inch diameter and ±3/16-inch for all diameters greater than 24-inch.
   4. Fittings:

a. The tolerance on angles of all fittings shall be ± one degree, up to and including 24-inch diameter and ±1/2 degree for 30-inch diameter and above.

5. Flanges:
   a. Flange faces shall be perpendicular to the axis of the duct within 1/2 degree.
   b. Flange faces shall be flat to within ± 1/32-inch, up to and including 18-inch diameter and flat within ± 1/16-inch for 20-inch diameter and larger.
   c. Provide custom filler pieces as required to mate flanges squarely.

M. Calculations for wall thickness determination shall be based on the structural fiberglass reinforced wall only. FRP ductwork shall be designed using a safety factor of ten to one for pressure and five to one for vacuum service. Ductwork shall be designed by manufacturer to resist all system forces and meet specified deflection requirements, but in no case shall FRP be less than the thickness listed in the table below. For buried pipe, wall thicknesses shall be based on depth of bury, trench condition, backfill loads and traffic loads, but in no case shall FRP be less than the thickness in the table below.

MINIMUM FRP ROUND DUCT DIMENSION AND PERFORMANCE SCHEDULE

ID (in.)	Structural Wall Thickness (min.) (in.)	Minimum Allowable Vacuum[1] (in. of water)	Min. Allowable Pressure[1] (in. of) water)	Flange Thickness (in.)	Bolt Circle Diameter (in.)	Bolt Size and No. of Bolt Holes	Maximum Allowable Span[2] (ft)
2	0.125	405	705	3/4	4-3/4	5/16 /4	9
3	0.125	405	500	3/4	6	5/16 /4	11
4	0.125	210	410	3/4	7-1/2	5/16 /8	12
6	0.125	64	350	3/4	9-1/2	5/16 /8	15
8	0.187	182	693	3/4	11-3/4	5/16 /8	17
10	0.187	94	693	3/4	14-1/4	5/16 /12	19
12	0.187	55	693	3/4	17	5/16 /12	20
14	0.250	91	693	3/4	18-3/4	1 /12	20
16	0.250	61	693	3/4	21-1/4	1 /16	20
18	0.250	44	693	3/4	22-3/4	1-1/8 /16	20
20	0.250	33	693	3/4	25	1-1/8 /20	20
24	0.250	18	693	3/4	28-1/2	1-1/4 /20	20
30	0.312	20	693	3/4	36	1-1/4 /28	20
36	0.375	23	693	3/4	42-3/4	1-1/2 /32	20
42	0.375	15	693	3/4	49-1/2	1-1/2 /36	20
48	0.437	15	693	3/4	56	1-1/2 /44	20
54	0.437	15	693	3/4	62-3/4	1-3/4 /44	20
60	0.437	15	693	3/4	69-1/4	1-3/4 /52	20
96	0.750	15	693	1	(3)	(3)	20

1. NOTES:
    a. These ratings were suitable for use up to 180°F (82.2°C) in pressure service and ambient atmospheric temperatures on vacuum service. For ratings at high temperatures, consult manufacturer.
    b. Based on 1/4-inch span deflection on air conveying systems at 180°F maximum. Also, based on duct systems not subjected to more severe service conditions such as additional weight caused by liquid or solids build-up in duct system, effects of wind loading on outdoor installations, or possible failure of intermediate duct hangers. Provide as a minimum, the number of duct supports as shown on the Drawings. Support continuous at all non-flanged pipe end connections.
    c. Submit for approval by the ENGINEER.

N. All connections to expansion joints, butterfly dampers, tanks, or other equipment shall be flanged. Duct flanges shall conform to the FRP Duct Schedule, above. Gaskets shall be EPDM. Bolts, nuts and washers shall be Type 316 stainless steel. Flanges shall be hand laid up to PS 15-69 thickness, except that minimum thickness shall be 3/4-inch. The flange shall be hand laid-up anchored to a waxed table to achieve the flatness tolerance outlined in Paragraph 2.4.M.5., above. The face shall be textured for use with full-face gaskets, as specified above, 1/8-inch minimum thickness. Pipe flange drilling shall be NBS PS 16-69. All FRP duct and pipe flange bolt holes shall be back spot faced for a washer seat. All flange bolts shall be torqued to values as recommended by manufacturer.

O. Hangers:
    1. All ductwork shall be supported from trapeze type hangers. Hanger rods shall be minimum 3/8-inch for all ducts with half perimeter up to 72-inches, and 1/2-inch diameter for all ducts with half perimeter larger than 72-inches. A pair of rods shall be provided at each duct support point.
    2. All hangers, rods, supports, bolts, nuts, washers, inserts, and appurtenances located in corrosive areas shall be Type 316 stainless steel.
    3. Hanger Construction and installation shall conform to SMACNA Standards, except as specified. No sheet metal duct hangers or straps will be allowed.
    4. Supports shall be provided at each fitting.

P. There shall be not less than a 1/4-inch buildup of FRP over the duct at each support. Each support shall be furnished with a 1/8-inch thick teflon sheet to shield the duct from the support. The teflon sheet shall extend beyond the support plate at least 1/2-inch on all sides.

Q. Furnish flexible connectors, as shown on the Drawings and details, with anchors and guides.
    1. Product and Manufacturer: Provide one of the following:
        a. Holz Rubber Company.
        b. Pathway Bellows Incorporated.
        c. Mercer Rubber Company.
        d. Or equal.

R. Round Fiberglass Reinforced Plastic Dampers:
    1. Furnish and install Balancing, Isolation or Backdraft Dampers where shown on the Drawings as detailed herein.

2. Damper frame shall be of one-piece construction with a resin rich interior corrosion barrier minimum of 100 mils.
3. Structural lay-up shall consist of alternate layers of chopped strand mat and woven roving conforming with ASME/ANSI RTP-1 and ASTM D3982.
4. Blade edge seals shall be provided on all Isolation Dampers, and shall be of the "Double Tadpole" design. Seal to be mechanically fastened to the blade perimeter using FRP retainer and fasteners. Seal will be continuous and shall not break at axle. Blade seal shall not be compressed against a blade stop. Blade seal shall be of the wiper design not a compression type. Seal and cored blade combination installed in damper frame shall meet or exceed 2.90 cfm leakage @ 26" of static pressure with bearings installed both upstream and downstream. Damper assembly to be leak tested in both directions.
5. Provide AMCA Certification AMCA label for Air Leakage in accordance to AMCA standard 511 on damper.
6. Rating Conditions:
    a. Velocity Through Damper: 3,000 fpm.
    b. Pressure Rating: 60 inches water column.
    c. Maximum Allowable Leakage: Three cfm per square foot at 10-inch w.g. pressure.
7. Materials:
    a. Resin: Fire retardant vinyl ester with MEKP cure system
    b. Bearings: Teflon.
    c. Blade: fire-retardant vinyl ester FRP
    d. Frame: fire-retardant vinyl ester FRP
    e. Axles: Type 316L stainless steel rods, full length of damper size as shown on the Drawings.
    f. Handle: Type 316L stainless steel.
    g. Pins: Type 316L stainless steel.
    h. Bushings: Teflon.
    i. Hardware: Hastelloy-C.
    j. Flanged ends with bolt holes drilled to match connecting ductwork.
    k. Blade Stops: FRP angles with full circumference EPDM seal.
8. Dimensions: As required.
9. Leakage test and performance data from an AMCA approved testing laboratory shall be submitted.
10. Actuators:
    a. Manual: unless shown otherwise on the drawings or listed herein, provide manual operation with 316 SST locking quadrant hand lever for balancing dampers. Any balancing dampers larger than 20-inch diameter shall have a worm gear.
    b. Electric:
        1) Motorized Isoloation Dampers with electrical actuators shown in the Drawings or listed below shall have electric actuators with local and remote control (automation by Others).
        2) Electric actuators shall be provided by the supplier of the dampers, fully integrated and factory-tested with the damper to ensure proper selection, sizing and operability of the damper.
            a) Provide two position, open-close actuation
            b) 240 V
            c) Close-coupled
            d) Rated torque of the actuator shall exceed the damper required closing torque by a minimum safety factor of 1.5.
11. Product and Manufacturer:

a. Manual Balancing Dampers:
   1) Belco Model 202
   2) Engineered Composite Systems XO1
   3) Swartwout Model 911
b. Motorized Isolation Dampers:
   1) Belco Model 203
   2) Engineered Composite Systems XO2
   3) Or Equal
c. Backdraft Dampers:
   1) Belco Model 401
   2) Engineered Composite Systems ECS BD-01
   3) Or Equal

S. Flexible Bellows:
   1. Provide flexible expansion bellows joints where shown on the Drawings. Joints shall provide compensations for misalignment, absorb expansion and contraction, and isolate vibration and shock.
   2. Bellows shall be pure white virgin PTFE isostatic resin conforming to ASTM D1457, without pigments, lubricants, hydrocarbons or additives of any kind.
   3. Flange allow and reinforcing rings shall conform to ASTM 60-45-12. Composite flanges and reinforcing rings shall have a nominal tensile strength of of 50,000 psi per ASTM D638.
   4. All flanges and bands shall be coated with an electrostatically applied epoxy.
   5. All materials shall be zinc phosphate treated or have Pureflex Durcor-62 composites.
   6. Flange diameter shall conform to ANSI B16.5. Bolt holes shall be tapped.
   7. Product:
      a. Ethylene Flexijoint PTFE Expansion Joint 36-FIPA-4
      b. Or Equal

T. FRP Transition Pieces:
   1. Provide transition pieces as shown on Drawings and herein specified.
   2. Construction:
      a. 1/4-inch minimum thickness FRP sheets and thickness not to be less than thickness of adjacent FRP ducting.
      b. All exposed hardware shall be Hastelloy-C screws, nuts, bolts and washers, as required.
      c. Flanges shall be designed as required to connect to fan or ductwork.
   3. Pressure Classification: Manufacturer shall design transition pieces so that they shall be free from buckling, pulsing, warp age, sagging and to the following pressure ratings:
      a. Vacuum Service: 10-inchs water gage, minimum.
      b. Pressure Service: 20-inches water gage, minimum.

U. Install round pipe sleeves and mechanical seals for all round duct wall and floor penetrations as herein specified:
   a. Non-metallic, non-corrosive, high-density polyethylene construction.
   b. Integral formed water stop and anchor plate.
   c. Sleeve and mechanical seal shall be manufactured by Thunderline Link-Seal or equal.

V. Install end caps on the end of each duct branch and provide a bolted duct access door as shown on the drawings.

W. Tools, Spare Parts and Maintenance Materials:
   1. The duct system shall be furnished with the following:
      a. Two sets of special tools required to maintain and repair the system.
      b. All materials in kit form to make or repair joints. Kits shall be in a number sufficient to repair ten percent of the exposed joints.
      c. Names and addresses of all manufacturers of: Fiberglass reinforcements, resins, hardeners and components used to repair and maintain FRP duct system.
   2. Spare parts shall be packed in sturdy containers with clear indelible identification markings and shall be stored in a dry, warm location, until transferred to the OWNER at the conclusion of the Project.

2.3 SURFACE PREPARATION AND PAINTING

A. Surface preparation and painting shall conform to the requirements of Section 09900, Painting.

B. Certify, in writing, that the shop primer and shop finish coating system conforms to the requirements of Section 09900, Painting.

C. All FRP exterior surfaces of pipe duct and fittings shall be painted with an approved epoxy paint system conforming to the requirements of Section 09900, Painting.

D. Ductwork shall be factory painted in accordance with paint system specified below.

E. Provide a sample FRP panel not less than two square feet which shall be painted and allowed to dry for not less than 48 hours and then be checked for paint adhesion by the paint system manufacturer and submitted to the ENGINEER.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all ductwork in accordance with manufacturer's recommendations and instructions and as shown on the Drawings and specified.

B. All ductwork shall conform accurately to the dimensions shown on the Drawings, the ducts shall be straight and smooth inside with joints neatly finished; ductwork shall be installed so as to preclude the possibility of vibration under all operating conditions.

C. Elbows shall have a minimum centerline radius of 1-1/2 times the width of the duct. Turning vanes shall be provided at all square elbows. Turning vanes shall be double wall and shall be quiet and free from vibration when the system is in operation.

D. Test holes shall be provided at each duct connection at all air moving equipment. Test holes shall be factory installed with no exposed fibers.

E. Provide manual volume dampers where shown on the Drawings and as required to facilitate accurate volume control. Damper blades shall be reinforced to prevent vibration.

F. Fire dampers shall be provided and installed where shown on the Drawings and where required by U.L. and shall be approved by the Mesa Building Code and in accordance with the requirements of the NFPA.

G. Provide access doors for all dampers for inspection and maintenance.

H. Install all ductwork and accessories to provide a system free from buckling, warping, breathing or vibration.

I. All expansion joints and ducts shall be suitably supported at each end by support guides within 12-inches of joint.

J. All ducts at flexible connections with fans shall be supported at free end within 12- inches of flexible connection.

K. Provisions shall be made for supporting all ductwork, dampers, and other ductwork accessories, where required.

L. All low points in the corrosion resistant ductwork shall be provided with 1-1/4-inch drains, unless otherwise noted. All drains shall be provided with a "P trap", unless otherwise noted. Above grade ductwork drains shall be piped to the nearest wastewater channel. Below grade condensate sumps shall be piped to the adjacent condensate eductor as shown on the Drawings.

M. All buried ductwork shall be bedded in sand. Sand shall extend a minimum of 6-inches below the bottom of the duct, 12-inches minimum on the sides of the duct, and shall be flush with the top of the duct, unless otherwise noted. Backfill with compacted selected fill in accordance with Section 15051, Buried Piping Installation.

N. Receive field assistance, if required, from the corrosion resistant ductwork manufacturer to ensure that the corrosion resistant ductwork is installed and jointed correctly.

O. All fittings, valves, expansion joints, specials and similar items shall be supported within 12-inches of the joint, unless otherwise noted.

3.2 ADJUSTMENT

A. Set volume control devices for approximate positions in preparation for final testing and balancing.

B. Start fan system and check for excessive leaks and vibration and correct.

3.3 CLEANING

A. Remove all loose materials and obstructions from interior of ducts.

B. Remove debris and waste materials resulting from installation.

3.4 INSPECTION OF DUCTWORK

A. ENGINEER reserves the right to reject any and all equipment found to have the following: blisters, chips, crazing, exposed glass, dry cracks, burned areas, dry spots,

foreign matter, or entrapped air at the laminate surfaces which do not satisfy the tolerances specified in ASTM D 2563, Table I Acceptance Level II inside and outside surfaces. Unacceptable Barcol hardness and acetone sensitivity shall also be cause for rejection.

+ + END OF SECTION + +

SECTION 15990

TESTING OF PRESSURE PIPING SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope: Provide all labor, materials, equipment, and incidentals as shown on the Drawings required to perform the pressure testing of piping systems.

1.2 SUBMITTALS

A. Testing Plan: Submit prior to testing and include at least the information that follows.
   a. Testing dates
   b. Piping systems and section(s) to be tested
   c. Test type
   d. Method of isolation
   e. Calculation of maximum allowable leakage for piping section(s) to be tested

B. Certifications of Calibration: Testing equipment

C. Certified Test Report

1.3 REFERENCE

A. Reference Section 15100 PS – Pipe Schedule for test pressure.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 NOTIFICATION

A. Notify ENGINEER in writing 5 days in advance of testing. Perform testing in presence of ENGINEER.

3.2 PRESSURE TESTING

A. General:
   1. Complete installation of piping system, including all thrust restraint, prior to pressure testing.
      a. If thrust blocking is specified, wait 5 days minimum after concrete thrust blocking is installed to perform pressure tests. If high-early strength cement is used for thrust blocking, wait may be reduced to 2 days.
   2. Prior to test, remove and replace with pipe spools or suitably isolate appurtenant instruments or devices that could be damaged by pressure testing.
   3. New Piping Connected to Existing Piping: Isolate new piping with grooved-end pipe caps, spectacle blinds, blind flanges, or as acceptable to ENGINEER.

4. Piping to be Pressure Tested and Test Pressure: as indicated on Piping Schedule.

B. Hydrostatic Testing (Pipe Other than PSDS HDPE2):
   1. Testing Fluid: Clean, potable water.
   2. Pipeline Protection:
      a. Maximum Filling Velocity: 0.25 foot per second, applied over full area of pipe.
      b. Vent piping during filling. Open vents at high points of piping system or loosen flanges, using at least four bolts, or use equipment vents to purge air pockets.
   3. Exposed Piping:
      a. Perform testing on insulated piping prior to application of insulation
      b. Maintain hydrostatic test pressure continuously for 60 minutes, minimum, and for such additional time as necessary to conduct examinations for leakage.
      c. Examine joints and connections for leakage.
         1) Correct visible leakage and retest as specified.
         2) Empty pipe of water prior to final cleaning or disinfection.
   4. Buried Piping:
      a. Test after backfilling has been completed.
      b. Expel air from piping system during filling.
      c. Apply and maintain specified test pressure with hydraulic force pump. Valve off piping system when test pressure is reached.
      d. Maintain hydrostatic test pressure continuously for 2 hours minimum, reopening isolation valve only as necessary to restore test pressure.
      e. Determine actual leakage by measuring quantity of water necessary to maintain specified test pressure for duration of test.
      f. Maximum Allowable Leakage:

$$L = \frac{SD(P)^{1/2}}{133{,}200}$$

where:

L = Allowable leakage, in gallons per hour.
S = Length of pipe tested, in feet.
D = Nominal diameter of pipe, in inches.
P = Test pressure during leakage test, in pounds per square inch.

      g. Correct leakage greater than allowable, and retest as specified.

C. Low-Pressure Testing with Air:
   1. Perform only where specifically allowed or called for in Pipe Schedule.
   2. Testing shall be limited to pipes less than 30-inches in diameter.
   3. Use Oil-free, dry air.
   4. Procedure:
      a. Clean and wet the line to be tested.
      b. Plug all pipe outlets with suitable test plugs and securely brace each plug.
      c. Add air slowly to the portion of the pipe installation under test until the internal air pressure is raised to 4.0 psig.
      d. Check exposed pipe and plugs for leakage by coating with a soap solution. If any failures are observed, bleed off air and make necessary repairs.
      e. After internal pressure of 4.0 psig is obtained, allow at least two minutes for internal air temperature to stabilize, adding only the amount of air required to maintain pressure.
      f. After the two-minute period, disconnect the air supply.

g. When the pressure decreases to 3.5 psig, start timing. Determine the time in seconds that is required for the pressure to fall from 3.5 psig to 2.5 psig. This test duration time must be equal to or greater than the minimum test duration time obtained as outlined below.

TABLE 15990-A MINIMUM TEST DURATION TIMES FOR LOW-PRESSURE AIR TESTING	
NOMINAL PIPE SIZE, INCHES	**TIME, SECONDS**
10	**283**
15	**425**

5. Allowable Leakage: Piping system, exclusive of possible localized instances at pump or valve packing, shall show no visual evidence of leakage.
6. After testing and final cleaning, purge with nitrogen those lines that will carry flammable gases to assure no explosive mixtures will be present in system during filling process.

3.3 PIPE PRESSURE TESTING LOG

A. All pressure tests shall be witnessed by ENGINEER. CONTRACTOR shall keep a pipe pressure testing log to document the pressure testing and ENGINEER's approval of such.
   1. Specific details of the contents and format pipe pressure testing log shall be determined by the CONTRACTOR and approved by the ENGINEER.
   2. At a minimum, pipe pressure testing log shall record, on a daily basis for any day when pipe pressure testing is performed:
      a. Test Report Documentation:
         1) Test date
         2) Description and identification of piping tested
         3) Test fluid
         4) Test pressure
         5) Remarks, including:
            a) Leaks (type, location)
            b) Repair/replacement performed to remedy excessive leakage
   3. Pipe pressure testing log shall be kept on-site. Pipe pressure testing log shall be signed on a daily basis, for any day when pipe pressure testing log work is performed, by the supervisor of the CONTRACTOR's field crew and by the ENGINEER.
   4. Any piping system which was pressure tested, but which was not recorded in the pipe pressure testing log, shall be re-tested at the ENGINEER's discretion.

+ + END OF SECTION + +

DIVISION 16

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SECTION 16050

GENERAL ELECTRICAL PROVISIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified, and required to complete the electrical Work.

B. Coordination:
   1. Review installation procedures under other Sections and coordinate the installation of items that shall be installed with the formwork, walls, partitions, ceilings and panels.
   2. CONTRACTOR shall be responsible for the installation of all conduits, inserts and other items to be embedded in the concrete, or built into walls, partitions, ceilings or panels constructed by other contractors. CONTRACTOR shall provide other contractors with detailed plans or sketches of the location of said conduits and other built-in items as may be required. CONTRACTOR shall keep himself fully informed of the construction where conduits and other built-in items are to be installed. CONTRACTOR shall install said conduits and other built-in items in such a manner and within such time periods as will not unnecessarily delay the Work of the other contractors.

C. General:
   1. Interpretation of Drawings:
      a. Dimensions shown on the Drawings that are related to equipment are based on one manufacturer's equipment. Coordinate the dimensions of the equipment furnished with the space allocated for that equipment.
      b. The Drawings show the principal elements of the electrical installation. They are not intended as detailed working drawings for the electrical Work but as a complement to the Specifications to clarify the principal features of the electrical systems.
      c. It is the intent of this Section that all equipment and devices, furnished and installed under this and other Sections, be properly connected and interconnected with other equipment so as to render the installations complete for successful operation, regardless of whether all the connections and interconnections are specifically mentioned in the Specifications or shown on the Drawings.

D. Related Work Specified Elsewhere:
   1. Section 01330, Submittal Procedures.
   2. Section 01610, General Equipment Requirements.
   3. Section 02300, Earthwork.

1.2 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:
   1. Permits: Obtain all permits required to commence work and, upon completion of the Work, obtain and deliver to ENGINEER a Certificate of Inspection and Approval from the State Board of Fire Underwriters or other authority having jurisdiction.

2. Codes: Material and equipment shall be installed in accordance with the current standards and recommendations of the National Electrical Code, the National Electrical Safety Code and with local codes which apply. Where discrepancies arise between codes, the most restrictive regulation shall apply.
3. Tests by Independent Regulatory Agencies: Electrical material and equipment shall be new and shall bear the label of the Underwriters' Laboratories, Inc., or other nationally-recognized, independent testing laboratory, wherever standards have been established and label service regularly applies.
4. Utilities:
   a. Work in connection with the electric service and utility metering shall be done in strict conformance with the requirements of the serving electric utility.

B. Reference Standards: Electrical material and equipment shall conform in all respects to the latest approved standards of the following:
1. National Electrical Manufacturers Association.
2. The American National Standards Institute.
3. The Institute of Electrical and Electronic Engineers.
4. Insulated Power Cable Engineers Association.
5. National Electrical Code (NEC).
6. National Electrical Safety Code (NESC).

1.3 SUBMITTALS

A. General:
1. Conform to requirements of Section 01330, Submittal Procedures.

B. Shop Drawings shall include the following information to the extent applicable to the particular item:
1. Manufacturer's name and product designation or catalog number.
2. Electrical ratings.
3. Conformance to applicable standards or specifications of ANSI, ASTM, ICEA, IEEE, ISA, NEC, NEMA, NFPA, OSHA, UL, or other organizations.
4. Dimensioned plan (including weight), section, and elevations showing means for mounting, conduit connection, and grounding.
5. Materials and finish specification, including paints.
6. List of components including manufacturer's names and catalog numbers.
7. Internal wiring diagram indicating all connection to components and numbered terminals for external connections.

1.4 PROJECT CLOSEOUT

A. Operation and Maintenance Data: Submit complete manuals including:
1. Copies of all Shop Drawings, test reports, maintenance data and schedules, description of operation, and spare parts information.
2. Furnish Operation and Maintenance Manuals in conformance with the requirements of Section 01330, Submittal Procedures.

B. Record Drawings:
1. Record Drawings shall include the following:
   a. One line wiring diagram of the distribution system.
   b. Actual in place conduit and cable layouts with schedule of conduit sizes and number and size of conductors.

c. Layouts of the grounding system and lighting arrangement.
d. Control wiring diagrams with terminal numbers and all control devices identified.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials: CONTRACTOR shall instruct the manufacturers and vendors as to the maximum shipping sizes of equipment that can be accommodated at the site.

B. Handling and Storage of Materials: Conform to the requirements of Section 01650, Transportation, Handling, and Storage.

1.6 CONTROL CABINETS AND PANELS

A. All control cabinets and panels located in corrosive environments shall be NEMA 4X, stainless steel, unless otherwise specified or noted on the Drawings.

B. All outdoor panels shall be provided with sunshade structures.

C. All control cabinets and panels located outdoors shall be weatherproof NEMA 3R steel, unless noted otherwise specified or noted on the Drawings.

1.7 ELECTRICAL EQUIPMENT

A. All electrical equipment shall be capable of operating successfully at full-rated load, without failure, with an ambient outside air temperature of 25°F to 131°F and an elevation of 1,050 feet (MSL).

B. All electrical devices and equipment shall have ratings based on 75°C terminations.

1.8 EQUIPMENT IDENTIFICATION. (ELECTRICAL AND INSTRUMENTATION)

A. Equipment Identification Tags shall be 1"x3" with two holes centered on each end of the tag (available from Brady). The tags shall be constructed of the following materials: Aluminum 0.020" thick and coated with black enamel paint. Each tag shall be engraved with the equipment identification number and description as indicated in the drawings and/or specifications. Print shall be ¼" Gothic. Each tag shall be attached with fasteners of nylon coated 48 mil stainless steel wire (Brady catalog number 23310 or equal) and brass wire clamps - double ferrule design (Brady catalog number 23312 or equal) to secure the stainless steel wire.

B. Instrument Identification Tags shall be GREEN 1-½" round aluminum (Brady catalog number 49903) engraved with the instrument loop number as indicated in the drawings and/or specifications. Print shall be ¼" Gothic". Each tag shall be attached with fasteners of 48 mil stainless steel wire (Brady catalog number 38091 or equal) and zinc wire clamps (Brady catalog number 38090 or equal) to secure the stainless steel wire.

Brady Signmark Division
2221 West Camden Road
P.O. Box 2999
Milwaukee, WI 53201-2999
www.bradysignmark.com
USA 1-800-635-7557

1.9 AREA CLASSIFICATIONS

A. Wet Locations: The following areas shall be considered wet locations:
   1. Outdoor Areas and indoors in the pump room.
   2. Materials, equipment and incidentals in areas identified as wet locations shall meet NEC and NEMA requirements for wet locations. Enclosures installed in wet locations shall meet NEMA 3R requirements unless otherwise indicated. Conduits shall be terminated at enclosures with watertight, threaded hubs.

B. Corrosive Locations: The following areas shall be considered corrosive locations:
   1. Entire area within the chlorination room.
   2. Materials, equipment and incidentals in areas identified as corrosive shall meet NEC and NEMA requirements for corrosive locations. Conduit systems shall be PVC coated galvanized steel and enclosures shall meet NEMA 4X requirements. Conduits shall be terminated at enclosures with watertight, threaded hubs. Where PVC coated conduit is required, all components such as device boxes, device covers, flexible conduit, fittings, seal offs, expansion fittings, explosion proof fittings, etc. shall be PVC coated and shall be manufactured by the same manufacturer as the conduit system.

1.10 SCHEMATIC DIAGRAMS

A. Schematic diagrams are provided for the CONTRACTOR'S guidance in fulfilling the operational intent of the Contract Documents.

B. It shall be the CONTRACTOR'S responsibility to meet all safety and electrical codes, and to provide all equipment, appurtenances and specialty items required to provide for complete and operable systems.

C. Review of control schemes submitted by the CONTRACTOR shall not relieve the CONTRACTOR of his contractual responsibility to provide complete and successfully operating systems.

PRODUCTS (NOT USED)

EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 16060

GROUNDING SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope: Furnish and install complete grounding for the electrical systems. The electrical service for this facility is existing. Connect to the existing grounding system as required.

1.2 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified:
   1. NEC Article 250, Grounding.
   2. UL Standard #467, Electrical Grounding and Bonding Equipment.

1.3 SUBMITTALS

A. Product Data: Submit, for approval, product data for all materials covered herein.

B. Shop Drawings: Submit, for approval, the following:
   1. Listing of grounding connector types identifying where they are to be used.
   2. Layouts of each structure ground grid.
   3. Test point construction details.

C. Test Records: Submit for review copies of written results of ground resistance tests at each test point.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Bare Ground Cable: Annealed, bare, stranded copper, No. 8 AWG minimum size or as otherwise shown on the Drawings.

B. Ground Rods: Copperclad rigid steel rods, 3/4-inch diameter, 10 feet long.

C. Grounding Connectors:
   1. Material: Pressure connectors shall be copper alloy castings, designed specifically for the items to be connected, and assembled with Durium or silicone bronze bolts, nuts and washers. Welded connections shall be by exothermic process utilizing molds, cartridges and hardware designed specifically for the connection to be made.
   2. Product and Manufacturer: Provide grounding connectors of one of the following:
      a. Pressure Connectors:
         1) O.Z./Gedney, Division of General Signal Corporation.
         2) Burndy Corporation.
         3) Or equal.
      b. Welded Connections:

1) Cadweld by Erico Products, Incorporated.
2) Therm-O-Weld by Burndy Corporation.
3) Or equal.

PART 3 - EXECUTION

3.1 STRUCTURE GROUND SYSTEM

A. Provide ground grids as shown on the Drawings:

B. Install ground rods where shown on the Drawings. Install additional ground rods if necessary to attain a resistance to ground of less than 5 ohms for each ground grid.

C. For structures with steel columns, install #4/0 ground cable from grid to each column around the perimeter of the structure. Connect cable to steel using exothermic welds.

D. Connect grids to a continuous underground water pipe system when practical.

E. Provide accessible test points for measuring the ground resistance of each grid.

F. Weld all buried connections, except for test points.

3.2 EQUIPMENT GROUNDING

A. Ground all electrical equipment in compliance with the National Electrical Code.

B. Equipment grounding conductors shall be bare stranded copper cable of adequate size installed in metal conduit where necessary for mechanical protection.

C. Connect ground conductors to conduit with copper clamps, straps or with grounding bushings.

D. Connect to piping by welding or brazing. Use copper bonding jumpers on all gasketed joints.

E. Connect to equipment by means of lug compressed on cable end. Bolt lug to equipment frame using holes or terminals provided on equipment specifically for grounding. Do not use holddown bolts. Where grounding provisions are not included, drill suitable holes in locations designated by ENGINEER.

F. Connect to motors by bolting directly to motor frames, not to sole plates or supporting structures.

G. Connect to service water piping by means of copper clamps. Use copper bonding jumpers on all gasketed joints.

H. Scrape bolted surfaces clean and coat with a conductive oxide-resistant compound.

3.3 TESTING

A. Test the completed ground systems for continuity and for resistance to ground using an electrical ground resistance tester.

++ END OF SECTION ++

SECTION 16125

INSTRUMENTATION CABLE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope: This Section includes instrumentation cable of the following types:
   1. Shielded instrument cable. Listed as "A" type cable as called out on the drawings.
   2. Unshielded instrument cable.
   3. Telephone cable.
   4. Intercom and Paging system cable.

1.2 SUBMITTALS

A. Product Data: Submit, for approval, the following:
   1. Manufacturer's technical information for shielded instrumentation cable proposed for use.
   2. Manufacturer's technical information for telephone cable and underground splicing for approval by the OWNER.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Single Shielded Pair Instrument Cable: Tinned copper, stranded, Polyethylene insulated conductors, No. 18 AWG minimum, twisted with aluminum-polyester shield, stranded tinned 20 AWG copper drain wire and PVC outer jacket. Rated for 300 volts. Belden 8760 or equal.

B. Single Unshielded Pair Instrument Cable: Bare, soft annealed copper, stranded, PVC insulated conductors, No. 18 AWG minimum, twisted. Outer jacket to be PVC. Rated for 300 volts minimum.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in conduit separate from power cables, unless otherwise noted.

B. Ground shield of shielded cables at one end only and as recommended by instrument manufacturer.

C. Terminate stranded conductors with pre-insulated crimp type spade or ring torque terminals properly sized to fit fastening device and wire size.

D. Install and terminate vendor furnished cable in accordance with vendor equipment requirements.

E. CONTRACTOR shall coordinate the installation and termination of the telephone cables with the OWNER and the Utility.

3.2 TESTING

A. Test shielded instrumentation cable shields with an ohmmeter for continuity along the full length of the cable and for shield continuity to ground.

B. Connect shielded instrumentation cables to a calibrated 4-20 milliamp DC signal transmitter and receiver. Test at 4, 12, and 20 milliamp transmitter settings.

++ END OF SECTION ++

SECTION 16130

CONDUIT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope: All electrical and instrumentation wiring shall be installed in conduit, unless otherwise shown. Provide conduit and fittings to form complete, coordinated and grounded raceway systems, as follows:
   1. Rigid steel conduit for exposed indoor conduit runs above grade level, unless otherwise indicated.
   2. PVC coated rigid steel for exposed conduit runs in all indoor areas below grade level, corrosive areas and in all outdoor areas.
   3. Schedule 40 PVC for concrete encased duct bank runs.
   4. Schedule 40 PVC for conduit runs embedded in structural concrete slabs.
   5. Schedule 40 PVC for direct buried conduit with minimum of 2 ft. 6 inches of cover with 6 inches of sand as shown on the details.
   6. PVC-coated rigid steel for underground conduit runs buried shallower than noted above (except those encased in concrete). No "taped" conduit allowed.
   7. Provide flexible conduit at motors and equipment that are subject to vibration or require movement for maintenance purposes. Provide necessary reducer where equipment furnished cannot accept 3/4-inch size flexible conduit. Limit flexible conduit length to three feet maximum. Where PVC coated conduit is required, provide PVC coated fittings for flex conduit to match.
   8. Provide sealing fittings for hazardous and corrosive locations as required by the National Electrical Code and where shown on the Drawings.
   9. Provide expansion fittings in conformance with the National Electrical Code where necessary to compensate for thermal expansion and contraction.
   10. Install expansion/deflection fittings where conduits cross structural expansion joints.
   11. No more than 270 degrees of bends allowed in a continuous run of conduit.

B. Coordination:
   1. Conduit runs shown are diagrammatic.
   2. Coordinate conduit installation with piping, ductwork, lighting fixtures and other systems and equipment and locate so as to avoid interferences.

C. Related Sections:
   1. Section 16136, Underground Duct Banks.

1.2 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified:
   1. NEC Article 346, Rigid Metal Conduit.
   2. NEC Article 347, Rigid Nonmetallic Conduit.
   3. NEC Article 351, Liquid-Tight Flexible Metal Conduit.
   4. NEC Article 500, Hazardous (Classified) Locations.
   5. UL Standard 467, Electrical Grounding and Bonding Equipment.
   6. UL Standard No. 6, Rigid Metal Electrical Conduit.
   7. UL Standard No. 360, Liquid-Tight Flexible Steel Conduit.

8. UL Standard No. 514, Electrical Outlet Boxes and Fittings.
9. UL Standard No. 651, Schedule 40 and 80 PVC Conduit.
10. UL Standard No. 886, Electrical Outlet Boxes and Fittings for Use in Hazardous Locations.
11. UL Standard 1242, Intermediate Metallic Conduit.
12. ANSI C80.1, Specification for Zinc Coated Rigid Steel Conduit.
13. NEMA FB 1, Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable
14. NEMA TC2, Electrical Plastic Tubing, Conduit and Fittings.
15. NEMA TC3, PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.3 SUBMITTAL

A. Product Data: Submit, for approval, product data for all materials covered herein.

B. Shop Drawings: Submit for approval the following: Layout drawings showing proposed routing of exposed conduits, conduits embedded in structural concrete and conduits directly buried in earth. Drawings shall show locations of pull and junction boxes, expansion fittings, sealing fittings, flexible conduit runs and all penetrations in walls and floor slabs.

C. Record Drawings: Include the actual routing of exposed and concealed conduit runs on Record Drawings.

PART 2 - PRODUCTS

2.1 RIGID CONDUIT

A. Rigid Steel Conduit, Elbows and Couplings: Rigid, heavy wall, mild steel, hot dip galvanized, smooth interior, tapered threads and carefully reamed ends; 3/4-inch NPS minimum size.

B. PVC Coated Rigid Steel Conduit, Elbows and Couplings: Material: Rigid, heavy wall, mild steel, hot dip galvanized, smooth interior, tapered threads, carefully reamed ends, 3/4-inch NPS minimum size with a exterior factory coating of 40-mil thick polyvinyl chloride and an interior coating of 2-mil thick urethane. Color of coating shall be the same on all conduit and fittings. Robroy, Permacote or Ocal.

C. Metallic Conduit Fittings and Outlet Bodies: Cast gray iron alloy, cast malleable iron bodies and covers. Outdoor units shall be gasketed and watertight. Gaskets shall be of an approved type designed for the purpose. Improvised gaskets are not acceptable. All units shall be threaded type with five full threads. Material shall conform to ANSI C80.4 and shall be listed by UL. Fittings and bodies in or on PVC coated conduit runs shall have an exterior factory-applied coating of 40 mil thick polyvinyl chloride, an interior coating of 2-mil thick urethane, and V-seal gasketing.

D. Non-Metallic Conduit: Schedule 40 PVC plastic, NEMA Type EPC-40-PVD, 90°C rated, conforming to UL No. 651. Form elbows, bodies, terminations, expansions and fasteners of same material and manufacturer as base conduit. Provide cement by same manufacturer as base conduit.

E. Conduit Hubs: (Myers or T&B).

1. Material: Threaded conduit hub, vibration proof, weather proof with captive O-ring seal, zinc metal with insulated throat. Hubs used on PVC coated conduit systems shall have a factory applied PVC coating.
2. Use: Provide for all conduit terminations to boxes, cabinets and other enclosures located in areas designated as set locations.

F. . Conduit Tags: Conduit Identification Tags shall be YELLOW 1-½" round aluminum (Brady catalog number 49900) engraved with the conduit number as indicated in the drawings and/or specifications. Print shall be ¼" Gothic". Each tag shall be attached with fasteners of nylon coated 48 mil stainless steel wire (Brady catalog number 23310 or equal) and brass wire clamps - double ferrule design (Brady catalog number 23312 or equal) to secure the stainless steel wire.

2.2 FLEXIBLE CONDUIT

A. Non-hazardous Areas: Flexible galvanized steel core with smooth, abrasion resistant, liquid-tight, polyvinyl chloride cover. Continuous copper ground built in for sizes 3/4-inch through 1-1/4 inch. Material shall be UL listed. Provide one of the following:
1. Sealtite UA by Anaconda Metal Hose Division, Anaconda American Brass Company.
2. Liquatite Type L.A. by Electric-Flex Company.
3. Anaconda Metal Hose

B. Hazardous Areas: Flexible brass inner core with bronze outer braid and protective vinyl plastic coating. Steel end fittings. Suitable for use in Class 1, Group D, Division 1 hazardous area. Minimum of 12-inches in length. Provide one of the following:
1. Type ECGJH or ECLK by Crouse Hinds Company.
2. Type EXGJH or EXLK by Appleton Electric Company.
3. Or equal.

C. Wet and/or Corrosive areas, including Hazardous wet / corrosive areas: All fittings shall be PVC coated .

D. Flexible Conduit Fittings: Malleable iron with cadmium finish. Fittings shall adapt the conduit to standard threaded connections, shall have an inside diameter not less than that of the corresponding standard conduit size and shall be UL listed. Provide one of the following:
1. Crouse-Hinds Company.
2. Appleton Electric Company.
3. Or equal.

2.3 SEALING FITTINGS

A. Cast gray iron alloy or cast malleable iron bodies with zinc electroplate and lacquer or enamel finish. Provide with ample opening with threaded closure for access to conduit hub for making dam. Sealing fiber for forming the dam within the hub and the sealing compound shall be approved for use with the fittings furnished. PVC Coated where required per these specifications and Section 16050. Provide one of the following:
1. Series EYS by Crouse Hinds Company.
2. EYS by Appleton Electric Company.
3. T&B.
4. Or Equal.

2.4 EXPANSION FITTINGS

A. Cast gray iron alloy or bronze end couplings, malleable iron or hot dipped galvanized body, stainless steel clamps and tinned copper braid bonding jumper. Fittings shall be watertight, corrosion-resistant UL listed and compatible with the conduit system. PVC Coated where required per these specifications and Section 16050. Provide one of the following:
   1. Type DX for expansion/deflection or AX for expansion only by O-Z Gedney Company.
   2. Type XD for expansion/deflection or XJ for expansion only by Crouse Hinds Company.
   3. Or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Supports:
   1. Rigidly support conduits with clamps, hangers or Unistrut channels.
   2. Support single conduits by means of one-hole pipe clamps in combination with one-screw back plates, to raise conduits from the support surface. Support multiple runs of conduits on trapeze type hangers with steel horizontal members and threaded hanger rods, Kindorff or equal. Rods shall be not less than 3/8-inch diameter, and shall be Type 316 stainless steel.
   3. For PVC coated rigid steel conduit, supports and hardware shall be stainless steel.

B. Fastenings: Fasten raceway systems rigidly and neatly to supporting structures by the following methods:
   1. To Wood: Wood screws.
   2. To Hollow Masonry Units: Toggle bolts.
   3. To Concrete: Reusable Expansion anchors. (Lead drive in or any anchors not re-usable are not allowed).
   4. To Steel: Steel welded threaded studs, beam clamps or bolts with lockwashers or locknuts.

C. Exposed Conduit:
   1. Install parallel or perpendicular to structural members or walls.
   2. Wherever possible, run in groups. Provide galvanized conduit racks of suitable width, length and height and arranged to suit field conditions. Provide support at every 10 feet minimum.
   3. Install on structural members in protected locations.
   4. Locate clear of interferences.
   5. Maintain 6-inches from hot fluid lines and 1/4-inch from walls.
   6. Install vertical runs plumb. Unsecured drop length shall not exceed 12 feet.

D. Conduit Embedded in Concrete:
   1. Separation: Three times outer diameter of larger conduit center to center.
   2. Minimum Slab Thickness:
      a. With no crisscrossing of conduit, three times outer diameter of conduit.
      b. With crisscrossing of conduits, four times outer diameter of larger conduit.
   3. Run conduit in center of slab.
   4. Before concrete is placed, make the necessary location measurements of the conduit to be embedded so that the information is available to prepare record drawings.

5. All conduits entering or exiting concrete shall be PVC coated a minimum of 12-inches on each side of air/concrete interface.

E. Underground Conduits:
   1. Install individual underground conduits a minimum of 24-inches below grade, unless otherwise indicated or as required to avoid existing obstructions.
   2. Perform all excavation, bedding, backfilling and surface restoration including pavement replacement where required.
   3. Make conduit connections watertight.

F. Empty Conduits:
   1. Install nylon pull wire in each empty conduit and cap conduits not terminating in boxes with permanent fittings designed for the purpose.
   2. Identify each empty conduit with a durable tag in accordance with Paragraph 2.1.F and Paragraph 3.3.A, showing the conduit number indicated on the Drawings.

G. Field Bends: No indentations. Diameter of conduit shall not vary more than 15 percent at any bend.

H. Joints:
   1. Apply conductive compound to all joints before assembly.
   2. Make up joints tight and ground thoroughly.
   3. Use standard tapered pipe threads for conduit and fittings.
   4. Cut conduit ends square and ream to prevent damage to wire and cable.
   5. Use full threaded couplings. Split couplings are not permitted.
   6. Use strap wrenches and vises to install conduit. Replace conduit with wrench marks.
   7. Apply zinc-rich paint to exposed threads and other areas of galvanized conduit system where the base metal is exposed.

