SAN ANTONIO WATER SYSTEM
CENTRAL WATER INTEGRATION PIPELINE
MALTSBERGER TANK REHABILITATION PROJECT
SAWS Job No. 18-8611
SAWS Solicitation No. CO-00183

ADDENDUM No. 1
July 17, 2018

To Bidder of Record:

This addendum, applicable to work referenced above, is an amendment to the bidding documents and as such will be made a part of and included in the Contract Documents. Acknowledge receipt of this addendum by entering the addendum number and issue date in the space provided in submitted copies of the proposal.

CLARIFICATIONS

1. The estimated cost for this project has changed to **$2,004,000.00**. This total includes the replacement of two 48-inch butterfly valves, one on each 48-inch tank outlet pipe. This revised estimate cost is also now reflected on the SAWS website at the following link: https://www.saws.org/business_center/ContractSol/Drill.cfm?id=3225&View=Yes

QUESTIONS AND ANSWERS

Q1. SAWS Standard Spec allows for Butterfly valves to be painted with 2 part Epoxy or FBE. This spec only allows for Fusion Bonded Epoxy. Will 2 Part Epoxy be accepted?

A1. No, for this project only a FBE coating will be acceptable.

Q2. Can we use a folding head line stop application in lieu of a 48” bag stop? The bag stops work well in small pipe diameter and low pressure situations – Larger diameter bag stops are not only expensive but have a higher risk of failure due to the size of the bag/debris/shavings, ect. A folding head line stop is the only way you can guarantee a 100% seal in a larger diameter application and it will be far less expensive. 48” folding head line stops will easily handle 250PSI and will be installed through a 36” diameter fitting. A bag stop is similar to a line freeze because it will be quoted at 10-12 hour hold times with additional costs per 10-12 period of hold time – a folding head line stop I can be left on the pipe as long as needed with minimal cost incurred to the contractor if needed for an extended period of time.

A2. No, the Contractor shall provide an inflatable pipe plug as noted in Detail 3 on Sheet D-2107. During the construction phase, the Contractor may submit a folding head line stop as an alternative for consideration.

Q3. What is the pipe type?

A3. Based on photos of this pipe taken at the Maltsberger Pump Station Site, it is assumed the 48-inch tank inlet pipe is painted steel. Note that Record Drawings do not indicate the pipe material.

Q4. If steel – what type of line stop fitting would you want: 476 flanged nozzle – 476 half wrap – or 477 split tee (I attached the weld on sleeve brochure)

A4. This will be determined during the construction phase at the time that a folding head line stop has been submitted as an alternative for consideration.

Q5. If it will be a bolt on sleeve: Would you prefer epoxy coated or stainless steel? Epoxy coated is less expensive and a better choice.

A5. An epoxy coated bolt on sleeve will be acceptable.

Q6. What is the operating pressure of the 48" line?

A6. It is anticipated that the operating pressure for the 48-inch tank inlet line will not be in excess of 50 psi.

Q7. What is the max operating pressure of the 48" line?

A7. As noted above, it is anticipated that the operating pressure for the 48-inch tank inlet line will not exceed 50 psi.

Q8. Do you know how long you would like the 48" line isolated? (this will likely be up to the contractor) **if the valve doesn't function properly it can be replaced under pressure after the line stop has isolated the line as long as you have an isolation point past the valve or we will need to do (2) 48" line stops.*

A8. It is anticipated that the 48-inch tank inlet line will be isolated for a period of 5 months (from November 1, 2018 – March 31, 2019).

Q9. Can you clarify the highlighted portion below please? Are there limitations to the size of the temporary opening?

Q. Tank Access: Existing manways will be used for access to the interior of the tank. No door sheet penetrations shall be permitted for tank interior access. If the CONTRACTOR desires to cut a temporary opening through the permanent structure for equipment and personnel access, the CONTRACTOR shall submit the following information to the OWNER and ENGINEER for review prior to cutting or welding on the shell. If the

submittal is reviewed and approved by the OWNER and ENGINEER, the CONTRACTOR shall remove and replace the shell plate in accordance with the American Petroleum Institute (API) Standard 653, API Standard 650, and AWWA D100. All required temporary stiffening shall be installed by the CONTRACTOR prior to cutting the temporary shell opening. The temporary stiffening shall be removed by the CONTRACTOR prior to cutting the shell opening. The temporary stiffening shall be removed by the CONTRACTOR after the door sheet is welded back into place. CONTRACTOR shall repair any surface imperfections prior to abrasive blasting and coating those areas of the tank surfaces. CONTRACTOR shall submit the following information for the review and approval of the OWNER and ENGINEER:

A9. As noted in the specification language, it is preferred that the existing manways be used for tank interior access. If a larger opening is desired by the CONTRACTOR, the proposed opening dimensions will require the approval of both the OWNER and ENGINEER.

Q10. What is the existing paint system on the inside shell?

A10. The tank interior shell has an epoxy coating.

Q11. Will blasting be required before tank floor inspection?

A11. It is anticipated that the tank floor shall be cleaned and pressure washed prior to inspection.

Q12. What will be the interior lining system for the buried pipe? Fusion bonded epoxy?

A12. Refer to Sections 09910 and 09911 which have been added to the Contract Documents as part of this addendum.

Q13. Will power to the site be shut down during the electrical construction work?

A13. Since there are two separate transformers providing power to the site, it is not anticipated that a shutdown will be required.

Q14. Does the existing Drainage Structure have a stand-alone concrete lid?

A14. No, the existing Drainage Structure has a concrete top slab that is not stand-alone relative to the structure's concrete walls.

REVISIONS TO CONTRACT DOCUMENTS AND TECHNICAL SPECIFICATIONS

TABLE OF CONTENTS

a) Page TOC-1, Division 2 – Site Construction, delete the following:

"02480 Landscaping"

b) Page TOC-1, Division 2 – Site Construction, add the following (in numerical order):

"02481 Treatment of Existing Trees
02921 Seeding"

c) Page TOC-2, Division 9 – Finishes, add the following (in numerical order):

"09910 Coating for Exposed Items
09911 Polyurethane Coating"

d) Page TOC-2, Division 17 – Instrumentation, delete the following:

"17314 Pressure Instruments"

CONTRACTOR'S BID PACKET CHECKLIST

a) Remove and replace the Contractor's Bid Packet Checklist in its entirety with the revised version attached to this Addendum. The Contractor Experience form (Attachment A) has been added to this checklist.

BID PROPOSAL

a) Remove and replace the Bid Proposal in its entirety with the revised version attached to this Addendum. A Supplementary Unit Price (Item No. S-8) has been added for "Welding Steel Plates". This version should be used when submitting a bid for this project.

WAGE DECISIONS

a) Remove the Building Wage Decision in its entirety and replace with the attached latest version issued by the Department of Labor on 7/6/18.

SUPPLEMENTARY CONDITIONS

a) INSTRUCTIONS TO BIDDERS, page IB-7, remove Section 24 in its entirety and replace with the following:

"24. To assist the San Antonio Water System Contracting Office in performing the bidder evaluation and subsequent recommendation of award, all bidders will submit the following items with their bid. Failure to provide the required information, may result in determining a non-responsive bidder:

(a) An information packet on company showing experience, organization and equipment.
(b) A statement regarding ability to complete the project within the schedule taking into account existing commitments.

(c) Contractor Experience form (Attachment A) showing a record of performance on five (5) 5.0 million gallon (MG) or larger ground storage tank rehabilitation projects over the last 10 years. Project references should include name of project, tank size, completion date, project address, telephone number and email address of Owner contact person for each project.
(d) A completed and signed W-9 Request for Taxpayer Identification Number and Certification form.

All other items to remain the same."

SECTION 01010 – SUMMARY OF WORK

a) Page 01010-1, Paragraph 1.03.A.1., delete this paragraph in its entirety and replace with:

"1. Ground Storage Tank: Complete SSPC-SP 10 near-white metal blast and recoating of interior surfaces and support members. Provide a single coat of 100% solids polyurethane on all interior carbon steel surfaces and support members – this excludes the aluminum roof but includes the tank floor. Complete SSPC-SP 6 commercial blast cleaning and recoating of the exterior carbon steel surfaces (excluding the aluminum roof) with full containment as outlined in SSPC Guide 6 Class 2A. Caulk all lap seams and chime area.

b) Page 01010-2, Paragraph 1.03.A.2.c., following this paragraph, add the Work items described below and renumber subsequent paragraphs:

"d. New 36-inch Inlet Pipe (and 36-inch Butterfly Valve)

e. New 48-inch Outlet Butterfly Valves

f. Tank Perimeter Screen Replacement

g. Drainage Structure Improvements

h. Replacement of Analyzer Drain Piping"

SECTION 01025 – MEASUREMENT AND PAYMENT

a) Remove Section 01025 in its entirety and replace with the revised version included in this Addendum. A description for the Supplementary Unit Price (Item No. S-8) that has been added for "Welding Steel Plates" is now included.

SECTION 01040 – COORDINATION

a) Page 01040-2, Paragraph 1.03.A., add the following to the end of this paragraph:

"Tank downtime shall be during the period that runs from November 1, 2018 until March 31, 2019. During this time, the Maltsberger Pump Station facility shall remain in service by

utilizing existing tank bypass pumping, thereby allowing the tank to be isolated for rehabilitation purposes."

b) Page 01040-6, Paragraph 3.02.M.6., delete this sentence in its entirety.

SECTION 01500 – CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

a) Page 01500-5, Paragraph 1.08.A., delete this paragraph in its entirety and replace with:

"CONTRACTOR shall provide their own security for the project site. OWNER will not be responsible for any vandalism."

b) Page 01500-6, Paragraph 1.09.A.1., delete the first sentence of this paragraph in its entirety and replace with:

"1. At his/her discretion, the CONTRACTOR may provide and maintain a temporary field office on the jobsite, location subject to approval by the OWNER, throughout the duration of construction."

SECTION 02100 – SITE PREPARATION

a) Page 02100-2, Paragraph 3.06.C., delete this paragraph in its entirety and replace with:

"C. Stockpile strippings for topsoil separately from other excavated material."

SECTION 02140 – DEWATERING DURING CONSTRUCTION

a) Remove Section 02140 in its entirety and replace with the revised version included in this Addendum. References to a wellpoint system and observation wells have been removed.

SECTION 02480 – LANDSCAPING

a) As part of this Addendum, delete Section 02480 in its entirety. Landscaping will be performed as part of the Central Water Integration Pipeline Maltsberger Pump Station Improvements Project.

SECTION 02481 – TREATMENT OF EXISTING TREES

a) As part of this Addendum, add the attached Section 02481 to the Contract Documents. This section includes tree protection requirements.

SECTION 02921 – SEEDING

a) As part of this Addendum, add the attached Section 02921 to the Contract Documents. This section provides requirements for revegetating the site following the completion of construction activities.

SECTION 05120 – STRUCTURAL STEEL

a) Remove Section 05120 in its entirety and replace with the revised version included in this Addendum. Additions to this section include Manufacturer/Fabricator QA/QC program requirements that include the use of a Certified Welding Inspector.

SECTION 09871 – EXTERIOR COATING SYSTEM FOR STEEL STORAGE TANKS

a) Remove Section 09871 in its entirety and replace with the revised version included in this Addendum. Modifications have been made to several coating requirements given for each manufacturer.

SECTION 09910 – COATING FOR EXPOSED ITEMS

a) As part of this Addendum, add the attached Section 09910 to the Contract Documents. This section includes coatings for exposed steel piping.

SECTION 09911 – POLYURETHANE COATING

a) As part of this Addendum, add the attached Section 09911 to the Contract Documents. This section includes the interior coating for steel pipe.

SECTION 13110 – CATHODIC PROTECTION SYSTEM

a) Page 13110-4, Paragraph 3.06, delete this paragraph in its entirety.

SECTION 13200 – STEEL WATER STORAGE TANK REHABILITATION

a) Page 13200-7, Paragraph 3.01.W., delete this paragraph in its entirety and renumber subsequent paragraphs.

SECTION 15100 – VALVES AND ACTUATORS

a) Remove Section 15100 in its entirety and replace with the revised version included in this Addendum. Electric motor actuators have been removed from this section and updates have been made for butterfly valve and gate valve requirements.

SECTION 16000 – ELECTRICAL – GENERAL PROVISIONS

a) Remove Section 16000 in its entirety and replace with the revised version included in this Addendum. Several modifications have been made to testing requirements.

SECTION 16140 – LIGHT SWITCHES AND RECEPTACLES

a) Remove Section 16140 in its entirety and replace with the revised version included in this Addendum. Several device plates have been deleted and installation requirements have been revised.

SECTION 16475 – LOW VOLTAGE ENCLOSED CIRCUIT BREAKERS AND DISCONNECT SWITCHES

a) Remove Section 16475 in its entirety and replace with the revised version included in this Addendum. Fused disconnect switches, motor isolation switches, and double throw manual transfer switches have been deleted. Field adjusting requirements have also been modified.

SECTION 17300 – PROCESS CONTROL SYSTEMS GENERAL PROVISIONS

a) Remove Section 17300 in its entirety and replace with the revised version included in this Addendum. The requirement for application development workshops has been deleted.

SECTION 17314 – PRESSURE INSTRUMENTS

a) As part of this Addendum, delete Section 17314 in its entirety. There are no pressure instruments planned for this project.

SECTION 17325 – PROCESS CONTROL SYSTEM CONTROL PANELS

a) Remove Section 17325 in its entirety and replace with the revised version included in this Addendum. The table that details PCSI-furnished control panels has been updated.

REVISIONS TO DRAWINGS

SHEET G-2101 – DRAWING INDEX & GENERAL NOTES

a) In the 'SHEET LIST TABLE', add the following entry under 'STRUCTURAL':

"S-2102 NOT USED"

SHEET G-2102 – OVERALL SITE PLAN

a) Remove Sheet G-2102 in its entirety and replace with the revised version included in this Addendum. Details on surrounding roadways have been added to the site plan.

SHEET G-2103 – CONSTRUCTION STAGING, SWPPP & TREE PROTECTION PLAN

a) Remove Sheet G-2103 in its entirety and replace with the revised version included in this Addendum. Contours and areas to revegetate have been added. Modifications have been

made to the sediment control fence location. Additional tree protection is shown on the tank's south side (resulting in a smaller Contractor staging area).

SHEET C-2101 – SITE IMPROVEMENT PLAN

a) Remove Sheet C-2101 in its entirety and replace with the revised version included in this Addendum. Additional details are provided relative to the civil/site work to perform.

SHEET S-2103 – REHABILITATION PLANS

a) Remove Sheet S-2103 in its entirety and replace with the revised version included in this Addendum. The locations of 4 additional downspouts are shown along with the concrete slab for the new Equipment Rack.

SHEET S-2104 – DETAILS

a) Remove Sheet S-2104 in its entirety and replace with the revised version included in this Addendum. Details for the new 36-inch manway, reinforcing plate around the new 36-inch tank inlet pipe, and modifications to the existing overflow weir box have been updated.

SHEET S-2105 – DETAILS

a) Remove Sheet S-2105 in its entirety and replace with the revised version included in this Addendum. A concrete splash pad has been added at each downspout and a detail has been added to show the concrete slab for the new Equipment Rack.

SHEET D-2101 – MALTSBERGER TANK DEMOLITION PHOTOS I

a) Remove Sheet D-2101 in its entirety and replace with the revised version included in this Addendum. Additional notes are given on Detail 2 (Pressure Transmitter Assembly).

SHEET D-2103 – MALTSBERGER TANK FLOOR & ROOF LAYOUT PLANS

a) Remove Sheet D-2103 in its entirety and replace with the revised version included in this Addendum. Detail cross references have been updated and some revisions have been made to the sheet's notes.

SHEET D-2104 – MALTSBERGER TANK DETAILS I

a) Remove Sheet D-2104 in its entirety and replace with the revised version included in this Addendum. Detail 2 (36" Shell Manway) and Detail 5 (Grout Repair) have been deleted. Detail 3 (Pipe Safety Railing) has been updated.

SHEET D-2105 – MALTSBERGER TANK DETAILS II

a) Remove Sheet D-2105 in its entirety and replace with the revised version included in this Addendum. Detail 4 (Vandal Deterrent) has been deleted and modifications have been made to all other sheet details.

SHEET D-2107 – MALTSBERGER TANK DETAILS IV

a) Remove Sheet D-2107 in its entirety and replace with the revised version included in this Addendum. Detail 4 (Buried Valve – Butterfly) and Detail 5 (Valve Box Complete) have been combined into a single detail.

SHEET D-2108 – MALTSBERGER TANK DETAILS IV

a) Remove Sheet D-2108 in its entirety and replace with the revised version included in this Addendum. Modifications have been made to Detail 2 (Tank Interior Ladder at Overflow Weir Box) and Detail 3 (36" Tank Inlet – Sidewall).

SHEET E-2104 – MALTSBERGER EXISTING GST DETAIL PLAN

a) Remove Sheet E-2104 in its entirety and replace with the revised version included in this Addendum. The detail for the new Equipment Rack has been updated.

SHEET E-2191 – STANDARD ELECTRICAL DETAILS

a) Remove Sheet E-2191 in its entirety and replace with the revised version included in this Addendum. Detail 7 (Pressure Transmitter) has been updated.

The remainder of the bid documents remain unchanged.

This addendum is comprised of a total of **199** pages (including attachments).

Bill D. Marriott, P.E.
Tetra Tech, Inc.

END OF ADDENDUM No. 1

CONTRACTOR'S BID PACKET CHECKLIST:
Central Water Integration Pipeline Maltsberger Tank Rehabilitation Project
SAWS Job No. 18-8611
SAWS Solicitation No. CO-00183

Items to be included for Submittal with Bid:

- O Bid proposal and Acknowledgement of All Addendums
- O Proposal Certification; page PC-1
- O Bid Bond/Cashier's Check
- O Statement on President's Executive Orders – Page IB 6 or 7
- O Good Faith Effort Plan
- O Conflict of Interest Questionnaire - Form CIQ *(Rev. 11/30/2015)*
- O Proof of Insurability (Letter from Insurer or Sample Certificate of Insurance)
- O Company Information Packet
- O Statement regarding ability to complete the project
- O Contractor Experience Form (Attachment A)
- O W-9

BID PROPOSAL

PROPOSAL OF_____, a corporation

a partnership consisting of _____

an individual doing business as _____

TO THE SAN ANTONIO WATER SYSTEM:

Pursuant to Instructions and Invitations to Bidders, the undersigned proposes to furnish all labor and materials as specified and perform the work required for the project as specified, in accordance with the Plans and Specifications for the following prices to wit:

LUMP SUM PRICES FOR:

ITEM NO.	ITEM DESCRIPTION	UNIT	QTY	UNIT PRICE (IN FIGURES)	TOTAL (IN FIGURES)
1	Central Water Integration Pipeline Maltsberger Tank Rehabilitation Project – Furnish all materials, labor, equipment and superintendence for painting and rehabilitation of an existing 7.5 million gallon ground water storage tank and appurtenances including: cleaning and repainting of interior and exterior surfaces; modifications to various tank equipment items: electrical and instrumentation upgrades; and additional site improvements in accordance with the Contract Documents, complete in place including Contractor mobilization and demobilization. Respondent shall indicate the coating system manufacturer to be used by **check**ing **one** of the following: ____ **Carboline** ____ **Sherwin Williams** ____ **Tnemec** ____ **PPG**	LS	1	$_____	$_____
2	General Allowance – Contractor shall include an allowance for items unforeseen or not specifically characterized in the Contract Documents, encountered during the course of construction.	Not to Exceed Allowance		$ 25,000.00	$ 25,000.00
A.	SUBTOTAL BASE BID (Items 1 thru 2)				$_____

SUPPLEMENTARY UNIT PRICES FOR:

ITEM NO.	ITEM DESCRIPTION	UNIT	QTY	UNIT PRICE (IN FIGURES)	TOTAL (IN FIGURES)
S-1	Furnish all materials, labor, equipment and appurtenances for "Interior Grinding", complete in place. Price is per hour of "Interior Grinding".	HR	100	$_____	$_____
S-2	Furnish all materials, labor, equipment and appurtenances for "Pit Welding", complete in place. Price is per square inch of "Pit Welding".	SQ IN	100	$_____	$_____
S-3	Furnish all materials, labor, equipment and appurtenances for "Seam Welding", complete in place. Price is per linear foot of "Seam Welding".	LF	100	$_____	$_____
S-4	Furnish all materials, labor, equipment and appurtenances for "Pit Filling", complete in place. Price is per gallon of "Pit Filling" provided and applied.	GAL	20	$_____	$_____
S-5	Furnish all materials, labor, equipment and appurtenances for "Additional Work", complete in place. Price is per hour of "Additional Work".	HR	500	$_____	$_____
S-6	Furnish all materials, labor, equipment and appurtenances for "Additional Tank Ventilation / Dehumidification", complete in place. Price is per week of "Additional Tank Ventilation / Dehumidification".	WK	4	$_____	$_____
S-7	Furnish all materials, labor, equipment and appurtenances for "Pressure Injection Grout Concrete Crack Repair", complete in place. Price is per linear foot of "Pressure Injection Grout Concrete Crack Repair".	LF	500	$_____	$_____
S-8	Furnish all materials, labor, equipment and appurtenances for "Welding Steel Floor Plates", complete in place. Price is per square foot of "Welding Steel Floor Plates".	SF	1,100	$_____	$_____

B. SUBTOTAL SUPPLEMENTARY ITEMS (Items S-1 thru S-8)	$ _____

Bidder acknowledges that estimated quantities for Supplementary Items are not guaranteed and are solely for the purpose of comparison of Price. Final payment for all Unit Price Line Items will be based on actual quantities provided by the Contractor during construction.

TOTAL PRICE (Line Items 'A' + 'B') $ _____

_____ _____
BIDDER'S SIGNATURE & TITLE FIRM'S NAME (TYPE OR PRINT)

_____ _____
FIRM'S ADDRESS FIRM'S PHONE NO./FAX NO.

_____
FIRM'S EMAIL ADDRESS

The Contractor herein acknowledges receipt of the following:

Addendum Nos._____

OWNER RESERVES THE RIGHT TO ACCEPT THE OVERALL MOST RESPONSIBLE BID.

The Bidder offers to construct the Project in accordance with the Contract Documents for the contract price, to substantially complete the work within **180 calendar days** after the start date and to complete all work on the Project within **210 calendar days** after the start date, as set forth in the Authorization to Proceed. **The Bidder understands and accepts the provisions of the Contract Documents relating to liquidated damages if not completed on time.**

Complete the additional requirements of the Bid Proposal which are included on the following pages.

END OF SECTION

General Decision Number: TX180280 07/06/2018 TX280

Superseded General Decision Number: TX20170280

State: Texas

Construction Type: Building

County: Bexar County in Texas.

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

Note: Under Executive Order (EO) 13658, an hourly minimum wage of $10.35 for calendar year 2018 applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least $10.35 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2018. The EO minimum wage rate will be adjusted annually. Please note that this EO applies to the above-mentioned types of contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but it does not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60). Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/05/2018
1	01/12/2018
2	03/23/2018
3	04/20/2018
4	07/06/2018

ASBE0087-014 01/01/2018

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR (Duct, Pipe and Mechanical System Insulation)	$ 22.72	10.02

BOIL0074-003 01/01/2017

	Rates	Fringes
BOILERMAKER	$ 28.00	22.35

ELEC0060-003 06/01/2016

	Rates	Fringes

ELECTRICIAN (Communication
Technician Only).....$ 21.57 9%+4.65

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* ELEC0060-004 06/01/2018

	Rates	Fringes
ELECTRICIAN (Excludes Low Voltage Wiring)	$ 28.30	13%+5.05

ELEV0081-001 01/01/2018

	Rates	Fringes
ELEVATOR MECHANIC	$ 39.32	32.645+a+b

FOOTNOTES:

A. 6% under 5 years based on regular hourly rate for all hours worked. 8% over 5 years based on regular hourly rate for all hours worked.

B. Holidays: New Year's Day; Memorial Day; Independence Day; Labor Day; Thanksgiving Day; Friday after Thanksgiving Day; Christmas Day; and Veterans Day.

ENGI0450-002 04/01/2014

	Rates	Fringes
POWER EQUIPMENT OPERATOR Cranes	$ 34.85	9.85

IRON0066-013 06/01/2017

	Rates	Fringes
IRONWORKER, STRUCTURAL	$ 21.55	6.73

IRON0084-011 06/01/2017

	Rates	Fringes
IRONWORKER, ORNAMENTAL	$ 23.27	7.12

PLUM0142-009 07/01/2017

	Rates	Fringes
HVAC MECHANIC (HVAC Electrical Temperature Control Installation Only)	$ 30.25	11.80
HVAC MECHANIC (HVAC Unit Installation Only)	$ 30.25	11.80
PIPEFITTER (Including HVAC Pipe Installation)	$ 30.25	11.80
PLUMBER (Excludes HVAC Pipe		

Installation)	$ 30.25	11.80

SFTX0669-002 04/01/2017

	Rates	Fringes
SPRINKLER FITTER (Fire Sprinklers)	$ 29.03	15.84

SHEE0067-004 04/01/2018

	Rates	Fringes
Sheet metal worker		
Excludes HVAC Duct Installation	$ 26.35	15.29
HVAC Duct Installation Only	$ 26.35	15.29

SUTX2014-006 07/21/2014

	Rates	Fringes
BRICKLAYER	$ 22.15	0.00
CARPENTER (Acoustical Ceiling Installation Only)	$ 17.83	0.00
CARPENTER (Form Work Only)	$ 13.63	0.00
CARPENTER, Excludes Acoustical Ceiling Installation, Drywall Hanging, Form Work, and Metal Stud Installation	$ 16.86	4.17
CAULKER	$ 15.00	0.00
CEMENT MASON/CONCRETE FINISHER	$ 22.27	5.30
DRYWALL FINISHER/TAPER	$ 13.81	0.00
DRYWALL HANGER AND METAL STUD INSTALLER	$ 15.18	0.00
ELECTRICIAN (Low Voltage Wiring Only)	$ 20.39	3.04
IRONWORKER, REINFORCING	$ 12.27	0.00
LABORER: Common or General	$ 10.75	0.00
LABORER: Mason Tender - Brick	$ 11.88	0.00
LABORER: Mason Tender - Cement/Concrete	$ 12.00	0.00
LABORER: Pipelayer	$ 11.00	0.00

LABORER: Roof Tearoff	$ 11.28	0.00
LABORER: Landscape and Irrigation	$ 8.00	0.00
OPERATOR: Backhoe/Excavator/Trackhoe	$ 15.98	0.00
OPERATOR: Bobcat/Skid Steer/Skid Loader	$ 14.00	0.00
OPERATOR: Bulldozer	$ 14.00	0.00
OPERATOR: Drill	$ 14.50	0.00
OPERATOR: Forklift	$ 12.50	0.00
OPERATOR: Grader/Blade	$ 23.00	5.07
OPERATOR: Loader	$ 12.79	0.00
OPERATOR: Mechanic	$ 18.75	5.12
OPERATOR: Paver (Asphalt, Aggregate, and Concrete)	$ 16.03	0.00
OPERATOR: Roller	$ 12.00	0.00
PAINTER (Brush, Roller and Spray), Excludes Drywall Finishing/Taping	$ 13.07	0.00
ROOFER	$ 12.00	0.00
TILE FINISHER	$ 11.32	0.00
TILE SETTER	$ 14.94	0.00
TRUCK DRIVER: Dump Truck	$ 12.39	1.18
TRUCK DRIVER: Flatbed Truck	$ 19.65	8.57
TRUCK DRIVER: Semi-Trailer Truck	$ 12.50	0.00
TRUCK DRIVER: Water Truck	$ 12.00	4.11

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

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any

solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

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

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

Union Rate Identifiers

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

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

Survey Rate Identifiers

Classifications listed under the "SU" identifier indicate that no one rate prevailed for this classification in the survey and

the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

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

Union Average Rate Identifiers

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

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

WAGE DETERMINATION APPEALS PROCESS

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

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

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

With regard to any other matter not yet ripe for the formal

process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

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

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

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

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

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

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

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

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END OF GENERAL DECISION

Attachment A
CONTRACTOR EXPERIENCE

CONTRACTOR must have successfully completed at least five (5) 5.0 million gallon (MG) or larger ground storage tank rehabilitation projects over the past 10 years. This form must be submitted with the CONTRACTOR's bid and may be used in the determination of responsiveness. **If all fields are not completed, the proposal may be found non-responsive.** It is **not** acceptable to indicate "see attached" as a response on this form.

Project Experience Reference 1			
Owner (Utility):			
Address:			
Owner Reference:		Title:	
Phone No.:		Email Address:	
Engineer Reference:		Title:	
Phone No.:		Email Address:	
Completion Date (within last 10 years):		Tank Size in million gallons (MG):	
Description of work performed:			
Project Experience Reference 2			
Owner (Utility):			
Address:			
Owner Reference:		Title:	
Phone No.:		Email Address:	
Engineer Reference:		Title:	
Phone No.:		Email Address:	
Completion Date (within last 10 years):		Tank Size in million gallons (MG):	
Description of work performed:			
Project Experience Reference 3			
Owner (Utility):			

Address:			
Owner Reference:		Title:	
Phone No.:		Email Address:	
Engineer Reference:		Title:	
Phone No.:		Email Address:	
Completion Date (within last 10 years):		Tank Size in million gallons (MG):	
Description of work performed:			
Project Experience Reference 4			
Owner (Utility):			
Address:			
Owner Reference:		Title:	
Phone No.:		Email Address:	
Engineer Reference:		Title:	
Phone No.:		Email Address:	
Completion Date (within last 10 years):		Tank Size in million gallons (MG):	
Description of work performed:			
Project Experience Reference 5			
Owner (Utility):			
Address:			
Owner Reference:		Title:	
Phone No.:		Email Address:	
Engineer Reference:		Title:	
Phone No.:		Email Address:	
Completion Date (within last 10 years):		Tank Size in million gallons (MG):	
Description of work performed:			

SECTION 01025

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This section defines the method that will be used to determine the quantities of Work performed or materials supplied and establish the basis upon which payment will be made.

1.02 ADMINISTRATIVE SUBMITTALS

A. Schedule of Values: Submit schedule on CONTRACTOR's standard form. Refer to Paragraph 1.05 of this Section and Section 01300 – Submittals for additional requirements.

B. Schedule of Estimated Progress Payments (refer to Paragraph 1.06 of this Section for additional requirements):

1. Submit with initially acceptable Schedule of Values.

2. Submit adjustments thereto with Application for Payment.

C. Application for Payment.

D. Final Application for Payment.

1.03 RELATED WORK

A. Section 01300 – Submittals.

1.04 PRICE

A. Required items of Work and incidentals necessary for the satisfactory completion of the Project shall be considered incidental to the specified Work required under this contract and shall be considered as included in the unit prices for the various proposal items. CONTRACTOR shall prepare his Bid accordingly to allow for such items:

1. Not specifically listed in the Bid Proposal.

2. Not specified in this section to be measured or to be included in one of the items listed in the Bid Proposal.

3. To include CONTRACTOR’s overhead and profit.

B. Work includes the furnishing of all labor, materials, equipment, tools, and related items for performing all operations required to complete the Project satisfactorily in place, as specified by the Contract Documents.

1.05 SCHEDULE OF VALUES

A. Prepare a separate Schedule of Values for each phase of Work under the Agreement. Submit the Schedule of Values within 10 days prior to submitting the first request for payment or as requested by the OWNER.

B. Use line items in the proposal as line items in the Schedule of Values. Provide adequate detail to allow easy determination of the percentage of work completed for each item.

C. Lump Sum Work

1. Reflect Schedule of Values format included in conformed Bid Proposal Form, specified allowances, alternates and equipment selected by OWNER, as applicable.

2. List bonds and insurance premiums, mobilization, demobilization, facility startup, and contract closeout separately.

3. Separate product costs and installation costs. Break down by Divisions 2 through 17 for each of the Project facilities.

    a. Product costs include cost for product, delivery and unloading, royalties and patent fees, taxes, and other cost paid directly to the supplier or vendor.

    b. Installation costs include cost for the supervision, labor and supervision, labor and equipment for field fabrication, erection, installation, start-up, initial operation and CONTRACTOR's overhead and profit.

4. Divide principal subcontract amounts into an adequate number of line items to allow determination of the percentage of work completed for each item. These line items may be used to establish the value of work to be added or deleted from the project.

D. Unit Price Work: Reflect unit price quantity and price breakdown from conformed Bid Proposal.

E. An unbalanced or front-end loaded schedule will not be acceptable.

F. Summation of the complete Schedule of Values representing all Work shall equal the Contract Price.

1.06 SCHEDULE OF ESTIMATED PROGRESS PAYMENTS

A. Show estimated payment requests throughout Contract Times aggregating the initial Contract Price.

B. Base estimated progress payments on initially acceptable progress schedule. Adjust to reflect subsequent adjustments in progress schedule and Contract Price as reflected by modifications to the Contract Documents.

1.07 APPLICATION FOR PAYMENT

A. Reference Article VII Contract Payments of the Contract General Conditions.

B. Transmittal Summary Form: Attach one Summary Form with each detailed Application for Payment for each schedule and include Request for Payment of Materials and Equipment on Hand as applicable. Execute certification by authorized officer of the CONTRACTOR.

C. Provide separate form for each schedule as applicable.

D. Include accepted Schedule of Values for each schedule or portion of Work, the unit price breakdown for Work to be paid on unit price basis, a listing of OWNER-selected equipment if applicable, and allowances, as appropriate.

E. Preparation:

1. Round values to nearest dollar.

2. List each Change Order and Written Amendment executed prior to date of submission as a separate line item. Totals to equal those shown on the Transmittal Summary Form for each schedule as applicable.

3. Submit Application for Payment, including a Transmittal Summary Form and detailed Application for Payment Form(s) for each schedule as applicable, a listing of materials on hand for each schedule as applicable and such supporting data as may be requested by the OWNER.

1.08 MEASUREMENT – GENERAL

A. Weighing, measuring, and metering devices used to measure quantity of materials for Work shall be suitable for purpose intended and conform to tolerances and specifications as specified in National Institute of Standards and Technology, Handbook 44.

B. Whenever pay quantities of material are determined by weight, the material shall be weighed on scales furnished by CONTRACTOR and certified accurate by the state agency responsible. A weight or load slip shall be obtained from the weigh facility and delivered to the OWNER's representative at the point of delivery of the material.

C. If material is shipped by rail, the car weights will be accepted provided that actual weight of material only will be paid for and not minimum car weight used for assessing freight tariff, and provided further that car weights will not be acceptable for material to be passed through mixing plants.

D. Vehicles used to haul material being paid for by weight shall be weighed empty daily and at such additional times as required by OWNER. Each vehicle shall bear a plainly legible identification mark.

E. All materials that are specified for measurement by the cubic yard measured in the vehicle shall be hauled in vehicles of such type and size that the actual contents may be readily and accurately determined. Unless all vehicles are of uniform capacity, each vehicle must bear a plainly legible identification mark indicating its water level capacity. All vehicles shall be loaded to at least their water level capacity. Loads hauled in vehicles not meeting the above requirements or loads of a quantity less than the capacity of the vehicle, measured after being leveled off as above provided, will be subject to rejection, and no compensation will be allowed for such material.

F. Quantities will be based on ground profiles shown. Field surveys will not be made to confirm accuracy of elevations shown.

G. Where measurement of quantities depends on elevation of existing ground, elevations obtained during construction will be compared with those shown on Drawings. Variations of one foot or less will be ignored, and profiles shown on Drawings will be used for determining quantities.

H. Units of measure shown on the Schedule of Values shall be as follows (unless specified otherwise):

Item	Method of Measurement
AC	Acre - Field Measure by OWNER
CY	Cubic Yard - Field Measure by OWNER within the limits specified or shown

CY-VM	Cubic Yard - Measured in the Vehicle by Volume
EA	Each-Field Count by OWNER
GAL	Gallon-Field Measure by OWNER
HR	Hour
LB	Pound(s) - Weight Measure by Scale
LF	Linear Foot - Field Measure by OWNER
LS	Lump Sum - Unit is one; no measurement will be made
MFBM	Thousand Foot Board Measure - Delivery Invoice
SF	Square Foot
SQ IN	Square Inch
SY	Square Yard
TON	Ton - Weight Measure by Scale (2,000 pounds)

1.09 PAYMENT

A. Reference Article VII Contract Payments of the General Conditions.

B. General:

1. Progress payments will be made within 30 calendar days of receipt of payment request.

2. The date for CONTRACTOR's submission of monthly Application for Payment shall be established at the Pre-Construction Conference.

C. Payment for all Work shown or specified in the Contract Documents is included in the Contract Price. No measurement or payment will be made for individual items.

1.10 NONPAYMENT FOR REJECTED OR UNUSED PRODUCTS

A. Payment will not be made for the following:

1. Loading, hauling, and disposing of rejected material.

2. Quantities of material wasted or disposed of in a manner not called for under the Contract Documents.

3. Rejected loads of material, including material rejected after it has been placed, by reason of failure of CONTRACTOR to conform to provisions of the Contract Documents.

4. Material not unloaded from transporting vehicle.

5. Defective Work not accepted by the OWNER.

6. Material remaining on hand after completion of the Work.

1.11 PARTIAL PAYMENT FOR STORED MATERIALS AND EQUIPMENT

A. Partial payment for stored materials and equipment shall be in accordance with Article VII, Section 7.2 of the General Conditions of these Contract Documents and any revisions to said General Conditions as documented in the Supplementary Conditions.

B. Final Payment: Will be made only for products incorporated in Work; remaining products, for which partial payments have been made, shall revert to CONTRACTOR unless otherwise agreed, and partial payments made for those items will be deducted from final payment.

1.12 BID PROPOSAL ITEMS

A. Bidder will complete the Work for the following listed Work items for the prices listed on the Bid Proposal:

Item No. 1: Base Bid for the Maltsberger Tank Rehabilitation

1. Description – The complete SSPC-SP-10 cleaning and repainting of the 7.5 MG steel ground water storage tank in San Antonio, Texas on the interior surfaces and support members, and the complete SSPC-SP-6 cleaning and repainting of the exterior surfaces with full containment as outlined in SSPC Guide 6 Class 2A. Interior/exterior coatings shall be applied to carbon steel surfaces and shall not be applied to aluminum surfaces (i.e., those corresponding with the aluminum geodesic dome).

    a. Rehabilitation and replacement of specified items which includes, but is not limited to:

        i. Repair concrete foundation;

        ii. Regrout tank base;

        iii. Tank bottom inspection;

        iv. Repair overflow weir box;

        v. Replacement of sample tap;

        vi. Modifications to one existing 36-inch manway;

        vii. Replacement of one existing 24-inch manway;

        viii. New interior ladders with safety climb devices (as applicable);

        ix. New safety climb device for exterior ladder;

        x. Replacement of conduit from ladder side rails to independently supported brackets;

        xi. Relocation of vandal guard deterrent from ladder side rails to tank wall;

        xii. New check valve and other modifications to existing overflow pipe;

        xiii. New valves and fittings for tank drain lines;

        xiv. Modifications to existing drainage structure;

        xv. Modifications to existing rain gutter system;

        xvi. Replacement and relocation of existing analyzer drain piping;

xvii. Recoating of exterior of existing 48-inch inlet pipe;

xviii. New 36-inch tank inlet piping (including 36-inch butterfly valve);

xix. New 48-inch tank outlet butterfly valves;

xx. Replacement of screens around tank perimeter (where tank shell meets aluminum geodesic dome);

xxi. Replacement of skid-resistant stripes along walkways atop aluminum geodesic dome;

xxii. Replacement and relocation of all electrical instruments, analyzer panel, electrical panels, tank grounding system, conduits, and wiring;

xxiii. Replacement and relocation of electrical panels to new electrical rack (mounted on concrete slab);

xxiv. Replacement of cathodic protection system (except for existing rectifier panel).

b. Site Improvements, including but not limited to:

i. Demolition;

ii. Storm water management and erosion control;

iii. Rough site grading work;

iv. All appurtenances and miscellaneous improvements for a complete in-place facility.

c. CONTRACTOR mobilization and demobilization.

d. It should be noted that Bidder shall indicate the coating system manufacturer to be used by making a selection on the Bid Proposal.

2. Measurement – Measurement of Item No. 1 will be by Lump Sum.

3. Payment of the full Lump Sum price shall be paid for the work performed and in accordance with the Schedule of Values. Payment shall constitute full compensation to the CONTRACTOR for furnishing all labor, equipment, tools, and materials; and for performing all operations required to furnish to the OWNER the project, complete in place, as specified and as indicated in the Contract Drawings and Specifications.

Item No. 2: General Allowance

1. Description – This item shall be an allowance for items unforeseen or not specifically characterized in the Contract Documents, which are encountered during the course of construction.

2. Measurement – Measurement for the item “General Allowance” will be by time and materials. The usage of the allowance shall meet the requirements of the General Conditions for contract changes and shall be only by written authorization of the OWNER.

3. Payment of the not to exceed allowance price shall be paid for the work. Payment shall constitute full compensation to the CONTRACTOR for any items unforeseen or not

specifically characterized in the Contract Documents. CONTRACTOR shall provide a detailed breakdown for furnishing all labor, materials and equipment for payment.

Item No. S-1: Interior Grinding

1. Description – This item shall be for furnishing all labor, materials, tools, equipment and incidentals required for Interior Grinding of any irregular surfaces identified by the CONTRACTOR and authorized by the Field Inspector and Project Representative. Irregular surfaces shall be removed from all interior surfaces of the tank by grinding these irregular surfaces in accordance with the Project Specifications.

2. Measurement – Measurement of the item "Interior Grinding" will be by the number of grinding man-hours on the tank interior and shall be paid for by the unit price per hour listed on the Bid Proposal.

Item No. S-2: Pit Welding

1. Description – This item shall be for furnishing all labor, materials, tools, equipment and incidentals required for Pit Welding all areas of apparent pitting. Work areas shall be initially abrasive blast cleaned, and any pits identified for Pit Welding by the CONTRACTOR and authorized by the Field Inspector and Project Representative shall be repaired by welding.

2. Measurement – Measurement for the item "Pit Welding" shall be as follows: Any pit less than 1 square inch in area shall be counted as 1 square inch. The number of square inches of pit area filled by welding shall be paid for by the unit price per square inch listed on the Bid Proposal.

Item No. S-3: Seam Welding

1. Description – This item shall be for furnishing all labor, materials, tools, equipment and incidentals required for Seam Welding all areas of apparent seam deterioration. Work areas shall be initially abrasive blast cleaned, and any seam corrosion or undercut identified by the CONTRACTOR and authorized by the Field Inspector and Project Representative shall be repaired by arc-gouging and welding.

2. Measurement – Measurement of the item "Seam Welding" will be by the number of linear feet of seam welding and shall be paid for by the unit price per linear foot listed on the Bid Proposal.

Item No. S-4: Pit Filling

1. Description – This item shall be for furnishing all labor, materials, tools, equipment and incidentals required for Pit Filling. All areas of apparent pitting shall be initially abrasive blast cleaned, and any pits, rough areas, or seams identified for pit filling by the CONTRACTOR and authorized by the Field Inspector and Project Representative shall be repaired. Work areas shall be filled with solventless polyamide epoxy seam sealer of the type recommended by the manufacturer of the interior paint system.

2. Measurement – Measurement of the item "Pit Filling" shall be for the number of gallons of pit filling required and shall be paid for by the unit price per gallon listed on the Bid Proposal.

Item No. S-5: Additional Work

1. Description – This item shall be for furnishing all labor, materials, tools, equipment and incidentals required for Additional Work. It is felt that the detailed Plans and Technical Specifications adequately describe the work to be performed. However, in the event that during the course of the work it is found that additional work is required, Additional Work shall be authorized in writing by the OWNER and ENGINEER.

2. Measurement – Measurement for the item "Additional Work" shall be paid for at the following price per single man-hour, including all welding, equipment, normal rigging, labor, supplies, overhead, insurance, and profit. The number of unanticipated additional man-hours shall be paid for by the unit price per hour listed on the Bid Proposal.

Item No. S-6: Additional Tank Ventilation/Dehumidification

1. Description – This item shall be for furnishing all labor, materials, tools, equipment and incidentals required for Additional Tank Ventilation/Dehumidification. CONTRACTOR shall provide additional tank ventilation in conformance with Section 09900, Paragraph 1.03.C. "Ventilation" beyond the 48 hours called for in the final cost. This may be called for by the OWNER to help meet VOC testing requirements for the water.

2. Measurement – Measurement of the item "Additional Tank Ventilation /Dehumidification" shall be for the number of weeks of additional tank ventilation based on a seven (7) day week and shall be paid for by the unit price per week listed on the Bid Proposal.

Item No. S-7: Pressure Injection Grout Concrete Crack Repair

1. Description – This item shall be for furnishing all labor, materials, tools, equipment and incidentals required for Pressure Injection of Grout in all areas of apparent cracks larger than 0.1-inch in width around the concrete foundation of the steel tank. Work areas shall be initially cleaned and any cracks found by the CONTRACTOR and authorized by the Field Inspector and Project Representative shall be repaired by a pressure injection grout system.

2. Measurement – Measurement of the item "Pressure Injection Grout Concrete Crack Repair" shall be by the number of linear feet of cracks and shall be paid for by the unit price per linear foot listed on the Bid Proposal.

Item No. S-8: Welding Steel Floor Plates

1. Description – This item shall be for furnishing all labor, materials, tools, equipment and incidentals required for Welding Steel Floor Plates for all areas identified by the tank bottom inspection. Work areas shall be removed in their entirety, as authorized by the Field Inspector and Project Representative, and shall be repaired by welding.

2. Measurement – Measurement for the item "Welding Steel Floor Plates" shall be by the number of square feet of steel floor plate requiring replacement (as denoted in the tank bottom inspection report). The number of square feet of steel floor plate replaced by welding shall be paid for by the unit price per square foot listed on the Bid Proposal.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 02140

DEWATERING DURING CONSTRUCTION

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope of Work: The work to be performed under this section shall include the design and installation of a temporary dewatering system until completion of construction to dewater subsurface waters from structures and piping as required. CONTRACTOR shall be responsible for all permitting activities, including permit fees, associated with obtaining applicable permits from the State Water Management District having jurisdiction over the installation and operation of the dewatering system.

B. Related Work Described Elsewhere:

1. Section 02200: Earthwork

C. General Design

1. Storm structures, water pipes, sanitary pipes, sanitary structures, tank foundation, and building foundations may require dewatering. It is the CONTRACTOR's responsibility to determine the extent of the dewatering area and the requirements for construction.

1.02 QUALITY ASSURANCE

A. Qualifications: The temporary dewatering system shall be designed by a firm who regularly engages in the design of dewatering systems and who is fully experienced, reputable, and qualified in the design of such dewatering systems. The firm shall have a successful record of operation for a minimum of five (5) years prior to bid date. The design firm shall supply the ENGINEER with previous installation details of at least three (3) successful dewatering operations of a similar nature in the State of Texas.

B. In lieu of experience, the dewatering firm shall provide a performance and warranty bond for 1.5 times the total installed cost of the temporary dewatering system. This bond shall be executed prior to award and/or contract execution.

C. Standards: The dewatering of any excavation areas and the disposal of water during construction shall be in strict accordance with all Local and State government rules and regulations. If a permit is required by local groundwater district, the CONTRACTOR shall be responsible for obtaining said permit.

1.03 SUBMITTALS

A. Materials and Shop Drawings: Shop drawings required to establish compliance with the specifications shall be submitted in accordance with the provisions of Section 01300 – Submittals. At a minimum, submittals shall include the following:

1. Design Notes and Drawings.

2. Descriptive literature of temporary dewatering system.

3. Layout of all piping involved.

4. Bill of materials.

1.04 PUMPING AND DRAINAGE

A. CONTRACTOR shall at all times during construction provide and maintain proper equipment and facilities to remove all water entering excavations and shall keep such excavations dry to obtain a satisfactory undisturbed subgrade foundation condition until the fills, structures or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural levels. CONTRACTOR shall submit to the ENGINEER, for review, a plan for dewatering systems prior to commencing work. The dewatering system installed shall be in conformity with the overall construction plan and certification of this shall be provided by a Geotechnical Engineer. The Geotechnical Engineer shall be required to monitor the performance of the dewatering systems during the progress of the work and stipulate such modifications as may be required to assure that the systems are performing satisfactorily.

B. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation and to preserve the integrity of adjacent structures. At a minimum, the water level shall be two (2) feet below the trench or structure bottom. To minimize consolidation or settlement of soils below surrounding existing structures, a recharge system may be required to maintain groundwater levels to prevent any consolidation of soils under surrounding structures.

C. Water entering the excavation from surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and pumped from the excavation to maintain a bottom free from standing water.

D. CONTRACTOR shall take all additional precautions to prevent uplift of any structure during construction.

E. The conveying of water in open ditches or trenches will not be allowed. Permission to use any storm sewers or drains for water disposal purposes shall be obtained from the controlling authority. Any requirements and costs for such use shall be the responsibility of the CONTRACTOR. However, the CONTRACTOR shall not cause flooding by overloading or blocking up the flow in the drainage facilities and the CONTRACTOR shall leave the facilities unrestricted and as clean as originally found. Any damage to facilities shall be repaired or restored at no cost to the OWNER.

