

ADDENDUM No. 1

Date: July 22, 2013

City of Austin

Project Name: Jollyville Reservoir Improvements Project

C.I.P. No. 3960 2207 6825

This Addendum forms a part of Contract and clarifies, corrects or modifies original Bid Documents, dated July 8, 2013. Acknowledge receipt of this addendum in space provided on bid form. Failure to do so may subject bidder to disqualification.

A. Project Manual Revisions:

1. Table of Contents (3 pages), delete this section in its entirety and replace with the attached revised section.
2. 00300U Bid Form 03-12-12 (14 pages), delete this section in its entirety and replace with the attached revised section.
3. 01010 Summary of Work 04-22-13 (5 Pages), delete this section in its entirety and replace with the attached revised section.
4. 02251 Demolition Salvage 06-28-13 (4 pages), delete this section in its entirety and replace with the attached revised section.
5. 16100 Electrical – General 10-03-11 (10 pages), delete this section in its entirety and replace with the attached revised section.
6. 16110 Raceways Fittings and Supports 10-03-11 (10 pages), delete this section in its entirety and replace with the attached revised section.
7. 16140 Wiring Devices 10-03-11 (2 pages), delete this section in its entirety and replace with the attached revised section.
8. 16400 Surge Protective Devices 10-03-11 (4 pages), delete this section in its entirety and replace with the attached revised section.
9. 16450 Grounding 10-03-11 (4 pages), delete this section in its entirety and replace with the attached revised section.
10. 16530 Aviation Obstruction Lights, delete this section in its entirety.
11. 16925 Field Instruments Control Panel Enclosure and Accessories 10-03-11 (9 pages), delete this section in its entirety and replace with the attached revised section.

Bidding Requirements, Contract Forms and Conditions of the Contract
ADDENDUM
Section 00900

B. Drawing Revisions: None

This addendum consists of 69 page(s)/sheet(s).

[Signature] 7-22-2013
Approved by OWNER

[Signature] 7-22-2013
Approved by ENGINEER/ARCHITECT



END

**Document
Number**

Title

VOLUME 1

INTRODUCTORY INFORMATION

05/06/11 Title Page
04/22/13 Table of Contents

BIDDING REQUIREMENTS, CONTRACT FORMS, & CONDITIONS OF THE CONTRACT

Pre-Bid Information

00020 04/22/13 Invitation for Bids

Instructions to Bidders

00100 04/22/13 Instructions to Bidders

Bid Forms

00300U 03/12/12 Bid Form (Unit Price)

Supplements to Bid Forms

00400 04/22/13 Statement of Bidder's Experience
00405 09/25/05 Certificate of Non-Suspension or Debarment
00410 05/06/11 Statement of Bidder's Safety Experience
00440 05/06/11 Affidavit - Prohibited Activities
00475 05/06/11 Nonresident Bidder Provisions

Agreement Form

00500 03/12/12 Agreement

Bonds and Certificates

00610 02/23/10 Performance Bond
00620 02/23/10 Payment Bond
00630 08/09/12 Nondiscrimination Certificate
00631 03/12/12 Title VI Assurances Appendix A
00650 07/30/12 Certificate of Insurance
00670 08/09/12 Sales Tax Exemption Certificate
00680 06/05/06 Non-Use of Asbestos Affidavit (Prior to Construction)
00681 06/05/06 Non-Use of Asbestos Affidavit (After Construction)

General Conditions

00700 04/22/13 General Conditions

Supplementary Conditions

00810 04/22/13 Supplemental General Conditions
00819 06/10/05 Security Requirements & SP-1070 Facility Security Procedure for
Contractors
00820 03/12/12 Modifications to Bidding and Contract Forms 00830 03/12/12 Wage
Rates and Payroll Reporting
00830HH 01/11/13 Wage Rates Highway Heavy

Addenda

00900 02/23/10 Addendum

**Document
Number**
Title**SPECIFICATIONS****Division 1 - General Requirements**

| | | |
|--------|----------|--|
| 01010 | 04/22/13 | Summary of Work |
| 01020 | 03/25/13 | Allowances |
| 01050 | 09/13/10 | Grades Lines & Levels |
| 01095 | 07/21/03 | Reference Standards and Definitions |
| 01200 | 08/09/12 | Project Meetings |
| 01300 | 04/22/13 | Submittals |
| 01310 | 03/25/13 | Schedules and Reports |
| 01352 | 04/22/13 | Sustainable Construction Requirements, .5 for Non-Building Projects |
| 01353 | 08/09/12 | Construction Equipment Emissions Reduction Plan |
| 01380 | 08/09/12 | Construction Photography & Videos |
| 01500 | 08/09/12 | Temporary Facilities |
| 01505 | 04/22/13 | Construction and Demolition Waste Management |
| 01550 | 08/09/12 | Public Safety and Convenience |
| 01650 | 03/25/13 | Facility Startup/Commissioning |
| 01730 | 03/25/13 | Operation and Maintenance Data |
| 01900 | 03/12/12 | Prohibition of Asbestos Containing Materials |
| 01900a | 06/05/06 | Statement of Non-Inclusion of Asbestos Containing Material (E/A Prior to Design) |
| 01900b | 06/05/06 | Statement of Non-Inclusion of Asbestos Containing Material (E/A After Design) |

Special Provisions

| | | |
|-----|----------|--|
| SP1 | 06/03/13 | Measurement and Payment for City of Austin General Requirements |
| SP2 | 06/20/13 | Measurement and Payment for 803S City of Austin Standard Details |

City Standard Technical Specifications

| | | |
|------|----------|--|
| 102S | 08/20/07 | Clearing and Grubbing |
| 130S | 09/26/12 | Borrow |
| 403S | 09/26/12 | Concrete for Structures |
| 413S | 11/13/07 | Cleaning and/or Sealing Joints and Cracks (Portland Cement Concrete) |
| 430S | 11/15/11 | P.C. Concrete Curb and Gutter |
| 433S | 12/09/08 | P.C. Concrete Driveways |
| 509S | 09/26/12 | Excavation Safety Systems |
| 510 | 01/02/13 | Pipe |
| 511S | 09/26/12 | Water Valves |
| 604S | 08/18/10 | Seeding for Erosion Control |
| 610S | 09/26/12 | Preservation of Trees and Other Vegetation |
| 633S | 11/26/01 | Landgrading |
| 641S | 06/21/07 | Stabilized Construction Entrance |
| 642S | 09/01/11 | Silt Fence |
| 700S | 09/26/12 | Mobilization |
| 701S | 09/26/12 | Fencing |
| 802S | 09/26/12 | Project Sign |
| 803S | 06/21/07 | Barricades, Signs and Traffic Handling |

City Standard Details

| | | |
|--------|----------|------------------------------------|
| 802S-1 | 01/04/11 | Project Sign Details |
| 804S-5 | 01/04/10 | Project Sign Mounting Skid Details |

| Document Number | Title |
|------------------------|--------------|
|------------------------|--------------|

Special Specifications**Structural**

| | | |
|-------|----------|------------------------|
| 02221 | 06/03/13 | Structural Demolition |
| 02251 | 06/28/13 | Demolition Salvage |
| 05120 | 06/03/13 | Structural Steel |
| 05121 | 06/03/13 | Welding |
| 07720 | 06/03/13 | Roof Accessories |
| 07721 | 06/03/13 | Fall Prevention System |

Coatings

| | | |
|-------|----------|--|
| 09871 | 06/03/13 | Interior and Exterior Recoating Specifications for Potable Water Storage Tanks |
|-------|----------|--|

Electrical

| | | |
|-------|----------|---|
| 16100 | 10/03/11 | Electrical, General |
| 16110 | 10/03/11 | Raceways, Fittings, and Supports |
| 16130 | 10/03/11 | Boxes and Cabinets |
| 16140 | 10/03/11 | Wiring Devices |
| 16200 | 10/03/11 | General Wiring |
| 16205 | 10/03/11 | Wire and Cable Tagging |
| 16400 | 10/03/11 | Surge Protective Devices |
| 16440 | 10/05/11 | Enclosed Disconnect Switch and Enclosed Circuit Breaker |
| 16450 | 10/03/11 | Grounding |
| 16642 | 08/15/12 | Cathodic Protection System |
| 16903 | 02/28/13 | Pressure/Level, Indicator, Transmitter |
| 16925 | 10/03/11 | Field Instrument and Controls Panel/Enclosure and Accessories |
| 16950 | 10/03/11 | Calibration and Testing |

Jollyville Ground Storage Tank Evaluation Report**VOLUME 2**

| | |
|----------|-------------------------------------|
| 07/08/13 | MBE/WBE Procurement Program Package |
|----------|-------------------------------------|

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Bidding Requirements, Contract Forms and Conditions of the Contract
UNIT PRICE BID FORM
Section 00300U

The undersigned, in compliance with the Invitation for Bids for construction of the following Project: Jollyville Reservoir Improvements

(CIP ID# 2127.026) (IFB# 6100 CLMC440) for the City of Austin, Texas, having examined the Project Manual, Drawings and Addenda, the site of the proposed Work and being familiar with all of the conditions surrounding construction of the proposed Project, having conducted all inquiries, tests and investigations deemed necessary and proper; hereby proposes to furnish all labor, permits, material, machinery, tools, supplies and equipment, and incidentals, and to perform all Work required for construction of the Project in accordance with the Project Manual, Drawings and Addenda within the time indicated for the following prices of:

Note: The Bidder will enter the line item subtotal in the "Amount" column below, which is the product of the estimated "Quantity" multiplied by the "Unit Price". Any mathematical errors will be corrected for the purpose of determining the correct Amount to be entered in the Bid Form. The Amounts, including any corrected Amounts, will then be totaled to determine the actual amount of the Bid.

| Bid Item | Quantity | Unit | Item Description | Unit Price | Amount |
|-----------------|-----------------|-------------|---|-------------------|---------------|
| 102S-C1 | 1 | LS | Clearing and Grubbing (Summary of Work Item JV-1) | \$ _____ | \$ _____ |
| 102S-C2 | 1 | LS | Clearing and Grubbing (Summary of Work Item JV-2) | \$ _____ | \$ _____ |
| 102S-C3 | 1 | LS | Clearing and Grubbing, Remove Ex. Driveway (Summary of Work Item JV-3) | \$ _____ | \$ _____ |
| 130S-T | 14 | CY | Class C (Topsoil), Plan Quantity (Summary of Work Item JV-4) | \$ _____ | \$ _____ |
| 403S-CY | 1 | CY | Concrete Vault Repair (Summary of Work Item JV-5) | \$ _____ | \$ _____ |
| 413S-B | 50 | LBS | Sealer (Summary of Work Item JV-6) | \$ _____ | \$ _____ |

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|-------------|-----|----|---|----------|----------|
| 430S-A | 35 | LF | P.C. Concrete Curb and Gutter (Excavation) (Summary of Work Item JV-7) | \$ _____ | \$ _____ |
| 433S-C | 480 | SF | Type II P.C. Concrete Driveway (Summary of Work Item JV-8) | \$ _____ | \$ _____ |
| 509S-1 | 31 | LF | Trench Excavation Safety Protective Systems (all depths) (Summary of Work Item JV-9) | \$ _____ | \$ _____ |
| 510-AW-6DI | 7 | LF | Pipe, Six (6) inch Diameter Class 350 Ductile Iron (all depths), including Excavation and Backfill (Summary of Work Item JV-10) | \$ _____ | \$ _____ |
| 510-AW-12DI | 24 | LF | Pipe, Twelve (12) inch Diameter Class 350 Ductile Iron Drain Line (all depths), including Excavation and Backfill (Summary of Work Item JV-11) | \$ _____ | \$ _____ |
| 510-JR | 1 | EA | Wet Connections, 16" Diameter x 6" Diameter (Summary of Work Item JV-12) | \$ _____ | \$ _____ |
| 511S-A-6 | 1 | EA | Valve, Gate, Six (6) Inch Diameter (Summary of Work Item JV-13) | \$ _____ | \$ _____ |
| 511S-A-12 | 2 | EA | Valve, Gate, Twelve (12) Inch Diameter (Summary of Work Item JV-14) | \$ _____ | \$ _____ |
| 511S-B | 1 | EA | Fire Hydrant (See Standard No. 511-17) (Summary of Work Item JV-15) | \$ _____ | \$ _____ |

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|---------------|------|----|---|----------|----------|
| 604S-A | 4103 | SY | Non-Native Seeding for Erosion Control Method, Fiber Mulch (Summary of Work Item JV-16) | \$ _____ | \$ _____ |
| 610S-A | 355 | LF | Protective Fencing Type A Chain Link Fence (Typical Application-high damage potential) (Summary of Work Item JV-17) | \$ _____ | \$ _____ |
| 633S-8 | 510 | SF | Landgrading (Summary of Work Item JV-18) | \$ _____ | \$ _____ |
| 641S | 1 | EA | Stabilized Construction Entrance (Summary of Work Item JV-19) | \$ _____ | \$ _____ |
| 642S | 292 | LF | Silt Fence for Erosion Control (Summary of Work Item JV-20) | \$ _____ | \$ _____ |
| 700S-TM | 1 | LS | Total Mobilization Payment (Summary of Work Item JV-21) | \$ _____ | \$ _____ |
| 701S-CS | 1 | EA | Chain Link Vehicle Sliding Gate, Twenty Two (22) foot x Six (6) foot plus 3- Strand Barbed Wire (Summary of Work Item JV-22) | \$ _____ | \$ _____ |
| 802S-A C.I.P. | 1 | LS | C.I.P. Project Signs (Summary of Work Item JV-23) | \$ _____ | \$ _____ |
| 01500-1 | 1 | LS | Furnish Job Shack (Summary of Work Item JV-24) | \$ _____ | \$ _____ |
| 16100-1 | 1 | LS | Install Electrical Modifications associated with new level transmitter. (Summary of Work Item JV-25) | \$ _____ | \$ _____ |