I. Terminations:
   1. Install insulated bushings on conduits entering boxes or cabinets, except threaded hub types.
   2. Provide locknuts on both inside and outside of enclosure for grounding.
   3. Bushings shall not be used in lieu of locknuts.

J. Moisture Protection:
   1. Plug or cap conduit ends at time of installation to prevent entrance of moisture or foreign materials.
   2. Make underground and embedded conduit connections watertight.
   3. Thruwall Seals: Install for conduits passing through new exterior subsurface walls or base slabs of buildings and for conduits passing through existing exterior walls. For individual exposed conduits passing through interior walls, install non-metallic sleeves to protect the conduit against action of alkaline substances that may be present.
   4. Drainage: Pay particular attention to drainage for conduit runs. Wherever possible, install conduit runs so as to drain to one end and away from buildings. Avoid pockets or depressions in conduit runs. Where conduits enter buildings below grade, seal inside of conduit to form a watertight seal around cables to prevent the entry of water into building. Sealant shall be Silicone and shall form an elastomeric compression seal. Sealant shall be Fire Barrier 2001 Silicone RTV Foam or equal.

K. Corrosion Protection:
   1. Conduit Curb:

a. In concrete slabs or floors, provide a 2-inch high curb extending 2-inches from the outer surface of the conduit penetrating the floor, to prevent corrosion.
b. Terminate conduit stub-ups in couplings, slightly above the finished concrete curb.

2. Dissimilar Metals:
a. Take every action to prevent the occurrence of electrolytic action between dissimilar metals.
b. Do not use copper products in connection with aluminum work, and do not use aluminum in locations subject to drainage of copper compounds on the bare aluminum.
c. Back paint aluminum in contact with masonry or concrete with two coats of aluminum-pigmented bituminous paint.

L. Reused Existing Conduits:
1. Pull rag swab through conduits to remove water and to clean conduit prior to installing cable.
2. Repeat swabbing until all foreign material is removed.
3. Pull mandrel through conduit, if necessary, to remove obstructions.

M. Core drill for individual conduits passing through existing concrete walls or slabs. Obtain authorization from OWNER prior to core drilling. Seal spaces around conduit and the wall penetration details as shown on the Drawings.

N. Non-Metallic Conduit:
1. Install in accordance with manufacturer's recommendations.
2. Join sections in accordance with manufacturer's installation procedures for push-fit, bell and spigot type joints, if applicable, or with manufacturer's recommended cement.
3. During installation provide expansion fittings for expansion and contraction to compensate for temperature variations. Expansion fittings shall be watertight and of the type suitable for direct burial.
4. Make transition to PVC coated rigid steel conduit before making turn up to enclosures.

3.2 TESTING

A. Test conduits by pulling through each conduit a cylindrical mandrel not less then two pipe inside diameters long, having an outside diameter equal to 90 percent of the inside diameter of the conduit.

B. Maintain a record, by number, of all conduits testing clear.

3.3 IDENTIFICATION

A. Tag all conduits at the ends and in all intermediate boxes, chambers, handholes and other enclosures. Fasten tags to conduits with bare stainless steel wire. Where this method is not practical, fasten to the adjacent masonry by means of expansion bolts.

B. Use numbers on all conduits as designated in the cable and conduit schedule and record the conduit numbers and the cable content by cable designation, size, quantity, origin and termination of conductors, and name of equipment served. Assign numbers to unidentified conduits such as home runs to panelboards. Lighting conduits are excluded from these requirements. This information shall be included with the Record Drawings.

++ END OF SECTION ++

SECTION 16135

OUTLET, PULL, AND JUNCTION BOXES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope: Provide boxes, as follows:
   1. Provide outlet boxes for mounting wiring devices and lighting fixtures.
   2. Provide junction or pull boxes in runs containing more than three 90 degree bends, runs exceeding 200 feet, where shown on the Drawings and where required to conform with the National Electrical Code.

1.2 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified:
   1. NEC Article 370, Outlet, Switch and Junction Boxes, and Fittings.
   2. UL Standard No. 50, Electrical Cabinets and Boxes.
   3. UL Standard No. 514, Electrical Outlet Boxes and Fittings.
   4. UL Standard No. 886, Electrical Outlet Boxes and Fittings for Use in Hazardous Locations.

1.3 SUBMITTAL

A. Product Data: Submit, for approval, product data for all materials covered herein.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Outlet Boxes: PVC Coated where required per these specifications and Section 16050. Cast gray iron alloy, or cast malleable iron, with zinc electroplate finish in damp, wet or exterior locations and zinc-coated sheet steel in dry locations. Provide boxes of one of the following:
   1. Crouse-Hinds Company.
   2. Appleton Electric Company.
   3. Bowers.
   4. Or equal.

B. Pull and Junction Boxes:
   1. Material and Construction:
      a. Cast gray iron alloy with hot-dip galvanized finish or cast malleable iron bodies and covers.
      b. Neoprene gaskets. Gaskets shall be of an approved type designed for the purpose. Improvised gaskets are not acceptable.
      c. Stainless steel cover screws.
      d. External mounting lugs.
      e. Drilled and tapped conduit holes.
      f. Boxes where conduits enter a building below grade shall have 1/4-inch drain hole.

2. Product and Manufacturer: Provide pull and junction boxes of one of the following:
   a. Appleton Electric Company.
   b. O-Z/Gedney Company.
   c. Hoffman.
   d. Or equal.
3. Large boxes not generally available in cast construction may be fabricated of copper-free aluminum alloy or Type 316 stainless steel as required by location.
4. Boxes for installation in areas classified as hazardous locations shall be explosion proof and shall comply with UL 886.
5. For flush-mounted pullboxes in exterior slabs or pavement and where indicated in interior slabs, provide vehicular traffic-bearing covers.
6. Junction boxes and pullboxes embedded in concrete slabs shall be cast iron. Junction boxes and pullboxes located in wet, or outdoor areas shall be NEMA 3R or NEMA 4. Junction boxes and pullboxes located in corrosive locations shall be NEMA 4X, Type 316 stainless steel. All other areas shall be NEMA 12.
7. PVC Coated where required per these specifications and Section 16050.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount boxes so that sufficient access and working space is provided.

B. Securely fasten boxes to walls, other structural surfaces or slabs on or in which they are mounted. Provide independent galvanized steel supports where no walls or other structural surface exists.

C. For units mounted on masonry or concrete walls, provide suitable 1/2-inch spacers to prevent mounting back of box directly against wall.

D. Where sizes are not indicated, size junction and pull boxes in accordance with the requirements of the National Electrical Code.

E. Provide terminal blocks in junction boxes where cable terminations or splices are required.

F. Leave no open conduit holes in boxes. Close unused openings with capped bushings.

G. Label each circuit in boxes and identify with durable tag.

++ END OF SECTION ++

SECTION 16136

UNDERGROUND DUCT BANKS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope: Provide underground ductbanks where shown and where required. Duct bank routing on the Drawings is diagrammatic. Coordinate installation with piping and other underground systems and structures and locate clear of interferences.

B. Related Sections:
   1. Section 02300, Earthwork.
   2. Section 03200, Concrete Reinforcement.
   3. Section 03300, Cast-In-Place Concrete.
   4. Section 16130, Conduit.

1.2 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the National Electrical Code and National Electrical Safety Code.

1.3 SUBMITTAL

A. Shop Drawings: Submit for approval typical cross-sections and Layouts showing the proposed routing of duct banks.

B. Record Drawings: Include the actual routing of underground duct bank runs on Record Drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Backfill: Select backfill in accordance with Section 02300, Earthwork.

B. Reinforcement: In accordance with Section 03200, Concrete Reinforcement.

C. Concrete: In accordance with Section 03300, Cast-In-Place Concrete.

D. Duct: Schedule 40 PVC conduit and fittings in accordance with Section 16130, Conduit.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Make duct bank installations and penetrations through foundation walls watertight.

B. Top of ductbanks shall be a minimum of 24-inches below grade, unless otherwise approved by the ENGINEER.

C. Assemble duct banks using non-magnetic saddles, spacers and separators. Position separators to provide 3-inch minimum concrete separation between the outer surfaces of the ducts.

D. Provide a 3-inch minimum concrete covering on both sides, top and bottom of concrete envelopes around conduits. Add red dye to concrete mix for easy identification during subsequent excavation.

E. Firmly fix ducts in place during pouring of concrete. Carefully spade and vibrate the concrete to ensure filling of all spaces between ducts.

F. Make bends with sweeps of not less than 48-inch radius or 5-degree angle couplings.

G. Make a transition from non-metallic to PVC Coated rigid steel conduit where duct banks enter structures or turn upward for continuation above grade. Continue ducts inside buildings with PVC Coated rigid steel conduit where required per the area classification.

H. Reinforce all duct banks. Unless otherwise noted on the Drawings, reinforce with No. 4 longitudinal steel bars placed at each corner and along each face at a maximum parallel spacing of 18-inches on centers, and No. 3 tie-bars transversely placed at 18-inch maximum longitudinal intervals. Maintain a minimum clearance of 2-inch from bars to the edge of the concrete encasement.

I. Where ducts enter structures such as manholes, handholes, pullboxes, transformer and switchgear compartments, or buildings, terminate the ducts in suitable end bells, insulated bushings or couplings on steel conduits.

J. Do not backfill with material containing large rock, paving materials, cinders, large or sharply angular substances, corrosive material or other materials which can damage or contribute to corrosion of ducts or cables or prevent adequate compaction of fill.

K. Slope duct runs for drainage toward manholes and away from buildings with a slope of approximately 3-inches per 100 feet.

L. Install a 3/0 bare stranded copper duct bank ground in each duct bank envelope. Make ground electrically continuous throughout the entire duct bank system and connect to switchgear and motor control center (MCC) ground buses and to steel conduit extensions of the underground duct system.

M. After completion of the duct bank and prior to pulling cable, pull a mandrel, not less than 12-inches long and with a cross section approximately 1/4-inch less than the inside cross section of the duct, through each duct. Then pull a rag swab or sponge through to make certain that no particles of earth, sand or gravel have been left in the duct.

N. Install a warning ribbon approximately 12-inches below finished grade over all underground duct banks carrying cables of 480 volts and higher. The identifying ribbon shall be a PVC tape, 3-inches wide, yellow color, permanently imprinted with "CAUTION BURIED ELECTRIC LINE BELOW" in black letters.

O. Reused Existing Ducts:

1. Pull rag swab through duct to remove water and to clean duct prior to installing new cable.
2. Repeat swabbing until all foreign material is removed.
3. Pull mandrel through duct, if necessary, to remove obstructions.

P. No more than 270 degrees of bends allowed in a continuous run of conduit.

++ END OF SECTION ++

SECTION 16137

MANHOLES AND HANDHOLES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope: Provide manholes and handholes where shown on Drawings. Verify final locations in field. CONTRACTOR shall be responsible for all excavation and backfilling required for installation.

B. Coordination: Coordinate manhole and handhole installation with piping, sheet piling and other underground systems and structures and locate clear of interferences.

C. Related Sections:
   1. Section 02300, Earthwork.
   2. Section 03200, Concrete Reinforcement.
   3. Section 03300, Cast-In-Place Concrete.
   4. Section 16136, Underground Duct Banks.

1.2 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified:
   1. National Electrical Code.
   2. National Electrical Safety Code.
   3. ASTM A 48, Gray Iron Castings.
   4. ANSI A14.3, Safety Requirements for Fixed Ladders.
   5. OSHA.

1.3 SUBMITTAL

A. Product Data: Submit, for approval, product data for all materials covered herein.

B. Shop Drawings: Submit, for approval, drawings showing interior and exterior dimensions and details of openings, jointing, inserts and reinforcing.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Material and Construction:
   1. Precast or cast-in-place type of reinforced concrete.
   2. Minimum interior dimensions as shown on the Drawings.
   3. Duct entrances sized and located to suit duct banks.

B. Accessories:
   1. Frames and Covers:
      a. Material: Cast iron conforming to ASTM A 48, Class 30A.

b. Covers: Watertight, sealed type marked "ELECTRICAL" in raised 2- inch letters.
c. Frame shall be grouted on the manhole or handhole.

2. Pulling Irons:
   a. Material: Galvanized steel.
   b. Cast in the wall opposite to the centerline of each incoming duct bank and 12-inches below centerline of bottom line of ducts.
3. Cable Racks:
   a. Material: Galvanized steel.
   b. Cable racks shall adequately support cables with space allowed for future cables.
   c. Each rack shall be a vertical assembly of 24-inch cable racks extending from within 6-inches of the manhole roof slab to within 6-inches of the manhole floor.
   d. Product and Manufacturer: Provide one of the following:
      1) Catalog Number J-5125 by Joslyn Manufacturing and Supply Company.
      2) Catalog Number 2125 by Hubbard and Company.
      3) Or equal.
4. Cable Hooks:
   a. Material: Galvanized steel.
   b. Length: 7-1/2-inch minimum.
   c. Product and Manufacturer: Provide one of the following:
      1) Catalog Number J-5132 by Joslyn Manufacturing and Supply Company.
      2) Catalog Number 2132 by Hubbard and Company.
      3) Or equal.
5. Insulators:
   a. Material: Porcelain.
   b. Product and Manufacturer: Provide one of the following:
      1) Catalog Number J-5122 by Joslyn Manufacturing and Supply Company.
      2) Catalog Number 2120 by Hubbard and Company.
      3) Or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Complete installation of manholes and handholes so that structures are watertight.

B. Cable Racks:
   1. Attach with 3-inch by 3/8-inch diameter "tamp-in" studs mounted in 1-inch holes drilled into walls of manholes in the absence of inserts.
   2. Provide cable hooks to support each cable on each rack along the cable run within the manholes.
   3. Individually support each cable at each hook on porcelain insulators.
   4. In the manhole securely tie each cable in place at each insulator block to prevent excessive movement of insulators, cables, or fireproof tape. Tie cables with non-metallic 3/4-inch strapping tape as manufactured by 3M or tie down with nylon straps.

C. Grounding: Install a 3/4-inch by 10-foot copper-clad ground rod for each manhole. Bond all exposed metal manhole accessories and the concrete reinforcing rods with No. 4 AWG minimum bare copper wire and connect to the ground rod and to the ductbank ground cable.

D. Provide grading rings for manholes when required to adjust manhole cover to proper grade. Stacks shall be minimum of 12-inches in height, constructed on the roof slab or cone section on which the manhole frame and cover shall be placed. The height of the grading ring shall be such as is necessary to bring the manhole frame to the proper grade.

++ END OF SECTION ++

SECTION 16140

WIRING DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope: Provide wiring devices, including:
   1. Receptacles.
   2. Snap switches for lighting and other systems.

B. Related Sections:
   1. Section 16050, General Provisions.
   2. Section 16135, Outlet, Pull, and Junction Boxes.

1.2 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified:
   1. National Electrical Code.
   2. UL Standard #20, General Use Snap Switches.
   3. UL Standard #894, Switches for Use in Hazardous Locations.
   4. UL Standard #1010, Electrical Receptacle - Plug Combinations for Use in Hazardous Locations.

1.3 SUBMITTAL

A. Product Data: Submit, for approval, product data for all materials covered herein.

PART 2 - PRODUCTS

2.1 RECEPTACLES

A. Non-Hazardous Locations: Duplex grounding receptacle, two pole, three wire, 125 volt AC, 20 ampere. All exterior outlets shall be ground-fault interrupting type. Provide one of the following:
   1. Catalog Number 53CM62, by Harvey Hubbell Incorporated.
   2. Catalog Number 5362-CR, by Arrow-Hart Incorporated.
   3. Leviton.
   4. Or equal.

B. Hazardous Locations: Factory sealed receptacle suitable for installation in Class I, Group D hazardous locations. Copper-free aluminum receptacle and cover with cast gray iron alloy or cast malleable iron mounting box with zinc electroplate finish. PVC Coated where required per these specifications and Section 16050. Receptacle rated at 20 amperes, 125-250 volt AC, 2 wire, three pole. Provide one of the following:
   1. Series CPS by Crouse-Hinds Company.
   2. Type CPS by Appleton Electric Company.
   3. Or equal.

C. Special Receptacles: Provide receptacles with number of poles, voltage and current rating as shown on the Drawings. Coordinate with equipment plugs. Provide matching plug for each receptacle.

2.2 SWITCHES

A. Non-Hazardous Locations:
   1. Single pole AC toggle switch, quiet type, 120/277 volt AC, 20 ampere, Ivory, specification grade. Provide one of the following:
      a. Catalog Number 1221-I, by Harvey Hubbell Incorporated.
      b. Catalog Number 1991-I, by Arrow-Hart Incorporated.
      c. Leviton.
      d. Or equal.
   2. Single pole, 3-way AC toggle switch, quiet type, 120/277 volt AC, 20 ampere, Ivory, specification grade. Provide one of the following:
      a. Catalog Number 1223-I, by Harvey Hubbell Incorporated.
      b. Catalog Number 1993-I, by Arrow-Hart Incorporated.
      c. Leviton.
      d. Or equal.
   3. Two pole AC toggle switch, quiet type, 120/277 volt AC, 20 ampere, Ivory, specification grade. Provide one of the following:
      a. Catalog Number 1222-I, by Harvey Hubbell Incorporated.
      b. Catalog Number 1992-I, by Arrow-Hart Incorporated.
      c. Leviton.
      d. Or equal.

B. Hazardous Locations: Factory sealed tumbler switch suitable for installation in Class I, Group D hazardous locations. Cast gray iron alloy or cast malleable iron body and cover with zinc electroplate finish. PVC Coated where required per these specifications and Section 16050. Switch rated at 20 amperes, 120/277 volt AC. Provide one of the following:
   1. Series EDS by Crouse-Hinds Company.
   2. Type EDS by Appleton Electric Company.
   3. Or equal.

C. Key Operated On-Off Switches: Key operated switches shall be complete with legend plate and NEMA 4 enclosure and two (2) keys.

2.3 COVERS

A. Indoor covers shall be Type 304, stainless steel.

B. Outdoor or wet location covers shall be weatherproof and corrosion resistant. PVC Coated where required per these specifications and Section 16050.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install wiring devices in outlet or device boxes in non-hazardous locations.

B. Install wiring devices in rigid metallic conduit systems in hazardous locations.

C. Install receptacles with ground pole in the down position.

D. Mount receptacles 18-inches above finished floor in non-hazardous locations and 4 feet-6 inches above finished floor in hazardous locations, unless otherwise noted.

E. Mount wall switches 4 feet-6 inches above finished floor unless otherwise noted.

++ END OF SECTION ++

SECTION 16215

POWER SYSTEM STUDIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment, services and incidentals required to perform Power System Studies and distribution system field testing.
   2. The Power System Studies shall include a Short Circuit Study, a Protective Device Evaluation Study, a Protective Device Coordination Study, and an Arc Flash Analysis.

1.2 REFERENCES

A. Standards referenced in this Section are listed below:
   1. American National Standards Institute, (ANSI).
      a. ANSI C37.04, Rating Structure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis.
      b. ANSI C37.010, Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Basis.
   2. Institute of Electrical and Electronics Engineers, (IEEE).
      a. IEEE 141, Electric Power Distribution in Industrial Plants.
      b. IEEE 399, Recommended Practice for Industrial and Commercial Power System Analysis.
   3. National Electrical Code, (NEC).

1.3 QUALITY ASSURANCE

A. Source Quality Control:
   1. Retain the services of a Registered Professional Engineer, to perform the Power System Studies and field services. The Registered Professional Engineer shall be from an independent consulting firm or from the manufacturer of the power distribution equipment.
   2. Coordinate with the Engineer performing the studies and assist him in the collection of all information necessary to complete the studies specified.
   3. All information pertaining to the existing system necessary to perform the studies shall be obtained in advance prior to performing the studies.
   4. All motor starting and transformer information shall be based upon the equipment actually installed.
   5. Retain the services of a Field Engineer to perform field testing of the power distribution system. The Field Engineer shall be from the manufacturer of the power distribution equipment.

B. All test equipment and instrument calibration shall be in accordance with the latest edition of the accuracy standard of the U.S. National Institute of Standards and Technology.

1.4 SUBMITTALS

A. Shop Drawings: Submit the following:
   1. Copies of calculations and results of the Short Circuit Study, Protective Device Evaluation, Coordination Studies, and Arc Flash Analysis in a report format. The report shall be stamped and signed by an Arizona Registered Professional Electrical Engineer.
   2. Work sequence for the field testing shall be submitted in advance prior to performing tests. The sequence shall indicate the schedule of work, time frame and downtime for the equipment.
   3. Time current curves for all protective devices included within the power system studies.

B. Reports:
   1. Field test report shall be submitted.

PART 2 - PRODUCTS

2.1 POWER SYSTEM STUDIES

A. General:
   1. Provide a current and complete Short Circuit Study, Protective Device Evaluation Study, and a Protective Device Coordination Study for the Electrical Distribution System.
   2. The studies shall include all portions of the high (12.47KVAC) and low voltage (240VAC) electrical distribution system from the normal and alternate sources of power through the low-voltage distribution system. Normal system operating method, alternate operation, and operations which could result in maximum fault conditions shall be thoroughly covered in the study.
   3. It is the intent of this Section that a complete study shall be performed to evaluate both new and existing devices and to make recommendations regarding any adjustments. The studies shall include both the normal utility supply and the standby generator supplies.
   4. Problem areas or equipment inadequacies shall be promptly brought to the ENGINEER'S attention.

B. Short Circuit Study:
   1. The Short Circuit Study shall be performed with the aid of a computer program.
   2. The study input data shall include the utility company's short circuit, single and three phase contributions, with the X/R ratio, the resistance

and reactance components of each branch impedance, motor and generator contributions, base quantities selected, and all other applicable circuit parameters.

3. Short-circuit momentary duties and interrupting duties shall be calculated on the basis of maximum available fault current at each switchgear bus, switchboard, motor control center, distribution panelboard, pertinent branch circuit panelboards, and other significant locations through the system.
4. The short circuit tabulations shall include symmetrical fault currents, and X/R ratios. For each fault location, the total duty on the bus, as well as the individual contribution from each connected branch, including motor back EMF current contributions shall be listed with its respective X/R ratio.

C. Protective Device Evaluation Study:
   1. A Protective Device Evaluation Study shall be performed to determine the adequacy of circuit breakers, controllers, surge arresters, busways, switches, and fuses by tabulating and comparing the short-circuit ratings of these devices with the available fault currents.
   2. Appropriate multiplying factors based upon system X/R ratios and protective device rating standards shall be applied.

D. Protective Device Coordination Study:
   1. A Protective Device Coordination Study shall be performed to select or to check the selections of the power fuse ratings, protective relay characteristics and settings, ratios and characteristics of associated voltage and current transformers, and low-voltage breaker trip characteristics and setting.
   2. The overcurrent device settings computed in the Protective Device Coordination Study shall provide complete 100 percent selectivity. The system shall be selectively coordinated such that only the device nearest a fault will operate to remove the faulted circuit. System selectively shall be based on both the magnitude and the duration of a fault current.
   3. The Protective Device Coordination Study shall include all voltage classes of equipment starting at the utility's incoming line protective device down to and including each of the medium and low voltage equipment. The phase and ground overcurrent and the phase and ground fault protection shall be included, as well as settings for all other adjustable protective devices.
   4. The time-current characteristics of the installed protective devices shall be plotted on the appropriate log-log paper. Reasonable coordination intervals and separation of characteristic curves shall be maintained. The coordination plots for phase and ground protective devices shall be provided on a complete system basis. Sufficient curves shall be used to clearly indicate selective coordination achieved through the utility main breaker, power distribution feeder breakers, and the overcurrent devices at each major load center.
   5. There shall be a maximum of eight protective devices per plot. Each plot shall be appropriately titled. Plots shall include the following information as required for the circuits shown:

a. Representative one-line diagram, legends and types of protective devices selected.
b. Power company's relays or fuse characteristics.
c. Significant motor starting characteristics.
d. Parameters of transformers, ANSI magnetizing inrush and withstand curves.
e. Operating bands of low voltage circuit breaker trip curves, and fuse curves.
f. Relay taps, time dial and instantaneous trip settings.
g. Cable damage curves.
h. Symmetrical and asymmetrical fault currents.

6. The selection and settings of the protective devices shall be provided separately in a tabulated form listing circuit identification, IEEE device number, current transformer ratios, manufacturer, type, range of adjustment, and recommended settings. A tabulation of the recommended power fuse selection shall be provided for all fuses in the system.

E. Arc Flash Analysis:
1. Conduct arc flash analysis after acceptance by ENGINEER of the short circuit and coordination studies. Perform arc flash analysis for each operating mode of the system, per IEEE 1584 and NFPA 70E.
2. Document the protection and calculation procedures and coordination review in the report. Analysis results shall be presented in tabular format showing the following:
a. Bus and protection device name.
b. Bolted and arcing fault values.
c. Protective device trip times.
d. Arc flash boundary, working distance, and incident energy.
e. Required protective FR clothing class.
3. As part of the arc flash analysis, provide personnel protective equipment labels per Section 16075, Electrical Identification.
4. Provide training for OWNER’s operation and maintenance personnel in personnel protection equipment. Provide at least four hours of training, per Division 1.

2.2 STUDY REPORT

A. The results of the Power Distribution System Coordination Study shall be summarized in a final report submitted in a binder with separation tabs for each section. The report shall include the following Sections:
1. Description, executive summary, purpose, basis, written scope, and a single-line diagram of the Power Distribution System which is included within the scope of the study.
2. Tabulations of circuit breaker, fuses, and other equipment ratings versus calculated short-circuit duties, and commentary regarding same.
3. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.

4. Fault current tabulation including a definition of terms and a guide for interpretation.
5. Tabulation of appropriate tap settings for relay seal-in units.
6. Tabulation of equipment survey information.

PART 3 - EXECUTION

3.1 FIELD SERVICES

A. The Registered Professional Engineer shall conduct an equipment survey of existing devices and information necessary to perform the Power System Studies.

B. The survey shall include the following information to the extent applicable:
1. Manufacturer, type and size of each power fuse.
2. Manufacturer, type, model and settings for each protective relay, trip unit and circuit breaker.
3. Current transformer ratios for each protective relay.
4. Appropriate data of motors and transformers included with the study.

C. The Registered Professional Engineer, as part of the field service Work, shall collect all data and coordinate with the equipment vendors to establish the proper settings for the actual devices provided.

3.2 FIELD TESTING

A. Provide field testing of the distribution system in accordance with the manufacturer's recommendations. All field testing shall be performed by the Field Engineer, after the completion and approval of the Power System Studies. The field testing results shall be documented within a report, with the final settings of all protective devices.

B. The Field Engineer with necessary tools and equipment shall adjust, set, calibrate and test all protective devices. All protective relays and meters in the medium and low voltage equipment shall be set, adjusted, calibrated and tested in accordance with the manufacturer's recommendations, the coordination study and best industry practice.

C. Proper operation of all equipment associated with the device under test and its compartment, shall be verified, as well as complete resistance, continuity and polarity tests of power, protective and metering circuits. Any minor adjustments, repairs and lubrication necessary to achieve proper operation shall be considered part of this Contract.

D. All solid state trip devices shall be set including all required programming necessary for the protection required. The devices shall be checked and tested for setting and operation. Circuit breakers and/or contactors associated with the trip devices shall be tested for trip and close function with their protective device.

3.3 MAINTENANCE OF OPERATIONS

A. Since the field testing work specified may require that certain pieces of equipment be taken out of service, CONTRACTOR shall perform the Work with due regard to maintenance of operations and construction staging in accordance with the requirements of Division 1 for Coordination with OWNER'S operation. All testing procedures and schedules must be scheduled in advance prior to any work beginning.

+ + END OF SECTION + +

SECTION 16232

SINGLE DIESEL FUELED ENGINE GENERATOR

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for:
   1. Packaged automatic "standby" diesel engine generator system including:
      a. Diesel engine with batteries and battery charger.
      b. Generator.
      c. Liquid coolant system.
      d. Fuel system and fuel storage tank(s).
      e. Exhaust system.
      f. Control system.
      g. Supporting and mounting skid.
      h. Weatherproof acoustical housing.
      i. All other equipment required for a complete and operable power generation system (coordinate ATS supply and settings with electrical contractor and manufacturer).

1.2 REFERENCES

A. Refer to Section 16050.

B. American Society for Testing and Materials (ASTM):
   1. A 53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
   2. A 106 - Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.
   3. A 181 - Standard Specification for Carbon Steel Forgings for General Purpose Piping.
   4. A 240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
   5. A 536 - Standard Specification for Ductile Iron Castings.
   6. D 2310 - Standard Classification for Machine-Made Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.

C. National Electrical Manufacturers Association (NEMA):
   1. 250 - Enclosures for Electrical Equipment (1,000 Volts Maximum).
   2. MG-1 - Motor and Generators.

D. National Fire Protection Association (NFPA):
   1. 30 - Flammable and Combustible Liquids Code.
   2. 37 - Combustion Engines and Gas Turbines, Stationary.
   3. 99 – General Overall Requirements.
   4. 110 - Standard for Emergency and Standby Power Systems.

E. Underwriters Laboratories (UL):d
   1. 142 – Standards for Steel Aboveground Tanks for Flammable and Combustible Liquids.

2. 508 – Standard for Safety for Industrial Control Equipment.
3. 2200 – Standards for Stationary Engine Generator Assemblies.

1.3 DEFINITIONS

A. Refer to Section 16050.

B. Specific Definitions:
   1. Standby Rated Duty: Defined as continuous operation for the duration of any power outage.
   2. Equipment Supplier: Defined as the prime manufacturer of at least one of the following items:
      a. Engine.
      b. Alternator (Generator).
      c. Control system.

1.4 SYSTEM DESCRIPTION

A. Provide a complete automatic standby diesel engine driven generator system, with all necessary components to make a complete and operating diesel-driven power supply. Coordinate the generator control design with the switchgear or transfer switches specified in Division 16 and as indicated on the Drawings. Provide a weatherproof, sound attenuated enclosure and double-wall diesel fuel tank with 24 hour operating capacity at 100% load.

B. Generator System Performance Requirements:
   1. Power Output Rating: Minimum kilowatts and voltage as indicated on the Drawings, delivered at 0.8 power factor, 3-phase, 4-wire, 60 hertz, without exceeding NEMA MG-1 temperature rise limits. Generator must be suitable for the variable frequency drive (VFD) loads as indicated on the drawings.
   2. It is the manufacturer's responsibility to properly size the engine generator based upon site conditions and actual loads. The Drawings and Specifications indicate a minimum size that the ENGINEER has determined based upon non-certified information. No increase in Contract amount will be considered if the equipment size needs to be increased to meet the load requirements after Bids have been submitted.
   3. Increases in size as a result of manufacturer sizing shall include any and all conduit and wire size changes:
      a. Manufacturer to size engine generator and provide calculations to substantiate voltage drop at any load step of no more than 10 percent.

C. Include the supply of such minor details of electrical, plumbing, or mechanical work not specified or indicated on the Drawings, which are necessary for the successful operation of the diesel engine-driven generator required by these Specifications.

1.5 SUBMITTALS

A. Furnish submittals in accordance with Contract Documents and Section 16050.

B. Product Data:
   1. Submit the following information:
      a. Weight of engine generator skid.
      b. Dimensions of engine generator skid, including length, width, and height.
      c. Type and grade of fuel recommended.

d. Fuel and Lubricating Oil Consumption at:
    1) 50 percent load.
    2) 75 percent load.
    3) 100 percent load.
        a) Type and grade lubricating oil recommended.
        b) Amount of lubricating oil required per oil change.
        c) Normal lubricating oil consumption.
        d) Recommended lubricating oil change periods:
            1. By hours run.
            2. By time.
e. Gauges to be furnished with engine and the normal operating range of each:
    1) Oil pressure.
    2) Coolant temperature.
    3) Primary fuel tank level.
    4) Fuel pressure.
f. Time interval from start-up contact closure until full load capabilities are available.
g. List of at least 4 installations using major components of the same type furnished for this application:
    1) Include name and telephone number of the persons most familiar with this equipment who can be contacted during the submittal review.
h. Number of cylinders, bore, stroke, and piston speed.
i. Displacement in cubic inches.
j. Compression RATIO.
k. RPM at 60 Hertz.
l. Size of exhaust outlet.
m. The following gaseous exhaust emissions in grams/BHP-HR and Lbs/BHP-HR:
    1) NOX.
    2) HC.
    3) CO.
    4) PM.
    5) Other exhaust emissions as required by the local air quality management district issuing the permit for the engine generator system.
    6) These levels shall be reported at rated speed and load as measured by SAE J177 and J215 recommended practices.
n. Voltage and frequency variation and duration with the step application and removal of 25 percent, 50 percent, 75 percent, and 100 percent of resistive load maximum.
o. Battery discharge ampere ratings at the 8 hour rate and the 1 minute rate to 1.75 volts per cell.
p. Certified published engine horsepower curves showing manufacturer's engine rating for generator set standby and prime power application.
q. Free field mechanical noise level at 23 feet. Provide overall decibels (A) rating.
r. Exhaust noise level at 5 feet from discharge end of silencer.
s. Start battery catalog number and descriptive bulletin.
t. Recommended spare parts.
u. Space and ambient temperature requirements for the engine control panel.
v. Size and capacity of base mounted fuel tank.
w. Manufacturer of:
    1) Engine.
    2) Generator.
    3) Generator Control Panel.
    4) Radiator.

5) Enclosure.
x. Estimated number of days to ship complete unit.
y. Jacket water heater
z. Weatherproof acoustical housing:
1) Dimensions:
a) Length.
b) Width.
c) Height.
d) Weight.
2) Materials.
3) Acoustic rating.
4) Door locations and access requirements.
5) Finish.

C. Shop Drawings:
1. Layout Drawings:
a. Provide detailed dimensional and to-scale layout drawings including:
1) A single drawing incorporating all equipment furnished:
a) Submittals that consist solely of individual Drawings for each component and require that these sheets be compiled by the ENGINEER, in order to view the entire piece of equipment, are not acceptable.
2. Detailed electrical wiring diagrams of the engine and generator including:
a. Engine interconnection terminal box.
b. Generator interconnection terminal box.
c. Fuel system Drawings.
d. All interface Drawings between the engine driven generator skid and the transfer equipment.
e. All wiring diagrams to show wire numbers and terminal block identifications:
1) Wire numbers are to correspond to the wire number on the equipment.
2) All wires are to be numbered.
f. Complete interior and exterior control panel layout:
1) Scaled.
2) With device descriptions.
3) With nameplates.
3. Mounting Drawings:
a. Detailed mounting drawings prepared and sealed by a registered Professional Engineer in Arizona:
1) Detailing mounting requirements for the project site seismic requirements as indicated in Section 16050.

D. Operation and Maintenance Manuals:
1. Submit operating instructions and a maintenance manual presenting full details for care and maintenance of equipment of every nature furnished and/or installed under this Contract:
2. Operating Instructions:
a. Printed and framed instruction chart shall be permanently mounted on the wall. The chart must detail the operational functions of all normally used controls that have been placed on the front of the control equipment.
3. Maintenance Manual:
a. Printed and bound instructions covering all details pertaining to care and maintenance of all equipment as well as data identifying all parts.
b. These manuals must include but are not limited to the following:
1) Electrical Controls:

a) Adjustment and test instructions covering the steps involved in the initial test, adjustment, and start-up procedures.
b) Detailed control instructions, which outline the purpose and operation of every control device used in normal operation.
c) Description of the sequence of operation that outlines the steps, which the controls follow during normal power failure and normal power return conditions.
d) All schematic, wiring, and external diagrams. Also, internal device wiring and schematic diagrams for all sub assemblies used in the equipment:

2) Drawing to be furnished in a reduced 11-inch by 17-inch format and shall be fully legible at that drawing size.
3) Engine and Generator:
a) Standard operational manuals normally furnished by the manufacturer.
b) Repair parts manuals normally furnished by the manufacturer:
1. Detailing all parts and sub-assemblies, which are available as repair parts.
4) Shop Maintenance Manuals:
a) Provide 1 shop manual on-site that is equivalent to the manual used by factory-authorized shop repair personnel.
b) Manuals for the following equipment:
1. Engine.
2. Radiator.
3. Generator.
4. Engine generator control panel.

c. Material Safety Data Sheets:
1) Complete MSDS forms for all substances.
2) Located in O&M manual.
3) Include separate manual labeled MSDS with additional copies of all MSDS forms.

d. Furnish a minimum of 6 manuals of each type identified, except for the Shop Maintenance Manual.

E. Test Reports:
1. Furnish complete test reports in accordance with Paragraphs 2.11 and 3.07 of this Section.

F. Certificates:
1. For the Complete Package: upon completion of installation, manufacturer must issue a certification of compliance with the Drawings and Specifications.

G. Calculations:
1. Complete loading calculations to support the recommended size of the engine-generator based upon actual facility loads, including VFD loads.
2. Supply documentation identifying the maximum static pressure acceptable for the radiator fan. It is the manufacturer's responsibility to then provide calculations as part of the layout drawings, to ensure that the transition ductwork at the discharge of the radiator does not exceed the maximum static pressure acceptable for the radiator fan.
3. Submit certification that a torsional analysis has been completed.
4. Submit exhaust system silencer noise attenuation curves.
5. Structural, mounting, and seismic calculations to be signed and stamped by a licensed Professional Engineer, registered in Arizona:
6. Submit vibration isolator calculations.

7. Submit exhaust silencer structural support calculations.
8. Submit factory certification of the radiator ambient capability.
9. Submit Exhaust System Pressure Loss Calculations: include piping, fittings, silencer, and rain cap in loss calculations.

1.6 QUALITY ASSURANCE

A. Refer to Section 16050.

B. Manufacturer Qualifications:
   1. The manufacturer of the engine, generator, and all major items of auxiliary equipment must be in current production of such equipment.
   2. Factory authorized parts and service facility located within 100 miles of the Project site.
   3. System to have complete engine generator unit factory-assembled and tested by the engine manufacturer and then shipped to the jobsite.
   4. Materials, equipment, and parts comprising the units specified must be new and unused, of current manufacture, and of the highest grade.
   5. Manufacturer is responsible for furnishing, testing, installation supervising, testing, and guaranteeing the system.

C. Regulatory Requirements:
   1. Meet NFPA-110 Type 10 (ten second) transfer requirements.
   2. Fuel tanks:
      a. UL listed.
      b. Primary and secondary tanks shall be tested to 3 to 5 psi to check for leaks.
      c. Comply with the following, if applicable:
         1) NFPA 30 – Flammable and Combustible Liquids.
         2) NFPA 37 – Installation and Use of Stationary Combustible and Gas Turbines.
         3) NFPA 110 – Emergency and Standby Power Systems.
   3. Regulations of the Fire Prevention Bureau of the Fire Department Having Jurisdiction.
   4. Fire Code as specified in Contract Documents.
   5. Other applicable state and local codes.
   6. EPA approved.
   7. Requirements of local Air Quality Management District or Air Pollution Control District.
   8. CONTRACTOR to comply with the Specifications that may be in excess of, and not contrary to, the regulations.

D. The generator set(s) shall be manufactured to the applicable specifications on file with Underwriters Laboratories and labeled with the UL 2200 mark.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Refer to Section 16050.

B. The engine-driven generator skid must be equipped with removable lifting and jacking angles, eye bolts, etc., to facilitate unloading and move-in operations.

C. Provisions on skid for the use of "Multiton" type rollers for moving the engine-driven generator skid into position.

D. Provide a means for jacking the engine-driven generator skid up for removal of the "Multiton" rollers and then for setting the engine generator skid in place.

E. The engine-driven generator skid is to be shipped from the factory complete with lifting eyes, jacking angles, etc., attached to the structural base.

F. Provide the services of a manufacturer's authorized representative to:
   1. Be present at the jobsite when the engine-driven generator arrives:
   2. Act as an advisor in assisting the CONTRACTOR regarding the unloading and move-in operations.
   3. Ship the engine-driven generator skid and all associated equipment to the jobsite on equipment that will allow the CONTRACTOR to use the equipment he has on site to efficiently unload the engine-driven generator skid.
   4. Coordinate the delivery of the shipment with the CONTRACTOR.
   5. Before start up, furnish written certification that the entire installation and all connections, both mechanical and electrical, have been inspected and are proper and consistent with all Drawings and Specifications.

1.8 PROJECT OR SITE CONDITIONS

A. Refer to Section 16050.

1.9 SEQUENCING

A. Complete factory prototype and factory production tests in accordance with NFPA 110 before equipment is shipped.

1.10 WARRANTY

A. Refer to Section 16050.

B. Extended Warranty:
   1. Provide a 2-year manufacturer's warranty for all equipment provided under this Section.

1.11 SYSTEM STARTUP

A. Refer to Section 16050.

B. Manufacturer services to include, but are not limited to:
   1. Furnish the services of manufacturer-certified technicians during the start-up and adjustment period to ensure that all items furnished are in proper operating condition:
      a. Engine technician must be completely knowledgeable in the operation, maintenance, and start-up of the mechanical system.
      b. Electrical technician must be completely knowledgeable in the operation, maintenance, and start-up of the electrical system.
      c. Provide training in conformance with paragraph 3.10 of this Section.
      d. Engine technician and electrical technician may be the same individual if certified by the respective equipment manufacturers in both engine and electrical fields.
   2. Furnish a written report after the start-up:
      a. Report must state that the installation is complete and satisfactory:
         1) List the items requiring additional attention.

3. Minimum required time on site by technician for start-up:
    a. One day to inspect entire installation, start-up, test operation, and conduct acceptance tests.

1.12 MAINTENANCE

A. Furnish the following spare parts:
    1. Sufficient coolant so that entire system may be flushed and replaced after initial burn-in period.
    2. Sufficient lubrication products so that the entire system may be flushed and replaced after initial burn-in period.
    3. One complete spare voltage regulator.
    4. One complete spare governor and governor controller.
    5. Three sets of lube oil filters, fuel filters, and gaskets.
    6. Two sets of air filters.
    7. Two sets of belts.
    8. Twelve spare lamps of each different lamp type.
    9. Two fuses (for each control circuit).
    10. One set of crankcase breather filters.
    11. Two gallons fuel additive.

B. Special Tools: Furnish a set of specialty tools necessary for routine maintenance of the equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The following list of manufacturers is a general guideline and makes no statement as to the capability of the manufacturer to meet the Specification requirements. The burden of proof of conformance with these Specifications lies with the CONTRACTOR and manufacturer. The CONTRACTOR must make special written application to use other than these named manufacturers:
    1. Engine Generators:
        a. Caterpillar
        b. No Equal
    2. Governor:
        a. Isochronous electronic by engine manufacturer.
    3. Battery:
        a. One of the following, or equal:
            1) Hawker.
    4. Base Mounted Fuel Tank:
        a. One of the following, or equal:
            1) Pryco.
            2) Tramont.

B. Exhaust System:
    1. One of the following or equal:
        a. Silencer:
            1) Harco Manufacturing.
            2) Silex Innovations.
        b. Expansion Joint:
            1) DME.

c. Exhaust Pipe Insulation:
    1) As specified in Section 15082.
d. Expansion Joint Insulation:
    1) Pittsburgh-Corning, Temp-Mat.