F. Flotation shall be prevented by the CONTRACTOR by maintaining a positive and continuous operation of the dewatering system. CONTRACTOR shall be fully responsible and liable for all damages which may result from failure of this system.

G. Removal of dewatering equipment shall be accomplished after the CONTRACTOR and the ENGINEER agree that the system is no longer required. The material and equipment constituting the system shall then be removed by the CONTRACTOR.

H. This project is within a public water supply area and therefore special consideration should be made to ensure that all necessary precautions have been made to preclude the

accidental discharge of fuel, oil, etc. to prevent adverse effects on groundwater or receiving water quality.

PART 2 PRODUCTS

2.01 GENERAL

A. The equipment specified herein shall be standard dewatering equipment of proven ability as designed, manufactured and installed by firms having experience in the design and production of such equipment. The equipment furnished shall be designed, constructed and installed in accordance with industry best practices and methods.

B. CONTRACTOR shall engage a Geotechnical Engineer registered in the State of Texas, to design the temporary dewatering system for all structures. CONTRACTOR shall submit a conceptual plan for the dewatering system prior to commencing work. The dewatering system installed shall be in conformity with the overall construction plan and certification of this shall be provided by the Geotechnical Engineer. The Geotechnical Engineer shall be required to monitor the performance of the dewatering system at the CONTRACTOR's expense during the progress of the work and stipulate such modifications as may be required to assure that the systems will perform satisfactorily. Dewatering system shall be designed in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at the proposed structures or utilities and to preserve the integrity of any adjacent structures.

PART 3 EXECUTION

3.01 PREPARATION

A. CONTRACTOR shall understand where existing utilities exist prior to constructing the dewatering system. All necessary precautions should be taken to preserve existing utilities so that they remain in service during construction.

3.02 INSTALLATION

A. Water entering the excavation from surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and pumped from the excavation to maintain a bottom free from standing water.

3.03 INSPECTION AND TESTING

A. CONTRACTOR's Geotechnical Engineer shall be required to assure that the dewatering system is operating properly.

B. CONTRACTOR's Geotechnical Engineer shall monitor the system performance and instruct any adjustment to the CONTRACTOR during construction.

3.04 PROTECTION AND SITE CLEAN-UP

A. At all times during the progress of the Work, the CONTRACTOR shall use all reasonable precautions to prevent the entrance of foreign material.

B. Immediately upon completion of construction activities, the CONTRACTOR shall remove all of his equipment, materials, and supplies from the site of the work, remove all surplus materials and debris, fill in all holes or excavations, and grade the site to

elevations of the surface levels which existed before work started. The site shall then be thoroughly cleaned and approved by the ENGINEER.

END OF SECTION

SECTION 02481

TREATMENT OF EXISTING TREES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Work specified in this section: Provide all labor, materials, transportation, and services necessary to furnish tree protection fencing, tree armor, watering, pruning and fertilization to existing trees.

1.02 RELATED WORK

A. The requirements of the "General and Supplementary Conditions of the Contract" and Division 1 specification sections shall apply to all work of this Section with the same force and effect as though repeated in full herein.

1. Section 01010 – Summary of Work
2. Section 02100 – Site Preparation
3. Section 02200 – Earthwork

1.03 REFERENCES

A. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

1.	ANSI Z60.1	(1996)	Nursery Stock.
2.	ANSI Z133.1	(1994)	Tree Care Operations – Pruning, Trimming, Repairing, Maintaining, and Removing Trees and Cutting Brush.
3.	ANSI A300	(1995)	Tree, Shrub and Other Woody Plant Maintenance – Standard Practices.

1.04 GOVERNING STANDARDS

A. Work procedures will be guided by the current provisions of the American National Standard Institute. Complete details of the provisions are found in the references listed. The two (2) basic objectives of the pruning operation shall include:

1. Hazard Reduction Pruning: Hazard reduction pruning shall be completed to remove visible hazards in a tree. Hazard pruning shall consist of one or more of the maintenance pruning types.
2. Maintenance Pruning: Maintenance pruning shall be completed to maintain and improve tree health and structure and includes hazard reduction pruning.

B. Watering Restrictions

1. General: Projects within the Extra-Territorial Jurisdiction (ETJ) and city limits of the City of San Antonio and SAWS customers shall observe all watering ordinances. See www.saws.orgfor current requirements.
2. Stage 1: See www.saws.org for current requirements.
3. Stage 2: See www.saws.org for current requirements.
4. Stage 3: See www.saws.org for current requirements.
5. Stage 4: See www.saws.org for current requirements.

1.05 DESCRIPTION OF WORK

A. CONTRACTOR shall employ a qualified Arborist to monitor construction activities that impact trees, pruning and feeding. Arborist is to be acceptable to the OWNER's Representative.

B. Arborist shall have the following minimum qualifications.

1. Membership in:
   a. NAA - National Arborist Association
   b. ISA - International Society of Arborists
2. Meet state requirements for insurance.
3. Licensed for application and use of pesticides.
4. Bonded.

1.06 SUBMITTALS

A. CONTRACTOR shall submit:

1. Certification: Copy of Arborist qualifications.
2. Mulch: Label from bag (Supplier's statement of analysis if bulk), and one (1) gallon container of mulch sample.
3. Fertilizer: Label from bag or Supplier's brochure.
4. Tree Armor: Cut sheet of wood and plywood.
5. Drip Irrigation: Cut sheet of drip line, valves, filters, air valves, and flush valves.

1.07 QUALITY ASSURANCE AND REQUIREMENTS

A. General: Comply with applicable Federal, State, County, and Local regulations governing, landscape materials and work.

B. Permits and Fees: CONTRACTOR shall obtain and pay for any and all permits and all inspections as required. CONTRACTOR shall also be responsible for all fees and costs involved for the work.

1. CONTRACTOR shall comply with City inspector directions with agreement from ENGINEER without additional cost to the OWNER.

C. Ordinances and Regulations: All local, municipal and state laws, and rules and regulations governing or relating to any portion of this work are hereby incorporated into and made a part of these specifications, and their provisions shall be carried out by the CONTRACTOR. Anything contained in these specifications shall not be construed to conflict with any of the above rules and regulations or requirements of the same. However, when these specifications and drawings call for or describe materials, workmanship, or construction of a better quality, higher standard, or larger size than is required by the above rules and regulations, the provisions of these specifications and drawings shall take precedence.

D. Personnel: Personnel shall be supervised by a Certified Arborist. Employ only experienced personnel who are familiar with the required work. Provide adequate supervision by a qualified foreman with minimum of five (5) years of experience.

1.08 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver packaged materials in containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery and while stored at site.

1.09 PROJECT CONDITIONS

A. Inspection: CONTRACTOR, Arborist and OWNER's Representative shall review pruning work to be completed prior to initiating work.

1.10 SCHEDULES

A. CONTRACTOR shall begin pruning and tree protection work upon acceptance of the Contract by the OWNER. Arborist shall submit a schedule for the work to be performed to the ENGINEER for approval.

1.11 PROTECTIONS

A. All items required to complete this contract remain the property and responsibility of the CONTRACTOR until final acceptance. Take adequate precautions to protect all existing trees. Cooperate fully with other trades to insure a satisfactory completion.

1.12 MAINTENANCE SERVICE

A. All existing trees to remain within shall have 6-inch layer of mulch at Root Protection Zone (RPZ) and to drip line and tree protection fencing properly maintained throughout construction work period.

PART 2 PRODUCTS

2.01 MATERIALS

A. Tree Barricade Fencing: Fabric of square link orange 4-foot width, high density polyethylene with 5 – 7 year life. Posts of 6-foot height studded T-posts with painted on finish for rust protection.

B. Mulch:

1. Mulch shall be free of deleterious material and shall be stored as to prevent inclusion of foreign material. Mulch shall be native shredded hardwood mulch, manufactured by Gardenville Horticultural Products, San Antonio, Texas, (210) 651-6115.

2. On-site existing tree mulch: Existing trees that are scheduled to be removed and removed branches may be grinded/double shredded and debris free.

3. Tree Wound Paint: Bituminous based paint of standard manufacture specifically formulated for tree wounds.

C. Fertilizer for Trees: Davey Arbor Green 30-10-7 for liquid suspended application, distributed by The Davey Company in San Antonio, Texas, (210) 698-0515.

D. Tree Armor:

1. Wood: SPFA utility grade, 2x4.

2. Plywood: SPFA utility grade, ¾-inch nominal thickness.

3. Wire: Annealed steel wire, 16-gauge minimum.

E. Drip Irrigation:

1. Rainbird XFS drip line as manufactured by Rainbird Irrigation, Inc. distributed by Longhorn Supply, San Antonio, Texas, (210) 340-3516. CONTRACTOR shall provide all necessary fittings and accessories as required by the manufacturer for the installation of the product. Drip line shall be XFS drip line, 12-inch o.c. emitters, 0.9 gallons per hour (gph).

2. Valve: Rainbird pre-assembled valve, filter and pressure regulator control zone kit.

3. Pressure Regulator: Pressure Regulator shall be Low flow for valves less than 4.5 gallons per minute (gpm) and High Flow for valves greater than 4.5 gpm.

4. Air/Vacuum Relief Valve, provide one per zone.

5. Flush Valve, provide one per zone.

PART 3 EXECUTION

3.01 PROTECTION FOR EXISTING TREES TO BE PRESERVED

A. All existing trees to remain within 30 feet of work on the project site shall be protected against damage from construction operations. Only remove those trees which are scheduled to be removed per plans. CONTRACTOR shall flag trees to remain for review by the ENGINEER.

B. CONTRACTOR shall erect fencing protection prior to beginning any clearing, demolition or construction activity, and maintain in place until construction is completed.

C. All trees to remain are to be protected by barricade fencing which is subject to approval of the ENGINEER. The tree protection barricade shall be placed before any excavating or grading is begun and maintained in good repair for the duration of the construction work. No material shall be stored or construction operation shall be carried on within the tree protection barricade.

D. Trees exposed to construction activity within the drip line or within 25 feet of any construction activity are to have trunks protected with tree armor. See requirements per tree armor section of this specification.

E. Tree protection barricade shall be erected at the edge of the drip line where possible. In circumstances where site improvements and construction operations interfere with fencing, fencing may be located at the edge of the root protection zone. The minimum distance the barrier shall be erected is five (5) feet from the trunk of tree or clump of trees.

F. Protect trees that are to remain, whether within barricade fencing or not, from the following:

1. Compaction of root area by equipment or material storage; construction materials shall not be stored closer to trees than the farthest extension of their limbs (drip line).

2. No vehicular traffic shall occur within the drip line of anytree.

3. The proposed finished grade within the root protection zone of any preserved tree shall not be raised or lowered more than three (3) inches. Retaining methods can be used to protect and/or provide lateral support to the area outside the root protection zone. No soil shall be spread, spoiled or otherwise disposed of under any tree within the drip line.

4. Cutting on roots by excavating, ditching, etc. Prior to excavation within the tree drip lines or the removal of trees adjacent to other trees that are to remain, make a clean cut between the disturbed and undisturbed root zones with a rock saw or similar equipment to minimize root damage.

5. Strangling by tying ropes or guy wires to trunks or large branches.

6. Poisoning by pouring solvents, gas, paint, etc., on or around trees and roots.

7. Trunk damage by moving equipment, material storage, nailing or bolting.

8. Damage of branches by improper pruning.

9. Drought from failure to water or by cutting or changing normal drainage pattern past roots. CONTRACTOR shall provide means as necessary to ensure positive drainage.

10. Changes of soil pH factor by disposal of lime base materials such as concrete, plaster, lime treatment at pavement subgrade, etc. When installing concrete adjacent to the root zone of a tree, use a minimum 6 mil plastic vapor barrier behind the concrete to prohibit leaching of lime into the soil.

G. Any damage done to existing tree crowns or root systems shall be repaired by the Arborist to the satisfaction of the OWNER's Representative. Broken branches shall be cut cleanly. Any roots cut shall be cut cleanly with a saw other means approved by the ENGINEER.

H. Repairs to the trees necessitated by damage caused through negligence of CONTRACTOR or his employees will be completed at the CONTRACTOR's expense. When trees other than those approved for removal are destroyed or killed, or badly damaged as a result of construction operations, the contract sum will be reduced by the value of the tree as determined by using the accepted International Society of Arboriculture's formula.

3.02 TREE ARMOR

A. Trees exposed to construction activity within the drip line or within 25 feet of any construction activity are to have trunks protected with tree armor to a height of 8 feet or to the limits of the lower branching in addition to barricade fencing. Butt 2x4's side to side completely around trunk. Wire wrap, do not nail, around trees. Maintain armor the duration of construction operations.

B. Where existing trees will be Root Zone (RPZ) shall be protected by plywood. Install 6-inch of shredded bark mulch and cover with ¾-inch plywood. Install both to drip line of tree(s).

C. Remove one week prior to Substantial Completion walkthrough.

3.03 ROOT PROTECTION ZONE

A. The root protection zone (RPZ) is measured with a radius from the trunk of 12-inch for each caliper inch of trunk measured at four and one-half (4-1/2') feet above grade or at the point where the smallest diameter closest to the branching occurs. No disturbance shall occur closer to the tree than one-half the radius of the RPZ or within five (5) feet of the tree whichever is greater.

3.04 ROOT PROTECTION ZONE IMPACTS

A. Those trees to remain which have some encroachment on their root protection zone shall have the following maximum allowable impacts:

1. No disturbance of natural grade (e.g., trenching or excavation) can occur closer to the tree than one-half the radius of the RPZ or within five (5) feet of the tree whichever is greater.

2. No cut or fill greater than three (3) inches will be located closer to the tree trunk than one-half the RPZ radius distance.

B. Existing trees to remain shall have a minimum of a six (6) inch layer of mulch placed and maintained over the root protection zone and to the drip line. Immediate pruning and shall occur per the pruning section of this specification.

3.05 ARBORIST'S REQUIREMENTS

A. General:

1. Arborist is to survey the condition of existing trees to remain. Notify ENGINEER of any problems/conditions affecting the livability of trees to remain. Document site as necessary.

2. Arborist is to install and/or inspect tree protection barriers before start of demolition and excavation activities. Notify ENGINEER of any problems/conditions that affect the livability of trees to remain.

3. Arborist is to observe excavation of site around existing trees from start of excavation until its conclusion. Arborist shall direct excavation which occurs near major root systems, relocation of roots, and installation of tree aeration systems as required to ensure livability and good health of trees. Arborist shall prescribe additional measures or protection required to provide optimal growth conditions at the construction site. Report any problems/conditions affecting the livability of trees to remain to ENGINEER.

4. Arborist shall make periodic inspections of the construction site for possibly dangerous or damaging practices, in relation to the existing trees, occurring or developing at the site. Inform ENGINEER of any problems/conditions and develop plan to repair damage that has occurred and prevent further damage.

B. Reports: Arborist shall provide a monthly inspection report of the construction site to the ENGINEER during the course of construction work.

3.06 EXCAVATION AT EXISTING TREES

A. Any excavation within the drip line of trees shall be under the direction of the Arborist. Excavate within the drip line of trees only where required and when absolutely necessary. Arborist shall be at site at all times while excavation is occurring within the drip line.

B. When excavation is required within drip line of trees, hand excavate to minimize damage to root systems. Use narrow tine spading forks and comb soil to expose roots. Relocate roots back into backfill areas wherever possible. If large main lateral roots are encountered, expose beyond excavation limits as required to bend and relocate without breaking.

C. If root relocation is not practical, clean cut roots using sharp ax approximately three (3) inches back from new construction. Paint all exposed root cuts with tree paint.

D. Where existing grade is higher than new finish grade, carefully excavate within the drip line to the new finish grade. Carefully hand excavate an additional eight (8) inches below the finish grade. Use narrow tine spading forks to comb the soil to expose the roots, and prune the exposed root structure as recommended by the Arborist. Keep the exposed roots damp by watering and mulch cover. Treat the cut roots as specified and as recommended by the Arborist. After pruning and treatment of the root structure is complete, backfill to finish grade with eight (8) inches of approved plant mix.

E. Temporarily support and protect roots against damage until permanently relocated and covered with recommended landscape material.

F. Where trenching is to occur within hitting distance of equipment to tree trunk, install tree armor per tree armor section of this specification.

G. Where removal of existing trees comes in conflict with existing hardscape/utilities to remain, the CONTRACTOR shall:

1. Coordinate with utility companies (if necessary).

2. Remove existing tree to grade.

3. Expose roots.

4. Use chainsaw to cut roots.

5. Grind stump 18-inch below grade.

6. Use trencher 2 – 3 feet deep to cut roots (if necessary).

3.07 WATERING REQUIREMENTS

A. Drought is defined as a protracted period of deficient precipitation resulting in extensive damage to plants, trees and lawn, resulting in loss.

B. During construction operations, provide water in a slow drip manner to existing trees (NSPI). Provide water to apply equivalent to 1 inch once per week to deeply soak in over the area within the drip line of the tree (NSPI). Spray tree crowns periodically to reduce dust accumulation on the leaves (NSPI).

C. At Stage 2, 3 and 4 (Section 1.4, B. Watering Restrictions), install drip line (gallons per hour) within the drip line of the trees at grade (NSPI). Install required drip valves with filters and pressure regulators with battery operated controllers (NSPI). Install 6-inch of mulch over drip irrigation. Protect valves as required (NSPI). All zones of temporary irrigation shall contain an isolation ball valve to separate from permanent irrigation system.

3.08 PRUNING

A. Pruning shall be required only at protected existing trees where the removal of limbs and branches is needed to provide clearance for work as approved by the OWNER's Representative or to repair damage to trees. Pruning shall be done per Paragraph 3.09 – Schedule. Pruning shall be completed to the satisfaction of the OWNER's Representative.

B. Pruning shall include but is not limited to removal of dead and broken branches, correction of structural defects or whenever the following conditions exist. Remove diseased wood, or structurally weak limbs that may cause a safety hazard. Remove branches that extend over buildings. Remove branches in front of windows and which obstruct traffic signs or street intersections. Provide clearance for emergency vehicles, buses, moving vans and similar vehicles along the streets. Prune trees according to their natural growth characteristics leaving trees well shaped and balanced.

C. Remove all ball moss, mistletoe, etc. from all existing trees.

3.09 SCHEDULE

A. Pruning shall be Class 1 Fine Pruning. All pruning shall be completed to accomplish the thinning of live branches. Thinning shall result in an even distribution of removal of branches on individual limbs and through-out the crown. Remove dead, dying, diseased and broken branches ½-inch in diameter or larger within the crown. No more than 25% of the crown shall be removed.

3.10 TREE CROWN PRUNING

A. Existing trees disturbed by construction shall have a maximum of 30 percent of the viable portion of a tree's crown removed as approved by the OWNER's Representative. Removal of more than 30 percent of the viable portion of a tree's crown will necessitate the tree's removal and replacement at the CONTRACTOR's expense. Replacement shall be governed at the ratio of 1 inch of new tree per inch of tree removed up to trees of size less than 24-inch caliper. For trees 24-inch caliper and greater, the ratio shall be 3 inches per new tree per inch of tree removed. Replacement trees shall have permanent irrigation bubblers and a one (1) year warranty.

3.11 STERILIZATION

A. All tools used will be sterilized with alcohol between trees.

3.12 PAINT CUTS

A. Paint cuts more than one-inch in diameter with an approved tree wound paint on all Oak species trees.

3.13 DISPOSAL

A. Wood and debris shall become property of the CONTRACTOR and shall be removed from the site. Cost of disposal to be paid by CONTRACTOR.

3.14 FERTILIZATION OF PRESERVED TREES

A. All existing trees that have root damage shall be fertilized. Feeding of existing trees shall be as follows:

1. Feeding shall be completed prior to construction of permanent improvements adjacent to all trees including site fill or paving including trenching operations.
2. Liquid tree fertilizer applied with a standard hydrant sprayer at a pressure of 100 to 200 psi shall be injected in slightly slanted holes approximately 12 inches in depth.
3. Concentration of suspension to be 40 pounds of fertilizer for trees in each 100 gallons of water. Application rate: six (6) pounds of actual nitrogen per 1,000 square feet of area under drip-line.
4. Holes are to be made in concentric circles and 3-foot on center around the tree with the last ring located at the drip line of the foliage of the trees.
5. Area beneath the drip line of the trees is to be well watered after the fertilization is placed.

3.15 MULCH

A. Mulch base of all existing trees with 6-inch deep mulch layer to RPZ or drip line which ever one is larger. If existing trees are grouped, the entire area is to be mulched in between the trees.

B. If acceptable to the OWNER, wood from tree removal and pruning activities can be grinded/ double shredded and used on site as mulch at locations as approved by OWNER's Representative. Mulch shall be less than 6-inch in length. All mulch shall be free of any debris.

3.16 CLEANUP

A. Wood and debris shall become property of the CONTRACTOR and shall be removed from the site. Cost of disposal to be paid by the CONTRACTOR.

END OF SECTION

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SECTION 02921

SEEDING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Seeding or hydroseeding; mulching and fertilizer.

B. Maintenance.

1.02 RELATED SECTIONS

A. Section 02200 - Earthwork

1.03 DEFINITIONS

A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.04 SUBMITTALS

A. Products:

1. Mulching Agent.

2. Certification of seed.

1.05 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer and herbicide composition.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable. Deliver seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.07 MAINTENANCE SERVICE

A. Furnish maintenance of seeded areas for three (3) months from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 SEED MIXTURE

A. Seed Mixture:

1. Grass Seed: Provide fresh, clean, new crop seed complying with tolerance for purity and germination established by the U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act and the Texas Seed Law.

   a. Seed which has become wet, moldy or otherwise damaged in transition in storage will not be accepted.

   b. Seed to be completely free of any objectionable foreign material that will hinder proper distribution.

   c. Seed to be treated with an approved fungicide by commercial or state laboratory not more than 6 months prior to date of planting.

   d. Seed rate to be Pure Live Seed (PLS). Minimum percent of PLS to be 90%. Seed type to be planted at the mixture, rate and planting conditions as follows:

      1) Hulled common Bermuda Grass (warm season grass) 2 pounds per 1000 square feet – May 1 to September 30.

      2) Perennial rye grass cool season grass – 6 pounds per 1000 square feet and unhulled common Bermuda Grass 2 pounds per 1000 square feet – October 1 to April 30.

2.02 ACCESSORIES

A. Mulching Agent: Wood cellulose fiber, dust form, free of growth or germination inhibiting ingredients.

B. Lawn Fertilizer: Complete fertilizer with an organic base, uniform in composition, dry and free flowing. Deliver fertilizer to site in original unopened containers, each bearing manufacturer's guaranteed statement of analysis. Fertilizer shall contain 12% nitrogen, 12% phosphoric acid, 12% potash, unless otherwise approved.

C. Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of grass.

D. Herbicide: Post emergent herbicide Round-Up by Monsanto Corp., or approved equal.

2.03 TESTS

A. Provide analysis of topsoil fill under provisions of Section 01400.

B. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content,

organic matter content, and pH value.

C. Submit minimum 10 oz; 16 oz sample of topsoil is proposed. Forward sample to approved testing laboratory in sealed containers to prevent contamination.

D. Testing is not required if recent tests are available for imported topsoil. Submit these test results to the testing laboratory for approval. Indicate, by test results, information necessary to determine suitability.

E. Provide recommendations on fertilization requirements for turf.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that prepared soil base is ready to receive the work of this Section.

3.02 PREPARATION

A. Prepare subgrade in accordance with Section 02200.

B. Place topsoil in accordance with Section 02200.

C. Install edging at periphery of seeded areas in straight lines to consistent depth.

3.03 INSTALLATION OF LAWN

A. General:

1. CONTRACTOR shall inspect and confirm final grade is free from ruts, uneven spots, and roughness. Final grade shall be smooth and free from large clods or debris. If this requirement is not met and lawn is installed, the grade shall be repaired to satisfaction of ENGINEER and hydromulch or sod re-installed at no cost to the OWNER.

2. CONTRACTOR is responsible for establishing a healthy and full stand of lawn of sod or seed. CONTRACTOR shall maintain lawn until established and approved by ENGINEER.

3. Winter rye grass installation shall be considered a temporary grass application. Should rye grass be installed, the CONTRACTOR shall return to site after March 15 to apply Bermuda Grass hydromulch.

4. Disturbed areas: All areas that are disturbed due to construction operations shall be hydromulched according to specifications. Any slopes 3:1 and greater shall be solid sodded per specifications. This will apply to areas on site whether or not identified on the plans.

3.04 FERTILIZING

A. Apply fertilizer in accordance with manufacturer's instructions; or at a rate recommended by the soils analysis.

B. Apply after smooth raking of topsoil and prior to roller compaction.

C. Do not apply fertilizer at same time or with same machine as will be used to apply seed.

D. Mix thoroughly into upper 2 inches of topsoil.

E. Lightly water to aid the dissipation of fertilizer.

3.05 HYDROMULCH SEEDING APPLICATION

A. Apply hydromulch slurry with a hydraulic seeder at rate of 45 pounds per 1000 square feet mulching agent and 7.6 pounds per 1000 square feet starter fertilizer.

1. Include seed at rate noted.

B. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.

C. Maintain watering as required to establish grass.

3.06 MAINTENANCE

A. Begin maintenance immediately after seeding. Maintenance shall continue until final acceptance of the project.

B. Watering: As necessary to keep top 4" of soil moist.

C. Water to prevent grass and soil from drying out.

1. Water for a minimum 30-day period after grass installation for acceptance of grass per approval of ENGINEER.

D. Roll surface to remove minor depressions or irregularities.

E. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.

F. Immediately reseed areas which show bare spots. Bare spots over 6-inch diameter in size will not be acceptable.

G. 30 days following establishment of the turf, fertilize the turf with lawn fertilizer at the rate to apply 1 pound of nitrogen per 1000 square feet.

H. Weeding: Remove weeds and foreign grass over bed and lawn areas at least once a week. Herbicides may be used only when approved by ENGINEER. Rake bed areas as required. Work will not be accepted with a presence of weeds in landscape.

I. Mowing and Edging: Mow and edge newly planted lawns weekly when growth reaches 2 ½-inch. Maintain at this height weekly.

J. Fertilizer, Pesticides, Insecticides, and Fungicides: It is the responsibility of the CONTRACTOR to insure plant material is in vigorous, healthy condition. Application of chemicals per manufacturer requirements and state and local codes is required as necessary to control any pest, insect, or fungal problems.

3.07 AREAS DISTURBED BY CONSTRUCTION

A. Recondition areas disturbed by construction operations including, but not limited to, graded areas, laydown areas, construction trailers and movement of vehicles. All compacted areas shall be tilled to 6" depth. Install 1 - 2" depth topsoil, rake smooth and free of any rock or other deleterious materials. Apply hydromulch seed as specified in these specifications. Solid sod all slopes 3:1 and greater. Install temporary irrigation as necessary to establish seeded and until accepted by the ENGINEER.

3.08 CLEAN UP AND PROTECTION

A. After seeding operations are finished, all paved areas shall be thoroughly cleaned by sweeping, and if necessary power washing.

B. Protect seeded areas with warning signs during maintenance period.

END OF SECTION

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SECTION 05120

STRUCTURAL STEEL

PART 1 GENERAL

1.01 SCOPE OF WORK

A. CONTRACTOR shall furnish, fabricate, and place all structural steel and make all connections necessary to provide a complete work and in accordance with the Contract Documents.

1.02 RELATED SECTIONS

A. General Requirements: Division 01.

1.03 REFERENCES

A. American Institute of Steel Construction (AISC):

1. Specification for Structural Steel Buildings – Allowable Stress Design and Plastic Design, excluding Section A7.1

2. Allowable Stress Design Specification for Structural Joints using ASTM A325 or A490 Bolts.

3. Manual of Steel Construction

4. Seismic Provisions for Structural Steel Buildings

5. Code of Standard Practice for Steel Buildings and Bridges, excluding Sections 3, 4, 7.11.3.3, 7.11.4, 7.11.5, and 7.13

6. AISC Quality Certification Program

7. AISC Erector Certification Program

B. American Society of Mechanical Engineers (ASME):

BPVC SEC IX Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing

C. American Society of Nondestructive Testing (ASNT):

ASNT-TC-IA Personnel Qualification and Certification in Nondestructive Testing

D. American Welding Society (AWS):

D1.1	Structural Welding Code-Steel
QC 1	Standard for AWS Certification of Welding Inspectors

E. ASTM International (ASTM):

A6	Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Steel Piling.
A36	Standard Specification for Structural Steel
A53	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
A123	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A143	Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedures for Detecting Embrittlement
A153	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
A307	Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
A325	Standard Specification for High-Strength Bolts for Structural Steel Joints
A384	Standard Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies
A385	Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip)
A490	Standard Specification for Heat-Treated Steel Structural bolts, 150 ksi Minimum Tensile Strength.
A500	Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
A501	Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
A563	Standard Specification for Carbon and Alloy Steel Nuts
A572	Standard Specification for High-Strength Low Alloy Columbium-Vanadium Structural Steel
A588	Standard Specification for High-Strength Low Alloy Structural Steel with 50 ksi Minimum Yield Point to 4 in. thick
A673	Standard Specification for Sampling Procedure for Impact Testing of Structural Steel
A780	Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
A992	Standard Specification for Steel for Structural Shapes for Use in Building Frames
B695	Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
F436	Standard Specification for Hardened Steel Washers

F959	Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners
F1852	Standard Specification for "Twist Off" Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/150 ksi Minimum Tensile Strength

1.04 SUBMITTALS

A. Provide shop drawings showing erection plans, member size and their connections.

B. Anchor bolt layouts.

C. Hardened washer details (if applicable).

D. Joint details for complete penetration welds

E. Schedules for fabrication procedures

F. Primer and other coatings for items in this Section

G. Name and address of manufacturer(s)

H. Product specifications

I. Manufacturers'/Fabricators' testing procedures and standards (QA/QC program)

J. Preparation and installation or application instructions, as appropriate

K. Mill Certificates of tests made in accordance with ASTM A6.

L. High-Strength Bolts (Plain Noncoated and Hot-Dip Galvanized):

1. Certificates of Compliance that products meet chemical and mechanical requirements of standards specified.
2. Manufacturer's inspection test report results for production lot(s) furnished, to include:
    a. Tensile strength
    b. Yield strength
    c. Reduction of area
    d. Elongation and hardness

M. Certified Mill Test Reports for Bolts and Nuts:

1. Name and address of manufacturer.
2. Bolts correctly marked.

3. Marked bolts and nuts used in required mill tests and manufacturer's inspection tests.

N. Direct Tension Indicators (DTIs): Furnish manufacturer's test report meeting requirements of ASTM F959.

O. Tension Control (TC) Bolts: Furnish manufacturer's test report meeting requirements of ASTM A325 and ASTM F1852.

P. Methods proposed to resolve misalignment between anchor bolts and bolt holes in steel members.

Q. AISC Quality Certification: AISC certificate showing name and address of certified firm, effective date, and category of certification.

1.05 QUALITY ASSURANCE

A. Mill identification marks in accordance with ASTM A6.

B. AISC Quality Certification for Fabricator: Conventional Steel Structures (Sbd).

C. Welding Qualifications:

1. AWS Certified Welding Fabricator: Certified in accordance with AWS Certified Welding Fabricator (CWF) program.

2. Welding Procedure Specifications: In accordance with AWS D1.1 (Annex E) or ASME BPVC SEC IX (Forms QW-482 and QW-483).

3. Welder/Welding Operator Performance Qualifications: In accordance with AWS D1.1 (Annex E), or ASME BPVC SEC IX (Form QW-484).

4. Certified Welding Inspector: Certified in accordance with AWS QC1, and having prior experience with the welding codes specified.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Load structural members in such a manner that they will be transported and unloaded without damage to coatings and without being excessively stressed, deformed, or otherwise damaged.

B. Storage:

1. Protect structural steel members and packaged materials from corrosion and deterioration.

2. Store in dry area and not in direct contact with ground.

3. Protect fasteners from dirt and moisture. Do not remove lubricant from bolts and nuts.

4. Handle materials to avoid distortion or damage to members or supporting structures.

PART 2 PRODUCTS

2.01 MATERIALS

A. Rolled Plates, Shapes except W-Shapes, and Bars: ASTM A36, unless indicated otherwise.

B. W-Shapes: ASTM A992, unless indicated otherwise on Drawings.

C. Plate material for frame connections shall be ASTM A572, Grade 50, where indicated on Drawings.

D. Steel Pipe: ASTM A53, Type E or S, Grade B.

E. Square and Rectangular Hollow Structural Sections (HSS): ASTM A500, Grade B (F_y equals 46 ksi).

2.02 FASTENERS

A. Anchor Bolts: As specified in Section 05500, METAL FABRICATIONS AND CASTINGS.

B. High-Strength Bolts: ASTM A325 or ASTM A490, bolt type 1, galvanized. Bolt length and thread length shall be as required for the connection type shown, with hardened washers as required.

C. Direct Tension Indicators (DTIs) or Load Indicator Washers:

1. ASTM F959, coating type to match bolt finish.

2. Type A325 or A490, to match bolt type.

3. Manufacturers and Products:

a. TurnaSure LLC, Langhorne, PA; DTI's.

b. Applied Bolting Technology Products, Ludlow, VT; DTI's, regular or Squirter type.

D. Tension Control (TC) Bolts:

1. High-strength, ASTM A325and F1852.

2. Manufacturers:

a. LeJeune Bolt Company, Burnsville, MN.

b. Nucor Fastener, Saint Joe, IN.

c. T.S. Bolts and Tools, Bristol Machine Co., Walnut, CA.

d. Haydon Bolts, Philadelphia, PA.

e. Vermont Fasteners Manufacturing, Swanton, VT.

E. Machine Bolts (M.B.): ASTM A307

F. Nuts: ASTM A563, type to match bolt type and finish.

G. Hardened Steel Flat and Beveled Washers: ASTM F436, type to match bolt finish.

H. Welded Shear Studs: As specified in Section 05500, METAL FABRICATIONS.

2.03 ANCILLARY MATERIALS

A. Surface Preparation and Primer: As specified in Section 09900, PAINTING AND COATING

B. Grout: As specified in Section 03600, GROUTING.

2.04 FABRICATION

A. General:

1. Fabricate as shown and in accordance with AISC Specification for Structural Steel Buildings and AISC Code of Standard Practice for Steel Buildings and Bridges.

2. Columns shall be full length members without splices, unless shown otherwise or approved by ENGINEER.

3. Mark and match mark materials for field assembly.

4. Complete assembly, including bolting and welding of units, before start of finishing operations.

5. Fabricate to agree with field measurements.

B. Connections:

1. Shop Connections: Weld or bolt, as shown.

2. Meet requirements of AISC Manual of Steel Construction tables for bolted double-angle shear connections, unless indicated otherwise.

3. Meet OSHA requirements for one independent bolt at beams framing in to column web connections.

4. Provide oversized holes for anchor bolts in column base plates in accordance with AISC Manual of Steel Construction, unless indicated otherwise.

C. Welded Construction:

1. Conform to governing welding codes for type of weld and material for each weld.

2. Groove and Butt Joint Welds: Complete penetration, unless otherwise indicated.

3. Interface with Other Work.

D. Holes:

1. As necessary or as indicated for securing other Work to structural steel framing, and for passage of other Work through steel framing members.

2. No flame-cut holes will be permitted without prior approval of ENGINEER.

3. Weld threaded nuts to framing, and other specialty items as shown to receive other Work.

E. Shop Paint Primer:

1. Surface Preparation and painting as specified in Section 09900, PAINTING AND COATING.

2. Do not shop prime the following surfaces, unless indicated otherwise:

a. Faying surfaces of slip critical bolted connections.

b. Within 2 inches of field-welded connections.

c. Steel members to be completely encased in reinforced concrete or coated with cementitious fireproofing.

F. Galvanizing:

1. Fabricate steel to be galvanized in accordance with ASTM A143, A384, and A385. Avoid fabrication techniques that could cause distortion or embrittlement of steel.

2. Remove welding slag, splatter, burrs, grease, oil, paint, lacquer, and other deleterious material prior to delivery for galvanizing.

3. Remove by blast cleaning or other methods surface contaminants and coatings not removable by normal chemical cleaning process in the galvanizing operation.

4. Hot-dip galvanize steel members, fabrications, and assemblies after fabrication in accordance with ASTM A123.

5. Hot-dip galvanize A325 bolts, nuts, washers, and hardware components in accordance with ASTM A153.

6. Oversize holes to allow for zinc alloy growth.

7. Shop assemble bolts, nuts, and washers with special lubricant and test in accordance with ASTM A325 and A563.

8. Tension-control (TC) bolts, nuts, and washers shall be mechanically zinc coated in accordance with ASTM F1852 and B695, Class 50.

9. Galvanize components of bolted assemblies separately before assembly.

G. Slip Critical Bolted Connections:

1. Mask faying surfaces of slip critical (SC) bolted connections to be shop painted as specified in Section 09900, PAINTING AND COATING.

2. Roughen galvanized faying surfaces with hand wire brushing.

2.05 SOURCE QUALITY CONTROL

A. Welding:

1. Provide a Manufacturers'/Fabricators' QA/QC program which includes welding oversight by an internal CWI. The CWI shall be present for fabrication and on-site during all welding production.

2. Visually inspect fabrication welds in accordance with AWS D1.1, Section 6 and Table 6.1, Visual Inspection Acceptance Criteria. The Minimum welding inspection program shall include:

a. Groove welds:

1) Radiographic (RT) or ultrasonic (UT) testing for 10 percent of randomly selected welds, unless otherwise indicated.

2) Use RT only for butt joint groove welds.

b. Fillet welds larger than 5/16-inch: Liquid penetrant (PT) or magnetic particle (MT) for 10 percent of randomly selected welds, unless otherwise indicated.

c. All Welds: 100 percent visually inspected (VT).

3. The Certified Welding Inspector (CWI) shall perform inspection prior and during assembly, during welding, and after welding. CWI duties include:

a. Verifying conformance of specified job material and proper storage.

b. Monitoring conformance with approved Welding Procedure Specification.

c. Monitoring conformance of Welder/Welding Operator Performance Qualification.

d. Inspecting weld joint fit-up and in-process inspection.

e. Providing 100 percent visual inspection of all welds.

f. Supervising nondestructive testing personnel and evaluating test results (if required).

g. Maintaining records and preparing report confirming results of inspection and testing comply with the Work.

4. Repair and retest rejected weld defects until sound weld metal has been deposited in accordance with appropriate welding codes.

B. Hot-Dip Galvanizing:

1. The Manufacturer/Fabricator may employ the services of an independent testing agency or provide qualified personnel to inspect and test hot-dip galvanized fabricated items in accordance with ASTM A123 and A153.

2. Visually inspect and test for thickness and adhesion of zinc coating for minimum of three (3) test samples from each lot in accordance with ASTM A123 and A153.

3. Reject and retest nonconforming articles in accordance with ASTM A123 and A153.

PART 3 EXECUTION

3.01 STEEL MEMBER ERECTION

A. Meet requirements of AISC Specification for Structural Steel Buildings and AISC Code of Standard Practice for Steel Buildings and Bridges, with exceptions as specified.

B. CONTRACTOR is responsible for design and installation of temporary bracing to support components as erection proceeds.

C. High-Strength Bolted Connections:

1. Tighten in accordance with AISC Specification for Structural Joints Using ASTM A325 or A490 Bolts.

2. Hardened Washers:

   a. Provide at locations required by Washer Requirements section of AISC Specification for Structural Joints Using ASTM A325 or A490 Bolts, to include slip critical connections using slotted or oversized holes or A490 bolts.

   b. Use beveled style and extra thickness where required by AISC Specification.

   c. Use square or rectangular beveled washers at inner flange surfaces of American Standard beams and channels.

   d. Do not substitute DTIs for hardened flat washers required at slotted and oversize holes.

3. For bearing-type connections not fully tensioned (N, X), tighten to snug tight condition. Use hardened washer over slotted or oversize holes in outer plies.

D. Fully Tensioned Bolted Connections:

1. Use DTIs or TC bolts at slip critical (SC) and fully tensioned (FT) bearing-type connections.

2. DTIs:

   a. Position within bolted assembly in accordance with ASTM F959.

   b. Install bolts, with DTIs plus hardened washers as required, in all holes of an assembly and tighten until plies are in firm contact and fasteners are uniformly snug tight.

3. Final tighten bolts, beginning at most rigid part of bolted connection and progressing toward free edges, until final twist-off of TC bolts or until DTIs have been compressed to an average gap equal to or less than shown in Table 2, ASTM F959.

E. Welded Connections:

1. Welding and Fabrication by Welding: Conform to AWS D1.1 Structural Welding Code based on material and type of weld.

2. Groove and Butt Joint Welds: Complete penetration, unless otherwise indicated.

3.02 ANCHOR BOLTS

A. Coordinate installation of anchor bolts and other connectors required for securing structural steel to in-place work.

B. Provide templates and other devices for presetting bolts and other anchors to accurate locations.

C. Projection of anchor bolts beyond face of concrete and threaded length shall be adequate to allow for full engagement of all threads of hold-down nuts, adjustment of leveling nuts, washer thicknesses, and construction tolerances, unless indicated otherwise.

D. Placement Tolerances:

1. As required by AISC Code of Standard Practice for Steel Buildings and Bridges, unless indicated otherwise.

2. Embedded anchor bolts shall not vary from the dimensions as shown on Drawings by more than the following:

a. Center to center of any two bolts within an anchor group: 1/8 inch.

b. Center to center of adjacent anchor bolt groups: 1/4 inch.

c. Variation from perpendicular to theoretical bearing surface: 1:50.

3.03 SETTING BASES AND BEARING PLATES

A. Clean concrete and masonry bearing surfaces of bond reducing materials and roughen to improve bond to bearing surfaces.

B. Clean bottom surface of base and bearing plates.

C. Set loose and attached base plates and bearing plates for structural members on wedges, shims, leveling nuts, or other adjustable devices. Use leveling plates where indicated on Drawings.

D. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to placing grout. Weld plate washers to base plates where indicated in Drawings.

E. Grout Under Base Plates: As specified in Section 03600, GROUTING, prior to placing loads on structure.

3.04 FIELD ASSEMBLY

A. Set structural frames accurately to lines and elevations shown.

B. Clean bearing surfaces and other surfaces that will be in permanent contact before assembly.

C. Align and adjust various members forming a part of a complete frame or structure before permanently fastening.

D. Level and plumb individual members of structure within tolerances shown in AISC Code of Standard Practice for Steel Buildings and Bridges.

E. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be completed and in service.

F. Perform necessary adjustments to compensate for minor discrepancies in elevations and alignment.

G. Provide additional field connection material as required by AISC Code of Standard Practice for Steel Buildings and Bridges.

H. Splice members only where indicated and accepted on shop drawings.

3.05 MISFITS AT BOLTED CONNECTIONS

A. Where misfits in erection bolting are encountered, immediately notify ENGINEER for approval of one of the following methods of correction:

1. Ream holes that must be enlarged to admit bolts and use oversized bolts.

2. Plug weld misaligned holes and redrill holes to admit standard size bolts.

3. Drill additional holes in connection, conforming with AISC Standards for bolt spacing and end and edge distances, and add additional bolts.

4. Reject member containing misfit, incorrect sized, or misaligned holes and fabricate new member to ensure proper fit.

B. Do not enlarge incorrectly sized or misaligned holes in members by burning or using a drift pin.

3.06 MISFITS AT ANCHOR BOLTS

A. Resolve misalignments between anchor bolts and bolt holes in steel members in accordance with approved submittal.

B. Do not flame cut to enlarge holes without prior approval of ENGINEER.

3.07 GAS CUTTING

A. Do not use gas cutting torches in field for correcting fabrication errors in structural framing.

B. Secondary members not under stress and concealed in finished structure may be corrected by gas cutting torches, if approved by ENGINEER.

C. Finish flame-cut sections equivalent to sheared and punched appearance.

3.08 REPAIR AND CLEANING

A. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop primer.

B. Remove and grind smooth tack welds, fit-up-lugs, and weld runoff tabs.

C. Remove weld back-up bars and grind smooth where indicated on Drawings.

D. Apply touchup paint primer by brush or spray of same thickness and material as that used in shop application and as specified in Section 09900, PAINTING AND COATING.

3.09 REPAIR OF DAMAGED HOT-DIP GALVANIZED COATING

A. Conform to ASTM A780.

B. For minor repairs at abraded areas, use sprayed zinc conforming to ASTM A780.

C. For flame cut or welded areas, use zinc-based solder, or zinc sticks, conforming to ASTM A780.

D. Use magnetic gauge to determine that thickness is equal to or greater than base galvanized coating.

3.10 FIELD QUALITY CONTROL

A. High-Strength Bolted Connections:

1. The Manufacturers'/Fabricators' CWI will perform the following inspection and testing in accordance with the AISC Specification for Structural Joints Using ASTM A325 or A490 Bolts:

    a. Marking identification and conformance to ASTM standards.

    b. Alignment of bolt holes.

    c. Placement, type, and thickness of hardened washers.

    d. Tightening of bolts.

2. Bearing-Type Connections Not Fully Tensioned (N, X): Snug tight condition with plies of joint in firm contact.

3. Fully Tensioned (FT) Bearing and Slip Critical (SC) Connections:

   a. Conduct preinstallation test.

   b. Monitor installation and tightening of DTIs or TC bolts.

   c. Monitor condition of faying surfaces for slip critical connections.

4. Preinstallation Test:

   a. Conduct jobsite test prior to start of work using a bolt tension measuring device.

   b. Select representative sample of not less than three bolts of each diameter, length, and grade.

   c. Include DTIs and flat hardened washers as required to match actual connection assembly.

   d. Conduct test in accordance with Specification for Structural Joints Using ASTM A325 or A490 Bolts.

5. Nondestructive Testing (NDT) Report: Prepare and submit a written NDT report identifying location of inspected bolted connections and summary of corrections as required to meet code acceptance criteria (if applicable)

6. Defective Connections: Correct and reinspect defective and improperly tightened high-strength bolted connections. Retest fully tensioned bolts as necessary to demonstrate compliance of completed work.

B. Welded Connections:

1. Visually inspect field welds in accordance with AWS D1.1, Section 6 and Table 6.1, Visual Inspection Acceptance Criteria.

2. The Manufacturers'/Fabricators' CWI shall perform the following inspection and testing of field welds.

3. Unless otherwise specified, perform nondestructive testing (NDT) of welds at a spot testing frequency as shown below in accordance with the referenced welding codes. Perform ultrasonic on complete joint penetration groove welds that cannot be readily radiographed. In case there is a conflict the higher frequency level of NDT shall apply:

   a. Complete Joint Penetration (CJP) Butt Joint Welds: 10 percent random Radiographic (RT).

   b. Groove Welds:

1) Radiographic (RT) or ultrasonic (UT) testing for 10 percent of randomly selected welds, unless otherwise indicated.

2) Use RT only for butt joint groove welds.

c. Fillet Welds Larger Than 5/16 Inch: Liquid penetrant (PT) or magnetic particle (MT) testing for 10 percent of randomly selected welds, unless otherwise indicated.

d. Partial Joint Penetration (PJP) Groove Welds: 10 percent random PT or MT.

e. All Welds: 100 percent visually inspected (VT).

4. Weld Acceptance:

a. Visual Testing:

1) Structural Pipe and Tubing: AWS D1.1, paragraph 6.9, Visual Inspection, Tubular Connections.

2) All Other Structural Steel: AWS D1.1, paragraph 6.9, Visual Inspection, Statically Loaded Nontubular Connections.

3) Stud Connections: AWS D1.1, paragraph 7.8.1.

b. Ultrasonic Testing: Perform UT of CJP groove welds in accordance with AWS D1.1, paragraph 6.13.3, Class R Indications.

c. Radiographic Testing: Perform RT of CJP butt joint welds in accordance with AWS D1.1, paragraph 6.12.1.

d. PT or MT:

1) Perform on fillet and PJP groove welds in accordance with AWS D1.1, paragraph 6.10.

2) Acceptance shall be in accordance with VT standards specified above.

5. The CWI shall be present whenever field welding is performed. The CWI shall perform inspections prior and during assembly, during and after welding. CWI duties include:

a. Verifying conformance of specified job material and proper storage.

b. Monitoring conformance with approved WPS.

c. Monitoring conformance of WPQ.

d. Inspecting weld joint fit-up and in-process inspection.

e. Providing 100 percent visual inspection of all welds.

f. Supervising nondestructive testing personnel and evaluating test results.

g. Maintaining records and preparing report confirming results of inspection and testing comply with the Work.

6. Repair and retest rejected weld defects until sound weld metal has been deposited in accordance with appropriate welding codes.

END OF SECTION

SECTION 09871

EXTERIOR COATING SYSTEM FOR STEEL STORAGE TANKS

PART 1 GENERAL

1.01 SECTION INCLUDES:

A. The exterior surfaces included are all exterior surfaces of the tank, including but not limited to:

1. the reservoir/container;
2. wind girder;
3. all inlet/outlet and overflow piping appurtenances;
4. exposed exterior concrete;
5. vents, manholes, ladders, platforms; and
6. bolts, threads, nuts, pins, brackets, seams, corners, knife edges, welds, etc.