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|------------|----|----|--|----------|----------|
| 16100-2 | 1 | LS | Provide temporary electrical service for construction. (Summary of Work Item JV-26) | \$ _____ | \$ _____ |
| 16200-1 | 1 | LS | Remove and replace existing tank fill valve's (Water Vault #1) and tank suction valve's (Water Vault #2) electrical power and control wiring in existing UG ductbank raceways; new wiring rating to match existing; per Keynote 3 and Keynote 4 on Drawing E-2-JV; coordinate new wiring accordingly with demolition for same per Demolition Keynotes D4 and D5, Drawing E-2-JV. (Summary of Work Item JV-27) | \$ _____ | \$ _____ |
| 16642-1 | 1 | LS | Install new CPS system, includes welding associated with removal and installation. (Summary of Work Item JV-28) | \$ _____ | \$ _____ |
| 16642-2 | 82 | EA | Removal of existing CPS handhole cap plates and installation of welded cap plates over existing handholes. (Summary of Work Item JV-29) | \$ _____ | \$ _____ |
| 16925-1 | 1 | LS | Demolition and removal of existing electrical enclosure and rack at each valve vault; replace with new rack and equipment as per electrical design Detail 1, Drawing E-8-JV. (Summary of Work Item JV-30) | \$ _____ | \$ _____ |
| SS 02221-1 | 1 | LS | Remove and properly dispose of one (1) existing roof hatch on the tank. (Summary of Work Item JV-31) | \$ _____ | \$ _____ |
| SS 02221-2 | 1 | LS | Remove and properly dispose of existing stabilizer straps from the top flange of all roof rafters. (Summary of Work Item JV-32) | \$ _____ | \$ _____ |

SS 02221-3 1 LS Remove and properly dispose of the roof rafter Chevron bracing.
(Summary of Work Item JV-33) \$ _____ \$ _____

SS 02221-4 1 LS Remove and properly dispose of existing painter's ring.
(Summary of Work Item JV-34) \$ _____ \$ _____

SS 02221-5 1 LS Remove and properly dispose of existing CPS system and existing electrical power rack – transformer, panel – all in entirety at tank near exterior ladder. Existing CPS rectifier and existing transformer are to be delivered to OWNER. (Summary of Work Item JV-35) \$ _____ \$ _____

SS 02221-6 1 LS Remove existing stainless steel fill pipe inside tank and deliver to a location of the OWNER'S choosing within the Austin ETJ.
(Summary of Work Item JV-36) \$ _____ \$ _____

SS 02221-7 1 LS Remove and properly dispose of existing overflow flap gate and pipe at flap gate.
(Summary of Work Item JV-37) \$ _____ \$ _____

SS 02221-8 1 LS Remove and properly dispose of existing grating and support structure from two (2) pipe vaults.
(Summary of Work Item JV-38) \$ _____ \$ _____

SS 05121-1 1 LS Install flanged dollar plate in center of roof and install existing center roof vent in center of flanged dollar plate, includes installation of new 16 Mesh, 304 stainless steel 0.018 inch screen on all roof vents.
(Summary of Work Item JV-39) \$ _____ \$ _____

SS 05121-2 3 EA Install bases for removable davit arm, one (1) carbon steel on tank roof near roof hatch, one (1) carbon steel on the top platform near exterior ladder and one (1) A316 stainless steel at the fill pipe hood inside tank.
(Summary of Work Item JV-40) \$ _____ \$ _____

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|-------------|---|----|--|----------|----------|
| SS 05121-3 | 3 | EA | Install A304 stainless steel lanyard rings on new guard rail at roof hatch and on exterior ladder at each landing. (Summary of Work Item JV-41) | \$ _____ | \$ _____ |
| SS 05121-4 | 2 | EA | Install A304 stainless steel ladder safety gate at top platform and at roof hatch on exterior of tank. (Summary of Work Item JV-42) | \$ _____ | \$ _____ |
| SS 05121-5 | 8 | LF | Install A304 stainless steel guard rail around new roof hatch. (Summary of Work Item JV-43) | \$ _____ | \$ _____ |
| SS 05121-6 | 1 | LS | Install modifications at top of A304 stainless steel ladder and install extension at bottom of ladder on exterior of tank. (Summary of Work Item JV-44) | \$ _____ | \$ _____ |
| SS 05121-7 | 1 | LS | Modify overflow pipe on exterior of tank and install new flap gate. (Summary of Work Item JV-45) | \$ _____ | \$ _____ |
| SS 05121-8 | 2 | EA | Install new galvanized grating with new supporting galvanized structure for pipe vaults. (Summary of Work Item JV-46) | \$ _____ | \$ _____ |
| SS 05121-9 | 2 | EA | Remove existing ladder steps from concrete walls inside vaults and install A304 stainless steel ladders. (Summary of Work Item JV-47) | \$ _____ | \$ _____ |
| SS 05121-10 | 1 | LS | Install A316 stainless steel four (4) inch diameter wash out pipe with carbon steel and A316 stainless steel flanges, includes four (4) inch carbon steel valve and blind plate with hot dipped galvanized bolts, nuts and flat washers. (Summary of Work Item JV-48) | \$ _____ | \$ _____ |

SS 05121-11 1 LS Install two (2), one (1) inch A316 stainless steel pipe nipples with brass ball valves in tank shell, includes installation of stainless steel tubing and heat trace.
(Summary of Work Item JV-49)

\$ _____ \$ _____

SS 05121-12 1 LS Remove two (2) inch pressure and two (2) inch level indicator taps at base of tank. Install welded plates where taps were removed. Includes removal of existing enclosure around taps.
(Summary of Work Item JV-50)

\$ _____ \$ _____

SS 05121-13 1 LS Door sheet removal and re-installation. Includes non-destructive testing of welds.
(Summary of Work Item JV-51)

\$ _____ \$ _____

SS 05121-14 1 LS Remove bolted cap plate and flange for "Igloo Door", and install welded plate in "Igloo Door" frame. Includes non-destructive testing of welds.
(Summary of Work Item JV-52)

\$ _____ \$ _____

SS 05121-15 2 EA Install two (2) thirty six (36) diameter manways in tank shell.
(Summary of Work Item JV-53)

\$ _____ \$ _____

SS 05121-16 1 LS Install ring collar at center column for support of roof rafters.
(Summary of Work Item JV-54)

\$ _____ \$ _____

SS 05121-17 790 LF Install new stabilizers for all roof rafters.
(Summary of Work Item JV-55)

\$ _____ \$ _____

SS 05121-18 204 EA Remove existing roof rafter seats on support beams and replace with new seats. Rafters to be relocated on support beams during installation of new seats.
(Summary of Work Item JV-56)

\$ _____ \$ _____

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|-------------|-----|----|--|----------|----------|
| SS 05121-19 | 148 | EA | Cut ends off of roof rafters at support beams to maximum overhang of three (3) inches past flanges of support beams. (Summary of Work Item JV-57) | \$ _____ | \$ _____ |
|-------------|-----|----|--|----------|----------|

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|-------------|----|----|--|----------|----------|
| SS 05121-20 | 12 | EA | Reposition roof rafter support beams to vertically plum. (Summary of Work Item JV-58) | \$ _____ | \$ _____ |
|-------------|----|----|--|----------|----------|

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|-------------|----|----|--|----------|----------|
| SS 05121-21 | 20 | EA | Reconstruct roof rafter support beam connections at columns. (Summary of Work Item JV-59) | \$ _____ | \$ _____ |
|-------------|----|----|--|----------|----------|

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|-------------|----|----|--|----------|----------|
| SS 05121-22 | 84 | EA | Remove existing roof rafter connection plates at roof knuckle and replace with new plates. (Summary of Work Item JV-60) | \$ _____ | \$ _____ |
|-------------|----|----|--|----------|----------|

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|-------------|-----|----|---|----------|----------|
| SS 05121-23 | 300 | LF | Install repair of roof rafter flange. (Summary of Work Item JV-61) | \$ _____ | \$ _____ |
|-------------|-----|----|---|----------|----------|

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|-------------|---|----|---|----------|----------|
| SS 05121-24 | 1 | LS | Install new carbon steel fill pipe hood. Includes installation of A316 stainless steel connection ring in top of hood and A316 sludge ring around fill pipe at floor. (Summary of Work Item JV-62) | \$ _____ | \$ _____ |
|-------------|---|----|---|----------|----------|

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|-------------|---|----|---|----------|----------|
| SS 05121-25 | 1 | LS | Fabricate and install A316 stainless steel Anti-Vortex assembly at suction line inside reservoir. New Anti-Vortex plate to include A316 stainless steel sludge ring around suction pipe at floor. (Summary of Work Item JV-63) | \$ _____ | \$ _____ |
|-------------|---|----|---|----------|----------|

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|-------------|---|----|---|----------|----------|
| SS 05121-26 | 1 | LS | Install twelve (12) inch diameter carbon steel and ductile iron drain line in floor, to extend to exterior of structural concrete ring at perimeter of tank. Includes tank drain diverter plates. (Summary of Work Item JV-64) | \$ _____ | \$ _____ |
|-------------|---|----|---|----------|----------|

| | | | | Unit Price Bid Form / 00300U | |
|-------------|----|----|--|-------------------------------------|----------|
| SS 05121-27 | 10 | LF | Install wall and floor seam repair by welding. (Summary of Work Item JV-65) | \$ _____ | \$ _____ |
| <hr/> | | | | | |
| SS 05121-28 | 20 | EA | Install corrosion pit repair by plug welding. (Summary of Work Item JV-66) | \$ _____ | \$ _____ |
| <hr/> | | | | | |
| SS 05121-29 | 10 | EA | Install corrosion pit repair by patch plate welding. (Summary of Work Item JV-67) | \$ _____ | \$ _____ |
| <hr/> | | | | | |
| SS 07720-1 | 1 | LS | Install new A316 stainless steel roof hatch. (Summary of Work Item JV-68) | \$ _____ | \$ _____ |
| <hr/> | | | | | |
| SS 07721-1 | 1 | EA | Install A304 stainless steel Saf-T-Mount in Saf-T-Rail on exterior ladder at intermediate landing. (Summary of Work Item JV-69) | \$ _____ | \$ _____ |
| <hr/> | | | | | |
| SS 07721-2 | 6 | LF | Install A316 stainless steel Saf-T-Rail extension at bottom of interior ladder. (Summary of Work Item JV-70) | \$ _____ | \$ _____ |
| <hr/> | | | | | |
| SS 07721-3 | 10 | LF | Install A304 stainless steel Saf-T-Rail extension at bottom of exterior ladder. (Summary of Work Item JV-71) | \$ _____ | \$ _____ |
| <hr/> | | | | | |
| SS 09871-1 | 1 | LS | Interior tank wet surface preparation (SSPC SP10) and recoating, Coating System IW-01. (Summary of Work Item JV-72) | \$ _____ | \$ _____ |
| <hr/> | | | | | |
| SS 09871-2 | 1 | LS | Propane powered dehumidification of interior of tank during abrasive blasting, lining application and lining curing. (Summary of Work Item JV-73) | \$ _____ | \$ _____ |
| <hr/> | | | | | |

SS 09871-3 1 LS Exterior tank dry surface preparation (SSPC-SP6) and recoating, includes portable containment, Coating System EN-01. (Summary of Work Item JV-74) \$_____ \$_____

SS 09871-4 1 LS Exterior pipe and valve surface preparation (SSPC-SP6), and recoating, Coating System EN-02 and Caulking System EC-02 for valves and piping in two (2) concrete pipe vaults. (Summary of Work Item JV-75) \$_____ \$_____

SS 09871-5 4 EA Exterior valve operator surface preparation (SSPC-SP2 and SSPC-SP3), and recoating, Coating System EN-03 for valve operators. (Summary of Work Item JV-76) \$_____ \$_____

SS 09871-6 1 LS Remove existing grout as detailed from base of tank between sketch plate and ring wall foundation and install caulk, Caulk System EC-02. (Summary of Work Item JV-77) \$_____ \$_____

Miscellaneous Welding Allowance \$ 50,000 _____

TOTAL BID (INCLUDING ALLOWANCES): \$ _____

In the event of a mathematical error, the correct product, determined by using the "Unit Price" and "Quantity", and the correct sum, determined by totaling the correct line item Amounts will prevail over the amount entered by the Bidder. The unit prices shown above will be the unit prices used to tabulate the Bid and used in the Contract, if awarded by the City.

Notes:

- For a more detailed explanation of Bid allowances, see Sections 00810 Supplemental General Conditions and 01020 Allowances.

Optional Information on Bid Prices Submitted by Computer Printout

In lieu of handwritten unit prices in figures in ink on the Bid forms above, Bidders, at their option, may submit an original computer printout sheet bearing certification by, and signature for, the Bidding firm. The unit prices shown on acceptable printouts will be the unit prices used to tabulate the Bid and used in the Contract if awarded by the City. As a minimum, computer printouts must contain all information and in the format shown on the attached page: "Example of Bid Prices Submitted by Computer Printout" form.

If a computer printout is used, the Bidder must still execute that portion of the unit price Bid form which acknowledges the Bid Guaranty, Time of Completion, Liquidated Damages, and all addenda that may have been issued.