2.2 EQUIPMENT

A. Characteristics of assembled unit:
1. The engine-driven generator consists of a diesel engine directly coupled to an electric generator providing continuous electric power for the duration of any power failure of the normal utility power supply.
2. The engine must start, attain full speed, voltage, and assume full load within a maximum of 10 seconds, with jacket water at 85 degrees Fahrenheit.
3. Furnish the engine-driven generator on a steel sub-base to support engine, generator, and accessories as a unit:
    a. Base: welded construction.
    b. Engine direct connected through a flexible coupling to a single bearing generator.
    c. System free of injurious torsional and bending vibrations within a speed range from 10 percent below to 10 percent above synchronous speed.
    d. Engine-driven generator balanced such that the peak-to-peak amplitude of vibration velocity in any direction does not exceed the engine or generator manufacturer's published limits.
    e. If shims are required under the feet of the generator for alignment purposes, use 1-piece laminated shim stock that covers at least 90 percent of the foot.
    f. Provide a complete assembled engine-driven generator skid requiring only the following field mechanical connections:
        1) Power leads from generator to the automatic transfer equipment.
        2) Control Connections to:
            a) Automatic Transfer Equipment.

B. Engine Generator Base:
    a. Support System:
    b. Bolt the engine-driven generator to steel pads that are an integral part of structural support base.
    c. Provide vibration isolators shall be provided between the engine generator and welded steel base or between the base and the floor:
        1) As recommended by the manufacturer.
    d. Support system design must meet the seismic requirements of the project site:
        1) Support system design must be stamped by a registered Professional Engineer registered in Arizona.
    e. Vibration isolators to properly support the engine driven generator skid on its concrete base:
        1) The isolators located for equal load distribution and deflection per isolator.
        2) Spring type designed for the load and seismic conditions as identified for the site.

C. Engine:
1. Full compression ignition, 4-cycle low emission unit, turbocharged, and aftercooled.
2. The rated net horsepower of the engine with all accessories, including radiator fan, must not be less than that required to produce the minimum specified generator capacity at site altitude.
3. Engine is to be equipped and designed as follows:
    a. Dual spin-on type replaceable lube oil filter cartridges.

b. Replaceable fuel filters.
c. Heat treated forged steel crankshaft:
    1) Dynamically balanced.
d. Forged steel connecting rods.
e. Crankshaft driven gear type lubricating pump.
f. Electric fuel shut-off valve.
g. Engine Air Cleaner: Dry type replaceable filter.
h. 12 or 24 volt direct current positive engagement solenoid shift-starting motor:
    1) The starting equipment must include the necessary devices to prevent an overcrank and lockout if the starter pinion fails to engage the flywheel ring gear on the initial crank attempt.
    2) This starter disconnect is to electronically sense the speed of the flywheel and when the flywheel setpoint speed has been reached, the electronic control signals the starter disconnect to disengage.
i. Oil level dip stick and oil drain pipe with valve and pipe plug:
    1) Oil drainpipe and valve are to extend 3 inches beyond edge of engine base.
j. Dry electrical contacts to report:
    1) Low oil pressure.
    2) Over speed.
    3) High water temperature.
k. Engines requiring glow plugs are not acceptable.
l. Crankcase breather filter:
    1) Provide crankcase ventilation system with coalescing filter/trap for blowby:
        a) Coalescing filter to be replaceable.
    2) If engine manufacturer recommends an open crankcase breather system, route outlet of breather filter to outside at 3 inches above grade and away from engine components:
        a) Provide on breather outlet Nelson "EcoVent" or equal, sized to match engine breather flow.
    3) If engine manufacturer recommends a closed crankcase breather system, provide integral crankcase pressure regulator with an automatic internal filter bypass and bypass indicator:
        a) Unit to be Racor Model CCV 4500 or equal.
m. Governor:
    1) Isochronous type to maintain engine speed:
        a) Within 0.5 percent for steady state conditions.
        b) Within 5 percent for a no load to full load step with recovery to within 2 seconds of step load application.
        c) Suitable for use on diesel engines.
        d) Electronic governor control of fuel.
        e) Suitable for automatic, unattended starts.
        f) Speed sensing failure circuit to signal actuator to close if speed pick-up signal is lost.
        g) With speed pick-up sensor.
        h) With capabilities of local or remote speed settings.
        i) Adjustable acceleration rate control from 0 to 8 seconds.
        j) Personnel guards over all exposed moving parts.
n. Equipped with a continuous duty shutdown system for normal remote stopping.
o. Equipped with gauges to indicate:
    1) Lube oil pressure.
    2) Fuel pressure.
    3) Gauges are to be mounted such that vibration will not cause premature failure.

p. Monitor engine coolant temperature by a thermometer with thermometer well or a temperature gauge.

4. Regulatory Requirements:
   a. Specifically designed to meet the discharge of gaseous pollutants to the atmosphere as required by the Environmental Protection Agency Tier 2 statute and local agency issuing the permit for the engine generator system.

D. Fuel System:
   1. General: Provide fuel system, accessories, and fuel tanks meeting the following requirements:
   2. Base mounted Fuel Tank: Provide a base mounted fuel tank meeting the following:
      a. Provide UL listed tank with secondary containment rupture basin.
      b. Construction: Reinforced steel channel system with minimum thickness of 7-gauge for channels and 12-gauge for tank construction.
      c. Provide tank baffle to separate hot fuel return from cooler supply fuel.
      d. Provide the Following Connections:
         1) 1.25-Inch Minimum Vent:
            a) Pipe vent outside any room or enclosure containing the generator set, using Schedule 40 black steel pipe.
         2) Two-inch minimum fill connection.
         3) Two-inch minimum main fuel storage level gauge.
         4) 1.25-inch minimum low fuel level alarm with level switch connected to control panel.
         5) 0.5-inch minimum fuel supply with dip tube.
         6) 0.5-inch minimum fuel return with dip tube.
      e. Provide rupture basin level switch and alarm.
      f. Provide interior epoxy coating system.
      g. Provide exterior epoxy coating with urethane top coat.
   3. Fuel Filters: Size filters for 10 percent above the engine fuel pump capacity:
      a. Provide water/fuel separator.
      b. Provide primary fuel filter.
      c. Provide secondary fuel filter.
   4. Engine Fuel Pump: Provide engine-driven fuel pump which transfers fuel from the fuel tank as indicated on the Drawings:
      a. Positive displacement pump.
      b. Capable of 10-foot lift minimum.
      c. Electrically driven fuel pumps are not acceptable.
      d. Provide fuel pressure gauges on the pump suction and discharge.
   5. Fuel Cooling: When a base mounted fuel tank is specified and engine return fuel is routed back to the tank, or when recommended by the engine manufacturer for the installation configuration indicated, provide a fuel cooling heat exchanger to limit the tank fuel temperature to less than 120 degrees Fahrenheit after 24 hours continuous full load operation.

E. Exhaust System:
   1. Provide a complete exhaust system following the general scheme as indicated on the Drawings and as specified.
   2. Back Pressure:
      a. Provide components such that the maximum back-pressure in the exhaust system including piping and silencer is as required by Engine manufacturer, measured at the exhaust manifold header:
         1) Reduce allowable back-pressure when recommended by the engine manufacturer.

b. Provide each exhaust manifold header with a lugged, tapped connection for the attachment of a test manometer.

3. Exhaust Piping:
   a. Type: Schedule 40 high temperature black steel pipe conforming to ASTM A106.
   b. Drainage: Slope piping to a drain point and provide drain plug.
   c. Finishes: Sand blast and coat outside of exhaust piping with not less than 6 mils of inorganic zinc primer:
      1) Finish coat in the field as specified in Section 09960.
   d. Insulation: As specified in Section 15082 for engine exhaust piping.
4. Exhaust Expansion Joints:
   a. Type:
      1) Metal with convoluted portion of 0.038 inch thick Type 321 stainless steel.
      2) Non-convoluted portions of expansion joint to be Type 304 stainless steel, Schedule 10S pipe.
      3) Provide flanged ends with ASME B16.5, Class 150 bolt hole drilling.
   b. Length: Minimum of 18 inches in length.
   c. Movement:
      1) Rated for a minimum of 1 inch lateral movement, and 1/2 inch axial movement.
      2) Rated movement defined as plus or minus travel from neutral or free position.
   d. Design Life: Infinite cycle life with 1,200 degrees Fahrenheit exhaust, no insulation over the expansion joint, and continuous duty service.
   e. Insulation:
      1) Insulate expansion joints with custom fitted, removable with reusable fastening system, ceramic fiber insulation blankets enclosed between inner and outer high temperature fabric cover rated for 1,200 degrees Fahrenheit continuous duty.
      2) Do not insulate expansion joints directly connected to turbocharger outlet.
5. Exhaust Silencer:
   a. Type: Heavy-duty industrial type fabricated of welded steel with ported tubes and snubbing chambers, and a rating meeting the specified sound attenuation.
   b. Mounting: as indicated on the Drawings.
   c. End Connections: Steel flanges with Class 150-pound drilling pattern.
   d. Shell:
      1) Sufficiently heavy and reinforced to eliminate excessive vibration, stress, or deflection and to support all operating loads with the silencer at elevated temperatures and insulated as specified.
      2) Loads include insulation weight and connecting piping.
   e. Drain: Provide threaded, plugged condensate drain.
   f. Sound Attenuation: Attain the following minimum sound attenuation at the listed octave band center frequencies with the engine at full load:

Frequency (Hz)	**63**	**125**	**250**	**500**	**1,000**	**2,000**	**4,000**	**8,000**
Attenuation (dB)	39	42	42	40	38	38	38	38

   g. Supports: Provide shell lug supports suitable for supporting and mounting the silencer as indicated on the Drawings; support design to account for elevated temperatures under insulated shell.
   h. Insulation: Insulate as specified for engine exhaust piping in Section 15082.
   i. Pressure drop not to exceed 7 inch water column at maximum engine rating.

F. Engine Jacket Water Heater:

1. Provide an in-line thermostat that disconnects power when coolant temperature exceeds an adjustable setpoint.
2. Contacts from the oil pressure switch to disconnect the heater power when the engine is running.
3. Equip the water heater with shutoff valves and unions to allow heater replacement without draining the cooling system.
4. Make all water heater connections with Aeroquip type hoses and fittings.
5. Size heater such that the engine block temperature is maintained at 85 to 100 degrees Fahrenheit in a 40 degree Fahrenheit ambient temperature.
6. Connect water heater and thermostat are to be connected to the engine in such a manner as to minimize heated water circulation through the radiator circuit.
7. Water heater power is to be supplied from a normal (utility) power source:
    a. Heaters larger than 3,000 watts shall be 460 volts, 3-phase.

G. Alternator (Generator):
1. Brushless synchronous alternator.
2. Re-connectable 12 lead if available.
3. Self-ventilated.
4. Full amortisseur windings.
5. Skewed for smooth voltage waveform.
6. With permanent magnet generator pilot exciter.
7. Drip-proof enclosure.
8. Protected against corrosion.
9. Single bearing design.
10. Insulation:
    a. Insulated for continuous operation at 40 degrees Celsius ambient temperature.
    b. Temperature rise not to exceed 70 degrees Celsius by thermometer and 80 degrees Celsius by resistance, consistent with a Class B rise.
    c. Class F (105 degrees Celsius rise by resistance) for medium voltage or Class H (125 degrees Celsius rise by resistance) for low voltage generators.
    d. Vacuum impregnated with epoxy varnish to be fungus resistant per MIL I-24092.
    e. Multiple dipped and baked with a non-hygroscopic varnish with a final dip of epoxy.
11. Terminate alternator power leads using compression lugs on an insulator and bus bar system within the alternator junction box:
    a. These terminations must not require any taping to complete the connection.
    b. Utilize copper locomotive type cables to connect from the alternator to the load bank manual transfer equipment:
        1) Sized for 125 percent of the alternator full load current.
        2) Neutral conductors shall be sized at 100 percent of the alternator full load rating.
    c. Provide a ground terminal inside the junction box to terminate the ground cables between the alternator to the automatic transfer equipment ground bus:
        1) Minimum size of the equipment-grounding conductor: 12 1/2 percent of the size of the phase conductors.
12. Maximum balanced telephone interference factor not to exceed 50.
13. Designed to supply power to the non-linear loads as indicated on the Drawings:
    a. Variable frequency drives (VFDs).
    b. Uninterruptible power supplies (UPS).

H. Alternator Voltage Regulator:
1. Located in the engine control panel.
2. Performance requirements:

a. Maintain the steady state voltage within 1 percent:
   1) From 40 degrees Fahrenheit to 120 degrees Fahrenheit.
   2) From no load to full load conditions.
3. Constant volts per hertz characteristics.
4. Static type:
5. Sized to match the power requirements at the permanent magnet generator pilot exciter.
6. Include manual control to adjust voltage drop, voltage level, and voltage gain.
7. With 3-phase sensing.
8. Sealed from the environment and isolated from the load to prevent tracking when connected to SCR loads.
9. Include loss of sensing shutdown to protect the generator against uncontrolled voltage output when the sensing circuit to the regulator is opened.
10. Shut down regulator when the sensing circuit to the regulator does not have continuity.
11. Include over-excitation shutdown to protect the generator against damage caused by prolonged field forcing.

I. Radiator And Cooling System:
1. Unit Mounted:
   a. Furnish a skid mounted closed type radiator system for the engine driven generator:
      1) Sized and selected by Engine manufacturer.
   b. Provide all necessary coolant specifically suitable for the location and conditions of service throughout the year:
      1) Ship both the engine and the radiator with the coolant installed.

J. Wiring:
1. All external wiring connection to and from the engine and alternator shall be made via 2 engine mounted junction boxes:
   a. Boxes shall be NEMA 12.
   b. One box shall be used for all control, and direct current power connections.
   c. The other box shall be used for the alternator output connections:
      1) The alternator output breaker may be used for these connections.
2. Enclose wiring in an NEC approved and recognized conduit system selected and sized by the engine generator manufacturer:
   a. Suitable for the temperatures, vibrations, and conditions on the engine-driven generator skid.
3. Control wiring shall terminate on terminal blocks in the Control Junction Box:
   a. All connections shall be made to terminal blocks:
      1) 600 volt rated.
      2) Wires terminated on box with compression type ring type lugs, installed with proper tooling.
      3) Terminal blocks shall be numbered.
      4) All wiring in terminal box both internal and field connections shall be routed in plastic wire duct.
4. Terminate wires using solderless compression type lugs:
   a. Lug manufacturer’s termination methods and tools must be used.
5. Splices are not allowed:
   a. All connections are to be made at the terminal blocks in the control junction boxes.

K. Battery System:
1. Installed on the engine-driven generator skid.

2. Provide extra flexible minimum 4/0 welding cable to make the connection between the battery and the engine:
    a. Proper compression lugs and tooling must be used to terminate these cables.
3. Provide a 24-volt lead acid recombination no maintenance engine start battery system:
    a. The battery rated such that the 90 second cranking current to 1.0 volts per cell exceeds the starter rolling current at 40 degrees Fahrenheit:
        1) For the above ratings to be valid, the starter breakaway current must not exceed the rolling current by a factor of more than 2.5.
        2) Increase the battery size in order to supply power to the room ventilation louvers, switchgear relaying and controls, and any direct current lighting.
4. Charger:
    a. Sized to provide sufficient power to both fully charge a drained battery and power the room ventilation louvers, controls, and any direct current lighting.
    b. Charger located on the engine skid.
    c. With direct current ammeter and direct current voltmeter.
    d. With On-Off switch.
    e. Solid-state device with adjustable float voltage control.
    f. Constant voltage design with current limit.
    g. With an equalize switch which will allow the battery to be overcharged for maintenance purposes.
    h. Designed to meet the charge, float, and equalize requirement of the battery furnished.
    i. Overload and short circuit protection.

L. Miscellaneous engine generator skid items:
1. Provide the following items:
    a. Sectionalized drip pans.
    b. Rain shields for exhaust lines.
    c. Roof jacks.

M. Automatic Generator Control Equipment:
1. Provide a microprocessor-based control system for automatic starting, monitoring, and control functions for the engine generator system.
2. Control system features and functions:
    a. Control Switches:
        1) Mode Selector Switch: The mode select switch initiates the following control modes:
            a) Provide a rotary switch or control panel keypads with status indicators.
            b) RUN or Manual Position:
                1. Generator set starts, and accelerates to rated speed and voltage.
            c) OFF or STOP Position:
                1. Generator set immediately stops, bypassing all time delays.
            d) AUTO Position:
                1. Generator set accepts a signal from a remote device to start and accelerate to rated speed and voltage.
        2) EMERGENCY STOP Switch:
            a) Red "mushroom-head" pushbutton.
            b) Activating the emergency stop switch causes the engine to immediately stop, and be locked out from automatic restarting.
        3) RESET Switch:
            a) Clears all faults and allow restarting the engine generator after it has shut down for any fault condition.

4) PANEL LAMP switch or automatic display panel illumination.

b. Alternating Current Output Metering: Provide the control system with metering including the following features and functions:
   1) Voltmeter:
      a) RMS Voltage.
      b) Line-to-line.
      c) Line-to-neutral.
   2) Ammeter:
      a) RMS current.
   3) Frequency.
   4) Power Factor.
   5) Kilowatts (kW):
      a) kW-hours.
      b) Output kW.
   6) Kilovars (kVars):
      a) kVar-hours.
      b) Output kVar.
   7) Provide Digital Metering:
      a) 1.0 percent accuracy.

c. Generator Alarm and Status Display:
   1) Provide high-intensity LED alarm and status indication lamps. Functions indicated include:
      a) Red alarm-indicating lamps.
      b) Red common shutdown lamp.
      c) Two Green Lamps:
         1. One to indicate the engine generator is running at rated frequency and voltage based on actual sensed voltage and frequency on the output terminals of the generator set.
         2. The second to indicate a remote start signal has been received.
      d) Flashing red lamp to indicate that the control is not in automatic state:
      e) Amber common warning indication lamp.
   2) Display the following alarm and shutdown conditions on an alphanumeric digital display panel:
      a) Low oil pressure (alarm).
      b) Low oil pressure (shutdown).
      c) Oil pressure sender failure (alarm or indication).
      d) Low coolant temperature (alarm).
      e) High coolant temperature (alarm).
      f) High coolant temperature (shutdown).
      g) High oil temperature (warning).
      h) Engine temperature sender failure (alarm or indication).
      i) Low coolant level (alarm or shutdown – selectable).
      j) Fail to crank (shutdown).
      k) Fail to start/overcrank (shutdown).
      l) Overspeed (shutdown).
      m) Low direct current voltage (alarm).
      n) High direct current voltage (alarm).
      o) High alternating current voltage (shutdown).
      p) Low alternating current voltage (shutdown).
      q) Under frequency (programmable for alarm or shutdown).
      r) Overcurrent (programmed for warning or shutdown).
      s) Short circuit – circuit breaker function (trip).
      t) Emergency stop (shutdown).

1. The control shutdown fault conditions shall be configurable for fault bypass.

d. Engine Status Monitoring:
   1) Display the following status conditions on an alphanumeric digital display panel:
      a) Engine oil pressure (pounds per square inch or kilopascal).
      b) Engine coolant temperature (degrees Fahrenheit or Celsius).
      c) Engine oil temperature (degrees Fahrenheit or Celsius).
      d) Engine speed (revolutions per minute).
      e) Number of start attempts.
      f) Battery voltage (direct current volts).

e. Data Logging and Display Provision:
   1) Log the last 10 warning or shutdown indications on the engine generator.
   2) Monitor the total load on the generator:
      a) Maintain data logs of total operating hours at specific load levels ranging from 0 to 110 percent of rated load, in 10 percent increments.
      b) Display total hours of operation at less than 30 percent load and total hours of operation at more than 90 percent of rated load.
   3) The Control System to Log:
      a) Total number of operating hours.
      b) Total kW hours.
      c) Total control on hours.
      d) Total values since reset.

f. Engine Control Functions:
   1) Provide a cycle cranking system, which allows for user selected crank time, rest time, and number of cycles:
      a) Initial settings shall be for 3 cranking periods of 15 seconds each, with 15-second rest period between cranking periods.
   2) Provide an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this Specification, including adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting.
   3) Provide time delay start (adjustable 0 to 300 seconds) and time delay stop (adjustable 0 to 600 seconds) functions.

g. Battery Monitoring System:
   1) Initiate alarms when the direct current control and starting voltage is less than 25 VDC or more than 32 VDC.
   2) Disable the low voltage limit during engine cranking (starter engaged).
   3) Monitor direct current voltage as load is applied to the battery, to detect impending battery failure or deteriorated battery condition.

h. Remote Control Interfaces:
   1) Provide a minimum of 4 programmable output relays:
      a) Configurable for any alarm, shutdown, or status condition.
   2) Provide a minimum of 4 programmable inputs:
      a) Label as indicated on the Drawings.
      b) Labels shall match other control labels.

N. Generator Output Circuit Breaker:
   1. Engine generator skid mounted and line side connected to alternator.
   2. Manually resettable.
   3. Line current sensing.
   4. Inverse time versus current response.

5. Sized and coordinated to protect the generator from damage from overload and/or short circuit:
    a. Coordinated with down stream devices:
        1) Refer to Section 16305.
6. Breakers shall be furnished in conformance with Section 16412.

2.3 ACCESSORIES

A. Weatherproof acoustical housing:
1. Provide engine enclosure to protect engine, generator, starting system, batteries, and other specified accessories from weather exposure.
2. Meet seismic and wind requirements at the Project Site.
3. Construction:
    a. Minimum 14 gauge steel panel thickness.
    b. All panels and members hot dip galvanized after fabrication.
    c. Enclosure removable to allow for maintenance.
    d. Fitted with lockable latches.
    e. Stainless steel latches and hinges.
4. Finishing: Factory or shop finished in epoxy and urethane coating system as specified in Section 09960.
5. Noise reduction:
    a. Provide acoustical insulation and acoustical enclosure ventilation louvers and fan discharge silencers as necessary to achieve a measured sound pressure level of 75 dBA when measured at 23 feet from the enclosure.
    b. Protect acoustical insulation with perforated metal covers and plastic bagging to prevent damage from abrasion or weather elements.
6. Provide an exhaust silencer matched to the enclosure to reduce the overall noise emissions level of the engine/generator assembly to the levels required above.
7. Coordinate supply of access platforms for both sides of the generator enclosure as shown on the plans. Reference Specification 05500 – Miscellaneous Metals.

2.4 SOURCE QUALITY CONTROL

A. Design prototype tests as follows:
1. Use design prototypes similar to the equipment specified herein for testing, and not the actual equipment for the project.
2. Minimum testing requirements:
    a. As required by NFPA.
    b. Maximum power in kW.
    c. Maximum starting kilovolt-ampere at 35 percent instantaneous voltage dip.
    d. Alternator temperature rise:
        1) By embedded thermocouple.
        2) By resistance method.
        3) Per NEMA MG1-22.40 and 16.40.
    e. Governor speed regulation under steady state and transient conditions.
    f. Fuel consumption at 25 percent, 50 percent, 75 percent, and 100 percent load.
    g. Harmonic analysis, voltage wave form deviation, and telephone influence factor.
    h. Cooling airflow.
    i. Torsional analysis testing to verify that the generator set is free of harmful torsional stresses.
    j. Endurance testing.
    k. A certified copy of the test results will be furnished to the OWNER.

B. Test each engine generator under varying loads with all machine safety guards and exhaust system in place.

C. The complete engine generator system is to be tested at full load in the manufacturer's establishment:
   1. Test must include:
      a. Radiator.
      b. Engine Control Panel.
      c. Single-step load pickup.
      d. Transient and steady-state governing.
      e. Safety shutdown device testing.
      f. Rated power.
      g. Maximum power.
   2. During the full load tests, re-circulate the radiator cooling air through the radiator as necessary to test the system under the maximum ambient conditions specified herein.
   3. Run the unit for 8 hours at 100 percent load with the following recordings made hourly:
      a. Frequency.
      b. Voltage.
      c. Amperage.
      d. Kilowatts.
      e. Room temperature as measured at the generator end of the unit.
      f. Radiator air inlet temperature.
      g. Coolant temperature.
      h. Oil pressure.
      i. Time engine takes to start in seconds.
   4. Record the following items:
      a. Maximum block load capabilities of the unit.
      b. Maximum fuel pump vacuum in inches of mercury as measured with the fuel suction line closed.
      c. Point at which Over Temperature Shutdown Occurs:
         1) By actual test of over temperature switch remote from engine.
      d. Point at which Over Speed Shutdown Occurs:
         1) By actual test of speed switch remote from engine.
      e. Point at which Low Oil Pressure Shutdown Occurs:
         1) By actual test of low oil pressure switch remote from engine.
      f. Point at which overcrank shutdown occurs.
      g. Point at which overspeed shutdown occurs.
      h. Low water temperature alarm.
      i. Low fuel level alarm.
      j. Fuel leak alarm.
      k. Overvoltage alarm and shutdown.
      l. Undervoltage alarm and shutdown.
      m. Under frequency alarm and shutdown.
      n. Low battery voltage alarm.
   5. Furnish a certified copy of the test results to the OWNER:
      a. These test results must record any minor adjustments made during the test.
      b. If major changes, as determined by the ENGINEER, are made, the 8-hour test must be repeated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Section 16050.

B. General:
   1. Install the equipment as indicated on the Drawings.
   2. Perform all work in accordance with manufacturer's instructions and shop drawings.

C. Installation shall be by personnel experienced and regularly engaged in field installation of power generation systems:
   1. Make all field mechanical and electrical connections.

D. Mount fuel tank at the elevation relative to the engine recommended by the manufacturer to achieve proper engine fuel pump suction conditions while avoiding fuel flooding in the engine return system.

3.2 FIELD QUALITY CONTROL

A. Refer to Section 16050.

B. Test actual backpressure during acceptance testing of the system.

C. Provide the services of a manufacturer's representative for the following:
   1. Before start-up, furnish written certification that the entire installation and all connections, both mechanical and electrical, have been inspected and are proper and consistent with all Drawings and Specifications.
   2. Furnish the services of factory-certified technicians during the start-up and adjustment period to make sure all items furnished are in proper operating condition:
      a. Engine technician must be completely knowledgeable in the operation, maintenance, and start-up of the mechanical system.
      b. Electrical technician must be completely knowledgeable in the operation, maintenance, and start-up of the electrical system.
      c. These technicians to instruct the OWNER's personnel regarding the operation and maintenance of all items supplied:
         1) Supply written handouts during the training period, and these handouts should be suitable for future reference after the training period is completed.
      d. Furnish a written report after the start-up:
         1) Report must state that the installation is complete and satisfactory.
         2) List the items requiring additional attention.

D. Manufacturer to perform installation check, start-up, and load test.

E. Certify that fuel, lubricating oil, and antifreeze conform with the manufacturer's recommendations under the environmental conditions present.

F. Check accessories that normally function while the equipment is in standby mode for proper operation, before cranking the engine:
   1. These accessories include but are not limited to:
      a. Battery charger.

G. Start-Up Under Manual Mode:

1. Check for the following items:
    a. Exhaust leaks.
    b. External path for exhaust gases.
    c. Cooling airflow.
    d. Movement during starting and stopping.
    e. Vibration during running.
    f. Normal and emergency line-to-line voltage and phase rotation.

H. Automatic Start-Up:
1. By means of simulated power outage test the following:
    a. Set all timers for proper system coordination.
    b. Remote automatic starting.
    c. Transfer of load.
    d. Automatic shutdown.
2. Continuously monitor the following parameters during this test:
    a. Engine temperature.
    b. Oil pressure.
    c. Battery charge level.
    d. Generator voltage.
    e. Generator amperes.
    f. Frequency.

3.3 ADJUSTING

A. Make adjustments as necessary and recommended by the manufacturer, ENGINEER, or testing firm.

3.4 DEMONSTRATION AND TRAINING

A. Refer to Section 16050.

B. Demonstrate operation of equipment in accordance with Section 01756.

C. Generating System:
1. Full-load test the generating system at the site in the presence of the ENGINEER for a period of 8 hours, with the manufacturer providing the necessary resistive and reactive load banks to test at 0.8 power factor:
    a. Permanently installed load banks supplied as part of the project may be utilized to provide part of the specified load.
2. Before acceptance of the installation, subject equipment to process system load tests, with available motor load, but not to exceed the generator's nameplate rating, for a period of 4 hours.
3. Correct defects that become evident during testing.
4. Measure flows, pressures and temperatures of fuel, coolant, exhaust gas, and radiator air at inlets and outlets to system components.
5. Provide test report.
6. Measure radiator performance at full load including airflow, air inlet temperature, and air outlet temperature.

D. Upon completion of the work, at a time to be designated by the OWNER's representative, manufacturer to demonstrate for the OWNER the operation of the engine installation, including any and all special systems furnished by them, or installed under their supervision.

E. Test all control functions in conjunction with the engine generator start-up:
   1. These tests must include all normal starting and stopping functions as outlined in these Specifications.

F. Training:
   1. Manufacturer's technicians must provide all training:
      a. Technicians to instruct the OWNER's personnel regarding the operation and maintenance of all items supplied:
         1) Supply written handouts during the training period that are suitable for future reference after the training period is completed.
      b. Mechanical maintenance training must cover:
         1) Mechanical operations.
         2) Preventative maintenance:
            a) Daily maintenance.
            b) Periodic maintenance.
            c) Detailed and overhaul maintenance of the engine and generator.
         3) Conducted by the manufacturer's mechanical technician.
         4) Maintenance training:
            a) Minimum of 8 hours.
            b) Two sessions of 4 hours each.
      c. Electrical maintenance training must cover:
         1) Preventative maintenance.
         2) Normal operational conditions
         3) Settings, and adjustments.
         4) Electrical training duration:
            a) Minimum of 4 hours.
            b) 1 session of 4 hours each.
         5) Conducted by the manufacturer's electrical technician.
      d. Combined maintenance training shall cover the interrelationship between the mechanical and electrical systems:
         1) Joint electrical and mechanical session duration:
            a) Minimum of 4 hours.
            b) One session of 4 hours each.
         2) To be conducted by the manufacturer's electrical and mechanical technicians.
      e. Operations training covering and detailing the normal, exercising, and day to day operations of the equipment:
         1) Operations training duration:
            a) Minimum of 4 hours.
            b) Two sessions of 2 hours each.
            c) Schedule around plant operations shifts.
   2. Furnish complete manuals, and training DVD for:
      a. Training up to three (3) plant personnel.

3.5 PROTECTION

A. Refer to Section 16050.

+ + END OF SECTION + +

SECTION 16269

VARIABLE FREQUENCY DRIVES - 600V

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the design, manufacturing, testing, and delivery to the jobsite of metal enclosed, free-standing Variable Frequency Controller (VFD)(drive), complete with accessories and all auxiliary equipment needed to accomplish the functions required by this specification.

B. This specification shall cover 6, 12, or 18 pulse and active front-end (AFE) Variable Frequency Controllers for 230V, 460V and 600V loads.

C. Related Sections
   1. 16000 Electrical General Requirements
   2. 16075 Electrical Identification
   3. 16120 Conductors and Cables
   4. 16130 Raceways and Boxes

1.2 REFERENCES

A. The drive shall comply with the following:
   1. National Electric Manufactures Association (NEMA) Safety standards for Construction and Guide for Selection, Installation and Operation of Variable Frequency Controller Systems
   2. National Electrical Code (NEC) NFPA 70
   3. NEMA 250 Enclosures for Electrical Equipment
   4. IEC 146 International Electrical Code
   5. ISO 9001
   6. UL 508 Qualifications
   7. IEEE Standard 519
   8. Additional standards as listed in DIV 1 project specifications.

1.3 DEFINITIONS

Section not used.

1.4 SYSTEM DESCRIPTION

A. The drives will be Manufacturers standard design, suitable for heavy duty industrial use and for the intended service. They will be installed in an industrial facility operating 24 hours a day 7 days a week.

B. Regulations

C. This specification requires compliance with all laws and regulations which may be applicable including the Occupational Safety and Health Act (OSHA), as well as rules, regulations, and standards of the Secretary of Labor.

1.5 SUBMITTALS

A. Shop Drawings: Submit for approval the following:
   1. Manufacturer's literature, illustrations, specifications and engineering data which indicate performance, dimensions, materials, size and weight.
   2. Complete list of components and catalogue identification.
   3. List of in-house manufactured key components.
   4. Quality Assurance Program description.
   5. Complete description of schematic and wiring diagrams and functional operation.
   6. Recommended spare parts list.

B. Submittal literature, drawings, and documentation shall be clear, legible, and written in English. Failure to comply will result in rejection of submittal.

C. Product brochures must be sufficiently detailed so that an engineering evaluation may be completed on the suitability and part number of the equipment.

D. Submit details of the manufacturing quality assurance/quality control program and any QA/QC certifications.

E. Receipt by Owner or Owner's Representative of all test and calibration submittals is a condition for final payment of the purchase order.

F. Submit written certification that all assembly, fabrication, and manufacturing has been performed in accordance with manufacturer's written QA/QC policy and standards. Receipt of this submittal is a condition for final payment of the purchase order.

G. Submit cost for the services of a factory trained technician or engineer to assist in startup and commissioning. Pricing shall include hourly or daily rate, estimated travel and per diem costs, and minimum number of days recommended for this service.

H. Note any exceptions to this Specification.

1.6 QUALITY ASSURANCE

A. Manufacturer shall be regularly engaged in the production of these drives and shall have in place a quality assurance program to be applied during the preparation and fabrication of the instruments.

B. After Sales Support
   1. Qualified support shall be available either directly from the manufacturing facility or from a network of factory-trained distributors and certified service centers located throughout North America and Canada.

C. Drive manufacturing facility shall be an ISO9001 certified manufacturing facility.

D. Assembly shop to be UL-508 certified.

E. Regulatory Requirements

1. Instruments shall have a UL listing and are marked and labeled in accordance with applicable codes and standards. If manufacturer's equipment is approved by a recognized testing laboratory other than UL, then the manufacturer shall provide a letter from the local authority having jurisdiction stating that such testing is acceptable to them.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading

B. All equipment shall be adequately crated or protected, including export packing where required to prevent damage in handling, transit, and storage at the site.

C. Each item, piece, or subassembly of equipment shall have a securely attached metal tag stamped with the tag number. All crates and boxes shall be stenciled with the tag number. Tags and stencils shall be in a conspicuous place and readable.

D. Transmit to Owner or Owner's Representative the shipping lists and delivery dates prior to the day the equipment leaves the shop. Transmittal receipt must be confirmed by Owner or Owner's Representative prior to shipping equipment.

E. Each shipping piece shall be clearly marked with 2 to 3 inch high contrasting numbers and/or letters, giving tag number as called out on detail drawing. Piece marking shall be with a non-erasable marker.

F. In addition to the piece marking, a standard 3 inch by 5 inch red shipping tag shall be wired to each shipping lot. This tag shall state the range of tag and mark numbers, Vendor's name and address, owner or Owner's Representative's name, jobsite address and Purchase Order number.

1.8 TAGGING

A. Each piece of equipment and loose accessory shall be tagged with a non-corroding metal tag as described below and securely affixed to the equipment by pins or non-corroding metal screws.

B. Tagging information shall include the Owner's Purchase Order Number, P.O. Item Number, Owner's Equipment Number, Vendor's Name, Vendor's Model Number, Vendor's Shop Order Number, and Voltage stamped on the tag. Letters and numbers must be at least 1/8" (.125 inches) high.

1.9 ACCEPTANCE AT SITE

A. Inspect for visible and hidden damage and immediately notify Owner and Shipper of damage. Return to manufacturer for repair or replacement without compromising the construction schedule.

1.10 STORAGE AND PROTECTION

A. Store and protect equipment in accordance with manufacturer's recommendations. At a minimum, protect equipment from water, excess heat or cold, and construction dirt and debris.
   1. project/site conditions

B. Environmental Requirements
   1. In accordance with specification Division 1
   2. Drive will be located outdoors. Enclosure must be suitable for outdoor use and must include enclosure air conditioning.

1.11 SCHEDULING

A. Coordinate shipping schedules as per priorities with the Owner or the Owner's Representative.

1.12 WARRANTY

A. The warranty period for the equipment specified herein shall be a minimum two (2) years from the date of commercial operation at Owner's facility or eighteen (18) months from the date of delivery, whichever comes first. Vendor shall retain originals of all test reports through the duration of the equipment warranty period

1.13 MAINTENANCE

Section not used.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Allen Bradley 755TL Active Front-End

B. No Substitution

2.2 GENERAL

A. This specification covers AC adjustable frequency drives for industrial applications.

B. The manufacturer shall not have less than fifteen years of experience in the manufacture of AFD's.

C. The drives shall be manufactured in the United States.

D. All components will be accessible from the cabinet door for service. Drive(s) must be designed for side-by-side, back-to-back, or against the wall installation.

E. Drive harmonics are to be meet the requirements of IEEE 519 at the point of common coupling. If drive by itself will not comply with IEEE 519, furnish line reactors or harmonic filters to achieve compliance.

F. The unit shall be NEMA type 1, freestanding metal enclosed control cabinet with hinged front access door(s), filtered ventilation system (if required) and containing main circuit breaker, static power conversion equipment, by-pass contactors with overloads (if required), and all necessary controls, protection and metering, mounted, wired and tested, including at least the following:
   1. Input disconnect switch, externally operated, with current limiting fuses for inverter. Provide mechanical interlocks with enclosure door.
   2. 115 Volt grounded AC control circuit.
      a. Operator controls as shown on the schematic diagram which may include the following:
      b. A speed control potentiometer
      c. Hand/Off/Auto Selector Switch
      d. Emergency Stop Pushbutton

G. Furnish each unit with a nameplate of laminated black and white plastic with beveled edges, with letters engraved through the white finish top lamination, exposing black interior lamination, containing the following information:
   1. Unit Number
   2. Shop Order Number
   3. Horsepower
   4. Short Circuit Rating
   5. Date Manufactured
   6. Drawing Number(s)

2.3 DESIGN CRITERIA

A. Input Power
   1. The drive main input power shall be three phase 480VAC 50/60 Hz
   2. The drive shall have a voltage tolerance of +/-10% for all 200V and 400V drives. The voltage tolerance for 600V drives twenty horsepower and above shall be +/-10% and +5/-10 for 600V product below 20 Hp.
   3. Input frequency tolerance shall be +/-5% for all ratings.
   4. The efficiency of the drive shall be a minimum of 97.0% at full load at full speed. Displacement power factor will be greater than 0.95 lagging over the entire speed range.
   5. The Maximum Short Circuit Current Rating of the VFD shall be 200,000A RMS symmetrical for all ratings.

B. Active Front End
   1. Use transistor-based Active Front End as the input rectifier that uses a Selective Harmonic Elimination algorithm, mitigating the harmonics enough to meet IEEE-519-2014 without the need for phase shifting transformers and multi-pulse diode rectifiers. Total current harmonic distortion shall not exceed 5% at the VFD input terminals at full load conditions. AFE rectifier shall be phase rotation insensitive, tolerant of line voltage imbalance up to 10% without affecting the harmonic mitigation or VFD output, and capable of operating the motor at full output with a 10% drop on input voltage.
   2. Use an LCL filter assembly to filter up to and including the 50th harmonic to reduce EMI/RFI emissions. The LCL filter assembly shall include Passive Dampening. The drive will provide Active Resonance Detection and Protection to minimize any damage to the drive from supply side resonance.

3. The drive shall have the following specific features to enable integration with a Rockwell Automation® ControlLogix® or CompactLogix™ Automation Controller
    a. Shall have an Add-on Profile available for use with Rockwell Automation® Studio 5000® programming software
    b. Shall support Rockwell Automation controller's Automatic Device Configuration functionality
4. The drive shall have a built-in circuit breaker as part of the drive's pre-charge circuit (250 hp and up) or provide built-in electrical connections for one to be field connected (10hp-250hp).
5. The drive will have two sets of tuning settings for the configuration of the line side converter such that appropriate values can be selected for two input sources (example: main utility power or back-up generator) and can be selected from the Human Interface Module or communications network.
6. The VFD shall meet the voltage sag ride-through requirements of SEMI-F47.
7. The VFD shall meet the seismic requirements of the following standards when installed according to the manufacturer's instructions
    a. American Society of Civil Engineering ASCE 7-10 (2010)
    b. The International Building Code IBC (2015)
    c. International Code Council Evaluation Service ICC_ES-AC156 (2012)
8. The operating elevation shall be up to 1000 Meters (3,300 ft) without derating (at a motor side inverter carrier Frequency of 1.33 KHz) and up to 4000 Meters with derating according to manufacturer's specifications.
9. Incorporate phase-to-phase and phase-to-ground MOV protection on the AC input line.
10. Use gold plated plug-in connections on printed circuit boards.
11. Microprocessor-based inverter and converter logic shall be isolated from power circuits.
12. Use latest generation IGBT inverter and converter sections that shall not require commutation capacitors.
13. Motor side inverters, line side converters and LCL filter modules (for drives greater than 250 Hp) shall be on roll-out chassis with front accessible connections for ease of repair or replacement and to provide access to load cables. Motor side inverter modules shall be removable without disturbing the load cables after installation.
14. Line converter modules and load inverter modules sections (for drives greater than 250 Hp) shall be interchangeable so as to reduce necessary spare parts.
15. Built-in managed dual EtherNet/IP ports for direct network connections, allowing linear or Device Level Ring topologies. The same network for control must support safety, I/O, and motion control, as well as be able to switch using standard unmodified Ethernet networking equipment.
16. Additional DPI™ port for handheld and remote HIM options.
17. Configurable digital input for hardware enablement.
18. Conformal coated printed circuit boards.
19. Provision for external 24V DC Auxiliary Control Power Supply.
20. Have a lineside converter input frequency range from 47 to 63 Hz
21. The carrier frequency of the lineside converter shall be fixed at 4 kHz.
22. The motor side inverter frequency output will be sine coded PWM with a carrier frequency that can be selected at 1.33 kHz, 2 kHz, or 4 kHz.

23. The VFD motor side inverter shall be capable of the following maximum frequency outputs:
    a. 325 Hz when operating with an output carrier frequency of 1.33kHz or 2 kHz.
    b. 590 Hz when operating with an output carrier frequency of 4kHz

24. The VFD enclosure (F7 and up) shall include the following:
    a. Shall be rated IP65 (UL Type NEMA 4) minimum with Air Conditioning
    b. The VFDs shall be of modular design with the following major components:
        i. AC pre-charge module
        ii. Roll out LCL filter modules
        iii. Roll out line side converter IGBT power modules
        iv. Roll out motor side inverters. IGBT power modules

C. Ratings
    1. Voltage
        a. Capable of accepting nominal plant power of 400V AC, 480V AC, 600V AC, or 690V AC at 50 Hz or 60 Hz as indicated on the contract drawings.
        b. The supply input voltage tolerance shall be ± 10% of nominal line voltage.
    2. Displacement Power Factor
        a. AFE Low Harmonic Drive's line side converter shall be capable of maintaining a minimum true power factor of up to 0.98 across the entire speed range.
    3. Efficiency
        a. A minimum of 97% (+/- 2%) at 100% speed and 100% motor load at nominal line voltage.
        b. Control power supplies, control circuits, and cooling fans shall be included in all loss calculations.
    4. Operating ambient temperature range without derating: -20°C - +40 °C (-4 °F - 104 °F), extendable to 55 °C (134 °F) with de-rating if indicated in the contract drawings.
    5. Operating relative humidity range shall be 5% to 95% non-condensing.