B. Specifications for the coating of the exterior surfaces of existing steel water storage tanks.

C. Preparations of all exterior surfaces which are to receive coating are included in this Section.

D. Paintings of all exterior surfaces which are to receive coating are included in this Section.

E. Exterior primers, intermediate, and finish coats for steel water storage tanks.

1.02 RELATED SECTIONS

A. Section 09900 – General Specifications for Coating Systems

PART 2 PRODUCTS

2.01 COATING SCHEDULE

A. Acceptable coating manufacturers and specifications for the exterior surfaces of steel water storage tanks, exterior piping and valves and exposed exterior concrete surfaces follow; however, the CONTRACTOR is advised that all Manufacturers presented below must submit and certify that the coatings furnished are in compliance with these Specifications and the Manufacturer's recommendations.

B. Tank Exterior Coating System to be of the same Manufacturer of all other coating products used on this project and shall be as follows:

1. Sherwin-Williams

Coat	Product	DFT (mils)	Color
Prime Coat	Macropoxy 646	5 - 7 mils	Mill White
Stripe Coat	Macropoxy 646		Beige
Intermediate Coat	Macropoxy 646	5 - 7 mils	Beige
Finish Coat	FluoKem HS	2 - 3 mils	Pantone #545C (Light Blue)
Minimum and Maximum DFT for System		13 - 17 mils	

2. Carboline

Coat	Product	DFT (mils)	Color
Prime Coat	Carboguard 60	4 - 6 mils	Mill White
Stripe Coat	Carboguard 60		Beige
Intermediate Coat	Carboguard 60	4 - 5 mils	Beige
Finish Coat	Carboxane 950	2 - 3 mils	Pantone #545C (Light Blue)
Minimum and Maximum DFT for System		10 - 14 mils	

3. PPG

Coat	Product	DFT (mils)	Color
Prime Coat	Amerlock 2/400	4 - 6 mils	Mill White
Stripe Coat	Amerlock 2/400		Beige
Intermediate Coat	Amerlock 2/400	4 - 6 mils	Beige
Finish Coat	Coraflon ADS Intermix	2 - 3 mils	Pantone #545C (Light Blue)
Minimum and Maximum DFT for System		10 - 15 mils	

4. Tnemec

Prime Coat	Hi-Build Epoxoline Series 66	4 - 6 mils	Mill White
Stripe Coat	Endura-Shield Series 73		Beige
Intermediate Coat	Endura-Shield Series 73	4 - 5 mils	Beige
Finish Coat	Series 700 Hydroflon	2 - 3 mils	Pantone #545C (Light Blue)
Minimum and Maximum DFT for System		10 - 14 mils	

5. Thinners: Only thinners recommended and furnished by the chosen coating Manufacturer shall be used to thin the paint products.

C. Exterior Valves and Piping Coating System to be of the same Manufacturer of all other coating products used on this project and shall be as follows:

1. Sherwin-Williams

Coat	Product	DFT (mils)	Color
Prime Coat	Epoxy Mastic II	5 - 10 mils	Aluminum
Stripe Coat	Macropoxy 646		Beige
Intermediate Coat	Macropoxy 646	5 - 10 mils	Beige
Finish Coat	Hi-Solids Polyurethane	3 - 5 mils	Pantone #284C (Safety Blue)
Minimum and Maximum DFT for System		13 – 25 mils	

2. Carboline

Coat	Product	DFT (mils)	Color
Prime Coat	Carbomastic 15	4 - 6 mils	Aluminum
Stripe Coat	Carboguard 60		Beige
Intermediate Coat	Carboguard 60	4 - 6 mils	Beige
Finish Coat	Carbothane 134HG	2 - 4 mils	Pantone #284C (Safety Blue)
Minimum and Maximum DFT for System		10 – 16 mils	

3. PPG

Coat	Product	DFT (mils)	Color
Prime Coat	Chembuild Series 135	4 - 6 mils	Aluminum
Stripe Coat	N69 Hi-Build Epoxo-line II		Beige
Intermediate Coat	N69 Hi-Build Epoxo-line II	4 - 6 mils	Beige
Finish Coat	N69 Hi-Build Epoxo-line II	2 - 5 mils	Pantone #284C (Safety Blue)
Minimum and Maximum DFT for System		10 – 17 mils	

4. Tnemec

Coat	Product	DFT (mils)	Color
Prime Coat	Amerlock 2/400	5 - 6 mils	Aluminum
Stripe Coat	Amerlock 2/400		Beige
Intermediate Coat	Amerlock 2/400	5 - 6 mils	Beige
Finish Coat	Amercoat 450HS	2 - 3 mils	Pantone #284C (Safety Blue)
Minimum and Maximum DFT for System		12 – 15 mils	

D. Exposed Exterior Concrete Surfaces (Tank Foundation):

1. Exposed exterior concrete surfaces including Tank Foundation to be blast cleaned to remove any paint drips and expose bare concrete.

PART 3 – EXECUTION

3.01 SURFACE PREPARATION

A. Rough Areas: These paragraphs apply to rough areas created during the repair and repainting processes. This Work is not included in the **Supplementary Unit Price Items** and shall be included in the **Base Price**.

1. Burrs, sharp edges, corners, weld spatter, or rough welds which would cause difficulty in achieving a defect free coating shall be ground smooth.

2. The objective of the grinding is to eliminate sharp edges and corners in order to provide a surface for the application of a uniform thickness coating without voids.

B. Surface Preparation: All exterior surfaces to be primed shall be cleaned in compliance with the SSPC-SP6, Commercial Blast Cleaning Specifications. Exposed exterior concrete surfaces shall be Commercial Blast Cleaned per SSPC-SP7, Brush Blast Cleaning. All cleaning shall be in accordance with Section 09900 – General Specifications for Coating Systems.

C. Surface Contamination: The surface to be painted shall be free from dust, moisture, mud, oil, grease, or other foreign material which would cause coating adhesion problems. If tests by the Field Inspector find questionable amounts of contamination on the steel substrates or painted substrates to be top-coated, a representative of the paint Manufacturer may be called to examine the substrates in question and assist in determining if the substrates are in accordance with these Specifications and the Manufacturer's recommendations.

3.02 APPLICATION

A. Priming:

1. Not later than the same day and before the formation of rust, the prepared (SSPC-SP 6) surfaces shall be primed with the specified primer.

2. Once the entire exterior surfaces have been blasted and painted and sufficient cure has taken place, the CONTRACTOR shall then pressure wash the exterior to remove all residual blasting dust and debris prior to moving to the stripe coat. Any areas found to flash rust shall be sanded and touched up.

3. The primer shall not be applied closer than 6 inch to an uncleaned surface.

B. Stripe Coat:

1. Special attention shall be given to welds, member intersections, lapped joints, corners, bolts, nuts, threads, knife edges and other deviations from smooth surfaces. These areas shall be primed by brush with a 10% thinned coat, after the complete priming and before the application of the intermediate coat. A one-inch overlap on

weld seams, knife edges and angles is needed. Pinholes, runs and/or sags shall be addressed prior to moving to the next coat.

C. Intermediate Coat:

1. After adequate curing of the prime coat and the stripe coat, all primed exterior surfaces shall be given a full intermediate coat of the specified paint in a different color than the primer. The color shall be slightly darker than that chosen for the finish coat, being dark enough to visually assure application of the finish coat.

D. Finish Coat:

1. After adequate curing of the intermediate coat, the entire exterior surfaces shall be given a final coat of the specified paint in the OWNER's selected color.

2. Tank Exterior Color: Pantone #545C (Light Blue) or as selected by the OWNER.

3. Potable Water Piping; Pantone #284C or as selected by the OWNER.

E. Coating Systems Labeling:

1. Following the application of the final coat of the exterior finish color, the CONTRACTOR shall stencil with black paint the entire interior tank coating system and the entire exterior tank coating system to the back side of the ladder vandal deterrent or other location as directed by the OWNER.

END OF SECTION

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SECTION 09910

COATING FOR EXPOSED ITEMS

PART 1 - GENERAL

1.1 SUMMARY

A. CONTRACTOR shall furnish all materials, labor, equipment, and incidentals required to provide a protective coating system for the surfaces listed herein and not otherwise excluded. All surfaces described shall be included within the scope of this Section.

B. The work does not include the steel storage tank which is covered by Sections 09871, 09872 and 09900. The work includes painting and finishing of interior and exterior exposed items and surfaces such as walls, floors, miscellaneous metal, doors, frames, construction signs, posts, pipes, fittings, valves, equipment, and all other work obviously required to be painted unless otherwise specified herein or on the Drawings. The work includes both new construction and all existing facilities that will be upgraded as part of the Project, including, but not limited to, walls, piping, metals, and pumps. The omission of minor items in the schedule of work shall not relieve the CONTRACTOR of his obligation to include such items where they come within the general intent of the Specifications as stated herein. The following major items of the Project shall be coated, including both new and existing construction:

1. Submerged surfaces and surfaces exposed to potable water of any ferrous metal and aluminum components of equipment, piping, fittings and valves (except stainless steel).

2. Exposed ferrous surfaces of equipment, pumps, motors, and ferrous or galvanized metal fittings and accessories.

3. Exposed ferrous metal surfaces and ferrous or galvanized metal fittings and accessories.

4. Exposed surfaces of PVC components of piping, fittings, valves, electrical conduit, and equipment.

5. Exposed exterior surfaces of all metallic piping, fittings, and valves.

6. Embedded aluminum or aluminum in contact with dissimilar metals or in contact with corrosive atmospheres.

C. "Paint" as used herein means all coating systems, materials, including primers, emulsions, enamels, epoxies, sealers and fillers, and other applied materials whether used as a prime, intermediate, or finish coats.

D. The following items will not be painted unless otherwise noted:

1. Any code-requiring labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name or nomenclature plates.

2. Any moving parts of operating units, such as valve and damper operators, linkages, sensing devices, and motor and fan shafts.

3. Aluminum or fiberglass handrails, walkways, toeboards, windows, louvers, grating, checker plate, hatches, and stairways.

4. Stainless steel angles, tube, pipe, etc.

5. Products with polished chrome, aluminum, nickel, or stainless steel finish.

6. Stainless steel, brass, bronze, and aluminum other than exposed utility tubing.

7. Flexible couplings, lubricated bearing surfaces, insulation, and plastic pipe or duct interiors.

8. Plastic switch plates and receptacle plates.

9. Signs and nameplates.

10. Finish hardware.

11. Packing glands and other adjustable parts, unless otherwise indicated.

12. Portions of metal, other than aluminum, embedded in concrete. This does not apply to the back face of items mounted to concrete or masonry surfaces which shall be painted before erection. Aluminum to be embedded in, or in contact with, concrete shall be coated to prevent electrolysis.

E. Description of Colors and Finishes:

1. Color Selection:

a. ENGINEER reserves the right to select non-standard colors for paint systems specified within ability of paint manufacturer to produce such non-standard colors. Provide such colors at no additional expense to OWNER.

2. Color Coding of Pipelines, Valves, Equipment, and Ducts:

a. Color-coding of pipelines, valves, equipment and ducts shall comply with applicable standards of ANSI A13.1, ANSI Z535.1, CFR 1910.144, Recommended Standards for Water Works, and Recommended Standards for Wastewater Facilities. For piping and equipment not covered by the above standards, conform to OWNER's color standards.

b. For equipment located on roofs and equipment that is exposed-to-view, color will be selected by ENGINEER.

3. Color Coding of Pipelines and Equipment:

a. Finish coats of paint for pipelines and equipment shall be coded in basic colors. Colors shall be brilliant, distinctive shades matching the following safety and pipeline colors per ANSI Z535.1, Recommended Standards for Water Works; Recommended Standards for Wastewater Facilities, color specifications for safety colors and other primary colors:

TABLE 09900-A

TABLE OF STANDARD COLORS

Color	**Designation***
Aqua	Aqua Sky: 10GN
Black	Black; 35GR
Blue	True/Safety Blue; 11SF
Brown	Terra Cotta; 07RD
Charcoal	Deep Space; GR34
Dark Blue	Old Glory Blue; 78BL
Dark Brown	Medium Bronze; 85BR
Dark Gray	Blackthorn; GR31
Gray	Gray-ANSI 61; 33GR
Green	Spearmint/Safety Green; 09SF
Light Blue	Fontainebleau; 25BL
Light Brown	Twine; 68BR
Light Gray	Light Gray; 32GR
Light Green	Misty Jade; GB38
Olive	Clover; 110GN
Orange	Tangerine/Safety Orange; 04SF
Red Candy	Apple/Safety Red; 06SF
White	White; 11WH
Yellow	Lemon/Safety Yellow; 02SF

* Color designations are provided per Tnemec Company, Inc. paint color numbers and are provided as a standard of quality; equivalent colors matching these colors are acceptable. Provide with Shop Drawing submittal direct color comparisons of color numbers available from manufacturer submitted.

b. General Color Code: Unless otherwise specified, use the following color code per TCEQ regulations:

TABLE 09900-B

PIPELINE COLOR TABLE

Pipeline	**Color**
WATER	
Air Conditioning Water	Blue
Backwash Water	Light Blue
Potable Water	Light Blue
Waste Water	Dark Gray
AIR AND GAS	
Blower Air	Light Green
Hydrogen	Red
CHEMICALS	
Sodium Hypochlorite Solution	Yellow
Fluoride	White with Yellow Bands
PROCESS	
Floor Drains	Dark Gray
Storage Tank Overflow	Brown
Storage Tank Drains	Dark Gray
Storm Drains	Dark Gray
Sump Drains	Dark Gray

c. Color of final coats shall match as closely as possible, without custom blending, color tabulated for specific pipeline service.

4. After approval by ENGINEER of colors and Shop Drawings and prior to commencing painting work, ENGINEER will furnish color schedules for surfaces to be painted.

1.2 RELATED WORK

A. Paint piping and equipment for identification purposes in accordance with Section 15000 – Mechanical General Requirements.

1.3 DEFINITIONS

A. Refer to ASTM D16 for definitions of terms used in this Section.

1.4 REFERENCE STANDARDS

A. ASTM International:

1. ANSI (American National Standards Institute)

2. NSF Standard 61 – Drinking Water Components – Health Effects

3. AWWA (American Water Works Association)

4. OSHA (Occupational Safety & Heath Administration)

5. NFPA (National Association of Pipe Fabricators)

6. SSPC (Society for Protective Coatings)

   a. SP COM – Surface Preparation Commentary for Steel and Concrete Substrates.
   b. SP-1 – Solvent Cleaning.
   c. SP-2 – Hand Tool Cleaning.
   d. SP-3 – Power Tool Cleaning.
   e. SP-5 – White Metal Blast Cleaning.
   f. SP-6 – Commercial Blast Cleaning.
   g. SP -7 – Brush-Off Blast Cleaning.
   h. SP-10 – Near-White Blast Cleaning.

7. NACE International.

B. All paints and materials which comes into contact with raw water shall conform to AWWA standards and/or Texas Commission on Environmental Quality (TCEQ) regulations as they may apply to potable water and shall be NSF (Standard 61) approved. The manufacturer furnishing the coating material shall furnish certification to the ENGINEER/OWNER that the materials meet these agency provisions.

1.5 QUALITY ASSURANCE

A. Provide the best quality grade of the various types of coatings as regularly manufactured by approved paint material manufacturers. Materials not displaying the manufacturer's identification as a standard, best-grade product will not be acceptable.

B. Provide undercoat paint produced by the same manufacturer as the finish coats. Undercoat and finish coat paints shall be compatible. Use only thinners approved by the paint manufacturer, and use only within recommended limits.

C. Painting shall be accomplished by experienced painters specializing in industrial painting familiar with all aspects of surface preparations and applications required for this project. Work shall be done in a safe and workmanlike manner.

D. MPI Standards:

1. Comply with indicated MPI standards.

2. Products: Listed in MPI - Approved Products List.

E. Surface Burning Characteristics:

1. Fire-Retardant Finishes: Maximum 25/450 flame-spread/smoke-developed index when tested according to ASTM E84.

1.6 SUBMITTALS

A. Section 01300 - Submittals: Requirements for submittals.

B. Materials and Shop Drawings: Submit to the ENGINEER as provided in Division 1 – General Conditions and Section 01300 – Submittals: Shop Drawings, Working Drawings, and Samples, shop drawings, manufacturer's specifications, and data on the proposed paint systems and detailed surface preparation, application procedures and dry film thickness (DFT).

C. Schedule

1. CONTRACTOR shall submit for approval a complete typewritten Schedule of Painting Operations within 90 days after the Notice to Proceed. This Schedule is imperative so that the various fabricators or suppliers may be notified of the proper prime coat to apply. It shall be the CONTRACTOR's responsibility to properly coordinate the fabricators' or suppliers' surface preparation and painting operations with these Specifications. This Schedule shall include for each surface to be painted, the brand name, generic type, solids by volume, application method, the coverage and the number of coats in order to achieve the specified dry film thickness, and color charts. When the Schedule has been approved, the CONTRACTOR shall apply all material in strict accordance with the approved Schedule and the manufacturer's instructions. Wet and dry paint film gauges may be utilized by the OWNER or ENGINEER to verify the proper application while work is in progress.

2. It is the intent of this Section that as much as possible all structures, equipment, and piping utilize coating systems specified herein supplied by a single manufacturer. All exceptions must be noted on the Schedule. For each coating system, only one (1) manufacturer's product shall be used.

D. Color Samples: Manufacturer's standard color charts for color selection by OWNER.

E. Samples- Painting

1. Paint colors will be selected by the OWNER. Compliance with all other requirements is the exclusive responsibility of the CONTRACTOR.

2. Samples of each finish and color shall be submitted to the OWNER or ENGINEER for approval before any work is started.

3. Samples shall be prepared so that an area of each sample indicates the appearance of the various coats. For example, where three (3) coat work is specified, the sample shall be divided into three (3) areas:

a. One (1) showing the application of one (1) coat only.

b. One (1) showing the application of two (2) coats.

c. One (1) showing the application of all three (3) coats.

4. Such samples when approved in writing shall constitute a standard, as to color and finish only, for acceptance or rejection of the finish work.

5. For piping, valves, equipment and miscellaneous metal work, provide sample chips or color charts of all paint selected showing color, finish, and general characteristics.

6. Rejected samples shall be resubmitted until approved.

F. CONTRACTOR shall submit to the OWNER, immediately upon completion of the job, certification from the manufacturer indicating that the quantity of each coating purchased was sufficient to coat all surfaces, in accordance with the requirements of this Section. Such certification shall make reference to square footage figures provided to the manufacturer by the CONTRACTOR.

G. Product Data:

1. Include description of physical properties of products including solids content and ingredient analysis, VOC content, temperature resistance, typical exposures and limitations.

a. Regulatory requirements: Submit data concerning the following:
1) VOC limitation
2) Coatings containing lead compounds and PCBs.
3) Abrasives and abrasive blast cleaning techniques and disposal.

H. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

I. Manufacturer Instructions: Submit special surface preparation procedures and substrate conditions requiring special attention.

J. Field Quality-Control Submittals: Indicate results of CONTRACTOR-furnished tests and inspections.

K. Qualifications Statements:

1. Submit qualifications for manufacturer and applicator.

2. Submit manufacturer's approval of applicator.

L. Operation and Maintenance Data: Submit information on cleaning, touchup, and repair of painted and coated surfaces.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years' documented experience.

B. Applicator: Company specializing in performing Work of this Section with minimum five years' documented experience and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 – Materials and Equipment: Requirements for transporting, handling, storing, and protecting products.

B. Deliver all materials to the job site in original, unopened packages and containers bearing manufacturer's name and label in accordance with Section 01600 – Materials and Equipment.

1. Provide labels on each container with the following information:

a. Name or title of material.

b. Fed. Spec. number if applicable.

c. Manufacturer's stock number, date of manufacture and expiration date (shelf life).

d. Manufacturer's formula or specification number.

e. Manufacturer's batch number.

f. Manufacturer's name.

g. Generic type.

h. Contents by volume, for major pigment and vehicle constituents.

i. Application instructions: thinning, ambient conditions, etc.

j. Color name and number.

2. Containers shall be clearly marked to indicate any hazards connected with the use of the paint and steps which should be taken to prevent injury to those handling the product.

C. All containers shall be handled and stored in such a manner as to prevent damage or loss of labels or containers.

D. Used rags shall be removed from the buildings every night and every precaution taken against spontaneous combustion.

E. Inspection:

1. Accept materials on Site in manufacturer's sealed and labeled containers.

2. Inspect for damage and to verify acceptability.

F. Store materials in ventilated area and otherwise according to manufacturer instructions.

G. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.

2. Provide additional protection according to manufacturer instructions.

1.9 WARRANTY AND GUARANTEES

A. Refer to Section 01700 – Contract Closeout.

B. All paint and coatings work performed under these Specifications shall be guaranteed by the coatings applicator for 100 percent of the total coated area for both materials and labor against failures during the warranty period.

C. Failure under this warranty shall include flaking, peeling, or delaminating of the coating due to aging, chemical attack, or poor workmanship; but it shall not include areas which have been damaged by unusual chemical, thermal, or mechanical abuse.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

1. Carboline Company

2. Tnemec Company

3. Porter International

4. Sherwin-Williams

2.2 MATERIALS

A. All paint shall be manufactured by one of the suppliers listed in Paragraph 1.03E., herein, and shall be their highest grade of paint.

B. The following coating systems list a product by name to establish a standard of quality; other products of the same generic types may be submitted to the ENGINEER for approval as described in Paragraph 1.04., herein. When other than the specified coating system is proposed, the CONTRACTOR shall submit a typewritten list giving the proposed coatings, brand, trade name, generic type and catalog number of the proposed system for the ENGINEER's approval.

C. Paint used in successive field coats shall be produced by the same manufacturer. Paint used in the first field coat over shop painted or previously painted surfaces shall cause no wrinkling, lifting,

or other damage to underlying paint. Shop paint shall be of the same type and manufacture as used for field painting by the CONTRACTOR.

D. Emulsion and alkyd paints shall contain a mildewcide and both the paint and mildewcide shall conform to OSHA and Federal requirements, including Federal Specification TT-P- 19.

E. Finish coats containing lead shall not be allowed. Oil shall be pure boiled linseed oil.

2.3 COATING SYSTEMS

A. Class 1 Exposures – Not Used

B. Class 2 Exposures – Not Used

C. Class 3 Exposures – Not Used

D. Class 4 Exposures - Not Used

E. Class 5 Exposures – Not Used

F. Class 6 Exposures – Not Used

G. Class 7 Exposures - Plastic Piping, Valves, Fittings, and Conduit, Interior and Exterior

1. Class 7 exposures consist of PVC or fiberglass piping or electrical systems requiring color coding, and for protection of exposed, exterior plastic components from the elements, and shall include the following:

    a. PVC and fiberglass (FRP) piping, fittings, valves, and electrical conduits requiring color coding in accordance with Section 15000 – Mechanical General Requirements.

    b. Exposed exterior plastic piping, valve, and fitting components subject to UV degradation and weathering by the elements.

2. Surface Preparation: As specified in Paragraph 3.02 herein, including cleaning and washing with detergent to remove all dirt and foreign material, and light surface abrasion using medium grade sandpaper. Remove dust, dirt and debris with clean rags prior to coating.

3. Class 7 Coating System:

    a. Prime Coat: Two component epoxy. Tnemec Series 66 Hi-Build Epoxoline at 3.0 mils DFT.

    b. Finish Coats for exterior surfaces: Tnemec Series 73 Endurashield at 3.0 mils DFT.

    c. Finish coat for interior exposure: Tnemec Series 66 Hi-Build Epoxoline at 3.0 mils DFT.

    d. Total minimum system finish coating thickness shall be 6 mils DFT.

H. Class 8 Exposures – Aluminum

1. Class 8 exposures consist of aluminum surfaces embedded or in contact with concrete, mortar or plaster, or aluminum in contact with dissimilar metals which may cause corrosion due to electrolysis, and shall include the following:

    a. Aluminum surfaces in contact with concrete, mortar or plaster, such as hatch cover frames, etc.

    b. Aluminum surfaces in contact with dissimilar metals which may cause corrosion due to electrolysis.

2. Surface Preparation: As specified in Paragraph 3.02 herein, including solvent cleaning in accordance with SSPC-SP1 standards for solvent cleaning and scarification.

3. Class 8 Coating System:

    a. Prime Coat: Two component polyamide epoxy. Tnemec Series 66 Hi-Build Epoxoline at 3.0 mils DFT.

    b. Finish Coats for Aluminum Exposed to View: Two-component, high build, acrylic urethane. Tnemec Series 73 Endurashield at 3.0 mils DFT.

    c. Finish Coat for Aluminum Not Exposed to View: Polyamide cured coal tar epoxy. Tnemec Series 46H-413 Hi-Build Tneme-Tar applied at 16.0 mils DFT.

    d. Total minimum system finish coating thickness shall be 19.0 mils DFT for areas not exposed to view or 6.0 mils for areas exposed.

I. Class 9 Exposures - Metals Exterior Exposed

1. Class 9 exposures consist of exterior metal surfaces exposed to the weather and environment.

    a. Pumps, motors, equipment, and appurtenances

    b. Above ground piping, fittings, valves, and metal conduit

    c. Miscellaneous metal surfaces

    d. Ladders, stairways, structural steel

    e. Roof mounted equipment, hatches, fans, etc.

    f. Galvanized and non-ferrous metal surfaces

    g. Other surfaces obviously requiring field painting

2. Surface Preparation: As specified in Paragraph 3.02 herein and, in addition, the following:

a. All bare metals or areas that were shop primed that have been damaged shall be abrasive blast cleaned to SSPC-SP6, commercial blast cleaning standards.

b. Shop primed items, stored on site for a prolonged period prior to coating, shall be prepared for coating following the coating manufacturer's recommendations prior to applying touch-up and subsequent coats. Surface preparation may include brush-off abrasive blasting or spot blasting to SSPC-SP6, commercial blast cleaning standards, for areas where the primer has been damaged and bare metal is showing.

c. Non-ferrous metals shall be degreased and cleaned by washing with a water based dispersant such as Carboline Surface Cleaner #3. Rinse thoroughly with clean water after cleaning.

3. Class 9 Coating System

a. Prime coat for ferrous and non-ferrous metal: Two part epoxy primer. Tnemec's Series 140, must be white, at 4.0 mils DFT.

b. Intermediate coat for ferrous metal: Two part epoxy. Tnemec Series 140 with a beige color at 3.0 mils DFT.

c. Finish coat for ferrous and non-ferrous metal: High Build Acrylic Polyurethane. Tnemec similar to Hydroflon Series 700 at 3.0 mils DFT.

d. Total minimum system finish shall be 7.0 mils DFT for non-ferrous metal and 10.0 mils DFT for ferrous metal surfaces.

J. Class 10 Exposures –Not used

K. Class 11 Exposures – Not Used

L. Class 13 Exposures – Not Used

M. Class 14 Exposures – Not Used

N. Class 15 Exposures – Not Used

O. Class 16 Exposures – Not Used

P. Class 17 Exposures – Not Used

Q. Class 18 Exposures – Not Used

PART 3 - EXECUTION

3.1 SHOP PAINTING

A. Surface Preparation - All ferrous metal to be primed in the shop shall have all rust, dust and scale, as well as all other foreign substances, removed by sandblasting or pickling in accordance with

SSPC-SP5 or SP8, respectively. Cleaned metal shall be primed or pretreated immediately after cleaning to prevent new rusting. Under no circumstances will cleaned metal be allowed to sit overnight before priming, or pretreatment and priming. All nonferrous metals shall be solvent cleaned prior to the application of primer. In addition, galvanized surfaces which are to be topcoated shall first be degreased then primed.

B. Materials Preparation

1. Mix and prepare painting materials in strict accordance with manufacturer's recommendations and directions, stirring materials before and during application to maintain a mixture of uniform density, free of film, dirt and other foreign materials.

2. No thinners shall be used except those specifically mentioned and only in such quantity as directed by the manufacturer in his instructions. If thinning is used, sufficient additional coats shall be applied to assure the required dry film thickness is achieved. The manufacturer's recommended thinner or clean-up solvent shall be used for all clean-up. Application by brush, spray, airless spray or roller shall be as recommended by the manufacturer for optimum performance and appearance.

C. Application

1. All painting shall be done by skilled and experienced craftsmen and shall be of highest quality workmanship. Coating systems shall be as specified herein.

2. Apply paint in accordance with the manufacturer's directions. Use applicators and techniques best suited for the type of material being applied.

3. All paint and coatings materials shall be stored under cover and at a temperature within 10°F of the anticipated application temperature and at least 5°F above the dew point.

4. Apply additional coats when undercoats, stains, or other conditions show through the final coat of paint, until the paint film is of uniform finish, color, and appearance.

5. Paint shall be applied in a neat manner with finished surfaces free of runs, sags, ridges, laps, and brush marks. Each coat shall be applied in a manner that will produce an even film of uniform and proper thickness.

6. Paint back sides of access panels and removable or hinged covers to match the exposed surfaces.

7. Equipment manufacturer or supplier shall provide touch-up paint for items with shop applied finish coats.

8. Where specified in the individual Sections, primer coat(s) shall be applied in the shop by the equipment manufacturer. The shop coats shall be as specified and shall be compatible with the field coat or coats.

D. Certification: CONTRACTOR shall obtain from the equipment manufacturer or supplier, prior to shipment of equipment, a written certification that surface preparation, coating brand, material, DFT, and application method complied with this Section.

3.2 SURFACE PREPARATION

A. All dirt, rust, scale, splinters, loose particles, disintegrated paint, grease, oil, and other deleterious substances shall be removed from all surfaces which are to be coated.

B. Hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items and surfaces not to be painted which are in contact with or near surfaces to be painted shall be removed, masked, or otherwise protected prior to surface preparation and painting operations. Refer to Paragraph 3.09B.

C. Before commencing work, the painter must make certain that surfaces to be covered are in proper condition and must obtain ENGINEER's approval to proceed. Should the painter find such surfaces impossible of acceptance, he shall report such fact to the ENGINEER. The application of paint shall be held as an acceptance of the surfaces and working conditions and the painter will be held responsible for the results reasonably expected from the materials and processes specified. Reference the paint manufacturer’s product data sheet for specific surface preparation requirements prior to product application.

D. Program the cleaning and painting so contaminants from the cleaning process will not fall onto wet, newly-painted surfaces.

E. Ferrous Metal Surfaces

1. Remove any oil or grease from surfaces to be coated with clean rags soaked in toluol or other solvent recommended by coating manufacturer in accordance with SSPC specifications. Any chemical contamination shall be eliminated by means of neutralization or flushing or both prior to additional surface preparation.

2. For immersion service, all sharp edges and welds shall be ground smooth to a rounder contour, all weld splatter shall be removed, and all pits and dents shall be filled, and all imperfections shall be corrected prior to sandblasting.

3. For non-immersion service, all sharp edges and welds shall be ground, all weld splatter shall be removed, all pits and dents shall be filled, and all imperfections shall be corrected prior to sandblasting.

4. For immersion service, all surfaces to be coated shall be sandblasted to white metal in accordance with Steel Structures Painting Council Specification SP-5. A white metal blast is defined as removing all rust, scale, paint, etc., to a clean white metal which has a uniform gray-white appearance. No streaks or stains or rust or any other contaminants are allowed. The proper abrasive to obtain the specified surface profile (anchor pattern) designated in the coating manufacturer's most recent printed application instructions shall be used. After sandblasting, dust and spent sand shall be removed from the surfaces by brushing or vacuum cleaning. The prime coat shall be applied as soon as possible after the blasting

preparation is finished and always before the surface starts to rust. No sandblasted surface shall stand overnight before coating.

5. For non-immersion service, or wherever specified in the coating manufacturer's most recent printed application instructions for other services, all surfaces to be coated shall be sandblasted to near white metal in accordance with Steel Structures Painting Council Specification SP-10. A near white metal blast is defined as removing all rust, scale, paint, etc., except for very light shadows, very slight streaks or slight discolorations caused by rust stain, mill scale oxides, or slight, tight residues of paint or coatings that may remain. The proper abrasive to obtain the specified surface profile (anchor pattern) designated in the coating manufacturer's most recent printed application instructions shall be used. After sandblasting, dust and spent sand shall be removed from the surfaces by brushing or vacuum cleaning. The prime coat shall be applied as soon as possible after the blasting preparation is finished and always before the surface starts to rust. No sandblasted surface shall stand overnight before coating.

6. Where blast cleaning is done in the field, only "virgin" sand, grit, or abrasive will be used.

7. Inaccessible areas, such as skip-welded lap joints, or in between back-to-back angle iron bracing, shall be coated before assembly to prevent corrosive action from taking place in these inaccessible areas. All surface voids shall be seal-welded. Sharp corners and edges shall be ground to a smooth contour and welds prepared as described above.

F. Wood Surfaces: Wood shall be clean and dry. Remove surface deposits of sap or pitch by scraping and wiping clean with rags dampened with mineral spirits or VM & P Naphtha. Seal knots and pitch pockets with shellac reduced with equal parts of shellac thinner (denatured alcohol) before sandpaper and finishing with fine grit and remove sanding dust. After the prime coat is dry, fill cracks and holes with putty or spackling compound. When filler is hard, sand flush with the surface using fine grit sandpaper. Sand lightly between coats with fine grit, open-coated sandpaper

G. Galvanized Steel and Non-Ferrous Metal

1. Galvanized steel and aluminum will only be coated when so specified.

2. Surfaces shall be clean and dry. Remove dust and dirt by blowing off the surface with high pressure air or wiping clean with dry rags. Oil, grease and protective mill coatings shall be removed by solvent cleaning in accordance with SSPC-SPl.

3. White rust should be removed from galvanized steel or aluminum by hand or power brushing. Care should be taken not to damage or remove the galvanizing. Rust should be removed from old galvanized steel by Hand or Power Tool Cleaning in accordance with SSPC-SP2 or SP3.

4. Other surface preparation as outlined in the coating manufacturer's latest written application instructions shall be observed for more demanding exposures.

H. Stainless Steel

1. Stainless steel will only be coated when so specified, or when it is adjacent to areas to be coated such as piping supports, anchor bolts or flange bolts.

2. Stainless steel requires only solvent cleaning prior to coating using any one of the methods in SSPC-SP1. Only solvents and cleaning solutions containing less than 200 ppm of halogens should be used to prevent stress corrosion cracking.

3. Stainless steel may be whip-blasted to provide a surface profile to increase the mechanical bond of the coating system. The height of the profile and the texture required shall be defined for the operator and as a standard for the acceptance of the work. Pictorial standards for the surface cleanliness of carbon steel are not applicable to stainless steel, since there are no corrosion products or mill scale to remove from the surface.

4. Abrasive blast cleaning procedures outlined by Steel Structures Painting Council for carbon steel may also be used for stainless steel. Only very hard silica sand or other abrasive media shall be used for a fast cutting action and to obtain a sharp angular profile.

I. PVC or Other Plastic Piping or Ductwork

1. Solvent clean.

2. If recommended by manufacturer, lightly abrade surface with medium grade sandpaper. Remove dust by wiping with clean rags. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

3.3 MATERIALS PREPARATION

A. Mix and prepare painting materials in strict accordance with manufacturer's recommendations and directions, stirring materials before and during application to maintain a mixture of uniform density, free of film, dirt, and other foreign materials.

B. Except where otherwise specified, thinning shall be done only if necessary for the workability of the coating material and then, only in accordance with the coating manufacturer's most recent printed application instructions. Use only thinner provided by coating manufacturer. If thinning is used, sufficient additional coats shall be applied to assure the required dry film thickness is achieved. The manufacturer's recommended thinner or clean-up solvent shall be used for all clean-up. Application by brush, spray, airless spray or roller shall be as recommended by the manufacturer for optimum performance and appearance.

3.4 APPLICATION

A. Paint all exposed surfaces in rooms scheduled for painting whether or not colors are designated in schedules, except where the natural finish of material is obviously intended and specifically noted as a surface that will not be painted. Where items or surfaces are not specifically mentioned, paint these the same as adjacent similar materials or areas. If color of finish is not designated, the ENGINEER will select these from standard colors available for the materials systems as specified.

B. Color Selection

1. Colors for Multi-Coat Systems: Each coat shall be applied in a different color or shade from the preceding coat to aid in determining the uniformity and coverage of the coating. The finish coat color shall be selected by the OWNER or ENGINEER. When a white finish coat is specified, the last two (2) coats shall be white.

2. Color Coding Piping: All exposed piping shall be identified as specified in Section 15000 – Mechanical General Requirements.

C. All painting shall be done by skilled and experienced craftsmen and shall be of highest quality workmanship.

D. Apply paint in accordance with the manufacturer's directions. Use applicators and techniques best suited for the type of material being applied. All equipment shall be maintained in good working order and shall be comparable to that described in the coating manufacturer's most recent application instructions. It shall be thoroughly cleaned and inspected daily. Worn spray nozzles, tips, etc., shall be replaced regularly. Effective oil and water separators shall be used and serviced on all air lines.

E. All paints and coating materials shall be stored under cover and at a temperature within 10°F of the anticipated application temperature and at least 5°F above the dew point.

F. Apply additional coats when undercoats, stains, or other conditions show through the final coat of paint, until the paint film is of uniform finish, color, and appearance.

G. Paint shall be applied in a neat manner with finished surfaces free of runs, sags, ridges, laps, and brush marks. Each coat shall be applied in a manner that will produce an even film of uniform and proper thickness. Allow each coat to dry thoroughly before applying the next coat following manufacturer's recommendations taking into account temperature and relative humidity.

H. All interior surfaces of structures shall be finish coated prior to installation of equipment, conduit, and other exposed items. Paint back sides of access panels and removable or hinged covers to match the exposed surfaces.

I. Finish exterior doors on tops, bottoms, and side edges the same as the exterior faces, unless otherwise indicated.

J. Sand lightly between each succeeding enamel or varnish coat.

K. Omit the field primer on metal surfaces which have been shop-primed and touch-up painted, unless otherwise specified.

L. The prime and intermediate coats as specified for the various coating systems may be applied in the shop by the manufacturer. The shop coats shall be of the type specified and shall be compatible with the field coating. Items such as pumps, motors, equipment, electrical panels, etc. shall be given at least one touch-up coat with the intermediate coating material and one (1) complete finish coat in the field. Do not apply finishes to surfaces that are not dry.

3.5 APPLICATION RESTRICTIONS

A. Environmental Requirements

1. Comply with manufacturer's recommendations as to environmental conditions under which coatings and coating systems can be applied.

    a. The conditions below shall be adhered to even if manufacturer's recommendations are less stringent. If manufacturer's recommendations are more stringent, they shall apply.

    b. No coatings shall be applied when the air, surface, and material temperature is below 55°F or above 95°F for 24 hours prior to and 24 hours after coating application. Surface temperature shall be at least 5°F above the dew point for 24 hours prior to and 24 hours after coating application. The dew point shall be determined by use of a sling psychrometer in conjunction with U.S. Weather Bureau psychometric tables. Do not apply coatings when the relative humidity exceeds 85 percent or to damp or wet surfaces, unless otherwise permitted by the coating manufacturer's printed instructions. No painting shall be done when the surfaces may become damaged by rain, fog or condensation.

    c. When it is anticipated that these conditions will prevail during the drying period, unless suitable enclosures to protect the surface are used. Where heat is necessary, it shall be supplied by the painting applicator and shall be of such type that it will maintain an air and coated surface temperature of 55°F minimum prior to and after the coating application as described above, and 90°F minimum during the cure stage if hot air forced curing is recommended by the coating manufacturer for special coatings. Further, this heater shall be of such type as not to contaminate the surface area to be or being coated with combustion products. CONTRACTOR shall supply utilities to run electric or gas heaters. Any surface coating damaged by moisture or rain shall be removed and redone as directed by the OWNER or ENGINEER.

2. Do not apply finish in areas where dust is being or will be generated during application through full cure.

3. All exterior painting shall be done only in dry weather.

4. Spray application shall occur only when wind velocities, including gusts, are less than 10 miles per hour. All materials, equipment, etc. in the vicinity of spray application shall be protected from overspray.

B. Application of materials shall be done only on properly prepared surfaces as herein specified. Between any two coats of material, unless specifically covered in the coating manufacturer's most recent printed application instructions, if more than one (1) week passes between subsequent coats, the coating manufacturer shall be contacted for his recommended preparation of the surface prior to application of the next coat. This preparation might include brush-off blasting, steam cleaning, or solvent wiping (with an indicated solvent) and shall be specified in writing by the material supplier and followed by the applicator. Any surface coating damaged by moisture or rain shall be removed and redone as directed by the OWNER or ENGINEER.

C. In no case shall paint be applied to surfaces which show a moisture content greater that 14 percent. The presence of moisture shall be determined prior to coating by testing with a moisture detection device such as a Delmhorst Model DLM2E.

3.6 MINIMUM COATING THICKNESS

A. Coating thickness shall meet or exceed the specified minimum dry film thickness (DFT) in all areas. The average coating thickness as determined by multiple representative DFT measurements shall meet or exceed the mid-point of the specified DFT range. If the measured DFT is below this value, the surface shall be recoated with at least the minimum DFT until the total DFT meets or exceeds the mid-point DFT.

B. Coverage rates are theoretical as calculated by the coating manufacturer and are, therefore, the maximum allowable.

C. Apply a prime coat to material which is required to be painted or finished, and which has not been prime coated by others.

D. On masonry, application rates will vary according to surface texture; however, in no case shall the manufacturer's stated coverage rate be exceeded. On porous surfaces, is shall be the painter's responsibility to achieve a protective and decorative finish either by decreasing the coverage rate or by applying additional coats of paint.

E. Recoat primed and sealed walls and ceilings where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.

3.7 FINISHES

A. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

B. Complete Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not in compliance with specific requirements.

3.8 FIELD QUALITY CONTROL

A. CONTRACTOR shall request acceptance of each coat by the OWNER's representative before applying the next coat; and the CONTRACTOR shall provide the necessary properly calibrated gauges. All nonferrous surfaces shall be checked for number of coats and thickness by use of a Tooke gauge. All ferrous surfaces shall be checked for film thickness by use of an Elcometer or Micro-Test magnetic dry film gauge properly calibrated. In addition, submerged tank linings and metals shall be tested for freedom from holidays and pinholes by use of a Tinker-Rasor or K-D Bird Dog Holiday Detector. All defects shall be corrected to the satisfaction of the OWNER.

3.9 PROTECTION

A. All other surfaces shall be protected while painting.

B. Protection of furniture and other movable objects, equipment, fittings, and accessories shall be provided throughout the painting operation. Remove all electric plates, surface hardware, etc., before painting; protect and replace when completed. Mask all machinery nameplates and all machined parts not to receive paint. Lay drop cloths in all areas where painting is being done to adequately protect flooring and other work from all damage.

3.10 CLEANING

A. CONTRACTOR shall perform the work under this Section while keeping the premises free from accumulation of dust, debris, and rubbish and shall remove all scaffolding, paint cloths, paint, empty paint containers, and brushes from buildings and the project site when completed.

B. Cleaning: All paint brushed, splattered, spilled, or splashed on any surface not specified to be painted shall be removed.

C. CONTRACTOR shall insure that all glass throughout the facility is cleaned of dirt and paint before he leaves the job site. Further, the CONTRACTOR shall insure that all glass is thoroughly washed and polished.

D. Upon completion of the project, the job site shall be left neat and clean.

3.11 EXTRA STOCK

A. Paint To Be Supplied To OWNER: Upon completion of painting work, the OWNER shall be furnished at no additional cost, unopened containers providing a minimum of one (1) gallon of each type and color of finish paint for touching up. Multi-component coatings shall have each component supplied in separate containers boxed together. Paint container labels shall be complete with manufacturer's name, generic type, number, color, and location where used.

END OF SECTION

SECTION 09911

POLYURETHANE COATING FOR STEEL PIPE

PART 1 GENERAL

1.01 WORK RESULTS

A. This section covers the work necessary to apply external polyurethane coating on steel pipe, field coating of joints, and field repair of coating damage, complete.

B. Exposed steel pipe will be coated as specified in Section 09910, unless specifically specified otherwise.

1.02 SUBMITTAL REQUIREMENTS

A. CONTRACTOR submittals shall be made in accordance with Section 01300 of these Specifications.

B. Shop Drawings: Catalog cuts and other information for all products proposed. Provide copy of approved coating system submittals to the coating applicator.

C. Quality Control Submittals: Furnish the following:

1. Applicator's Experience with list of references substantiating compliance.
2. Coating manufacturer's certification stating the applicator meets or exceeds their coating application requirements and recommendations.
3. Coating manufacturer shall provide a copy of the manufacturer’s coating application quality assurance manual.
4. If the manufacturer of field-applied coating differs from that of the shop applied primer, provide written confirmation from both manufacturers’ that the two coating materials are compatible.
5. CONTRACTOR to submit a color pallet. OWNER will specify color.

D. Provide copies of Certified Test Reports for all coating and lining tests.

1.03 QUALITY ASSURANCE

A. Coating Applicator's Experience and Certification:

1. Coating Application Company and coating application supervisor (Certified Applicator) shall have a minimum of five (5) years of experience applying the specified coating system. Coating application personnel, whom have direct coating application responsibility, shall have a minimum of two (2) years of practical experience in application of the indicated coating system.

2. Coating applicator shall be certified by the coating manufacturer as an approved applicator.

B. Coating and/or lining manufacturer technical representative shall be present for a minimum of three days technical assistance and instruction at the start of coating and/or lining operations within the shop. During this visit, the technical representative shall observe surface preparation and coating application and conduct tests of the coating to insure conformance with application instructions, recommended methods, and conditions.

C. CONTRACTOR shall provide manufacturer's site visits in accordance with Section 01400 – Quality Control, during the fabrication and coating of the pipe.

D. During the site visit, the coating manufacturer's technical representative shall present with OWNER to observe surface preparation and coating application and conduct tests of the coating to insure conformance with application instructions, recommended methods, and conditions.

E. Coating and/or lining manufacturer's technical representative shall be onsite for three working days, minimum, at the start of each construction season to inspect coating application and procedures in the field. During this visit, the technical representative shall observe surface preparation and coating application and conduct tests of the coating to insure conformance with application instructions, recommended methods, and conditions.

F. Coating and/or lining manufacturer shall include eight (8) hours per month of field or shop coating technical support when requested by the ENGINEER.

G. Technical representative shall provide a written report to the ENGINEER for each visit. Report shall include copies of test data collected, description of observations, and all recommended corrective actions. Report shall be submitted within five (5) working days after the visit. When deemed necessary by the ENGINEER, work will not be permitted to proceed until the recommended corrective actions have been implemented. After all corrective recommendations have been completed; the manufacturer representative shall return and certify that the application complies with the manufacturer's coating application recommendations.

H. Additional visits by the manufacturer's representative shall be made at sufficient intervals during surface preparation and coating or lining as may be required for product application quality assurance, and to determine compliance with manufacturer's instructions, and as may be necessary to resolve problems attributable to, or associated with, manufacturer's products furnished for this project.

1.04 ABBREVIATIONS

MDFT	Minimum Dry Film Thickness
mil	Thousandths of an Inch

1.05 DEFINITIONS

A. Manufacturer's Representative: Employee of coating manufacturer who is factory trained and knowledgeable in all technical aspects of their products and systems. Sales representatives are not acceptable as a technical representative unless written authorization from the coating manufacture is provided which states the sales representative has full authority to act on the behalf of the coating manufacturer.

1.06 REFERENCE STANDARDS

AWWA C205	Cement-Mortar Protective Lining and Coating for Steel Water Pipe-4-inch and Larger- Shop Applied.
AWWA C209	Cold Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines.
AWWA C210	Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.
AWWA C216	Heat-shrinkable Cross-linked Polyolefin Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines.
AWWA C217	Cold-Applied Petrolatum Tape and Petroleum Wax Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines.
AWWA C222	Polyurethane Coatings for Interior and Exterior of Steel Water Pipe and Fittings
NACE RP-0274	High Voltage Electrical Inspection of Pipeline Coatings Prior to Installation.
SSPC-SP-1	Solvent Cleaning Surface Preparation
SSPC-SP-2	Hand Tool Cleaning Surface Preparation
SSPC-SP-3	Power Tool Cleaning Surface Preparation
SSPC-SP-5	White metal Abrasive Blast Surface Preparation
SSPC-SP-6	Commercial Abrasive Blast Surface Preparation
SSPC-SP-10	Near White Metal Abrasive Blast Surface Preparation
SSPC-SP-11	Power Tool Cleaning to Bare Metal

1.07 SPECIAL WARRANTY REQUIREMENTS

A. CONTRACTOR and coating applicator shall warrant to the OWNER and guarantee the work under this section against defective workmanship and materials for a period of two (2) years commencing on the date of final acceptance of the work.

1.08 OBSERVATION OF WORK

A. CONTRACTOR shall give the OWNER Representative a minimum of 14 days advance notice of the start of any work to allow scheduling for shop or field observation. Provide OWNER Representative a minimum three (3) days' notice for actual start of surface preparation and coating application work.

B. Provisions shall be made to allow OWNER's representative full access to facilities and appropriate documentation regarding coating application.

C. Observation by the OWNER's representative or the waiver of observation of any particular portion of the work shall not be construed to relieve the CONTRACTOR of his responsibility to perform the work in accordance with these Specifications.

D. Materials shall be subject to testing for conformance with these specifications as the OWNER's representative may determine, prior to or during incorporation into the work.