Bids with unit prices by computer printout may be rejected, if:

1. The computer printout does not include the required certification, set forth in the attached "Example".
2. The computer printout is not signed in the name of the firm to whom the Project Manual was issued.
3. The computer printout is non-responsive or otherwise omits required Bid items or includes items not shown on the Bid forms in the Project Manual.
4. The other required Bid documents issued by the City are not fully executed as provided above.
5. The signed Section 00300U is not returned with the signed computer printout.

If the Bid submitted by the Bidder contains both the form furnished by the City, completed according to the instructions, and also a computer printout, completed according to the instructions, unit prices of only one will be considered. In this situation, the unit Bid prices shown on the computer printout will be used to determine the Bid.

BID GUARANTY: A Bid guaranty must be enclosed with this Bid, as required in Section 00020 or Section 00020S, in the amount of not less than five percent (5%) of the total Bid. Following the Bid opening, submitted Bids may not be withdrawn for a period of (90) Calendar Days. Award of Contract will occur within this period, unless mutually agreed between the parties. The Bid guaranty may become the property of the OWNER, or the OWNER may pursue any other action allowed by law, if:

- Bidder withdraws a submitted Bid within the period stated above;
- Bidder fails to submit the required post Bid information within the period specified in Section 00020S or 00100, or any mutually agreed extension of that period;
- or Bidder fails to execute the Contract and furnish the prescribed documentation (bonds, insurance, etc.) needed to complete execution of the Contract within five (5) calendar days after notice of award, or any mutually agreed extension of that period.

TIME OF COMPLETION: The undersigned Bidder agrees to commence work on the date specified in the written "Notice to Proceed" to be issued by the OWNER and to substantially complete construction of the improvements, as required by the Project Manual, Drawings and Addenda for the Work within one hundred sixty (160) Calendar Days. If a Substantial Completion date **has been specified, the bidder agrees to reach Final Completion shall be reached within one hundred twenty (120) Calendar Days after Substantial Completion as required by the Project Manual, Drawings and Addenda for the work.** The Bidder further agrees that should the Bidder fail to **substantially complete the Work and to finally complete the Work** within the number of days indicated in the Bid or as subsequently adjusted, Bidder shall pay the liquidated damages for each consecutive day thereafter as provided below; unless the OWNER elects to pursue any other action allowed by law.

WAIVER OF ATTORNEY FEES: In submitting its bid, in consideration for the waiver of its right to attorney's fees by the OWNER, the Bidder knowingly and intentionally agrees to and shall waive the right to attorney's fees under Section 271.153 of the Texas Local Government Code in any administrative proceeding, alternative dispute resolution proceeding, or litigation arising out of or connected to any Contract awarded pursuant to this solicitation process.

LIQUIDATED DAMAGES: The Bidder understands and agrees that the timely completion of the described Work is of the essence. If both **Substantial and Final Completion** dates have been specified, the Bidder and OWNER further agree that the OWNER's actual damages for delay caused by failure to timely complete the Project are difficult, if not impossible to measure. However, with respect to the additional administrative and consultant costs to be incurred by OWNER, the reasonable estimate of such damages has been calculated and agreed to by OWNER and Bidder. Therefore, the Bidder and the OWNER agree that for each and every **Calendar Day** the Work or any portion thereof, remains incomplete after the **Substantial Completion** date as established by the above paragraph, "Time of Completion", payment will be due to the OWNER in the amount of **one thousand dollars (\$1000.00) per Calendar Day** as liquidated damages, not as a penalty, but for delay damages to the OWNER. **The Bidder and the OWNER** further agree that for each and every **Calendar Day** the Work or any portion thereof, remains incomplete after the Final Completion date as established by the above paragraph, "Time of Completion", payment will be due to the OWNER in the amount of **five hundred dollars (\$500) per Calendar Day** as liquidated damages, not as a penalty, but for delay damages to the OWNER. Such amount shall be deducted by the OWNER from any Contract payment due. In the event of a default or breach by the CONTRACTOR and demand is made upon the surety to complete the project, in accordance with the Contract Documents, the surety shall be liable for liquidated damages pursuant to the Contract Documents in the same manner as the CONTRACTOR would have been.

OWNER reserves the right to reject any or all Bids and to waive any minor informality in any Bid or solicitation procedure (a minor informality is one that does not affect the competitiveness of the Bids).

The undersigned acknowledges receipt of the following addenda:

Addendum No. 1 dated _____ Received _____
Addendum No. 2 dated _____ Received _____
Addendum No. 3 dated _____ Received _____

Secretary, *if Bidder is a Corporation

Bidder

(Seal)

Authorized Signature

Title

Date

Address

Telephone Number / FAX Number

Email Address for Person Signing Bid

Email Address for Bidder's Primary Contact Person

* Copy of Corporate Resolution and minutes with certificate of officer of Bidder as to authority of signatory to bind Bidder is to be signed and dated no earlier than one week before Bid date, and attached to this document.

EXAMPLE: BID PRICES SUBMITTED BY COMPUTER PRINTOUT

| |
|----------------------|
| Project Name: |
| CIP ID #: |
| IFB #: |

| Bid Item # | Bid Item Description | Unit | Qty | Unit Bid Price | Total Amount |
|-------------------|-----------------------------|-------------|------------|-----------------------|---------------------|
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| | | | | | |
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| | | | | | |
| Total Bid: | | | | | |

(YOUR FIRM'S NAME) certifies that the unit prices shown on this completed computer printout for all of the bid items and the alternates contained in this proposal are the unit prices intended and that its Bid will be tabulated using these unit prices and no other information from this printout. (YOUR FIRM'S NAME) acknowledges and agrees that the total bid amount shown will be read as its total bid. *In the event of a mathematical error*, the correct product, determined by using the "Unit Price" and "Quantity", and the correct sum, determined by totaling the correct line item Amounts will prevail over the amount entered by the Bidder.

Signed: _____

Title: _____

Date: _____

END

PART 1 - GENERAL

1.1 Related Documents:

- A. Drawings and general provisions of Contract, including General Conditions, Section 00700, and Supplemental General Conditions, Section 00810, and Division 1 requirements.

1.2. DESCRIPTION OF WORK:

- A. The Work of this Contract includes sustainability requirements as shown in the Division 1 Section 01352 and/or 01505 and all other applicable Specification sections. It is the intent of the OWNER to work in partnership with the CONTRACTOR in implementing sustainable construction practices.

- B. The work of this contract involves one (1) project site, Jollyville Ground Storage Tank, nominal capacity of eleven (11) MG:

- JV-1 Clearing and Grubbing, remove existing electric/instrumentation conduit lying on ground on the North side of tank and existing exposed electrical conduits at overflow washout area.
- JV-2 Clearing and Grubbing, remove all vegetation growing on ring beam around the perimeter of the tank. Refer to tank repair details for working with gaps in ring beam.
- JV-3 Clearing and Grubbing, remove existing driveway.
- JV-4 Class C (Topsoil), Plan Quantity.
- JV-5 Concrete Vault Repair, remove concrete vault top from vault on Southeast side of tank, remove and properly dispose of existing square concrete beam under vault top, and install reinforced square concrete beam.
- JV-6 Sealer, plug hole in wall of vault that is allowing dirt to erode into vault.
- JV-7 P.C. Concrete Curb and Gutter.
- JV-8 Type II P.C. Concrete Driveway.
- JV-9 Trench Excavation Safety Protective Systems (all depths).
- JV-10 Pipe, six (6) inch diameter Class 350 Ductile Iron (all depths), including Excavation and Backfill.
- JV-11 Pipe, twelve (12) inch diameter Class 350 Ductile Iron drain line (all depths), including Excavation and Backfill. Install drain line from exterior of structural concrete ring at perimeter of tank to existing sludge vault and new overflow drain line. Drain line to include two (2) 12 inch gate valves.
- JV-12 Wet Connections, 16" diameter x 6" diameter.
- JV-13 Valve, Gate, six (6) inch diameter.
- JV-14 Valve, Gate, twelve (12) inch diameter.
- JV-15 Fire Hydrant.
- JV-16 Non-Native Seeding for Erosion Control Method, Fiber Mulch.
- JV-17 Protective Fencing Type A Chain Link Fence, installation, maintenance and removal of fencing.

- JV-18 Landgrading, remove and properly dispose of grate, and refill hole that will be left in yard on East side of Drive three (3).
- JV-19 Stabilized Construction Entrance, installation, maintenance and removal of stabilized construction entrance.
- JV-20 Silt Fence for Erosion Control, installation, maintenance and removal of silt fence for erosion/sedimentation control and contactor limits of construction.
- JV-21 Total Mobilization Payment, Mobilization/Demobilization to accomplish work.
- JV-22 Chain Link Vehicle Sliding Gate, twenty two (22) foot x six (6) foot plus 3 strand barbed wire.
- JV-23 C.I.P. Project Signs, install CIP sign.
- JV-24 Furnish Job Shack for project site.
- JV-25 Install Electrical Modifications associated with new level transmitter.
- JV-26 Provide temporary electrical service for construction.
- JV-27 Remove and replace existing tank fill valve's (Water Vault #1) and tank suction valve's (Water Vault #2) electrical power and control wiring in existing UG ductbank raceways; new wiring rating to match existing; per Keynote 3 and Keynote 4 on Drawing E-2-JV; coordinate new wiring accordingly with demolition for same per Demolition Keynotes D4 and D5, Drawing E-2-JV.
- JV-28 Install new CPS system, includes welding associated with removal and installation.
- JV-29 Removal of existing CPS handhole cap plates and installation of welded cap plates over existing handholes.
- JV-30 Demolition and removal of existing electrical enclosure and rack at each valve vault; replace with new rack and equipment as per electrical design Detail 1, Drawing. E-8-JV.
- JV-31 Remove and properly dispose of one (1) existing roof hatch on tank.
- JV-32 Remove and properly dispose of existing stabilizer straps from top flange of all roof rafters.
- JV-33 Remove and properly dispose of roof rafter Chevron bracing.
- JV-34 Remove and properly dispose of existing painter's ring.
- JV-35 Remove and properly dispose of existing CPS system and existing electrical power rack – transformer, panel – all in entirety at tank near exterior ladder. Existing CPS rectifier and existing transformer are to be delivered to OWNER.
- JV-36 Remove existing stainless steel fill pipe inside tank and deliver to a location of OWNER'S choosing within Austin ETJ.
- JV-37 Remove and properly dispose of existing overflow flap gate.
- JV-38 Remove and properly dispose of existing grating and support structure from two (2) pipe vaults.
- JV-39 Install flanged dollar plate in center of roof and install existing center roof vent in center of flanged dollar plate. Includes installation of new 16 Mesh, 304 stainless steel 0.018 inch screen on all roof vents.

- JV-40 Install bases for removable davit arm, one (1) carbon steel on tank roof near roof hatch, one (1) carbon steel on the top platform near exterior ladder and one (1) A316 stainless steel at the fill pipe hood inside tank.
- JV-41 Install A304 stainless steel lanyard rings on new guard rail at roof hatch and on exterior ladder at each landing.
- JV-42 Install A304 stainless steel ladder safety gate at top platform and at roof hatch on exterior of tank.
- JV-43 Install A304 stainless steel guard rail around new roof hatch.
- JV-44 Install modifications at top of A304 stainless steel ladder and install extension at bottom of ladder on exterior of tank.
- JV-45 Modify overflow pipe on exterior of tank and install new flap gate.
- JV-46 Install new galvanized grating with new supporting galvanized structure for pipe vaults.
- JV-47 Remove existing ladder steps from concrete walls inside pipe vaults and install A304 stainless steel ladders.
- JV-48 Install A316 stainless steel four (4) inch diameter wash out pipe with carbon steel and A316 stainless steel flanges, includes four (4) inch carbon steel valve and blind plate with hot dipped galvanized bolts, nuts and flat washers.
- JV-49 Install two (2), one (1) inch A316 stainless steel pipe nipples with brass ball valves in tank shell, includes installation of stainless steel tubing and heat trace.
- JV-50 Remove two (2) inch pressure and two (2) inch level indicator taps at base of tank. Install welded plates where taps were removed. Includes removal of existing enclosure around taps.
- JV-51 Door sheet removal and re-installation. Includes non-destructive testing of welds.
- JV-52 Remove bolted cap plate and flange for "Igloo Door", and install welded plate in "Igloo Door" frame. Includes non-destructive testing of welds.
- JV-53 Install two (2) thirty six (36) diameter manways in tank shell.
- JV-54 Install ring collar at center column for support of roof rafters.
- JV-55 Install new stabilizers for all roof rafters.
- JV-56 Remove existing roof rafter seats on support beams and replace new seats. Rafters to be relocated on support beams during installation of new seats.
- JV-57 Cut ends off of roof rafters at support beams to maximum overhang of three (3) inches past flanges of support beams.
- JV-58 Reposition roof rafter support beams to vertically plum.
- JV-59 Reconstruct roof rafter support beam connections at columns.
- JV-60 Remove existing roof rafter connection plates at roof knuckle and replace new plates.
- JV-61 Install repair of roof rafter flange.
- JV-62 Install new carbon steel fill pipe hood. Includes installation of A316 stainless steel connection ring in top of hood and A316 sludge ring around fill pipe at floor.