D. Hardware Design
    1. Overall hardware design is for maximum flexibility, robustness, serviceability, and reliability for the most demanding applications.
    2. Power Terminations are oversized for the drive current rating to allow for flexibility on all power terminations.
    3. Drive cabinets contain a minimum of three ground termination points.
    4. Power Terminations are 'finger safe' and clearly labeled with both the US (NEMA) standards (L1, L2...T2) and IEC standards (R, S…W).
    5. The latest technology in packaging, heat sink design, and cooling is utilized to minimize overall size and weight without degrading performance or functionality.
    6. Plastics, where used, are UV resistant.
    7. Standard packaging is NEMA 1.
    8. Interrupting current rating of 200KAIC for all ratings.

9. Power Semiconductor heat sinks contain one or more thermal sensors monitored by the microprocessor to prevent semiconductor damage caused by excessive heat or fan loss.

E. Converter Section
1. The drive employs diode bridge rectification to convert AC to DC. SCRs and other switching power devices are not used in the converter section of the drive to minimize line notching and RFI.
2. The Converter Section is unaffected by phase rotation/phase sequence.
3. Semiconductors on all ratings are sized (current) to allow full operation and overload capabilities at minimum input voltage.
4. PIV Ratings of the rectifier will be as follows:
   a. 220V drives--rectifier minimum PIV rating of 800V
   b. 460V drives—rectifier minimum PIV rating of 1600V
   c. 600V drives – rectifier minimum PIV rating of 1700V
5. The drive shall have MOVs mounted phase to phase for surge protection.
6. Isolation transformers are not required for operation on most standard distribution systems.
7. The converter section is usable on 50Hz or 60Hz distribution systems.

F. DC Bus Section
1. Overall DC Bus design is passive capacitive filter to minimize ripple and maximize power-loss ride-through.
2. DC Bus capacitance (total filter capacitance) is sized to eliminate any requirement for bus inductance (for filtering purposes) when the DRIVE is used on a three-phase distribution system.
3. The DC bus voltage and current are monitored by the control section to prevent damage to either the drive or the driven equipment.
4. All ratings will contain fast acting fuses in the DC Bus section.
5. 220V drives – bus capacitance voltage rating 400VDC (minimum)
6. 460V drives – bus capacitance voltage rating 800VDC (minimum)
7. 600V drives – bus capacitance voltage rating 1050VDC (minimum)
8. All capacitors have balance/discharge resistors to equalize charge voltage and permit safe discharge on power outage
9. Soft charge circuitry does not utilize power transistors nor time delay relays
10. The DC Bus Section has complete power terminations to allowing:
    a. Rectifier Isolation (positive side)
    b. Addition of extended 'ride through' capacitor bank
    c. Line regeneration using third party units
    d. DC Link inductor
    e. Common DC bus applications
    f. DC input
11. A readily visible LED indicates when DC voltages are present
12. The DC Bus section is designed to permit common DC bussing of multiple drives.

G. Inverter Section
1. The inverter section makes use of the latest generation of IGBT power switching transistors to convert DC to three phase, variable frequency, sinusoidal coded PWM waveform.
2. IGBT initialization testing is performed by the control section on each power up and run command.

3. The inverter section does not require commutation capacitors.
4. All drives have software and hardware to limit reflected wave caused by long motor cable lengths.
5. The IGBT ratings will be as follows:
6. 220V drives – IGBT minimum Vce rating 600V
7. 460V drives – IGBT minimum Vce rating 1200V
8. 600V drives – IGBT minimum Vce rating 1200V
9. All IGBTs have reversed biased diodes (free wheeling) to prevent IGBT failure when subjected to motor discharge spikes
10. PWM switching frequencies are adjustable from 0.5 to 15kHz to 100Hp and 0.5 to 5kHz above to minimize audible motor noise and maximize both motor and drive efficiency.
11. IGBTs are sized (current) to allow the drive to operate at 110% (current) continuous and 150% (current) for up to 120 seconds. On units greater than 100Hp IGBT's will have an overcurrent rating of 130% for 120 seconds.
12. To allow dissipation of regenerated energy, all drives contain a microprocessor controlled dynamic braking transistor. The dynamic braking transistor is an IGBT power semiconductor that is sized to allow 100% motor braking torque when connected to an appropriate resistor.
13. The dynamic braking transistor is fully protected by the microprocessor.
14. The dynamic braking transistor will not 'turn on' when the drive is not actively engaged in controlling a motor.
15. Output currents in each phase are monitored using hall-effect current transducers to enabling control of flux current, torque current, and providing protection to both the drive and driven equipment.
16. The inverter section is capable of sensing and interrupting a phase to phase or phase to ground fault on the output of the drive.

H. Control Section
1. The control section is designed to provide complete monitoring and protection of drive internal operations while communicating with the outside world via one or more user interfaces.
2. The microprocessor used is the latest design CPU with adjustable frequency drive specific circuitry and firmware.
3. Algorithms for sensorless vector speed control, sensorless vector torque control, feedback vector speed, torque, and position control are resident in EEPROM memory and utilized by the microprocessor when applicable.
4. Microprocessor logic circuits are isolated from power circuits
5. Where switching logic power supplies are utilized, they are powered from the DC Bus Section of the drive.
6. Microprocessor diagnostics are performed (on application of power) to prove functionality and viability of the microprocessor.
7. Memory cyclic redundancy check (CRC) is performed (on application of power) to prove integrity of EEPROM and UVPROM memories.
8. Motor diagnostics are performed (on application of power and each start) to prevent damage to a grounded or shorted motor. The motor diagnostics may be disabled when using a low impedance motor.
9. All ratings contain at a minimum the following communications ports;
   a. 1200 to 9600 baud rate, automatic baud rate and parity setting
   b. RS222/RS485 automatic switching port – 1200 to 28400 baud rate,

10. The control section is designed to allow 'quick change' of the interface sections for both configuration and functionality.

I. Interface Section
   1. Each drive shall have two user interfaces (in addition to the communication ports) as standard:
      a. Electronic Operator Interface – A 90 X 280 (nominal) Graphical Backlit LCD display with the ability to display multiple parameters on one screen. The EOI shall provide complete operating, monitoring, and programming functionality. The EOI shall be capable of operation from an external power source and firmware operating system is flash upgradeable and may be customized for special applications. The EOI shall contain a TTL communication port and an RS485 communications port for remote mounting. A Real Time Clock option shall be available for the EOI that allows provides complete data logging in the event of a fault.
      b. Terminal Board Interface shall provide complete operation functionality. Standard terminal board interface shall provide eight digital inputs, three digital outputs, four analog inputs, two analog outputs, and one pulse output. Inputs and outputs are independently configurable for both scaling and functionality.
   2. The drive shall retain the ability to function with no attached interface.
      a. Output Power
         1) The output voltage is adjustable from 0 to rated input voltage.
         2) The output frequency range is adjustable for a maximum frequency output of 60 Hz.
         3) The output (inverter) section of the drive will produce a PWM sinusoidal coded waveform.
         4) The output power switching devices shall be IGBT devices of the latest design.

2.4 ELECTRONIC OPERATOR INTERFACE

A. The EOI shall provide a convenient method of programming, operating, and monitoring the AFD. Parameters shall be grouped in a logical manner allowing rapid access to all parameters. All parameters are displayed in an easily understandable format using plain English for all items.

B. The graphical display shall allow groupings of multiple, logically associated parameters to be displayed on a single screen.

C. EOI backlighting controls may be configured for the wide range of ambient lighting conditions.

D. The customizable graphical display enables the use of user friendly units such as feet per minute, gallons per hour.

E. For security, the EOI functionality and access may be limited and password protected preventing an unauthorized user from accessing parameters, functions, or monitoring.

2.5 FUNCTIONALITY

A. Drive shall contain four sets of independently configurable acceleration / deceleration ramps. Each set is configurable as to both time and pattern. Times are adjustable from 0.01seconds to 6000 seconds.

B. Available patterns are Linear, S-Curve, and Overspeed 'C' Curve with both 'S' and 'C' curves allow user adjustment to customize the pattern

C. Acceleration/Deceleration sets (total four) are selectable via discrete input, Electronic Operator Interface, communications, or automatic switching based on output frequency.

D. An automatic acceleration/deceleration selection is available which dynamically structures each change in speed to match conditions of the driven equipment to minimize shock due to changes in velocity and/or load conditions.

E. Overvoltage stall and overcurrent stall settings prevent damage to the driven equipment should acceleration or deceleration settings exceed the ability of the motor to accelerate or decelerate the driven equipment.

F. Braking
   1. Drive shall have as an integral part of the power and control circuitry an IGBT transistor for dynamic braking. The braking transistor is controlled by the AFD control system and allows, with the addition of an optional resistor, an economical means of rapidly stopping a high inertia load with up to 100% braking torque.
   2. The braking transistor, braking resistor, and associated circuitry are fully protected by adjustable protection parameters eliminating the requirement for an external resistor overload protective device.
   3. In addition to the dynamic braking, DC injection braking configurable for both standard and emergency stops, allowing full motor current applied as DC to rapidly bring a rotating load to a stop.

G. Control modes
   1. The AFD shall have three distinct modes of operation
      a. Speed control as V/Hz sensorless vector, or feedback vector
      b. Torque control both sensorless vector and feedback vector
      c. Position control with feedback vector
   2. The drive has the ability to switch between modes of operation while running.

H. Current Detection/protection
   1. Overcurrent stall adjustable from 0.0 to 250%
   2. Configurable undercurrent detection and response
   3. UL recognized speed sensitive motor FLA trip curves adjustable from 10 to 100% inverter current rating
   4. Motor 150% OL time limits adjustable from 10 seconds to 2400 seconds
   5. OL Reduction Frequencies to optimize the speed sensitive motor overload to the application/motor characteristics
   6. Configurable overtorque detection levels, times, and reactions

I. Critical (skip) Frequencies

1. To avoid mechanical resonate frequencies, the AFD shall contains three programmable jump frequencies with adjustable bandwidths.
2. The jump frequencies may be any frequency less than or equal to the programmed value of maximum frequency.
3. The jump frequency bandwidths are independently programmable from +/- 0.00 to +/- 20.0 Hertz.

J. Load Sharing
1. AFD shall have the ability to share the load among multiple motors mechanically coupled to a common load. Because of variances in motors and mechanical speed reducers, one motor may experience more load than it counterparts and become overloaded. Drooping allows the overload motor to slow down, thus shedding torque and forcing the other motors to pick up the slack.
2. The drooping parameters allow the user complete adjustment over drooping gain, speed droop and multiple load levels, drooping filters, and drooping torque range.

K. Process Control (PID)
1. The AFD shall contain an internal PID control algorithm with adjustable proportional, integral, and differential. Feedback may be configured for direct or inverse reaction and is adjustable to span. PID may be enabled via discrete input, Electronic Operator Interface, or communications. Reaction to loss of feedback is configurable and discrete outputs may be configured to indicate loss of feedback or maximum deviation from setpoint.

L. Electronic Thermal Motor Protection
1. The drive contains four independently configurable electronic thermal motor protection levels. The electronic thermal motor protection level may be selected by Electronic Operator Interface, discrete input, communication protocol, or fixed frequency.
2. The Electronic Thermal Motor Protection is speed sensitive and adjustable for motors with speed ranges of 2:1 to 10000:1 allowing the user to optimize motor protection to suit a variety of motors and applications.
3. The Electronic Thermal Motor Protection levels have configurable 150% motor FLA time limits allowing the user to adjust the I^2T protection slope.

M. Emergency off Modes and Settings
1. Emergency off response is configurable to either Deceleration Stop, Coast Stop, or DC Injection Stop regardless of the standard stop mode. Emergency stop may be operator initiated via EOI, Discrete input (multiple E-Stop inputs allowed), Communication protocol

N. Feedback
1. For process control purposes, the drive will accept feedback signals as either an analog signal, binary digital, BCD digital, communication protocol, or 50% duty cycle pulse train.

O. Input/Output (I/O)
1. As a minimum, the standard control terminal board contains:
   a. Four discrete inputs independently configurable for any of multiple functions, sink or source selectable and 'true/false' on closure software selectable

b. Two discrete relay outputs configurable for any of multiple functions with form 'C' contacts rated 2 amps/250v
c. Three analog inputs with adjustable gains and bias and multiple functions
d. Potentiometer input
e. Two analog outputs with adjustable gain and bias 0-1ma or 4-20ma switch selectable

2. All control terminal boards are remote mountable (up to fifteen feet) using a standard 25conductor computer cable.

P. Jog
1. Jog frequency may be configured for any frequency from 0.0Hz to 10Hz. Jog is initiated from an appropriately configured input terminal, Electronic Operator Interface, or communication protocol.
2. Jog stop method is user configurable to coast, controlled deceleration or DC Injection.
3. Jog may be configured to allow reversing or only operate in a configured direction.
4. When jog direction is reverse from direction of motor rotation, the drives jog function will smoothly decelerate the motor to zero then jog in the commanded direction.

Q. Override Control
1. Override control allows one or more analog signals to act as a trim source to a frequency command. Override may be configured as either a additive (or subtractive) input such as – 5Hz to +5Hz, or as a percent of frequency command. Override may be assigned to any analog input, communication option, or Electronic Operator Interface.

R. Overvoltage Stall
1. Overvoltage stall prevents faults caused by regeneration. During deceleration, overvoltage stall extends deceleration time when bus levels reach a user configurable level. When applied to overhauling loads, the drive will compensate for rising dc bus levels by momentarily increasing output frequency. Two overvoltage stall levels allow complete configuration and control for most cyclic overhauling loads and high inertia loads.

S. Pattern Run
1. The Pattern Run feature allows the drive to emulate many of the function of a small programmable logic controller. Useful on any application which requires a set pattern of speed changes, based on either time or contact input, the drive may be programmed for four independent or interactive patterns each consisting of up to 7 changes in speed and/or direction. Each step may be configured to any of the four accel/decel times and patterns, direction, and timed from either step change, speed reached, or contact closure.

T. Preset Speeds
1. Up to 15 preset speeds may be configured in the drive. Each preset speed may have defined direction, 1 of 4 accel/decel times and patterns, and motor protective set. The preset speed may be selected via input terminals (using BCD selection), Electronic Operator Interface, or communication function.

U. Ridethrough

1. Ridethrough mode allows the user to configure the drive to utilize motor regenerative voltages to continue operation during brief power outages. Undervoltage detection time and undervoltage stall levels are user configurable items in addition to the drives response to undervoltage conditions.

V. Retry/Restart
   1. The retry/restart drive function allows the drive to smoothly start a rotating load regardless of the direction of rotation. When enabled, the drive will attempt to restart after a fault. The number of attempts and time between attempts are configurable items.

W. Soft Stall
   1. Soft Stall allows the drive to reduce output frequency when the current requirements of the motor exceed the motor's Electronic Thermal Protection setting. If the current drops below the motors overload protection level within the specified time, the output frequency of the drive will return to the commanded output frequency. Soft Stall is highly effective in preventing motor overload trips when used on fans, blowers, pumps, and other centrifugal loads which require less torque and current at lower speeds.

X. Torque Limiting
   1. Drive shall have a torque limiting function prevents mechanical shock to rotating equipment by allowing a user to establish a maximum torque limit. When enabled, the drive will prevent motor torque in excess of the user programmed torque limit.
   2. Separate Torque Limits are configurable for positive and negative torque, and user adjustable from 0 to 250% motor torque. This allows complete torque control over both the motoring and generating regions on applications such as vibratory feeders and stamping machines.

Y. Torque Speed Limiting
   1. Speed limits unique to torque control modes are configurable for both forward and reverse operation.

2.6 REGULATION

A. Speed Control
   1. Sensorless Vector – 0.1% of motor base speed from 1 to 60HZ

B. Torque Control
   1. Sensorless Vector -- +/-10% of torque setpoint from 50 to 100% of the motors rated torque.

2.7 SOFTWARE AND COMMUNICATION

A. Programming Software
   1. Drive shall be programmable via a computer software program and which shall provide the same functionality as the EOI with the additional capabilities of data logging, trending, storing and restoring multiple parameter sets. Cascading windows allow a user interface similar to the EOI in look and feel while allowing direct parameter access for experienced users. Trending and monitoring functions

allow up to three items be graphically displayed on a standard trend chart and logged to a historical data file for future reference.

B. Communications
   1. All parameters are accessible from any of the following drive supported communication protocols.
      a. RS222
      b. RS485
      c. DeviceNet
      d. Profibus
      e. Modbus RTU
      f. Ethernet IP

C. Environment
   1. Operating environmental ambient conditions without derating shall be:
      a. Temperature: –10 to +40 C
      b. Relative humidity: 5 to 95% non condensing
      c. Elevation: to 1000 meters (2200 ft)
      d. Shock: 0.5 G maximum
   2. Storage environmental ambient conditions:
      a. Temperature: -10 to +65 C
      b. Relative humidity: 5 to 98% non condensing
      c. Elevation: to 5000 meters

2.8 LONG LEAD LENGTH

A. All drives shall have software and hardware to limit reflected wave caused by long motor cable lengths. When applied to motors with insulation systems that are compliance with NEMA MG-1-1998 Section IV Part 31, output filters shall not be required when motor lead length are within recommended limits.

B. If motor lead lengths are in excess of recommended limits, provide output filters with the drive.

PART 3 - EXECUTION

3.1 ACCEPTABLE INSTALLERS

A. Contractor installing and commissioning the facility.

3.2 EXAMINATION

A. Contractor shall be responsible for inspecting the jobsite and identifying site conditions which may affect the installation, storage, or operation of the equipment and notifying Owner or Owner’s Representative of such conditions.

3.3 PREPARATION

A. Protect equipment from damage during installation.

B. Prepare installation location in accordance with manufacturers recommendations.

3.4 ERECTION

A. Section not used.

3.5 INSTALLATION

A. Install equipment in accordance with manufacturer's recommendations.

B. Do not locate drives where subject to mechanical damage or where subject to washdown or frequent water spray.

C. Securely attach wall mount units to a wall or fabricated support stand.

D. Provide a 3" housekeeping pad extending 2" out from all sides of the drive for floor mount units.

E. Allow sufficient space around the drive to allow for required cooling.

F. Install conduit and cable for power and control.

G. Ground drive in accordance with NEC and manufacturer's requirements.

H. Coordinate installation with other trades and disciplines.

3.6 APPLICATION

Section not used.

3.7 CONSTRUCTION

A. Fabricate and assemble drives and test to assure conformance to specification requirements.

B. Notify Owner or Owner's Representative of factory testing schedule so that they have the option of witnessing the factory tests.

C. Provide each drive with an engraved nameplate of laminated black and white plastic with beveled edges. Letters shall be black on a white background. Nameplates shall contain the following information:
   1. Drive tag number
   2. Shop order number
   3. Horsepower, voltage, phases
   4. Short circuit rating
   5. Date manufactured
   6. Reference drawing numbers

3.8 REPAIR/RESTORATION

A. Repair or restore to previous condition any facility or equipment damaged or disturbed by the installation of the equipment.

3.9 RE-INSTALLATION

Section not used.

3.10 FIELD QUALITY CONTROL

A. Verify installation in accordance with manufacturer's recommendations and with the requirements of this specification.

B. Verify field wiring and equipment calibration.

C. If required by the purchase order, schedule Manufacturer's Field Services representative for startup assistance. Submit report detailing all actions performed by this individual, all findings and recommendations. Report must state that manufacturer's representative has certified the installation in compliance with manufacturer's requirements.

3.11 ADJUSTING

A. Perform any field adjustments required by manufacturer or the manufacturer's representative.

B. Configure all drive parameters required for proper operation. Submit to Owner or Owner's Representative a configuration and startup report documenting all drive settings and containing the following information:
   1. Date of startup/configuration
   2. Name of technician
   3. Tag number and name of drive
   4. Complete list of all configured parameters.

C. If parameters have been downloaded to a computer, submit a CD with this configuration file and labeled with the information required above.

3.12 CLEANING

A. Clean all debris from the equipment. Vacuum out all loose dirt and materials. Wipe down outside of drive.

3.13 DEMONSTRATION

A. Demonstrate proper operation to Owner or Owner's Representative and leave equipment ready for normal operation.

3.14 PROTECTION

A. Protect work at all times from damage by other trades or disciplines. Repair or replace any equipment damaged by other trades or disciplines.

++ END OF SECTION ++

SECTION 16350

SERVICE ENTRANCE AND UTILITY METERING SECTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install the service entrance section as shown on the Drawings.
   2. The service entrance section and the low-voltage distribution switchboard shall be provided by the same manufacturer.
   3. The service entrance section, automatic transfer switch, and low-voltage distribution switchboard shall be bus connected and comprise a single unit assembly, once installed. The service entrance section manufacturer shall coordinate the required interconnections and provide transition sections with bussing and splicing hardware

B. Coordination: Provide in accordance with Utility Company requirements for Service Entrance Sections.

C. Related Sections:
   1. Section 01330, Submittal Procedures.
   2. Section 01750, Testing, Training and Startup.
   3. Section 16445 Low Voltage Distribution Switchboard.
   4. Section 16496 Automatic Transfer Switch.

1.2 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified:
   1. Underwriters Laboratories, Inc. (UL).
   2. Institute of Electrical and Electronics Engineers (IEEE).
   3. National Electrical Code (NEC).
   4. The serving utility Service Specifications.
   5. Insulated Cable Engineers' Association (ICEA).

1.3 SUBMITTALS

A. Product Data and Drawings: Submit for approval the following:
   1. Manufacturer's technical information for equipment proposed for use.
   2. Outline and summary sheets with schedules of equipment in each unit.
   3. Unit control schematic and elementary wiring diagrams showing numbered terminal points and interconnections to other units.
   4. Nameplate schedule.

B. Operation and Maintenance Data: Submit complete manuals including:
   1. Copies of all Shop Drawings, test reports, maintenance data and schedules, description of operation, and spare parts information.
   2. Furnish Operation and Maintenance Manuals.

1.4 WARRANTY

A. Submit manufacturer's standard warranty.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Service entrance section lineups shall be provided as shown on the Drawings. Service entrance section including structures, appurtenances and all major components (contactors, circuit breakers etc.) therein shall be the product of one manufacturer unless shown on the drawing bill of material lists.
   1. Service: Voltage rating and number of wires shall be as shown on the Drawings. Service entrance section shall operate from a 3 phase, 60 Hertz system.
   2. Wiring: NEMA Class II, Type B.
   3. Enclosure: NEMA 3R for outdoor applications.

B. Construction:
   1. The SES shall be a single panel or assembly of panels on which shall be mounted on a deadfront mounting plate, fused switches, metering equipment provisions, power distribution panel and any monitoring or protection devices as indicated on the plans.
   2. The SES shall be a one-piece enclosure with front accessibility and vandal resistant. The SES shall have a metered distribution section and a pull section for underground service, all of which shall comply with the requirements of the serving utility.
   3. The enclosure shall be zinc coated steel, minimum 12 gauge thickness. Cabinet shall be protected against corrosion in accordance with UL 50, Cabinets and Boxes, Section 16160. Exterior doors to be minimum 10 gauge steel and shall have heavy duty padlocking provisions. Deadfront shall be a hinged type, 10 gauge minimum, and shall require the use of a tool to expose interior components for installation or servicing. All factory installed components shall be UL listed. All factory installed conductors shall be copper, size and type to conform to NEC and UL requirements. Ventilation openings shall be provided.
   4. Finish shall be two (2) coats of ANSI 61 Grey enamel paint.

C. Bus System and Conductors:
   1. Rating: Bus bracing of 65,000 amps symmetrical unless shown otherwise on the drawings and bus current capacities as indicated on the Drawings.
   2. All bus bars (including neutral and ground) shall be silver or tin plated copper rated to UL heat rise standards.

3. Bus bar connections easily accessible with simple tools.
4. Main Bus: Continuous edge mounted, and isolated from wireways and working areas for use on 480 volt 3 phase 4 wire service with entire assembly suitable for 600 volts.
5. Grounding Bus: Full length mounted across the bottom, drilled with lugs of appropriate capacity as required. Ground each housing directly to this bus.
6. Neutral Bus: Insulated, continuous through section for 4 wire services, drilled with lugs of appropriate capacity as required.
7. All control conductors shall be type MTW, No. 14 AWG minimum.

D. Service Entrance Interrupting Switches:
1. The service entrance interrupting switch(es) shall be operable without opening the compartment door inside of the exterior door. A viewing window shall be provided in the compartment door to allow full view of the switch blades. The compartment door shall be hinged and interlocked with the switch shaft so that the switch must be opened before access to the fuses is possible and the door must be closed before the switch can be closed. True conditions of switch blades when fully open and fully closed shall be accurately and conspicuously labeled for switch handle positions. Handle shall be lockable only in the true, fully-open switch condition. The operator handles shall pivot up-down, with the down position as OFF. The ON-OFF condition of the disconnecting means shall be indicated by the handle position, Red and Green colored indicators which include the words ON and OFF, and the international symbols I and O along with a pictorial indication of the handle position. It shall be possible to lock the handle in the OFF position with up to 3/8" diameter shackle padlocks.
2. A mechanical interlock shall prevent the operator from opening the unit door when the disconnect is in the ON position. Another mechanical interlock shall prevent the operator from placing the disconnect in the ON position while the unit door is open. It shall be possible for authorized personnel to defeat these interlocks. A non-defeatable interlock shall be provided between the handle operator and the cam lever to prevent installing or removing a plug-on unit unless the disconnect is in the OFF position.

E. Utility Metering Section:
1. Instrument transformer compartments shall be bussed with rectangular bus bar in accordance with the utility company requirements.
2. Meter panels shall be constructed of 12 gauge steel (minimum) and shall be reversible, sealable, hinged and interchangeable.
3. Meter panels shall have a handle attached at unsupported end.
4. Metering section shall be approved by the utility company, prior to fabrication.
5. Provisions for the utility company seals shall be provided on doors, meter sockets, etc. in accordance with utility company requirements.

F. Nameplates:
1. Provide engraved plastic nameplates to identify switchgear units, door mounted components, and internal components.
2. White lamicoid with black letters fastened with stainless steel drive pins, engraved with the circuit number, and circuit name, and identification

consistent with the drawings. Nameplates of engraved phenolic shall be provided for each SES compartment measuring a minimum of 1.5"H x 6"W total outside dimensions.

3. Label per requirements of NEC, Articles 110-21 and 110-22.

G. Product and Manufacturer: Provide one of the following:
   1. Square D Company.
   2. Siemens.
   3. General Electric
   4. Eaton-Cutler Hammer

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install on raised concrete base at location shown on the Drawings. Install support channels in concrete according to manufacturer's recommendations.

B. Provide no openings in top or side of units not required for conduit.

C. Field test all SES components.

D. Verify that wiring diagrams on inside of door of each compartment reflects the "as-built" circuitry.

E. Install in conformance with the National Electrical Code, and the serving utility requirements.

F. Arrange with the utility company for metering installation, feeder installation and inspection prior to energization.

++ END OF SECTION ++

SECTION 16410

DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope: Furnish and install disconnect switches as shown on the drawings and as specified herein.

B. Related Sections:
   1. Section 16140, Wiring Devices, for disconnect switches on 120 volt, single-phase circuits.

1.2 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified:
   1. National Electrical Code.
   2. UL #98, Enclosed Switches.
   3. NEMA KS-1, Enclosed Switches.

1.3 SUBMITTAL

A. Submit, for approval, Product Data for disconnect switches proposed for use.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Single Throw, Circuit Disconnect Switches:
   1. Type: Fused or unfused, horsepower rated, heavy-duty, single- throw, quick-make, quick-break mechanism, visible blades in the OFF position and safety handle.
   2. Rating: 600 volts, with number of poles and ampere rating as required for motor or equipment circuits being disconnected. Switches shall bear a UL label.

B. Double Throw Safety Switches:
   1. Type: Unfused, double throw with center OFF position, quick-make, quick-break mechanism, visible blades in the OFF position and safety handle.
   2. Rating: 600 volts, with number of poles and ampere rating as shown on the Drawings for the circuits being disconnected.

C. Enclosure:
   1. NEMA 12 for dry, indoor non-corrosive areas.
   2. NEMA 3R or 4 for all wet or outdoor non-corrosive locations.
   3. NEMA 4X stainless steel for corrosive locations.
   4. NEMA 7 or 9 for all hazardous locations.
   5. Nameplate identifying equipment for which switches serve as the disconnecting means.

D. Product and Manufacturer: Provide disconnect switches of one of the following:
   1. Square D
   2. GE
   3. Allen Bradley
   4. Appleton
   5. Killark

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount equipment so that sufficient access and working space is provided for ready and safe operation and maintenance.

B. Securely fasten equipment to walls, handrails or other structural supports on which they are mounted. Provide independent stainless steel supports where no wall or other structural surface exists.

C. Furnish one (1) set of spare fuses for each fused disconnect switch to be installed.

D. Install in conformance with National Electrical Code.

++ END OF SECTION ++

SECTION 16415

CONTROL STATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope: Provide pushbutton, selector switch and other control stations as shown on the Drawings and/or as specified in the Equipment Sections.

1.2 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified.
   1. NEMA Standard ICS2-216, Pushbuttons, Selector Switches, Indicating Lights and Pushbutton Stations.
   2. National Electrical Code.

1.3 SUBMITTALS

A. Product Data: Submit, for approval, product data for all materials covered herein.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Type: Industrial, heavy duty, oiltight construction with clearly marked legend plates.

B. Lockout Stop: Maintained contact type with provisions for locking in the "STOP" position.

C. Pushbuttons: Momentary or maintained types, NEMA A600 contact rating.

D. Selector Switches: Rotary type with round or oval handles and positioning device to securely hold switch in selected position for maintained type and for spring return from left, right, or both left and right to maintained position.

E. Indicating Lights: Transformer type with 6 volt lamp. Lens color red for running, green for stopped or ready and amber for failure.

F. Enclosures: NEMA 12 for dry indoor locations, NEMA 3R for outdoor and damp or wet locations. PVC coated RGS for corrosive locations.

G. Nameplates identifying equipment controlled if not readily apparent.

H. Product and Manufacturer: Provide control stations of one of the following:
   1. Square D.
   2. General Electric Company.
   3. Allen Bradley Company.
   4. Or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount equipment so that sufficient access and working space is provided for ready and safe operation and maintenance.

B. Securely fasten equipment to walls or other surfaces on which they are mounted. Provide independent galvanized steel supports where no wall or other surface exists.

C. Install in conformance with National Electrical Code.

++ END OF SECTION ++

SECTION 16430

CUSTOMER POWER METERING SYSTEM

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This specification covers the customer power monitoring system installed on the service entrance section(s), motor control center(s), and other distribution panel(s) as indicated on Plans.

1.2 SUBMITTALS

A. Products shall be submitted in accordance with Section 16050, and elsewhere in the Contract Documents, prior to installation.

B. Submit manufacturer's catalog cut sheet indicating all options to be supplied as specified herein.

C. Submit shop drawing indicating wiring connection diagram and elevation drawing indicating location of component(s) on the service entrance section.

1.3 MANUFACTURERS

A. Acceptable manufacturers subject to compliance with the specifications herein are as follows:
   1. Square D.
   2. Multilin.
   3. Eaton-Cutler Hammer
   4. General Electric.
   5. Siemens.

PART 2 - PRODUCTS

2.1 GENERAL

A. The system shall consist of electronic circuit monitors as required to obtain signals as specified herein. Components shall include CT's, PT's, CPT, etc. and other devices as required.
   1. The electronic Circuit Monitors shall report metering values such as frequency, temperature, current, voltage, power factor, power, demand current, and real power, and accumulated energy.
   2. Each Circuit Monitor shall retain historical circuit data, time and date, setup and configuration values, and diagnostics data in the event of a control power failure without the need for an internal battery.
   3. Each Circuit Monitor shall be capable of capturing current and voltage waveforms, which may be exported to a personal computer where waveform or other power quality analysis may be performed.

4. The Circuit Monitor shall include an LED readout which will allow local display of the following electrical parameters:
    a. Current, per phase RMS.
    b. Voltage, phase-to-phase & phase-to-neutral.
    c. Real power, 3-phase total.
    d. Reactive power, 3-phase total.
    e. Apparent power, 3-phase total.
    f. Power factor, 3-phase total & per phase.
    g. Frequency.
    h. Peak demand current, per phase.
    i. Peak demand, real power.
    j. Accumulated Energy, (MWH and MVARH).
5. Reset the following electrical parameters shall also be allowed from the front of the Circuit Monitor:
    a. Peak demand current.
    b. Peak demand power.
    c. Energy (MWH).
    d. Reactive energy (MVARH).
6. Circuit Monitor setup for system requirements shall be allowed from the front of the Circuit Monitor. Setup provisions shall include:
    a. CT rating (600:5).
    b. PT rating (480:120).
    c. System type (3-wire and 4-wire).
    d. Demand interval (5-60 min.).
7. All reset and functions shall be keyswitch protected to prevent unauthorized/accidental changes.

B. The system shall have System Display units, which display data from the Circuit Monitors. The display unit shall contain the following:
    1. Each System Display shall provide real-time access to all metering data available for each circuit (present as well as historical data).
    2. Each System Display unit shall access and display the data available from selected electronic Circuit Monitors connected on the individual data transfer network.
    3. The System Display unit shall utilize a 4 line by 20 character, high contrast LCD technology display with backlighting to provide high reliability and superior readability in all light conditions.
    4. The level of backlighting as well as the contrast shall be adjustable.
    5. The System Display unit shall allow for easy operation by providing a keypad with large keys for operator selections.
    6. The keys shall have a raised perimeter and tactile feedback to ensure a positive response even with gloved hand operation.
    7. The keys shall be clearly marked to indicate the function and separated into meaningful groups with display prompting to assist the user in operation.
    8. Each System Display unit shall be configured by the manufacturer with all necessary data such as CT ratios, PT ratios, main and feeder device nameplates, demand alarm set points, etc.
    9. It shall be possible to change the configuration for each System Display unit using the keypad provided on each display.
    10. This capability shall be password protected to prevent unauthorized modification of the configuration.
    11. All data with the exception of the captured waveform shall be accessible by the System Display unit.

12. Data shall be displayed in a logically organized manner complete with the proper scaling and units.
13. It shall be possible to sequentially view all available data from a selected Circuit Monitor by single keystroke advancing through the various display pages.
14. It shall be possible to view the same pages of data from other Circuit Monitors by single keystroke advancing back and forth from Circuit Monitor to Circuit Monitor.

C. Software for a personal computer shall be provided as specified herein:
   1. The Metering System Software to be supplied shall be suitable for operation on a personal computer.
   2. System Software shall be capable of alarm reporting, event logging, data logging, on-line monitoring of instrumentation/status/alarms, waveform analysis, manual control of circuit breakers or other selected devices and shall include sufficient levels of password protection.
   3. The software shall be capable of performing background activities such as alarms and automatic logging while the computer is used for other programs such as word processing, spreadsheet, etc.
   4. Software shall be supplied by switchgear manufacturer, which will display all information available from the Circuit Monitors. This software shall include the following characteristics/capabilities:
      a. MicroSoft windows based with mouse.
      b. View & log instrumentation data.
      c. View voltage/current waveforms and analyze waveform data.
      d. Perform diagnostics/setup.
      e. Display tables, charts & graphs.
      f. Display meters, meter panels graphically.
      g. Event logging.
      h. Alarm reporting.
      i. Reset energy alarms/historical data.
      j. Background data logging.
      k. Three level password protection.
      l. Manual control of Circuit Monitor outputs.
      m. Display status (circuit breakers, relays, trip units, etc.).

PART 3 - EXECUTION

3.1 INSTALLATION

A. System Display units shall be installed by the manufacturer in the switchgear as indicated on the plans.

B. The System Display units shall be flush mounted on switchgear door panels.

C. Electronic Circuit Monitors shall be installed by the switchgear manufacturer for all circuits as indicated by the project drawings.

D. All control power, CT, PT, and communications wire shall be factory wired and harnessed within the switchgear lineup.

E. Where external circuit connections are required, terminal blocks shall be provided and the manufacturer's drawings must clearly identify the interconnection requirements including wire type to be used.

F. The metering components included within the service entrance sections shall be factory installed, wired and tested prior to shipment to the job site.

G. All wiring required to externally connect the personal computer shall be installed by the Contractor per manufacturer's requirements and per other portions of these specifications.

H. Contractor interconnection wiring requirements shall be clearly identified on the metering system drawings to be submitted for approval.

3.2 TRAINING

A. On-site start-up and training of the metering system shall be included in the project bid.

B. Start-up shall include a complete working demonstration of the system with simulation of possible operating conditions, which may be encountered.

C. Training shall include any documentation and hands-on exercises necessary to enable operations personnel to assume full operating responsibility for the system after completion of the training period.

D. The project bid shall include 2 days start-up assistance and 1 day training.

++END OF SECTION ++

SECTION 16440

LIGHTING AND DISTRIBUTION PANELBOARDS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope: Provide lighting and distribution panelboards, as shown. Installation of new circuit breakers in existing panelboards shall be included in this specification and shall be rated as specified herein.

1.2 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified:
   1. NEC Article 384, Switchboards and Panelboards.
   2. UL Standard #50, Electrical Cabinets and Boxes.
   3. UL Standard #67, Electric Panelboards.
   4. NEMA PB1, Panelboards.

1.3 SUBMITTALS

A. Product Data: Submit, for approval, product data for all materials covered herein, and a listing of the panelboards to be furnished identifying their location and number of branch circuit breakers.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Panelboards:
   1. Rating: Voltage rating, current rating, number of phases, number of wires and number of poles shall be as shown on the Drawings.
   2. Circuit Breakers: Molded case, bolt-in thermal magnetic type with number of poles and trip ratings as shown on the Drawings.
   3. Main and branch circuit breakers shall be fully rated with interrupting capacities as follows:
      a. 22,000 or 35,000 amps or as shown on the drawings for 480/277 volt circuit breakers.
      b. 10,000 or 22,000 amps or as shown on drawings for 120/240 volt circuit breakers.
   4. Bus Bars: 98 percent conductivity copper, tin plated. All 4 wire panelboards shall have a solid neutral bar. All panels shall have ground bus.
   5. Main: All panelboards shall have a main circuit breaker, unless Drawings specifically call for main lugs only.
   6. Branch circuit breakers connected for sequence phasing.
   7. Construction: Code grade steel, NEMA 12, ample gutter space, flush door, flush snaplatch and lock for dry indoor locations. NEMA 3R steel for all damp, or wet locations. NEMA 4X stainless steel for corrosive locations.
   8. Trim: Surface or flush as required.

9. Directory: Typed card, with glass cover in frame on back of door giving the circuit numbers and the area or equipment served.
10. Identification: Nameplate identifying the panel number and voltage.
11. Product and Manufacturer: Provide panelboards of one of the following:
    a. Square D.
    b. GE.
    c. Eaton-Culter Hammer
    d. Siemens.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mounting: Install panelboards at locations shown on Drawings. Set cabinets so that top circuit breaker is not over 6 feet from the floor.

B. Directory: Complete typewritten directory indicating items controlled by each circuit breaker and the size of feeder serving the panel.

C. Arrange circuits to balance the loads on the panelboards.

++ END OF SECTION ++

SECTION 16445

LOW-VOLTAGE DISTRIBUTION SWITCHBOARDS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope: Furnish and install, where indicated, free-standing, dead-front type low-voltage distribution switchboards, utilizing group mounted circuit protective devices as specified herein, and as shown on the Drawings.

B. Related Sections:
   1. Section 01330, Submittal Procedures.
   2. Section 01750, Testing, Training and Startup.
   3. Section 16350 Service Entrance Section.
   4. Section 16496 Automatic Transfer Switch.

1.2 QUALITY ASSURANCE

A. The low-voltage distribution switchboards and all components shall be designed, manufactured and tested in accordance with the latest applicable following standards:
   1. NEMA PB-2
   2. UL Standard 891.
   3. National Fire Protection Association 79, Electrical Standard for Industrial Machinery.

B. The low-voltage switchboards shall be UL labeled.

C. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of ANSI and NEMA standards:
   1. The switchboard shall be completely assembled, wired, adjusted, and tested at the factory. After assembly, the complete switchboard will be tested for operation under simulated service conditions to assure the accuracy of the wiring and the functioning of all equipment. The main circuits shall be given a dielectric test of 2200 volts for one (1) minute between live parts and ground, and between opposite polarities. The wiring and control circuits shall be given a dielectric test of 1500 volts for one (1) minute between live parts and ground.

D. The manufacturer shall provide three (3) certified copies of factory test reports.

1.3 SUBMITTAL

A. Product Date: Submit, for approval, including:
   1. Assembly and major component ratings for:
      a. Short-circuit/ Interrupt
      b. Voltage
      c. Continuous current
   2. Cable terminal sizes.
   3. Nameplate schedule
   4. Component list

5. Conduit entry/exit locations
6. Certified production test reports.
7. Installation information, including seismic certification and equipment anchorage details.

B. Shop Drawings: Submit, for approval, including:
1. Copies of manufacturer's technical information.
2. NFPA 79, Annex "D" Standard elementary and wiring diagrams.
3. Master drawing index
4. Front view elevation
5. Floor plan
6. Top view
7. Single line
8. Wiring diagrams.
9. Schematic diagram

C. Where applicable, the following additional information shall be submitted to the ENGINEER:
1. Busway connection
2. Connection details between close-coupled assemblies
3. Composite floor plan of close-coupled assemblies
4. Key interlock scheme drawing and sequence of operations

D. Operation and Maintenance Data: Furnish Operations and Maintenance Manuals in conformance with requirements of Section 01780, Operation and Maintenance Data.

1.4 QUALIFICATIONS

A. The manufacturer of the assembly shall be the manufacturer of the circuit protective devices within the assembly.

B. For the equipment specified herein, the manufacturer shall be ISO 9000, 9001 or 9002 certified.

C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the ENGINEER, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

D. The switchboards shall be suitable for and certified to meet all applicable seismic requirements of the Uniform Building Code (UBC) for zone 4 application. Guidelines for the installation consistent with these requirements shall be provided by the switchgear manufacturer and be based upon testing of representative equipment.

PART 2 - PRODUCTS

2.1 SWITCHGEAR

A. Product and Manufacturer:
1. Cutler-Hammer, "Pow-R-Line C".
2. Square D.

3. GE.
4. Siemens.

B. Ratings:
   1. The assembly shall be rated to withstand mechanical forces exerted during short-circuit conditions when connected directly to a power source having available fault current of 65,000 amperes symmetrical at rated voltage.
   2. Voltage rating shall be 480/277 volts, 3 phase, 3 or 4 wire as shown..

C. Construction:
   1. Switchboards shall consist of the required number of vertical sections bolted together to form a rigid assembly. The sides and rear shall be covered with removable bolt-on covers. All edges of front covers or hinged front panels shall be formed. Provide adequate ventilation within the enclosure.
   2. All sections of the switchboard shall be rear aligned with depth as shown on the Drawings. All protective devices shall be group mounted. Devices shall be front removable and load connections front accessible enabling switchboard to be mounted against a wall.

D. Bus:
   1. All bus bars shall be tin-plated copper. Main horizontal bus bars shall be mounted with all three phases arranged in the same vertical plane. Bus sizing shall be based on NEMA standard temperature rise criteria of 65 degrees C over a 40 degrees C ambient (outside the enclosure).
   2. Provide a full capacity neutral bus where a neutral bus as shown on the Drawings.
   3. A copper ground bus (minimum 1/4 by 2-inch), shall be furnished firmly secured to each vertical section structure and shall extend the entire length of the switchboard.
   4. All hardware used on conductors shall be high-tensile strength and zinc-plated. All bus joints shall be provided with conical spring-type washers.