PART 2 MATERIALS

2.01 GENERAL

A. Exterior and interior pipe and fitting surfaces shall be prepared and coated in accordance with referenced standards, written directions of the coating or lining manufacturer's, and these specifications, whichever is more stringent.

B. Coatings and linings will be stored, handled, and applied per manufacturer's written directions.

C. Pipeline coating or lining shall be the product of a single manufacturer. Product substitutions during the project will not be permitted.

2.02 EXTERIOR SHOP-APPLIED COATINGS

A. General.

1. Steel pipe shall be coated in accordance with AWWA C222, except as modified herein.
2. Pipe that is atmospherically exposed shall be shop primed as specified herein and Section 09910.
3. Buried dielectrically coated pipe and fittings passing through a structure wall or floor shall be coated for a minimum of two-inches beyond the interior wall or floor surface.

B. Plural Component Polyurethane:

1. General: Plural component, polyurethane coating system (referred to as a polyurethane system) shall be applied in accordance with AWWA C222, and as modified herein. Polyurethane coating shall have a light color to reflect sunlight and reduce thermal cycling of pipe and coating.

2. Shop Surface Preparation:

   a. Steel pipe: SSPC-SP5, White Metal blast, 3.00 mil profile, minimum, or as required by the manufacturer, whichever is greater using standardized testing procedures including Press-O-Film and micrometer.

3. Shop Applied Coating Requirements:

   a. Self-priming, plural component, 100 percent solids, non-extended polyurethane, suitable for burial or immersion.

   b. One coat, 35 mils total dry film thickness, minimum, or as required to meet the holiday and coating defects limits specified this section.

   c. Shall be one of the following products, subject to review and acceptance of submitted product performance reports:

      1) Protec II, Futura Coatings, Hazelwood, Missouri

      2) Chemthane 2265, Chemline, Inc, St. Louis, Missouri

      3) Carboline, Polyclad 777, Carboline Company, St. Louis, Missouri

      4) LifeLast Durashield 210

   d. Acceptance of submitted product is contingent upon:

      1) Submission of an independent testing report conducted within three years prior to bid opening documenting conformance to the coating performance criteria specified herein.

      2) Verification that no significant change in product formulation has occurred through comparison of current product Part A and B formulation with infrared spectrometry analysis of test product for the laboratory test report.

4. Laboratory Coating Testing and Report:

   a. General: Coating manufacturer shall submit to the ENGINEER for approval, test reports indicating conformance to the specified performance criteria using prepared samples as defined using coating materials conforming to the following general requirements:

      1) Polyurethane coating material tested shall have been manufactured within 30 days of test sample preparation.

      2) Coating material to have a minimum of three years prior pipeline coating application history.

      3) Extended polyurethane coatings will not be acceptable.

4) Submission of incomplete reports, use of test procedures or methods other than those specified, or preparation of samples with a coating material other than those listed will result in rejection of the coating.

5) Reports shall be submitted for review and approval not less than 30 days prior to coating application along with current product data sheets and MSDS sheets for parts A and B.

6) New product formula tests shall be accompanied with Part A and B wet samples for infrared spectrometry analysis. Wet samples shall be from the lot and batch tested and shall be collected and seal by the ENGINEER for laboratory analysis by the ENGINEER.

b. Test Sample Preparation:

1) Coating manufacturer to provide 10 days advanced notification of coating sample preparation for ENGINEER observation, unless previous test reports are used, which have been approved within three years of bid opening.

2) Failure to fully conform to the preparation requirements will result in rejection of the submitted coating material.

3) Sample preparation completed by the coating manufacturer shall be fully documented and reported to the testing agency by the manufacturer.

4) All coating test samples shall be prepared in conformance with the following general requirements.

c. Sample Surface preparation.

1) Method: Abrasive Blast, Green Diamond or Steel Grit, SSPC-SP5, White Metal

2) Profile: 3.25 mils (±0.25 mils), Angular profile, 90 Peak Count per inch minimum, measured and recorded using surface profilometer.

d. Coating Application:

1) Method: Spray film, in accordance with manufacturer's written shop application requirements.

2) Thickness: Greater than or equal to 30 mils with no runs.

3) Cure: Air cure only, oven or other accelerated cures will not be acceptable.

4) Form: Sheet, steel panel, or steel pipe as required for test procedure.

e. Sample Quantity: Three (3) minimum for each test performed or as required by the ASTM Test Standard, whichever is more stringent.

f. Coating Tests:

1) Testing shall be performed by a certified independent laboratory testing agency with a minimum five (5) years of experience in the performance of ASTM test procedures on coating systems.

2) All testing shall be at room temperature, unless specifically required otherwise by the ASTM test procedure.

3) Water Absorption (ASTM D570)

a) Criteria: 2.00 percent, maximum

b) Method: Long-term Immersion

c) Sample: Sheet, 1 mm maximum thickness

4) Permeance (ASTM E96).

a) Criteria: 0.20 inch-pound

b) Method: Water Procedure BW (App. X1)

c) Conditions: Supported in manner to provide full circulation of air around test container for duration of test procedure.

5) Impact Resistance (ASTM G14).

Criteria: 125 inch-pounds, minimum

6) Cathodic Disbondment (ASTM G95)

a) Criteria: 12 mm, maximum

b) Potential: -3.00 volts

c) Duration: 30 days

d) Radius: Measured from original holiday radius

7) Adhesion to Steel, Dry (ASTM D4541):

a) Criteria: 3,000 psi, minimum

b) Equipment: Delfesko Positest

c) Dollies: 20 mm, maximum, scored to metal substrate

8) Abrasion (ASTM D4060).

a) Criteria: 85 mg loss, maximum

b) Conditions: CS-17 wheel, 1,000 grams weight, 1,000 revolutions

9) Tensile Strength (ASTM D412).

Criteria: 4,000 psi, minimum

10) Hardness, Shore D (ASTM D2240).

Criteria: 70, Shore D, minimum

11) Flexibility (ASTM D522).

a) Criteria: Pass (no cracking)

b) Mandrel Diameter: 3 inch, 180 degrees

g. Reporting

1) The coating applicator shall submit daily inspection reports within one week of inspection date to the OWNER and CM. As required by the ASTM test method, and the following additional information:

a) Sample panel preparation date and identification

b) Surface preparation method and abrasive

c) Surface Preparation profile and peak count

d) Coating lot and date of manufacture

e) Application spray gun and equipment used

f) Application temperatures of coating materials and material temperature at the gun, ambient temperature, and panel surface temperature

2) Include all periodic test data and/or observations for all tested samples and show all multiple measurements in both table and graph.

3) Show all calculations as required by the ASTM test method.

4) Include digital photographic documentation of all visual assessments, test apparatus, and final panel condition using 4 mega pixels minimum resolution.

5) Submit reports in both PDF and color printed format with photographs in JEPG format on CD.

C. Exterior Coating for Exposed Steel Pipe.

1. All atmospherically exposed or vault piping shall be shop coated with the coating system as specified in Section 09910.

2.03 SPECIALS, FITTINGS, AND CONNECTIONS

A. Coating and lining application for special sections, connections, and fittings for steel or ductile iron pipe shall conform to coating system and application requirements as specified in this section.

B. Specials, fittings, and connections shall be defined as any pipe section with turnouts for blowoffs, interconnects, any valve, or other appurtenances; tees; crosses; wyes; laterals; manholes; mitered angles or elbows; and pipes which require special fabrication that

prevents mechanical production application of the specified coating system from end to end of pipe joint.

C. In addition to the items listed as specials, the following items shall also be considered as specials:

1. Pipe joints with pass through holes.

D. Hand applied tape coatings will not be permitted on any specials, fittings, connections, and elbow fittings.

E. Specials, fittings, and connections shall be externally coated with polyurethane coating system applied from end to end of pipe joint on all specials, fittings, and connections.

2.04 EXTERIOR FIELD JOINT COATING

A. Pipe joints shall be field coated after pipe assembly in accordance with AWWA C216, or C217, whichever is applicable and as specified herein.

B. Field joint coating shall be compatible with the shop-applied coating system and provided by the same manufacturer or a manufacturer approved by the pipe coating manufacturer.

C. All joints on pipe 24-inches in diameter or greater shall be coated with a heat shrink coating material.

D. Field joint coating materials shall be as follows or an approved equal.

1. Heat Shrink Sleeves:

a. Filler Material:

1) Provide filler material for all push-on, flange, and coupling type joints and at all changes in outside diameter are greater than 1/8-inch.

2) Filler material shall adhere to the pipe and heat shrink sleeve. Size and type shall be as recommended by the sleeve manufacturer for type of pipe and joint.

3) Filler mastic for joints subject to weld after backfill shall exceed 500 degrees F melt point temperature.

4) Filler material shall be applied in a manner and of sufficient thickness that no tenting or voids remain under the heat shrink sleeve.

b. Joint Coating:

1) Heat shrink, cross-linked polyolefin wrap or sleeve with a mastic sealant, 85-mils nominal thickness, suitable for pipeline operating temperature, as recommended by the manufacturer.

2) Provide standard recovery sleeve for welded or bell and spigot steel pipe joints. High recovery sleeves shall be provided for flange joints and coupling style joints.

3) Width of heat shrink sleeves shall be sufficient to overlap existing coating 2-inches minimum.

4) Consider sleeve shrinkage during installation and joint profile in determining sleeve width required. Overlapping of two or more heat shrink sleeves to achieve the necessary width on pipe joints will not be permitted without ENGINEER approval.

5) Sleeve shall meet requirements for "Weld After Backfill" when allowed and approved by ENGINEER and OWNER.

c. Manufacturer's: Canusa-CPS – Aqua-Shield AQW-WAB System or Berry Plastics CPG – Covalence WaterWrap-WAB system.

2. Wax Tape Coating:

a. Apply coating in accordance with AWWA C217, except as modified herein.

b. Sleeves shall be field applied on all buried flexible joints, thrust restraint rods and brackets, and on joints, fittings, or irregular shapes or complex configurations that are not suited for the use of heat shrink coating system.

c. Do not use wax tape coating systems on vault piping, atmospherically exposed piping and appurtenances, or where subject to UV exposures.

1) Provide filler material to fill and smooth all irregular surfaces, such that no tenting or voids remain under the applied sleeve.

d. Holdback Primer: As specified this section

e. Use sand backfill to protect wax coating from damage.

f. Coating System:

1) Surface Preparation: SP11 Power Tool to Bare Metal.

2) Primer: petroleum or petrolatum wax

a) Manufacturers: Canusa, Raychem-Covalence, or approved equal

3) Filler Material: Filled petroleum or petrolatum wax

4) Inner Tape: Petroleum or petrolatum wax impregnated fabric, 6-inch width maximum, 40 mils thick

5) Outer Wrap: PVC or tape suitable for application to inner tape.

g. Wax tape coating system shall be as manufactured by:

1) Denso North American

2) Trenton

3) Or approved equal

2.05 MATERIALS FOR REPAIR OF COATINGS AND LININGS

A. General.

1. Coating or lining repair materials shall be compatible with the shop-applied coating or lining system and shall be approved by the coating or lining manufacturer.

2. All major repairs on pipe greater than 24-inches in diameter or coated with polyurethane coating system shall be repaired using heat shrink sleeves as specified for field joint coating in accordance with C216, except as modified herein.

3. Minor coating repairs for polyurethane coated or exposed pipe shall be as specified herein.

B. Coating Repair Materials.

1. Heat Shrink Sleeves (major field repair):

a. Filler Mastic: Provide mastic filler to fill tape void as required.

b. Full Wrap Coating: Cross-linked polyolefin wrap with a mastic sealant, 85-mil thickness nominal, suitable for pipeline operating temperature, sleeve material recovery as recommended by the manufacturer. Sleeve length shall provide a minimum of 3 inches overlap onto intact pipe coating.

c. Manufacturer's: Canusa, Raychem (Polyken), or approved equal.

2. Heat-Applied Patches (minor field repair).

a. Heat applied adhesive, polyolefin backed, mastic coated tape, 12-inches maximum size.

b. Patch shall provide a minimum of 2 inches overlap onto intact pipe coating.

c. CRP patch as manufactured by Canusa, PERP patch as manufactured by Raychem (Polyken), or approved equal.

C. Polyurethane Coating Factory Repairs.

1. Polyurethane coating system repair shall be in accordance with the coating manufacturer's recommended procedures.

2. Coating material for minor repairs shall be single use kits or other mix ratio controlled packages of slow set polyurethane coating material similar to the existing coating.

3. Major repairs will be completed using the coating material specified for the coating or the lining. Coating shall be reapplied using plural component spray equipment by a manufacturer certified coating applicator.

D. Exposed Pipe Coating System.

1. Touch-up repair all damage to the primer and/or intermediate coats with the specified coating system prior to final coating of the pipeline in accordance with Section 09910.

PART 3 EXECUTION

3.01 ENVIRONMENTAL LIMITATIONS

A. General.

1. Products shall comply with Federal, State, and Local requirements limiting the emission of volatile organic compounds and worker exposure.
2. Comply with applicable Federal, State, and Local, air pollution and environmental control regulations for surface preparation, blast cleaning, disposition of spent aggregate and debris, and coating application.
3. Do not perform abrasive blast cleaning whenever the relative humidity exceeds 85 percent, whenever surface temperature is less than 5 degrees above the dew point of the ambient air.
4. Do not apply coatings when:
    a. Surface and ambient temperatures exceeds the maximum or minimum temperatures recommended by the coating manufacturer as written in published product literature.
    b. The surface temperature exceeds 10 degrees F below the maximum temperature recommended by the coating manufacturer as written in published product literature during application and curing.
    c. In dust or smoke-laden atmosphere, blowing dust or debris, damp or humid weather, or under conditions that could cause icing on the metal surface.
    d. For epoxy coatings or linings when it expected that surface temperatures would drop below 5 degrees above dew point within four (4) hours after application of coating.
    e. Whenever relative humidity exceeds 85 percent for polyurethane coating application.
5. Where weather conditions or project requirements dictate, CONTRACTOR shall provide and operate heaters and/or dehumidification equipment to allow pipe surfaces to be abrasive blasted and coated as specified and in accordance with the manufacturers coating application recommendations.
6. Work activities can be restricted by the ENGINEER until adequate temperature and humidity controls are in place and functioning within the environmental limits specified.
7. Coating applicator shall provide a monitoring system approved by the coating manufacturer that constantly records pipe and coating conditions during coating application. Recorded monitoring parameters shall include pipe temperature, line

speed, surface preparation, holiday test and other parameters applicable to the type of coating.

B. Temperature Control.

1. In cold weather or if moisture collects on the pipe, preheat pipe to a temperature between 45 and 90 degrees and 5 degrees above dew point, whichever is greater.

2. When temperatures are above or below the coating manufacturers recommended application temperatures, the CONTRACTOR will provide temperature controls as necessary to permit work to precede within the manufacturer's temperature limitations.

3. Provide tenting, insulating blankets, baffles, or bulkheads as required to zone and control heating or cooling effectiveness.

4. Heating shall be with indirect fired heaters that do not increase humidity levels within the work area. Heaters shall be sized for the area to be heated.

C. Dehumidification.

1. CONTRACTOR shall provide dehumidification equipment when necessary for shop or field environmental control during surface preparation and/or coating application. Dehumidification equipment shall be properly sized to maintain dew point temperature 5 degrees or more below surface temperature of metal surfaces to be cleaned and coated.

2. Cleaned metal surfaces shall be prevented from flash rusting throughout the project duration, condensation or icing shall be prevented throughout surface preparation and coating application.

3. Equipment size and power requirements shall be designed by personnel trained in the operation and setup of dehumidification equipment based on project requirements and anticipated weather conditions.

4. Dehumidification equipment shall operate 24 hours per day and continuously throughout surface preparation and coating application.

5. CONTRACTOR to provide personnel properly trained in the operation and maintenance of the dehumidification equipment or provided training by the dehumidification equipment supplier.

6. Daily maintenance requirements of the equipment shall be documented in writing and posted near the equipment for review by the ENGINEER.

7. Reblasting of flash rusted metal surfaces or removal of damaged coatings, because of equipment malfunction, shutdown, or other events that result in the loss of environmental control, will be at the sole expense of the CONTRACTOR.

3.02 SURFACE PREPARATION

A. General.

1. Inspect and provide substrate surfaces prepared in accordance with these Specifications and the printed directions and recommendations of coating manufacturer whose product is to be applied.

2. Visible oil, grease, dirt, and contamination shall be removed in accordance with SSPC-SP1, solvent cleaning.

3. Surface imperfections such as metal slivers, burrs, weld splatter, gouges, or delaminations in the metal shall be removed by filing or grinding prior to abrasive surface preparation.

4. Protect prepared pipe from humidity, moisture, and rain. All flash rust, imperfections, or contamination on cleaned pipe surface shall be removed by reblasting.

5. Priming and coating of pipe shall be completed the same day as surface preparation.

B. Weld Surface Preparation.

1. Requirements: Spray applied coating systems do not require weld grinding.

C. Steel Surface Preparation.

1. Surface preparation of steel pipe shall be in accordance with SSPC surface preparation standards utilizing the degree of cleanliness specified in Section 2.02.B.2.a.

2. Grit and/or shot abrasive mixture and gradation shall be as required to achieve the degree of cleanliness and coating adhesion specified.

3. Pipe cleaned by abrasive blasting with recyclable steel grit and/or shot or other abrasive shall be cleaned of debris and spent abrasive in an air wash separator.

4. Polyurethane coating system shall have a sharp angular surface profile of the minimum depth specified.

5. Work shall be performed in a manner that does not permit the cleaned metal surface to rust back or flash rust.

6. Rust back or flash rust shall be fully removed with the steel surface cleanliness equal to the metal surface cleanliness prior to rust back or flash rusting. Determination of the equivalent surface cleanliness shall be at the ENGINEER's sole discretion.

3.03 SHOP – APPLIED COATING SYSTEMS

A. Polyurethane Coating or Lining.

1. Applicator Qualifications:

a. Equipment will be certified by the coating manufacturer to meet the requirements for material mixing, temperature control, application rate, and ratio control for multi-part coatings.

b. Equipment not meeting the written requirements of the coating manufacturer shall be rejected for coating application until repairs or replacement of the equipment is made to the satisfaction of the ENGINEER.

c. Personnel responsible for the application of the coating system shall have certification of attendance at the coating manufacturer's training class within the last three (3) years. The certified applicator shall be present during all coating application work and shall have responsibility for controlling all aspects of the coating application.

2. Pipe surface temperature shall be within temperature and dew point recommended in manufacturer's product literature and as specified in this Section

3. Coating application shall be performed in an environmentally controlled shop area that meets or exceeds the written environmental application requirements of the coating manufacturer. Application in outdoor conditions will not be acceptable without adequate environmental shelter, environmental controls, and/or dehumidification.

4. Coating adhesion and holidays testing shall be tested as specified in this Section.

5. Coating manufacturer shall provide to the ENGINEER a copy of the manufacturer's coating application quality assurance manual prior to beginning coating application. Strict conformance to the requirements of the manual will be required. Deviation from the requirements of the manual will be grounds for the ENGINEER to reject the applied coating.

6. Unacceptable Coating Application:

a. Coating applied under improper environmental conditions will be rejected.

b. Pipes that exceed the allowable quantity of coating defects, regardless of size or cause, shall be rejected.

c. Coating which fails the adhesion or holiday testing as specified this section shall be rejected.

d. Pipe coating that is subject to off ratio application, blistering, or is not applied in conformance with the coating manufacturer's written instructions or recommendations shall be rejected.

7. Rejected coating shall be removed from the full length of the pipe to bare metal and reapplied using proper application methods in accordance with the quality assurance manual and the requirements of these specifications.

8. Perform coating and lining repairs as specified in this section.

3.04 EXTERIOR COATING HOLDBACK

A. Coating holdbacks shall be straight and cut through the full thickness of the coating.

B. Cutbacks shall be completed in a manner that permits field coating of joints in accordance with the manufacturer's recommendations and as specified herein.

C. Holdbacks shall be as required for proper jointing of pipe, considering joint welding requirements, and be as follows:

Polyurethane coating	
Push-on joint, spigot	1 inch before centerline gasket
Push-on, bell	Flush with bell end
Welded, spigot	3 inches, minimum
Welded, Bell	4-inches, minimum

D. Holdback Corrosion Protection:

1. Holding primer for corrosion protection of cutbacks or holdbacks shall be compatible with the specified joint coating system and weld after backfill requirements, when applicable.

2. Approved holdback primers are:

   a. Tnemec Omnithane – Suitable for all joints, except joints subject to weld after backfill.

   b. Tnemec 90E-92 Ethyl Silicate Inorganic Zinc Primer – suitable for all joints, including weld after backfill joints.

   c. ICI Devoe Cathacoat 304V Ethyl Silicate Inorganic Zinc Primer – suitable for all joints including weld after backfill joints.

   d. Polyken or other tape primers are not allowed.

3. Primer shall not result in running or melting of the coating or cause toxic fumes when heated during weld after backfill operations.

4. Application and thickness of holding primer shall be in accordance with the coating manufacturer's recommendations, but shall not impair the clearances required for proper joint installation.

5. Primer application on spigot end of field welded pipe shall be held back 1 to 2 inches from the end of the spigot or as necessary to prevent toxic fumes during field welding.

6. Any corrosion within the holdback areas shall be abrasively blasted to near white metal in accordance with SP10 or power tool cleaned to bare metal in accordance with SP11 prior to applying joint coating.

3.05 FIELD COATING JOINTS

A. General:

1. Remove all oil or grease contamination by solvent wiping the pipe and adjacent coating in accordance with SSPC-SP1, Solvent cleaning.

2. Clean pipe surface and adjacent coating of all mud, corrosion, and other foreign contaminates in accordance with SSPC-SP11, Power Tool Cleaning to Bare Metal

or abrasive blast joints in accordance with SSPC-SP10, near white metal blast, that exhibit any surface corrosion or staining. When required, clean the full circumference of the pipe and a minimum of 6 inches onto the existing coating.

3. Remove all loose or damage pipe coating at joint and either repair the coating as specified herein or increase the length of the joint coating, where reasonable and practical.

4. Complete joint bonding of pipe joints before application of joint coating. Joint bonds shall be installed as specified in Section 13110, CATHODIC PROTECTION SYSTEM. Joint bonds shall be low profile bonds and all gaps and crevices around the bonds shall be filled with mastic sealant.

5. CONTRACTOR to electrically test completed joint coating for holidays with high voltage spark tester.

B. Weld After Backfill Joint Requirements:

1. Post-welded or 'Weld after Backfill' joints are defined as welded pipe joints that have been coated and backfilled prior to completing interior welds.

2. Post welded joints shall be coated and protected as follows:

a. Joint coating shall be heat shrink joint sleeves only. Tape wrapped joints will not be acceptable.

b. Provide 6-inch wide protective layer centered over the interior weld location as recommended by the joint sleeve manufacturer. Heat resistant tape will not be acceptable.

c. Hold back primer shall be suitable for post weld conditions as specified this section and shall not exhibit any binder breakdown in the heat effect zone that causes loss of joint coating adhesion to the holdback primer.

d. Filler mastic materials shall be high temperature materials with 500 degree F minimum melting point.

e. Joints shall be fully buried prior to welding, with not less than 36-inch cover of soil or flowable fill material on all sides. Sand or flowable fill backfill is preferred for weld after backfill joints.

3. Welding of the joints shall be in conformance with the Section 02571, STEEL PIPE-MORTAR LINED, and as modified herein:

a. If CONTRACTOR elects to post-weld any joints, CONTRACTOR shall demonstrate that the joint welding procedures will not significantly damage the coating by fully excavating the first two joints for evaluation of the joint coating condition. ENGINEER will randomly select up to five additional post-welded joints for excavation by CONTRACTOR for evaluation of joint coating condition. Joint coating will be destructively evaluated by the ENGINEER. CONTRACTOR will remove and replace joint heat shrink sleeve upon completion of the evaluation.

4. In the event that any excavated post welded joint exhibits any heat related damage as defined herein, CONTRACTOR shall modify and test a new post welding

procedure prior to completing any additional post-welded joints. CONTRACTOR shall demonstrate that the revised joint welding procedure will not significantly damage the coating by repeating the weld after backfill evaluation requirements defined in this Section, including excavation of the five additional randomly selected joints for destructive evaluation.

C. Heat Shrink Sleeve Joint Coating:

1. Store, handle, and apply field heat shrink sleeve coatings in accordance with AWWA C216 and these specifications.

2. Store sleeves in shipping box until use is required. Keep dry and sheltered from exposure to direct sunlight. Store off the ground or concrete floors and maintain at a temperature between 60 and 100 degrees as recommended by the sleeve manufacturer.

3. Metal surface shall be free of all dirt, dust, and surface corrosion prior to sleeve application. Surface preparation shall be in accordance with the joint coating manufacturer's recommendations.

4. Where corrosion in the holdback area is visible, surfaces shall be prepared in accordance with SSPC-SP10, near white metal blast, or SSPC-SP11, power tool cleaning to bare metal.

5. Preheat pipe uniformly as recommended by the sleeve manufacturer. Monitor pipe temperature using a surface temperature gauge, infrared thermometer, or color changing crayons. Protect preheated pipe from rain, snow, frost, or moisture with tenting or shields and do not permit the joint to cool.

6. Fill all cracks, crevices, gaps, and step-downs greater than $^1/_4$ inch with filler mastic in accordance with the manufacturer's recommendations for the full circumference of the pipe.

7. Apply heat shrink sleeve when it is at a minimum temperature of 60 degrees and while maintaining the pipe temperature above the preheat temperature specified. Apply sleeve in accordance with the manufacturer's instructions and center the sleeve over the joint to provide a minimum 2-inch overlap onto the existing pipe coating.

8. Completed joint sleeve shall be fully bonded to the pipe and existing coating surface without voids. Mastic beading shall be visible along the full circumference of the sleeve. There shall be no excessive wrinkling or burns on the sleeves. Sleeves that do not meet these requirements shall be removed and the joint recoated as directed by the ENGINEER. Minor repairs may be repaired using heat applied patch material specified for minor coating repairs.

9. Allow the sleeve to cool before backfilling. In hot climates, provide shading from direct sunlight. Water quenching will be allowed only when permitted by the sleeve manufacturer.

10. Heat shrink joint coatings which have become wrinkled or disbonded because of prolonged exposure to UV light or thermal cycling shall be removed and replaced.

11. Double coating of defective or damaged heat shrink coatings will not be permitted. Any double coated heat shrink sleeves shall be immediately rejected and CONTRACTOR shall remove and recoat the joint.

3.06 REPAIR OF COATINGS AND LININGS

A. General:

1. All areas where holidays are detected or coating is visually damaged, such as blisters, tears, rips, bubbles, wrinkles, cuts, or other defects shall be repaired. Areas where no holidays are detected, but are visually damaged shall also be repaired.

2. Maximum defects allowable shall be as specified herein for the coating system.

B. Polyurethane Coating or Lining Repairs.

1. General.

a. Complete coating or lining repairs on any piece of pipe length shall be in accordance with the coating manufacturers written instructions and these specifications, whichever is stricter.

b. Defect Size:

1) Minor repairs - repairs that are less than 6-inches in the greatest dimension.

2) Major repairs - repairs that exceed 6-inches in the greatest dimension.

c. Pipes exceeding the maximum number or size of coating defects shall be stripped of coating, reblasted, and recoated.

d. Pipe arriving in the field with defects or repairs exceeding the maximum number or size of coating defects will be returned to the shop for recoating at the CONTRACTOR's expense.

2. Minor Repairs:

a. Coating or lining repairs on any joint of pipe shall not exceed 1.5 per 100 square feet of surface area.

b. Two or more minor repairs within 6-inches diameter circle will be considered a single repair.

c. Repairs for adhesion testing will not be included in the total number of repairs.

d. Minor repairs:

1) Surface Preparation: Clean and feather the defect by power tool sanding with 80 grit or coarser sandpaper to roughen the existing coat and feather the edges of the defect for a minimum of 2 inches around the defect.

2) Shop repair Materials:

a) Slow setting parent material polyurethane coating material in syringes or other single use packaging that controls mix ratio.

b) Coating Manufacturer's polyurethane coating repair products subject to ENGINEER approval.

3) Field Repair Materials:

a) Heat applied coating materials; CRP Patch, Canusa; PERP Patch, Tyco Adhesives, or approved equal.

4) Apply a single coat of the specified patch coating material at the specified coating thickness.

5) Repairs adhesion shall be 50 percent of the specified coating adhesion.

3. Major Repairs:

a. Major repairs shall not exceed two (2) per pipe joint and the combined area shall not be greater than 50 percent of the pipe.

b. Major repairs:

1) Surface Preparation:

a) The metal surface and surrounding coating shall be abrasively blasted in accordance with SSPC-SP5, White Metal Blast, or to equal in cleanliness and profile as the original surface preparation.

b) Existing coating shall be feathered and roughened to the equivalent of 40 grit sandpaper.

2) Shop Repair Materials:

Same material as the pipeline coating or lining and shall be applied by using plural component spray equipment.

3) Field Repair Materials:

a) Same material as the pipeline coating or lining and shall be applied.

b) Heat shrink sleeves as specified for pipeline joints.

c) Maximum allowable area of wraps needed for repair shall be a total of 24-inch by 24-inch. If repair exceeds 24-inch by 24-inch, then pipe shall be shipped to the factory for coating repair.

c. One coat of the specified original coating material shall be applied over the repaired surface at the specified thickness.

d. Repair adhesion shall be equal to the specified coating adhesion.

3.07 INSPECTION AND TESTING

A. General.

1. Applicator shall inspect and test the coating system in accordance with referenced standards and these specifications, whichever is more stringent as determined by the ENGINEER and OWNER.

2. The frequency of the testing shall be determined by the applicator, but shall not be less than the requirements of this specification.

3. OWNER or OWNER's Representative will conduct random independent inspections and tests for the final acceptance or rejection of pipe coating or lining at any time prior to installing and backfilling pipe.

B. Adhesion Testing.

1. General.

a. Adhesion testing shall be conducted at the shop prior to shipment. Pipe shipped without adhesion testing will be field-tested. Pipe rejected in the field will be returned to the shop for repair at the sole expense of the CONTRACTOR.

b. A minimum of two (2) pipes will be tested for adhesion from each lot of pipe coated up to 3,000 square feet of pipe. An additional adhesion test will be conducted on every increment up to 2,000 square feet of pipe coated in excess of the first 3,000 square feet of pipe. (i.e., if one workday of production is 6,000 square feet of pipe, four adhesion tests will be conducted on the pipe lot).

c. A pipe lot is defined as the quantity of pipe that is coated by a single crew within a work shift, but not to exceed 12 hours.

d. The pipe coating applicator shall repair all coating damage from shop adhesion testing. CONTRACTOR shall be responsible for coating repairs for all field adhesion testing.

e. Adhesion tests will be performed not less than 24 hours after coating application. Tests conducted prior to 24 hours will be acceptable only if the test meets or exceeds the adhesion criteria specified and the test was requested by the pipe fabricator.

f. Pipe will be randomly selected for adhesion testing.

g. OWNER or the OWNER's Representative has the right to conduct additional adhesion testing as deemed necessary to assure the pipe meets or exceeds the requirements of this specification at any time and location prior to pipe installation.

2. Rejection of Coating.

a. If any pipe within a lot fails to meet the test criteria specified for the coating type, that pipe shall be rejected along with all other pes within the lot. Each pipe within the rejected pipe lot will then be individually tested and rejected on a pipe-by-pipe basis in conformance with the test procedures and criteria specific for the coating type.

b. All rejected pipe shall have all coating removed from the full length pipe and the pipe abrasive blasted and recoated.

3. Polyurethane Adhesion Testing.

a. Acceptance Criteria.

1) Acceptance will be based on one pull minimum, with no pulls less than the minimum 1,750 pound criteria where multiple accepted pulls are conducted on the same joint of pipe (Addendum 2).

2) The average value for all coating or lining adhesion pulls performed within a lot of pipe shall not be less than 2,000 psi.

3) Adhesion testing shall be conducted on two (2) sufficiently cured, coated sections of pipe from each shift selected at random with one from the beginning shift and one from halfway through the shift. Adhesion testing shall be conducted in accordance with ASTM D4541. The coating around the dolly shall be scored completely through to the steel substrate. If the adhesion is not satisfactory, two (2) additional tests shall be made at two different locations on the same pipe. If either additional test fails, the pipe shall be rejected. If the pipe is rejected, a systematic inspection of all pipe coated on that shift shall be made, and all pipe not meeting this adhesion requirement shall be rejected. Damaged test areas of accepted pipe and areas determined to have unsatisfactory adhesion shall be repaired as outlined in this specification. (Addendum 2).

4) Each pipe in a lot shall be tested if the initial average value for the first two (2) pipe spools is below the minimum requirement. Pipe lots that do not meet the average value for all adhesion pulls shall be rejected. Each pipe that fails the minimum adhesion criteria shall be rejected as determined above. (Addendum 2).

5) Failure shall be by adhesive and cohesive failure only. Adhesive failure is defined as separation of the coating from the steel substrate. Cohesive failure is defined as failure within the coating, resulting in coating remaining both on the steel substrate and dolly.

b. Test Procedures.

1) Polyurethane coating adhesion to steel substrates shall be tested using self-aligning pneumatic pull off equipment, such as the Delfesko Positest, and test procedures in accordance with ASTM D4541 and AWWA C222, except as modified in this section.

2) All adhesion test pull records shall be maintained in an electronic spreadsheet that includes pipe identification, pipe coating date, adhesion test date, surface tested (interior or exterior), surface temperature, coating thickness, tensile force applied, rate of pressure change per second, mode of failure, and percentage of substrate failure relative of dolly surface.

3) Dollies for adhesion testing shall be 20 millimeters in diameter, and glued to the coating surface and allowed to cure for a minimum of 12 hours before testing.

4) Polyurethane coatings shall be scored around the dolly prior to conducting the adhesion test. Scoring shall be completed manually, normal to the pipe surface, or in a manner that does not stress or over heat the coating.

5) Adhesion testing shall be performed at temperatures between 55 and 100 degrees F. Tests may be performed at temperatures up to 115 degrees F if no significant affect in the test results are statistically detectable.

6) Partial substrate and glue failures will be retested if the substrate failure is less than 50 percent relative of the dolly surface area and the applied tension was less than the specified adhesion. Pipes that have partial substrate failures greater than 50 percent and less than the specified adhesion will be rejected as a substrate adhesion failure.

7) Glue failures in excess of the minimum required tensile adhesion would be accepted as meeting the specified adhesion requirements.

8) Adhesion tests will be conducted on polyurethane pipe coating and lining independently and will be accepted or rejected independently of the other.

C. Holiday Testing.

1. Holiday tests on polyurethane coatings linings will be conducted on the completed coating after cure or 24 hours, whichever is less, using a high voltage spark test in accordance with NACE Standard RP-0274 and these specifications. In addition, the pipe shall be holiday tested by the CONTRACTOR just before the pipe is laid in the trench.

2. Coating thickness used for holiday testing shall be the minimum specified coating thickness.

D. Dry Film Thickness Testing.

1. Coatings shall be tested for dry film thickness using a properly calibrated magnetic pull off or eddy current equipment.

2. Coating thickness measurements shall be conducted as necessary and without limitation. Testing conformance to the requirements of SSPC PA-2 is specifically excluded from this specification.

3.08 HANDLING, TRANSPORTATION, AND STORAGE

A. Pipe shall be handled in accordance with Section 15072.

END OF SECTION

SECTION 15100

VALVES AND ACTUATORS

PART 1 GENERAL

1.01 DESCRIPTION

A. CONTRACTOR shall furnish all tools, equipment, materials, and supplies and shall perform all labor required to furnish and install all valves, actuators and appurtenances shown on the plans and specified herein.

1.02 SCOPE OF WORK

A. The work of this section shall include the furnishing, installation, and testing of all valves, actuators and appurtenances as specified herein, shown on the plans, and as required to make the facility operable and complete. Items to be provided include, but shall not be limited to the following:

1. Valves.

2. Actuators, operators, and valve boxes.

1.03 RELATED WORK

A. Related work not included in this section can be found in the following sections:

1. Section 02200 - Earthwork.

2. Division 15 – Mechanical.

1.04 SUBMITTALS

A. Provide the following in conformance with applicable requirements contained in Section 01300 – Submittals.

1. Shop Drawings: Submit shop drawings for valves, actuators and miscellaneous components. Shop drawings shall be complete with bill-of-materials showing kind and class of materials and catalog and engineering data showing compliance with the specified requirements.

2. Certified shop drawings shall include the principal dimensions, general construction and material specification of the valve proposed. The number of turns to open (close) shall be clearly noted in the valve information submitted with the proposal documents. The number of turns to open or close the valve shall be consistent for each valve size for each approved manufacturer.

B. For each type and model of valve and actuators provide the following:

1. Assembly instructions and spare parts list.

2. Preventative/corrective maintenance instructions.

3. Certificate of seat exposure with entailed fluid exposure.

C. Erection Drawings: Erection drawings shall include the procedures to be used in setting, supporting, and anchoring the valves, the fitting of the line pipe to the valves for proper coupling, and for adjusting and testing all valve assemblies.

1.05 QUALITY ASSURANCE

A. All valves, actuators and miscellaneous components shall be new, free from defects or contamination, and wherever possible shall be the standard product of the manufacturer.

1.06 EQUIPMENT STORAGE AND HANDLING

A. Valves, actuators and miscellaneous components shall be handled with equipment designed to prevent damage to the components.

1.07 JOINT RESTRAINT

A. All valves shall be installed with joint restraint including reaction blocks and thrust blocking as detailed in SAWS standard drawings for butterfly and gate valve installations. Where applicable, a restrained joint pipe may be used, subject to ENGINEER's approval.

PART 2 PRODUCTS

2.01 GENERAL

A. All valves shall be provided as shown in the plans, schedules, and as specified herein. Unless otherwise shown or specified, all aboveground valves shall be flanged, screwed, or welded, non-rising stem, and hand wheel operated. Buried valves shall be mechanical joint, non-rising stem, and wrench operated. The valve assemblies shall be furnished complete and adequate for the specified or shown purpose, and shall include all essential components of equipment, together with all mountings and other appurtenances normal and necessary for proper installation, whether shown or not.

B. All valves and hydrants shall have a pressure rating adequate to meet the working and transient/test pressure of the piping assembly where is the valve is to be installed.

C. All valves shall match existing flanges at flange tie-in points.

D. Enclosed and buried valves shall be coated inside and outside with a fusion bonded epoxy having a nominal 10 mils dry film thickness, which meets or exceeds AWWA C550 and to the maximum extent possible shall be free of holidays. The exterior of exposed valves shall receive a paint system compatible with and equivalent to the exposed steel pipe paint system. All coatings in contact with potable water shall be approved for potable water immersion service per AWWA/NSP Standard 61.

E. All wetted parts of all valves, including interior coatings and seals, shall comply with AWWA/NSF Standard 61 requirements for potable water service.

F. If not specified otherwise, valves shall open in the same direction as the existing valve.

2.02 OPERATORS

A. General: The operators shall be sized based on the maximum expected torque as per valve manufacturer's recommendations. The responsibility for proper operation shall reside with the valve supplier.

B. Manual Operators

1. Manual operators for AWWA butterfly valves shall be in compliance with AWWA C504 and shall be quarter-turn traveling nut type actuators. Manufacturer shall have a quality management system that is certified to ISO 9001 by an accredited, certifying body.

2. Actuators with output torque ratings less than 18,600 ft-lbs shall be of the slotted lever design using centralizing ACME threads. Actuators with output torque ratings greater than 18,600 ft-lbs shall be of the link and lever design.

3. Actuator shall be equipped with a 2-inch cast iron nut requiring a maximum torque of 150 ft-lbs, or a handwheel requiring a maximum of 80 lbs rim pull.

4. Actuator shall be equipped with a bevel gear unit. A three to one (3:1) mechanical ratio to reduce input torque is required for the link and lever design.

5. The actuator housing shall be fully sealed and constructed of ASTM A48 Class 40 gray iron or ASTM A536 Grade 65-45-12 ductile iron. Mounting shall use blind tapped holes to prevent leakage of grease. All fasteners shall be Type 316 stainless steel.

6. Actuators shall be equipped with position stops capable of withstanding 4450 ft-lbs of input torque. External stop covers shall be sealed with O-rings.

7. Actuators of the link and lever design shall be equipped with adjustable threaded stops secured to the stem with spring pins. Closed stops shall be externally adjustable.

8. Actuators of the link and lever design shall have provisions for installing a lifting eye bolt.

9. Materials:

a. Lever shall be ductile iron to prevent fracture from valve vibration.

b. Crosshead shall be bronze or aluminum bronze and the stem shall be alloy steel to prevent galling.

c. Moving parts shall be lubricated with water resistant, extreme pressure grease.

d. Actuator shall be equipped with Teflon-lined, fiberglass-backed sleeve bearings to reduce friction. Link and lever design shall be equipped with thrust ball bearings to absorb the crosshead thrust.

10. For above ground indication, an indicator arrow shall rotate over “OPEN” and “CLOSE” markings on the actuator cover. For buried service, the input shaft shall be stainless steel and the housing shall be 90-percent grease packed.

11. Suitable manufacturers include EIM, Limitorque or Dezurik.

2.03 VALVE BOXES

A. CONTRACTOR shall provide cast-iron valve boxes for each buried valve. Each valve box shall be adjustable to fit the depth of cover over the valve and shall be designed to prevent the transmission of surface loads directly to the valve. Valve boxes shall have an interior diameter of not less than 6 inches and shall be coated with a bituminous coating two (2) mils thick. Valve boxes shall be installed to reserve a minimum of 50 percent of the adjustment for future extension. Extension sections shall be cast-iron only. All valve boxes shall be constructed to prevent tipping and rattling.

B. Boxes shall be a minimum of 3/16-inch thick as manufactured by Western Iron Works, Alamo Iron Works, US Foundry, or approved equal.

C. All valve boxes installed in paved areas shall be provided with a protective concrete collar as shown in the Contract Drawings.

D. Cast iron valve box covers shall read “Water - Open Left” for all valves located inside the fenced production area.

E. Square covers shall be provided for all recycled water main valve boxes.

2.04 GATE VALVES

A. In accordance with SAWS Standard Construction Specification Item No. 828, “Gate Valves” and SAWS Material Specification, “Resilient Seated Gate Valves” Item No. 21 except as otherwise noted or specified herein.

B. Except as otherwise noted or specified herein, AWWA Standard C509 shall govern the design, physical and chemical properties of component materials, construction, manufacture and testing of all resilient seated gate valves furnished for this specification. Valves shall be suitable for frequent operation as well as service involving long periods of inactivity. Valves shall be NSF-61 certified.

C. The minimum design working pressure for gate valves that have a nominal diameter of 12 inches or less shall be 200 psig unless otherwise specified. The minimum design working pressure for gate valves that have a nominal diameter of 16 inches or larger shall be 150 psig unless otherwise specified.

D. Gate valves shall be resilient-seated types, bronze mounted with non-rising stems. The closure member shall be fully encapsulated by an elastomer without thin spots or voids. When open the valve shall have a clear, full-port, unobstructed waterway.

E. Gray iron, ductile iron, steel, brass and bronze materials shall meet or exceed the material requirements of Section 2: Materials of AWWA C509-01.

F. Gaskets, O-rings, Coatings, and elastomers shall meet or exceed the material requirements of Section 2: Materials of AWWA C509-01

G. Gate valves shall be designed for installation in either a horizontal or vertical position. Valves shall be designed for buried installation with stem in the vertical position and shall be furnished for mounting in a horizontal pipeline, unless otherwise specified.

H. Valve components of brass or bronze shall be manufactured to ASTM recognized alloy specifications of low zinc content bronze, as shown in Table 1 of Section 2.2.4. of ANSI/AWWA Standard C509 or the latest revision thereof. Materials for the stem have minimum yield strength of 40,000 psi. A minimum elongation in 2 inches of 12% and shall be made of bronze per ASTM B763, alloy number UNS C99500. A maximum zinc content of 2% as shown in Table 2 Chemical Requirements of ASTM B763-96 or the latest revision thereof. Stem nut material shall be ASTM B62 UNS C83600 or ASTM B584 UNS C84400. The stem shall have a visible external marking at the top to indicate low-zinc, high strength material. The marking shall include a red plastic or neoprene washer placed around the top of the stem under the operating nut.

I. Valve ends shall be either flanged, tapping valve, mechanical joint, push-on joint or any combination thereof, as specified. All mechanical joint valves shall be supplied with glands, bolts, and gaskets. Valve body bolts and nuts shall meet the strength requirements of ASTM A307 with dimensions conforming to ANSI B18.2.1. The size of the bolt head shall be equal to the size of the nut and shall be stainless steel in accordance with ASTM 276.

J. Valves within the fenced production facilities shall open left (counterclockwise), unless otherwise specified. Valves outside the fenced areas shall open right (clockwise).

K. The following parts of the valve shall be made of either gray or ductile iron: bonnet, body, yoke, wrench nut, O-ring packing plate or seal plate, and gland follower. The gate may be made of gray or ductile iron.

L. If glands and bushings are used for NRS valves they shall be made of ASTM B763 bronze UNS C99500. The stem shall be made of cast, forged, or rolled ASTM B763 bronze UNS C99500. The stem nut material shall be ASTM B62 bronze UNS C83600 or ASTM B584 bronze UNS C84400. The gate may be made of bronze ASTM B763 bronze UNS C99500. Stem seals shall be “O” ring type. The seals shall be designed for dynamic applications. The design shall be such that the seal above the stem collar can be replaced with the valve under full pressure in the fully open position. Materials for the “O” ring packing plate shall be in accordance with Section 4.8.3 of the ANSI/AWWA C509 Standard or the latest revision thereof.

M. Valves 20-inch nominal pipe size and larger shall be geared. Gears shall be cut tooth steel and gear cases shall be the totally enclosed, weather tight type to enclose the gears, stuffing box, and the valve stem, attached to the bonnet.

N. Valves 20-inch nominal pipe size and larger shall be provided with a bypass and bypass valve.

O. Approved manufacturers of gate valves, sizes 3-inch through 12-inch, include:

1. American Flow Control – Series 500
2. Clow Valve Company – 2640
3. Kennedy Valve – Ken-Seal II
4. M&H Valve Company – 4067
5. Mueller Company – 2360 Series Gate Valve
6. United States Pipe and Foundry – A-USPO

P. Approved manufacturers of gate valves, sizes 16-inch through 24-inch, include:

1. United States Pipe and Foundry – A-USPO

2.05 BUTTERFLY VALVES

A. Except as otherwise modified or supplemented herein, AWWA Standard C504 or the latest revision thereof, shall govern the design, component material construction, manufacture and testing of all butterfly valves.

B. Valves furnished under this specification shall be as manufactured by one of the following, or approved equal:

1. Henry Pratt Co – HP 250 (below ground)
2. Henry Pratt Co. – HP 250 (above ground)
3. Mueller – Lineseal XP
4. DeZurik - BAW
5. CMB – K-Flow
6. Val-Matic – Series 2000

C. Valves shall be Class 150 of the short-body type with a 150 psig bi-directional shut-off rating and a 300 psig hydrostatic body shell test. Valves shall have a maximum line velocity rating of 16 feet per second (ft/sec) for valves 4-inch through 20-inch and 8 ft/sec for valves 24-inch through 54-inch.

D. Valves shall be in the same alignment as a horizontal pipe and shall be for buried service, unless otherwise noted. Valve shall be configured with a horizontal valve shaft and a vertical actuator shaft with a standard 2-inch AWWA operating nut. Actuator shall be side mounted.

E. Valve body shall be of cast iron conforming to ASTM Specification A-126, Class B or Ductile Iron ASTM A536, grade 65-45-12.

F. Valve body ends shall be flat faced flanged with facing and drilling in accordance with ANSI B16.l, Class 250. All valves shall conform to AWWA C504, Table 2, laying lengths for flanged valves and minimum body shell thickness for all body types.

G. Valve shall be of such design that the disc will seat at 90 degrees with the pipe axis.

H. Valve shall be of such design that the disc will not flutter or vibrate when operated in a throttled position.

I. Valves disc shall be of Cast Iron A48, Cast Iron A126, Class B or Ductile Iron ASTM A536, Grade 65-45-12 and shall be of the disc design to provide 360 degree uninterrupted seating.

J. The valve seat shall be natural or synthetic rubber and may be applied to the disc or body. For valves 30 inches or larger, the rubber seat shall be capable of mechanical adjustment in the field and shall be field replaceable without the need for special tools. Mechanical adjustment or attachment of the seat and seat ring does not include welding. The mating seat surface shall be Type 304 or Type 316 stainless steel, no-chrome or Monel. Sprayed or plate mating seat surface are not acceptable.

K. Valve shafts shall be Type 304 stainless steel conforming to ASTM A-276 and shall have a diameter equal to or greater than that shown for Class 1 SOB in Table 3 of AWWA C504. Shafts shall conform to the requirements of Section 3.3, Valves Shaft of AWWA C504 for one-piece or stub shaft types. Connection between the shaft and disc shall be dowel or taper pins, which are mechanically secured.

L. The valve assembly shall be furnished with a factory-set, non-adjustable disc shaft thrust bearing that insures the valve disc is centered within the valve body seat at all times.

M. Valve shaft bearings shall be permanent, self-lubricated bearings which provide continuous, low-friction maintenance-free operation. Shaft bearing shall be contained in integral hubs of the valve body.