- JV-63 Fabricate and install A316 stainless steel Anti-Vortex assembly at suction line inside reservoir. New Anti-Vortex plate to include A316 stainless steel sludge ring around suction pipe at floor.
- JV-64 Install twelve (12) inch diameter carbon steel and ductile iron drain line in floor, to extend to exterior of structural concrete ring at perimeter of tank. Includes tank drain diverter plates.
- JV-65 Install wall and floor seam repair by welding.
- JV-66 Install corrosion pit repair by plug welding.
- JV-67 Install corrosion pit repair by patch plate welding.
- JV-68 Install new A316 stainless steel roof hatch.
- JV-69 Install A304 stainless steel Saf-T-Mount in Saf-T-Rail on exterior ladder at intermediate landing.
- JV-70 Install A316 stainless steel Saf-T-Rail extension at bottom of interior ladder.
- JV-71 Install A304 stainless steel Saf-T-Rail extension at bottom of exterior ladder.
- JV-72 Interior tank wet surface preparation (SSPC SP10) and relining, Lining System IW-01.
- JV-73 Propane powered dehumidification of interior of tank during abrasive blasting, coating application and coating curing.
- JV-74 Exterior tank dry surface preparation (SSPC-SP6) and recoating, includes portable containment, Coating System EN-01.
- JV-75 Exterior pipe and valve surface preparation (SSPC-SP6), and recoating, Coating System EN-02 and Caulking System EC-02 for valves and piping in two (2) concrete pipe vaults.
- JV-76 Exterior valve operator surface preparation (SSPC-SP2 and SSPC-SP3), and recoating, Coating System EN-03 for valve operators.
- JV-77 Remove existing grout from base of tank between sketch plate and ring wall foundation and install caulk, Caulk System EC-02.

C. The OWNER will only drain the tank of water for the CONTRACTOR to perform the Work items listed. The CONTRACTOR shall pump any residual water out of the tank after it has been drained. The CONTRACTOR shall be responsible for all means and methods for all Work items listed.

D. All materials that are to be disposed of shall be disposed of in accordance with Specification 01505, Construction & Demolition Waste Management.

E. The contract documents indicate the Work of the contract and related requirements and conditions.

1.3 SUBMITTALS

A. Provide shop drawings and other information as required by Section 01300 for coordination of the work.

1.4 CONTRACTOR'S USE OF CONSTRUCTION SITE

A. CONTRACTOR shall not unreasonably encumber construction site with materials or equipment. CONTRACTOR shall assume reasonable responsibility for protection of construction site.

1.5 WORK TO BE PERFORMED BY THE JOLLYVILLE TUNNEL CONTRACTOR ON THE JOLLYVILLE GROUND STORAGE TANK PROJECT SITE

- A. The following work will be performed on the Jollyville Ground Storage Tank site by others from the Jollyville Tunnel project:
 - 1. Replace existing 66 inch butterfly valve and motor activator. Run electrical conduit to motor actuator.
 - 2. Install 66 inch transmission main and connect to existing piping at two locations adjacent to the reservoir with 66 inch gate valves at each connections.
- B. The Jollyville Ground Storage Tank CONTRACTOR shall plan to allow the Jollyville Tunnel CONTRACTOR onto the Jollyville Ground Storage Tank site to perform the work listed in 1.4 of this Specification. The Jollyville Tunnel CONTRACTOR'S work that is to be performed on the Jollyville Ground Storage Tank site shall be included in the Jollyville Ground Storage Tank CONTRACTOR'S progress schedule.
- C. The Jollyville Ground Storage Tank CONTRACTOR shall plan and coordinate meetings with the OWNER, the OWNER'S Representatives, the Jollyville Ground Storage Tank CONTRACTOR and the Jollyville Tunnel CONTRACTOR to coordinate this work.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END

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PART 1 -- GENERAL

1.1 SCOPE OF WORK

- A. This section includes existing facilities and site/s designated and required demolition --inclusive of materials, equipment, etc. to be salvaged and returned to the **OWNER** or demolished and removed from the site as trash by the **CONTRACTOR** or salvaged and/or reused as part of this Contract.
- B. Furnish all labor, material, equipment, permits/applications and incidentals required to demolish, modify, or alter existing facilities as designated by Contract specifications and drawings or as specified and as required for the installation of new improvements--mechanical, piping, civil/structural, electrical, etc. equipment, systems, etc. Coordinate with the **A/E & OWNER** for all materials, equipment, etc. to be turned over to the **OWNER**.

1.2 RELATED WORK –APPLICABLE SPECIFICATIONS, SECTIONS, DIVISIONS, ETC.

- A. Inclusive for any and all **CONTRACT** specifications, sections, divisions and PLANS where required and/or designated applicable, respective demolition and/or salvage work.
- B. Related section/s affecting this section, as may be applicable but not necessarily limited to, are:
 - 1. Section 15010 Mechanical - General
 - 2. Section 16100 Electrical – General
 - 3. Section 17100 Process Instrumentation and Controls System, PICS
- C. Coordination/Schedule with Other Work - where applicable and required, coordinate/schedule demolition with other disciplines and work in accordance with sequence of construction as managed/directed by the **CONTRACTOR**.

1.3 REFERENCES AND STANDARDS

- A. Applicable industry standards, practices, references, etc. –per OSHA, EPA, ANSI, NEMA, NFPA, NEC, IEEE, UL, NESC, UBC, inclusive of local, state, federal (national) codes, ordinances, regulations.

1.4 PERFORMANCE REQUIREMENTS

- A. **Existing Conditions:** **CONTRACTOR** shall inspect the site for the nature and condition of facilities to be demolished, modified, or altered prior to making BID. No increase in cost or extension of **CONTRACT** time will be considered for failure of knowledge of demolition requirements. A written salvage plan shall be prepared and submitted covering all demolition for the project.
- B. **Salvage:** **OWNER** reserves the right to salvage any or all items designated for demolition. **CONTRACTOR** shall carefully remove and relocate salvaged items to designated storage area/s. **CONTRACTOR** shall protect salvaged items from weather, discoloration/staining, construction damage, theft and vandalism. **CONTRACTOR** shall coordinate and schedule with **OWNER** for delivery/relocation of salvage item/s.
- C. **Commencement:**
 - 1. **CONTRACTOR** shall prepare, submit and acquire approved outline, coordination/schedule and make provisions and resources for planned demolition and salvage work. The **CONTRACTOR** shall submit to the **A/E (Architect/Engineer) and OWNER** minimum of five (business days) prior to commencement of demolition/salvage

work in any area. The **A/E, OWNER** shall have tagged all equipment, items, etc. with color coded system to designate items to be salvaged and stored.

2. The **CONTRACTOR** shall provide four (4) colors of wire tags by EMED Co. Inc. # LMT70 or equal at a minimum quantity of 50 each color.

D. Demolition and Disposal: All other materials removed under not designated for salvage or storage by the **OWNER**, including dismantled equipment and materials----piping, pumps, valves, machinery, gates, concrete, metals, masonry, miscellaneous and other construction debris shall become the property and responsibility of the **CONTRACTOR** and removed from the site. Demolished and removed equipment, materials, trash, debris, etc. shall be legally disposed, off the site. **CONTRACTOR** shall have the rights of salvage. **CONTRACTOR** shall provide proper/required documentation of all legally disposed/removed from site; submit in triplicate copy this documentation to **A/E, OWNER**.

E. Demolition, Removal, Disposal, etc.: All demolition work shall be done in a safe manner -- observing all required and necessary safety operations, procedures, regulations, etc.

F. Demolition Performance: Repair damage to paint finishes caused by demolition and equipment removal, etc. Cleaning - maintain and end with neat, clean work area/s; maintain workmanlike conditions. Perform electrical and controls system/s testing and adjustment/s where required applicable in the performance of EIC related demolition work.

1.5 QUALITY ASSURANCE

A. Demolition -- Protection of Existing Facilities

1. The **CONTRACTOR** shall diligently protect existing structures and property of the **OWNER** while performing work of this section and the entire **CONTRACT**. All damage shall be repaired at once to the satisfaction of the **OWNER**. All such repairs shall be at the expense of the **CONTRACTOR** and no claims for additional payment will be allowed.
2. When removing materials or portions of existing structures and when making openings in walls and partitions, the **CONTRACTOR** shall provide barriers, dust screens, and other protective devices so as not to damage the structure beyond the limits necessary for the new work.

B. Demolition -- Disposal and Removal

1. The **CONTRACTOR** shall safely, properly and legally dispose and remove off-site all demolished equipment, materials, items, etc. so designated and not designated for return or salvage to the **OWNER**.
2. Demolition disposal and removal shall not cause any detrimental impact to public health and safety nor detrimental impact to the environment. Appropriate and adequate protection shall be taken in performing demolition and demolition disposal and removal.

PART 2 PRODUCTS (NONE)

PART 3 EXECUTION

3.1 GENERAL

A. **Control of Hazard and Nuisance Conditions:** All demolition, salvage, and renovation work shall be conducted in a manner which will protect the environment, promote public health and safety, and preclude nuisance conditions, in strict conformance with the requirements of the Specifications.

- B. **Penetrations:** Where holes in existing masonry or concrete are required to be sealed, unless otherwise specified, they shall be sealed with cement mortar or concrete. The side of the openings shall be provided with keyed joints and shall be suitably roughened to furnish a good bond and make a watertight joint. All loose or unsound material adjacent to the opening shall be removed and, if necessary, be replaced with new sealant material/s. The method of placing the mortar seal shall provide a suitable means of releasing entrapped air.
- C. **Piping Modifications:** Where necessary or required for the purpose of making piping connections, cut existing pipelines and provide suitable plugs, bulkheads, or other means to hold back the flow of water or other liquids, all as required in the performance of this work. The remaining open ends of all piping, valves, fittings, and appurtenances that are removed shall be plugged with standard pipe plugs or closed with fittings and/or flanges so that there will be no leakage through the closure/end seal.

3.2 STRUCTURAL DEMOLITION

- A. **Existing Structures:** Structures that are in the way of new construction shall be removed completely, regardless if they are above or below existing or proposed ground or grade. This work may be done in any manner selected by the **CONTRACTOR**, and reviewed by the **A/E** or **OWNER**, that does not endanger adjacent structures and property. The use of explosives are not permitted for any purposes.
- B. **Grading and Backfill:** All excavation made in connection with this work and all openings below permanent ground caused by the removal of a structure shall be backfilled with suitable material, approved by **A/E** or **OWNER** and graded to match the proposed grading plan and/or as designated per the Contract Specifications and Drawings.

3.3 MECHANICAL DEMOLITION & SALVAGE

- A. All mechanical equipment shall be demolished, dismantled and removed and disposed or where designated per Contract Specifications and Drawings. Designated mechanical equipment for salvage shall be turned over to **OWNER**; coordinate and schedule with **OWNER**, accordingly.
- B. When existing underground piping is to be altered or removed, the remaining piping shall be properly capped. Abandoned underground piping may be left in place, unless it interferes with the required work or is shown or designated to be removed. Abandoned underground piping left in place shall be filled with slurry of approved composition. **CONTRACTOR** shall submit and acquire approval by the **A/E** or **OWNER** for slurry.

3.4 ELECTRICAL, INSTRUMENTATION & CONTROLS (EIC) DEMOLITION & SALVAGE

- A. **CONTRACTOR** shall demolish and remove existing EIC related work as designated per the Contract Drawings. Contractor shall request the **A/E**, **OWNER** to identify all items to be salvaged prior to the start of demolish work.
- B. **CONTRACTOR** shall verify/ensure that existing EIC work designated for demolition are de-energized and decommissioned before disconnecting and removing any equipment and/or materials. **CONTRACTOR** shall be responsible for following appropriate lock-out/tag-out requirements for safe electrical work. **CONTRACTOR** shall coordinate and schedule all EIC demolition work with **A/E**, **OWNER** prior to beginning demolition.
- C. EIC demolition and removal shall consist of the removal of existing ---transformers, distribution panelboards, control panels, conduits and wires --including underground ductbank/s where designated applicable, poles and overhead wiring, panel/control enclosure/s, I&C/DCS/SCADA system/s, lighting fixtures and miscellaneous electrical equipment, etc. as shown, specified, or otherwise designated and/or required work for complete removal and/or for implementing new improvements.

- D. All existing electrical equipment and fixtures to be removed shall be removed with such care as may be required to prevent unnecessary damage, to keep existing systems in operation and to keep the integrity of the existing electrical grounding systems.
- E. Abandoned existing conduits and wire/s: Generally where associated electrical equipment is removed, all associated electrical power and control wiring and conduit which are no longer required shall be removed. Removed wires and wiring back to its power source and/or to the control panel. Remove conduit, unless otherwise designated, back to the nearest junction box or point on conduit encasement. Where designated, underground ductbank shall be abandoned in place; seal/cap ends of encased conduits after removal of wires.
- F. Existing power panelboards shall be removed and disposed. All cutting/patching/etc. necessary for removal and replacement of new panelboard shall be performed.

3.5 SALVAGED ITEMS --- RETURNED TO OWNER

- A. **CONTRACTOR** shall request the **A/E, OWNER** to identify all items to be salvaged prior to the start of demolish work. Salvaged items shall be properly disconnected/dismantled to their full salvage value and cleaned before turning over to the **OWNER** or placing in **OWNER's** storage. **OWNER** reserves the right to salvage any or all items/materials/etc. prior to approved demolition work.

PART 4: MEASUREMENT AND PAYMENT

No separate measurement or payment for work performed under this Section. Include the cost of same in the **CONTRACT** price bid for which this is a component part.

END

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish labor, materials, applicable and required services to provide, install and make operation --but is not limited to, the following electric/electrical principal systems and equipment as specified, designated, and required per Contract SPECIFICATIONS and PLANS:
1. 120/208 Volt and 120/240 Volt, 3-phase & 1-phase, power System/s.
 2. 480 Volt, 3-phase, power System/s.
 3. Motor/s.
 4. Motor Control Center/s.
 5. Power Distribution Panelboard/s and Mini-Power Center/s.
 6. Conduit and Raceways --above ground system/s & underground duct bank system/s.
 7. Transformer/s.
 8. Lighting fixtures and lamps.
 9. Grounding and Lightning Protection.
 10. Conductors/Wires/Cable & wire/cable tagging.
 11. Miscellaneous Controls and Equipment.
- B. Also, provide same electrical equipment and services REQUIRED for related, respective Process Instrumentation and Controls System, PICS.