E. Wiring/Terminations:
   1. Small wiring, necessary fuse blocks and terminal blocks within the switchboard shall be furnished as required. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer's wiring diagrams.
   2. Mechanical-type terminals shall be provided for all line and load terminations suitable for copper or aluminum cable rated for 75 degrees C of the size as shown on the Drawings.
   3. Lugs shall be provided in the incoming line section for connection of the main grounding conductor. Additional lugs for connection of other grounding conductors shall be provided as shown on the Drawings.
   4. All control wire shall be Type SIS, bundled and secured with nylon ties. Insulated locking spade terminals shall be provided for all control connections, except where saddle type terminals are provided integral to a device. All current transformer secondary leads shall first be connected to conveniently accessible short-circuit terminal blocks before connecting to any other device. All groups of control wires leaving the switchboard shall be provided with terminals blocks with suitable numbering strips. Provide wire markers at each end of all control wiring.

F. Molded Case Protective Devices:

1. Main breakers and feeder circuit breakers of 600 amp frame and above shall be molded case circuit breakers with microprocessor based trip unit which shall provide adjustable long time pickup and delay, adjustable short time pickup and delay, adjustable instantaneous and adjustable ground fault pickup and delay-Cutler-Hammer Digitrip RMS 310 or equal. Interrupting rating shall be 65,000 amps symmetrical. Circuit breakers of 600 amp frame and below shall have thermal-magnetic trip units and inverse time characteristics. Molded case breakers shall be Cutler-Hammer Series C, or equal.
2. Circuit breakers shall be operated by a toggle-type handle and shall have a quick-make/quick-break over-center switching mechanism that is mechanically trip-free. Automatic tripping of the breaker shall be clearly indicated by the handle position. Contacts shall be nonwelding silver alloy, and arc extinction shall be accomplished by means of arc chutes. A push-to-trip button on the front of the circuit breaker shall provide a local manual means to exercise the trip mechanism.
3. Circuit breakers shall have a minimum symmetrical interrupting capacity as shown on the Drawings.
4. Where indicated circuit breakers shall be current limiting.

G. Miscellaneous Devices:
   1. Control power transformers with primary and secondary protection shall be provided, as shown on the Drawings, or as required for serving space heaters.
   2. Each section of the switchboard shall be provided with a thermostatically controlled space heater. Power for the space heaters shall be obtained from a control power transformer within the switchboard. Supply voltage shall be 120 volts AC.

H. Enclosures shall be NEMA 1 for indoor installations and NEMA 3R for damp, wet or outdoor installations.

I. Nameplates:
   1. Engraved nameplates, mounted on the face of the assembly, shall be furnished for all main and feeder circuits as shown on the Drawings. Nameplates shall be laminated plastic, black characters on white background. Characters shall be 3/16-inch high, minimum. Nameplates shall give item designation and circuit number as well as frame ampere size and appropriate trip rating. Furnish master nameplate giving switchboard designation, voltage ampere rating, short-circuit rating, manufacturer's name, general order number and item number.
   2. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer's wiring diagrams.

J. Finish. All exterior and interior steel surfaces of the switchboard shall be properly cleaned and provided with a rust-inhibiting phosphatized coating. Color and finish of the switchboard shall be ANSI 61 light gray.

PART 3 - EXECUTION

3.1 INSTALLATION

A. CONTRACTOR shall install all equipment in accordance with the manufacturer's instructions, Drawings and National Electrical Code.

B. The assembly shall be provided with adequate lifting means and shall be capable of being moved into installation position and bolted directly to CONTRACTOR supplied floor sills to be set level in concrete in accordance with manufacturer's recommendations. All necessary hardware to secure the assembly in place shall be provided by CONTRACTOR.

3.2 MANUFACTURER'S SERVICES

A. A factory trained representative shall be provided for installation supervision, startup and test services, and operation and maintenance personnel training services. The serviceman shall make three (3) visits to the site. The first visit shall be for assistance in the installation of the equipment. The second visit shall be for checking the completed installation and startup of the system. The third visit shall be as described under Section 01750, Testing, Training and Startup.

++ END OF SECTION ++

SECTION 16496

AUTOMATIC TRANSFER SWITCH

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Automatic transfer switch shall be furnished and installed, as indicated on the Drawings, with full load current rating as indicated on the Drawings. The switch shall be capable of switching all classes of load, and shall be rated for continuous duty when installed in a non-ventilated enclosure. Withstand current rating shall be as indicated on the Drawings.

B. The automatic transfer switch (ATS) shall be bus connected and shall be an integral piece to the Service Entrance Section (SES) and Distribution Switchboard assembly. The automatic transfer switch manufacturer shall coordinate the installation and bus connection requirements with the service entrance section manufacturer.

C. The automatic transfer switch shall be a true double throw non-circuit breaker type.

D. Related Sections:
   1. Section 01330, Submittal Procedures.
   2. Section 01750, Testing, Training and Startup.
   3. Section 16350 Service Entrance Section.
   4. Section 16445 Low Voltage Distribution Switchboard.

1.2 REFERENCES

A. NFPA 70 - National Electrical Code.

B. NEMA ICS 1 - General Standards for Industrial Control and Systems.

C. NEMA ICS 2 - Standards for Industrial Control Devices, Controllers, and Assemblies.

D. NEMA ICS 6 - Enclosures for Industrial Controls and Systems.

1.3 SUBMITTALS

A. Submit in compliance with the special provisions.

B. Product Data: Provide catalog sheets showing voltage, switch size, ratings and size of switching and overcurrent protective devices, operating logic, short circuit ratings, dimensions, and enclosure details.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.4 OPERATION AND MAINTENANCE DATA

A. Submit in compliance with the special provisions.

B. Operation Data: Include instructions for operating equipment. Include instructions for operating equipment when engine generator is running.

C. Maintenance Data: Include routine preventative maintenance and lubrication schedule. List special tools, maintenance materials, and replacement parts.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience, and with service facilities within 250 miles of Project.

B. Supplier: Authorized distributor of specified manufacturer with minimum three years documented experience.

1.6 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by UL as suitable for purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site per the instructions of the owner.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to internal components, enclosure and finish.

1.8 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated by manufacturer.

1.9 MAINTENANCE SERVICE

A. Furnish service and maintenance of transfer switch for one year from Date of Substantial Completion.

1.10 MAINTENANCE MATERIALS

A. Provide maintenance materials as required.

B. Provide two of each special tool required for maintenance.

PART 2 - PRODUCTS

A. Acceptable manufacturers subject to compliance with the specifications herein are as follows:

B. Automatic Switch Company.

C. Russelectric.

D. Or equal.

2.2 AUTOMATIC TRANSFER SWITCH

A. Description: NEMA ICS 2, automatic transfer switch.

B. Configuration: Electrically operated, mechanically held transfer switch.

2.3 SERVICE CONDITIONS

A. Service Conditions: NEMA ICS 1.

B. Temperature: 130 degrees F ambient.

C. Altitude: 1,300 feet.

2.4 RATINGS

A. Voltage: 480/277 volts, three phase, four wire, 60 Hz.

B. Switched Poles: 3.

C. Continuous Rating: 600 amperes.

D. Interrupting Capacity: 600 percent of continuous rating at 0.5 power factor.

E. Withstand Current Rating: 65,000 rms symmetrical amperes.

2.5 PRODUCT OPTIONS AND FEATURES

A. Indicating Lights: Mount in cover of enclosure to indicate NORMAL SOURCE AVAILABLE, ALTERNATE SOURCE AVAILABLE, SWITCH POSITION.

B. Test Switch: Mount in cover of enclosure to simulate failure of normal source.

C. Return to Normal Switch: Mount in cover of enclosure to initiate manual transfer from alternate to normal source.

D. Transfer Switch Auxiliary Contacts: 12 normally open; 12 normally closed.

E. Normal Source Monitor: Monitor normal source voltage and frequency; initiate transfer when voltage drops below 85 percent or frequency varies more than 3 percent from rated nominal value.

F. Alternate Source Monitor: Monitor alternate source voltage and frequency; inhibit transfer when voltage is below 85 percent or frequency varies more than 3 percent from rated nominal value.

2.6 AUTOMATIC SEQUENCE OF OPERATION

A. Initiate Time Delay to Start Alternate Source Engine Generator: Upon initiation by normal source monitor.

B. Time Delay To Start Alternate Source Engine Generator: 0 to 5 seconds, adjustable.

C. Initiate Transfer Load to Alternate Source: Upon initiation by normal source monitor and permission by alternate source monitor.

D. Time Delay Before Transfer to Alternate Power Source: 0 to 30 seconds, adjustable.

E. Initiate Retransfer Load to Normal Source: Upon permission by normal source monitor.

F. Time Delay Before Transfer to Normal Power: 0 to 30 minutes, adjustable; bypass time delay in event of alternate source failure.

G. Time Delay Before Engine Shut Down: 0 to 30 minutes, adjustable, of unloaded operation.

H. Delayed transition automatic transfer. Incorporate a timed center off position for motor load decay. Transfer time shall be adjustable from 0.1 seconds to 2 minutes minimum. A mechanical and electrical interlock shall be provided to ensure that both sets of contacts cannot be closed at the same time.

I. Engine Exerciser: Start engine every 7 days; run for 30 minutes before shutting down. Bypass exerciser control if normal source fails during exercising period.

2.7 ENCLOSURE

A. Enclosure: Install in Service Entrance Section.

2.8 SPARE PARTS

A. One of each type of control board.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify conditions suitable for installation.

B. Verify that surface is suitable for transfer switch installation.

3.2 PREPARATION

A. Provide all equipment as required.

3.3 INSTALLATION

A. Install transfer switches in accordance with manufacturer's instructions.

3.4 INSTALLATION TESTING

A. When conducting temperature rise tests in accordance with UL-1008, the manufacturer shall include post-endurance temperature rise tests to verify the ability of the switches to carry full rated current after completing the overload and endurance tests.

B. On completion of the installation, start-up shall be performed by a factory-trained service representative in the presence of the OWNER and the ENGINEER.

++ END OF SECTION ++

SECTION 16500

LIGHTING FIXTURES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope: Provide lighting fixtures as shown and/or scheduled.

B. Coordination:
   1. Coordinate location of fixtures with piping, ductwork, openings and other systems and equipment and locate clear of interferences.
   2. Coordinate fixtures to be mounted in hung ceilings with the ceiling suspension system proposed for use.

C. Related Sections:
   1. Section 16135, Outlet, Pull, and Junction Boxes.

1.2 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified:
   1. National Electrical Code.
   2. UL Standard #57, Electric Lighting Fixtures.
   3. UL Standard #844, Electric Lighting Fixtures for Use in Hazardous Locations.
   4. UL Standard #1570, Fluorescent Lighting Fixtures.
   5. UL Standard #1571, Incandescent Lighting Fixtures.
   6. UL Standard #1572, High Intensity Discharge Lighting Fixtures.

1.3 SUBMITTALS

A. Product Data: Submit, for approval, including the following:
   1. Fixture construction details.
   2. ETL photometric and isocandle curves for each fixture proposed.
   3. Verification that recessed fixtures that are to be mounted in hung ceilings are compatible with the ceiling suspension system proposed for use.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Type: Lighting fixtures are noted in the Fixture Schedule in the Drawings. Fixtures to be complete with supports, ballasts, lamps and incidentals as required.

B. Lamps:
   1. Fluorescent: Cool white, energy efficient type.
   2. High Pressure Sodium: Color corrected.
   3. Incandescent: Inside frosted.
   4. Metal Halide.
   5. Spare: Ten (10) percent spare lamps of each type and wattage.

C. Ballasts:
   1. Fluorescent: High power factor, energy efficient type, equipped with thermal protectors (Type "P" ballast), compatible with the lamps installed. Fixtures shall be equipped with no less than one ballast for every two lamps. For example, four lamp fluorescent fixtures shall be equipped with two ballasts.
   2. High Intensity Discharge: High power factor, constant wattage, stabilized autotransformer with line starting current the same or less than operating current.
   3. Ballasts to have "C" sound rating (min.) and be ETL/CBM certified.
   4. Spare: Ten (10) percent spare ballasts of each type.

D. Fixtures located in an area which is identified as a hazardous location shall be approved as a complete assembly for the hazardous location classification shown on the Drawings, shall be clearly marked to indicate maximum wattage of lamps for which they are approved, and shall be protected against physical damage by suitable guards.

E. Hardware: All necessary hangers, supports, conduit adaptors, reducers, hooks, brackets and other hardware required for safe fixture mounting shall be furnished. Hardware shall have a protective, non-corrosive finish.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Fixture mounting heights and locations shown on the Drawings are approximate and are subject to revision in the field, where necessary to clear conflicts and obstructions.

B. Suspended Fixtures: Pendant mount using 1/2-inch conduit stems. Ground to outlet box. Attach mounting to building structure with expansion anchors. Fixtures shall not be dependent on the outlet box cover screws for support.

C. Surface Mounted Fixtures: Attach to appropriate outlet box.

D. Boxes and Fixtures:
   1. For units mounted against masonry or concrete walls, provide suitable 1/2-inch spacers to prevent mounting back of box directly against wall.
   2. Bolt units rigidly to building with expansion anchors, toggle bolts, hangers or Unistrut.
   3. No boxes shall be installed with open conduit holes.
   4. Cable each circuit and identify with tag.

E. Mounting Heights: Mounting heights or elevations are to bottom of the fixture or to centerline of device.

F. Relamp all fluorescent fixtures with new lamps at end of construction period, prior to final acceptance of the new facilities by OWNER.

++ END OF SECTION ++

SECTION 16570

LIGHTING CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope: Provide lighting controls, as shown and specified herein.

1.2 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified:
   1. UL Standard #917, Clock-Operated Switches.
   2. National Electrical Code.

1.3 SUBMITTALS

A. Product Data: Submit, for approval, including wiring diagrams.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Time Switch where shown on drawings:
   1. Type: Astronomic dial time switch with day-omitting device.
   2. Timing Motor: Heavy duty, synchronous, self-starting, high torque, 120 volt or 277, 60 cycles, as shown on the Drawings.
   3. Capacity: 40 Amps per pole at 277 volts.
   4. Dial: 24 hour rotation, with gear to provide one revolution per year which automatically raises the ON and OFF settings each day according to seasonal changes of sunset and sunrise for the Town of Buckeye, Arizona area.
   5. Reserve Power: Spring driven reserve sufficient to operate time switch contacts for a minimum of 30 hours after power failure. On restoration of power, time switch shall transfer to synchronous motor drive and automatically rewind reserve.
   6. Product and Manufacturer: Provide one of the following:
      a. Z Series by Tork Time Controls, Incorporated.
      b. Or equal.

B. Combination Lighting Contactors:
   1. Rated 600 volts, 30 amps, electrically held number of poles as shown on the Drawings, housed in NEMA 12 enclosure.
   2. Additional devices such as selector switches, circuit breakers, control power transformers, fuses, time clocks etc. as shown on the Drawings.
   3. Product and Manufacturer: Provide one of the following:
      a. Class 8903 by Square D.
      b. Or equal.

C. Photocell:

1. Cadmium sulphide hermetically sealed cell, fully temperature compensated, with time delay of at least 15 seconds to prevent false switching.
2. Built-in fail safe light level selector, adjustable within limits of 2 to 50 foot candles and factory set at 25 foot candles.
3. Product and Manufacturer: Provide one of the following:
   a. 2100 Series by Tork Time Controls, Incorporated.
   b. Or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount equipment so that sufficient access and working space is provided for ready and safe operation and maintenance.

B. Mount photocell in appropriate outside location or as shown on the Drawings and adjust footcandle setting for proper dusk and dawn photocontrol. Provide wiring in conduit from the photocell to controls.

C. Securely fasten equipment to walls or other surfaces on which they are mounted.

++ END OF SECTION ++

SECTION 16622

STANDBY DIESEL ELECTRIC GENERATOR

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The outdoor standby electric generating system shall be rated for standby service and sized as shown on the Drawings.

B. The Contractor shall be responsible for obtaining any required air quality permits on behalf of the Owner, posting all public notices, and shall include all associated fees in their bid, listed as separate line items in the schedule of values. The generator vendor shall provide the Contractor with the documentation required for permitting, showing published proof of EPA certification on the engine specified and furnished herein.

1.2 SUBMITTALS

A. Submit product data in accordance with Division 16 and the Contract Documents.

B. Submit shop drawings containing actual dimensions, complete wiring and schematic diagrams, control diagrams, and any other details required to demonstrate that the system has been coordinated, and will properly function as a unit. Shop drawings shall show proposed layout, anchoring, support and appurtenances, including clearances for maintenance and operations. Shop drawings shall show details of piping connections for fuel.

C. Submit a complete list of equipment and material, including manufacturer's specifications, performance charts, catalog cuts and installation instructions, and recommended spare parts list. Submit data for each different item of equipment specified, including but not limited to engine, generator, switchgear, automatic transfer switch, vibration isolators, radiator, and other components. The data shall include a complete list of parts and source of supply.

D. Submit performance test reports in booklet form showing all field tests, and adjustments performed to prove compliance with specified criteria.

E. Operation and maintenance (O&M) manuals shall describe the step-by-step procedure required for system start-up, operation and routine maintenance. The O&M manuals shall include troubleshooting and repair guidelines, as well as wiring diagrams of the system as installed.

F. Miscellaneous:
   1. Manufacturers kilowatts output curve and fuel consumption.
   2. Manufacturers transient response data of the complete engine generator set upon 50%, 75%, and 100% block loads at 1.0 pf. Data shall include maximum voltage dips, maximum frequency dips, and recovery time periods.
   3. Engine altitude duration curve.
   4. Generator motor starting curves showing the voltage dips versus starting KVA.
   5. Prototype test certifications showing all components comply with specifications.
   6. The following spare parts for the engine generator shall be supplied to the OWNER prior to acceptance of work.

a. Two sets of oil filters
b. Two sets of heavy duty air filters
c. One dozen spare lamps
d. Two fuses (for each control circuit)

1.3 MANUFACTURERS

A. Generator set shall be manufactured by Cummins (Onan), Caterpillar, or equal.

PART 2 - PRODUCTS

2.1 ENGINE GENERATOR SET

A. The provision of a standby electric generating system shall be rated for standby service as indicated on Drawings and as described in these Specifications, delivered at 0.8 power factor, 480 volts, three phase, four wire, 60 hertz, for ambient air temperature of 50 degrees C, and specifically rated for the operating altitude shown on the Drawings, without exceeding NEMA MG1 - temperature rise limits.

B. The system shall be a package of:
1. A diesel engine driven electric plant to provide standby electric power.
2. Engine mounted control system.
3. An automatic load transfer switch for switching of the load and control to provide automatic starting and stopping of the engine generator system, as specified in Section 16496 of these Specifications.
4. Mounted accessories as specified
5. Integral fuel and exhaust systems.
6. All other equipment as required to provide a complete and operable system.
7. Fully Enclosed weatherproof enclosure.

C. The engine-generator set and all its accessories shall be constructed for outdoor installation and operation all electrical components shall be housed in NEMA 3R enclosures.

D. All materials, equipment, and parts comprising the units specified herein, shall be new and unused, or current manufacture and of the highest grade.

E. The engine, generator and all major items of auxiliary equipment shall be manufactured in the U.S. by manufacturers currently engaged in the production of such equipment. The unit shall be factory assembled and tested by the engine manufacturer and shipped to the job site by his authorized dealer having a parts and service facility in the area. The performance of the electric plant shall be certified by manufacturer as to the plant's full power rating, stability and voltage and frequency regulation, and field load tested at site.

F. The units offered under these Contract Documents shall be covered by the manufacturer's standard warranty, or guarantee, on new machines, and shall be a minimum of two years after the date of substantial completion.

2.2 ENGINE

A. The engine shall be water cooled in-line, or Vee-type compression ignition diesel, designed to operate on No. 2 fuel oil. Diesel engines requiring premium fuels will not

be considered. The engine shall be equipped with fuel, lube oil, and intake air filters; lube oil coolers, fuel transfer pump, fuel priming pump, and gear driven water pump.

B. The engine governor shall maintain frequency regulation not to exceed 1 percent from no load to full rated load.

C. The unit shall be mounted on a structural steel sub-base and shall be provided with suitable vibration isolators.

D. Safety shut-offs for high water temperature, low oil pressure, overspeed, and engine overcrank shall be provided. An engine-mounted radiator with blower type fan shall be sized to maintain safe operation at specified ambient temperature. The radiator shall be equipped for a duct adapter flange. Air flow restriction from the radiator shall not exceed 0.5 inch of water.

E. The engine cooling system shall be filled with a solution of 30 percent ethylene glycol.

F. Provide a Critical Grade type silencer as manufactured by Kittel, Maxim, or GT Exhaust Systems, including stainless steel flexible exhaust fitting, properly sized and installed, according to the manufacturer's recommendation. Mounting shall be provided as part of the generator set assembly. Silencer shall be mounted so that its weight is not supported by the engine. Exhaust pipe size shall be sufficient to ensure that measured exhaust back pressure does not exceed the maximum limitations specified by the generator set manufacturer. Noise attenuation shall limit the exhaust note to 85dBA within 15 feet of the exhaust stack.

G. Exhaust piping shall have stainless steel automatic exhaust cap, and shall be coated with not less than 6 mils of inorganic zinc after sandblasting to "white metal".

H. The fuel storage tank shall be a subbase type, with integral secondary containment, gauges, piping, fittings, and valves shall be supplied as part of the generator set. The fuel storage tank shall be aboveground and an integral part of the generator. The fuel tank shall be U.L. listed.

I. The tank shall be provided with a level gauge in the primary tank, and leak detection in the secondary tank capable of producing low level and leakage alarm.

J. The tank shall be of sufficient capacity to run the generator set at full load for 12 hours.

K. The level gauges shall be Liquidometer industrial type as manufactured by Hersey Products Company, Petro-Meter Company, or equal.

L. An engine-mounted fuel filter, fuel pressure gauge, and engine fuel priming pump shall be provided.

M. A DC electric starting system with positive engagement drive shall be furnished.

N. Fully automatic generator set start-stop controls in the generator control panel shall be provided. Controls shall provide two auxiliary contacts for activating accessory items. Controls shall include a 30 second cranking cycle limit with lockout. (Three 10 second cranks or a single 30 second crank.)

O. A unit mounted thermal circulation type water heater shall be furnished to maintain engine jacket water to 90 degrees F in an ambient temperature of zero degrees F. The heater shall be single phase, 60 hertz, 120/240 volts. Heater shall be Chromalox, General Electric, or equal.

P. A lead-acid storage battery set of the heavy-duty diesel starting type shall be provided. The battery set shall be of sufficient capacity to provide for 1-1/2 minutes total cranking time without recharging and shall be rated no less than 220 amp-hours. A battery rack and necessary cables and clamps shall be provided as part of the generator set.

Q. A current limiting battery charger shall be furnished to automatically recharge the batteries. The charger shall float at 2.17 volts per cell and equalize at 2.33 volts per cell. It shall include overload protection, silicon diode full wave rectifiers, voltage surge suppressers, DC ammeter, DC voltmeter and fused AC input. Amperage output shall be no less than 10 amperes.

2.3 GENERATOR

A. The generator shall be a 4-pole or 6-pole revolving field type with static exciter and magnetic amplifier or SCR voltage regulator. No commutator or commutator brushes shall be allowed. Class F insulation shall be used on the stator and rotor, and both shall be further protected with 100 percent epoxy impregnation and an overcoat of resilient insulating material to reduce possible fungus and/or abrasive deterioration. The starter shall be directly connected to the engine flywheel housing, and the rotor shall be driven through a semi-flexible driving flange to insure permanent alignment. Voltage regulation shall be within plus or minus 2 percent of rated voltage, from no load to full-load. The instantaneous voltage dip shall be less than 15 percent of rated voltage when full load and rated power factor is applied to the generator. Recovery to stable operation shall occur within 5 seconds. Stable or steady-state operation is defined as operation with terminal voltage remaining constant within plus or minus one percent of rated voltage. A rheostat shall provide a minimum of plus or minus 5 percent voltage adjustment from rated value. Temperature rise at full-load determined by resistance shall be within rating as defined by NEMA MG-1.

B. The specified standby kW shall be for continuous electrical service during interruption of the normal utility source.

C. These ratings must be substantiated by manufacturer's standard published curves. Special ratings or maximum ratings are not acceptable.

D. A generator mounted vibration isolated 14 gauge steel control panel shall be provided.

E. Control panel shall be microprocessor-based, and shall provide the following features:
   1. Voltmeter, 3-1/2 inch, 2 percent accuracy
   2. Ammeter, 3-1/2 inch, 2 percent accuracy
   3. Voltmeter/Ammeter phase selector switch
   4. Frequency meter, 3-1/2 inch, dial type
   5. Automatic starting controls
   6. Panel illumination lights and switch
   7. Voltage level adjustment rheostat
   8. Engine oil pressure gauge
   9. Engine water temperature gauge

10. Dry contacts for remote alarms wired to terminal strips for the following:
    a. Run status
    b. Trouble alarm
    c. Fault alarm
11. Fault indicators for low oil pressure, high water temperature, overspeed, and overcrank
12. Four position function switch marked AUTO, MANUAL, OFF/RESET, and STOP
13. Battery charge rate ammeter if not furnished on separate charger
14. Running time meter

F. A generator mounted main line molded case circuit breaker shall be installed as a load circuit interrupting and protection device. It shall operate both manually for normal switching function and automatically during overload and short circuit conditions.

G. Generator exciter field circuit breakers do not meet the above electrical standards and are unacceptable for line protection.

H. Provide a sign at the service entrance equipment indicating type and location of standby power generator per NEC.

2.4 MINI POWER CENTER

A. The generator system shall be equipped with a mini power center to provide power to the water jacket heater(s), battery charger, and other single phase loads. The mini power center shall be rated for 15kVA, 480-120/240 volt, single phase, and shall include an integral transformer with primary circuit breaker, and distribution panelboard with a main circuit breaker. Circuit breakers shall bolt on and buses shall be copper. Higher amperage rated transformers panelboards shall be provided if required by the generator system. The panelboard shall be UL 67 listed.

B. The mini power center shall be mounted where fully accessible. The mini power center enclosures shall be NEMA 3R. The minimum interrupting capacity of any device shall be 10,000 amps unless indicated otherwise on Drawings.

C. All devices requiring power inside the generator system shall be prewired to the mini power center in accordance with NEC requirements. Provide grounding per NEC, and Section 16060 of the Specifications.

D. The mini power center shall be as manufactured by Square D, or equal.

PART 3 - EXECUTION

3.1 FACTORY TESTS

A. Before the equipment is installed, a factory certified test log of the generator set showing a minimum of ¾ hour testing with ½ hour at 100 percent rated load, continuously, shall be submitted to the ENGINEER.

3.2 INSTALLATION

A. The generating system shall be installed as indicated on the Drawings, per manufacturer's recommendations and shall meet all applicable codes and regulations.

3.3 START-UP

A. On completion of the installation, start-up shall be performed by a factory-trained dealer service representative.

B. This generating system shall be full-load tested at site in the presence of the ENGINEER for a period of 8 hours, with supplier providing necessary resistive load banks. Any defects which become evident during this test shall be corrected by the CONTRACTOR at his own expense.

C. After installation the tank shall be filled with No. 2 fuel oil. The tank shall be refilled after the 8-hour on-site test.

3.4 GROUNDING

A. Provide grounding as shown on the Drawings, and as per NEC.

+ + END OF SECTION + +

SECTION 16671

TRANSIENT VOLTAGE SURGE SUPPRESSION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope: The manufacturer or representative of the manufacturer shall furnish and arrange for the installation of the Transient Voltage Surge Suppression (TVSS) equipment having the warranties, guarantees, electrical characteristics, ratings, energy savings performance, and modifications as specified herein.

B. Related Sections:
   1. Division 16, Electrical.

1.2 QUALITY ASSURANCE

A. The USA manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement. The company shall be in the TVSS manufacturing business for over 10 years in the USA.

B. The TVSS units and all components shall be designed, manufactured, and tested in accordance with the latest applicable standards of the following:

   1. UL Listed under UL 1449 – 2nd Edition

   2. The UL 1449 suppression voltage ratings (SVR) shall be permanently affixed to the TVSS unit.

C. TVSS units shall be Underwriters Laboratories listed.

1.3 SUBMITTAL

A. Provide verification that the TVSS device complies with the required UL 1449 specification.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One copy of these instructions shall be included with the equipment at time of shipment.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. This specification is written to describe the REDI/VOLT II System IV (or equal in all respects) as supplied by ENER/TECH SALES, INC. or their authorized representatives. In

the state of Arizona, the authorized representative includes, but is not necessarily limited to, ENERGY REDUCTION, INC.

2.2 TRANSIENT VOLTAGE SURGE SUPPRESSION – GENERAL

A. ELECTRICAL REQUIREMENTS –
   1. Unit Operating Voltage – Refer to drawings and product specifications for operating voltage and unit configuration.
   2. Maximum Continuous Operating Voltage (MCOV) – The MCOV shall not be greater than 115% of the nominal system operating voltage.
   3. The TVSS unit shall have a response time of less than 90 picoseconds (trillionths of a second).
   4. The TVSS units shall have clamp response activation at 10 % above line voltage.

B. TVSS DESIGN:
   1. Balanced Suppression Platform – The surge current shall be equally distributed to all MOV components to insure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV.
   2. Internal Connections – No plug-in component modules shall be used as surge current conductors. All internal components shall be hardwired with connections utilizing low impedance conductors and compression fittings.
   3. The TVSS unit shall have monitoring lights indicating that the unit is performing. Fault detection is indicated by the failure of any one of the monitoring lights on the front of the TVSS unit.
   4. Warranty – The manufacturer shall provide a lifetime warranty from the date of installation against any TVSS part failure when installed in compliance with the manufacturer's written instructions and any applicable national or local electrical code.
   5. Protected Equipment – The manufacturer shall provide a lifetime protected equipment warranty to repair or replace any equipment damaged by a transient voltage surge/spike while properly connected through the TVSS unit. The warranty is for repair or replacement, at ENER/TECH's option, for an amount equal to the fair market value of the damaged equipment or the original price of the equipment, whichever is less, up to a maximum amount of $100,000. (See attached Sample Warranty page for complete details).
   6. The manufacturer must guarantee and insure 20% savings in kwhr consumption over the first two years of TVSS operation following installation. The insurance policy must be issued to the customer and underwritten by a major third party insurance carrier.

2.3 SYSTEM APPLICATION

A. The Products covered by this specification have been tested and demonstrated that they are suitable for ANSI/IEEE C62.41 Category C1 environments. (See attached product specification page)

B. The TVSS units are capable of withstanding a total surge current 8 x 20 microsecond waveform shall be 80 kA per phase.

C. Each TVSS unit must be capable of surviving more than 2500 category C1 transients without failure or degradation of UL 1449 Suppression Voltage Rating.

D. A direct bus bar connection may be used to mount the TVSS component to the panelboard bus bar to reduce the impedance of the shunt path.

E. The maximum conductor lead length between breaker and suppressor shall not exceed 18 inches, but should be as short as possible.

2.4 ENCLOSURES

A. The TVSS units shall be contained in a NEMA 4 watertight steel casing for indoor or outdoor use primarily to provide protection against windblown dust and rain, splashing rain, hose-directed water, and damage from external ice formation.

PART 3 - EXECUTION

3.1 FACTORY TESTING

A. Standard Factory tests are performed on the equipment in accordance with the latest version of NEMA and UL standards.

TRANSIENT VOLTAGE SURGE SUPPRESSOR PERFORMANCE SPECIFICATIONS

UNIT MODEL	**S/C 120/240** Volt Single Phase	**3D 120/240** Volt Three Phase Delta	**3W 120/208** Volt Three Phase WYE	**"3" 377/480** Volt Three Phase WYE
Wiring	3 Wire plus ground	4 Wire plus ground	4 Wire plus ground	4 Wire plus ground
Maximum Surge Current	80 kA per phase	80 kA per phase	80 kA per phase	80 kA per phase
Response Time	85 picoseconds	85 picoseconds	85 picoseconds	85 picoseconds
Clamp Voltage (VPeak)	Cat. C1/B3 ANSI/EEE C62.41 - 1991 (6kV-1.2/5.0 ☐s, 3kA-8/20 ☐s)	Cat. C1/B3 ANSI/EEE C62.41 - 1991 (6kV-1.2/5.0 ☐s, 3kA-8/20 ☐s)	Cat. C1/B3 ANSI/EEE C62.41 - 1991 (6kV-1.2/5.0 ☐s, 3kA-8/20 ☐s)	Cat. C1/B3 ANSI/EEE C62.41 - 1991 (6kV-1.2/5.0 ☐s, 3kA-8/20 ☐s)
Line to Neutral	330 volts	600 Volts(A & C)	330 Volts	800 Volts
Line (B-Hi-Leg) to Neutral		700 Volts (B)		
Rating of Varistor Component				
Line to Neutral	130 Volts	130 Volts(A & C)	130 Volts	320 Volts
Line (B-Hi-Leg) to Neutral		230 Volts (B)		
Rated Voltage (RMS)				

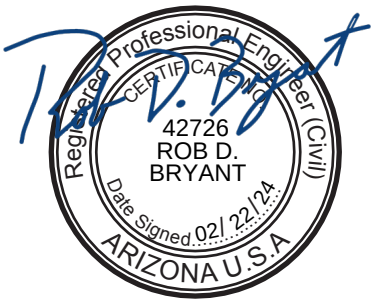
UNIT MODEL	**S/C 120/240** Volt Single Phase	**3D 120/240** Volt Three Phase Delta	**3W 120/208** Volt Three Phase WYE	**"3" 377/480** Volt Three Phase WYE
Line to Neutral	120 Volts	120 Volts (A & C)	120 Volts	277 Volts
Line (B-Hi-Leg) to Neutral		240 Volts (B)		
Line to Line	240 Volts	240 Volts (A &C)	208 Volts	480 Volts
Line (B-Hi-Leg) to Line		360 Volts (B)		
Total Capacitance (F:1Mhz)	1900	1900	1900	750
Relative Humidity Range	100%	100%	100%	100%
Operating Frequency	50 - 60 Hertz	50 - 60 Hertz	50 - 60 Hertz	50 - 60 Hertz
Operating Temp. Range (°C)	- 55°C to +85°C	- 55°C to +85°C	- 55°C to +85°C	- 55°C to +85°C

++ END OF SECTION ++

CITY OF PRESCOTT, YAVAPAI
HILLS LIFT STATION # 1
STANDARD DETAILS

FOR CONSTRUCTION
VOLUME 3 OF 4

CITY OF PRESCOTT
ARIZONA
Everybody's Hometown



February 2024

PREPARED BY:
WATER WORKS ENGINEERS, LLC.
7500 N. Dobson Road #200
Scottsdale, AZ 85256
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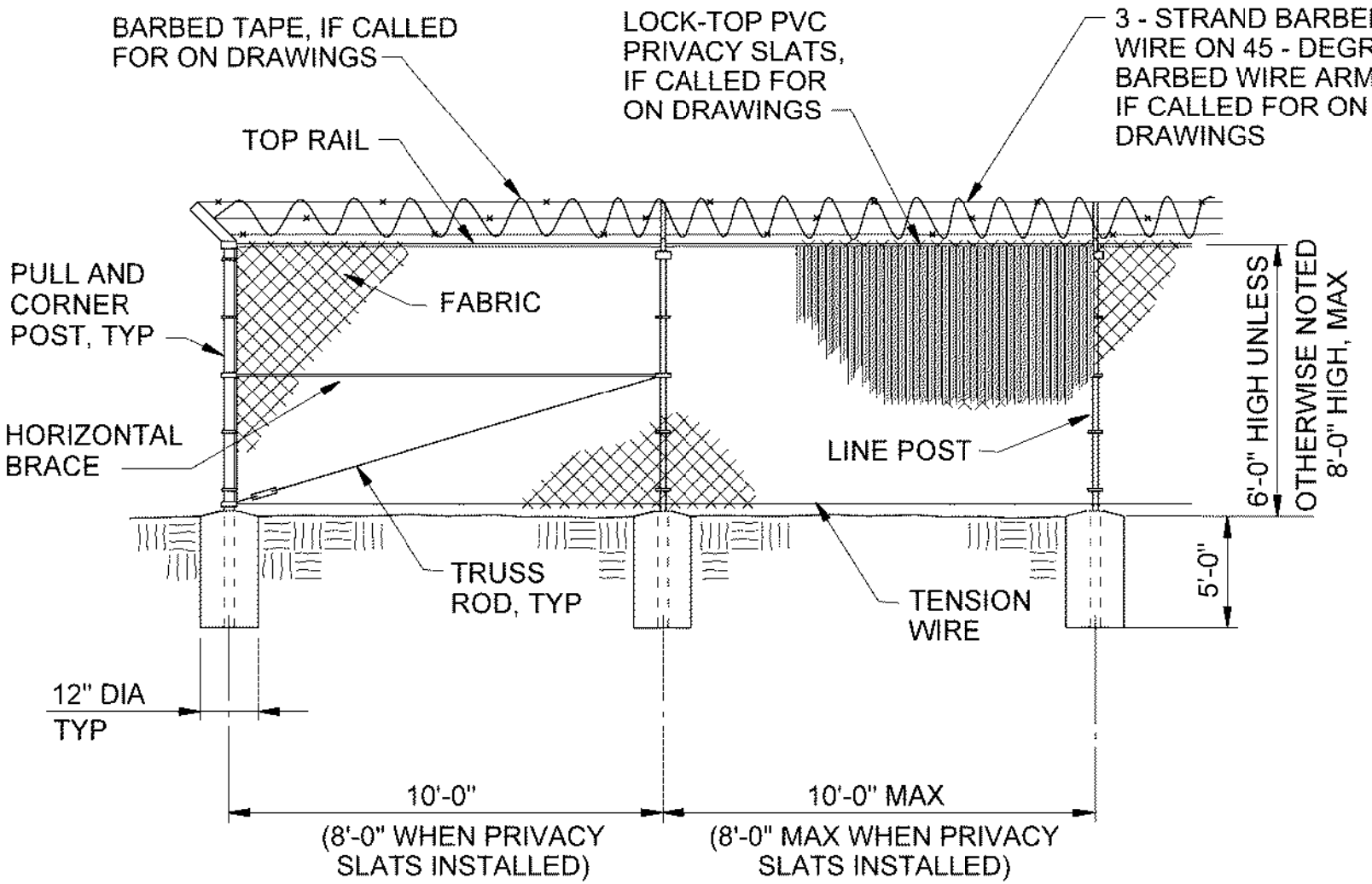
WATERWORKS ENGINEERS



CHAINLINK FENCE

NTS

2800

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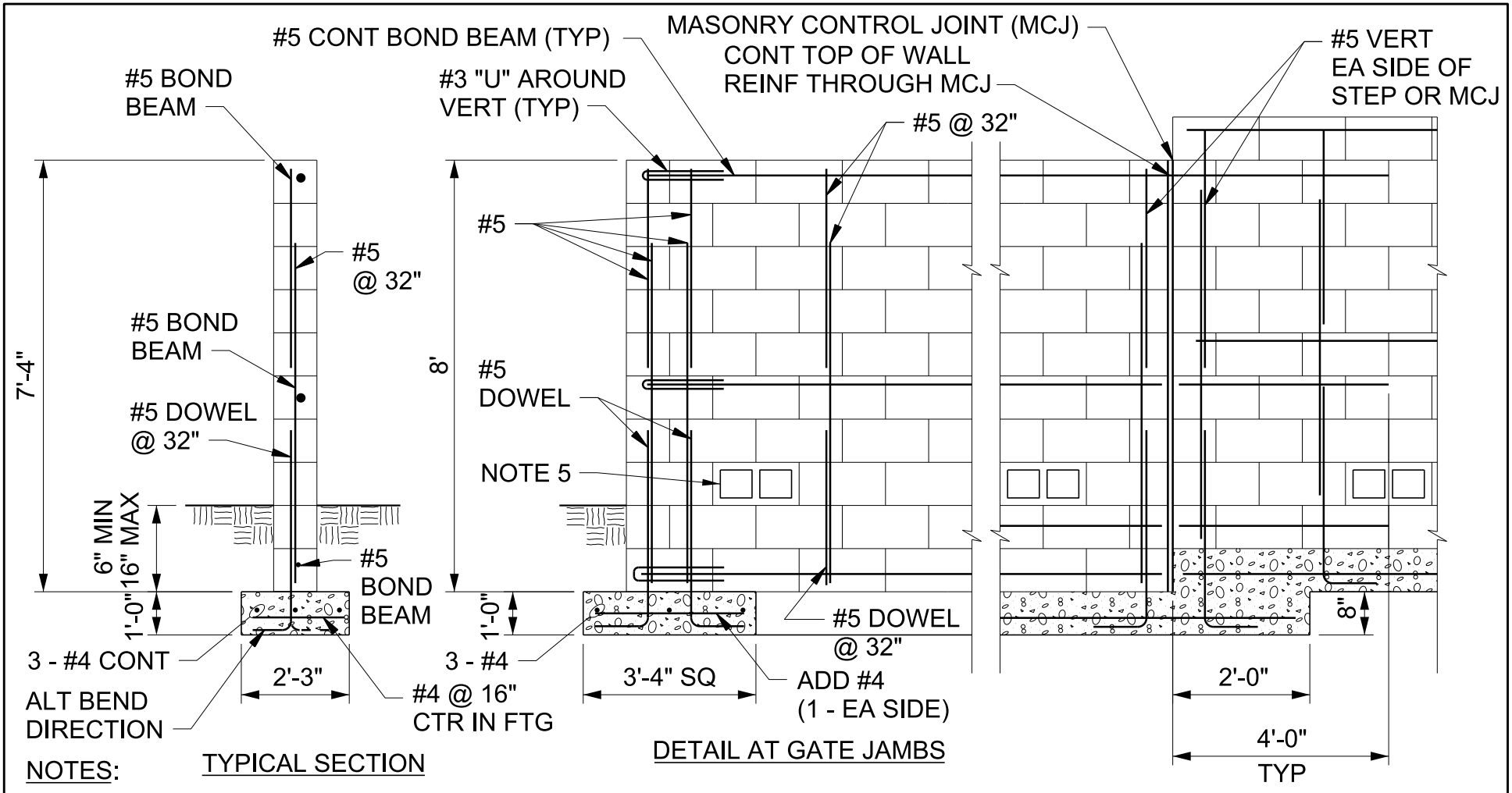

NOTES:

1. FILL SOLID ALL BLOCK BELOW GRADE, AND CELLS WITH REINFORCING.
2. PROVIDE 9 GAUGE LADDER REINF CONTINUOUS EVERY OTHER COURSE.
3. PROVIDE MASONRY CONTROL JOINT (MCJ) AT 30' - 0" OC MAXIMUM.
4. PROVIDE STEPS AS REQUIRED TO MAINTAIN 6' - 0" MINIMUM EXPOSED WALL HEIGHT AND 6" MINIMUM DEPTH OF BURY FOR FOOTING.
5. INSTALL DRAIN BLOCK AT GRADE WHERE DIRECTED.