N. Valve shaft seal shall consist of "O" rings or "Vee" ring packing where the shaft projects through the valve body for the actuator connection.

O. The valve shall be provided with a fully enclosed, permanently lubricated actuator of the traveling nut design. The operator shall be designed such that constant input speed results in variable output speed with slowing down valve closure at the ends of travel. The effect is to maintain the rated output torque throughout the entire travel. The actuator shall be connected to the valve shaft by means of a key and keyway connection.

P. All actuators shall have adjustable, mechanical stop limits in accordance with C504 Section 3.8.2. All 6-inch to 42-inch valve actuators shall be capable of withstanding 450 ft-lbs of input torque against the open or closed stops without damage.

Q. Valves for below ground applications shall be provided with an AWWA wrench nut. The wrench nut shall have an arrow cast thereon, indicating the direction of the opening. The wrench nut shall be suitably fastened to the actuator input shaft. If the shaft is smooth, the wrench nut shall be fastened to the input shaft by means of a 5/16-inch diameter steel pin passing entirely through the shaft and the wrench nut. Key with keyway will be acceptable. If the shaft is splined, the wrench nut shall be formed to fit the splined shaft. The actuator shall be designed to produce the specified torque with a maximum input of 150 ft-lbs applied to the wrench nut.

R. Valves for above ground applications shall be provided with a hand wheel. The hand wheel shall have an arrow thereon, indicating the direction of the opening. The hand wheel shall be suitably fastened to the actuator input shaft. Actuators equipped with hand wheels shall be designed to produce the specified torque with a maximum pull of 80 pounds of the hand wheel rim.

S. The requirement for either wrench nut or hand wheel and the direction of opening will be specified on each purchase order.

T. The number of turns to open (close) the valve shall be consistent with each valve size for the manufacturer and shall be approved by the OWNER.

U. The supplier/manufacturer shall provide Affidavit of Compliance with applicable sections of AWWA C504 to include the following: Results of ASTM testing procedures and requirements for materials, Manufacturer's Quality Assurance Program, leak-tightness testing and proof of design testing of representative actuators in accordance with AWWA C504 Section 3.8.5.2 as modified herein (450 ft-lbs). Compliance assurance will be required in accordance with AWWA C504 Section 5.1.2 Affidavits. Results of performance tests, proof of design test, AWWA C504 Section 5.2.4, hydrostatic test, leakage test, and Affidavit of Compliance shall be provided with the bid or with the shipping documents and shall be approved by the OWNER.

V. Butterfly valves 24-inch and larger shall be provided with a fusion bonded epoxy coating.

PART 3 EXECUTION

3.01 INSTALLATION

A. Valves and valve boxes shall be in true alignment and grade in accordance with the procedures submitted with the shop and erection drawings. All adjustments and operating settings of the valves shall be made in accordance with the procedures and details presented in the erection drawings. All valve boxes and extended bonnets installed in paved areas shall have a concrete collar cast around the box or bonnet once it has been set at proper grade.

B. Buried valves shall be firmly supported in place by foundations to preclude strain on the pipe connections. The valve boxes shall be checked for centering plumb over the wrench nut to ensure that the box cover is flush with the finished grade. Earth backfill shall be carefully tamped around each valve box on all sides to the undisturbed face of the trench wall. Valves shall have their interiors cleaned of all foreign matter before installation. The valves shall be inspected in opened and closed positions to ensure that all parts are in working condition.

C. Above ground valves shall be rigidly held in place using supports and hangars as shown in the plans. The stem orientation of valves in elevated piping shall be approved by the OWNER for accessibility, but no valve shall have the stem in the downward direction. Saddle type supports shall be provided for all valves located in vaults. Supports shall be of rugged construction providing at least 120 degrees under support for the valve body. All supports shall be anchored to concrete foundations using Type 316 stainless steel anchor bolts.

3.02 PROTECTIVE COATINGS

A. Enclosed and buried valves shall be coated inside and outside with a fusion bonded epoxy having a nominal 8 mils dry film thickness, which meets or exceeds AWWA C550-01 and to the maximum extent possible shall be free of holidays. All coatings in contact with the potable water shall be approved for potable water immersion service per ANSI/NSF Standard 61.

3.03 TESTS

A. Shop and Laboratory Tests: Perform shop and laboratory tests on valves and appurtenances as follows:

1. Butterfly Valves:

a. Material Tests: Physical and chemical properties tests shall be performed on all material components to be used in the manufacture of butterfly valves in accordance with AWWA C504-94, including valve seat bearing materials.

b. Gear Operator Tests: Manufacturer shall test each model of gear operator and establish torque rating curves in accordance with AWWA C504-94.

c. Performance Tests: Manufacturer shall shop test each butterfly valve for performance, leakage, and hydrostatic pressure in accordance with AWWA C504-94. Results of these tests shall be submitted in accordance with Section 01300 – Submittals.

B. Field Tests: Test all valves and appurtenances for proper operating adjustments and settings and for freedom from vibration, binding, scraping, and other defects. The adequacy of all pipe hangers, pipe supports, and valve supports to meet specified requirements shall be verified. Upon installation, all valves shall be field tested hydrostatically for two (2) hours in the presence of the OWNER.

3.04 COORDINATION WITH INSTRUMENTATION

A. CONTRACTOR is responsible to coordinate with Division 16 regarding the requirements of electric actuated valves, control valves and flow monitoring.

END OF SECTION

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SECTION 16000

ELECTRICAL - GENERAL PROVISIONS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials and equipment required to install, test and provide an operational, electrical system as specified and as shown on the Drawings.

B. All equipment described herein shall be submitted and furnished as an integral part of equipment specified elsewhere in these Specifications.

C. The work shall include furnishing, installing and testing the equipment and materials detailed in each Section of Division 16.

D. The work shall include furnishing and installing the following:

1. Conduit, wiring and terminations for all field-mounted instruments furnished and mounted under other Divisions, including process instrumentation primary elements, transmitters, local indicators and control panels. Lightning and surge protection equipment wiring at process instrumentation transmitters. Install vendor furnished cables specified under other Divisions.

2. A complete raceway system for the specialty cable systems. Install the specialty cable systems, furnished under the Instrumentation Division in accordance with the system manufacturers' installation instructions. Review the raceway layout, prior to installation, with the Process Control System supplier and the cable manufacturer to ensure raceway compatibility with the systems and materials being furnished.

1.02 RELATED WORK

A. No references are made to any other section which may contain work related to any other section. The Contract Documents shall be taken as a whole with every section related to every other section as required to meet the requirements specified. The organization of the Contract Documents into specification divisions and sections is for organization of the documents themselves and does not relate to the division of suppliers or labor which the CONTRACTOR may choose to employ in the execution of the Contract. Where references are made to other Sections and other Divisions of the Specifications, the CONTRACTOR shall provide such information or additional work as may be required in those references, and include such information or work as may be specified.

B. Other Divisions

1. CONTRACTOR shall be responsible for examining all Sections of the Specifications and Drawings, and shall determine the power and wiring requirements and shall provide external wiring and raceways, as required to provide a fully functioning power, control and process control systems. If the equipment requires more conductors and/or wiring, due to different equipment being supplied, the CONTRACTOR shall furnish the additional conductors, raceways and/or wiring, with no change in the Contract Price, and with no increase in Contract Time.

1.03 SUBMITTALS

A. Submit Shop Drawings, in accordance with Division 1 requirements, for equipment, materials and all other items furnished under each Section of Division 16, except where specifically stated otherwise. An individually packaged submittal shall be made for each Section, and shall contain all of the information required by Section. Partial submittals will not be accepted and will be returned unreviewed.

B. Submittals will not be accepted for Section 16000.

C. Each Section submittal shall be complete, contain all of the items listed in the Specification Section, and shall be clearly marked to indicate which items are applicable on each cut sheet page. The Submittal shall list any exceptions to the Specifications and Drawings, and the reason for such deviation.

D. CONTRACTOR shall check shop drawings for accuracy and contract requirements prior to submittal to the ENGINEER. Errors and omissions on approved shop drawings shall not relieve the CONTRACTOR from the responsibility of providing materials and workmanship required by the Specifications and Drawings. Shop drawings shall be stamped with the date checked and a statement indicating that the shop drawings conform to Specifications and Drawings. Only one Specification Section may be made per transmittal.

E. Material shall not be ordered or shipped until the shop drawings have been approved. No material shall be ordered or shop work started if shop drawings are marked "APPROVED AS NOTED CONFIRM", "APPROVED AS NOTED RESUBMIT" or "NOT APPROVED".

F. Shop Drawings, O&M Manuals, and other documentation, shall be submitted as listed in each of the individual Electrical Specification Sections.

1. Submit operations and maintenance data for equipment furnished under this Division, in accordance with Division 1. The manuals shall be prepared specifically for this installation and shall include catalog data sheets, drawings, equipment lists, descriptions, parts lists, etc., to instruct operating and maintenance personnel unfamiliar with such equipment.

2. Manuals shall include the following as a minimum:

   a. A comprehensive index.

   b. A complete "As-Built" set of approved shop drawings.

   c. A complete list of the equipment supplied, including serial numbers, ranges and pertinent data.

   d. A table listing of the "as left" settings for all timing relays and alarm and trip setpoints.

   e. System schematic drawings "As-Built", illustrating all components, piping and electric connections of the systems supplied under this Section.

   f. Detailed service, maintenance and operation instructions for each item supplied.

g. Special maintenance requirements particular to this system shall be clearly defined, along with special calibration and test procedures.

h. The operating instructions shall also incorporate a functional description of the entire system, with references to the systems schematic drawings and instructions.

i. Complete parts list with stock numbers, including spare parts.

G. Up-to-Date Record Drawings shall be promptly furnished when the equipment installation is complete. Payment will be withheld until Record Drawings have been furnished and approved.

H. At the time of jobsite delivery of the equipment, the CONTRACTOR shall have an approved shop drawing in his possession for the OWNER's Inspector and OWNER's Engineer, for verification.

1.04 REFERENCE CODES AND STANDARDS

A. Electric equipment, materials and installation shall comply with the National Electrical Code (NEC) and with the latest edition of the following codes and standards:

1. National Electrical Safety Code (NESC)
2. Occupational Safety and Health Administration (OSHA)
3. National Fire Protection Association (NFPA)
4. National Electrical Manufacturers Association (NEMA)
5. American National Standards Institute (ANSI)
6. Insulated Cable Engineers Association (ICEA)
7. Instrument Society of America (ISA)
8. Underwriters Laboratories (UL)
9. Factory Mutual (FM)
10. City of San Antonio Electrical Codes

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

C. All material and equipment, for which a UL standard exists, shall bear a UL label. No such material or equipment shall be brought onsite without the UL label affixed.

D. If the issue of priority is due to a conflict or discrepancy between the provisions of the Contract Documents and any referenced standard, or code of any technical society, organization or association, the provisions of the Contract Documents will take precedence if they are more stringent or presumptively cause a higher level of performance. If there is any conflict or discrepancy between standard specifications, or codes of any technical society, organization or association, or between Laws and Regulations, the higher performance requirement shall be binding on the CONTRACTOR, unless otherwise directed by the OWNER/ENGINEER.

E. In accordance with the intent of the Contract Documents, the CONTRACTOR accepts the fact that compliance with the priority order specified shall not justify an increase in Contract Price or an extension in Contract Time nor limit in any way, the CONTRACTOR's responsibility to comply with all Laws and Regulations at all times.

1.05 ELECTRICAL EQUIPMENT ENCLOSURE TYPES FOR AREA CLASSIFICATIONS

A. Unless otherwise specified herein or shown on the Drawings, electrical equipment enclosures and associated installations shall have the following ratings:

1. Provide NEMA 7/8 combination enclosures for either indoor or outdoor use in hazardous (classified as Class 1, Division 1, Groups B, C and D), as defined in NFPA 70.

2. Provide NEMA 12 enclosures, unless otherwise specified herein or shown on the Drawings, for all dry, indoor above grade locations. These areas shall be limited to electrical rooms, administration areas, control rooms and storage rooms.

3. Provide NEMA 4X 316 Stainless Steel enclosures for all other locations.

4. NEMA Types 1 or 1A enclosures will not be permitted, unless specifically stated in the Specification for the equipment, or shown on the Drawings.

1.06 CODES, INSPECTION AND FEES

A. Equipment, materials and installation shall comply with the requirements of the local authority having jurisdiction.

B. Obtain all necessary permits and pay all fees required for permits and inspections.

C. The OWNER will negotiate with the electric utility for the costs of new or revised services and make payment to the electric utility for such costs, but the CONTRACTOR shall be responsible for the coordination with the electric utility during the installation of such services.

D. Make all arrangements with the power company for obtaining electrical service, pay all power company charges and furnish all labor and material required for the electrical service.

1.07 SIZE OF EQUIPMENT

A. Investigate each space in the structure through which equipment must pass to reach its final location. Coordinate shipping splits with the manufacturer to permit safe handling and passage through restricted areas in the structure.

B. The equipment shall be kept upright at all times during storage and handling. When equipment must be tilted for passage through restricted areas, brace the equipment to ensure that the tilting does not impair the functional integrity of the equipment.

1.08 RECORD DRAWINGS

A. As the work progresses, legibly record all field changes on a set of Project Contract Drawings, hereinafter called the "Record Drawings". The Record Drawings and Specifications shall be kept up to date throughout the project.

B. The Record Drawings shall be reviewed in a meeting with the OWNER/ENGINEER on a monthly basis.

C. Record Drawings shall accurately show the installed (as-built) condition of the following items:

1. One-line diagram(s).
2. Raceways and pullboxes.
3. Conductor sizes and conduit fills.
4. Panel Schedule(s).
5. Control Wiring Diagram(s).
6. Lighting Fixture Schedule(s).
7. Lighting fixture, receptacle and switch outlet locations.
8. Underground raceway and duct bank routing.
9. Plan view, sizes and locations of switchgear, distribution transformers, substations, motor control centers and panelboards.

D. Submit a typical example of a schedule of control wiring raceways and wire numbers, including the following information:

1. Circuit origin, destination and wire numbers.
2. Field wiring terminal strip names and numbers.

E. As an alternate, submit a typical example of point-to-point connection diagrams showing the same information, may be submitted in place of the schedule of control wiring raceways and wire numbers.

F. Submit the Record Drawings and the schedule of control wiring raceways and wire numbers (or the point-to-point connection diagram) to the ENGINEER.

1.09 EQUIPMENT INTERCONNECTIONS

A. Review shop drawings of equipment furnished under other related Divisions and prepare coordinated wiring interconnection diagrams or wiring tables. Submit copies of wiring diagrams or tables with Record Drawings.

B. Furnish and install all equipment interconnections.

1.10 MATERIALS AND EQUIPMENT

A. Materials and equipment shall be new, except where specifically identified on the Drawings to be re-used.

B. CONTRACTOR shall not bring onsite, material or equipment from a manufacturer, not submitted and approved for this project. Use of any such material or equipment, will be rejected, removed and replaced by the CONTRACTOR, with the approved material and equipment, at his own expense.

C. Material and equipment shall be UL listed, where such listing exists.

D. CONTRACTOR shall be responsible for all material, product, equipment and workmanship being furnished by him for the duration of the project. He shall replace the equipment if it does not meet the Contract Documents.

1.11 JOBSITE DELIVERY, STORAGE AND HANDLING

A. Prior to jobsite delivery, the CONTRACTOR shall have successfully completed all submittal requirements, and present to the ENGINEER upon delivery of the equipment, an approved copy of all such submittals. Delivery of incomplete constructed equipment, or equipment which failed any factory tests, will not be permitted.

B. Equipment and materials shall be handled and stored in accordance with the manufacturer's instructions, and as specified in the individual Specification Sections.

1.12 WARRANTIES

A. Manufacturer's warranties shall be as specified in each of the Specification Sections, with a two (2) year minimum.

1.13 EQUIPMENT IDENTIFICATION

A. Identify equipment (disconnect switches, separately mounted motor starters, control stations, etc.) furnished under Division 16 with the name of the equipment it serves. Motor control centers, control panels, panelboards, switchboards, switchgear, junction or terminal boxes, transfer switches, etc., shall have nameplate designations as shown on the Drawings.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 INTERPRETATION OF DRAWINGS

A. The Drawings are not intended to show exact locations of conduit runs. Coordinate the conduit installation with other trades and the actual supplied equipment.

B. Install each 3 phase circuit in a separate conduit unless otherwise shown on the Drawings.

C. Unless otherwise approved by the OWNER/ENGINEER, conduit shown exposed shall be installed exposed; conduit shown concealed shall be installed concealed.

D. Where circuits are shown as "home-runs" all necessary fittings and boxes shall be provided for a complete raceway installation.

E. Verify the exact locations and mounting heights of lighting fixtures, switches and receptacles prior to installation.

F. Except where dimensions are shown, the locations of equipment, fixtures, outlets and similar devices shown on the Drawings are approximate only. Exact locations shall be determined by the CONTRACTOR and approved by the ENGINEER during construction. Obtain information relevant to the placing of electrical work and in case of any interference with other work, proceed as directed by the OWNER/ENGINEER and furnish all labor and materials necessary to complete the work in an approved manner.

G. Circuit layouts are not intended to show the number of fittings, or other installation details. Furnish all labor and materials necessary to install and place in satisfactory operation all power, lighting and other electrical systems shown.

H. Redesign of electrical or mechanical work, which is required due to the CONTRACTOR's use of a pre-approved alternate item, arrangement of equipment and/or layout other than specified herein, shall be done by the CONTRACTOR at his/her own expense. Redesign and detailed plans shall be submitted to the OWNER/ENGINEER for approval. No additional compensation will be provided for changes in the work, either his/her own or others, caused by such redesign.

I. Raceways and conductors for lighting, switches, receptacles and other miscellaneous low voltage power and signal systems as specified are not shown on the Drawings. Raceways and conductors shall be provided as required for a complete and operating system. Refer to riser diagrams for signal system wiring. Homeruns, as shown on the Drawings, are to assist the CONTRACTOR in identifying raceways to be run exposed and raceways to be run concealed. Raceways installed exposed shall be near the ceiling or along walls of the areas through which they pass and shall be routed to avoid conflicts with HVAC ducts, cranes hoists, monorails, equipment hatches, doors, windows, etc. Raceways installed concealed shall be run in the center of concrete floor slabs, above suspended ceilings, or in partitions as required.

J. CONTRACTOR shall run all conduit and wire to RTU and/or PLC termination cabinets, where designated on the Drawings. The conduit and wire as shown on the interface drawings may not necessarily be shown on the floor plan.

K. Install conductors carrying low voltage signals (typically twisted shielded pair cables) in raceways totally separate from all other raceways containing power or 120 volt control conductors.

L. Raceways and conductors for the fire alarm, sound and page party systems are not shown on the Drawings. Provide raceways and conductors as required by the system manufacturer for a complete and operating system. All raceways and power conductors shall be in accordance with Division 16. Raceways shall be installed concealed in all finished spaces and may be installed exposed or concealed in process spaces.

3.02 EQUIPMENT PADS AND SUPPORTS

A. Electrical equipment pads and supports, of concrete or steel including structural reinforcing and lighting pole foundations, are shown on the Structural Drawings.

B. No electrical equipment or raceways shall be attached to or supported from, sheet metal walls.

3.03 SLEEVES AND FORMS FOR OPENINGS

A. Provide and place all sleeves for conduits penetrating floors, walls, partitions, etc. Locate all necessary slots for electrical work and form before concrete is poured.

B. Exact locations are required for stubbing-up and terminating concealed conduit. Obtain shop drawings and templates from equipment vendors or other subcontractors and locate the concealed conduit before the floor slab is poured.

C. Where setting drawings are not available in time to avoid delay in scheduled floor slab pours, the OWNER/ENGINEER may allow the installations of such conduit to be exposed. Requests for this deviation must be submitted in writing. No additional compensation for such change will be allowed.

D. Seal all openings, sleeves, penetration and slots as specified in Section 16110.

3.04 CUTTING AND PATCHING

A. Cutting and patching shall be done in a thoroughly workmanlike manner. Saw cut all concrete and masonry prior to breaking out sections.

B. Core drill holes in concrete floors and walls as required. CONTRACTOR shall obtain written permission from the ENGINEER before core drilling any holes larger than 2 inches.

C. Install work at such time as to require the minimum amount of cutting and patching.

D. Do not cut joists, beams, girders, columns or any other structural members.

E. Cut opening only large enough to allow easy installation of the conduit.

F. Patching to be of the same kind and quality of material as was removed.

G. The completed patching work shall restore the surface to its original appearance or better.

H. Patching of waterproofed surfaces shall render the area of the patching completely waterproofed.

I. Remove rubble and excess patching materials from the premises.

J. When existing conduits are cut at the floor line of wall line, they shall be filled with grout of suitable patching material.

3.05 INSTALLATION

A. Any work not installed according to the Drawings and this Section shall be subject to change as directed by the ENGINEER. No extra compensation will be allowed for making these changes.

B. All dimensions shall be field verified at the job site and coordinated with the work of all other trades.

C. Electrical equipment shall be protected at all times against mechanical injury or damage by water. Electrical equipment shall not be stored outdoors. Electrical equipment shall be stored in dry permanent shelters as required by each Specification Section. Do not install electrical equipment in its permanent location until structures are weather-tight. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and tested as directed by the OWNER/ENGINEER, or shall be replaced at no additional cost at the OWNER/ENGINEER's discretion.

D. Equipment that has been damaged shall be replaced or repaired by the equipment manufacturer, at the OWNER/ENGINEER's discretion.

E. Repaint any damage to the factory applied paint finish using touch-up paint furnished by the equipment manufacturer. If the metallic portion of the panel or section is damaged, the entire panel or section shall be replaced.

3.06 PHASE BALANCING

A. The Drawings do not attempt to balance the electrical loads across the phases. Circuits on motor control centers and panelboards shall be field connected to result in evenly balanced loads across all phases.

B. Field balancing of circuits shall not alter the conductor color coding requirements as specified in Section 16120.

3.07 MANUFACTURER'S SERVICE

A. Provide manufacturer's services for testing and start-up of the equipment as listed in each individual Specification Section. All settings, including those settings and arc flash labels required by the Power System Study, shall be made to the equipment and approved by the ENGINEER prior to energizing of the equipment.

B. Testing and startup shall not be combined with training. Testing and start-up time shall not be used for manufacturer warranty repairs.

3.08 TESTS AND SETTINGS

A. Test systems and equipment furnished under Division 16 and repair or replace all defective work. Make adjustments to the systems as specified and/or required.

B. Prior to energizing electrical equipment, make all tests as required by the individual specification Sections. Submit a sample test form or procedure and submit the required test reports and data to the OWNER/ENGINEER for approval at least two weeks prior to the startup of the tested equipment. Include names of all test personnel and initial each test.

C. Check motor nameplates for correct phase and voltage. Check bearings for proper lubrication.

D. Check wire and cable terminations for tightness.

E. Check rotation of motors prior to energization. Disconnect driven equipment if damage could occur due to wrong rotation. If the motor rotates in the wrong direction, the rotation shall be immediately corrected, or tagged and locked out until rotation is corrected.

F. Verify all terminations at transformers, equipment, capacitor connections, panels, and enclosures by producing a 1 2 3 rotation on a phase sequenced motor when connected to "A", "B" and "C" phases.

G. Mechanical inspection, testing and setting of circuit breakers, disconnect switches, motor starters, control equipment, etc. for proper operation.

H. Check interlocking, control and instrument wiring for each system and/or part of a system to prove that the system will function properly as indicated by schematic and wiring diagrams.

I. Check the ampere rating of thermal overloads for motors and submit a typed record to the ENGINEER of same, including MCC cubicle location and load designation, motor service factor, horsepower, full load current and starting code letter. If inconsistencies are found, new thermal elements shall be supplied and installed.

J. Verify motor power factor capacitor ratings.

K. Testing shall be scheduled and coordinated with the ENGINEER at least two (2) weeks in advance. Provide qualified test personnel, instruments and test equipment.

L. Refer to the individual equipment sections for additional specific testing requirements.

M. Make adjustments to the systems and instruct the OWNER's personnel in the proper operation of the systems.

3.09 TRAINING

A. CONTRACTOR shall provide manufacturer’s training as specified in each individual section of the Specifications.

END OF SECTION

SECTION 16140

LIGHT SWITCHES AND RECEPTACLES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and install wiring devices as shown on the Drawings and as specified herein.

B. Provide all interconnecting conduit and branch circuit wiring for receptacle circuits in accordance with the NEC.

1.02 RELATED WORK

A. No references are made to any other section which may contain work related to any other section. The Contract Documents shall be taken as a whole with every section related to every other section as required to meet the requirements specified. The organization of the Contract Documents into specification divisions and sections is for organization of the documents themselves and does not relate to the division of suppliers or labor which the CONTRACTOR may choose to employ in the execution of the Contract. Where references are made to other Sections and other Divisions of the Specifications, the CONTRACTOR shall provide such information or additional work as may be required in those references, and include such information or work as may be specified.

B. Other Divisions

1. CONTRACTOR shall be responsible for examining all Sections of the Specifications and Drawings, and shall determine the power and wiring requirements and shall provide external wiring and raceways, as required to provide a fully functioning power, control and process control systems. If the equipment requires more conductors and/or wiring, due to different equipment being supplied, the CONTRACTOR shall furnish the additional conductors, raceways and/or wiring, with no change in the Contract Price, and with no increase in Contract Time.

1.03 SUBMITTALS

A. Shop Drawings

1. Submit catalog data of all switches, receptacles and other specified items under this Section, with all options, application locations and exceptions clearly indicated.

1.04 REFERENCE STANDARDS

A. Wiring devices shall comply with the requirements of the National Electrical Code (NEC) and shall be Underwriters Laboratories (UL) labeled.

1.05 QUALITY ASSURANCE

A. The manufacturer of these materials shall have produced similar electrical materials and equipment for a minimum period of five (5) years. When requested by the OWNER/ENGINEER, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

B. The manufacturer of the assembly shall be the manufacturer of the major components

within the assembly. All assemblies shall be of the same manufacturer.

1.06 JOBSITE DELIVERY, STORAGE AND HANDLING

A. Prior to jobsite delivery, the CONTRACTOR shall have successfully completed all submittal requirements, and present to the OWNER/ENGINEER upon delivery of the equipment, an approved copy of all such submittals. Delivery of incomplete constructed equipment, or equipment which failed any factory tests, will not be permitted.

B. Equipment shall be handled and stored in accordance with manufacturer's instructions.

C. Equipment shall be stored indoors and protected from moisture, dust and other contaminants.

D. Equipment shall not be installed until the location is finished and protected from the elements.

1.07 WARRANTY

A. The Manufacturer shall warrant the equipment to be free from defects in material and workmanship for two (2) years from date of final acceptance of the equipment. Within such period of warranty, the Manufacturer shall promptly furnish all material and labor necessary to return the equipment to new operating condition.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the Manufacturers listed in each product category are acceptable.

B. The listing of specific manufacturers does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed are not relieved from meeting these specifications in their entirety.

2.02 RATINGS

A. The service voltage, shall be as shown on the Drawings. The overall short circuit withstand and interrupting rating of the equipment and devices shall be equal to or greater than the overall short circuit withstand and interrupting rating of the feeder device immediately upstream of the equipment.

2.03 MATERIALS

A. Wall switches shall be heavy duty, industrial specification grade, toggle action, flush mounting quiet type. All switches shall conform to the latest revision of Federal Specification WS 896. Wall switches shall be of the following types and manufacturer:

1. Single pole, 20 Amp, 120/277 Volt - Cooper, Catalog No. 2221V, similar to Hubbell, Inc.; Pass & Seymour, Inc. or equal.

2. Double pole, 20 Amp, 120/277 Volt - Cooper, Catalog No. 2222V, similar by Hubbell, Inc.; Pass & Seymour, Inc. or equal.

3. Three way, 20 Amp, 120/277 Volt - Cooper, Catalog No. 2223V, similar by Hubbell, Inc.; Pass & Seymour, Inc. or equal.

B. Receptacles shall be heavy duty, corrosion resistant, specification grade of the following types and manufacturer or equal. Receptacles shall conform to Fed Spec WC596.

1. Duplex, 20 Amp, 125 Volt, 2 Pole, 3 Wire Grounding, high impact, arc and moisture resistant yellow nylon construction, heavy nickel plating on metal parts; Cooper, Catalog No. 5362CRY, similar by Hubbell, Inc.; Pass & Seymour, Inc. or equal.

2. Single, 20 Amp, 250 Volt, 2 Pole, 3 Wire; Cooper, Catalog No. 5461GY, similar by Hubbell, Inc.; Pass & Seymour, Inc. or equal.

3. Weatherproof/corrosion resistant single, 20 Amp, 125 Volt, 2 Pole, 3 Wire Grounding Receptacle, as specified above, with polycarbonate while-in-use weatherproof cover, Crouse-Hinds Catalog No. TP7491, or similar by Thomas & Betts or equal.

4. Weatherproof/corrosion resistant duplex, 20 Amp, 250 Volt, 2 Pole, 3 Wire Grounding Receptacle, as specified above, with polycarbonate while-in-use weatherproof cover, Crouse-Hinds Catalog No. TP7491, or similar by Thomas & Betts or equal.

C. Device Plates

1. Device plates for switches mounted outdoors or indicated as weatherproof shall be gasketed, cast aluminum with provisions for padlocking switches "On" and "Off", Crouse Hinds No. DS185, or equal.

2. Multiple surface mounted devices shall be ganged in a single, common box and provided with an adapter, if necessary, to allow mounting of single gang device plates on multigang cast boxes.

3. Engraved device plates shall be provided where required.

4. Weatherproof, gasketed cover for GFI receptacle mounted in a FS/FD box shall be Cooper, Catalog No. 4501-FS, similar by Hubbell, Inc.; Pass & Seymour, Inc. or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Do not install flush mounted devices in areas designated DAMP, WET or WET/CORROSIVE on the Drawings. Provide surface mounted devices in these areas.

B. Provide weatherproof devices covers in areas designated WET or WET/CORROSIVE on the Drawings.

C. Unless otherwise shown on the Drawings, wall switches and other wall mounted controls shall be installed at 4’-6” AFF.

D. Convenience receptacles installed outdoors and in rooms where equipment may be hosed down shall be 18-inch above floor or grade. Switches shall be ganged together under one cover plate.

E. The location of all devices is shown, in general, on the Drawings and may be varied within reasonable limits so as to avoid any piping or other obstruction without extra cost, subject to the approval of the OWNER. Coordinate the installation of the devices for piping and equipment clearance.

3.02 FIELD QUALITY CONTROL

A. Test wiring devices to ensure electrical continuity of grounding. Energize the circuit to demonstrate compliance with the requirements.

END OF SECTION

SECTION 16475

LOW VOLTAGE ENCLOSED CIRCUIT BREAKERS AND DISCONNECT SWITCHES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. CONTRACTOR shall furnish and install low voltage enclosed circuit breakers and disconnect switches, together with appurtenances, complete and operable, as specified herein and as shown on the Contract Drawings.

1.02 RELATED WORK

A. No references are made to any other section which may contain work related to any other section. The Contract Documents shall be taken as a whole with every section related to every other section as required to meet the requirements specified. The organization of the Contract Documents into specification divisions and sections is for organization of the documents themselves and does not relate to the division of suppliers or labor which the CONTRACTOR may choose to employ in the execution of the Contract. Where references are made to other Sections and other Divisions of the Specifications, the CONTRACTOR shall provide such information or additional work as may be required in those references, and include such information or work as may be specified.

B. Other Divisions

1. CONTRACTOR shall be responsible for examining all Sections of the Specifications and Drawings, and shall determine the power and wiring requirements and shall provide external wiring and raceways, as required to provide a fully functioning power, control and process control systems. If the equipment requires more conductors and/or wiring, due to different equipment being supplied, the CONTRACTOR shall furnish the additional conductors, raceways and/or wiring, with no change in the Contract Price, and with no increase in Contract Time.

1.03 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of Division 1, Section 16000 and as specified herein.

B. Submittals shall also contain information on related equipment to be furnished under this Specification but described in the related Sections listed in the Related Work paragraph above. Incomplete submittals not containing the required information on the related equipment will also be returned unreviewed.

C. The original equipment manufacturer shall create all equipment shop drawings, including all wiring diagrams, in the manufacturer's Engineering department. All equipment shop drawings shall bear the original equipment manufacturer's logo, drawing file numbers, and shall be maintained on file in the original equipment manufacturer's archive file system. Photocopies of the ENGINEER's ladder schematics are unacceptable as shop drawings.

D. Submit to the OWNER/ENGINEER, shop drawings and product data, for the following:

1. Product data sheets and catalog numbers for overcurrent protective trip devices on circuit breakers and switches, relaying, meters, pilot lights, etc. The manufacturer's name shall be clearly visible on the each cut sheet submitted. List all options, trip adjustments and accessories furnished specifically for this project.
2. Provide control systems engineering to produce custom unit elementary drawings showing interwiring and interlocking between components and to remotely mounted devices. Include and identify all connecting equipment and remote devices on the schematics. The notation "Remote Device" will not be acceptable. Show wire and terminal numbers. Indicate special identifications for electrical devices per the Drawings.
3. Provide plan and elevation drawings of each controller or enclosure, with dimensions, exterior and interior views, showing component layouts, controls, terminal blocks, etc.
4. Schematic diagram.
5. Nameplate schedule.
6. UL Listing of the completed assembly.
7. Component list with detailed component information, including original manufacturer's part number.
8. Conduit entry/exit locations.
9. Assembly ratings including:
    a. Short-circuit rating
    b. Voltage
    c. Continuous current
10. Major component ratings including:
    a. Voltage
    b. Continuous current
    c. Interrupting ratings
11. Number and size of cables per phase, neutral if present, ground and all cable terminal sizes.
12. Key interlock scheme drawing and sequence of operations.
13. Busway connection and amperage rating.
14. Instruction and renewal parts books.

E. Factory Tests. Submittals shall be made for factory tests specified herein.

F. Field Test Reports. Submittals shall be made for field tests specified herein.

G. Operation and Maintenance Manuals.

1. Operation and maintenance manuals shall include the following information:

    a. Manufacturer's contact address and telephone number for parts and service.

    b. Instruction books and/or leaflets.

    c. Recommended renewal parts list.

    d. Record Documents for the information required by the Submittals paragraph above.

1.04 REFERENCE CODES AND STANDARDS

A. All products and components shown on the Drawings and listed in this specification shall be designed and manufactured according to latest revision of the following standards (unless otherwise noted):

1. NEMA Standard AB1 – Molded Case Circuit Breakers, Molded Case Switches and Circuit Breaker Enclosures

2. NFPA 70 – National Electrical Code (NEC)

3. NFPA 70E – Standard for Electrical Safety in the Workplace

4. IEEE 242 – Protection and Coordination of Industrial and Commercial Power Systems

5. IEEE 399 – Power Systems Analysis

6. UL 489 – Molded Case Circuit Breakers and Circuit Breaker Enclosures

7. UL 1066 – Low Voltage AC and DC Power Circuit Breakers Used in Enclosures

B. All equipment components and completed assemblies specified in this Section of the Specifications shall bear the appropriate label of Underwriters Laboratories.

1.05 QUALITY ASSURANCE

A. The manufacturer of this equipment shall have produced similar equipment for a minimum period of 10 years. When requested by the ENGINEER, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

B. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly. All assemblies shall be of the same manufacturer. Equipment that is manufactured by a third party and "brand labeled" shall not be acceptable.

C. All components and material shall be new and of the latest field proven design and in current production. Obsolete components or components scheduled for immediate discontinuation shall not be used.

D. Equipment submitted shall fit within the space shown on the Drawings. Equipment which does not fit within the space is not acceptable.

E. For the equipment specified herein, the manufacturer shall be ISO 9001 2000 certified.

1.06 JOBSITE DELIVERY, STORAGE AND HANDLING

A. Prior to jobsite delivery, the CONTRACTOR shall have successfully completed all submittal requirements, and present to the OWNER/ENGINEER upon delivery of the equipment, an approved copy of all such submittals. Delivery of incomplete constructed equipment, or equipment which failed any factory tests, will not be permitted.,

B. Equipment shall be handled and stored in accordance with manufacturer's instructions.

C. Equipment shall be stored indoors and protected from moisture, dust and other contaminants.

D. Equipment shall not be installed until the location is finished and protected from the elements.

1.07 WARRANTY

A. The Manufacturer shall warrant the equipment to be free from defects in material and workmanship for two (2) years from date of final acceptance of the equipment. Within such period of warranty, the Manufacturer shall promptly furnish all material and labor necessary to return the equipment to new operating condition. Any warranty work requiring shipping or transporting of the equipment or components shall be performed by the CONTRACTOR at no expense to the OWNER.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:

1. Eaton Cutler Hammer
2. General Electric Co.
3. Schneider Electric Square D

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

C. All equipment furnished under this Section shall be of the same manufacturer.

2.02 RATINGS

A. The service voltage, shall be as shown on the Drawings. The overall short circuit withstand and interrupting rating of the equipment and devices shall be equal to or greater than the overall short circuit withstand and interrupting rating of the feeder device immediately upstream of the circuit breaker or switch. Systems employing series connected ratings for main and feeder devices shall not be used.

B. Circuit breakers, safety switches and associated devices shall be designed for continuous operation at rated current in a 40 degree C ambient temperature.

C. For additional ratings and construction notes, refer to the Drawings.

2.03 CONSTRUCTION

A. General

1. Refer to Drawings for: actual layout and location of equipment and components; current ratings of devices, components; protective relays, voltage ratings of devices, components and assemblies; and other required details.

2. Furnish lugs for incoming wiring, sizes as shown on the Drawings. Allow adequate clearance for bending and terminating of cable size and type specified.

3. Built in control stations and indicating lights shall be furnished where shown on the Drawings.

4. Furnish nameplates for each device as indicated in Drawings. Nameplates shall be engraved, laminated impact acrylic, matte finish, not less than 1/16-inch thick by 3/4-inch by 2-1/2-inch, Rowmark 322402. Nameplates shall be Type 316 SS screw mounted to all enclosures except for NEMA 4 and 4X. Nameplates for NEMA 4 and 4X enclosures shall be attached with double faced adhesive strips, TESA TUFF TAPE 4970, .009 X ½", or equal. Prior to installing the nameplates, the metal surface shall be thoroughly cleaned with 70% alcohol until all residue has been removed. Epoxy adhesive or foam tape is not acceptable.

B. Internal Wiring

1. Wiring: Stranded copper, minimum size No. 14 AWG, with 600 Volt, 90 degree C, flame retardant, Type MTW thermoplastic insulation, NEMA Class II, Type B wiring. Line side power wiring shall be sized for the full rating or frame size of the connected device.

2. All wiring shall be tagged and coded with an identification number as shown on the Drawings. Coding shall be typed on a heat shrinkable tube applied to each end showing origination and destination of each wire. The marking shall be permanent, non-smearing, solvent-resistant type similar to Raychem TMS-SCE, or equal.

3. All wiring shall be neatly bundled with tie wraps and supported to wire way supports. Control wiring shall be bundled separately from power wiring. In addition, low signal wiring (millivolt and milliamp) shall be bundle separately from the rest of the control wiring.

C. Field Installed Internal Wiring

1. Field installed interior wiring shall be neatly grouped by circuit and bound by plastic tie wraps. Circuit groups shall be supported so that circuit terminations are not stressed. In addition, low signal wiring (millivolt and milliamp) shall be bundle separately from the rest of the control wiring.

2. All field wiring shall be tagged and coded with an identification number. Coding shall be typed on a heat shrinkable tube applied to each end of the wire. The marking shall be a permanent, non-smearing, solvent-resistant type similar to Raychem TMS-SCE, or equal

3. In general, all conduit entering or leaving equipment shall be stubbed up into the

bottom of the enclosure directly below the area in which the conductors are to be terminated, or from the top if shown on the Drawings. Conduits shall not enter the side unless approved in writing by the OWNER/ENGINEER.

2.04 CIRCUIT BREAKERS

A. Insulated Case Circuit Breakers (ICCB's)

1. Unless otherwise shown on the Drawings, circuit breakers, larger than a 1200 ampere rating, shall be insulated case (ICCB), 3 Pole, 600 Volt, fixed type, with stored energy closing mechanism.

2. Breakers shall be manually operated unless indicated as electrically operated (EO) on the Drawings.

3. All insulated case circuit breakers shall have a minimum symmetrical interrupting capacity of 65,000 amperes, with individual interrupting capacity as shown on the Drawings. Insulated case circuit breakers without an instantaneous trip element adjustment shall be equipped with a fixed internal instantaneous override set the upper limit.

4. All insulated case circuit breakers shall be constructed and tested in accordance with UL 489. The circuit breakers shall carry a UL label.

5. All insulated case circuit breakers shall have an adjustable long-time pickup, and delay; adjustable short time pickup and delay; short time i2t switch; high range instantaneous (fixed at the breaker's short-time withstand rating), and overload, short circuit, and ground fault indicator lights.

B. Molded Case Circuit Breakers (MCCB's)

1. Unless otherwise shown on the Drawings, circuit breakers 225 ampere frame rating through 1200 Ampere, shall be molded case (MCCB), 3 Pole, 600 Volt, fixed type, with stored energy closing mechanism. Breakers shall be manually operated. Trip device shall be solid state with adjustable long-time pickup, and delay; adjustable short time pickup and delay; short time i2t switch; adjustable ground fault pickup and delay, and ground fault delay and pickup trips for selective tripping.

2. Unless otherwise shown on the Drawings, circuit breakers less than 225 ampere frame rating shall be molded case, 3 Pole, 600 Volt, fixed type, manually operated with stored energy closing mechanism. Circuit breakers shall have inverse time and instantaneous tripping characteristics.

3. Where shown on the Drawings, breakers shall be rated for 100% continuous duty, and shall carry a UL 489 listing.

2.05 DISCONNECT SWITCHES

A. Disconnect switches shall be heavy duty, quick make, quick break, visible blades, 600 Volt, 3 Pole with full cover interlock, interlock defeat and flange mounted operating handle.

2.06 SPARE PARTS

A. Provide the following spare parts:

1. 3 – Fuses of each size and type used.

B. Spare parts shall be boxed or packaged for long term storage and clearly identified on the exterior of package. Identify each item with manufacturers name, description and part number

2.07 FACTORY TESTING

A. The circuit breakers and disconnects shall be completely assembled, wired, and adjusted at the factory and shall be given the manufacturer's routine shop tests and any other additional operational test to insure the workability and reliable operation of the equipment.

B. Factory test equipment and test methods shall conform with the latest applicable requirements of ANSI, IEEE, UL, and NEMA standards, and shall be subject to the OWNER/ENGINEER's approval.

PART 3 EXECUTION

3.01 INSTALLER'S QUALIFICATIONS

A. Installer shall be specialized in installing low voltage circuit breakers and disconnect switches with minimum five (5) years documented experience. Experience documentation shall be submitted for approval prior to beginning work on this project.

3.02 EXAMINATION

A. Examine installation area to assure there is enough clearance to install the equipment.

B. Verify that the equipment is ready to install.

C. Verify field measurements are as instructed by manufacturer.

3.03 INSTALLATION

A. CONTRACTOR shall install all equipment per the manufacturer's recommendations and Contract Drawings.

B. Install required safety labels.

3.04 FIELD QUALITY CONTROL

A. Inspect installed equipment for anchoring, alignment, grounding and physical damage.

B. Check tightness of all accessible electrical connections. Minimum acceptable values are specified in manufacturer's instructions.

3.05 FIELD ADJUSTING

A. Adjust all circuit breakers, switches, access doors, operating handles for free mechanical and electrical operation as described in manufacturer's instructions.

3.06 FIELD TESTING

A. Perform all electrical field tests recommended by the manufacturer. Disconnect all connections to solid-state equipment prior to testing.

B. Megger and record phase to phase and phase to ground insulation resistance. Megger, for 1 minute, at minimum voltage of 1000 VDC. Measured Insulation resistance shall be at least 100 megohms. In no case shall the manufacturer's maximum test voltages be exceeded.

C. Test the ground fault protection system using a high current injection method.

D. Test the rating plug for correct rating.

3.07 CLEANING

A. Remove all rubbish and debris from inside and around the equipment. Remove dirt, dust, or concrete spatter from the interior and exterior of the equipment using brushes, vacuum cleaner, or clean, lint free rags. Do not use compressed air.

3.08 EQUIPMENT PROTECTION AND RESTORATION

A. Touch-up and restore damaged surfaces to factory finish, as approved by the manufacturer. If the damaged surface cannot be returned to factory specification, the surface shall be replaced.

END OF SECTION

SECTION 17300

PROCESS CONTROL SYSTEMS GENERAL PROVISIONS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials and equipment required to provide, install, test and make operational, a Process Instrumentation and Control System as specified herein and related specifications, and as shown on the Drawings.

B. The work shall include furnishing, installing and testing the equipment and materials detailed in each Section of Division 17 Instrumentation Sections.

C. Equipment furnished as a part of other Divisions, and shown on the Instrumentation and/or Electrical Drawings shall be integrated into the overall Instrumentation System under the Instrumentation Sections of this Division. Instrumentation specified in other Divisions shall meet the Specification requirements of the Instrumentation Sections of this Division.

D. The Electrical Subcontractor shall provide the services of a Process Control Systems Integrator (PCSI) who shall perform all work necessary to select, furnish, configure, customize, debug, install, connect, calibrate, and place into operation all instrumentation hardware specified within this Division, The PCSI shall coordinate with the OWNER, ENGINEER and ASP, for all scheduling, installation, and startup services. The PCSI shall have qualifications as described herein.

E. The Electrical Subcontractor shall coordinate and schedule all required testing with the OWNER, Design Engineer, PCSI and ASP. The work shall also include the following:

1. Make connections, including field connections and interfacing between instrumentation, controllers, control devices, control panels and instrumentation furnished under other Divisions. The Electrical Subcontractor shall coordinate his construction schedule and instrumentation and control interface with the supplier of instrumentation and control equipment specified under other Divisions.

2. Make wiring terminations for all field-mounted instruments furnished and mounted under other Divisions, including process instrumentation primary elements, transmitters, local indicators and control panels. Install vendor furnished cables specified under other Divisions.

3. Auxiliary and accessory devices necessary for system operation or performance to interface with existing equipment or equipment provided by other suppliers under other Sections of these specifications, shall be included whether they are shown on the Construction Drawings. These devices include, but are not limited to, transducers, current isolators, and signal conditioners, interposing relays or protocol converters.

4. System design shall allow removing individual devices from service without disrupting other unrelated devices in service.

5. Equipment shall be fabricated, assembled, installed, and placed in proper operating condition in full conformity with detail drawings, specifications, engineering data, instructions, and recommendations by the equipment manufacturer as approved by the Design Engineer.

6. Actual installation of the system need not be performed by the Electrical Subcontractor's PCSI employees; however, the PCSI shall provide the on-site technical supervision of the installation.

7. The PCSI shall furnish equipment which is the product of one manufacturer to the maximum practical extent. Where this is not practical, all equipment of a given type shall be the product of one manufacturer.

8. All materials, equipment, labor, and services necessary to achieve the monitoring and control functions described herein shall be provided in a timely manner so that the monitoring and control functions are available when the equipment is ready to be placed into service.

9. Provide all instrumentation relocation work associated with the relocation of equipment for the existing and new facilities, including disconnecting all existing wiring and conduits and terminating, calibrating and placing into service the relocated equipment.

10. Coordinate the sequence of demolition with the sequence of construction to maintain plant operation in each area. Remove and demolish equipment and materials in such a sequence that the existing and proposed plant will function properly with no disruption of treatment.

11. Modifications to existing instrumentation and control systems as required to new and existing equipment to maintain the plant in operation.

1.02 RELATED WORK

A. Where references are made to the Related Work paragraph in each Specification Section, referring to other Sections and other Divisions of the Specifications, the Contractor shall provide such information or work as may be required in those references, and include such information or work as may be specified.

B. All Instrumentation work related to Process and Mechanical Divisions equipment that is shown on the Instrumentation Drawings shall fully comply with the requirements of Division 17 Instrumentation Sections.

C. All instrumentation Equipment and work provided under any Division of the Specifications shall fully comply with the requirements of Division 17 Sections.