1.02 RELATED SPECIFICATIONS

- A. 01300 Submittals
- B. 01730 Operations and Maintenance (O&M) Manual/s
- C. DIVISION 16 Electrical
- D. DIVISION 17 -- Process Instrumentation and Controls System, PICS
- E. ALL process and/or mechanical packaged system/s --having electrical, instrumentation and control system/s, components, devices, etc. Reference all applicable and respective, related packaged system/s specification section/s, accordingly.
- F. Other related work as may be designated, required, and/or called for per the CONTRACT DRAWINGS, other related TECHNICAL / EQUIPMENT SPECIFICATIONS and/ or as elsewhere defined or designated.

1.03 CODES, REFERENCES AND STANDARDS

- A. Perform work, furnish and install materials and equipment in full accordance with the latest issue of the applicable rules, regulations, requirements, and specifications of the following:
1. Local laws and ordinances.
 2. State and Federal Laws.
 3. National Electrical Code (NEC)
 4. National Fire & Protection Act (NFPA-70E)
 5. State Fire Marshal.
 6. Underwriters' Laboratories (UL).
 7. National Electrical Safety Code (NESC).
 8. American National Standards Institute (ANSI).
 9. National Electrical Manufacturer's Association (NEMA).

10. National Electrical CONTRACTOR's Association (NECA) Standard of Installation.
11. Institute of Electrical and Electronics Engineers (IEEE).
12. Insulated Cable Engineers Association (ICEA).
13. Occupational Safety and Health Act (OSHA).
14. International Electrical Testing Association (NETA).
15. American Society for Testing and Materials (ASTM).
16. National Fire Protection Association (NFPA).
17. American Concrete Institute (ACI).
18. International Building Code (IBC).
19. Insulated Power Cable Engineers Association (IPCEA).
20. Association Edison Illuminating Company (AEIC).

- B. Wherever the requirements of the Specifications or Drawings exceed those of the above items, the requirements of the Specifications or Drawings govern. Code compliance is mandatory.
- C. Product Quality: All electrical items shall be new and unused. Items such as cables, transformers, motors, control centers, etc., shall be newly manufactured for this project. Proof of purchase documents shall be provided upon request. Utilize products of a single Manufacturer for each item.

1.04 CONTRACT DOCUMENTS

- A. Intent:
 1. The intent of the contract drawings or Plans is to establish the types of systems and functions, but not to set forth each item essential to the functioning of the system.
 2. Electrical drawings are generally diagrammatic and show approximate location and extent of work.
 3. Install the work complete, including minor details necessary to perform the function indicated.
 4. In case of doubt as to work intended, or if amplification or clarification is needed, request instructions from the Engineer.
 5. It is also the intent of these Contract Documents for the electrical and process system Contractor/s to coordinate with each other in order to provide a complete and workable system with all wiring, conduit and accessories required which may not be shown on the Plans.
- B. Discrepancies:
 1. Review pertinent drawings and adjust the work to conditions shown.
 2. Where discrepancies occur between Plans, Specifications, and actual field conditions, immediately notify the Engineer for his interpretation.
 3. Dimensions on electrical drawings shall be verified with structural, architectural and mechanical drawings.
- C. Outlet and Equipment Locations:
 1. Coordinate the actual locations of electrical outlets and equipment with building features and mechanical equipment as indicated on architectural, structural and mechanical drawings.
 2. Review with the Engineer any proposed changes in outlet or equipment location.
 3. Relocation of outlets before installation, up to 10 feet from the position indicated, may be directed by OWNER without additional cost.
 4. Remove and relocate outlets placed in an unsuitable location, when so requested by the Engineer.

1.05 REGULATIONS AND PERMITS

- A. Regulations: Work, materials and equipment must comply with the latest rules and regulations of the following:
 1. National Electrical Code (NFPA 70, NEC).
 2. National Electrical Safety Code (NESC).

3. National Fire Protection Association (NFPA 70E)
 4. Occupational Safety and Health Act (OSHA).
 5. State and federal codes, ordinances and regulations.
 6. Local Electrical Code.
- B. Discrepancies:
1. The Plans and Specifications are intended to comply with listed codes, ordinances, regulations and standards.
 2. Where discrepancies occur, immediately notify the Engineer in writing and ask for an interpretation.
 3. Should installed materials or workmanship fail to comply, the Contractor is responsible for correcting the improper installation.
 4. Additionally, where sizes, capacities, or other such features are required in excess of minimum code or standards requirement, provide those specified or shown.
- C. Permits: Obtain certificates of inspection and other permits required as a part of this work.
1. Electric Contractor shall be knowledgeable and experienced in processing and completing electrical service plan application (ESPA) with Austin Energy (the electric utility company) and electrical permit with the CITY of AUSTIN, Building Permits.
 2. Electrical Contractor shall process construction electric service request and permits as required for the Contract / Contractor. Coordinate and schedule construction electric service load requirements with the Contractor, accordingly.
 3. All electric utilities billing shall be the responsibility of the CONTRACTOR until project's final acceptance at which time billing shall be transferred to OWNER.

1.06 CONTRACTOR QUALIFICATIONS

- A. An acceptable Electrical Contractor for the work under this DIVISION must have personnel with experience, training, and skill to provide a practical operational working electrical system. The Electrical Contractor shall have previous water and wastewater experience with at least 5 years in business.
1. The Electrical Contractor shall be required to furnish acceptable evidence of having installed not less than three systems of size and type comparable to this project.
 2. The systems must have served satisfactorily for not less than 3 years.
 3. The superintendent must have had experience in installing not less than three systems.
 4. The Electrical Contractor shall submit qualifications of his firm and resumes of his personnel who will work on this project.
 5. Electrical Contractor shall have performed a minimum of three projects with the OWNER.

1.07 GENERAL REQUIREMENTS FOR WORKMANSHIP, EQUIPMENT AND MATERIALS

- A. All electrical work shall be performed by workmen skilled in the electrical trade and licensed for electrical work by the local authority. (Licensed by the State of Texas)
- B. A licensed Master Electrician will be required for the issuance of a building permit for constructing, installing, altering, maintaining, repairing, or replacing any electrical wiring, apparatus, or equipment on all voltage levels. A licensed Master Electrician or a licensed Journeyman Electrician holding a current license in the State of Texas is required to be on the job site during the performance of any electrical work. Master Electrician shall spend minimum of 2 hours per week at the job site reviewing work completed.
- C. All cable splicing and termination methods and materials shall be of the type recommended by the splicing materials Manufacturer for the cable to be spliced, and shall be approved by the Engineer prior to installation.
- D. All materials and equipment shall be installed in accordance with the approved recommendations of the Manufacturer, the best practices of the trade, and in conformance with the Contract Documents. The

Contractor shall promptly notify the OWNER in writing of any conflict between any requirements of the Contract Documents and Manufacturer's directions, and shall obtain written instructions from the OWNER before proceeding with the work. Should the Contractor perform any work that does not comply with the Manufacturer's directions or such written instructions from the OWNER, he shall bear all costs arising in correcting deficiencies.

- E. All equipment and materials shall be new, unless specifically noted otherwise, and shall bear the Manufacturer's name, trademark and ASME, UL, and/or other labels in every case where a standard has been established for the particular item. Equipment shall be the latest approved design of a standard product of a Manufacturer regularly engaged in the production of the required type of equipment, and shall be supported by a service organization that is, in the opinion of the OWNER, reasonably convenient to the site.
- F. It is the responsibility of the Contractor to insure that items furnished fit the space available with adequate room for proper operation and maintenance. He shall make measurements to ascertain space requirements, including those for connections, and shall furnish and install such sizes and shapes of equipment that, in the final inspection, will suit the true intent and meaning of the Plans, Specifications and Contract Documents.
- G. The Contractor shall furnish and install all equipment, accessories, connections and incidental items necessary to complete the work, ready for use and operation by the ENGINEER/OWNER.
- H. When the ENGINEER/OWNER has reviewed equipment submittals and given instructions to proceed (Approved Submittals) with the installation of items of equipment that require arrangements or connections different from those shown on the drawings, it shall be the responsibility of the Contractor to install the equipment to operate properly and in accordance with the intent of the Contract PLANS and SPECIFICATIONS, and Contractor shall provide any additional equipment and materials that may be required. The Contractor shall be responsible for coordination and the proper location of roughing-in and connections by other trades. All changes shall be made at no increase in the Contract Amount or additional costs to other trades.
- I. The Contractor shall support the installation of all equipment, plumb, rigid and true to line. The Contractor shall determine how equipment, fixtures, conduit, etc., are to be installed, and shall provide foundations, bolts, inserts, stands, hangers, brackets and accessories for proper support whether or not shown on the drawings.

1.08 SHOP DRAWINGS AND PRODUCT DATA

- A. Data Required:
 - 1. Submit shop drawings, product data and all other required information as specified in Division 1. Submittals are required on all products and items to be installed on this project.
 - 2. Submittal data must show Manufacturer's name, published ratings or capacity data, detailed equipment drawing for fabricated items, panel diagrams, wiring diagrams, installation instructions and other pertinent data.
 - 3. Where literature is submitted covering a group or series of similar items, the applicable items must be clearly indicated. Mark through items not being provided and clearly identify all options being provided.
 - 4. Do not combine submittal for multiple Specifications Sections.
- B. Submittal Items: Submittals are required for all equipment and materials to be used on this project. Submittals shall be complete with all pertinent information and installation details. Assume all costs and liabilities which may result from the ordering of any material or equipment prior to the review of the shop drawings or submittals, and no work shall be done until the shop drawings or submittals have been reviewed. In case of correction or rejection, resubmit until such time as they are accepted by the OWNER's Representative, and such procedures will not be cause for delay
- C. Terminal Connection Diagrams:

1. Submit terminal connection diagrams for approval prior to any wire installation.
2. Submit finalized terminal connection diagrams at the end of the Contract.
3. All Manufacturers named are a basis as a standard of quality and substitutions of any equal product will be considered for acceptance. The judgment of equality of product substitution shall be made by the Engineer.

1.09 ELECTRICAL SYSTEM RESPONSIBILITY

- A. The Electrical Contractor shall be responsible for:
1. Complete, all electrical systems in accordance with the intent of the Contract Documents.
 2. Coordinating the details of facility/system equipment and construction for all Specification Divisions and related specification which affect the work covered under DIVISION 16, Electrical.
 3. Electrical Contractor to coordinate and implement the required provisions, where designated and required for electrical system and equipment compliance per NFPA 70E, Arc Flash Fault Hazard. Coordinate required provisions per Section 16485 for same.
 4. Furnishing and installing incidental items not actually shown or specified, but which are required by good practice to provide complete functional systems.
 5. Coordinate the work with the instrumentation and control system (I&C/DCS/SCADA) -- I&C Contractor as per the PICS.
 - a. The I&C Contractor shall furnish, install and make operational the primary and secondary instruments, main and auxiliary control panel/s and related I&C system work.
 - b. The conduit and wiring to and from instruments, typical field electrical wiring –conduit and wiring, shall be furnished and installed by the Electrical Contractor. Termination in the instrument shall be by the Instrument Contractor.
 - c. All terminations in the control panel shall be by the I&C system Contractor.
 - d. The Electrical Contractor shall provide termination drawings for the I&C Contractor.
 - e. The equipment pad and wall and/or freestanding support/s for the control panels, consoles and instrument panels shall be by the Electrical Contractor.
 - f. The Electrical Contractor shall coordinate the testing of the electrical system being furnished. He shall be responsible for the equipment he is supplying.
 - g. The Electrical Contractor shall be present at the time of the I&C system testing and start-up. Electrical Contractor and/or the General Contractor, shall be responsible to coordinate the testing and startup of the facility with the I&C Contractor, ENGINEER and OWNER.
 - h. The Electrical Contractor shall coordinate the interface requirements between each motor starter and/or control panel furnished under this Contract with the I&C Contractor.
- B. Electrical PLANS drawings show only general locations of equipment, devices, and raceway, unless specifically dimensioned. The Contractor shall be responsible for the proper routing of raceway, subject to the approval of the Engineer.
- C. Submit to the Engineer, in writing, details of any necessary, proposed departures from these Contract Documents, and the reasons therefore. Submit such request as soon as practicable, and within ten (10) days after award of the Contract. Make no such departures without written approval of the Engineer. Early notice of schedule issues, departures, long term equipment/materials/supplies delivery, etc. shall be presented and identified at the Pre-Construction Conference for the project.
- D. Dimensions on electrical drawings shall be verified with structural, architectural, and mechanical drawings per the Contract PLANS.
- E. Where the Contractor is submitting a packaged system, Contractor shall meet the requirements of electrical requirements, specifications and provisions of DIVISION 16 --as directed here-in, Section 16100. This includes field cables, conductors, labeling, relays, terminal blocks, conduits, junction boxes, circuit breakers, combination starters, pushbuttons, pilot lights, and motors. Deviations shall not be accepted, unless approved in writing, in advance. Control centers and special control cabinets wired to

terminal blocks shall include the Manufacturer's standard quality, unless specifically mentioned to the contrary on the drawings or in the specifications.