8 - INCH MASONRY WALL

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2812

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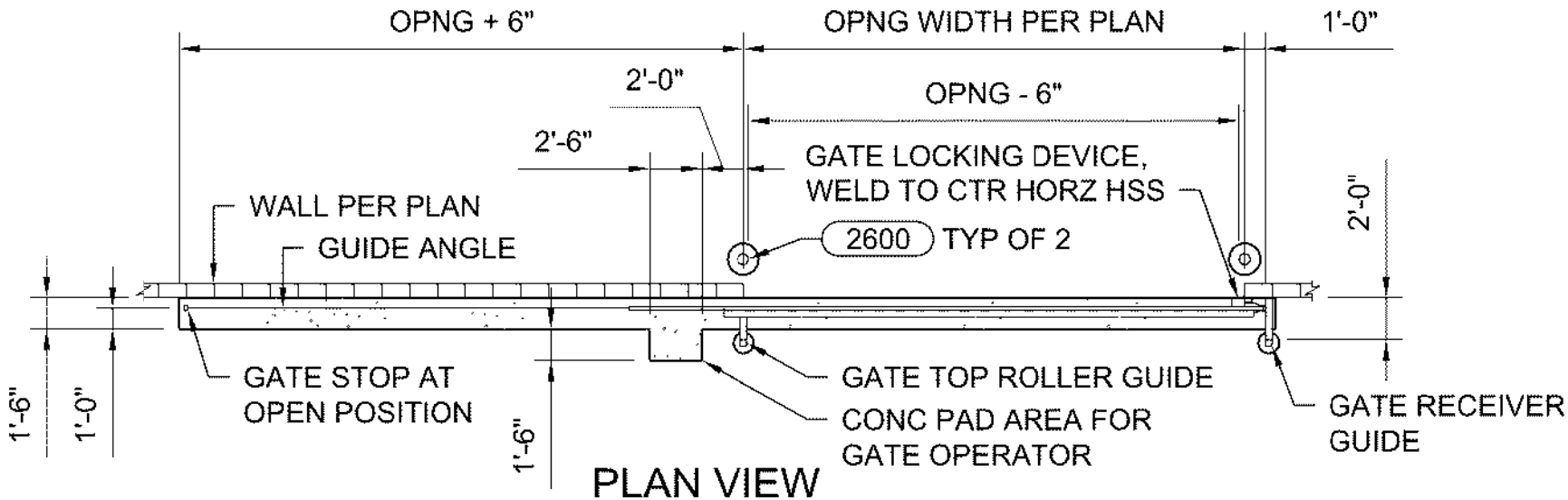
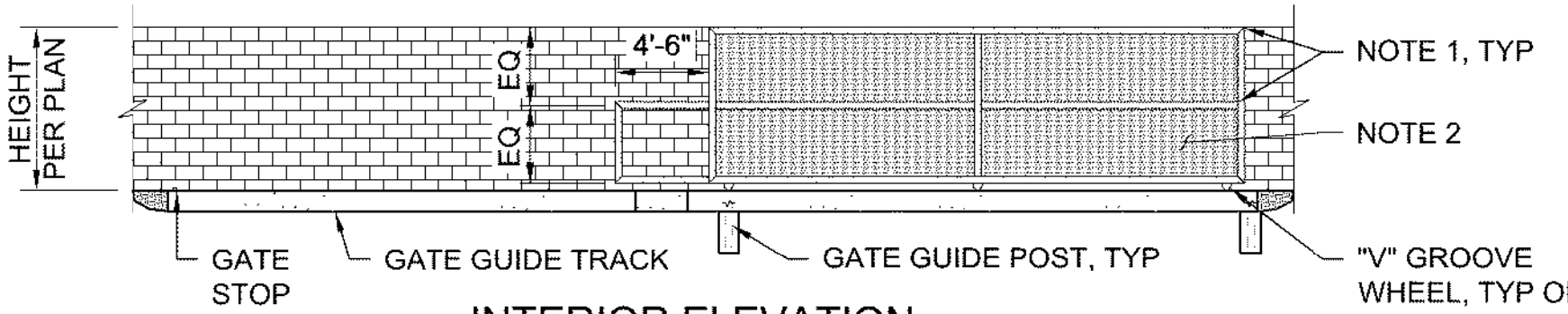


PLAN VIEW



INTERIOR ELEVATION

NOTES:

1. HSS2x4x1/4 FRAME, MITER CORNERS AND FULLY WELD ALL JOINTS. COORDINATE GATE WIDTH WITH HARDWARE TO PROPERLY FIT IN THE ROUGH OPENING. GRIND SMOOTH ALL SHARP CORNERS.
2. 1 1/2" DEEP 18 GAUGE PERFORATED / CORRUGATED METAL PANEL WITH 1/4" DIAMETER PERFORATIONS AT 1/2" CENTERS. WELD TO SUPPORTING FRAME AS SHOWN IN THE DETAILS.
3. PAINT ENTIRE GATE ASSEMBLY AFTER FABRICATION USING SYSTEM 300, COLOR SELECTED BY OWNER.
4. FOR ADDITIONAL CONNECTION DETAILS SEE 2819 .

STEEL ROLLING GATE

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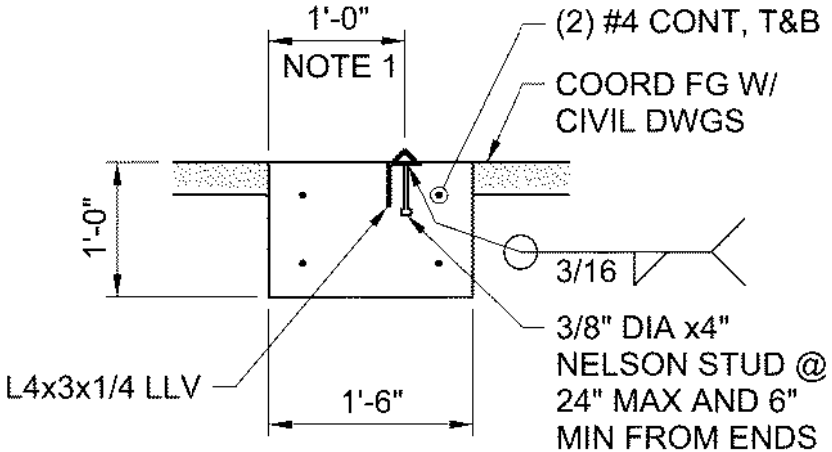
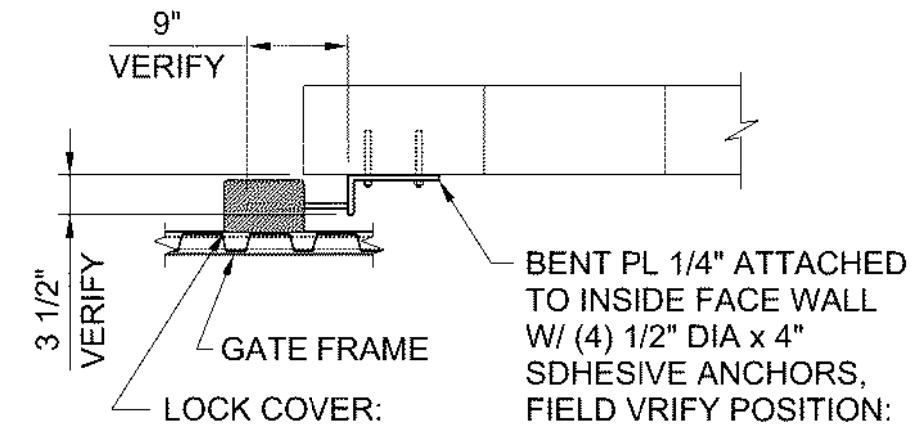
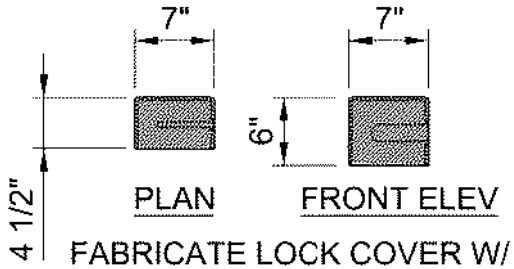


NOTES:

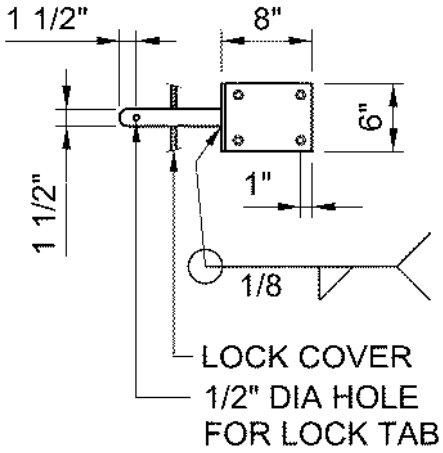
1. COORDINATE WHEEL TRACK LOCATION W/ GATE MFR FOR PRECISE ASSEMBLY. CONSTRUCT TRACK W/ L1 1/2x1 1/2x1/4 ANGLE WELDED TO L4x3, BUTT WELD AND GRIND SMOOTH ALL JOINTS.

GATE GUIDE TRACK





FABRICATE LOCK COVER W/ PL 1/4", TOP FRONT AND SIDES ONLY, BTM AND BACK TO REMAIN OPEN, ALL CORNERS SHALL BE WELDED AND MILLED TO A 1/8" RADIUS, FIELD VERIFY LOCATION W/ GATE OPERATION, PROVIDE SLOT FOR LOCK TAB



GATE LOCKING DEVICE

STEEL ROLLING GATE

NTS

2815

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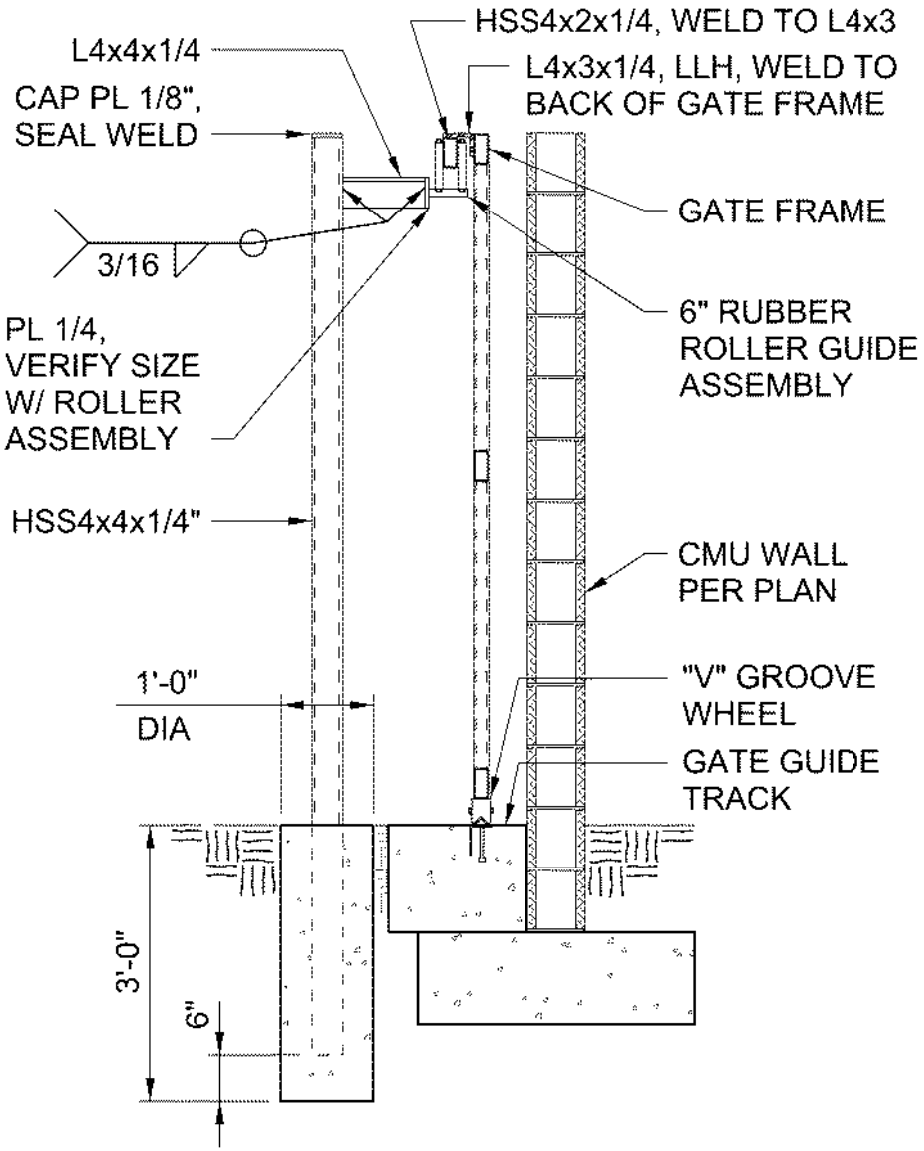
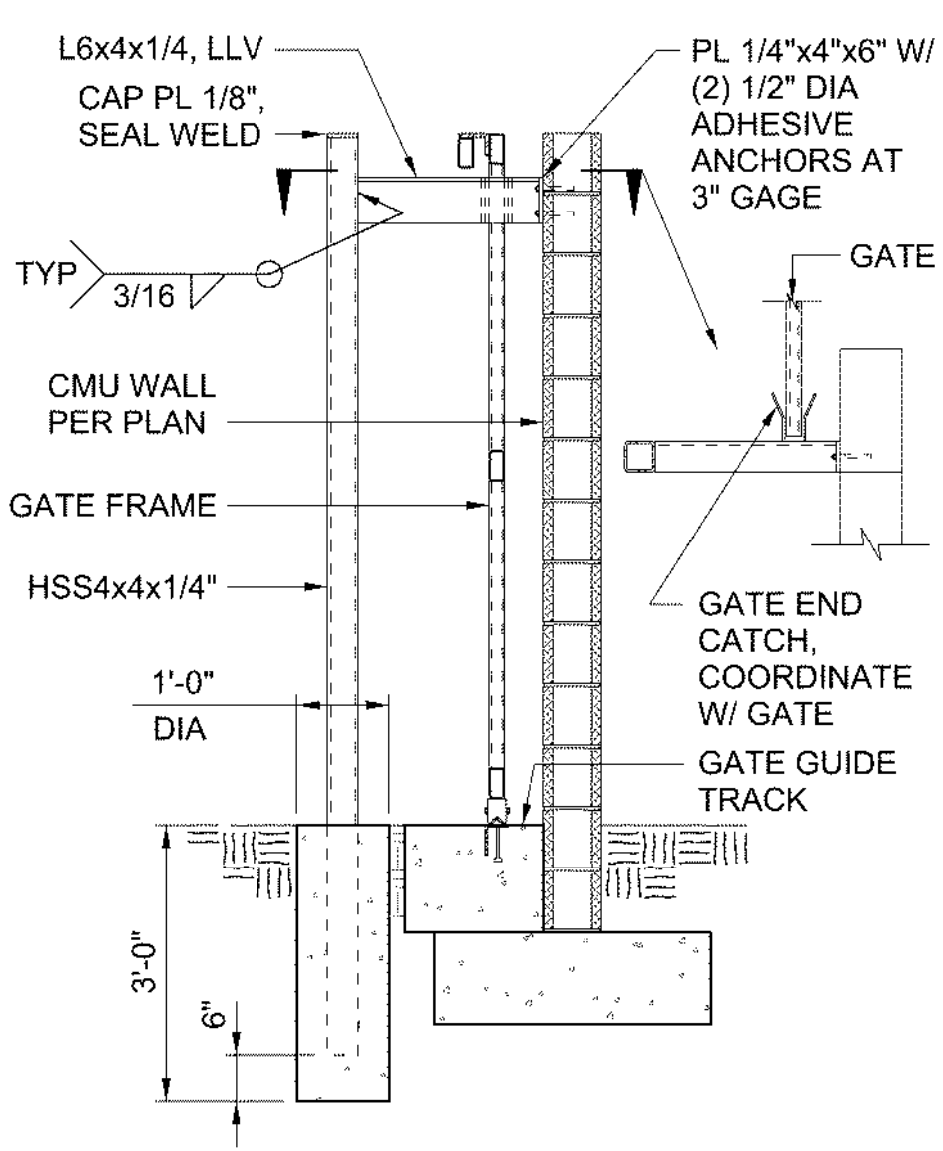


GATE TOP ROLLER GUIDE



GATE RECEIVER GUIDE

STEEL ROLLING GATE

NTS

2815

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NOTES:

1. PAD SIZE SHALL BE MINIMUM INDICATED OR AS SHOWN ON THE DRAWINGS OR AS INDICATED BY THE MANUFACTURER AND APPROVED BY THE ENGINEER.
2. THE SIZE, NUMBER, TYPE, LOCATION, AND THREAD PROJECTION OF THE ANCHOR BOLTS SHALL BE DETERMINED BY THE EQUIPMENT MANUFACTURER, AND SHALL BE AS APPROVED BY THE ENGINEER. ANCHOR BOLTS SHALL BE HELD IN POSITION WITH A ONE PIECE TEMPLATE, MATCHING THE BASE PLATE, WHILE PAD IS BEING POURED.
3. ANCHOR BOLT SLEEVES SHALL BE USED TO PROVIDE THE ANCHOR BOLT A MINIMUM MOVEMENT OF 1/2" IN ALL DIRECTIONS. THE MINIMUM SLEEVE LENGTH SHALL BE 8 TIMES THE BOLT DIAMETER. SLEEVES SHALL BE FILLED WITH NON-SHRINK GROUT.
4. ANCHOR BOLT SLEEVES SHALL HAVE A MINIMUM INTERNAL DIAMETER 1" GREATER THAN BOLT DIAMETER AND A MAXIMUM INTERNAL DIAMETER 3" GREATER THAN ANCHOR BOLT DIAMETER. SLEEVES SHALL BE FILLED WITH NON-SHRINK GROUT.
5. EQUIPMENT BASES SHALL BE INSTALLED LEVEL UNLESS SPECIFIED OTHERWISE.
6. TYPE "D" DETAIL SHALL BE USED ONLY FOR SLABS ON GRADE AND AT GRADE. THE SURROUNDING FLOOR SLAB SHALL NOT BE PLACED UNTIL THE EXACT SIZE AND LOCATION OF THE PAD IS KNOWN.
7. WEDGES OR SHIMS SHALL BE USED TO SUPPORT THE BASE WHILE THE NON-SHRINK GROUT IS PLACED. TEMPORARY LEVELING NUTS SHALL BE BACKED OFF. IF LEFT IN, THE WEDGES OR SHIMS SHALL NOT BE EXPOSED TO VIEW.
8. HEIGHT OF PADS SHALL BE MINIMUM REQUIRED FOR ANCHOR BOLT CLEARANCE TO KEEP ANCHOR BOLT OUT OF SLAB (SEE TABLE BELOW). WHERE EQUIPMENT OR PIPING ELEVATION REQUIRE A PAD HEIGHT LESS THAN THE MINIMUM SHOWN, USE TYPE B WITH BLOCKOUT.

AB DIA (IN.)	1/2	5/8	3/4	7/8	1	1 1/4	1 3/8	1 1/2	1 3/4	2
MIN PAD HT (IN.)	7	8 1/2	10	11	12 1/2	15	16 1/2	18	21	24

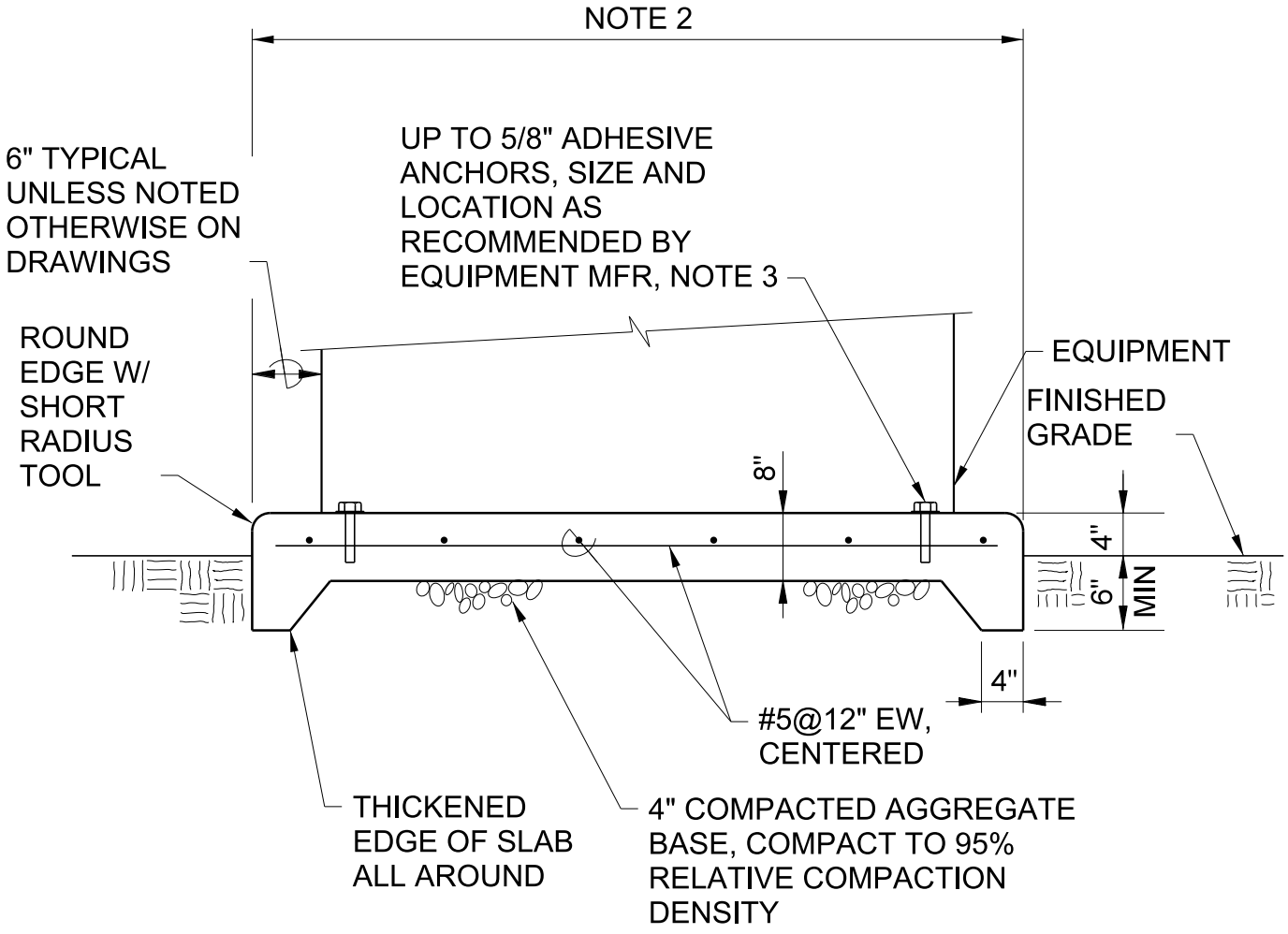
9. TYPE "F" PADS MAY BE SUBSTITUTED FOR TYPE "A" PADS FOR LOCATIONS APPROVED IN WRITING BY THE ENGINEER.
10. SEE ANCHOR BOLT AND BLOCKOUT DETAILS (3210) .

EQUIPMENT PAD NOTES

3200

NTS

WATERWORKS ENGINEERS



NOTES:

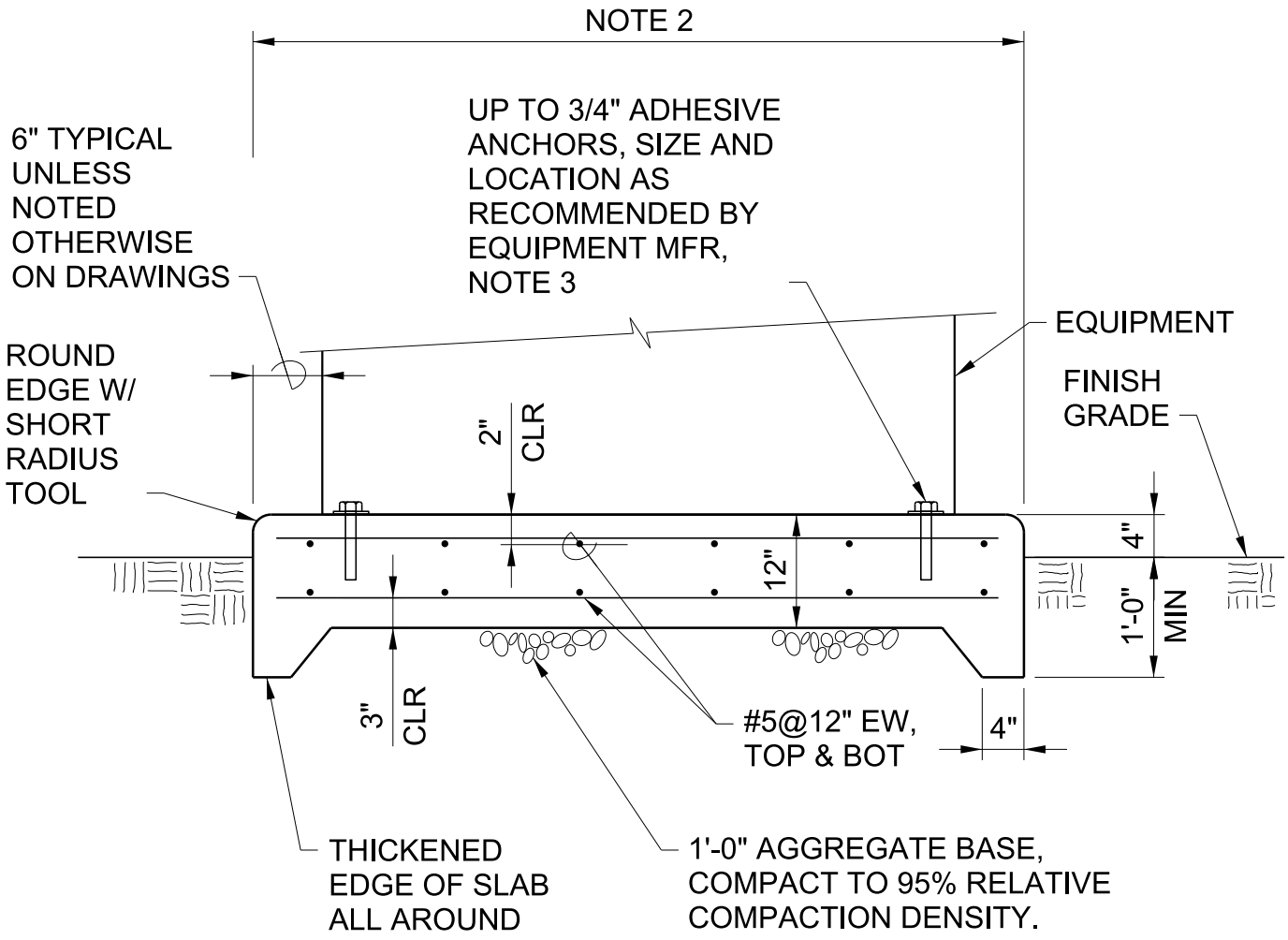
1. SEE (3200) FOR GENERAL EQUIPMENT PAD NOTES.
2. EQUIPMENT PAD SIZE PER DRAWINGS. WHERE PAD SIZE IS NOT SHOWN, SIZE TO FIT EQUIPMENT.
3. IF ANCHOR BOLTS ARE CALLED OUT FOR ON DRAWINGS, PROVIDE ANCHOR BOLTS PER (3210) IN LIEU OF ADHESIVE ANCHORS.

EQUIPMENT PAD-TYPE D

(3200D)

NTS

WATERWORKS ENGINEERS



NOTES:

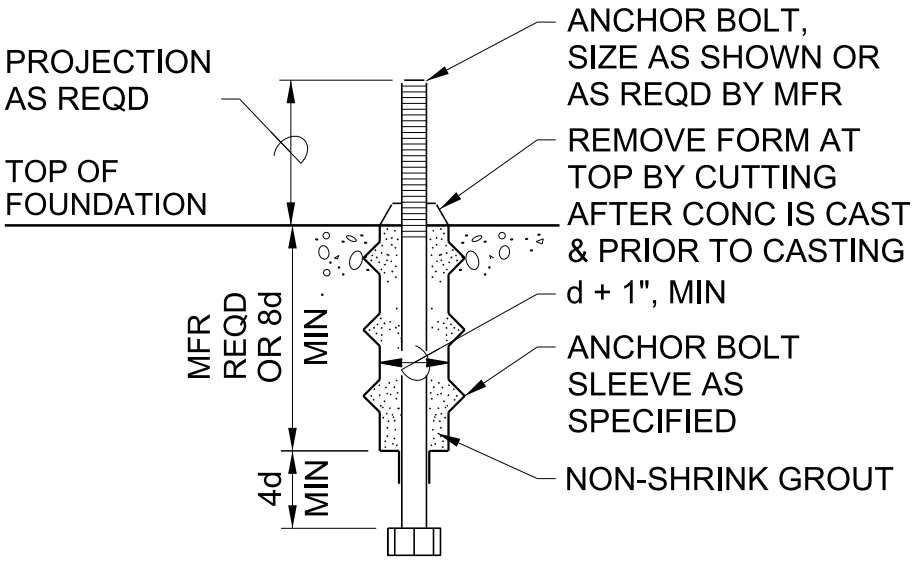
1. SEE (3200) FOR GENERAL EQUIPMENT PAD NOTES.
2. EQUIPMENT PAD SIZE PER DRAWINGS. WHERE PAD SIZE IS NOT SHOWN, SIZE TO FIT EQUIPMENT.
3. IF ANCHOR BOLTS ARE CALLED OUT FOR ON DRAWINGS, PROVIDE ANCHOR BOLTS PER (3210) IN LIEU OF ADHESIVE ANCHORS.

EQUIPMENT PAD-TYPE E

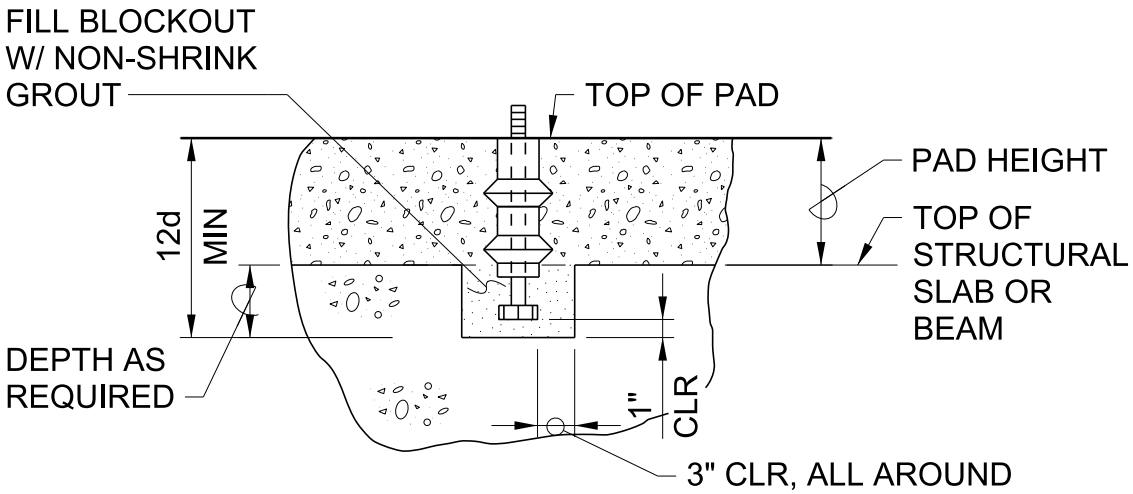
NTS

3200E

WATERWORKS ENGINEERS



ANCHOR BOLT DETAIL



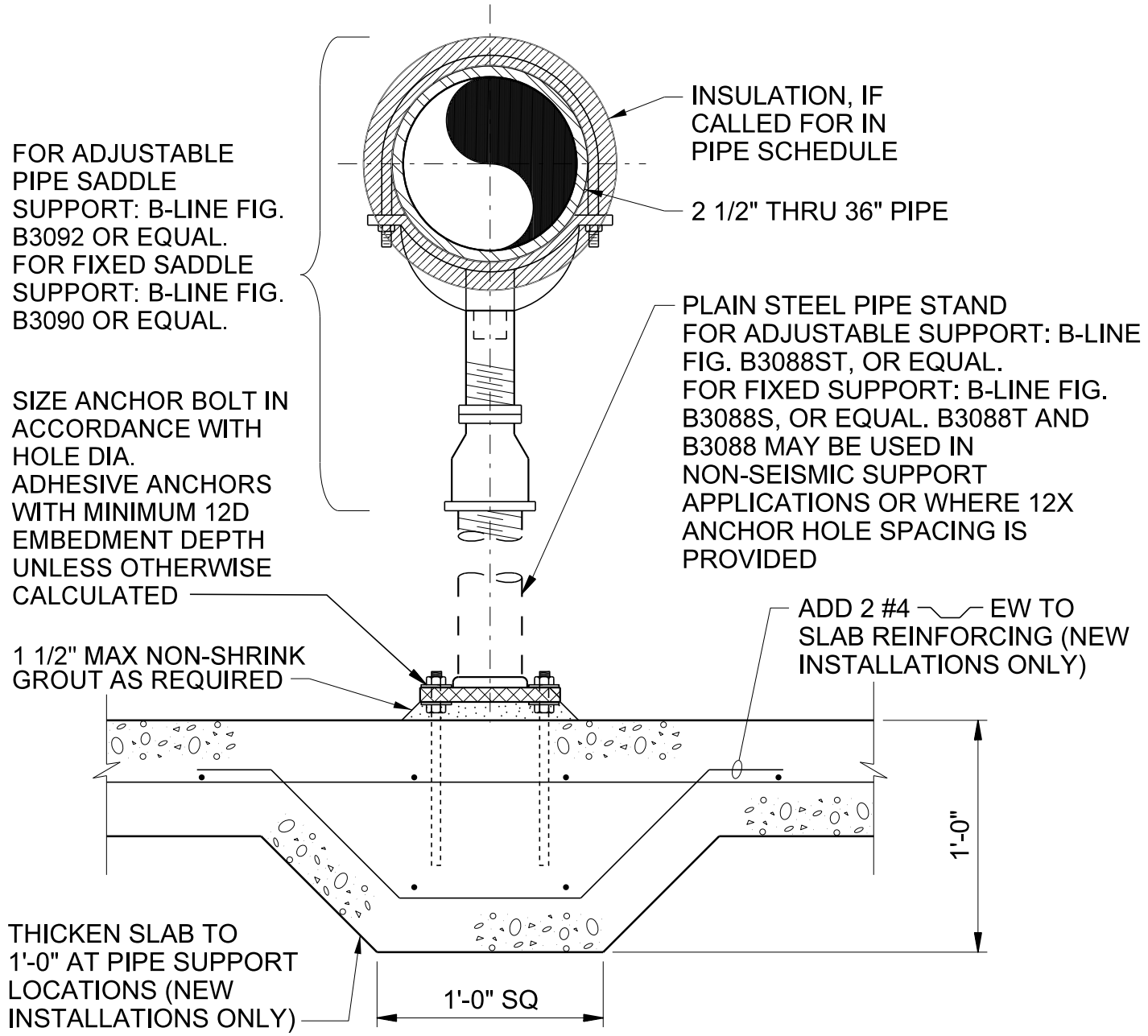
ANCHOR BOLT BLOCKOUT

ANCHOR BOLT DETAILS

NTS

3210

WATERWORKS ENGINEERS



NOTES:

1. COAT ALL SHAPES PER SPECIFICATION SECTION 09900 SYSTEM 300.

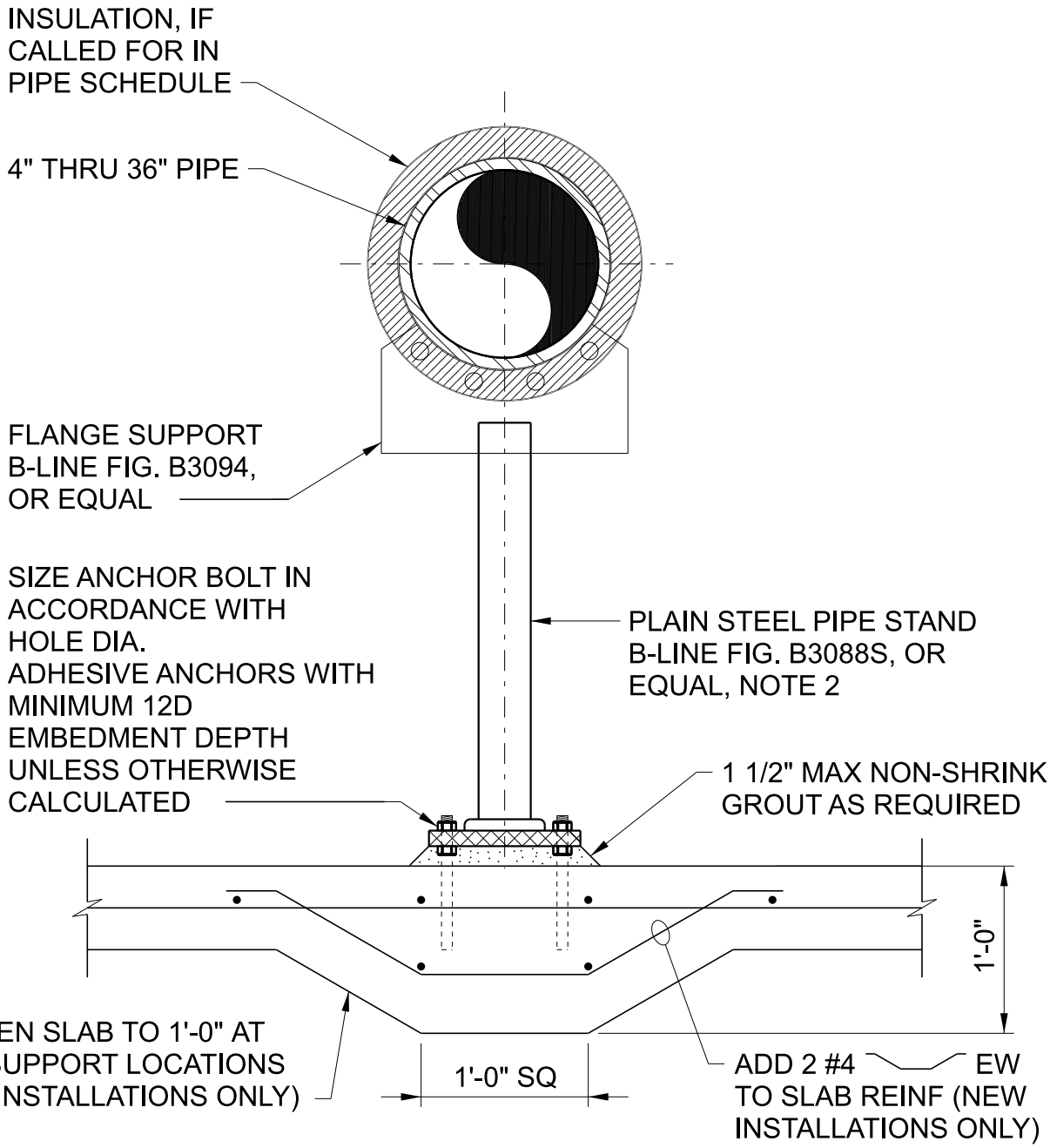
2. ADJUSTABLE OR FIXED SUPPORT INSTALLATION AT CONTRACTOR'S DISCRETION, UNLESS SHOWN OTHERWISE.

SADDLE PIPE SUPPORT

NTS

15000

WATERWORKS ENGINEERS



NOTES:

1. COAT ALL SHAPES PER SPECIFICATION SECTION 09900 SYSTEM 300.

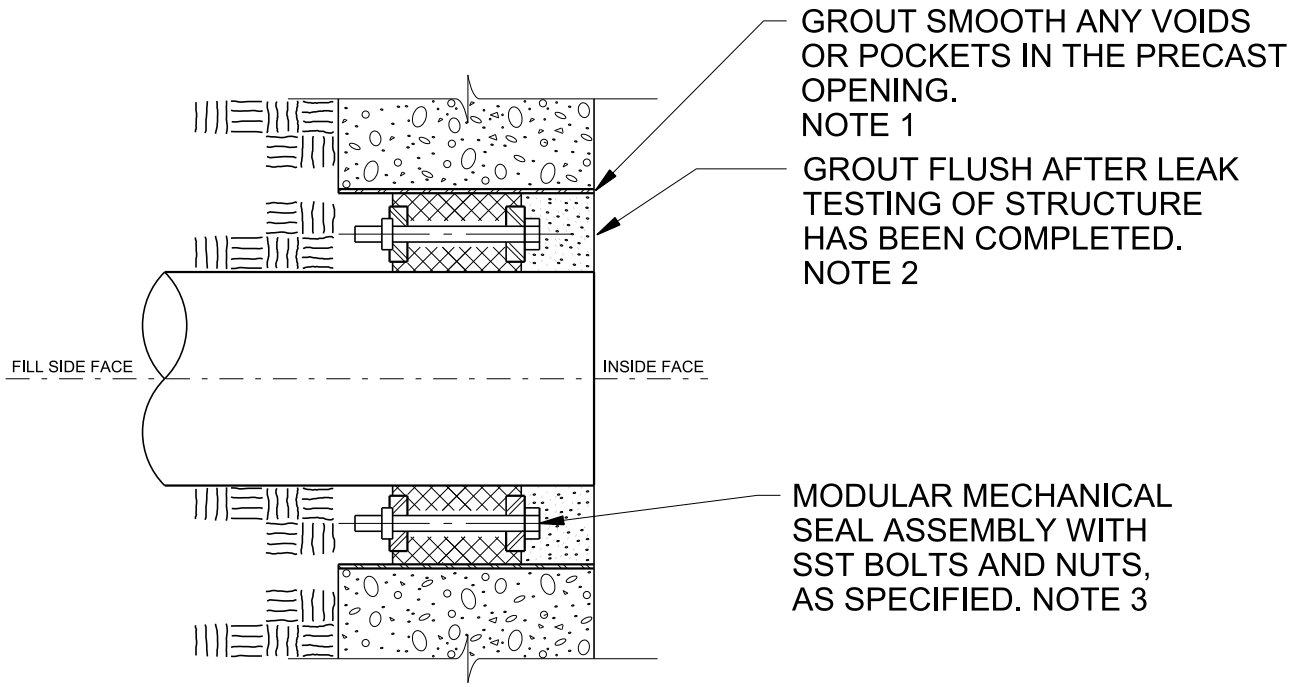
2. B-LINE FIG. B3088 MAY BE USED IN NON-SEISMIC SUPPORT APPLICATIONS OR WHERE 12X ANCHOR HOLE SPACING IS PROVIDED. FOR VERTICAL ADJUSTMENTS USE PIPE ADJUSTER B-LINE FIG. B3089 AND FIG. B3088ST OR FIG. B3088T IN NON-SEISMIC SUPPORT APPLICATIONS.

FLANGE MOUNTED PIPE SUPPORT

NTS

15002

WATERWORKS ENGINEERS



NOTES:

1. COORDINATE MODULAR SEAL SPACE REQUIRMENTS WITH PRECAST VENDER FOR OPENING SIZES PRIOR TO PLACING ORDER OF PRE-CAST STRUCTURE.