D. Related Sections

1. Section 01000 General Conditions
2. Section 17312 Level Instruments
3. Section 17314 Pressure Instruments
4. Section 17318 Analytical Instruments
5. Section 17325 Process Control Systems Control Panels
6. Section 17327 Panel Mounted Control Devices
7. Section 17345 Instrument Support Hardware

1.03 SUBMITTALS

A. General

1. Refer to Division 1 for general project submittal requirements.
2. Refer to all other Division 17 for additional specific submittal requirements.
3. Shop drawings shall be submitted as detailed herein. Shop drawings shall demonstrate that the equipment and services to be furnished comply with the provisions of these specifications and shall provide a complete record of the equipment as manufactured, delivered, installed and placed in service.
4. Submittals shall be complete and shall give equipment specifications, details of connections, wiring, ranges, installation requirements, and specific dimensions. Submittals consisting of only general sales literature shall not be acceptable.
5. Submittals shall be bound in separate three-ring binders, with an index and sectional dividers, and with all included drawings reduced to a maximum size of 11-inches by 17-inches, then folded to 8.5-inches by 11-inches for inclusion inside the binder. Maximum binder thickness shall be 3 inches.
6. The shop drawings title block shall include, as a minimum, the PCSI's registered business name and address, OWNER and project name, drawing name, revision level, and shall identify personnel responsible for the content of the drawing.
7. Incomplete submittals not complying with the submittal requirements outlined in this Section will be returned without review.
8. In each submission, include the applicable specification section noted with PCSI’s indication of compliance with each requirement.
9. Unless discussed with and approved by the ENGINEER prior to submission, partial submittals are not acceptable and will be returned un-reviewed.
10. Any reproduction of the Contract Documents or portions thereof, and presentation of these as submittal content to the OWNER and ENGINEER is not acceptable unless it is for indicating compliance with specification requirements and is clearly marked as such.
11. The design intent for the Process Instrumentation and Control Systems work as specified in the Division 17 specifications sections is for all requirements to be fulfilled in their entirety by the PCSI. Submittals with notes indicating that required items or work are being furnished “by others” are not acceptable and will be returned un-reviewed. Unless discussed with and approved by the ENGINEER prior to submission, any deviations in this regard are not acceptable. Approval of all deviations from the Contract Documents is at the discretion of the OWNER and/or ENGINEER.
12. Include project-specific tagging and descriptions as shown in the Contract Documents as well as quantities for all devices and systems being provided to facilitate OWNER’s and ENGINEER’s cross-referencing with requirements and verification of completeness.

13. Separate submittals as listed in Table 1 below shall be made.

Table 1 Required Submittals

Item Number	Submittal Title	Submittal Number	Governing Specifications
1	Project Plan, Schedule, and Deviation List	17300-01	17300
2	Hardware and Software Packages	17300-02	17300, 17325,17327, 17328,17500, 17515,17550
5	Process Instruments	17410-01	17300, 17310, 17312, 17314, 17318, 17345
6	Panel Layout Drawings, Wiring Diagrams and Loop Wiring Diagrams	17300-05	17300, 17325, 17327
7	Testing Plan	17302-01	17300, 17302, 17305
8	Training Plan	17303-01	17300, 17303
9	Spares, Expendables, and Test Equipment.	17300-06	17300, 17310, 17312, 17314, 17318,17320, 17325,17327, 17500, 17515,
10	Final System Documentation	Per O&M Submittal Numbering Convention	01730, 17300

B. Project Plan, Schedule and Deviation List Submittal

1. Submit a Project Plan, Schedule and Deviation List Submittal. The Project Plan, Schedule and Deviation List Submittal shall be submitted and favorably approved before any additional submittals will be accepted and prior to scheduling of the first PCSI coordination meeting.

2. The Project Plan, Schedule and Deviation List Submittal shall, as a minimum, contain the following:

a. Overview of the Process Control System, clearly describing the PCSI's understanding of the project work and interfaces to other systems; and including:

   i. a proposed project work schedule detailing all PCSI's work activities.

b. Approach to work clearly describing how the PCSI intends to execute the work, including detailed discussion of switchover, startup, replacement of existing equipment with new, and other tasks as required by these specifications as applicable.

c. Preliminary PLC hardware submittal information shall be included solely for determining compliance with the requirements of the Contract Documents prior to beginning development of application programming. Review and approval of software and hardware systems as part of this Project Plan stage shall not relieve the PCSI of meeting all the functional and performance requirements of the system as specified herein. Substitution of manufacturer or model of these systems after the submittal is approved shall not be permitted without prior ENGINEER approval.

d. Details of personnel assigned to the project and organizational structure including the PCSI's project manager, project engineer, and lead project technicians. Include resumes of each key individual and specify in writing their commitment to this project.

e. Preliminary coordination meeting agendas as specified herein.

f. Preliminary training plan

g. Samples of shop drawings to be submitted in conformance with the requirements of the Specifications shall be submitted. At a minimum include samples of panel fabrication drawings, loop, and I/O wiring diagrams.

3. Exceptions to the Specifications or Drawings shall be clearly defined in a separate Deviation List. The Deviation List shall consist of a paragraph by paragraph review of the Specifications indicating acceptance or any proposed deviations, the reason for exception, the exact nature of the exception and the proposed substitution so that an evaluation may be made by the ENGINEER. The acceptability of any device or methodology submitted as an "equal' or "exception" to the specifications shall be at the sole discretion of the Design Engineer. If no exceptions are taken to the Specifications or Drawings, the PCSI shall make a statement indicating so. If there is no statement included by the PCSI, it shall be interpreted by the ENGINEER to mean that no exceptions are taken.

4. A Project Schedule shall be prepared and submitted using P6 or Microsoft Project. The schedule shall be prepared in Gantt chart format clearly showing task linkages for all tasks and identifying critical path elements. The PCSI's schedule shall be based on and coordinated with the General Contractor's and ASP schedules and must meet all field installation, testing, and startup milestones in those schedules.

5. The PCSI schedule shall illustrate all major project milestones including the following:

a. Schedule for all subsequent project submittals. Include in the time allotment the time required for General Contractor submittal preparation, ENGINEER's review, and a minimum of two complete review cycles.

b. Proposed dates for all required project Coordination Meetings and workshops

c. Hardware purchasing, fabrication, and assembly (following approval of related submittals)

d. Software purchasing and configuration (following approval of related submittals)

e. Shipment of all instrumentation and control system equipment

f. Installation of all instrumentation and control system equipment

g. Duration and dates for all required testing activities. Testing schedule shall include submittal of test procedures a minimum of 150 days prior to commencement of testing. Schedule shall also include submittal of completed documentation of testing activities for review and approval by the ENGINEER prior to equipment shipment, startup, or subsequent project work.

h. The PCSI shall arrange the schedule to accommodate the requirements of the ASP to develop, test, troubleshoot, and train the OWNER’s staff on the PLC and HMI application and systems. The timing of these coordination efforts shall be jointly determined by the ASP and PCSI; however, the PCSI shall include all necessary costs to accommodate the minimum time slots in their overall project schedule. All time allotments shall exclude any legal holidays, or days lost due to delays caused by the General Contractor or PCSI.

i. Include a schedule for system cutover, startup, and/or placing in service for each major system. At a minimum, include the schedule for each process controller modified or provided under this Contract.

j. Schedule for all training including submittal and approval of O&M manuals.

C. Hardware and Software Packages Submittal

1. Submit details of field instrument, power monitoring, and field device digital networks. Submittal shall include details of the field device digital networks technology including type, power requirements, wiring requirements, configuration details, device addressing, and interface to the process control system. Include separate details of the field device digital network configuration(s) for each field level digital network and sub-network.

2. Submit details for all software packages to be furnished, including specification number, product name, manufacturer, product number, license versions and quantities.

D. Process Instruments Submittal

1. Submit complete documentation of all field instruments using ISA-S20 data sheet formats. Submit a complete Bill of Materials (BOM) listing all instrumentation equipment using project identification, such as tags and descriptions as shown in the Contract Documents.

2. Submit separate data sheets for each instrument including:

a. Plant Equipment Number and ISA tag number per the Drawings

b. Product (item) name used herein and on the Contract Drawings

c. Manufacturer's complete model number

d. Location of the device

e. Input - output characteristics

f. Range, size, and graduations in engineering units

g. Physical size with dimensions, enclosure NEMA classification and mounting details in sufficient detail to determine compliance with the requirements of the Contract Documents

h. Materials of construction for enclosure and wetted parts

i. Instrument or control device sizing calculations where applicable

j. Certified calibration data for all flow metering devices

k. Two-wire or four-wire device type, as applicable

3. Submit index and data sheets in electronic format as well as hard copies on 8 1/2" x 11" formats. Electronic format shall be in Microsoft Excel or Word. Submit electronic copy.

E. Panel Layout Drawings, Wiring Diagrams and Loop Wiring Diagrams Submittal

1. Where direct hardwired interfaces exist between the PCSI control panels and vendor provided control panels furnished under other Divisions, the General Contractor or Electrical Subcontractor shall provide to the PCSI the approved shop drawings and submittals for the PCSI to provide complete wiring diagrams showing all wiring connections in the I/O system. This includes but is not limited to terminal block numbering, relay contact information, instruments, equipment, and control panel names. These drawings will be included in the Final Documentation submittal. Leaving this information blank on the Final Documentation drawings is not acceptable.

2. Include a complete Bill of Materials for each individual control panel being furnished.

3. Include manufacturer literature for each item in the Bill of Materials with all required markings indicating exactly what versions, options, etc. are being proposed and indicate compliance with specification requirements. Manufacturer literature for common components need only be included once, for the first panel in the submittal with references to this literature included as applicable thereafter in submittal.

4. Panel Layout Drawings: Drawings shall be furnished for all panels, consoles, and equipment enclosures specified. Panel assembly and elevation drawings shall be drawn to scale and detail all equipment in or on the panel. Panel drawings shall be 11 "x 17" minimum in size. As a minimum, the panel drawings shall include the following:

a. Interior and exterior panel elevation drawings to scale

b. Nameplate schedule

c. Conduit access locations

d. Panel construction details

e. Include cabinet assembly and layout drawings shown drawn to scale. The assembly drawing shall include a bill of material on the drawing with each panel component clearly defined. The bill of material shall be cross-referenced to the assembly drawing so that a non-technical person can readily identify any component of the assembly by manufacturer and model number.

f. Fabrication and painting specifications including color (or color samples)

g. Submit construction details, NEMA ratings, intrinsically safe barrier information, gas sealing recommendations, purging system details, etc. for panels located in hazardous locations or interfacing to equipment located in hazardous areas.

h. Heating and cooling calculations for each panel supplied indicating conformance with cooling requirements of the supplied equipment and environmental conditions. Calculations shall include the recommended type of equipment required for both heating and cooling.

i. Submit evidence that all control panels shall be constructed in conformance with UL 508 and bear the UL seal confirming the construction. Specify if UL compliance and seal application shall be accomplished at the fabrication location or by field inspection by UL inspectors. All costs associated with obtaining the UL seal and any inspections shall be borne by the PCSI and included in the Project Bid Price.

5. Panel Wiring Diagrams: Panel wiring diagrams depicting wiring within and on the panel as well as connections to external devices. Equipment external to the control panel and related external connections do not need to be shown on the Panel Wiring Diagrams. Panel wiring diagrams shall include power and signal connections, UPS and normal power sources, all panel ancillary equipment, protective devices, wiring and wire numbers, and terminal blocks and numbering. Field device wiring shall include the device ISA-tag and a unique numeric identifier. The diagrams shall identify all device terminal points that the system connects to, including terminal points where I/O wiring lands on equipment not supplied by the PCSI. Wiring labeling used on the drawings shall match that shown on the Contract Documents or as developed by the PCSI and approved by the ENGINEER. I/O wiring shall be numbered with rack number, slot number, and point number. Two-wire and four-wire equipment shall be clearly identified and power sources noted. Submit final wire numbering scheme. Panel drawings shall be 11" x 17" minimum in size.

6. ISA Loop Wiring Diagrams: Detailed ISA loop wiring diagrams showing requirements for each loop which is shown on the contract drawings. The Loop Drawings shall be prepared in accordance with ISA Standard S5.4, latest version, and with the layout following Figures 5 and 6 (shown in the S5.4 Standard), titled Minimum Required Items Plus Optional items". Loop drawings shall be 11" x 17" minimum in size. The information required on the Loop Drawings to satisfy the "minimum" and "optional" requirements is as follows:

   a. Minimum Required Items – The following information shall be provided on Loop Drawings to meet this requirement:

b. Identification of the loop and loop components shown on the P&IDs Other principal components of the loop to be shown and identified under ISA-5.1, "Instrumentation Symbols and Identification".

c. Word description of loop functions within the title. If not adequate, use a supplemental note. Identify any special features or functions of shutdown and safety circuits.

d. Indication of the interrelation to other instrumentation loops, including overrides, interlocks, cascaded set points, shutdowns and safety circuits.

e. All point-to-point interconnections with identifying numbers or colors of electrical cables, conductors, pneumatic multitubes, and individual pneumatic and hydraulic tubing and this identification of interconnections includes junction boxes, terminals, bulkheads, ports, and grounding connections.

f. General location of devices such as field, panel, auxiliary equipment, rack, termination cabinet, cable spreading room, I/O cabinet, etc.

g. Energy sources of devices, such as electrical power, air supply, and hydraulic fluid supply. Identify voltage, pressure, and other applicable requirements. For electrical sources, identify circuit or disconnect numbers.

h. Process lines and equipment sufficient to describe the process side of the loop and provide clarity of control action. Include what is being measured and what is being controlled.

i. Actions or fail-safe positions (electronic, pneumatic, or both) of control devices such as controllers, switches, control valves, solenoid valves, and transmitters (if reverse- acting). These are to be identified in accordance with ISA-5.1, "Instrumentation Symbols and Identification".

j. References to equipment descriptions, manufacturers, model numbers, hardware types, specifications or data sheets, purchase order numbers.

k. Signal ranges and calibration information, including set point values for switches, and alarm and shutdown devices.

F. Testing Plan Submittal

1. Test Procedures: Submit the procedures proposed to be followed for each test. Procedures shall include test descriptions, forms, and checklists to be used to control and document the required tests. Include sign-off forms for each testing phase or loop with sign-off areas for the PCSI, ENGINEER, and OWNER. Refer to Section 17302 and Section 0100 General Conditions for specific testing requirements, and submit separate procedures for each specified test phase including:

a. Unwitnessed Hardware Factory Acceptance Testing (UFT)

b. System Integration Testing (SIT)

c. Witnessed Hardware Factory Test (WHFT)

d. Witnessed Software Factory Test (WSFT)

e. Unwitnessed Operational

2. Test Documentation: Upon completion of each required test, document the test by submitting a copy of the signed off test procedures. Testing shall not be considered complete until the signed-off test procedures have been submitted and favorably reviewed. Submittal of other test documentation, including "highlighted" wiring diagrams with field technician notes, are not acceptable substitutes for the formal test documentation.

3. Each loop shall have a Loop Status signoff form to organize and track its inspection, adjustment and calibration. These forms shall include the following information and check-off items:

   a. Project Name

   b. Loop Number

   c. Detailed test procedure indicating exactly how the loop will be tested including all required test equipment, necessary terminal block numbers, and simulation techniques required.

   d. Tag Number for each component.

   e. Check-offs/sign-offs for each component:

      Tag/identification

      Installation

      Termination - wiring

      Termination - tubing

      Calibration/adjustment

   f. Check-off/sign-off space for each loop:

      Panel interface terminations

      I/O interface terminations

      I/O signal operation

      Inputs/outputs operational: received/sent, processed, adjusted

      Total loop operation

      Space for comments.

      Sign off and date fields for the Design Builder, the Design Engineer, and the PCSI.

4. Each active analog subsystem element shall have a Component Calibration form. These forms shall have the following information including space for data entry:

   a. Project Name

   b. Loop Number

c. ISA Tag Number and I/O Module Address

d. Manufacturer

e. Model Number/Serial Number

f. Summary of Functional Requirements, for example:

For Indicators: Scale ranges

For Transmitters/Converters: Scale and chart ranges

For Computing Elements: Function

For Controllers: Action (direct/reverse) control modes (PID)

For Switching Elements: Unit range, differential (fixed/adjustable), reset (auto/manual)

For I/O Modules: Input or output

g. Calibrations, for example:

For Analog Devices: Required and actual inputs and outputs at 0, 25, 50, 75 and 100 percent of span.

For Discrete Devices: Required and actual trip points and reset points.

For Controllers: Mode settings (PID).

For I/O Modules: Required and actual inputs or outputs for 0, 50 and 100 percent of span.

h. Space for comments.

i. Sign off and date fields for the OWNER, the ENGINEER, and the PCSI.

G. Spares, Expendables, and Test Equipment

1. All spares, expendables and test equipment in the listed Sections shall be included in a single submittal.

2. This submittal shall include for each subsystem:

a. A list of, and descriptive literature for, spares, expendables, and test equipment as specified under Division 17 specifications

b. A list of, and descriptive literature for, additional spares, expendables, and test equipment recommended by the manufacturer

c. Unit and total costs for the additional spare items specified or recommended for each subsystem.

H. Final System Documentation

1. The Final System Documentation shall consist of operations and maintenance manuals as specified herein. The manuals shall be bound in three-ring binders, maximum size of three inches, with Drawings reduced to 11 inches by 17 inches, then folded to 8.5 inch by 11 inches for inclusion. Each section shall have a uniquely numbered tab

divider, and each component within each section shall have a separate binder tab divider.

2. The operations and maintenance manuals shall, at a minimum, contain the following information:

   a. Table of Contents

   b. A Table of Contents shall be provided for the entire manual with the specific contents of each volume clearly listed. The complete Table of Contents shall appear in each volume.

   c. Instrument and Equipment Lists

      The following lists shall be developed in Excel and provided not only as a hardcopy in O&M.

      An instrument list for all devices supplied including tag number, description, specification section and paragraph number, manufacturer, model number, serial number, range, span, location, manufacturer phone number, local supplier name, local supplier phone number, completion year replacement cost, and any other pertinent data.

      An equipment list for all non-instrument devices supplied listing description, specification section and paragraph number, manufacturer, model number, serial number, location, manufacturer phone number, local supplier name, local supplier phone number, completion year replacement cost, and any other pertinent data.

   d. Data Sheets with Vendor Operations and Maintenance Information

   e. ISA S20 data sheets shall be provided for all field instruments.

      Cover page for each device, piece of equipment, and OEM software that lists, at a minimum, date, specification number, product name, manufacturer, model number, Location(s), and power required. Preferred format for the cover page is ISA S20, general data sheet; however, other formats will be acceptable provided they contain all required information.

      Final vendor O&M documentation for each device, piece of equipment, or OEM software shall be either new documentation written specifically for this project, or modified standard vendor documentation. All standard vendor documentation furnished shall have all portions that apply clearly indicated with arrows or circles. All portions that do not apply shall be neatly lined out or crossed out. Groups of pages that do not apply at all to the specific model supplied shall be removed.

      For any component requiring dip switch settings or custom software configuration, that information shall be included along with the corresponding data sheets and O&M information.

   f. As-Built Drawings

      Complete As-built Drawings, including all Drawings and diagrams specified in this Section under the "Submittals" paragraph. These Drawings shall include all

termination points on all equipment the system in connected to, including terminal points of equipment not supplied by the PCSI.

As-built documentation shall include information from submittals, as described in this Specification, updated to reflect the as-built system. Any errors in or modifications to the system resulting from the Factory and/or Functional Acceptance Tests shall be incorporated in this documentation.

g. Original Licensed Software

Submit original software diskettes or CD-ROMs for all software provided under this Contract. Submit original documentation, both hard copies and in electronic format, for all software provided. Submit license agreement information including serial numbers, license agreements, User Registration Numbers and related information. All software provided under this Contract shall be licensed to the OWNER at the time of purchase. Provide media in original packages provided by manufacturer.

h. Electronic O&M Information

In addition to the hard copy of O&M data, provide an electronic version of all equipment manuals. Electronic documents shall be supplied in Adobe Acrobat format.

Provide electronic files for all custom-developed manuals. Text shall be supplied in both Microsoft Office format and Adobe Acrobat format.

Provide electronic files for all drawings produced. Drawings shall be in AutoCAD 2007 ".dwg" format and in Adobe Acrobat format. Drawings shall be provided using the AutoCAD eTransmit feature to bind external references, pen/line styles, and fonts into individual zip files along with the drawing file.

- Each computer system hardware device shall be backed up onto CDROM or DVD after Substantial Completion and shall be turned over to the OWNER.
- If specified in the training section, provide digital copies of all training videos. Videos shall be in a format that is readable by standard DVD players and by standard PC DVD drives. Format and shall be a minimum of 800 by 600 pixels and shall include sound.

3. The cover and edge of each volume shall contain the following information:
4. Project Name (refer to Contract Documents)
5. Contract Number (refer to Contract Documents)
6. Instrumentation and Control Systems
7. Hardware [or Applications Engineering] Operations and Maintenance Manual
8. Specification Sections _____, _____, _____
9. Subcontractor Name
10. Date

11. Volume X of Y

12. (Where X is the volume number and Y is the number of volumes)

I. Fiber Optic Cabling and Equipment Submittal

1. Refer to Section 17320 for specific fiber optic cabling and equipment submittal requirements.

J. Integrated Security System Submittal

1. Refer to Section 17550 for specific training requirements.

1.04 REFERENCE CODES AND STANDARDS

A. Instrumentation equipment, materials and installation shall comply with the National Electrical Code (NEC) and with the latest edition of the following codes and standards:

1. National Electrical Safety Code (NESC)
2. Occupational Safety and Health Administration (OSHA)
3. National Fire Protection Association (NFPA)
4. National Electrical Manufacturers Association (NEMA)
5. American National Standards Institute (ANSI)
6. Insulated Cable Engineers Association (ICEA)
7. The International Society of Automation (ISA)
8. Underwriters Laboratories (UL)
9. UL 508, the Standard of Safety for Industrial Control Equipment
10. UL 508A, the Standard of Safety for Industrial Control Panels
11. UL 50, the Standard of Safety for Enclosures for Electrical Equipment.
12. NFPA 79, Electrical Standard for Industrial Machinery
13. Factory Mutual (FM)
14. All equipment and installations shall satisfy applicable Federal, State, and local codes.

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

C. All material and equipment, for which a UL standard exists, shall bear a UL label. No such material or equipment shall be brought onsite without the UL label affixed.

D. If the issue of priority is due to a conflict or discrepancy between the provisions of the Contract Documents and any referenced standard, or code of any technical society, organization or association, the provisions of the Contract Documents shall take precedence if they are more stringent or presumptively cause a higher level of performance. If there is any conflict or discrepancy between standard specifications, or codes of any technical society, organization or association, or between Laws and Regulations, the higher

performance requirement shall be binding on the Contractor, unless otherwise directed by the OWNER/ENGINEER.

E. In accordance with the intent of the Contract Documents, the Electrical Subcontractor or PCSI accepts the fact that compliance with the priority order specified shall not justify an increase in Contract Price or an extension in Contract Time nor limit in any way, the Contractor or PCSI's responsibility to comply with all Laws and Regulations at all times

F. All control panels shall be constructed and the labeling shall be affixed in a UL 508 facility.

1.05 PROCESS CONTROL SYSTEMS INTEGRATOR (PCSI)

A. The Electrical Subcontractor shall provide the services of a pre-approved Process Control Systems Integrator (PCSI) for all work under the instrumentation sections of this and related Divisions, as described in this section and related sections.

B. Where shown on the Bid Documents, the Electrical Subcontractor shall name the proposed PCSI. Only approved suppliers, as listed herein, will be accepted.

C. Qualifications

1. The PCSI shall be a "systems house," regularly engaged in the design and installation of control and instrumentation systems and their associated subsystems as they apply to the municipal water or wastewater industry. For the purposes of this and other applicable Divisions, a "systems house" shall be interpreted to mean an organization that complies with all of the following criteria:

   a. Employs a registered professional Control Systems Engineer or Electrical Engineer in the State of Texas to supervise or perform the work required by this Specification Section.

   b. Employs personnel on this project who have successfully completed a manufacturer's training course on the hardware configuration and implementation of the specific programmable controllers, computers, and software proposed for this project.

   c. Has been in the water/wastewater industry performing the type of work specified in this specification section for a minimum of five (5) continuous years.

   d. The PCSI shall maintain a fully equipped office/production facility with full-time employees capable of fabricating, configuring, installing, calibrating, troubleshooting, and testing the system specified herein. Qualified repair personnel shall be available and capable of reaching the facility within 24 hours.

   e. PCSI shall have an Electrical Contractor's license in the State of Texas.

D. The PCSI shall be one of the following:

2. Prime Controls

   1725 Lakepointe Dr.

   Lewisville, TX 75057

   Attn: Gary McNeil

Phone: 972-221-4849

Fax: 972-420-4842

3. Control Panel USA

   2530 Shell Road

   Georgetown, TX 78628

   Attn: Martin Salyer

   Phone: 512-863-3224

4. Richardson Logic Controls, LLC

   2596 CR 168

   McKinney, TX 75071

   Attn: Michael Cunningham

   Phone: 972-542-7375

   Fax: 214-733-8254

5. The listing of specific PCSI organizations above does not imply acceptance of their products and capabilities that do not meet the specified ratings, features and functions.

6. PCSI's listed above are not relieved from meeting these specifications in their entirety.

1.06 HAZARDOUS AREAS

A. Equipment, materials and installation in areas designated as hazardous on the Drawings shall comply with NEC Articles 500, 501, 502 and 503.

B. Equipment and materials installed in hazardous areas shall be UL listed for the appropriate hazardous area classification.

1.07 CODES, INSPECTION AND FEES

A. Equipment, materials and installation shall comply with the requirements of the local authority having jurisdiction.

B. Obtain all necessary permits and pay all fees required for permits and inspections.

1.08 SIZE OF EQUIPMENT

A. Investigate each space in the structure through which equipment must pass to reach its final location. Coordinate shipping splits with the manufacturer to permit safe handling and passage through restricted areas in the structure.

B. The equipment shall be kept upright at all times during storage and handling. When equipment must be tilted for passage through restricted areas, brace the equipment to ensure that the tilting does not impair the functional integrity of the equipment.

1.09 RECORD DRAWINGS

A. As the work progresses, legibly record all field changes on a set of Project Contract Drawings, hereinafter called the "Record Drawings". The Record Drawings and Specifications shall be kept up to date throughout the project.

1.10 EQUIPMENT INTERCONNECTIONS

A. Review shop drawings of equipment furnished under other related Divisions and prepare coordinated wiring interconnection diagrams or wiring tables. Submit copies of wiring diagrams or tables with Record Drawings.

B. Furnish and install all equipment interconnections.

1.11 MATERIALS AND EQUIPMENT

A. Materials and equipment shall be new, except where specifically identified on the Drawings to be re-used.

B. The Electrical Subcontractor, PCSI or ASP shall not bring onsite, material or equipment from a manufacturer, not submitted and approved for this project. Use of any such material or equipment, will be rejected, removed and replaced by the Electrical Subcontractor, PCSI, ASP with the approved material and equipment, at his own expense.

C. Material and equipment shall be UL listed, where such listing exists.

D. The Electrical Subcontractor, PCSI, ASP shall be responsible for all material, product, equipment and workmanship being furnished by him for the duration of the project. He shall replace the equipment if it does not meet the requirements of the Contract Documents.

1.12 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. Two (2) copies of these instructions shall be included with the equipment at time of shipment, and shall be made available to the ENGINEER and OWNER.

B. Shipping groups shall be designed to be shipped by truck, rail, or ship. Indoor groups shall be bolted to skids. Accessories shall be packaged and shipped separately.

C. Equipment shall be equipped to be handled by crane. Equipment shall be suitable for skidding in place on rollers using jacks to raise and lower the groups.

D. Equipment shall be installed in its permanent, finished location shown on the Drawings. Equipment shall be delivered, inventoried and stored on site until installation.

E. Where space heaters are provided in equipment or control panels, provide temporary electrical power and operate space heaters during jobsite storage and after equipment is installed in permanent location, until equipment is placed in service.

1.13 EQUIPMENT IDENTIFICATION

A. Identify equipment (control panels, control stations, instruments, etc.) furnished under instrumentation sections of Division 17 with the name of the equipment it serves. Control panels, Instruments, meters junction or terminal boxes, etc., shall have nameplate designations as shown on the Drawings.

B. Nameplates shall be engraved, laminated impact acrylic, black lettering on a white background, matte finish, not less than 1/16-in thick by 3/4-in by 2-1/2-in, Rowmark 322402. Nameplates shall be 316 SS screw mounted to all enclosures except for NEMA 4 and 4X. Nameplates for NEMA 4 and 4X enclosures shall be attached with double faced adhesive strips, TESA TUFF TAPE 4970, .009 X ½", no equal. Prior to installing the nameplates, the metal surface shall be thoroughly cleaned, with a 70% alcohol solution, until the metal surface residue has been removed. Epoxy adhesive or foam tape is not acceptable.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 COORDINATION MEETINGS

A. The PCSI shall schedule and administer a minimum of three mandatory Coordination Meetings. The PCSI shall plan and schedule coordination meetings; prepare agendas and distribute copies to participants at least one week before scheduled meetings. The meetings shall be held at the General Contractor's field office at the site and shall include, as a minimum, attendance by the OWNER, ENGINEER, ASP's Project Engineer, PCSI's Project Engineer, and the Electrical Subcontractor.

1. The first coordination meeting shall be held in advance of the first PCSI shop drawing submittals (Project Plan and I/O List). The purpose of the first meeting shall be for the PCSI to:

    a. Summarize their understanding of the project

    b. Discuss any proposed substitutions or alternatives

    c. Schedule testing and delivery milestone dates

    d. Provide a forum for the PCSI and OWNER to coordinate hardware and software related issues

    e. Request any additional information required from the OWNER and/or ENGINEER.

    f. The PCSI shall bring a draft version of shop drawings to the meeting to provide the basis for the OWNER's and ENGINEER's input into their development.

2. The second coordination meeting shall be held after the Field Instruments, Hardware and Software Submittals, and Panel Layout Drawing/Wiring Diagrams/Loop Drawing Submittal package has been reviewed by the ENGINEER and returned to the PCSI. The purpose of the second meeting shall be to discuss:

    a. Review comments made on the submittal packages.

    b. Refine scheduled milestone dates.

    c. Coordinate equipment installation activities.

    d. Provide a forum for any additional coordination.

3. The third coordination meeting shall be held one month prior to witnessed factory testing. The purpose of the third coordination meeting is to discuss any remaining coordination requirements.

4. A typical agenda may include, but shall not be limited to, the following:

   a. Review minutes of previous meetings

   b. Review of work progress

   c. Field observations, problems, and decisions

   d. Identification of problems which may impede planned progress

   e. Review of submittal schedule and submittal status

   f. Review of off-site fabrications and delivery schedules

   g. Maintenance of progress schedule

   h. Corrective measures to regain projected schedules

   i. Planned activities for subsequent work period

   j. Coordination of projected progress

   k. Maintenance of quality and work standards

   l. Effect of proposed changes on progress schedule and coordination

   m. Other business relating to project work

3.02 INTERPRETATION OF DRAWINGS

A. Raceways and conductors for instrumentation, communications and other miscellaneous low voltage power and signal systems as specified not shown on the Drawings shall be provided as required for a complete and operating system.

B. The PCSI shall terminate all conductors of instrumentation systems to RTU and/or PLC Termination Cabinets, where designated on the Drawings. The conduit and wire, as shown on the electrical interface drawings, may not necessarily be shown on the floor plan.

C. Install conductors carrying low voltage signals (typically twisted shielded pair cables) in raceways totally separate from all other raceways containing power or 120 volt control conductors, Refer to NEC article 725. DC and AC control wiring shall be installed in separate raceways.

D. Redesign of electrical or mechanical work, which is required due to the Electrical Subcontractor's use of a pre-approved alternate instrumentation or control item, or arrangement of equipment and/or layout other than specified herein, shall be done by the Electrical Subcontractor at his/her own expense. Redesign and detailed plans shall be submitted to the Design Builder/Design Engineer for approval. No additional compensation will be provided for changes in the work, either his/her own or others, caused by such redesign.

3.03 INSTRUMENTATION EQUIPMENT PADS AND SUPPORTS

A. Equipment pads and supports, of concrete or steel including structural reinforcing and foundations, are shown on the Structural Drawings.

3.04 INSTALLATION

A. Any work not installed according to the Drawings and this Section shall be subject to change as directed by the OWNER/ENGINEER. No extra compensation will be allowed for making these changes.

B. All dimensions shall be field verified at the job site and coordinated with the work of all other trades.

C. Equipment shall be protected at all times against mechanical injury or damage by water. Equipment shall not be stored outdoors. Equipment shall be stored in dry permanent shelters as required by each Specification Section. Do not install equipment in its permanent location until structures are weather-tight. If any apparatus has been subject to possible injury by water, Equipment shall be thoroughly dried out and tested as directed by the OWNER/ENGINEER, or shall be replaced at no additional cost at the OWNER/ENGINEER's discretion.

D. Equipment that has been damaged shall be replaced or repaired by the equipment manufacturer, at the OWNER/ENGINEER's discretion.

E. Repaint any damage to the factory applied paint finish using touch-up paint furnished by the equipment manufacturer. If the metallic portion of the panel or section is damaged, the entire panel or section shall be replaced, at no additional cost to the OWNER.

3.05 MANUFACTURER'S SERVICE

A. Provide manufacturer's services for testing and start-up of the equipment as listed in each individual Specification Section.

B. Testing and startup shall not be combined with training. Testing and start-up time shall not be used for manufacturer's warranty repairs.

C. Check interlocking, control and instrument wiring for each system and/or part of a system to prove that the system will function properly as indicated by schematics, wiring diagrams and Control Descriptions.

D. Testing shall be scheduled and coordinated with the OWNER/ENGINEER at least six (6) months in advance. Provide qualified test personnel, instruments and test equipment.

E. Refer to the individual Instrumentation Equipment Sections for additional specific testing requirements.

F. Make adjustments to the systems and instruct the OWNER's personnel in the proper operation of the systems.

END OF SECTION

SECTION 17325

PROCESS CONTROL SYSTEM CONTROL PANELS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish and install fully functional control panels to manually and automatically operate control systems as specified in the detailed requirements of the instrumentation sections of Division 17, and supplemented with logic and schematics diagrams as shown on the Electrical and Instrumentation Drawings.

B. It is the intent of these specifications to have all I/O and signal conditioning components included within their respective control panels. The panel sizes listed herein shall be considered minimum. The Process Control System Integrator (PCSI) shall be responsible for final sizing of enclosures to meet the clearance requirements of NFPA 79, the NEC and as specified herein. Should the PCSI submit a panel size and layout that is, in the opinion of the OWNER and/or ENGINEER, insufficient in size to meet these requirements, the submittal will not be approved and will be returned for revision and resubmission. The PCSI shall be required to revise the panel size and layout and resubmit for approval at no additional cost to the OWNER.

C. Control panels as specified in the Process Equipment Division, Electrical Equipment Division or Mechanical Equipment Divisions, except as specifically stated herein shall not be submitted under this section.

D. All enclosures and panel components shall be of the same manufacture wherever possible.

E. Installation and configuration of network infrastructure cabling and equipment shall be a cooperative and coordinated effort between the General CONTRACTOR, the PCSI and the Application Services Provider (ASP). The PCSI shall furnish all labor necessary for the installation and testing as required to fully meet the applicable specifications of this equipment.

F. The following panels shall be furnished by the PCSI. Each panel shall be supplied with full back panels and side panels as necessary. CONTRACTOR shall be responsible for furnishing any and all control panels shown in the Drawings but not included in the following listing.

Table 17325 PCSI-Furnished Control Panels

PANEL ID	ENCLOSURE MATERIAL	ENCLOSURE RATING	PANEL LOCATION	MINIMUM ENCLOSURE SIZE*
Analyzer Panel	Stainless Steel	NEMA 4X	GST area	60” W x 18” D x 62” H
Level Controller Relay Panel	Stainless Steel	NEMA 4X	GST area	24” W x 12” D x 24” H
Level Transmitter Enclosure	Stainless Steel	NEMA 4X	GST	24” W x 12” D x 24” H

***Final enclosure sizing is the responsibility of the PCSI.**

1.02 RELATED WORK

A. Section 17300 Process Control Systems General Provisions

B. Section 17327 Panel Mounted Control Devices

1.03 SUBMITTALS

A. Submittal Process:

1. Submittals shall be made in accordance with the requirements of Section 17300, and as additionally specified herein.

2. Submittals require information on related equipment to be furnished under this Specification, and described in the related sections listed in the Related Work paragraph above. Incomplete submittals not containing the required information on the related equipment will be returned un-reviewed.

3. Equipment specified in Process, Mechanical, or Electrical Equipment Divisions, and supplied as an integral part of a process equipment manufacturer’s package shall be submitted with the manufacturer’s submittals, in those Divisions.

B. Submittal Content:

1. The PCSI shall create equipment shop drawings, including all wiring diagrams, in the PCSI’s engineering department. All equipment shop drawings shall bear the PCSI logo, drawing file numbers, and shall be maintained on file in the original equipment manufacturer’s archive file system. Photocopies of the ENGINEER’s ladder schematics are unacceptable as shop drawings.

C. Required Submittals:

1. Copies of previously approved related work submittals

2. Documentation confirming that the Panel Assembly Facility is a UL-508 certified panel shop

3. Facsimile of the UL label that is to be applied to each of the completed panels

4. Shop Drawings:

   a. Shop Drawings shall include the following:

      1) Drawings shall be to scale and shall show the location of panel mounted devices, including doors, and sub panels.

      2) Equipment outline drawings showing elevation, plan and interior views, front panel arrangement, dimensions, weight, shipping splits, conduit entrance points and anchor bolt pattern. Indicate all options, special features, ratings and deviations from this section's requirements.

      3) The first sheet of each Panel Drawing Packet shall contain a Bill of Materials for that panel. The Bill of Materials shall list all devices mounted within the panel, and shall include the tag number, description, manufacturer, and model number of each item.

      4) Following the Bill of Material shall be a listing, uniquely identifying each component of the Panel, and a description of the item used, i.e. devices by their assigned tag numbers, nameplate inscriptions, service legend, and annunciator inscriptions.

      5) Include power and control schematics with external connections. Show wire and terminal numbers and color-coding.

   b. Interconnecting Wiring Diagrams:

      1) Provide interconnecting wiring diagrams showing electrical connections between equipment, consoles, panels, terminal junction boxes, and field mounted components.

      2) Diagrams shall show component and panel terminal board identification numbers, and external wire and cable numbers.

      3) Circuit names corresponding to the Circuit and Raceway Schedule shall be shown. The diagram shall include intermediate terminations between field elements and panels (e.g., terminal junction boxes, pull boxes, etc.)

1.04 REFERENCE CODES AND STANDARDS

A. Instrumentation equipment, materials and installation shall comply with the National Electrical Code (NEC and with the latest edition of the following codes and standards:

1. NEMA ICS 6 Enclosures for Industrial Controls and Systems

2. Underwriters Laboratories (UL)

3. UL 508, the Standard of Safety for Industrial Control Equipment

4. UL 508A, the Standard of Safety for Industrial Control Panels

5. NEMA ICS 4 Terminal Blocks for Industrial Use.

6. NEMA LS1 Low Voltage Surge Protection Devices

7. All equipment and installations shall conform to applicable Federal, State, and local

codes.

1.05 QUALITY ASSURANCE

A. The manufacturer of this equipment shall have produced similar equipment for a minimum period of five (5) years. When requested by the OWNER or ENGINEER, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

B. The control panels shall be assembled in a UL-certified panel shop, experienced in the assembled of control panels for water and waste water treatment systems. A submittal of the documentation, that certifies the panel fabrication shop is a UL-certified shop, is required.

C. Equipment components and devices shall be UL labeled wherever UL standards exist for such equipment. The completed control panel shall be UL Labeled in accordance with UL 508 and or 508A as applicable. The panel shall be UL labeled for the environment in which it is to be placed. A UL label shall be affixed to the inside of the external door by the panel fabrication assembly shop. Submit a facsimile of the UL label in the submittal information.

D. Equipment submitted shall fit within the space shown on the Drawings. Equipment which does not fit within the space is not acceptable.

1.06 DELIVERY STORAGE AND HANDLING

A. Completed control panels and related equipment shall be handled and stored in accordance with manufacturer's instructions. Two (2) copies of these instructions shall be included with the equipment at time of shipment, and shall be made available to the general contractor, the OWNER and ENGINEER.

B. Shipping groups shall be designed to be shipped by truck, rail, or ship. Indoor groups shall be bolted to skids. Accessories shall be packaged and shipped with each panel.

C. Visible shipping damage to any portion of a shipment shall be assumed to have also damaged the surrounding portion. The visibly damaged and the surrounding panels shall be returned to the manufacturer’s UL 508 facility, for examination and damaged equipment replaced, followed by a Witnessed Test of the returned portion, as specified in Section 17302, at no expense to the OWNER or ENGINEER.

D. Control Panels shall be installed in their permanent finished location shown on the Drawings within seven (7) calendar days of arriving onsite. If the equipment cannot be installed within seven (7) calendar days, the equipment shall not be delivered to the site, but stored offsite, at the contractor’s expense, until such time that the site is ready for permanent installation of the equipment.

E. Space heaters shall be furnished in control panels and the contractor shall provide temporary electrical power and operate space heaters during storage, and after equipment is installed in permanent location, until equipment is placed in service.

1.07 WARRANTY

A. The Manufacturer shall warrant the equipment to be free from defects in material and workmanship for two (2) years with terms as further defined in Section 17300.

PART 1 PRODUCTS

2.01 MATERIAL MANUFACTURERS

A. Subject to compliance with the contract documents, the following material manufacturers are acceptable:

1. Hoffman
2. EMF
3. Approved Equal

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Materials Manufactures listed above are not relieved from meeting these Specifications in their entirety.

C. Manufactures of all related devises and components shall be as specified elsewhere in related work specifications.

2.02 RATINGS

A. The complete control panel assembly shall be UL certified or carry a UL 508A listing for "Industrial Control Panels".

B. The control panel shall meet all applicable requirements of the National Electrical Code.

C. All devices unless otherwise specified shall be designed for continuous operation at rated current in a 40-degree C ambient temperature.

D. For additional ratings and construction notes, refer to the Drawings.

E. The service voltage shall be as specified and as shown on the Drawings. The overall short circuit withstand and interrupting rating of the equipment and devices shall be equal to or greater than the overall short circuit withstand and interrupting rating of the feeder device immediately upstream of the Control Panel, but not less than 10,000 amperes RMS symmetrical at 120 volts single phase.

2.03 CONSTRUCTION

A. General:

1. Refer to the Drawings for: schematics, actual layout and location of equipment and components; current ratings of devices, bus bars, components; protective relays, voltage ratings of devices, components and assemblies; and other required details.

B. Enclosures:

1. General:

a. Each enclosure shall incorporate a removable back panel, and side panels, on which control components shall be mounted. Back panel shall be secured to the enclosure with collar studs for wall mounted enclosures, and Type 316 SS hardware for free standing enclosures.

b. All free-standing enclosures shall be provided with feet of the same construction as the enclosure.

c. Back panel shall be tapped to accept all mounting screws. Self-tapping screws shall not be used to mount any components.

d. All enclosure doors shall have bonding studs. The enclosure interior shall have a bonding stud.

e. Each enclosure shall be provided with a documentation pocket on the inner door.

f. Enclosures shall not have holes or knockouts.

g. Provide manufacturer's window kits where shown on the Drawings.

h. All panels installed outdoors shall have a factory applied, suitable primer and final coat of weatherproof white paint.

i. All enclosures shall be pad lockable.

j. All enclosures shall be lockable, and keyed alike.

2. NEMA 4X All panels not otherwise defined:

a. Where an enclosure is not otherwise defined or shown on the Drawings:

1) NEMA 4X Type 316 Stainless Steel

2) Type 316 stainless steel, body and door

3) Stainless steel continuous hinge or concealed stainless steel hinges

4) Foam in-place gasket or PORON AquaPro

5) Single point quarter turn latches (20" x 24" and below). All others 3-point latch

b. Manufacturers:

1) Hoffman Concept Series

2) EMF Company

3) NEMA Enclosures Company

4) Hammond Company

5) Unity Manufacturing

6) Approved Equal

C. Environmental Controls: (Analyzer Cabinet Only)

1. Enclosure Condensate Heaters:

a. A self-contained enclosure condensation heater with thermostat and fan shall be mounted inside the control panel, if panel is to be installed outdoors or in a non-air-conditioned space:

1) Enclosure heaters shall be energized from 120 volt, single-phase power supply and sized to prevent condensation within the enclosure.

2) Locate enclosure heaters to avoid overheating electronic hardware or producing large temperature fluctuations on the hardware.

3) Enclosure heaters shall have an internal fan for heat distribution and shall be controlled with adjustable thermostats. The thermostat shall have an adjustment range of 40 degrees Fahrenheit to 90 degrees Fahrenheit. Provide a circuit breaker or fused disconnect switch within the enclosure.

4) Enclosure heaters shall be Hoffman type DAH.

b. Strip heaters may be provided if they are 240 volt rated, powered at 120 volts AC and do not have a surface temperature higher than 60° C. Strip heaters and thermostats shall be as manufactured by Chromalox:

1) Strip heaters shall be Chromalox, Type OT, 1.5-in wide, 240 Volts, single phase, 150 watts, energized at 120 volts, with rust resisting iron sheath, Catalog No. OT-715, Product Code No. 129314. Provide sufficient wattage in heaters to prevent condensation should the interior temperature of the enclosure drop below the dew point.

2) A control thermostat mounted inside the control panel shall be Chromalox, Type WR, single stage, Catalog No. WR-80, Product Code No.263177.

3) The strip heater terminals shall be guarded by a protective terminal cover.

4) High temperature connecting lead wire shall be used between the thermostat and the heater terminals. Wire shall be No. 12 AWG stranded nickel-plated copper with Teflon glass insulation and shall be the product of Chromalox, Catalog No. 6-CFI-12, and Product Code No. 263783.

2. Enclosure Air Conditioner:

a. Enclosures containing electronic devices or electrical equipment to be installed outdoors or in a non-air conditioned space shall have air conditioners that will maintain the internal temperature at or below the equipment rating without violating the NEMA rating of the enclosure.

b. The panel builder shall provide panel internal heat rise calculations to show that the panel internal temperatures will be maintained below the maximum operating temperatures of the panel components:

1) For enclosures mounted indoors in non-air-conditioned spaces, include an ambient air temperature of 40 degrees C and a humidity of 100% non-condensing.

2) For enclosures mounted in direct sunlight add the appropriate solar heat gain component to the calculation, and raise the ambient temperature to 60 degrees C.

3) The calculation shall show all the internal and external heat gain loads, the expected internal temperature rise in degrees C above the specified ambient without the air conditioner. Provide a calculation showing the expected temperature rise in degrees C above the specified ambient with the air conditioner running.

c. The air conditioner shall have the following features:

1) Use CFC-free R134a refrigerant.

2) Have fully gasket flanges on all four (4) mounting edges for a watertight seal that maintains NEMA rating of the panel.

3) Thermostatic low temperature control to provide energy efficient operation and prevents over-cooling.

4) EMI/RFI suppressor to minimize transient spikes during compressor on/off cycling.

5) Separated blower-driven evaporator and condenser air systems for closed loop cooling.

6) UL listed.

7) Stainless steel enclosure rated NEMA 4X.

8) Internal corrosion resistant coating and/or galvanized steel components.

9) Low ambient kit.

10) Short cycle protector.

d. Manufacturers:

1) Rittal

2) Cooper B-Line

3) ICE Cube

4) Approved Equal

3. Corrosion Protection:

a. Provide corrosion protection in each control panel with a Corrosion-Inhibiting vapor capsule as manufactured by Northern Instruments; Model Zerust VC, or Hoffman Engineering; Model A-HCI.

2.04 PANEL EQUIPMENT

A. Equipment Requirements:

1. The requirements for equipment, controls, meters, converters, etc., for each Control Panel, shall be as shown on the Panel Schedule herein, the Drawings, panel schematics, and the functions specified in the control narratives sections of the specifications.

2. All other equipment, controls, meters, converters that are designed as a part of the control panel, shall be as specified in Section 17327 Panel Mounted Equipment and the Related Work Sections specified herein.

3. Furnish installed in each Control Panel, a dedicated Surge Protective Device (SPD) (UL 1449 Type 3), permanently connected, on the load side of the power entrance, as specified in Section 17327 Panel Mounted Equipment.

4. Provide a main circuit protective device, DIN rail mounted, to protect the panel equipment with an external cable actuated lockable disconnected means.

B. Panel Control Device Requirements:

1. Control Devices and Indicators:

a. All operating control devices, indicators, and instruments shall be securely mounted on the panel door. All controls and indicators shall be 30 mm, corrosion resistant, NEMA 4X/13, anodized aluminum or reinforced plastic. Booted control devices are not acceptable. Auxiliary contacts shall be provided for remote run indication and indication of each status and alarm condition. Additional controls shall be provided as specified herein and as required by the detailed mechanical and electrical equipment requirements.

b. Indicator lamps shall be LED type. For all control applications, indicator lamps shall incorporate a push-to-test feature. Lens colors shall be as follows:

1) Red for RUNNING, Valve OPENED, and Breaker CLOSED.

2) Green for OFF, Valve CLOSED, and Breaker OPEN

3) Amber for FAILED

4) Blue for READY

5) White for POWER ON

c. Mode selector switches (HAND-OFF-AUTO, LOCAL-OFF-REMOTE, etc.) shall be as shown on the Drawings. Units shall have the number of positions and contact arrangements, as required. Each switch shall have an extra dry contact for remote monitoring.

d. Pushbuttons shall be as follows:

1) Red for RUNNING, Valve OPEN, Breaker CLOSE, and mushroom Red for EMERGENCY STOP

2) Green for STOP, Valve CLOSE, and Breaker OPEN

3) Black for RESET

e. Furnish nameplates for each device. All nameplates shall be laminated plastic, black lettering on a white background, attached with stainless steel screws. Device mounted nameplates are not acceptable.