- F. Maintain continuity of electric service to functioning portions of the process or buildings during hours they are normally in use. Temporary outages will be permitted during cutover work at such times and places as can be prearranged/coordinated with the OWNER. Give the OWNER a minimum of one week notice prior to any shutdowns. Such outages shall be kept to a minimum number and minimum length of time. Make no outages without prior written authorization of the Engineer. Include costs for temporary wiring and overtime work required in the Contract price. Remove temporary wiring at the completion of the work. The Contractor shall be responsible to provide and pay for temporary power to any facility during construction to facilitate the new construction. If generator is needed Contractor shall be responsible for all the cost associated with providing generator electric power, including fuel.
- G. Unless shown in detail, the drawings are diagrammatic and do not necessarily give exact details as to elevations and routing of raceways, nor do they show all offsets and fittings; nevertheless, install the raceway system to conform to the structural and mechanical conditions of the construction.
- H. Cabling inside equipment shall be carefully routed, trained, and laced/ty-wrapped. Placing cables so that they obstruct equipment devices is not acceptable.

PART 2 PRODUCTS

2.01 PRODUCT REQUIREMENTS

- A. Condition: Materials and equipment provided under these Specifications must be new products of Manufacturers regularly engaged in production of such equipment. Provide the Manufacturer's latest standard design for the type of equipment specified.
- B. NEC and UL: Products must conform to requirements of the National Electrical Code. Where Underwriters' Laboratories have set standards, listed products, and issued labels, products used must be listed and labeled by UL.
- C. NEMA and IEC: Only NEMA rated equipment is acceptable. IEC or dual rated NEMA/IEC equipment are not acceptable.
- D. Space Limitations: Equipment selected must conform to the buildings features and must be coordinated with them. Do not provide equipment that will not suit arrangement and space limitations.
- E. Factory Finish: Equipment must be delivered with a hard surface, factory-applied finish so that no additional field painting is required.
- F. Field Installation: All field installed equipment, conduit, etc., shall require Type 316 stainless steel nuts, bolts, washers, metal framing and supports, and other items as indicated on the Plans.
- G. Seismic Design: All electrical equipment to be designed in accordance with/IBC-2006 & ASCE 7-05 code for Seismic Design.

PART 3 EXECUTION

3.01 PROTECTION OF EQUIPMENT

- A. Moisture:
 - 1. During construction, provide heaters to protect switchgear, transformers, motors, control equipment, and other items from moisture absorption and corrosion.
 - 2. Apply protection immediately on receiving the products and provide continuous protection.
 - 3. Store all equipment indoors in dry, well ventilated and heated space.

- B. Clean: Keep products clean by elevating above ground or floor and by using suitable coverings.
- C. Damage: Take such precautions as are necessary to protect apparatus and materials from damage. Failure to protect materials is sufficient cause for rejection of the apparatus or material in question.
- D. Finish: Protect factory finish from damage during construction operations and until final acceptance of the project.
- E. Protect Equipment per the Manufacturer's requirements.

3.02 INSTALLATION

- A. Cooperation and Coordinate with Other Trades and Engineering Disciplines:
 1. Cooperation with trades of adjacent, related or affected materials or operations, and of trades performing continuations of this work under subsequent contracts, is considered a part of this work in order to effect timely and accurate placing of work and to bring together, in proper and correct sequence, the work of such trades.
 2. Coordinate equipment layout in sufficient time to be coordinated with work of others, provide drawings and layout work showing exact size and location of sleeves, openings or inserts for electrical equipment in slabs, walls, partitions and chases.
- B. Workmanship: Work must be performed by workmen skilled in their trade. The installation must be complete, whether the work is concealed or exposed. Installed work shall be in a workmanlike manner.
- C. Concrete Equipment Pads:
 1. Install minimal 4-inch-thick concrete housekeeping pads with chamfered edges for indoor and outdoor floor mounted equipment.
 2. Pour pads on roughened floor slabs, sized so that outer edges extend a minimum of 3 inches beyond indoor equipment.
 3. Exterior pads shall extend one foot beyond the equipment, including cooling fins.
 4. Trowel pads smooth and chamfer edges to a 1-inch bevel.
 5. Provide dowels in slab, and rebar between the dowels.
 6. Pads must drain away from the equipment.
 7. Secure equipment to pads as recommended by the Manufacturer.
 8. Follow structural detail where applicable.
- D. Setting of Equipment:
 1. Equipment must be leveled and set plumb.
 2. Stainless Steel 316 enclosures mounted against a wall must be separated from the wall not less than 1/2-inch by means of corrosion resistant 316 Stainless Steel spacers or by 3- inches of air for freestanding units. Mount on 316 Stainless Steel Unistrut Support Channel/s.
 3. Stainless Steel 316 bolts, nuts and washers to bolt-up/connect and anchor Unistrut channel/s and equipment.
- E. Sealing of Equipment:
 1. Permanently seal outdoor equipment at the base using concrete grout.
 2. Seal or screen openings into equipment to prevent entrance of animals, birds and insects.
 3. Use stainless steel mesh with openings not larger than 1/16-inch squares for screened openings.
 4. Seal small cracks and openings from the inside with silicone sealing compound.
- F. Concealed Work: Conceal electrical work in walls, floors, chases, under floors, underground and above ceilings, and electric underground duct bank/s except:
 1. Where shown or specified to be exposed. Exposed is understood to mean open to view.
 2. Where exposure is necessary to the proper function.
 3. Where size of materials and equipment precludes concealment.

3.03 TESTING

- A. Test Conditions:
1. Place circuits and equipment into service under normal conditions, collectively and separately, as may be necessary to determine satisfactory operation.
 2. Perform specified tests in the presence of the Engineer, as specified in Division 1 - General Provisions and Division 16 – Electrical work and/or as applicable per Division 17 – Process Control and Instrumentation System, PCIS work.
 3. Furnish all instruments, wiring, equipment, and personnel required for conducting tests. Engage the services of an independent contractor if required. Test equipment shall be calibrated within the last 6 months.
 4. Demonstrate that the equipment operates in accordance with requirements of the plans and specifications.
 5. No process equipment is to be operated until any associated HVAC equipment and auxiliary equipment is operational.
- B. Test Dates: Schedule final acceptance tests sufficiently in advance of the Contract completion date to permit completion of any necessary adjustment or alterations within the number of days allotted for completion of the Contract.
- C. Retests: Conduct retests as directed by the Engineer of such time duration as may be necessary to assure proper functioning of adjusted or altered parts or items of equipment. Any resultant delay as a result of such necessary retests does not relieve the Contractor of his responsibility under this contract. Provide notice to Engineer and OWNER of testing 30-days prior to testing.

3.04 PROJECT RECORD DOCUMENTS

- A. Preparation:
1. At the job site, maintain a set of white prints of the contract drawings.
 2. At the job site, maintain a set of equipment terminal connection diagrams.
 3. On the prints, record field changes and diagrams of those portions of work in which actual construction is at variance with the contract drawings.
 4. Mark the drawings with a colored pencil. Record installed feeder conduits, dimensioning the exact location and elevation of the conduit.
- B. Delivery: Deliver record drawings to the Engineer in the number and manner specified in Division 1 - General Requirements and/or Section 01300 "Submittals" and Section 01730 "Operation and Maintenance (O&M) Manual/s".

3.05 TRAINING AND SPARE PARTS

- A. Provide and/or coordinate provisions for contract training where specified for electrical and/or controls system equipment --where required and as applicable. Coordinate and schedule accordingly with sufficient notice time --minimum five working days or as designated per Contract documents.
- B. Furnish all (complete) electrical system/s spare parts per the Contract Documents including complete spare parts list to designated/authorized, OWNER representative.

3.06 CUTTING AND PATCHING

- A. Lay out work carefully in advance. Do not cut or notch any structural member or building surface without specific approval of the Engineer. Carefully carry out any cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, paving, or other surfaces required for the installation, support, or anchorage of conduit, raceways, or other electrical materials and equipment. Following such work, restore surfaces neatly to original condition.

3.07 LOAD BALANCE

- A. The Drawings and Specifications indicate circuiting to electrical loads and distribution equipment. Balance electrical load between phases as nearly as possible on switchboards, panelboards, motor control centers, etc.

3.08 MOTOR ROTATION

- A. Before and after final service connections are made, check and correct as necessary the rotation of motor/s.
- B. Coordinate rotation checks with the Engineer and the Contractor responsible for the driven equipment. Submit a written report to the Engineer for each motor verifying that rotation has been checked and corrected.

3.09 CLEANING AND TOUCH-UP PAINTING

- A. Touch up scratches, scrapes, or chips in interior and exterior surfaces of devices and equipment with finishes matching as nearly as possible the type, color, consistency, and type of surface of the original finish. If extensive damage is done to equipment paint surfaces, refinish the entire equipment in a manner that provides finish equal to or better than the factory finish, and that meets the requirements of the Specifications and is acceptable to the Engineer.
- B. Remove all temporary labels, dirt, paint, grease and stains from all exposed equipment. Upon completion of work, clean equipment and the entire installation so as to present a first class job suitable for occupancy. No loose parts or scraps of equipment shall be left on the premises.
- C. All temporary wiring, wiring devices and associated equipment shall be removed upon completion of the project.

PART 4: MEASUREMENT AND PAYMENT

No separate measurement or payment for work performed under this Section. Include the cost of same in the **CONTRACT** price bid for which this is a component part.

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PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Provide, furnish, install all raceways, fittings, and supports system for all electrical conductors, wire and cables for all electrical service, electrical equipment, etc. specified here-in, required, and designated per the Contract PLANS.

1.02 RELATED SPECIFICATIONS

- A. DIVISION 16 – Electrical; primary related sections 16200, 16450, 16951
- B. DIVISION 17 – Process Instrumentation and Controls System, PICS
- C. ALL process and/or mechanical packaged system/s --having electrical, instrumentation and control system/s, components, devices, etc. Reference all applicable and respective, related packaged system/s specification section/s, accordingly.
- D. Other related work as may be designated, required, and/or called for per the CONTRACT DRAWINGS, other related TECHNICAL / EQUIPMENT SPECIFICATIONS and/ or as elsewhere defined or designated.

1.03 REFERENCES AND STANDARDS

| <u>Code</u> | <u>Title</u> |
|-----------------|---|
| NFPA 70 | National Electrical Code (NEC) |
| <u>Standard</u> | <u>Title</u> |
| NEMA 250 | Enclosures for Electrical Equipment (1,000 volts maximum) |
| ANSI C80.4 | Fittings and Supports for Conduit and Cable Assemblies |
| ANSI C80.5 | Rigid Aluminum Conduit |
| NEMA RN 1 | PVC Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit |
| NEMA TC2 | Electrical Plastic Tubing (EPT) and Conduit (EPC-40) |
| NEMA TC3 | PVC Fittings for Use with Rigid PVC Conduit and Tubing |
| UL7 514B | Fittings for Conduits and Outlet Boxes |
| UL 5 | Safety standard for Surface Metal Raceways and Fittings |
| UL 6; UL 614 | Electrical Rigid Metal Conduit |
| UL 360 | Liquid-tight Flexible Steel Conduit |
| UL 651 | Schedule 40 Rigid PVC Conduit |

1.04 PERFORMANCE REQUIREMENTS FOR HANGERS AND SUPPORTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified Professional Engineer licensed in the state where the project shall be built, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- D. Rated Strength: Adequate in tension and shear force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of 3 times the applied force.

1.05 SUBMITTALS

- A. Submittals shall be made in accordance with the requirements of Section 01300, "Submittals".
 - 1. Submit product data, spec's, catalog data in full and complete compliance with the specifications and/or other project requirements.
 - 2. Exceptions or deviation submittal shall be clearly marked and identify alternate compliance to the specifications.
- B. Operations and Maintenance (O&M) Manuals shall be made in accordance with the requirements of Section 01730. Include approved submittals in the O&M Manual/s.

PART 2 PRODUCT

2.01 EXPOSED, ABOVE GROUND

- A. Rigid Aluminum Metal Conduit System
 - 1. Above ground conduit system shall be U.L. listed 99% copper free, Schedule 40, rigid aluminum conduit and meet the requirements of ANSI C80.5. Conduit pipe straps and hardware to be 316 stainless steel. Conduit shall be manufactured by "Allied Tube and Conduit" or approved equal.
 - 2. **Minimum above grade conduit size for all work shall be 3/4-inch.**
- B. Conduit Seals
 - 1. Conduit seals to be suitable for use in Class-I, Group B, C, and D, and Class-II Group F and G per N.E.C. . Conduit seals shall also meet or exceed the following minimum requirements:
 - a. Seal body, nipples and closures shall be 99% copper-free aluminum. Seals bodies shall be filled with **3M #2123 Re-Enterable Sealing Compound**.
 - b. Drain: Stainless steel
 - c. Removable Nipples: 99% copper-free aluminum
 - d. Seals can be installed/removed without disassembling the conduit system. Conduit seals to be manufactured by "Crouse-Hinds" type EYS drain seals with specified options, or approved equal.