2. AFTER MODULAR SEAL INSTALL AND LEAK TEST BUT BEFORE GROUT IS PLACED, GREASE INSIDE FACE OF SEAL.

3. INSTALL PER MANUFACTURER'S INSTRUCTIONS WITH THE BOLT HEADS FACING THE INSIDE FACE OF THE STRUCTURE.

PRE-CAST OPENING WITH MODULAR MECHANICAL SEAL (BURIED)

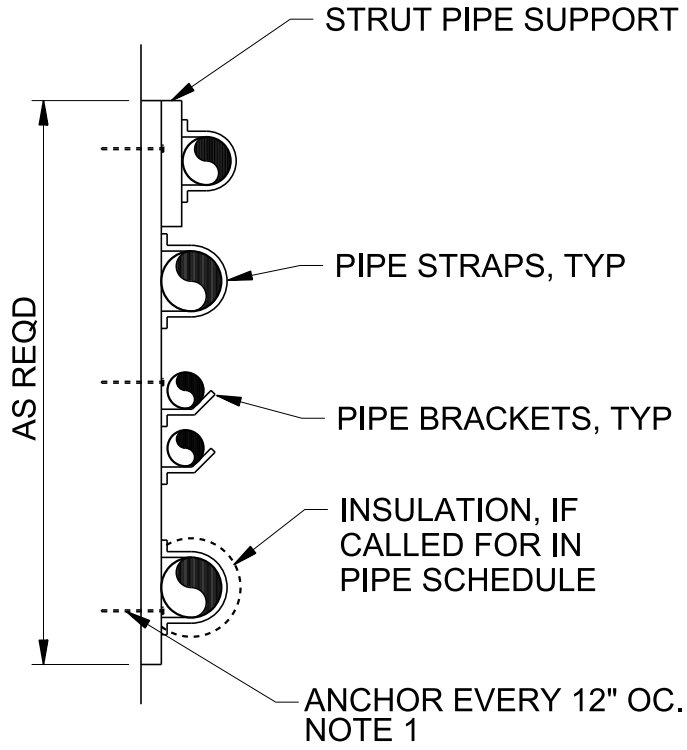
NTS

15132A

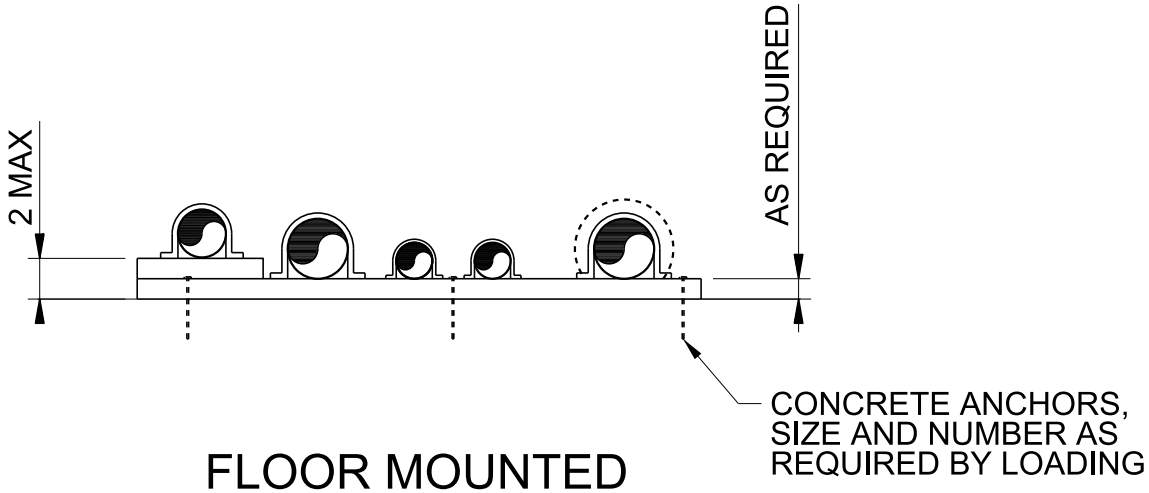
WATERWORKS ENGINEERS

NOTE:

USE NEOPRENE SLEEVE ON COPPER AND PVC PIPING AT STRAPS AND BRACKETS.



WALL MOUNTED



FLOOR MOUNTED

NOTE :

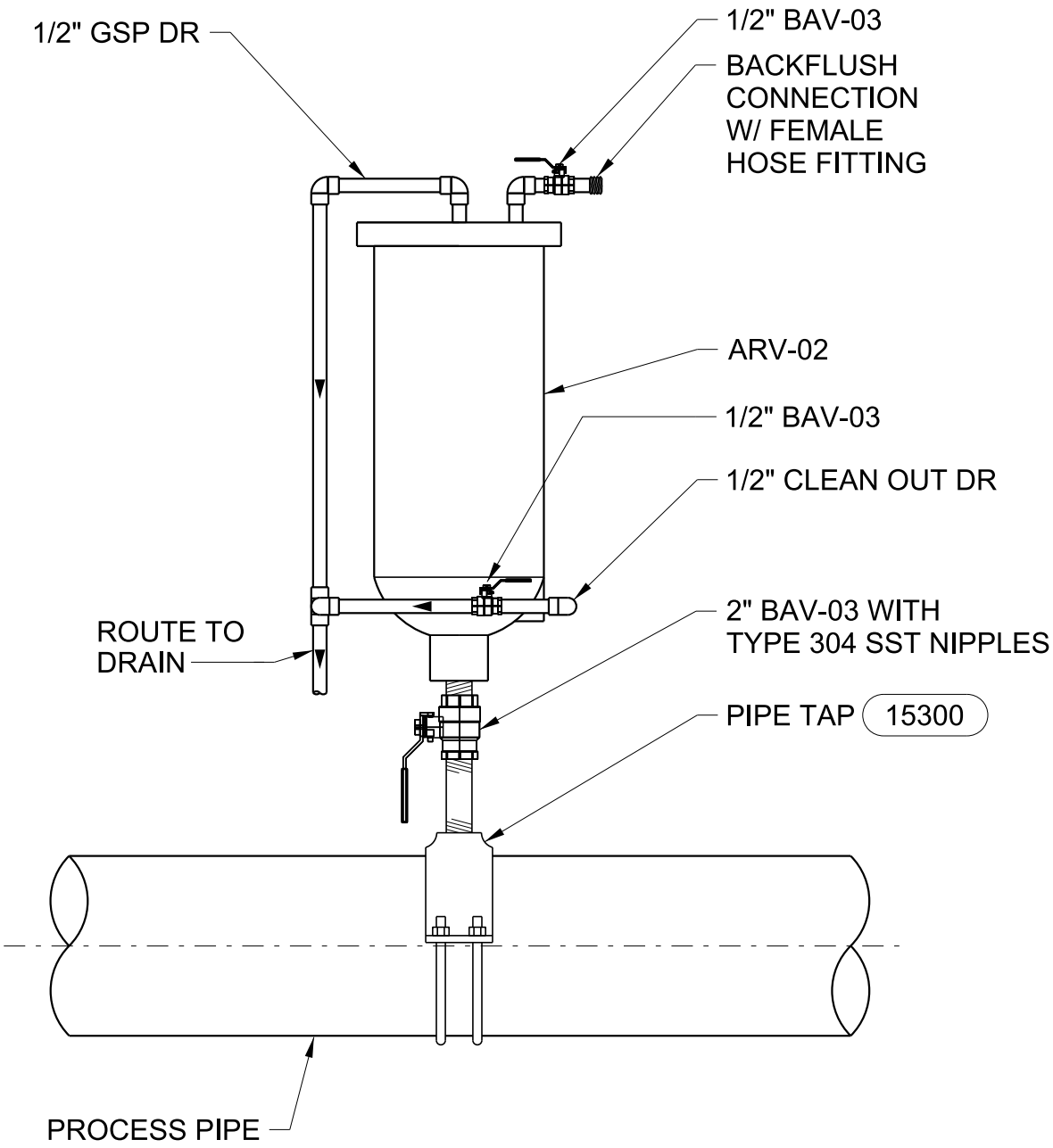
1. ATTACH TO WALL WITH SST ANCHORS, 3/8" DIAMETER MIN, COORDINATED WITH WALL CONSTRUCTION

PIPE SUPPORTS

NTS

15010

WATERWORKS ENGINEERS



NOTES:

1. PIPING BETWEEN PIPE TAP AND ISOLATION VALVE SHALL BE TYPE 304 SST. ALL OTHER PIPING SHALL BE GALVANIZED STEEL.

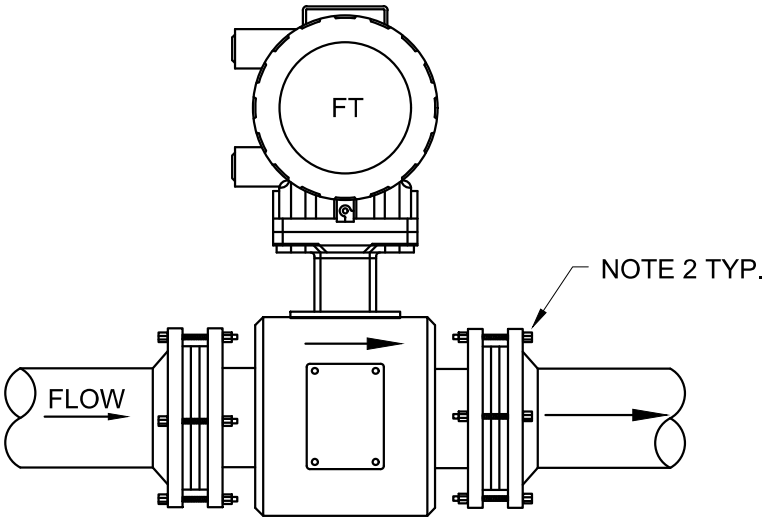
AIR RELEASE VALVE INSTALLATION SEWAGE SERVICE

NTS

15231

WATERWORKS ENGINEERS

FILENAME: 15231.DGN PLOT DATE: 1/3/2019 11:08:59 AM



NOTES:

1. INSTALL WITH A MINIMUM OF FIVE (5) STRAIGHT PIPE DIAMETERS UPSTREAM AND TWO (2) STRAIGHT PIPE DIAMETERS DOWNSTREAM.

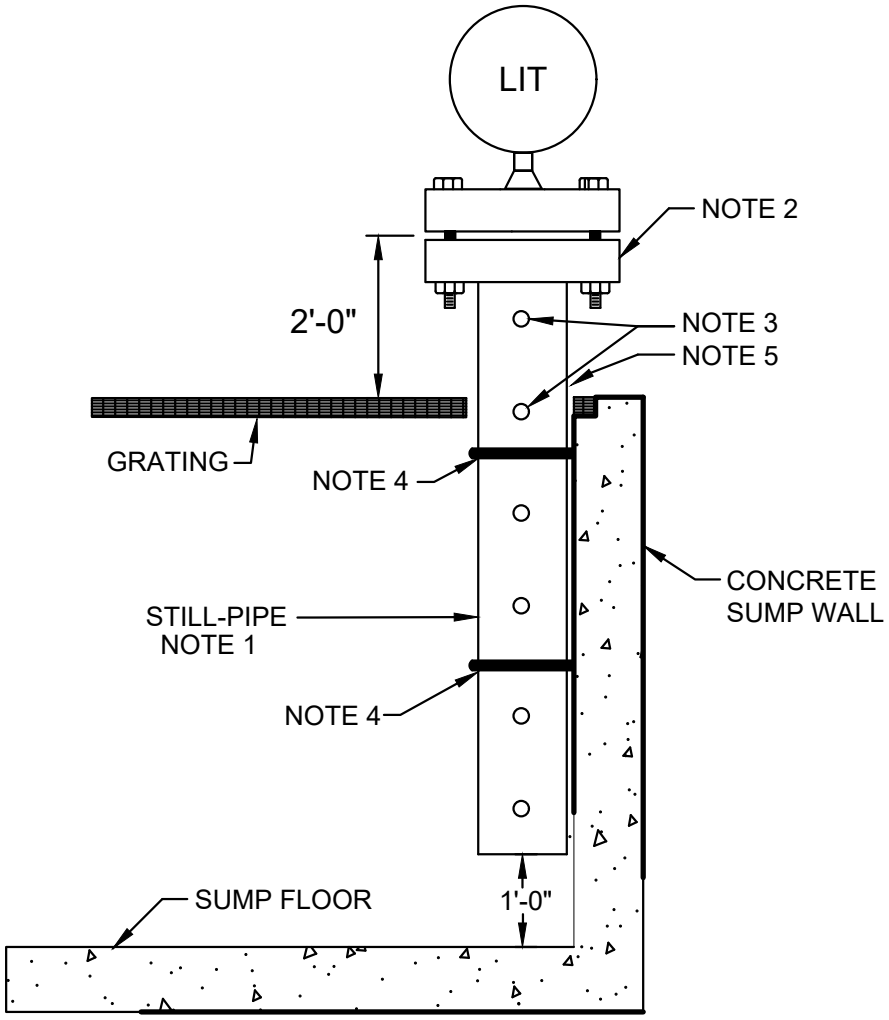
2. PROVIDE MATING FLANGES, GASKETS, AND BOLTING PER THE PDT OF THE PROCESS PIPE.

MAGNETIC FLOWMETER DETAIL

NTS

15235

WATERWORKS ENGINEERS



NOTES:

1. 4" PIPE PER PDT 42.

2. 4" FLANGE, BOLTING, AND GASKET PER PDT 42.

3. DRILL 3/8" DIAMETER HOLE 2" DOWN FROM FLANGE. DRILL REMAINING HOLES DOWN THE SAME SIDE OF THE PIPE AND NO CLOSER THAN 6 INCHES APART.

4. FABRICATE BRACKET WITH STAINLESS STEEL HARDWARE TO SUPPORT STILL-PIPE. BOLT BRACKET WITH 1/2" EXPANSION STUD ANCHORS WITH NUTS AND WASHERS. INSTALL ONE BRACKET AT LEAST EVERY 5'.

5. CUT ACCESS IN GRATING FOR STILL-PIPE. IF GRATING IS METAL, COLD GALVANIZE CUT ENDS.

NON-CONTACT RADAR LEVEL TRANSMITTER

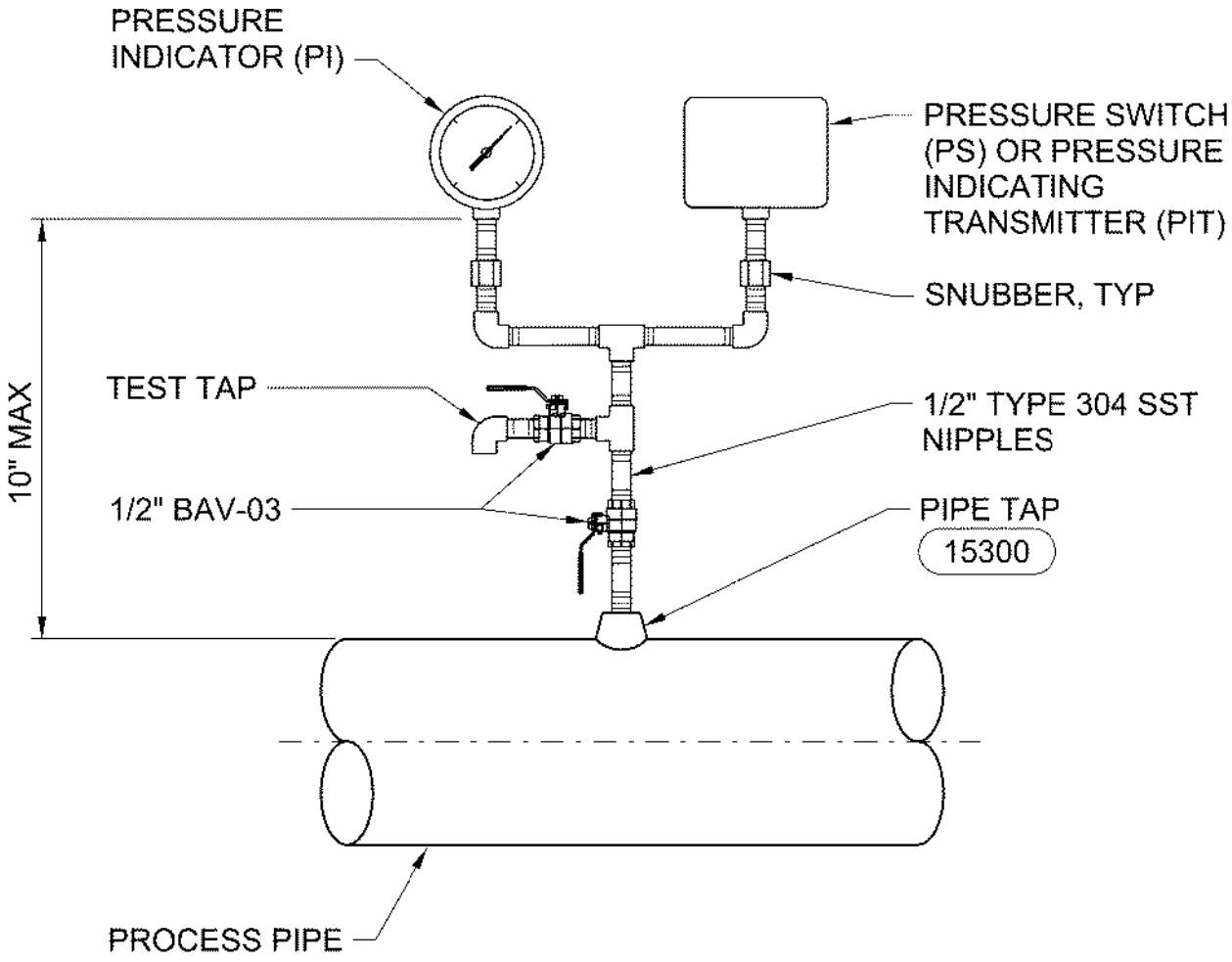
NTS

15340

FILENAME: 40 70 03.03 - NON-CONTACT RADAR LEVEL TRANSMITTER.DWG

REV DATE: August 24, 2021

WATERWORKS ENGINEERS



DIRECT INSTALLATION

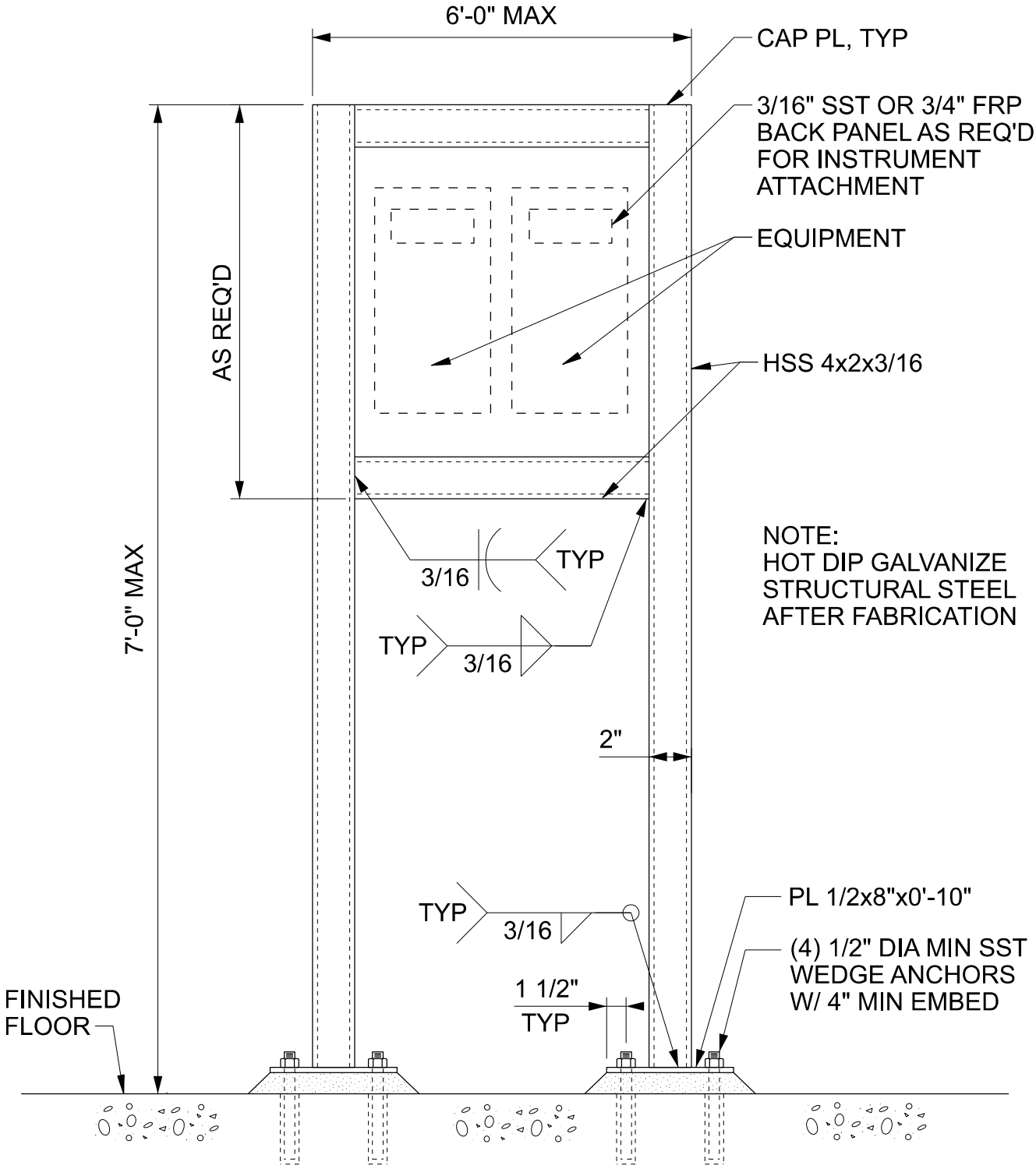
PRESSURE SWITCH AND INDICATOR INSTALLATION

NTS

15312

WATERWORKS ENGINEERS

FILENAME: 15312.DGN PLOT DATE: 12/10/2014 2:41:11 PM

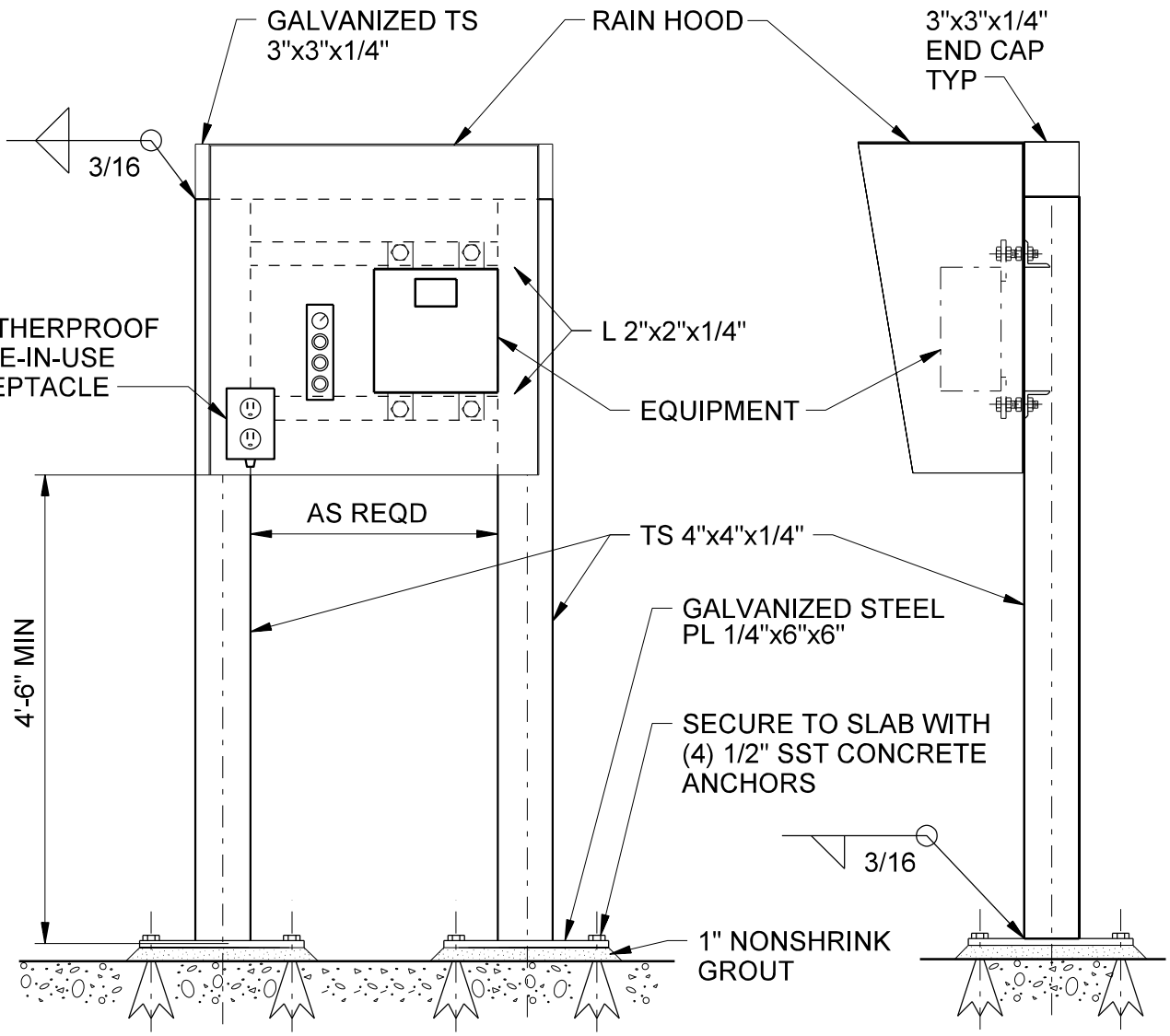


TUBE STEEL SUPPORT FOR INSTRUMENTS

NTS

16000A

WATERWORKS ENGINEERS



NOTE:

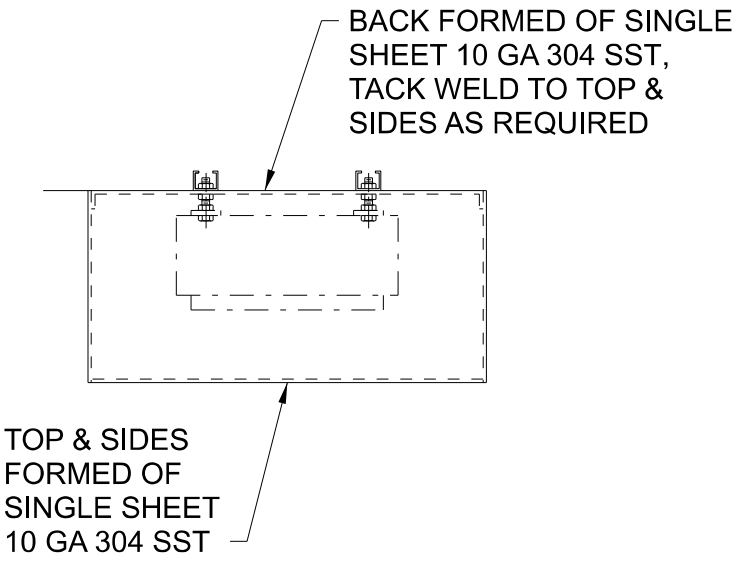
1. ROUND OFF ALL EXPOSED EDGES AND CORNERS.

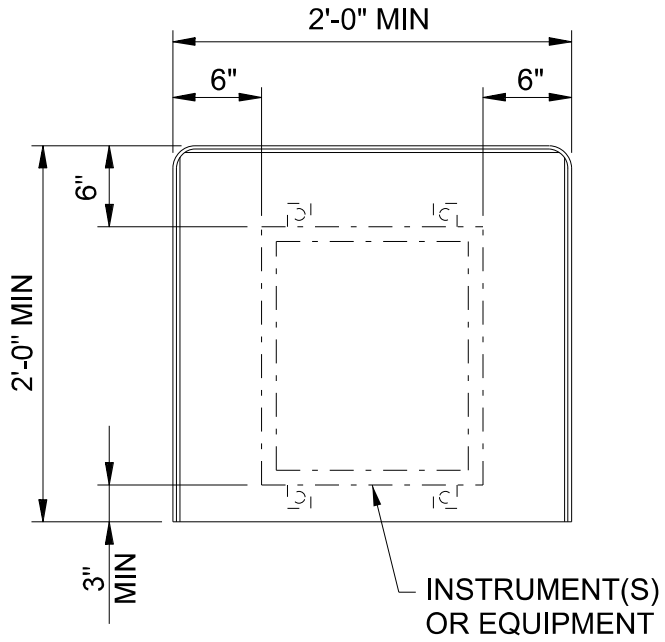
TUBE STEEL EQUIPMENT SUPPORT WITH RAIN HOOD

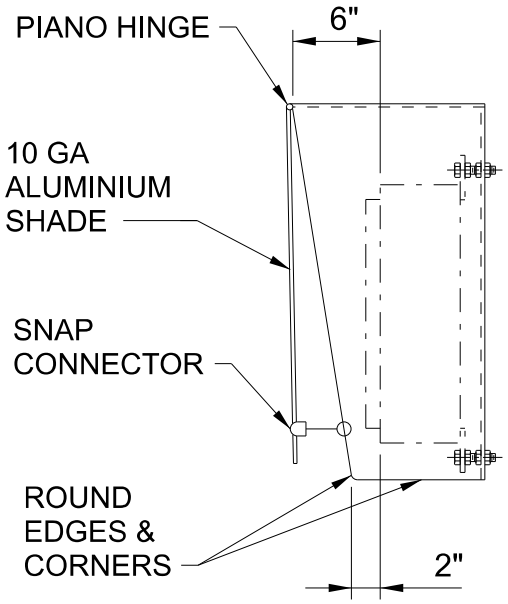
NTS

16000R

WATERWORKS ENGINEERS







NOTES:

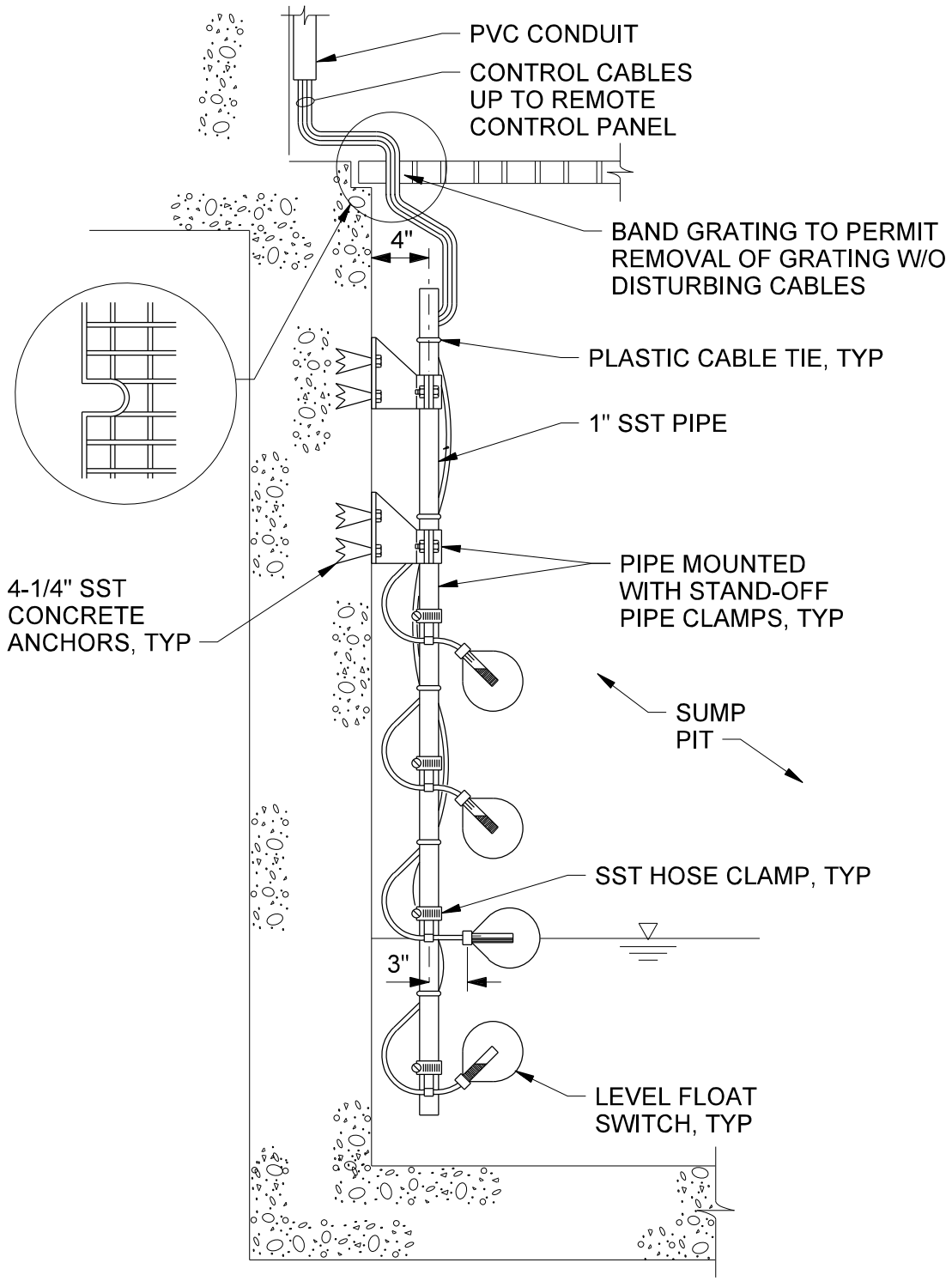
1. ALL EXPOSED EDGES TO BE GROUND SMOOTH AND BURR FREE.
2. ATTACH INSTRUMENT OR EQUIPMENT TO BACK OF RAIN HOOD AS REQUIRED USING 304 SST HARDWARE.

RAIN / SUN HOOD INSTALLATION

NTS

16000Q

WATERWORKS ENGINEERS

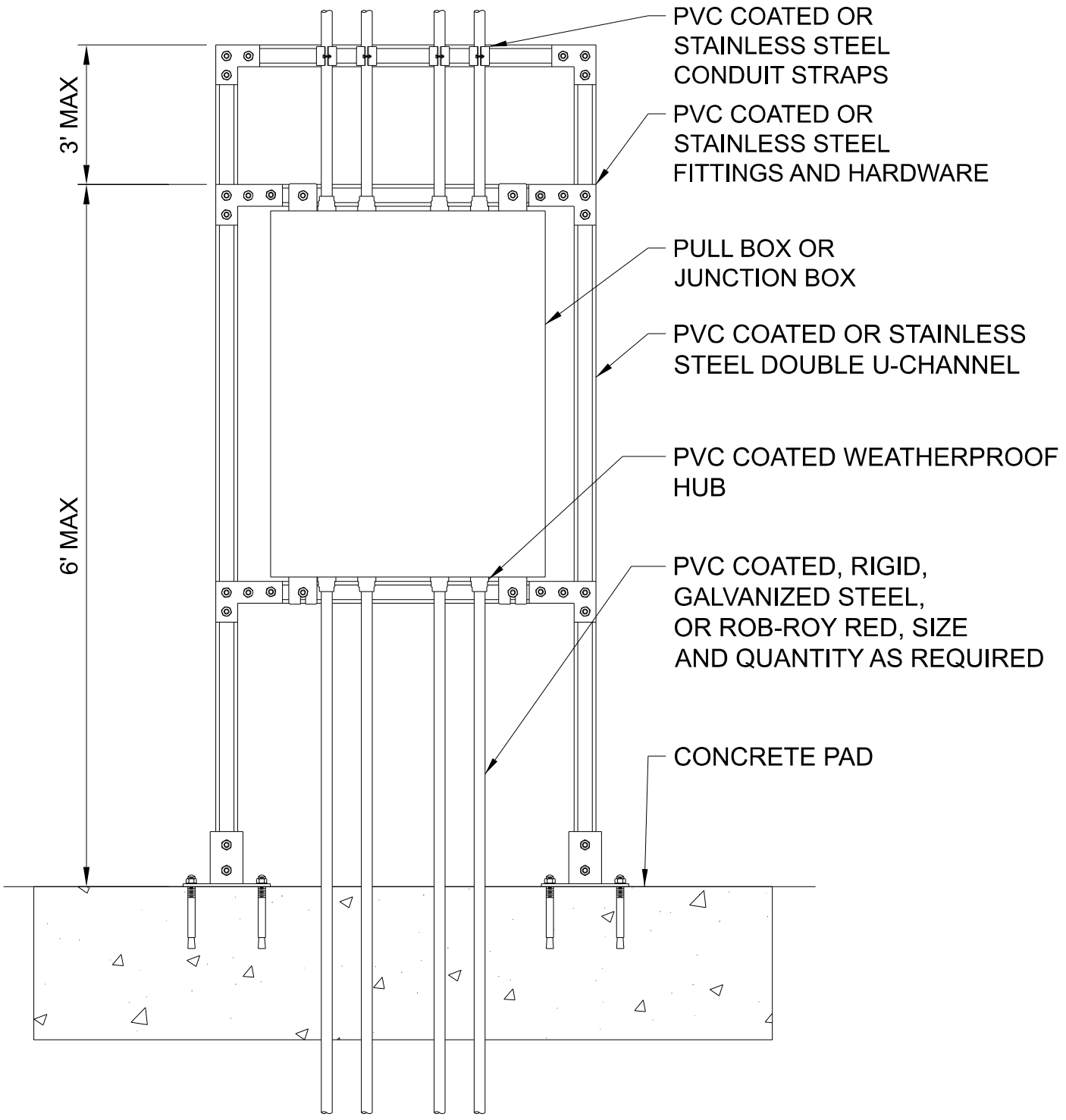


LEVEL SWITCH SUPPORT BRACKET

NTS

16191S

WATERWORKS ENGINEERS

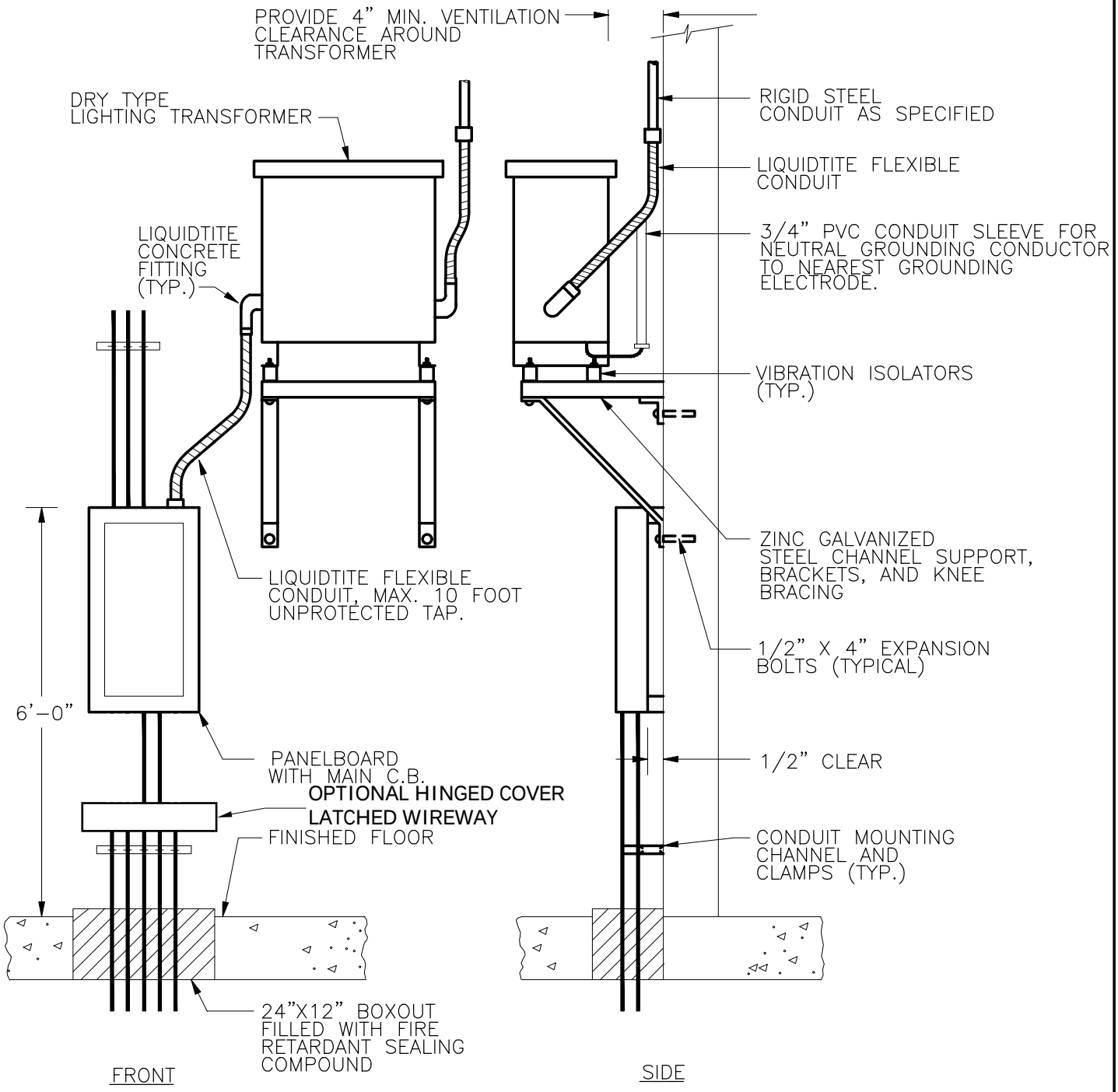


PULL BOX OR JUNCTION BOX EQUIPMENT RACK DETAIL

NTS

16000X

WATERWORKS ENGINEERS



LIGHTING PANEL AND TRANSFORMER INSTALLATION

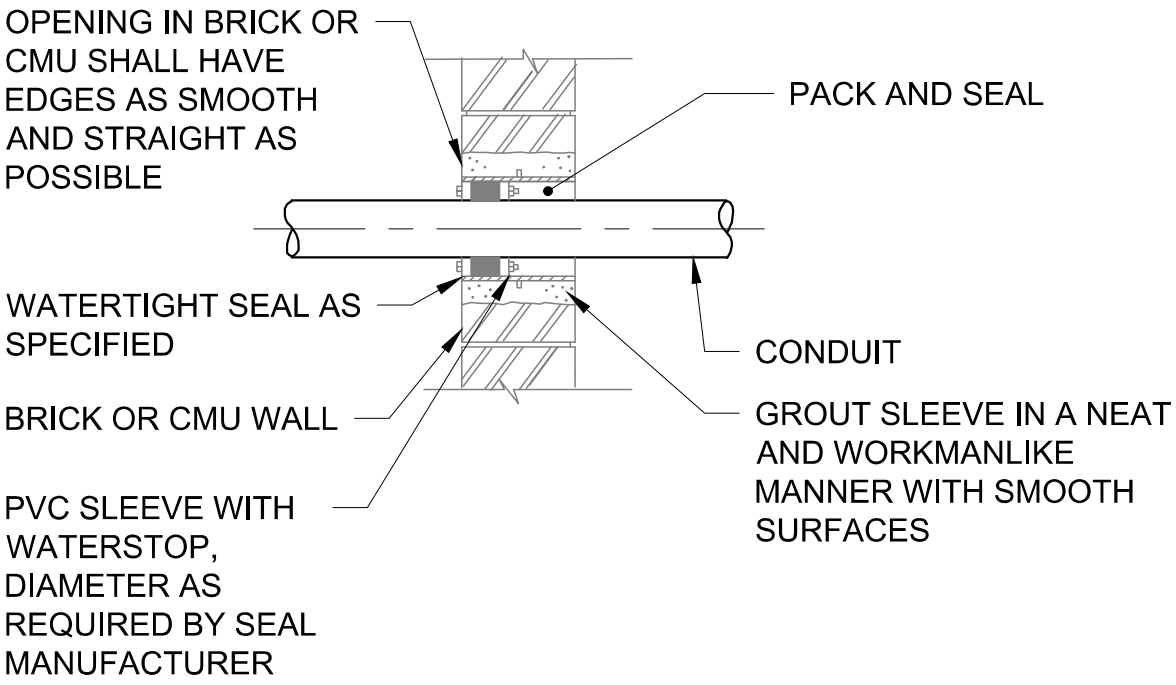
NTS

16010

FILENAME: 26 05 30.10 - LIGHTING PANEL AND TRANSFORMER INSTALLATION.DWG

REV DATE: August 24, 2021

WATERWORKS ENGINEERS

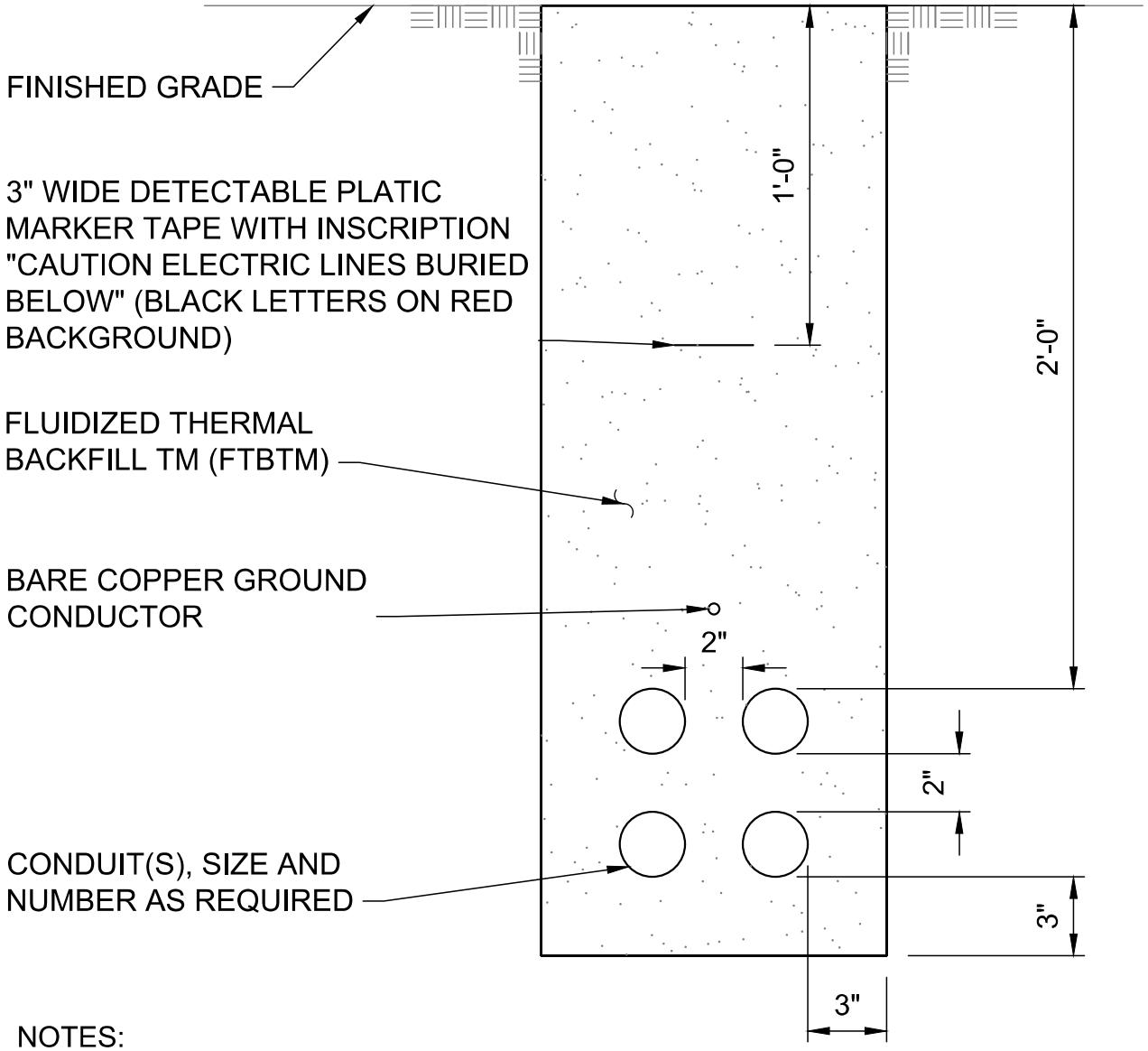


WATERTIGHT CONDUIT PENETRATION, BRICK OR CMU

NTS

16110B

WATERWORKS ENGINEERS



NOTES:

1. GROUND CONDUCTORS SHALL RUN CONTINUOUSLY THROUGH MANHOLES AND SHALL CONTINUE FROM DUCTBANK INTO SWITCHGEAR OR BUILDING GROUNDING SYSTEM AND SHALL BE BONDED TO EACH RIGID METAL CONDUIT. SIZE TO BE 4/0 UNLESS OTHERWISE INDICATED ON PLANS.