2. A failure alarm with horn and beacon light shall be provided when required or specified. Silence and reset buttons shall be furnished. Alarm horn and beacon shall be by Federal Signal or Crouse-Hinds, NEMA 4X for all areas except for NEMA 7 areas, which shall be NEMA 7/4X cast aluminum.

3. Control and Instrument Power Transformers:

a. Control power transformers shall be provided where shown on the Drawings. Transformer shall be sized for the entire load, including space heaters, plus 25% spare capacity, and shall be not less than 100 VA.

b. Control power transformers shall be 120 volt grounded secondary. Primary side of the transformer shall be fused in both legs. One leg of the transformer secondary shall be solidly grounded while the other leg shall be fused.

2.05 EQUIPMENT INSTALLATION

A. Equipment Mounting:

1. The location of the installed equipment shall be as shown on the Panel Layouts on the Drawings.

2. Each piece of equipment shall be securely mounted to the back plate or side plate in accordance with the manufacturer's installation instructions. All mounting hardware shall be from the front of the back plate or side plate with threaded screws. Attaching hardware shall not be installed from the rear of the back plate or side plate. Removal of any piece of equipment shall not require the removal or loosening of any other piece of equipment.

3. Operator interface equipment installed on the door shall be arranged as shown on the Drawings in accordance with the manufacturer's installation instructions. No penetrations of the door shall be made except for equipment mounting. Provide adequate clearance between pieces of equipment and door latching mechanisms.

B. Nameplates:

1. External:

a. Nameplates shall be engraved, laminated impact acrylic, matte finish, not less than 1/16-inch thick by 3/4-inch by 2-1/2-inch, Rowmark 322402. Nameplates shall be Type 316 SS screw mounted to all enclosures except for NEMA 4 and 4X. Nameplates for NEMA 4 and 4X enclosures shall be attached with double faced adhesive strips, TESA TUFF TAPE 4970,.009 X ½". Prior to installing the adhesive nameplates, the metal surface shall be thoroughly cleaned with 70% alcohol until all residues has been removed. Epoxy adhesive or foam tape is not acceptable:

1) There shall be a master nameplate that indicates supply voltage equipment ratings, short circuit current rating, manufacturer's name, shop order number and general information. Cubicle nameplates shall be mounted on the front face, on the rear panel and inside the assembly, visible when the rear panel is removed.

2) Provide permanent warning signs as follows:

a) "Danger- High Voltage- Keep Out" on all doors where any voltage over 125 volts AC is present.

b) "Warning- Hazard of Electric Shock - Disconnect Power Before Opening or Working on This Unit" on main power disconnect or disconnects.

2. Internal:

a. Provide the panel with a UL 508A label.

b. 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 the submitted and reviewed wiring diagrams.

3. Special:

    a. Identification nameplates shall be white with black letters, caution nameplates shall be yellow with black letters, and warning nameplates shall be red with white letters.

C. Wiring Trough and Terminal Block Installation:

1. Space between wiring troughs and equipment shall be such that space for terminal blocks is provided for termination of each conductor or group of conductors before connection to the equipment. Removal of equipment for service shall not leave any exposed conductors hanging unconnected.

2. Install the wiring troughs such that one may be removed without interference from the other. Troughs shall be installed such that trough covers may be removed without cover interference.

3. Install terminal blocks on DIN rail with adequate space for access to the terminal with clear view of the wire identification label. All incoming or outgoing wiring shall enter or leave the panel on terminal blocks. Terminal blocks or wiring troughs shall not be installed on the doors. Provide terminal blocks on side plates and back plates for all door mounted equipment.

4. In no case shall internal and external wiring share a wiring trough.

5. Provide 600 volt rated terminal blocks for any conductor carrying any voltage over 120 volts to ground.

6. Provide 600 volt rated strap screw terminal blocks for any power conductors carrying over 20 amps, at any voltage. Terminals shall be double sided and supplied with removable covers to prevent accidental contact with live circuits.

7. Power conductors carrying over 20 amps, at any voltage shall be terminated to strap-screw type terminal blocks with crimp type, pre-insulated, ring-tongue lugs. Lugs shall be of the appropriate size for the terminal block screws and for the number and size of the wires terminated. Do not terminate more than one conductor in any lug, and do not land more than two conductors under any strap- screw terminal point.

8. Terminals shall have permanent, legible identification, clearly visible with the protective cover removed. Each terminal block shall have 20 percent spare terminals, but not less than two (2) spare terminals.

9. Do not land more than two (2) conductors per terminal point. Use the manufacturer's provided bridge connectors to interconnect terminal blocks terminating common or ground conductors.

10. Twisted shielded pair or triad cables shall have each individual conductor and shield drain wire landed on individual terminal blocks. Use the manufacturer's provided bridge connectors to interconnect terminal blocks terminating the shield drain wire conductors.

11. Provide an AC ground bar bonded to the panel enclosure, if metal, with 20 percent spare terminals.

12. Provided ground terminal blocks for each twisted-shielded pair drain wire.

D. Internal Panel Wiring:

1. Power and control wiring shall be tinned stranded copper, minimum size No. 14 AWG, with 600 volt, 90-degree C, flame retardant, Type MTW thermoplastic insulation. Line side power wiring shall be sized for the full fault current rating or frame size of the connected device, and as shown on the Drawings.

2. Analog signal wires shall be 600 Volt Class, insulated stranded tinned copper, twisted shielded #16 AWG pair.

3. All interconnecting wires between panel mounted equipment and external equipment shall be terminated at numbered terminal blocks. Field wiring shall not be terminated directly on any panel-mounted device.

4. All wiring shall be tagged and coded with an identification number as shown on the Drawings. Coding shall be typed on a heat shrinkable tube applied to each end showing origination and destination of each wire. The marking shall be permanent, non-smearing, solvent-resistant type similar to Raychem TMS-SCE.

5. All wiring shall be enclosed in PVC wire trough with slotted side openings and removable cover. Plan wire routing such that no twisted shielded pair cable conducting analog 4-20 mA signals or low voltage analog signals are routed in the same wire trough as conductors carrying discrete signals or power.

6. Control panel wire color code shall be as follows:

   a. Black: AC power at line voltage

   b. Red: switched AC power

   c. Orange: May be energized while the main disconnect is in the off position

   d. White: AC neutral

   e. Orange/white stripe or white/orange stripe: separate derived neutral

   f. Red/white stripe or white/red stripe: switched neutral

   g. Green or green w/ yellow tracer: ground/earth ground

   h. Blue: Ungrounded DC power

   i. Blue/white stripe or white/blue stripe: DC grounded common

   j. Brown: 480 V AC 3 phase - phase A

   k. Orange: 480 V AC 3 phase - phase B

   l. Yellow: 480 V AC 3 Phase - phase C

   m. Purple: common for analog signal wiring

   n. Brown: positive leg of an analog signal

E. Field Entrance Internal Wiring:

1. Field entrance internal wiring shall be neatly grouped by circuit and bound by plastic tie wraps. Circuit groups shall be supported so that circuit terminations are not stressed. In addition, low signal wiring (millivolt and milliamp) shall be bundle separately from the rest of the control wiring.

2. All field wiring shall be tagged and coded with an identification number. Coding shall be typed on a heat shrinkable tube applied to each end of the wire. The marking shall be a permanent, non-smearing, solvent-resistant type similar to Raychem TMS-SCE.

3. All conduit entering or leaving equipment shall be coordinated, in advance with the panel installer, so that the conduit entrances to the enclosure are directly below the termination area for immediate termination. Conduits shall not enter the top or side of the panel unless approved in writing by the OWNER and ENGINEER.

PART 3 EXECUTION

3.01 INSTALLER'S QUALIFICATIONS

A. Installer shall be specialized in installing this type of equipment with minimum five (5) years documented experience. Experience documentation shall be submitted for approval prior to beginning work on this project.

3.02 EXAMINATION

A. Examine installation area to assure there is enough clearance to install the equipment.

B. Housekeeping pads shall be included for the floor mounted panels as detailed on the Drawings.

C. Check concrete pads and baseplates for uniformity and level surface.

D. Verify that the equipment is ready to install.

E. Verify field measurements are as instructed by manufacturer.

3.03 INSTALLATION

A. CONTRACTOR shall install all equipment per the manufacturer's recommendations and Contract Drawings.

B. Conduit hubs for use on raceway system pull and junction boxes shall be watertight, threaded aluminum, insulated throat, stainless steel grounding screw, as manufactured by T&B H150GRA Series.

C. Conduits entering a control Panel or box containing electrical equipment shall not enter the enclosure through the top.

D. Install required safety labels.

3.04 RACEWAY SEALING

A. Where raceways enter junction boxes or control panels containing electrical or instrumentation equipment, all entrances shall be sealed with 3M 1000NS Watertight Sealant.

B. This requirement shall be strictly adhered to for all raceways in the conduit system.

3.05 FIELD QUALITY CONTROL

A. Inspect installed equipment for anchoring, alignment, grounding and physical damage.

B. Check tightness of all accessible electrical connections. Minimum acceptable values are specified in manufacturer's instructions.

C. Provide laminated copies of the Control schematics in each enclosure door pocket.

3.06 CLEANING

A. Remove all rubbish and debris from inside and around the panel. Remove dirt, dust, or concrete spatter from the interior and exterior of the equipment using brushes, vacuum cleaner, or clean, lint free rags. Do not use compressed air.

3.07 EQUIPMENT PROTECTION AND RESTORATION

A. Touch-up and restore damaged surfaces to factory finish, as approved by the manufacturer. If the damaged surface cannot be returned to factory specification, the surface shall be replaced.

END OF SECTION

N

0 40' 80' 160'

SCALE: 1" = 80'

TETRA TECH
Texas Registration No. F-3924
www.tetratech.com
700 N. St Mary's, Suite 300
San Antonio, TX 78205
Ph (210) 299-7900 Fax (210) 226-8497

ADDENDUM

SAN ANTONIO WATER SYSTEM

MARK	DATE	DESCRIPTION	BY
1	07/16/18	PER ADDENDUM NO. 1	DA

SAN ANTONIO WATER SYSTEM

CENTRAL WATER INTEGRATION PIPELINE
MALTSBERGER TANK REHABILITATION

OVERALL SITE PLAN

STATE OF TEXAS
BILL D. MARRIOTT
88701
LICENSED
PROFESSIONAL ENGINEER
7/17/2018

PROJ:	200-09308-18001
DESN:	JK
DRWN:	DA
CHKD:	DB

G-2102

Bar measures 1 inch, otherwise drawing is not to scale

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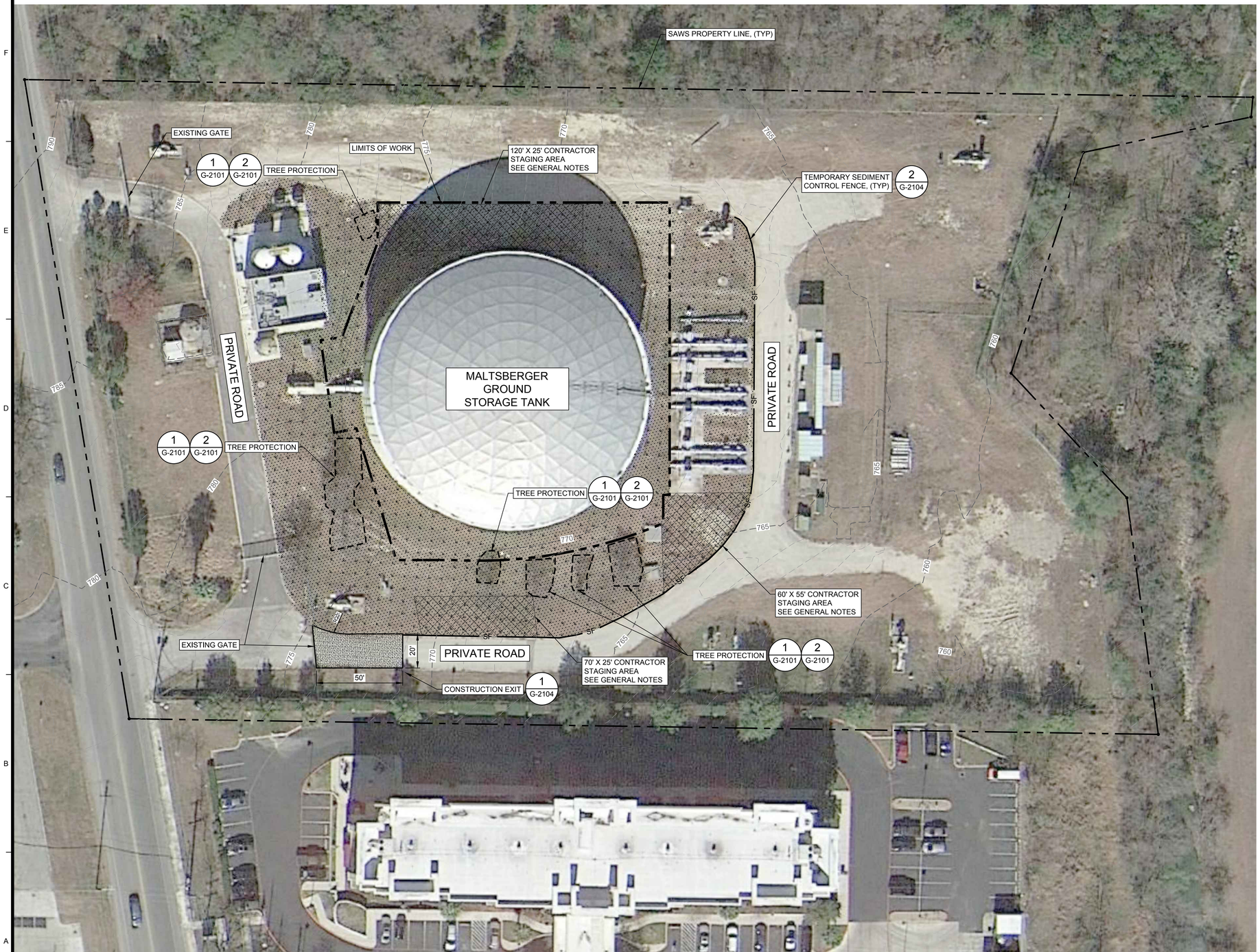

N

0 15' 30' 60'

SCALE: 1" = 30'

LEGEND:

- LIMITS OF WORK
- TREE PROTECTION
- SF — SILT FENCE
- CONTRACTOR STAGING AREA
- REVEGETATION

TOTAL LENGTH:

SILT FENCE= 400 FT

GENERAL NOTES:

1. CONTRACTOR STAGING AREAS TO BE APPROVED BY SAWS CONSTRUCTION INSPECTOR.

SW3P NOTES:

1. CONTRACTOR SHALL REVEGETATE DISTURBED AREAS IN A TIMELY MANNER UPON COMPLETION OF WORK. REVEGETATION SHALL BE IN ACCORDANCE WITH PROJECT SPECIFICATIONS.
2. RESTORATION OF THE SITE SHALL OCCUR PRIOR TO FINAL COMPLETION AND SHALL BE IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS.
3. CONTRACTOR SHALL IMPLEMENT BEST MANAGEMENT PRACTICES (BMPs) AS REQUIRED FOR EROSION AND SEDIMENT CONTROL WHETHER SHOWN ON THESE PLANS OR NOT. NO SEPARATE PAY ITEM.
4. REFER TO SHEET G-2101 FOR TREE PROTECTION NOTES AND DETAILS.
5. PROVIDE SOIL RETENTION WITHIN 50 FEET OF PAVED ROAD.
6. CONTRACTOR MUST ALLOW VEHICULAR TRAFFIC AROUND THE HIGH SERVICE PUMPS AT ALL TIMES.
7. CONTRACTOR SHALL HYDROMULCH SEED STAGING AREAS, STORAGE AREA AND ANY DISTURBED AREAS AS NOTED IN THE PROJECT SPECIFICATIONS.

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ADDENDUM

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MARK	DATE	DESCRIPTION	BY
1	07/16/18	PER ADDENDUM NO. 1	DA

SAN ANTONIO WATER SYSTEM

CENTRAL WATER INTEGRATION PIPELINE
MALTSBERGER TANK REHABILITATION

CONSTRUCTION STAGING, SWPPP & TREE PROTECTION PLAN

STATE OF TEXAS
BILL D. MARRIOTT
88701
LICENSED PROFESSIONAL ENGINEER
7/17/2018

PROJ:	200-09308-18001
DESN:	JK
DRWN:	DA
CHKD:	DB

G-2103

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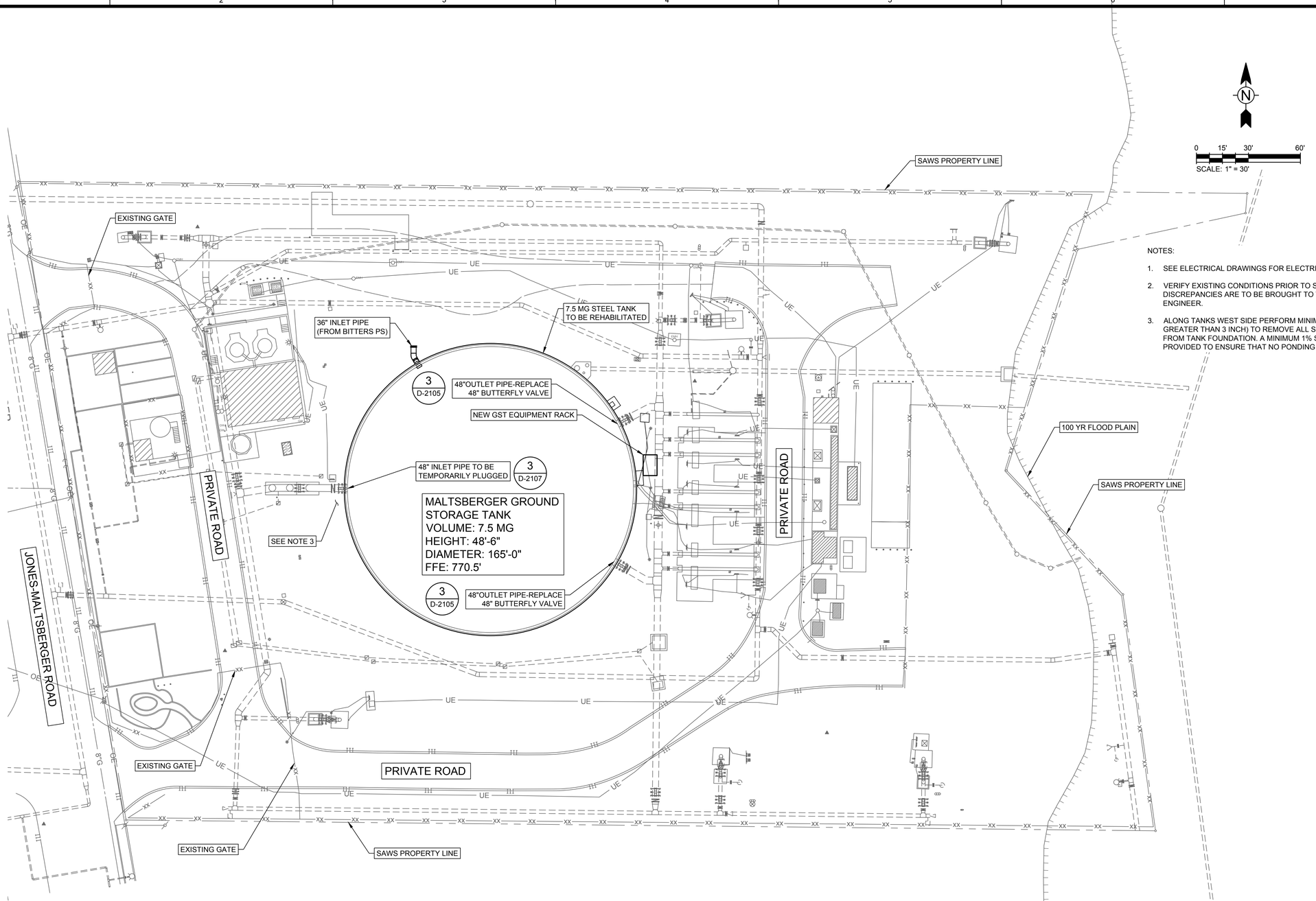

NOTES:

1. SEE ELECTRICAL DRAWINGS FOR ELECTRICAL IMPROVEMENTS.
2. VERIFY EXISTING CONDITIONS PRIOR TO STARTING WORK. ANY DISCREPANCIES ARE TO BE BROUGHT TO THE ATTENTION OF THE ENGINEER.
3. ALONG TANKS WEST SIDE PERFORM MINIMAL GRADING (NO GREATER THAN 3 INCH) TO REMOVE ALL SILT ACCUMULATION FROM TANK FOUNDATION. A MINIMUM 1% SLOPE SHALL BE PROVIDED TO ENSURE THAT NO PONDING OCCURS.

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ADDENDUM

SAN ANTONIO WATER SYSTEM

MARK	DATE	DESCRIPTION	BY
1	07/16/18	PER ADDENDUM NO. 1	DA

SAN ANTONIO WATER SYSTEM
CENTRAL WATER INTEGRATION PIPELINE
MALTSBERGER TANK REHABILITATION
SITE IMPROVEMENT PLAN

1

STATE OF TEXAS
BILL D. MARRIOTT
86701
LICENSED
PROFESSIONAL ENGINEER
7/17/2018

PROJ:	200-09308-18001
DESN:	JK
DRWN:	DA
CHKD:	DB

C-2101

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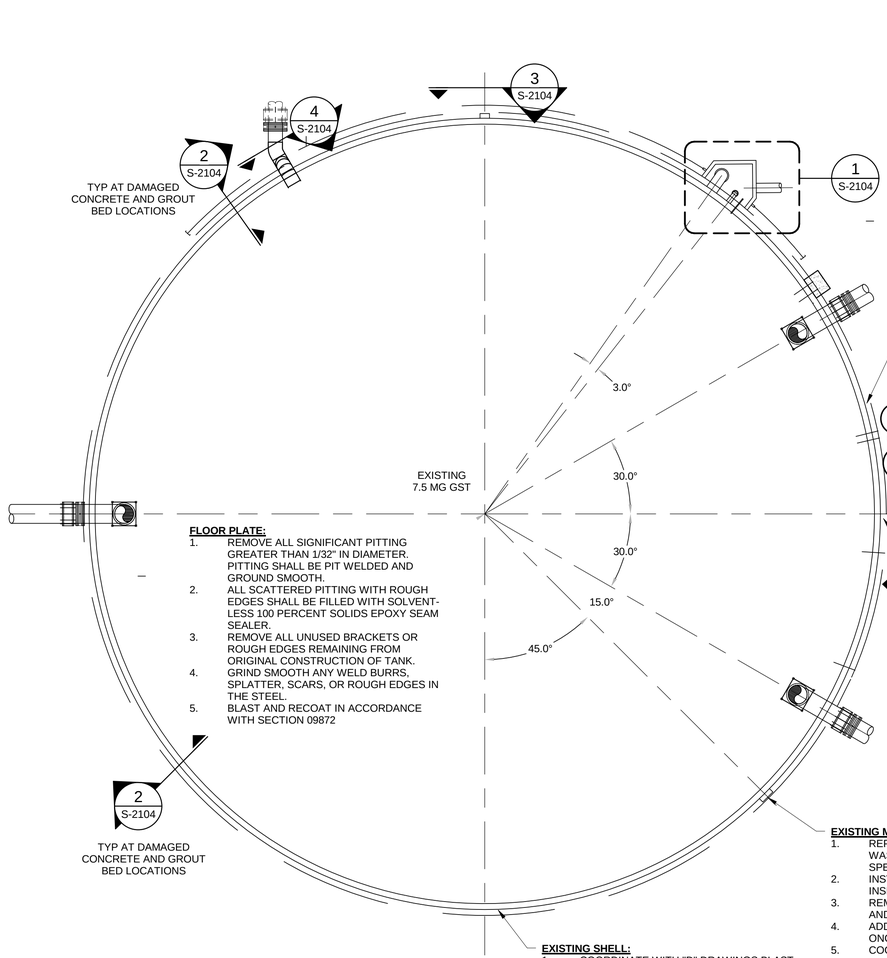


FLOOR PLATE:

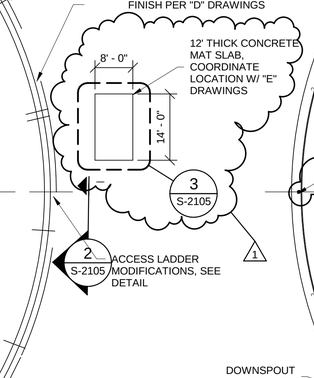
1. REMOVE ALL SIGNIFICANT PITTING GREATER THAN 1/32" IN DIAMETER. PITTING SHALL BE PIT WELDED AND GROUND SMOOTH.
2. ALL SCATTERED PITTING WITH ROUGH EDGES SHALL BE FILLED WITH SOLVENT-LESS 100 PERCENT SOLIDS EPOXY SEAM SEALER.
3. REMOVE ALL UNUSED BRACKETS OR ROUGH EDGES REMAINING FROM ORIGINAL CONSTRUCTION OF TANK.
4. GRIND SMOOTH ANY WELD BURRS, SPLATTER, SCARS, OR ROUGH EDGES IN THE STEEL.
5. BLAST AND RECOAT IN ACCORDANCE WITH SECTION 09872

EXISTING SHELL:

1. COORDINATE WITH "D" DRAWINGS BLAST CLEANING REQUIREMENTS
2. REMOVE ALL UNUSED BRACKETS ETC. GRIND SMOOTH AND FINISH PER "D" DRAWINGS.

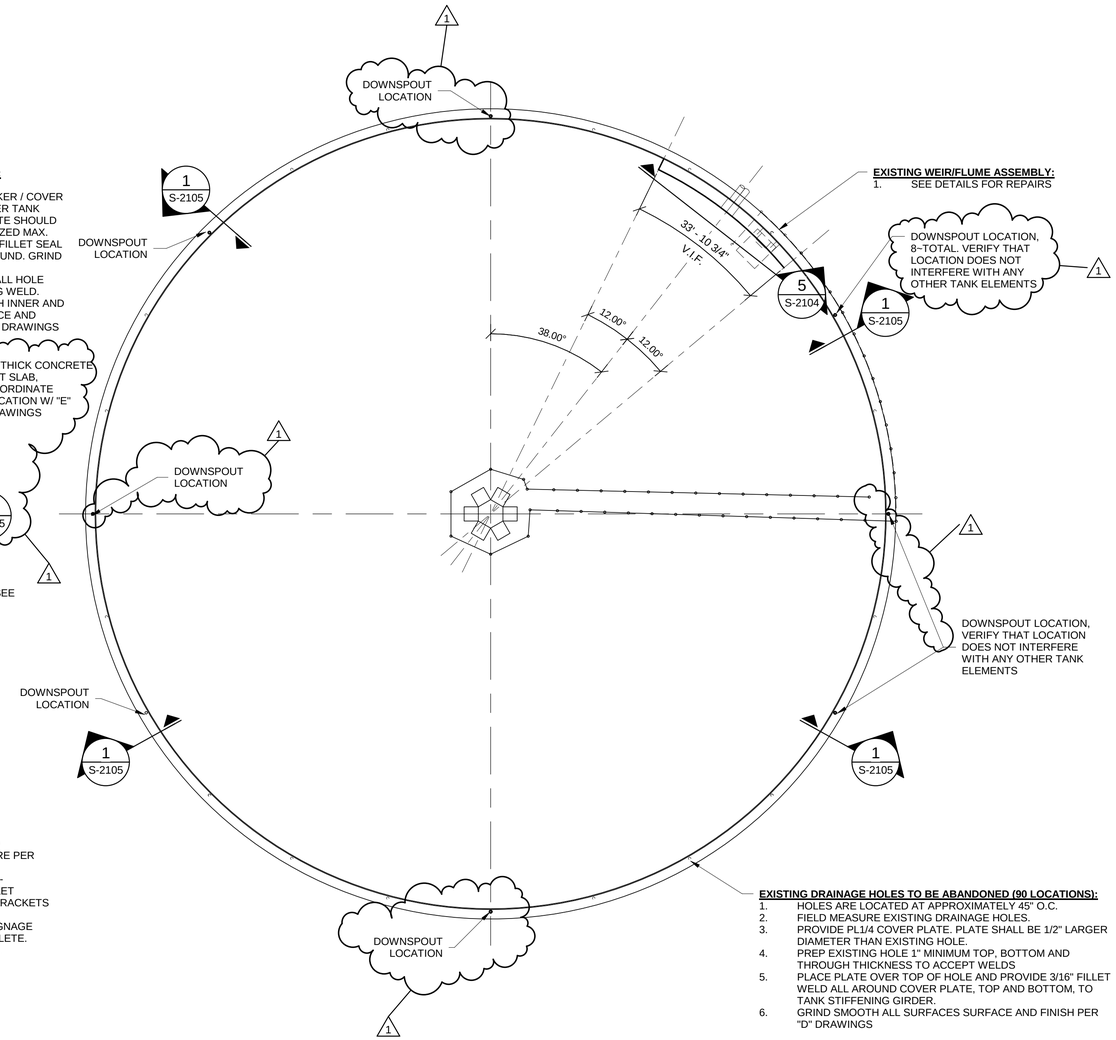
UNUSED SAMPLE TAP:

1. REMOVE TAP.
2. PROVIDE BACKER / COVER PLATE ON INNER TANK SURFACE. PLATE SHOULD BE 1/4" OVERSIZED MAX. PROVIDE 3/16" FILLET SEAL WELD ALL-AROUND. GRIND SMOOTH.
3. PLUG TANK WALL HOLE WITH CJP PLUG WELD.
4. GRIND SMOOTH INNER AND OUTER SURFACE AND FINISH PER "D" DRAWINGS



EXISTING MANWAY:

1. REPLACE ALL NUTS, BOLTS AND WASHERS W/ NEW SS HARDWARE PER SPECIFICATIONS.
2. INSTALL NEW FULL FACE CLOTH-INSERTED GASKET CLOTH GASKET
3. REMOVE UNUSED NAMEPLATE BRACKETS AND REPAIR SURFACE.
4. ADD OSHA CONFINED SPACE SIGNAGE ONCE REHABILITATION IS COMPLETE.
5. COORDINATE W/ "D" DRAWINGS.



EXISTING WEIR/FLUME ASSEMBLY:

1. SEE DETAILS FOR REPAIRS

EXISTING DRAINAGE HOLES TO BE ABANDONED (90 LOCATIONS):

1. HOLES ARE LOCATED AT APPROXIMATELY 45" O.C.
2. FIELD MEASURE EXISTING DRAINAGE HOLES.
3. PROVIDE PL1/4 COVER PLATE. PLATE SHALL BE 1/2" LARGER DIAMETER THAN EXISTING HOLE.
4. PREP EXISTING HOLE 1" MINIMUM TOP, BOTTOM AND THROUGH THICKNESS TO ACCEPT WELDS
5. PLACE PLATE OVER TOP OF HOLE AND PROVIDE 3/16" FILLET WELD ALL AROUND COVER PLATE, TOP AND BOTTOM, TO TANK STIFFENING GIRDER.
6. GRIND SMOOTH ALL SURFACES SURFACE AND FINISH PER "D" DRAWINGS

TANK FLOOR AND ROOF LAYOUTS

SCALE: 1/16" = 1'-0"

N

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TBPE REG NO. F-3924
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San Antonio, TX 78205
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ADDENDUM

STRUCTURAL ENGINEERING ASSOCIATES INC.
CONSULTING ENGINEERS
TBPE FIRM REG. NO. F-199
SAN ANTONIO, TX. 78229
(210) 735-9202 WWW.SEATX.COM

SAN ANTONIO WATER SYSTEM

MARK	DATE	DESCRIPTION	BY
1	7/17/201 8	PER ADDENDUM #1	

SAN ANTONIO WATER SYSTEM

CENTRAL WATER INTEGRATION PIPELINE
MALTSBERGER TANK REHABILITATION

REHABILITATION PLANS

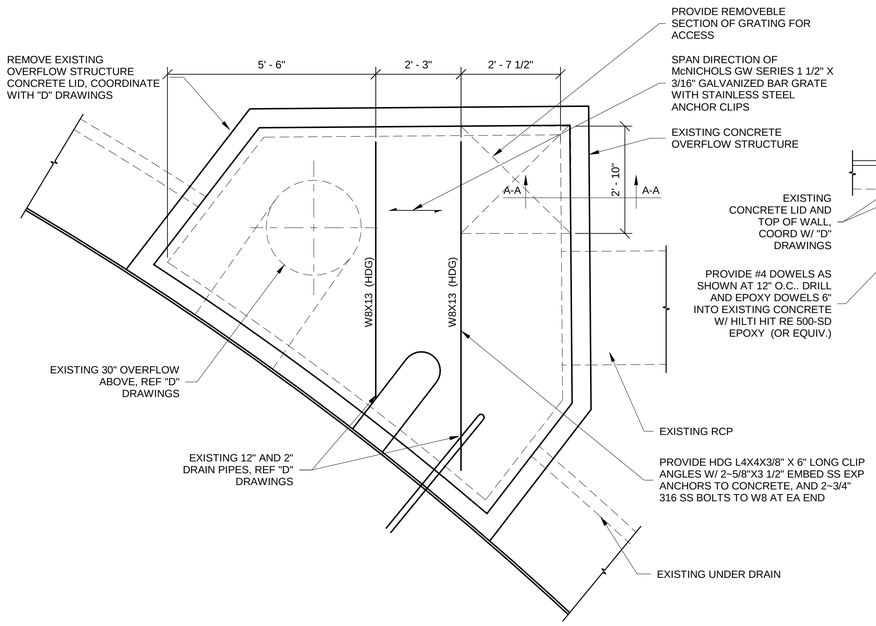
STATE OF TEXAS
ERIC H. JAHELKA
109207
LICENSED PROFESSIONAL ENGINEER

PROJ:	200-09308-18001
DESN:	EHJ
DRWN:	EHJ
CHKD:	SD

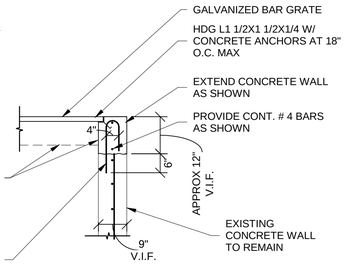
S-2103

Bar measures 1 inch, otherwise drawing is not to scale

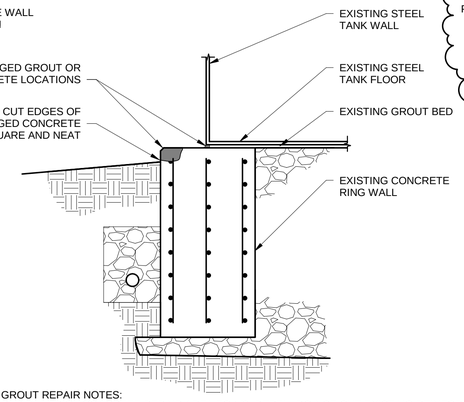
7/17/2018 10:03:02 AM BIM 360://200-09308-18001 CWIPP/09308-02-02-MALT-GST-S-2017.rvt



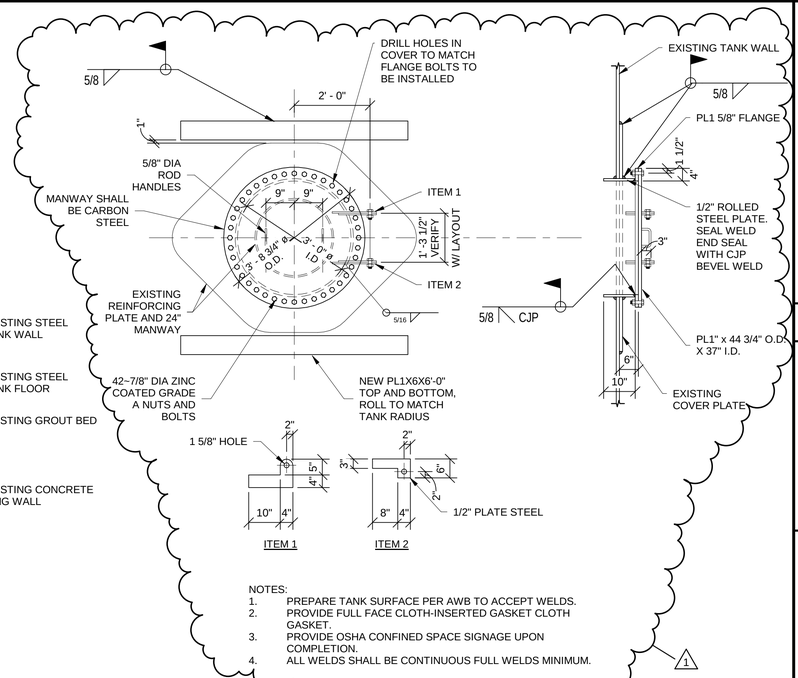
1 PARTIAL PLAN
S-2103 SCALE: 1/2" = 1'-0"



SECTION A-A



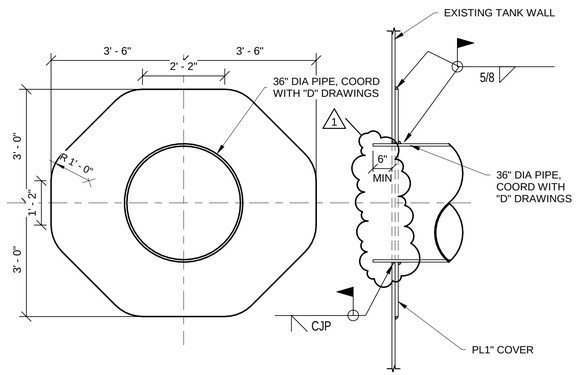
CONCRETE AND GROUT REPAIR NOTES:
1. SAWCUT PERIMETER OF CONCRETE REPAIR AREA TO 1/2" DEPTH. DO NOT CUT EXISTING REINFORCING STEEL, CHIP SUBSTRATE TO OBTAIN SURFACE PROFILE OF 1/8" AMPLITUDE. GROUT BED MAY BE CHIPPED/BUSH HAMMERED WITHOUT SAW CUTTING)
2. REMOVE ALL LOOSE AND DETERIORATED CONCRETE/GROUT TO 1/2" MINIMUM DEPTH.
3. REMOVE ALL LOOSE AND DETERIORATED CONCRETE AROUND ANY EXISTING REINFORCING STEEL EXPOSED BY CONCRETE REMOVAL
4. SANDBLAST EXISTING REINFORCING STEEL TO REMOVE ALL CONTAMINANTS AND RUST.
5. CHIP (E) CONC TO MIN 1/2" BEHIND (E) REBAR - TYP.
6. AREA TO BE PATCHED MUST BE CLEAN AND FREE OF DELETERIOUS MATERIAL. SOAK REPAIR AREA WITH POTABLE WATER.
7. HAND APPLY A 1/4" MINIMUM THICK LAYER OF VERSA SPEED HORIZONTAL REPAIR MORTAR BY EUCLID CHEM COMPANY OR APPROVED EQUAL. APPLY MORTAR IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS. APPLY MORTAR TO SATURATED SURFACE DRY (SSD) SUBSTRATE IN SUCCESSIVE LIFTS IF RECOMMENDED BY MANUFACTURER. EPOXY MORTAR MIN COMPRESSIVE STRENGTH = 6,000 PSI.
8. ALL EXPOSED TANK CONCRETE FOUNDATION AROUND PERIMETER OF TANK SHALL BE SAND BLASTED TO REMOVE ALL PAINT DRIPPINGS



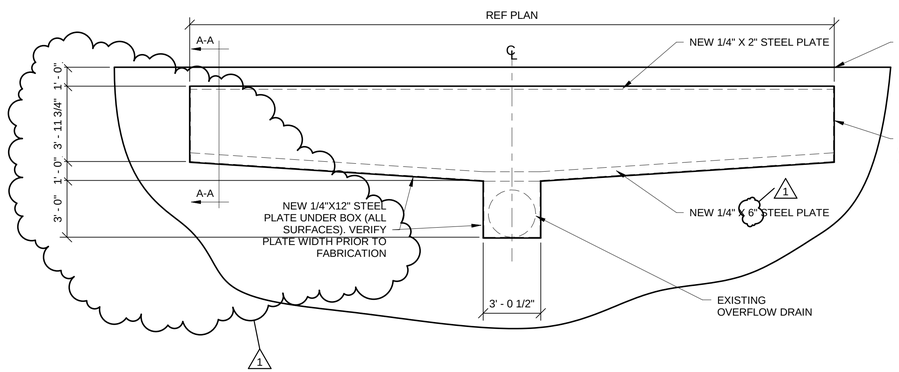
NOTES:
1. PREPARE TANK SURFACE PER AWB TO ACCEPT WELDS.
2. PROVIDE FULL FACE CLOTH-INSERTED GASKET CLOTH GASKET.
3. PROVIDE OSHA CONFINED SPACE SIGNAGE UPON COMPLETION.
4. ALL WELDS SHALL BE CONTINUOUS FULL WELDS MINIMUM.

3 PARTIAL ELEVATION/SECTION
S-2103 SCALE: 1/2" = 1'-0"

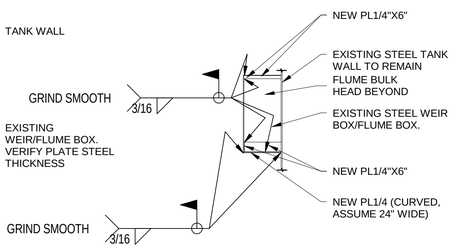
2 SECTION
S-2103 SCALE: 1/2" = 1'-0"



4 PARTIAL ELEVATION/SECTION
S-2103 SCALE: 1/2" = 1'-0"



5 ELEVATION
S-2103 SCALE: 1/4" = 1'-0"



SECTION A-A

NOTE: ALL EDGES OF PLATE TO RECEIVE FILET WELD - SEAL COMPLETELY

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ADDENDUM

STRUCTURAL ENGINEERING ASSOCIATES INC.
CONSULTING ENGINEERS
TBPE FIRM REG. NO. F-199
SAN ANTONIO, TX. 78229
(210) 735-9202 WWW.SEATX.COM

SAN ANTONIO WATER SYSTEM

MARK	DATE	DESCRIPTION	BY
1	7/17/2018	PER ADDENDUM #1	

SAN ANTONIO WATER SYSTEM
CENTRAL WATER INTEGRATION PIPELINE
MALTSBERGER TANK REHABILITATION
DETAILS

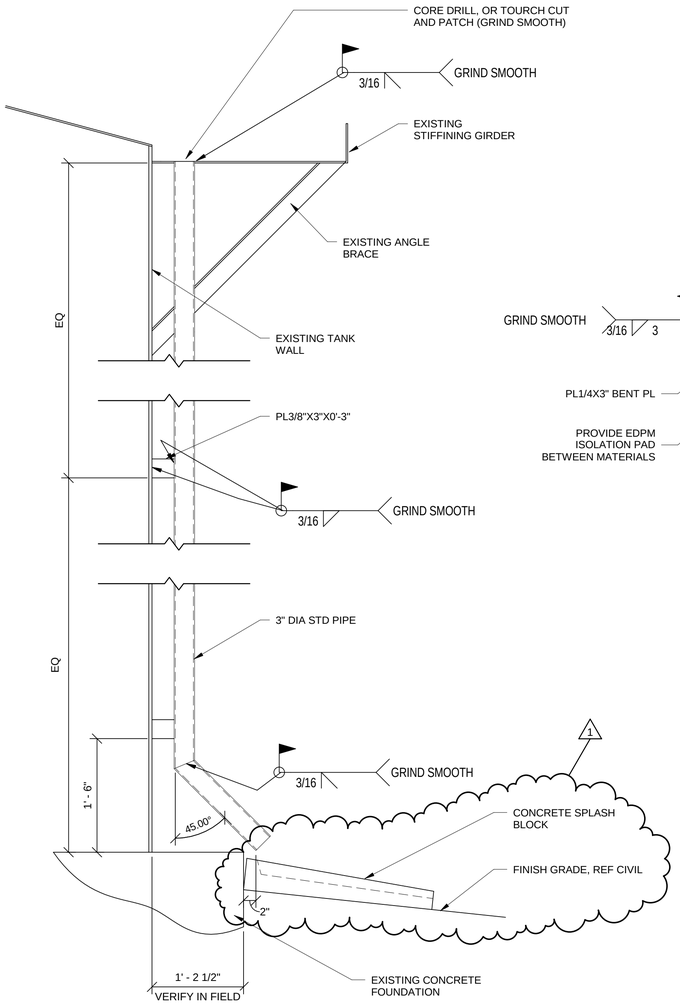
STATE OF TEXAS
ERIC H. JAHELKA
109207
LICENSED PROFESSIONAL ENGINEER

PROJ: 200-09308-18001
DESN: EHJ
DRWN: EHJ
CHKD:

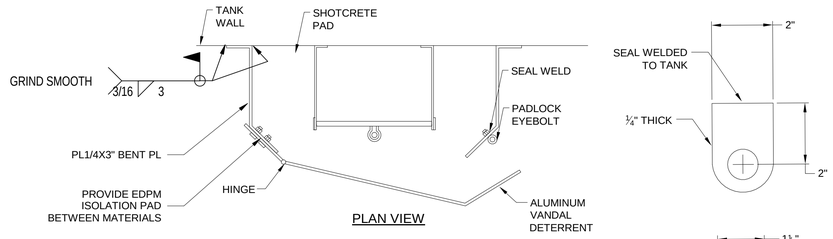
S-2104

7/17/2018 10:03:08 AM BIM 360://200-09308-18001 CWIPP/09308-02-02-MALT-GST-S-2017.rvt

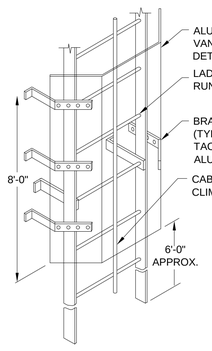
Bar measures 1 inch, otherwise drawing is not to scale



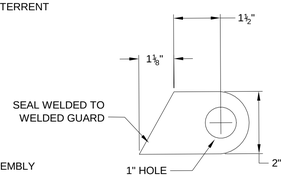
1 DETAIL
S-2103 SCALE: 1" = 1'-0"



PLAN VIEW

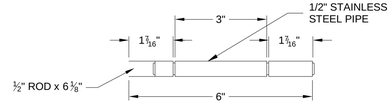


ISO VIEW



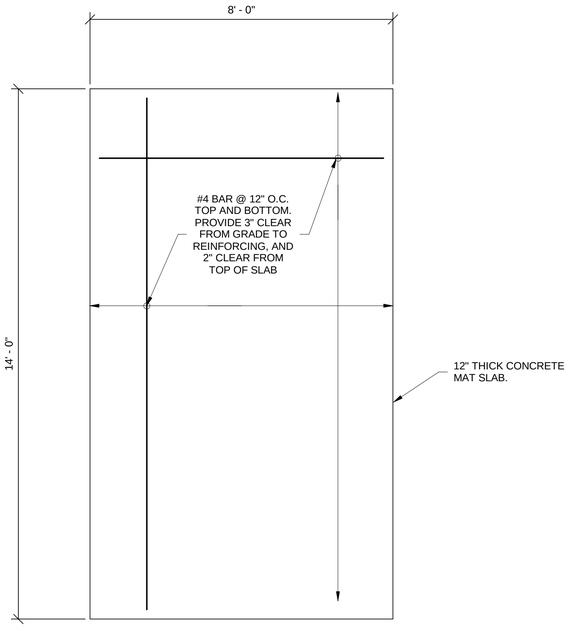
HASP DETAIL

NOTE:
1. ALL HARDWARE AND CONNECTIONS ASSEMBLIES SHALL BE ALUMINUM.