- e. Seals to be installed directly adjacent to, and, just immediately before entering wet well junction box. See details on drawings.
- C. Conduit Hubs
 - 1. Conduit hubs shall be the grounding type, 99% copper-free aluminum (body, nipples, etc.), with integral insulated throat, and with solder-less grounding lugs as manufactured by "Myers", or approved equal. Conduit hubs shall be furnished complete with rubber gasket.
- D. Grounding Bushings
 - 1. Conduit grounding bushing shall be 99% copper-free aluminum (body, nipples, etc.), with integral insulated throat, and with solder-less grounding lugs as manufactured by Meyers type STAG, or approved equal.
- E. Conduit Bodies
 - 1. All conduit bodies shall be 99% copper-free aluminum. Conduit bodies shall be manufactured by "Crouse-Hinds" Form 7, or approved equal.
- F. Conduit Unions
 - 1. Conduit unions shall be threaded, 99% copper-free aluminum. Conduit unions shall be manufactured by "Crouse-Hinds" type UNF or UNY, or approved equal by "Appleton" or "O.Z. Gedney".
- G. Condulet Covers
 - 1. Condulet Covers shall be die cast aluminum with 316 stainless steel screws. Snap on covers are unacceptable. Supply gaskets with all covers.
- H. Clamp Backs
 - 1. Single runs of conduit may be supported with aluminum clamp backs with stainless steel hardware and standoffs.
- I. Conduit Straps
 - 1. Conduit straps to be 316 Stainless Steel.
- J. Conduit Drains
 - 1. Conduit drains shall be Crouse Hinds ECD Universal, or approved equal.
- K. Smoke and fire seals
 - 1. Material shall be intumescent, one (1) part (requiring no mixing) and capable of expanding up to a minimum of eight (8) times. Material shall be U.L. classified with a fire rating equal to or greater than the penetrated number. Products to be in caulk, putty, wrap strip, sheet, or access kit foam and shall be 3M "Fire Barrier".
- L. Weatherheads
 - 1. Weatherheads shall be threaded aluminum for threaded rigid conduit application and shall not be a clamp type. Weatherheads shall be Crouse Hinds series F,O-Z type 17 or Appleton Series F.
- M. Accessories
 - 1. Reducers, washers, etc. shall be 316 stainless steel.

2.02 UNDERGROUND CONDUIT ELECTRICAL DUCT BANK SYSTEM -- CONDUIT CONCEALED IN CONCRETE UNDERGROUND

- A. All underground electrical conduit system shall be concrete encased rigid, PVC conduit (lateral run) and PVC coated, rigid, galvanized steel conduit (above/below grade transitions).
1. Underground electrical duct bank system shall be --
 - a. Lateral run: Schedule 40, PVC, rigid conduit -- U.L. listed, No. 651, conforming to NEMA standard TC-2-75 and listed in conformity with Article 347 of the NEC. Conduit to be manufactured by "Carlon", or approved equal. Solvent weld shall be a type approved by the PVC conduit manufacturer.
 - b. Above/below grade transition: PVC coated, rigid, Schedule 40, galvanized steel conduit -- U.L. listed and conforming to NEMA RN 1; manufactured by Rob Roy or approved equal. PVC conduit rigid steel adapter shall be a type approved for the application/service.
 2. **Minimum underground conduit size for all work shall be one (1) inch.**
 3. Minimum conduit run in concrete slab/foundation (only) shall be 3/4 inch trade side---lateral run PVC conduit with PVC coated, rigid, galvanized steel conduit above/below transitions.
- B. Above/Below ground conduit transition shall be UL listed, PVC coated, rigid, galvanized steel conduit factory bends --coated with a 40 mil exterior PVC coating and a 2 mil urethane galvanizing interior coating. The PVC coating system shall be in compliant with ETL PVC-001. Refer to Part 3-Execution of this Section, and to details provided on the Contract PLANS. PVC Coated, Rigid, Galvanized Steel conduit shall be Plasti-Bond REDH2OT or Perma-Cote PVC coated conduit as manufactured by Rob Roy.
- C. Identifying tape for buried conduits: 6" wide, metal detectable polyethylene with continuous printing along the length of the tape, as manufactured by Brady "Identoline" or Sentry Lin "Terra Tape". Use red with black letters for buried electrical power conduits. Use green with black letters for buried electric instrumentation and communication conduits.

2.03 LIQUID TIGHT FLEXIBLE CONDUIT

- A. Liquid tight flexible conduit shall be non-metallic type liquid tight conduit (2.5" and larger use standard seal tight with metal inner liner), formed from PVC plastic, accepts metallic or nonmetallic liquid tight fittings, and suitable for installation in temperature range between -20 degrees C to + 60 degrees C (suitable for use outdoors and indoors). Liquid tight flexible conduit and associated fittings shall be UL listed. Liquid tight flexible conduit and fittings shall be as manufactured by "Electri-Flex" series NM type B-PVC, Thomas & Bettis type LT-38P, or approved equal.
- B. Liquid tight flexible conduit shall be used for connections to motors, field instruments, etc., and any equipment subject to vibration, and, where shown on the drawings. Maximum length to be 36" unless otherwise noted on drawings. Minimum conduit size shall be 3/4" unless approved by engineer or AWU representative.

2.04 ELECTRICAL EQUIPMENT AND RACEWAYS SUPPORT CHANNELS

- A. Electrical equipment and raceway support channels shall be fabricated of 316 stainless steel material manufactured by "Unistrut Corporation" series P-1000SS and P-1001SS, or approved equal. All fastening hardware, fittings, supports, base posts,

clamps, framing system, etc. shall also be fabricated with 316 stainless steel. Manufacturer shall be "Unistrut Corporation," or approved equal. If manufacturer other than Unistrut is selected, contractor to provide proof and calculations that equipment supplied is equal or superior to that manufactured by Unistrut.

2.05 MOUNTING, ANCHORING, AND ATTACHMENT COMPONENTS

Items for fastening electrical conduit, equipment, or their supports to building surfaces include the following:

- A. Mechanical-Expansion Anchors: Wedge-type 316 Stainless Steel, for use in hardened portland cement concrete, with tension and shear capacities appropriate for supported loads and building materials where used.
 - 1. Manufacturers: Hilti Inc. only
- B. Concrete Inserts: 316 Stainless Steel, Slotted support system units.
- C. Clamps for Attachment to Steel Structural Elements: 316 Stainless Steel, type suitable for attached structural element.
- D. Through Bolts: Structural type, hex head, and high strength of 316 Stainless Steel materials. Toggle Bolts: 316 Stainless Steel materials. Nut/s and washer/s: 316 Stainless Steel materials.
- E. Hanger Rods: 316 Stainless Steel

PART 3 EXECUTION

3.01 GENERAL

- A. Install electrical equipment and raceway system conduit in accordance with the recommendations of the manufacturer, the requirements of the National Electrical Code, local codes, and the Contract PLANS.
- B. Use only persons skilled in this type of work.

3.02 CONDUIT SYSTEM

- A. Install Schedule 40, PVC conduit underground in duct banks changing to PVC coated, rigid galvanized steel conduit at the final 90 degree bend, transitioning underground to/from the above ground conduit system. The transition to/from PVC coated rigid galvanized steel shall be made minimum of 6" above the ground, finished slab, and/or housekeeping pad. Duct banks and/or conduit banks shall remain reinforced (along the entire length utilizing stirrups on a minimum of 18" to 48" on-centers spacing dependent on the soil condition per Geotechnical Report), encased in concrete to its final destination even when routed under building/structure, concrete floor slab, and/or equipment concrete/housekeeping concrete pad. Rebar shall be kept a minimum of 2" off the ground to allow complete concrete coverage. Concrete shall be 3000 p.s.i. strength. A red add mixture, HBS #120 Conduit Red as manufactured by Chem Systems, Inc., or equal, shall be added to the concrete at a rate of 5 pounds per 94 pound sack of cement or 16 pounds per cubic yard of concrete. Forms shall be used except that side forms are not necessary where the earth is firm enough to support the concrete.

- B. Conduit sizes, where not indicated, shall be N.E.C code sized to accommodate the number and diameter of wires/conductors/cables to be pulled in the conduit.
- C. Install conduit explosion proof seals per N.E.C. compliance, locations per the Contract PLANS.
- D. Run exposed conduit parallel or at right angles to building lines.
- E. Secure conduits to all cabinets and boxes with specified hubs and bonding jumpers in such a manner that each system is electrically continuous throughout.
- F. Install all conduits as a complete system before wiring is pulled in. Conduits shall be reamed and swabbed clean immediately before wiring is pulled in.
- G. Cap conduits during construction to prevent entrance of dirt, trash, and water.
- H. Equip conduit across structural joints, where structural movement is allowed with an O.Z./Gedney, or equal, 99 % aluminum expansion fittings of that conduit size.
- I. Conduit nipples shall have two independent sets of threads. Running threads shall not be used. Where conditions require joining two fixed conduits into a continuous run, a conduit union shall be used.
- J. Coat all conduit threads with a Noalox, Penetrox, or approved equal.
- K. Provide a minimum of 2-inches separation utilizing Plastic conduit chairs between conduits installed in concrete duct bank. Spacing may be less at panel boards, pull or junction boxes or other locations where the conduits have to be grouped.
- L. Conduit Penetrations:
 1. Link-Seal modular seals shall be used for all cored conduit penetrations.
 2. Holes for raceway penetration into sheet metal cabinets and boxes shall be accurately made with an approved tool. Cutting openings with a torch or other device that produces a jagged, rough cut will not be acceptable.
 3. PVC pipe shall be used for all pour-in-place concrete conduit penetrations.
- M. Maintain 6" clearance between conduit and piping and 12" clearance between conduit and heat sources such as flues, steam pipes and heating appliances.
- N. Arrange conduits to maintain headroom and present a neat appearance.
- O. Conduits run above ground shall be supported at least every 10 feet and once in every change in direction and at the end of each straight run terminating in an enclosure and within three feet of every junction box.
- P. Secure conduit runs firmly to specified support channels by stainless steel conduit straps or by hangers, as required.
- Q. Top of duct bank shall be installed a minimum of 18 inches below grade and shall slope 3 inches per 100 feet from high points toward the manholes.
- R. Slope conduits such that they drain and install drain fitting as required to remove condensation from the conduit.

- S. All underground conduit joints shall be waterproofed in accordance with the manufacturer's recommendations.
- T. Rigid conduit joints to be cut square, threaded, reamed smooth and drawn up tight. Bends or offsets to be made with standard conduit ells. Make field bends with an approved bender or hickey or hub type conduit fittings. Conduit shall contain no more than the equivalent of three (3) 90 degree bends between outlets or fittings.
- U. Backfilling shall be done in such a manner that voids will be minimized. Tamp backfill so that it is the same density as the surrounding soil. Excess soil shall be piled on top and shall be well tamped. All rock and debris shall be removed from the site.
- V. Conduits joints to be staggered a minimum of 6".
- W. Where a duct bank penetrates or turns up next to a structure, dowel rebar a minimum of 4" into the structure at the point of connection/intersection tying the steel reinforcing of the duct bank to the structure at a minimum of four doweled locations.
- X. All duct banks shall be placed under building slab (not in building slab) with longitudinal duct bank steel reinforcement tied to building slab steel reinforcement with an 18-inch overlap.
- Y. Conduits shall penetrate building slab at 90 degrees and shall run in duct banks under building slab and not run parallel through building slabs.
- Z. Install a drain fitting for all conduits subject to condensation. Condensation water shall never enter electrical or instrumentation enclosure. Install, use water proof sealant by 3M Corporation, Part # 2123 re-enterable, water proof sealant.
- AA. Provide conduit measuring tape, model number Ideal 31-347 or approved equal, in conduits in which wiring is not installed under this work, such as telephone, signal, and similar systems. Identify both ends of the line by means of labels or tags reading "Pulling Line." Also, state the panel the conduit originated from. Apply write-on identification to empty conduits to identify each conduit as to terminus of other end and also to identify trade size of conduit.
- BB. All termination at an enclosure shall be made from the bottom of the enclosure, no overhead penetrations are allowed. When conduits are located above the enclosure route the conduit at the same height as the bottom of the enclosure, install a drip lane at the end of the conduit and use flexible conduit to terminate at the bottom of the enclosure.
- CC. PVC Coated conduit shall be installed by manufacturer certified installer. PVC coated conduit installation shall follow manufacturer's recommendation. Contractor shall provide copy of workman's manufacturer installer certification for PVC coated conduit system installation.
- DD. Where metal conduits terminate in equipment having a ground bus, such as in switchgear, motor control centers and panelboards, terminate conduit with a Myers Hub with insulated grounding bushing in lieu of locking ring and extend a suitable grounding wire to the ground bus.
- EE. Provide chrome-plated floor and ceiling plates around conduits exposed to view and passing through walls, floors, partitions, or ceilings in finished areas.

3.03 INSTALLATION OF SUPPORT CHANNELS

- A. Utilize 316 stainless steel support channels to install raceways, and any other surface mounted electrical, instrumentation and control equipment. Refer to details shown on the Contract PLANS.
- B. All mounting hardware and straps shall be 316 stainless steel.
- C. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this specification.
- D. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 300 lb.
- E. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts mechanical expansion anchor bolt.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Mechanical Expansion Anchor System provided with lock washers and nuts shall be used in existing normal weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete slabs or wall less than 4 inches thick.
 - 5. Expansion Anchor Bolt can be used for concrete thickness less than 4 inches to meet minimum mechanical support strength.
 - 6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts
 - 7. To Light Steel: Sheet metal screws.
 - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panel boards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint wind strength and anchorage requirements.

3.04 RACEWAY/S SYSTEM INSPECTION

- A. All conduits/raceways system construction and installation shall be inspected for construction compliance, for design compliance and per NEC code compliance.
- B. Contractor shall coordinate and schedule the required inspection/s. Provide sufficient time for inspection –notice and schedule and sufficient time and required resources to make the inspection/s.
- C. All conduit/raceway system construction and installation/s not passing inspection shall be resolved accordingly for compliance and receive a re-inspection to meet approved inspection.
- D. All underground conduits/raceways system (electrical duct bank/s) shall be inspected before placing/pouring of concrete.

- E. Inspection inspector shall be by current, licensed Master Electrician, authorized registered Professional Engineer and/or Engineer/Owner.

END

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PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish and install all necessary wiring devices at the locations designated per the Contract PLANS and elsewhere as required.