2. ALL DIMENSIONS ARE MINIMUM.

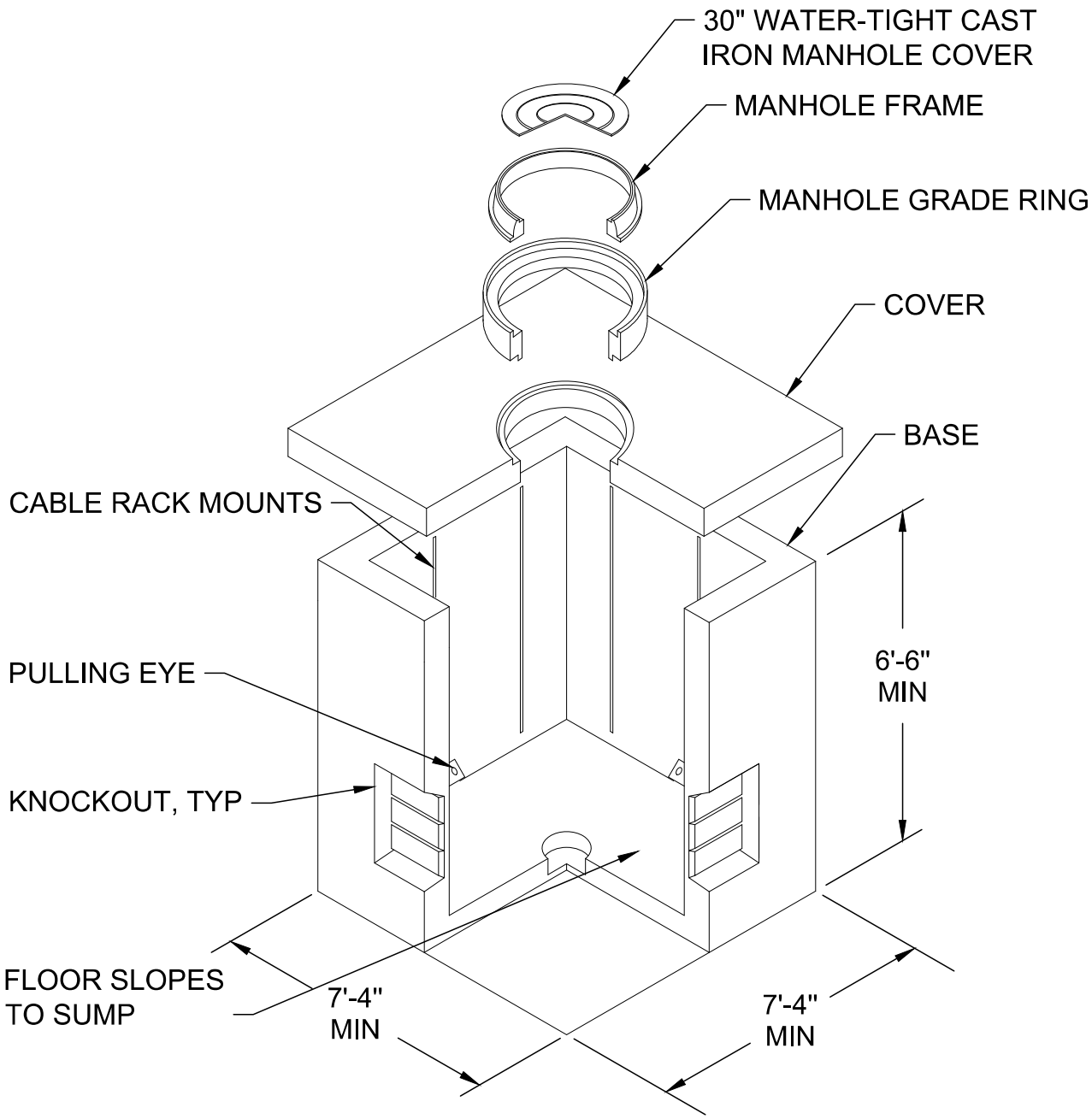
3. FLUIDIZED THERMAL BACKFILL TM (FTBTM) SHALL HAVE MINIMUM RHO OF 75 C-CM/W.

TRENCH/DUCTBANK DETAIL

NTS

16600T

WATERWORKS ENGINEERS



NOTE:

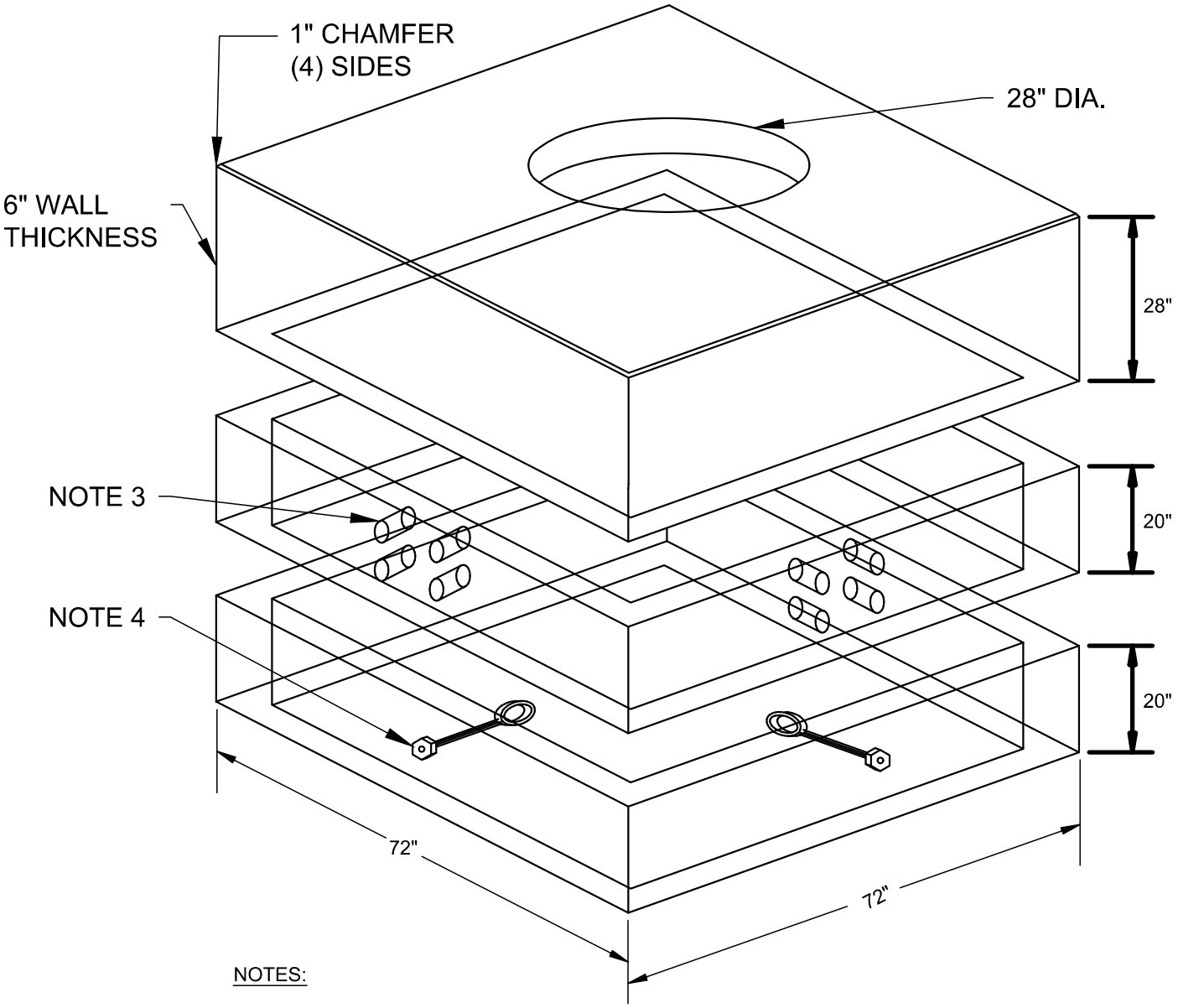
1. INSTALL A GROUND ROD AND CONNECT TO DUCT BANK GROUND. TRAIN CABLES AROUND INTERIOR PERIMETER ON CABLE RACKS

ELECTRIC MANHOLE

NTS

16600M

WATERWORKS ENGINEERS



NOTES:

1. CONCRETE TO BE 5000# HIGH EARLY STRENGTH.
2. CONCRETE TO BE COMPACTED WITH VIBRATOR.
3. 4-1/2" DIA. HOLES ON 7-1/2" CENTERS, IN LINE ALL FOUR SIDES.
4. GALVANIZED PULLING EYES CENTERED ON ALL FOUR SIDES. OPTIONAL.
5. SUPPLIER SHALL BE FRUEAN FE-3A OR LINHARES 6-4.

PRIMARY AND/OR SECONDARY JUNCTION BOX

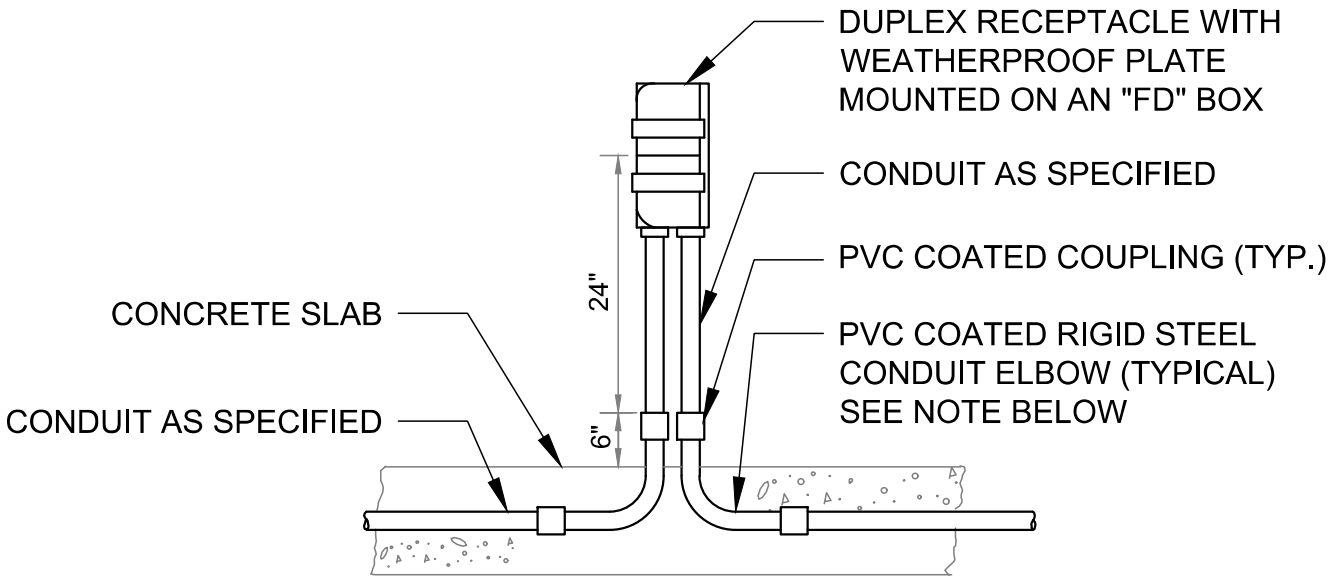
NTS

16640

FILENAME: 26 05 45.03 - PRIMARY AND OR SECONDARY JUNCTION BOX.DWG

REV DATE: August 24, 2021

WATERWORKS ENGINEERS



NOTE:

1. ELBOW TO BE CAPPED IN SLAB ON LAST RECEPTACLE IN ROW (FOR SUPPORT)

DECK MOUNTED RECEPTACLE

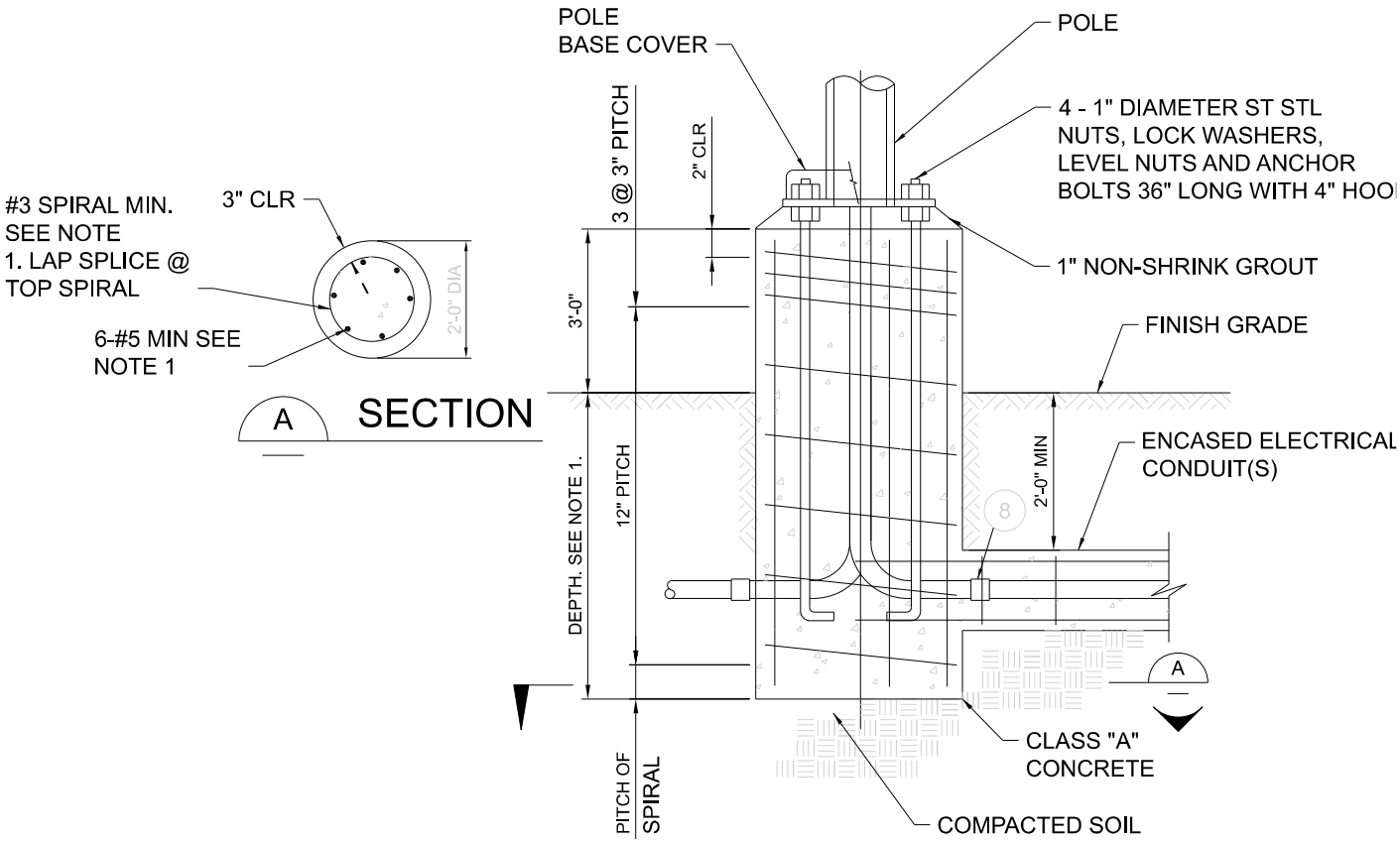
NTS

16650

FILENAME: 26 18 03.01 - DECK MOUNTED RECEPTACLE.DWG

REV DATE: August 25, 2021

WATERWORKS ENGINEERS



NOTES:

1. IF DEPTH AND REINFORCEMENT REQUIREMENTS ARE NOT PROVIDED BY THE POLE MANUFACTURER, PROVIDE A MINIMUM 5' DEPTH AND 2' DIAMETER BASE. LOADING SHALL BE DEAD LOAD PLUS 100 MPH WIND WITH EXPOSURE "C". PROVIDE SIGNED/SEALED STRUCTURAL CALCULATIONS IN SHOP DRAWING SUBMITTAL.

2. COORDINATE WITH RADIO PATH STUDY FOR REQUIRED POLE HEIGHT NOT TO EXCEED 20 FEET.

POLE BASE DETAIL

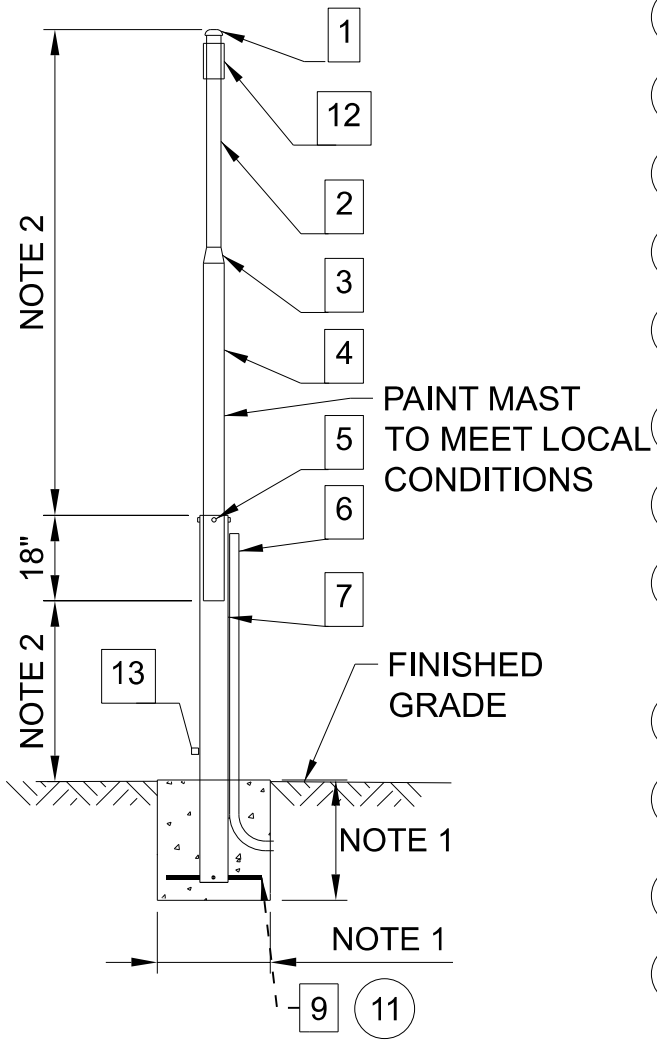
NTS

16660

FILENAME: WWE-BDR_8.5X11.DWG

REV DATE: August 18, 2021

WATERWORKS ENGINEERS



1. RAINTIGHT CAP
2. 2" GALVANIZED RIGID STEEL CONDUIT
3. 2 1/2" TO 2" GALVAIZED STEEL REDUCER
4. 2 1/2" GALVANIZED RIGID STEEL CONDUIT
5. 1/2" SET SCREW (TYP - 4 EACH)
6. 1" RIGID STEEL CONDUIT, STRAP TO MAST INSTALL BUSHING ON TOP OF CONDUIT
7. 3" GALVANIZED RIGID STEEL CONDUIT
8. PVC TO RIGID STEEL CONDUIT FITTING
9. CONCRETE FOUNDATION, CLASS "B" OR AS RECOMMENDED BY POLE MANUFACTURER. SEE NOTE 1
10. 1" PVC CONDUIT TO RADIO TANSCEIVING UNIT
11. REBAR AS RECOMMENDED BY POLE MANUFACTURER. SEE NOTE 1
12. MOUNT YAGI ANTENNA
13. GROUND LUG 12" ABOVE GRADE. CADWELD SYSTEM GROUND TO BUSHINGS AND POLE PER SPECIFICATION 16061.

NOTES:

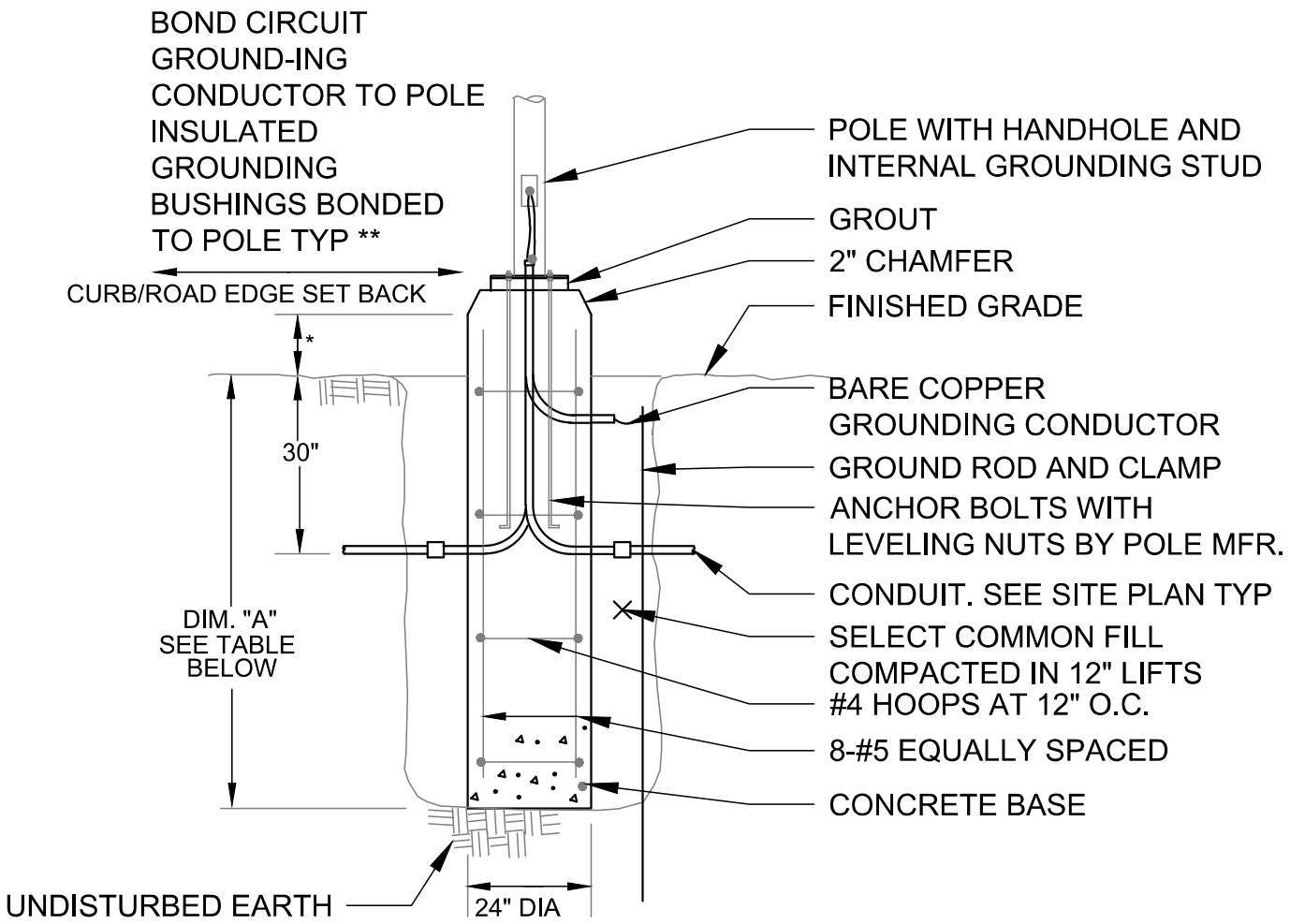
1. IF DEPTH AND REINFORCEMENT REQUIREMENTS ARE NOT PROVIDED BY THE POLE MANUFACTURER, PROVIDE A MINIMUM 5' DEPTH AND 2' DIAMETER BASE. LOADING SHALL BE DEAD LOAD PLUS 100 MPH WIND WITH EXPOSURE "C". PROVIDE SIGNED/SEALED STRUCTURAL CALCULATIONS IN SHOP DRAWING SUBMITTAL.
2. COORDINATE WITH RADIO PATH STUDY FOR REQUIRED POLE HEIGHT NOT TO EXCEED 20 FEET.

POLE DETAIL

NTS

16500P

WATERWORKS ENGINEERS



POLE HEIGHT	DIMENSION "A"
10'-0"	4'-6"
20'-0"	4'-6"
30'-0"	6'-6"
40'-0"	6'-6"

* = 2" AT WALKWAYS; 18" AT ROADWAYS & PARKING AREAS

** = 48" AT WALKWAYS; 24" AT ROADWAYS

NOTE:

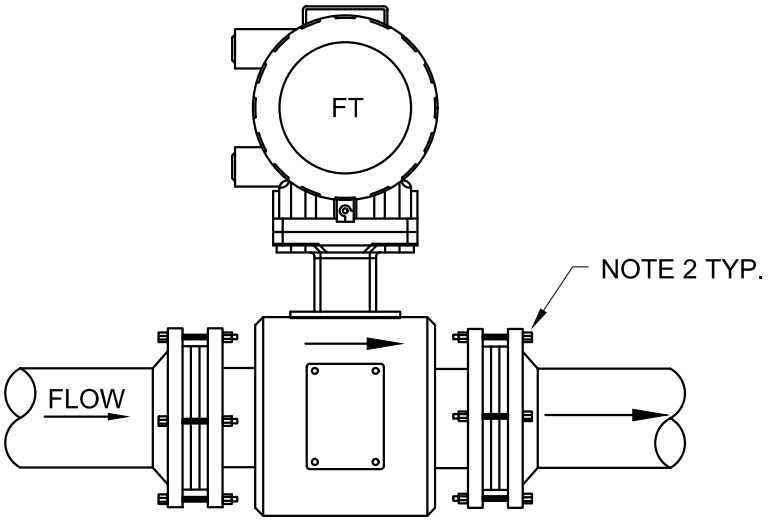
1. REFER TO SPECIFICATIONS FOR MATERIALS

STANDARD LIGHTING BASE

NTS

16500PB

WATERWORKS ENGINEERS



NOTES:

1. INSTALL WITH A MINIMUM OF FIVE (5) STRAIGHT PIPE DIAMETERS UPSTREAM AND TWO (2) STRAIGHT PIPE DIAMETERS DOWNSTREAM.

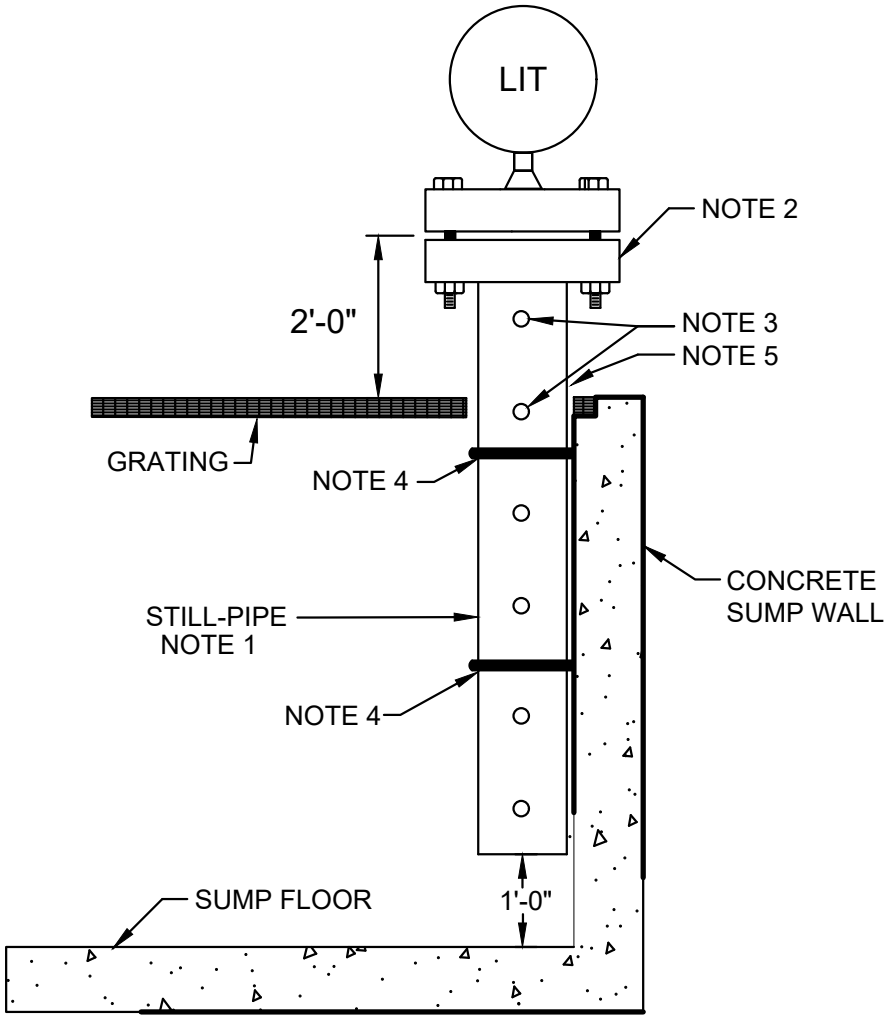
2. PROVIDE MATING FLANGES, GASKETS, AND BOLTING PER THE PDT OF THE PROCESS PIPE.

MAGNETIC FLOWMETER DETAIL

NTS

16191F

WATERWORKS ENGINEERS



NOTES:

1. 4" PIPE PER PDT 42.

2. 4" FLANGE, BOLTING, AND GASKET PER PDT 42.

3. DRILL 3/8" DIAMETER HOLE 2" DOWN FROM FLANGE. DRILL REMAINING HOLES DOWN THE SAME SIDE OF THE PIPE AND NO CLOSER THAN 6 INCHES APART.

4. FABRICATE BRACKET WITH STAINLESS STEEL HARDWARE TO SUPPORT STILL-PIPE. BOLT BRACKET WITH 1/2" EXPANSION STUD ANCHORS WITH NUTS AND WASHERS. INSTALL ONE BRACKET AT LEAST EVERY 5'.

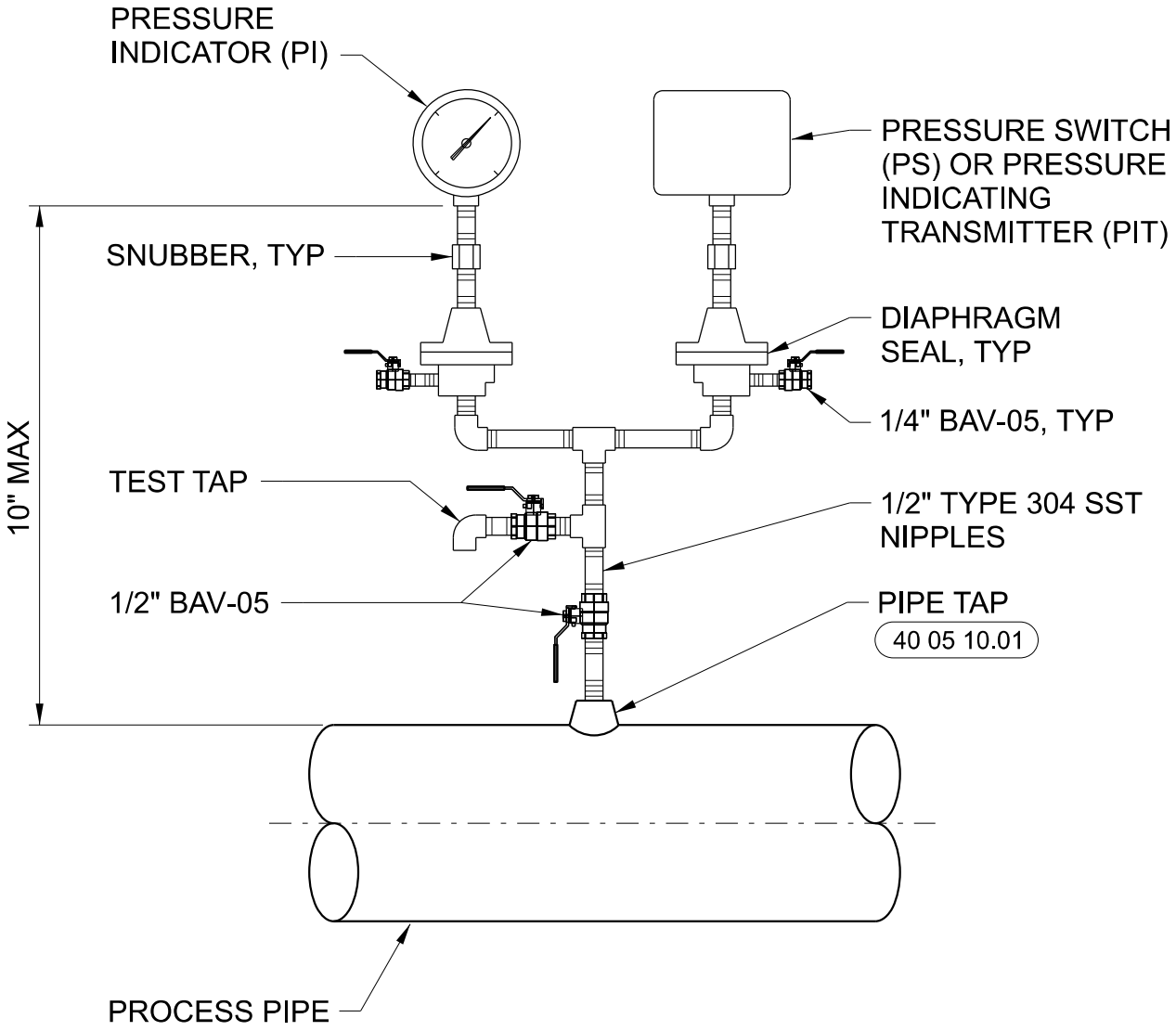
5. CUT ACCESS IN GRATING FOR STILL-PIPE. IF GRATING IS METAL, COLD GALVANIZE CUT ENDS.

NON-CONTACT
RADAR LEVEL TRANSMITTER

NTS

16191LR

WATERWORKS ENGINEERS



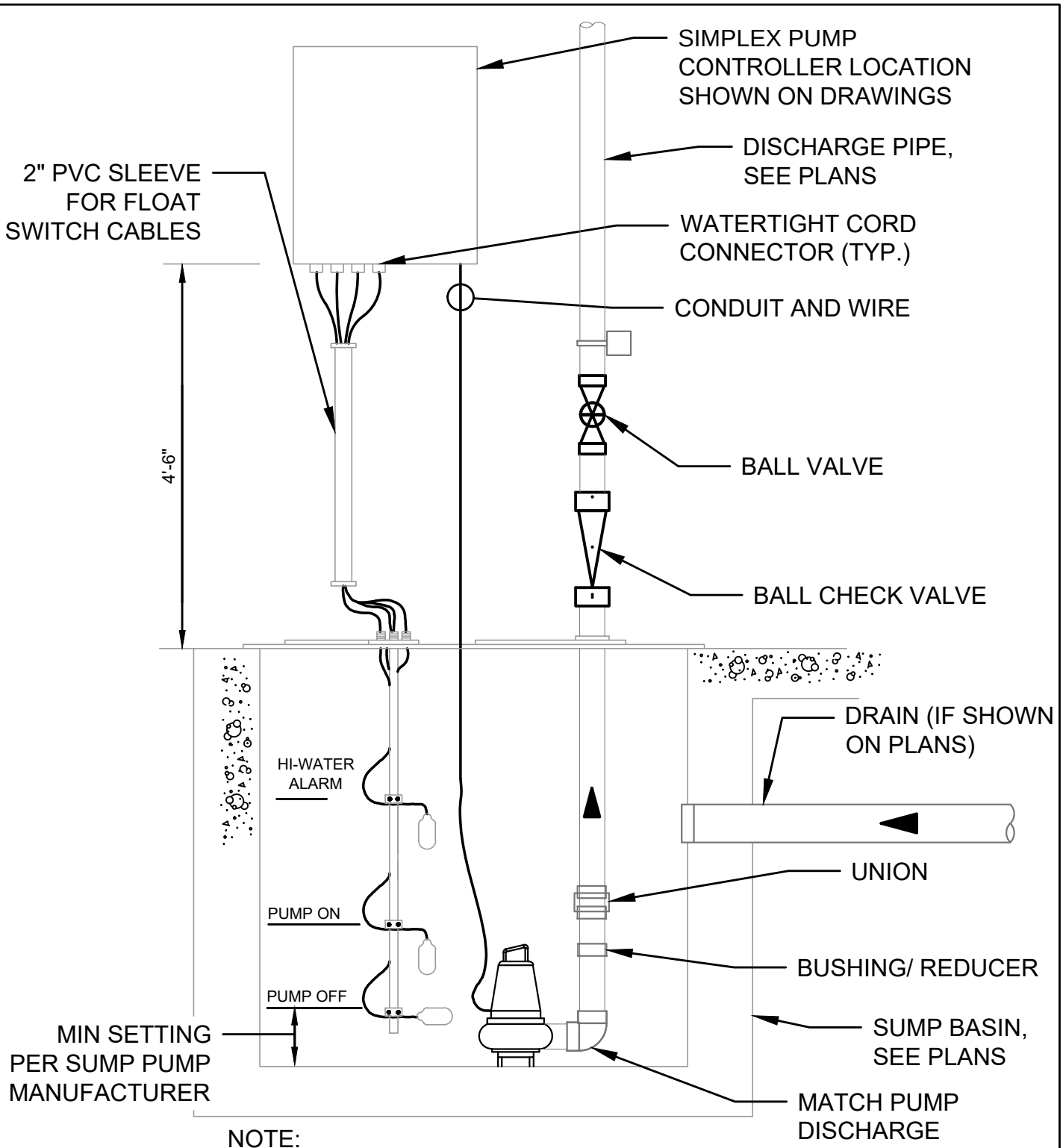
DIRECT MOUNTING WITH DIAPHRAGM SEAL

PRESSURE SWITCH AND INDICATOR INSTALLATION

NTS

16191P

WATERWORKS ENGINEERS



NOTE:

1. PIPE, FITTING, AND VALVE SIZE AND MATERIALS SHALL MATCH DOWNSTREAM DISCHARGE PIPE.
2. CONTRACTOR SHALL VERIFY MATERIAL COMPLIANCE WITH SERVICE AND CHEMICAL EXPOSURE.

SIMPLEX SUMP PUMP WITH FLOATS

NTS

16191AC

WATERWORKS ENGINEERS