HINGE DETAIL

2 DETAIL
S-2103 SCALE: 1" = 1'-0"



NOTE: COORDINATE LOCATION, ELEVATION AND FINISHED GRADING W/ "E" AND "C" DRAWINGS

3 ELECTRICAL EQUIPMENT PAD
S-2103 SCALE: 1/2" = 1'-0"

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ADDENDUM

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CONSULTING ENGINEERS
TBPE FIRM REG. NO. F-199
SAN ANTONIO, TX. 78229
(210) 735-9202 WWW.SEATX.COM

SAN ANTONIO WATER SYSTEM

MARK	DATE	DESCRIPTION	BY
1	7/17/201 8	PER ADDENDUM #1	

SAN ANTONIO WATER SYSTEM

CENTRAL WATER INTEGRATION PIPELINE
MALTSBERGER TANK REHABILITATION

DETAILS

STATE OF TEXAS
ERIC H. JAHELKA
109207
LICENSED PROFESSIONAL ENGINEER

PROJ:	200-09308-18001
DESN:	EHJ
DRWN:	EHJ
CHKD:	EM

S-2105

Bar measures 1 inch, otherwise drawing is not to scale

7/17/2018 10:03:14 AM BIM 360://200-09308-18001 CWIPP/09308-02-02-MALT-GST-S-2017.rvt

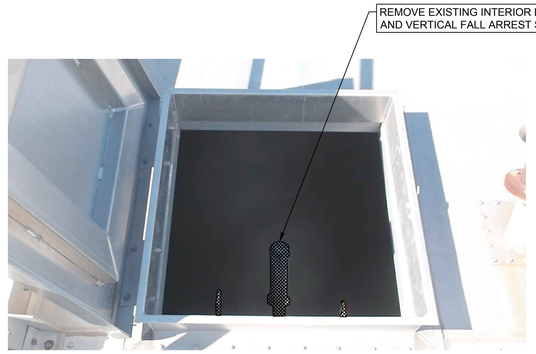
SAMPLE TAP

1 DETAIL
SCALE: NTS

PRESSURE TRANSMITTER ASSEMBLY

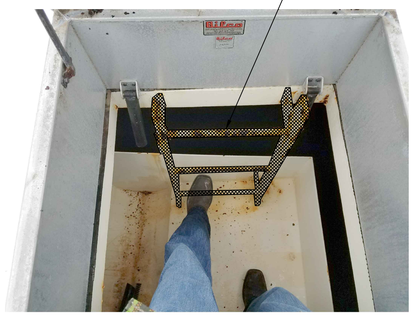
2 DETAIL
SCALE: NTS

INTERIOR LADDER AT PRIMARY ACCESS HATCH



3 DETAIL
SCALE: NTS

INTERIOR LADDER AT OVERFLOW WEIR BOX



4 DETAIL
SCALE: NTS

ANALYZER DRAIN PIPING

5 DETAIL
SCALE: NTS

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ADDENDUM

SAN ANTONIO WATER SYSTEM

MARK	DATE	DESCRIPTION	BY
1	07/16/18	PER ADDENDUM NO. 1	DA

SAN ANTONIO WATER SYSTEM
CENTRAL WATER INTEGRATION PIPELINE
MALTSBERGER TANK REHABILITATION
MALTSBERGER TANK
DEMOLITION PHOTOS I

1

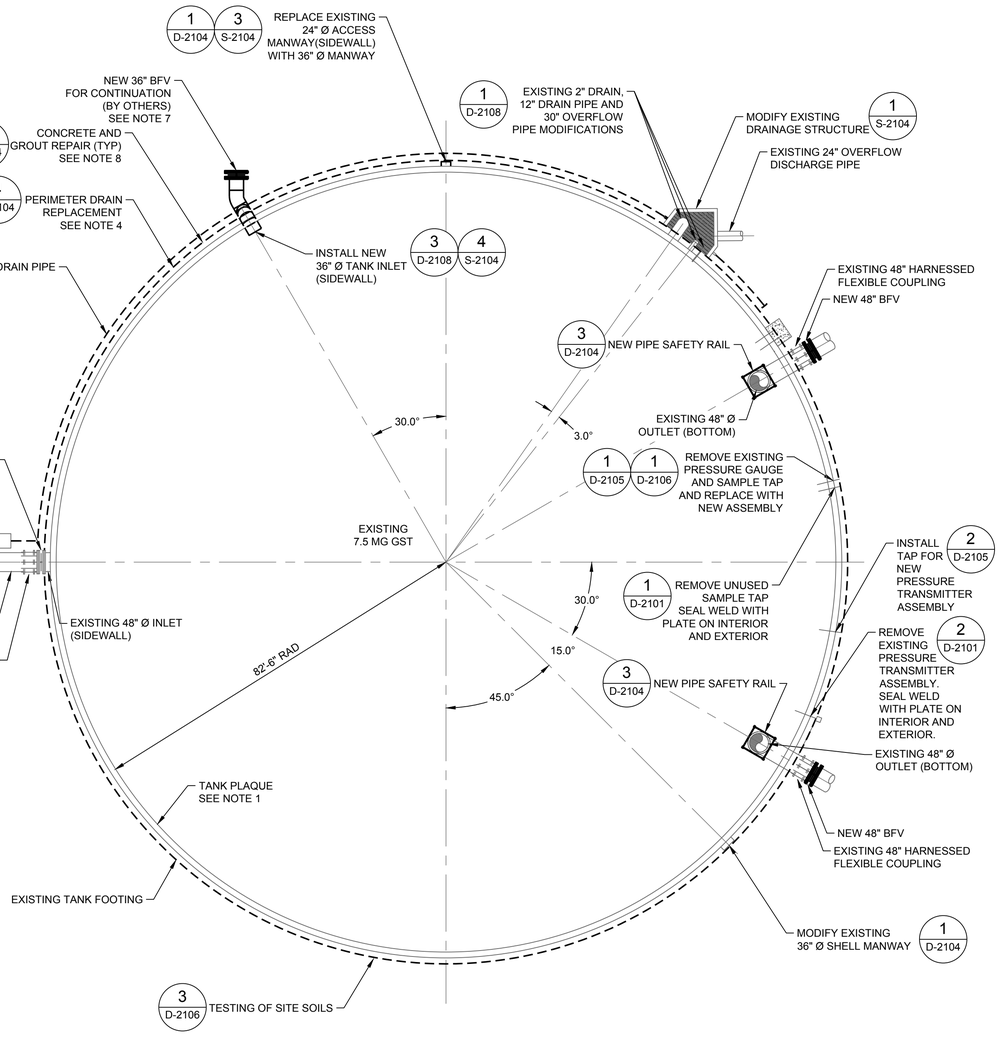
STATE OF TEXAS
BILL D. MARRIOTT
86701
LICENSED
PROFESSIONAL ENGINEER
7/17/2018

PROJ:	200-09308-18001
DESN:	BM
DRWN:	DA
CHKD:	DB

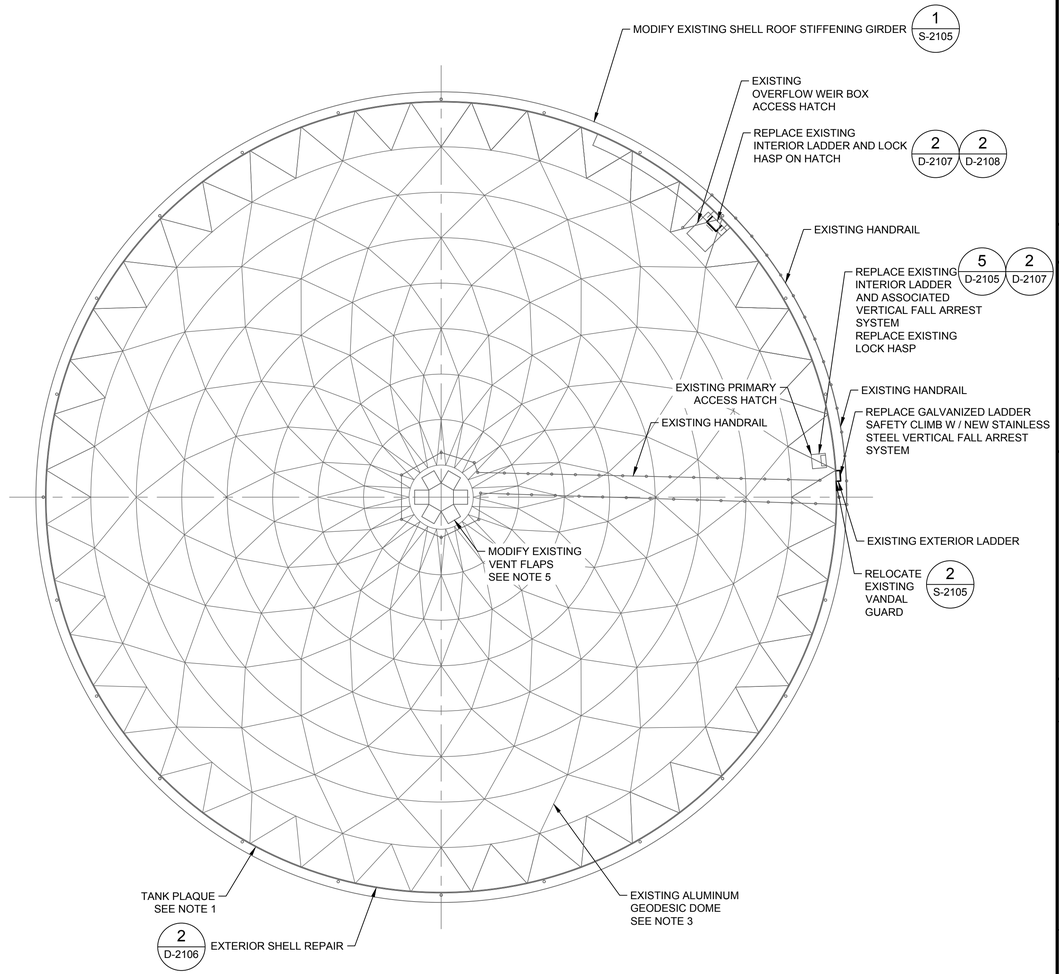
D-2101

Bar measures 1 inch, otherwise drawing is not to scale

7/17/2018 8:49:47 AM - O:\PROJECTS\SAN ANTONIO\09308\200-09308-18001-C\CAD\SHEETFILES\MALTSBERGER TANK\D - MALTSBERGER PS TANK DEMOLITION DETAILS I.DWG - ANDERSON, DEBORAH



1 - TANK FLOOR LAYOUT PLAN
SCALE: NTS



2 - TANK ROOF LAYOUT PLAN
SCALE: NTS

NOTES:

1. REMOVE AND CLEAN TANK PLAQUE PRIOR TO PAINTING. REATTACH TANK PLAQUE AFTER EXTERIOR COATING IS APPLIED.
2. USE FOLLOWING TANK DIMENSIONS TO ESTIMATE TANK SURFACE AREAS (FOR RECOATING PURPOSES):
   - TANK INSIDE DIAMETER = 165 FT
   - TANK SIDEWALL HEIGHT = 48.5 FT
   - TANK FINISHED FLOOR ELEVATION = 770.5 FT
3. NO MODIFICATIONS SHALL BE MADE TO EXISTING ALUMINUM GEODESIC DOME. CONFINE WORK TO THOSE AREAS ON ROOF THAT ARE ACCESSIBLE VIA THE EXISTING HANDRAIL.
4. REPLACE EXISTING PERIMETER DRAIN ONLY WHERE DAMAGED BY THE WORK OF THE CONTRACTOR.
5. MODIFY VENT CLOSURE FLAPS TO ENSURE THAT INGRESS / EGRESS OF BIRDS AND INSECTS IS PREVENTED. COORDINATE WITH VENT MANUFACTURER TO DETERMINE BEST MEANS TO REDUCE STICKING OF VENT FLAPS DURING OPENING AND CLOSING OPERATIONS.
6. EXISTING ANALYZER DRAIN PIPING SHALL BE REPLACED WITH BURIED 1" SCHEDULE 80 PVC PIPING. NEW PIPING SHALL EXTEND FROM THE ANALYZER TO THE DRAINAGE STRUCTURE. CORE OPENING INTO WALL OF DRAINAGE STRUCTURE TO PERMIT DIRECT DISCHARGE. COORDINATE PIPE PLACEMENT SO THAT IT DOES NOT IMPACT EXISTING PERIMETER DRAIN PIPING.
7. INSTALL 1/4" METAL PLATE AS TEMPORARY COVER FOR 36" BFV.
8. GROUT REPAIR SHALL BE MADE FOR THE ENTIRE TANK CIRCUMFERENCE BETWEEN THE TANK BASE PLATE AND CONCRETE FOUNDATION.

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ADDENDUM

SAN ANTONIO WATER SYSTEM

MARK	DATE	DESCRIPTION
1	07/16/18	PER ADDENDUM NO. 1

SAN ANTONIO WATER SYSTEM
CENTRAL WATER INTEGRATION PIPELINE
MALTSBERGER TANK REHABILITATION

MALTSBERGER TANK FLOOR & ROOF LAYOUT PLANS

1

STATE OF TEXAS
BILL D. MARRIOTT
88701
LICENSED
PROFESSIONAL ENGINEER
7/17/18

PROJ:	200-09308-18001
DESN:	BM
DRWN:	DA
CHKD:	DB

D-2103

Bar measures 1 inch, otherwise drawing is not to scale

EXISTING ACCESS MANWAYS

MANWAY #1

NOTES:

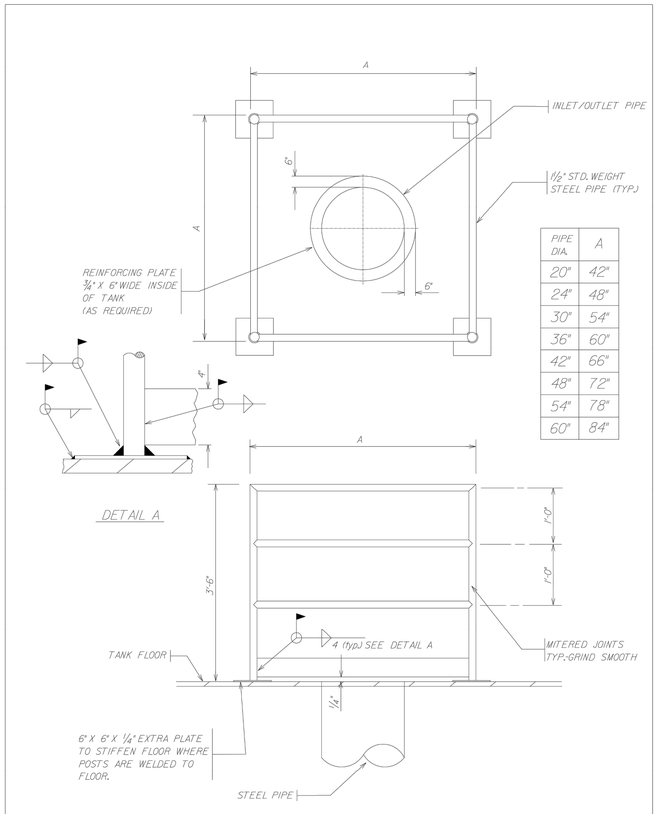
1. MANWAY SIZES: 36" Ø MANWAY
2. PROVIDE NEW 1/4" FULL FACE CLOTH - INSERTED GASKETS, S.S. NUTS, BOLTS & WASHERS AND REINSTALL FOR EACH EXISTING MANWAY.
3. INSTALL NEW "CONFINED SPACE" SIGNAGE FOR BOTH MANWAYS (ONE EXISTING, ONE NEW) PER OSHA REGULATIONS.
4. REMOVE ALL UNUSED NAMEPLATE BRACKETS FROM MANWAY REPAD SURFACE.

1 - DETAIL
SCALE: NTS

NOT USED

2 - DETAIL
SCALE: NTS

PIPE SAFETY RAILING

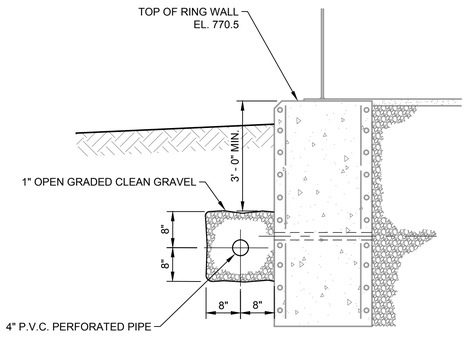


PIPE DIA.	A
20"	42"
24"	48"
30"	54"
36"	60"
42"	66"
48"	72"
54"	78"
60"	84"

PROPERTY OF		APPROVED	REVISED	
SAN ANTONIO WATER SYSTEM SAN ANTONIO, TEXAS	INLET/OUTLET PIPE SAFETY RAILINGS	7-14-00	9-11-03	11-23-04
		DD-900-12	SHEET 2 OF 2	

3 - DETAIL
SCALE: NTS

PERIMETER DRAIN



NOTES :

1. PURPOSE OF 4" PERFORATED PIPE IS TO DETECT A TANK LEAK - PIPE TO DRAIN INTO DRAINAGE STRUCTURE.
2. DETAIL SHALL ONLY APPLY TO SEGMENTS DAMAGED BY THE CONTRACTOR THAT WILL REQUIRE REPLACEMENT.

4 - DETAIL
SCALE: NTS

NOT USED

5 - DETAIL
SCALE: NTS

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San Antonio, TX 78205
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ADDENDUM

SAN ANTONIO WATER SYSTEM

MARK	DATE	DESCRIPTION	BY	DA
1	07/16/18	PER ADDENDUM NO. 1		

SAN ANTONIO WATER SYSTEM
CENTRAL WATER INTEGRATION PIPELINE
MALTSBERGER TANK REHABILITATION
MALTSBERGER TANK
DETAILS I

1

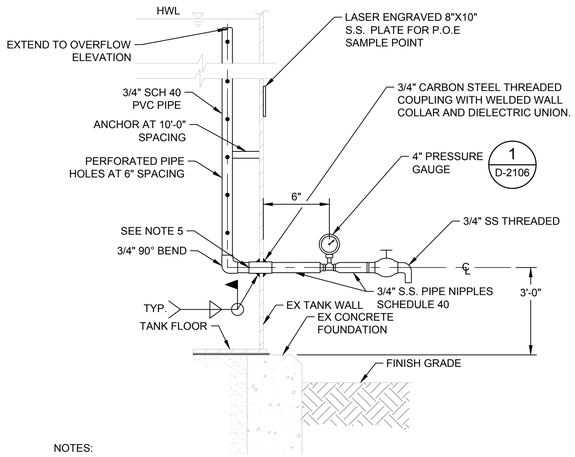
STATE OF TEXAS
BILL D. MARRIOTT
88701
LICENSED
PROFESSIONAL ENGINEER
7/17/18

PROJ:	200-09308-18001
DESN:	BM
DRWN:	DA
CHKD:	DB

D-2104

Bar measures 1 inch, otherwise drawing is not to scale

SAMPLE TAP

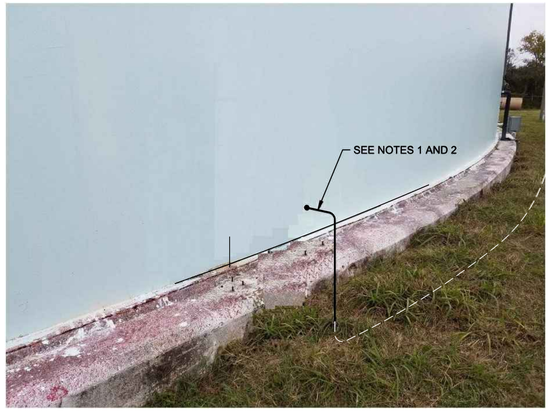


NOTES:

1. CONTRACTOR TO VERIFY ALL LENGTHS AND DIMENSIONS PRIOR TO FABRICATION.
2. ALL WELDED COUPLINGS SHALL BE RATED FOR 3000 LBS.
3. ALL LAPPED SEAL WELDS SHALL BE MAG SEAL WELDS AND SHALL BE X-RAY TESTED.
4. PROVIDE INSULATION ON PIPING OUTSIDE TANK WALL.
5. TRANSITION FROM PVC TO STAINLESS STEEL.
6. PROVIDE ISOLATION BETWEEN DISSIMILAR METALS.

1 / - DETAIL
SCALE: NTS

PRESSURE TRANSMITTER ASSEMBLY

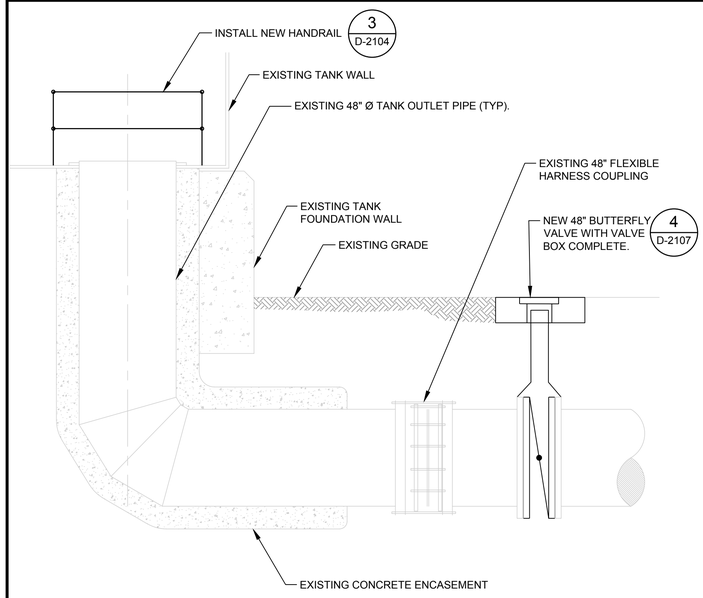


NOTES:

1. INSTALL NEW TAP INTO TANK WALL AT SAME ELEVATION AS TAP FOR EXISTING PRESSURE TRANSMITTER ASSEMBLY. MEASURE HEIGHT OF EXISTING TAP BEFORE REMOVING IT FROM SERVICE.
2. PROVIDE DIELECTRIC UNION TO TAP 1/2" COPPER TUBING TYPE K, INTO TANK WALL. ROUTE 1/2" COPPER TUBING INSIDE ELECTRICAL, CONDUIT TO NEW EQUIPMENT RACK. REFERENCE ELECTRICAL DRAWINGS FOR LOCATION OF EQUIPMENT RACK.
3. SEE ELECTRICAL DRAWINGS FOR LOCATION OF NEW PRESSURE TRANSMITTER ASSEMBLY.

2 / - DETAIL
SCALE: NTS

48" OUTLET PIPES



3 / - DETAIL
SCALE: NTS

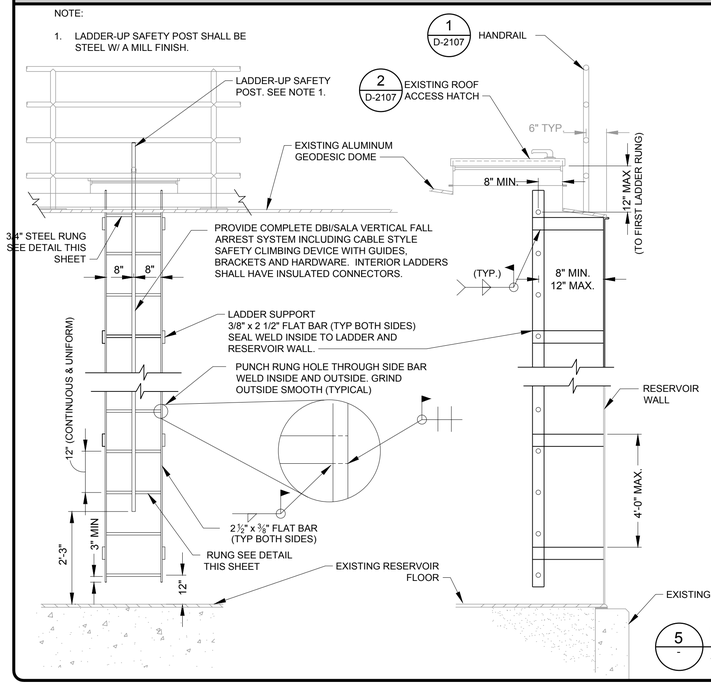
NOT USED

4 / - DETAIL
SCALE: NTS

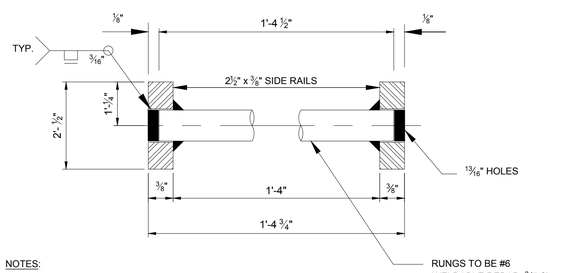
TANK INTERIOR LADDER

NOTE:

1. LADDER-UP SAFETY POST SHALL BE STEEL W/ A MILL FINISH.



5 / - DETAIL
SCALE: NTS



NOTES:

1. REMOVE EXISTING INTERIOR LADDER AND REPLACE WITH NEW LADDER PER THIS DETAIL.
2. CONTRACTOR TO VERIFY ALL LENGTHS AND DIMENSIONS PRIOR TO FABRICATION TO ENSURE 8" MIN. TOE CLEARANCE FROM CENTER OF RUNGS.

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ADDENDUM

SAN ANTONIO WATER SYSTEM

MARK	DATE	DESCRIPTION	BY
1	07/16/18	PER ADDENDUM NO. 1	DA

SAN ANTONIO WATER SYSTEM
CENTRAL WATER INTEGRATION PIPELINE
MALTSBERGER TANK REHABILITATION
MALTSBERGER TANK DETAILS II

1

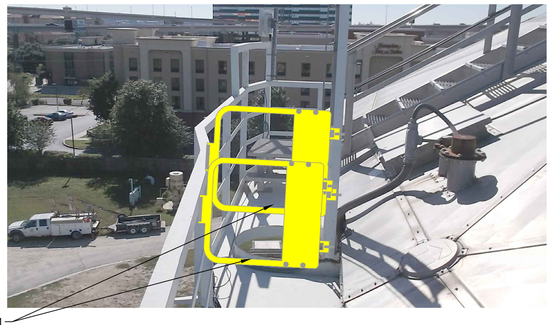
STATE OF TEXAS
BILL D. MARRIOTT
88701
LICENSED PROFESSIONAL ENGINEER
7/17/18

PROJ:	200-09308-18001
DESN:	BM
DRWN:	DA
CHKD:	DB

D-2105

Bar measures 1 inch, otherwise drawing is not to scale

EXISTING EXTERIOR LADDER REPAIR



NOTES:

1. INSTALL NEW SELF-CLOSING ACCESS GATES AT EXTERIOR LADDER ACCESS OPENING.
2. REPLACE EXISTING GALVANIZED SAFETY CLIMB CABLE WITH NEW STAINLESS STEEL LADDER HARDWARE.
3. PROVIDE STAINLESS STEEL DBI/ SALA LAD-SAF FLEXIBLE CABLE LADDER SAFETY SYSTEM. SAFETY SYSTEM MUST INCLUDE TOP BRACKET, BOTTOM BRACKET, 3/8" CABLE AND CABLE GUIDE AND SHALL BE INSTALLED BY QUALIFIED PERSONNEL.

1 DETAIL
- SCALE: NTS

EXISTING ROOF ACCESS HATCH REPAIR

NOTES:

1. REPLACE LOCK HASPS ON BOTH ROOF ACCESS HATCHES TO FACILITATE INSTALLATION / REMOVAL OF EXISTING LOCKS.
2. REMOVE EXISTING LOCK HASPS AND WELD ON NEW LOCK HASPS IN A LOCATION THAT IS MORE ACCESSIBLE FOR EACH LOCK. PROVIDE SUBMITTAL SHOWING PROPOSED REVISIONS FOR OWNER APPROVAL.

2 DETAIL
- SCALE: NTS

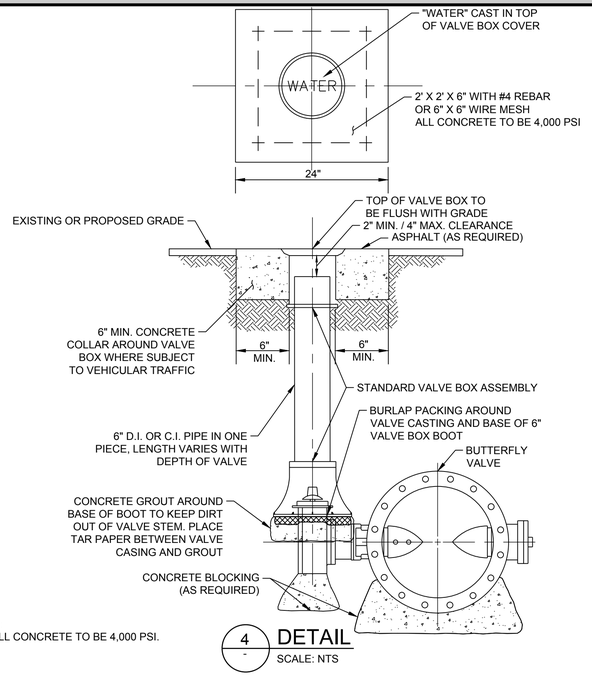
48" INLET PIPE RECOATING AND PLUGGING

NOTES:

1. RECOAT EXTERIOR OF 48" INLET PIPE PER PROJECT SPECIFICATIONS. COATING LIMITS SHALL INCLUDE ALL EXPOSED PIPING FROM CONCRETE PIPE SUPPORT (TO EAST) TO FACE OF TANK WALL (TO WEST).
2. PLUG EXISTING INLET PIPE W / PETERSEN MULTI - FLEX HIGH PRESSURE LINE STOP PLUG PART #129-048 TO SEAL AGAINST POSSIBLE NON-SEALING VALVE.

3 DETAIL
- SCALE: NTS

BURIED BUTTERFLY VALVE W / VALVE BOX



NOTE:
1. ALL CONCRETE TO BE 4,000 PSI.

4 DETAIL
- SCALE: NTS

NOT USED

5 DETAIL
- SCALE: NTS

TETRA TECH
Texas Registration No. F-3924
www.tetratech.com
700 N. St Mary's, Suite 300
San Antonio, TX 78205
Ph (210) 299-7900 Fax (210) 226-8497

ADDENDUM

SAN ANTONIO WATER SYSTEM

MARK	DATE	DESCRIPTION	BY
1	07/16/18	PER ADDENDUM NO. 1	DA

SAN ANTONIO WATER SYSTEM
CENTRAL WATER INTEGRATION PIPELINE
MALTSBERGER TANK REHABILITATION

MALTSBERGER TANK DETAILS IV

1

STATE OF TEXAS
BILL D. MARRIOTT
86701
LICENSED
PROFESSIONAL ENGINEER
7/17/2018

PROJ:	200-09308-18001
DESN:	BM
DRWN:	DA
CHKD:	DB

D-2107

Bar measures 1 inch, otherwise drawing is not to scale

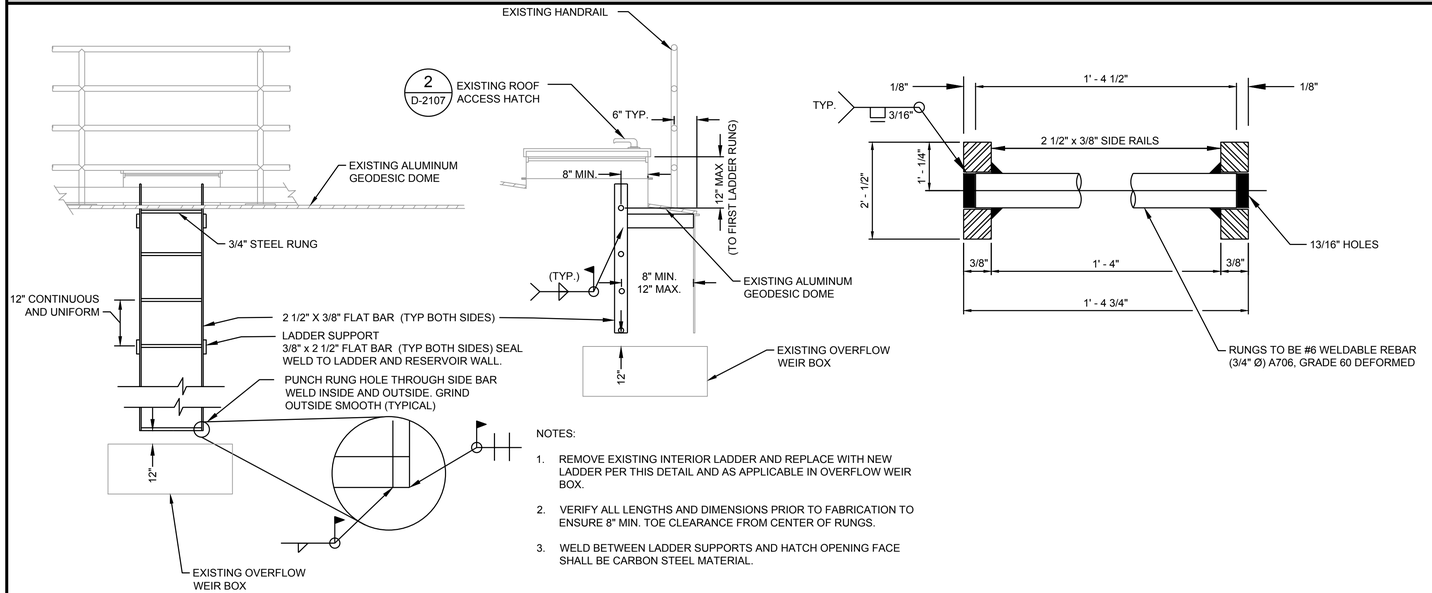
EXISTING OVERFLOW AND DRAIN PIPES

NOTES:

1. INSTALL NEW 30" TIDEFLEX SERIES 35 CHECK VALVE OR EQUAL ON EXISTING 30" OVERFLOW PIPE. FLANGE (AWWA CLASS B) SHALL BE WELDED ONTO PIPE TO CONNECT FLANGED CHECK VALVE.
2. INSTALL NEW 12" GATE VALVE AND 12" 90 DEG BEND (ROTATED DOWN) ON EXISTING 12" DRAIN LINE. PROVIDE CHAIN AND LOCK FOR VALVE WHEELS. HAND WHEEL SHALL BE PAINTED RED. PROVIDE ALL NEW FLANGE HARDWARE.
3. INSTALL NEW 2" BALL VALVE AND 2" 90 DEG BEND ON EXISTING 2" DRAIN LINE. PROVIDE VALVE LOCK OUT FOR OPERATOR.
4. REFERENCE DETAIL 1 ON SHEET S-2104 FOR MODIFICATIONS TO DRAINAGE STRUCTURE.

1 / - DETAIL
SCALE: NTS

TANK INTERIOR LADDER (AT OVERFLOW WEIR BOX)

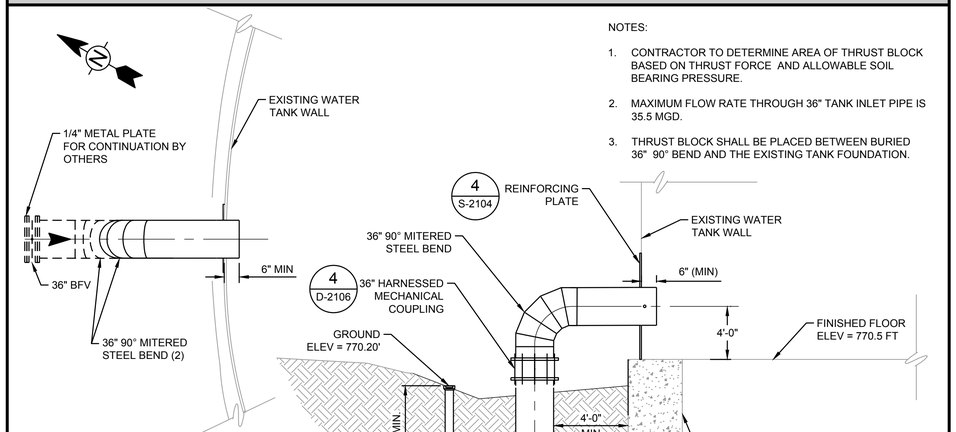


NOTES:

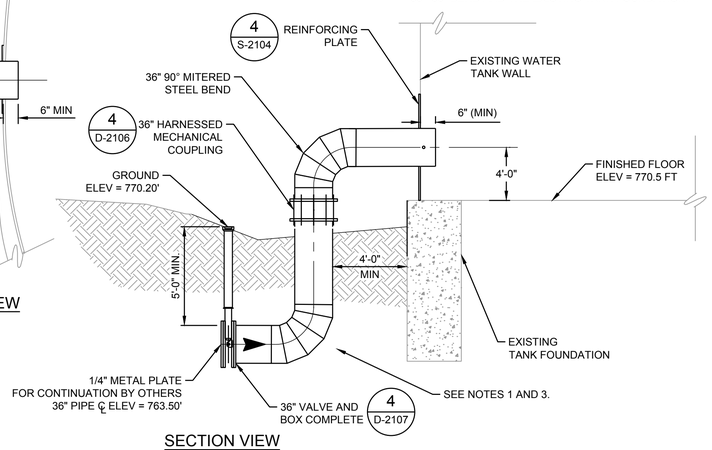
1. REMOVE EXISTING INTERIOR LADDER AND REPLACE WITH NEW LADDER PER THIS DETAIL AND AS APPLICABLE IN OVERFLOW WEIR BOX.
2. VERIFY ALL LENGTHS AND DIMENSIONS PRIOR TO FABRICATION TO ENSURE 8" MIN. TOE CLEARANCE FROM CENTER OF RUNGS.
3. WELD BETWEEN LADDER SUPPORTS AND HATCH OPENING FACE SHALL BE CARBON STEEL MATERIAL.

2 / - DETAIL
SCALE: NTS

36" TANK INLET (SIDEWALL)



ENLARGED PLAN VIEW



SECTION VIEW

NOTES:

1. CONTRACTOR TO DETERMINE AREA OF THRUST BLOCK BASED ON THRUST FORCE AND ALLOWABLE SOIL BEARING PRESSURE.
2. MAXIMUM FLOW RATE THROUGH 36" TANK INLET PIPE IS 35.5 MGD.
3. THRUST BLOCK SHALL BE PLACED BETWEEN BURIED 36" 90° BEND AND THE EXISTING TANK FOUNDATION.

3 / - DETAIL
SCALE: NTS

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ADDENDUM

SAN ANTONIO WATER SYSTEM

MARK	DATE	DESCRIPTION	BY
1	07/16/18	PER ADDENDUM NO. 1	DA

SAN ANTONIO WATER SYSTEM
CENTRAL WATER INTEGRATION PIPELINE
MALTSBERGER TANK REHABILITATION
MALTSBERGER TANK DETAILS V

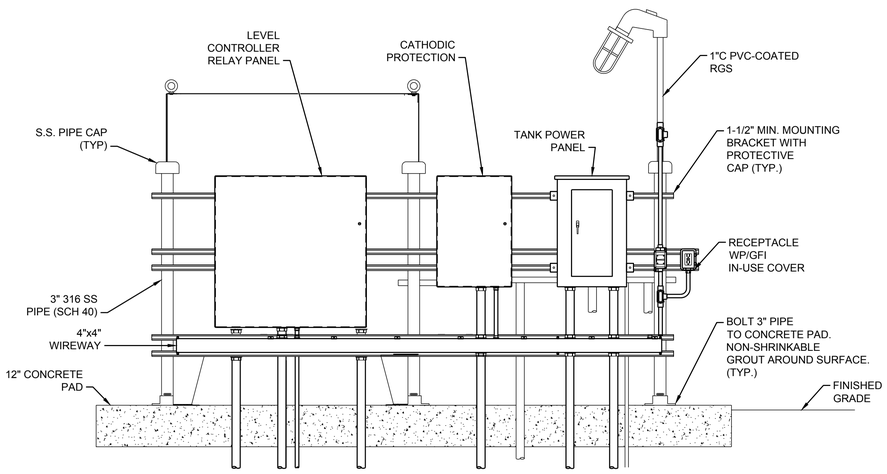
1

STATE OF TEXAS
BILL D. MARRIOTT
88701
LICENSED PROFESSIONAL ENGINEER

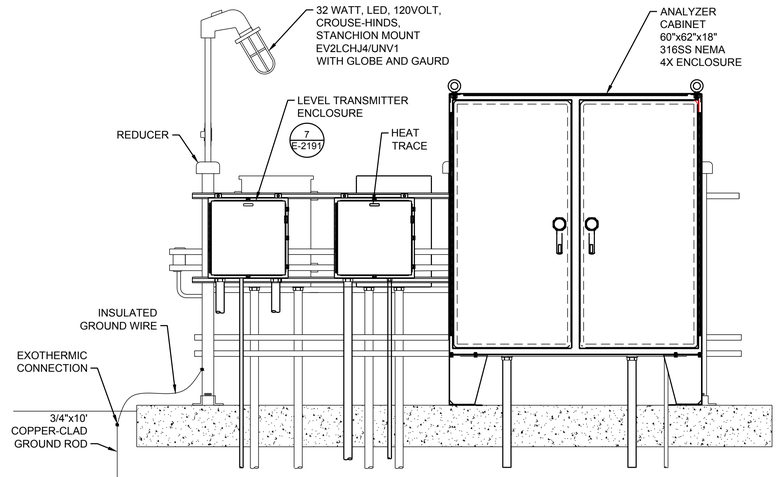
PROJ:	200-09308-18001
DESN:	BM
DRWN:	DA
CHKD:	DB

D-2108

Bar measures 1 inch, otherwise drawing is not to scale



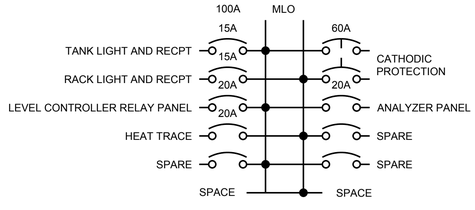
FRONT VIEW



REAR VIEW

1 NEW GST EQUIPMENT RACK DETAIL

SCALE: NTS



TANK POWER PANEL

NO SCALE

1

MARK	DATE	DESCRIPTION	BY
1	07/16/18	PER ADDENDUM NO. 1	TG

ADDENDUM

SAN ANTONIO WATER SYSTEM

CENTRAL WATER INTEGRATION PIPELINE
MALTSBERGER TANK REHABILITATION

MALTSBERGER EXISTING GST DETAIL PLAN

STATE OF TEXAS
TIMOTHY D. GOBROGGE
128455
LICENSED PROFESSIONAL ENGINEER
7/16/2018

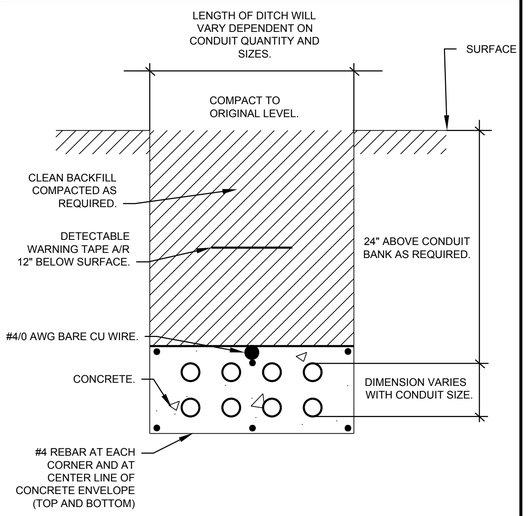
PROJ:	200-09308-18001
DESN:	TDG
DRWN:	EDJ
CHKD:	-

E-2104

TETRA TECH
Texas Registration No. F-3924
www.tetratech.com
700 N. St Mary's, Suite 300
San Antonio, TX 78205
Ph (210) 299-7900 Fax (210) 226-8497

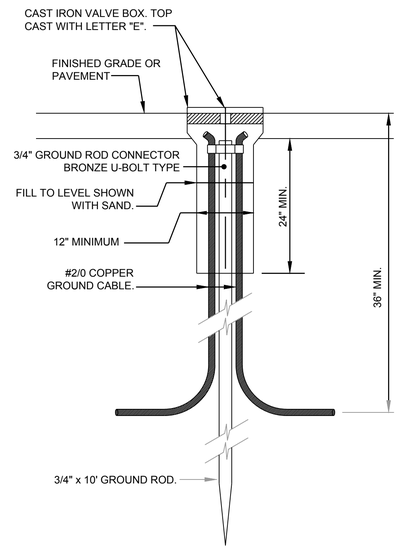
Bar measures 1 inch, otherwise drawing is not to scale

CONCRETE REINFORCED DUCT BANK SECTION



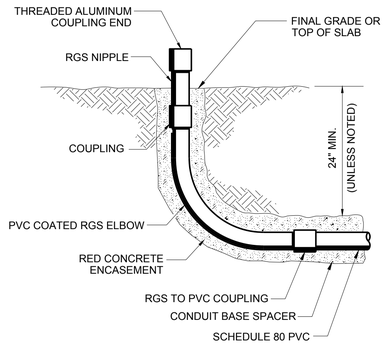
1 DETAIL
SCALE: NTS

GROUND ROD INSPECTION TEST WELL INSTALLATION



2 DETAIL
SCALE: NTS

CONDUIT STUB-UP

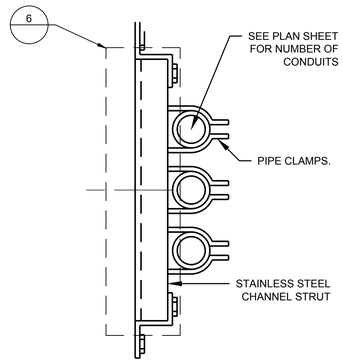


NOTES:

1. CONTRACTOR SHALL COORDINATE WITH UNDER GROUND PIPING.
2. PROVIDE 100% CONCRETE ENCASEMENT BOTH HORIZONTALLY & VERTICALLY.

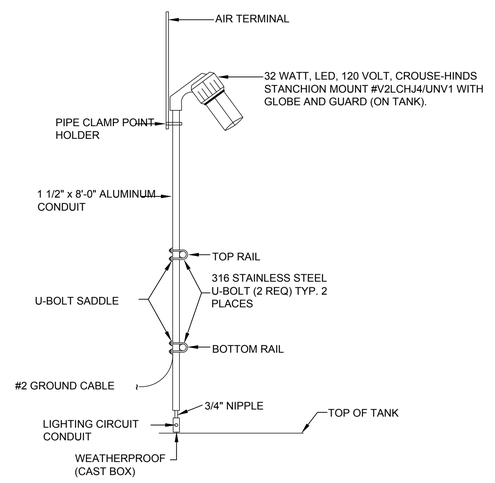
3 DETAIL
SCALE: NTS

CONDUIT SUPPORT



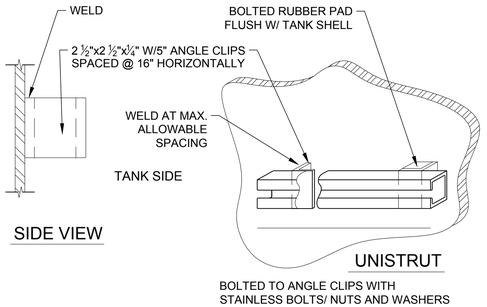
4 DETAIL
SCALE: NTS

GROUND STORAGE TANK LIGHT FIXTURE



5 DETAIL
SCALE: NTS

CONDUIT SUPPORT BRACKETS

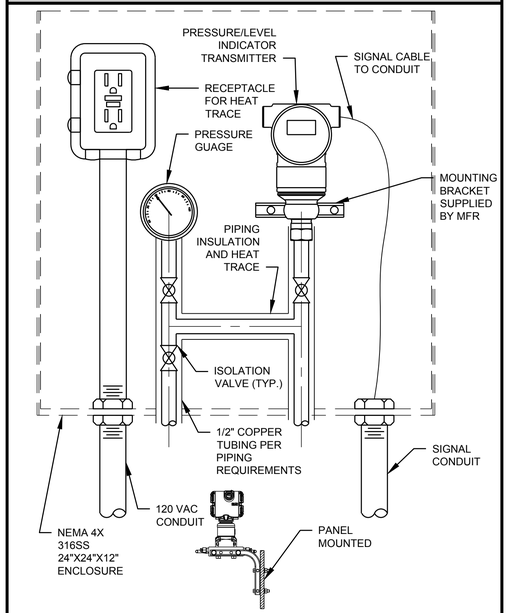


NOTES:

1. NEW "KINDORF" CLAMPS FOR CONDUIT AND CABLE INSTALLATION. INSTALL 7" MAX FROM LADDER SIDE RAILS. (MAX. 10 FT. O.C. VERTICAL SPACING)

6 DETAIL
SCALE: NTS

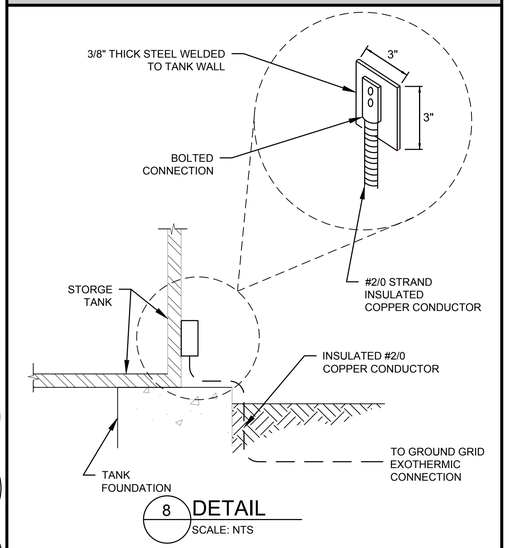
PRESSURE TRANSMITTER



7 DETAIL
SCALE: NTS

1

TANK GROUNDING DETAIL



8 DETAIL
SCALE: NTS

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ADDENDUM

SAN ANTONIO WATER SYSTEM

MARK	DATE	DESCRIPTION	BY
1	07/16/18	PER ADDENDUM NO. 1	TG

SAN ANTONIO WATER SYSTEM
CENTRAL WATER INTEGRATION PIPELINE
MALTSBERGER TANK REHABILITATION

STANDARD ELECTRICAL DETAILS

STATE OF TEXAS
TIMOTHY D. GOBROGGE
128455
LICENSED
PROFESSIONAL ENGINEER
7/16/2018

PROJ:	200-09308-18001
DESN:	TDG
DRWN:	EDJ
CHKD:	-

E-2191

Bar measures 1 inch, otherwise drawing is not to scale

7/17/2018 9:30:29 AM - O:\PROJECTS\SAN ANTONIO\09308\200-09308-18001-C\CAD\SHEETFILES\MALTSBERGER TANK\E - 2191 STANDARD ELECTRICAL DETAILS.DWG - ANDERSON, DEBORAH