1.02 RELATED SPECIFICATIONS

- A. 01300 Submittals
- B. 01730 Operations and Maintenance (O&M) Manual/s
- C. DIVISION 16 Electrical
- D. DIVISION 17 – Process Instrumentation and Controls System, PICS
- E. ALL process and/or mechanical packaged system/s --having electrical, instrumentation and control system/s, components, devices, etc. Reference all applicable and respective, related packaged system/s specification section/s, accordingly.
- F. Other related work as may be designated, required, and/or called for per the CONTRACT DRAWINGS, other related TECHNICAL / EQUIPMENT SPECIFICATIONS and/ or as elsewhere defined or designated.

1.03 SUBMITTALS

- A. Submittals shall be made in accordance with the requirements of Section 01300, "Submittals".
- B. Operations and Maintenance (O&M) Manuals shall be made in accordance with the requirements of Section 01730.

PART 2 PRODUCTS

2.01 LIGHT SWITCHES

- A. Specification grade, 20 amp, 120/277 volts. Hubbell 1221-I through 1224-I (single pole through four-way respectively). Ivory operating handle: Equals by Bryant, General Electric, Pass and Seymour are acceptable.
- B. Switch cover plates shall be Die Cast Aluminum, 99 % copper-free, "Crouse Hinds" DS185, or approved equal.
- C. Mount in boxes as specified in Section 16130.
- D. All mounting hardware is to be 316 stainless steel.

2.02 RECEPTACLES

- A. Standard: Hubbell No. 5362-I, or equal by Bryant, General Electric, Pass and Seymour or equal. Duplex, 3-wire, polarized grounding type, rated 20 amp, 125 volt, 60 Hertz.
- B. Ground Fault: Hubble # GFI 5362-I
- C. Receptacle cover plates shall be Die Cast Aluminum, 99 % copper-free, manufactured by "Crouse-Hinds" WLRS (single cover) and WLRD (duplex cover), or approved equal.
- D. Mount in boxes as specified in Section 16130.

2.03 RECEPTACLE COVERS

- A. Outdoor receptacle covers shall be **While-In-Use** covers of corrosion resistant, aluminum materials of construction, rated wet-location per N.E.C. .

PART 3 EXECUTION

3.01 INSTALLATION

- A. Mount switches at 48" A.F.F. unless otherwise noted. Locate switch on the side of the door opening opposite the hinges and as shown on the drawings.
- B. Mount receptacles at 36" A.F.F. in all areas (unless otherwise noted for higher than 36" A.F.F. mounting elevation on the drawings).
- C. Indoor and outdoor boxes shall be grounded per section 16450 "Grounding".

END

PART 1: GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes surge protection device/s for low-voltage power, control, and communication equipment.

1.03 DEFINITIONS

- A. ATS: Acceptance Testing Specifications.
- B. SVR: Suppressed Voltage Rating.
- C. SPD: Surge protection device/s

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated, include rated capacities, operating weights, operating characteristics, furnished specialties, and accessories.
- B. Product Certificates: For surge protection device/ss, signed by product manufacturer certifying compliance with the following standards:
 - 1. UL 1283 - Electromagnetic.
 - 2. UL 1449 3rd Edition – UL Standard for Surge protection device/ss.
- C. Qualification Data: For testing agency.
- D. Field quality-control test reports, including the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Failed test results and corrective action taken to achieve requirements.
- E. Operation and Maintenance Data: For transient voltage suppression devices to include in emergency, operation, and maintenance manuals.
- F. Warranties: Special warranties specified in this Section.

1.05 QUALITY ASSURANCE

- A. Source Limitations: Obtain all surge protection device/s and accessories through one source from a single manufacturer.
- B. Product Options: Drawings indicate size, dimensional requirements, and electrical performance of surge protection device and are based on the specific system indicated.

- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with IEEE C62.41, "IEEE Guide for Surge Voltages in Low Voltage AC Power Circuits," and test devices according to IEEE C62.45, "IEEE Guide on Surge Testing for Equipment Connected to Low-Voltage (1000 Volts or less) AC Power Circuits."
- E. Comply with NEMA LS 1, "Low Voltage Surge Protection Devices."
- F. Comply with UL 1283, "Electromagnetic Interference Filters," and UL 1449, "Standard for Surge protection device/ss."

1.06 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 1. Notify Engineer and OWNER not less than two days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Engineer's written permission.
- B. Service Conditions: Rate surge protection device/s for continuous operation under the following conditions, unless otherwise indicated:
 1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.
 2. Operating Temperature: 30 to 120 deg F (0 to 50 deg C).
 3. Humidity: 0 to 85 percent, non-condensing.
 4. Altitude: Less than 20,000 feet (6090 m) above sea level.

1.07 COORDINATION

- A. Coordinate location of field-mounted surge protection device/s to allow adequate clearances for maintenance.

1.08 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge protection device/s that fail in materials or workmanship within ten years from date of Substantial Completion.

PART 2: PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. General Electric Company
 2. Surge Suppression, Inc.
 3. Square D/ Schneider Electric
 4. Eaton/Cutler Hammer

2.02 POWER DISTRIBUTION PANELBOARD SURGE PROTECTION DEVICE

- A. Surge protection device with the following features and accessories:
 - 1. Fuses, rated at 200-kA interrupting capacity.
 - 2. Fabrication using bolted compression lugs for internal wiring.
 - 5. Integral disconnect switch.
 - 6. Redundant suppression circuits.
 - 7. Redundant replaceable modules.
 - 8. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
 - 9. LED indicator lights for power and protection status.
 - 10. Audible alarm, with silencing switch, to indicate when protection has failed.
 - 11. One set of dry contacts rated at 5 A and 250Vac, for remote monitoring of protection status. Coordinate with building power monitoring and control system.
 - 12. Surge-event operations counter.
- B. Peak Single-Impulse Surge Current Rating: 120 kA / phase
- C. Connection Means: Permanently wired.
- D. Protection modes and UL 1449 SVR for grounded wye circuits of 480Y/277V, 3-phase, 4-wire (w/ neutral) and ground circuits and 480V, 3-phase, 3-wire and ground circuits shall be as follows:
 - 1. Line to Line: 3000 V
 - 2. Line to Neutral: 1200 V
 - 3. Line to Ground: 1000 V
 - 4. Neutral to Ground: 1000 V
- E. Protection modes and UL 1449 SVR for grounded wye circuits of 208Y/120V, 3-phase, 4-wire (w/ neutral) and ground circuits and 120/240V, 1-phase, 3-wire (w/ neutral) and ground circuits shall be as follows:
 - 1. Line to Neutral: 700V
 - 2. Line to Ground: 600V
 - 3. Neutral to Ground: 600V

2.03 CLASS 1, CLASS 2, CLASS 3 CIRCUITS AND REMOTE CONTROLS & COMMUNICATIONS LOW VOLTAGE CIRCUITS SURGE PROTECTION DEVICE

- A. Surge protection device with the following features and accessories:
 - 1. Fuses, rated for required interrupting capacity.
 - 2. Redundant suppression circuits.
 - 3. Redundant replaceable modules.
 - 4. Arrangement with wire connections to circuit and ground bus.
 - 5. LED indicator lights for power and protection status.
 - 6. Surge-event operations counter.
- B. Peak Single-Impulse Surge Current Rating: 10 kA
- C. Connection Means: Permanently wired.
- D. Protection modes and UL 1449 SVR for Class1, Class 2, Class 3 circuits and remote/controls/communication low voltage rated circuits as follows:

1. Line to Neutral: 500 V
2. Positive to Negative (Ground): 500 V

PART 3: EXECUTION

3.01 INSTALLATION OF SURGE PROTECTION DEVICES

- A. Install 480V rated surge protection device in NEMA 4X SS enclosure at outdoor enclosed circuit breaker/disconnect, mounted on rack as shown on the drawing, dedicated for Tank Outlet Valve Control and Tank Fill Valve Control .
- B. Install appropriately rated surge protection device in control equipment/panel/etc. circuits and schematics for applicable low voltage controls/communications and Class 1, Class 2, Class 3 circuits.

3.02 PLACING SYSTEM INTO SERVICE

- A. Do not energize or connect service entrance equipment, panelboards, control terminals, data terminals to their sources until surge protection device/s are properly installed and connected.

3.03 FIELD QUALITY CONTROL

- A. Remove and replace malfunctioning units and retest.

3.04 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transient voltage surge protection device/s.

END

PART 1: GENERAL

1.01 Scope

- A. Provide electrical grounding system in accordance with the design **DRAWINGS**, these Specifications and compliance per the N.E.C. Included within this section are furnishing and installing all wire/cable, ground electrodes, ground connections, ground wells/test wells, ground plates, etc. and ground testing report associated with the electrical grounding system.

1.02 Related Work

- A. 01300 Submittals
- B. 01730 Operation and Maintenance Manuals
- C. 16100 Electrical--General
- D. 16110 Raceways, Fittings and Supports
- E. 16130 Boxes and Cabinets
- F. 16140 Wiring Devices
- G. 16200 General Wiring
- H. 16205 Wire and Cable Tagging
- I. 16950 Calibration and Testing
- J. Other related work as may be designated, required, and/or called for per the **CONTRACT DRAWINGS**, other related **TECHNICAL / EQUIPMENT SPECIFICATIONS** and/ or as elsewhere defined or designated.

1.03 Standards and References

Grounding system shall be designed, constructed, and tested according to the latest applicable sections of ANSI, ASTM, IEA, IEEE, NEC, NEMA, NFPA, UL, AEIC, IAE, ISA and ISO9001/9003 standards. Requirements listed in the **DRAWINGS** and specifications are considered additional to the standard requirements listed herein.

1.04 Submittals

- A. Submittals shall be made in accordance with the requirements of Section 01300, "Submittals" and Section 16100 "Electrical - General". In addition the following specific information here in shall be complied.
- B. Submittal Data: Submit the following data for ground system, accessories and appurtenances:

1. Manufacturer and model number (s) for all system components furnished and installed.
 2. Submit data for grounding equipment--ground rods; ground wire/cable; procedure, materials and equipment for ground connections--i.e. thermal welds—exothermic, thermite weld by Thermoweld and/or Cadweld (brand names); ground well terminations; ground test well terminations; ground to steel structure connections; etc.
- C. Submittal data shall be sufficient to determine compliance, either meet or exceed these specifications.

OPERATIONS & MAINTENANCE MANUALS (O & M MANUALS) SUBMITTALS

- D. O & M Manuals: Furnish complete documentation and quantity per Section 01730 of the **CONTRACT**. As a minimum, O & M Manuals shall provide the following:
1. All data per SUBMITTALS as designated here-in and all grounding testing data and report/s.

1.05 Delivery, Storage and Handling

- A. Delivery, storage, and handling shall be in accordance with Section 01610, "Delivery, Storage and Handling".
- B. Grounding equipment, materials, supplies, etc. shall be stored off the ground and keep dry at all time, up to time of its installation. Handle with care to prevent damage, loss or compromise of its packing material.

1.6 Warranty

- A. CONTRACTOR shall guarantee and warrant the installed electrical ground system as integral part of the complete electrical system and/or as designed and designated. Provide written electrical ground system warranty as part of the warranty for the complete electrical system.

PART 2: PRODUCTS

2.1 Ground electrode (ground plate) shall be Erico copper plate @ 1/8" thick, 24" x 24" (minimum) with terminated, welded pigtails or approved equal or as designated per the design **DRAWINGS**.

2.2 Ground connection and wire/cable shall be as follows:

- A. Below grade: Cadweld, Burndy Thermoweld, or approved equal thermite reaction welding system ground connection.
- B. Above grade: Burndy Type GAR, GB, GBM or GG connector as required or approved equal. Where applicable and/or as designated, install thermite weld ("Thermoweld, Cadweld, etc.") ground cable connection to all designated equipment and/or metal structural grounding above grade.
- C. Ground wire shall be green color insulation, stranded, copper conductor THW rated for raceways/conduits and bare, stranded, annealed copper wire/conductor for underground

ground grid, ground loop/s, etc. Ground wire shall be sized as designated on the designed **DRAWINGS** compliance per N.E.C., not less than #6 AWG service ground and not less than #2/0 AWG bare copper ground for underground ground grid, ground loop/s, etc.

- D. Ground well/s shall be precast box with accessible cast iron lid. Lid shall read "Ground Well" on top. Brooks precast box, model # 3-RT, not less than 8"x8"x8" deep or approved equal—see applicable ground well detail per the Contract Drawings. Ground well/s located in driveway shall have AASHO H-20 traffic load *rating*.
- E. Ground test well/s shall be precast box with accessible cast iron lid. Lid shall read "Ground Test Well" on top. Brooks precast box, model # 3-RT or approved equal—not less than 8"x8"x8" deep; see applicable ground test well detail per the Contract Drawings. Ground test well/s located in driveway shall have AASHO H-20 traffic load rating.

PART 3: EXECUTION

3.1 Ground Grid

- A. Install the number of ground electrodes, ground wells and ground test wells as shown on the **DRAWINGS**.
- B. Use a thermal fusion process --Burndy Thermoweld, Cadweld, or approved equal to make ground grid connections to ground electrodes and at any joint or connection which will be inaccessible --buried/concealed after installation/construction. Coat connections with Koppers Bitumastic No. 505 or equivalent coal tar pitch extended to 3 inches of conductor or full length of exposed ground conductor coverage to and overlapping conductor's insulation where insulated ground conductor is employed. Do not cover/backfill below grade/concealed connections until each connection has been inspected by the **ENGINEER / OWNER** or electrical construction inspector. Where applicable and/or as designated, ditto this process for above grade ground connections to designated equipment and to metal structural ground connections.
- C. Provide minimum of one ground test well accessible for ground grid testing and connection inspection. Utilize a ground test well with removable cover for accessibility from finished grade—comply as specified here-in.

3.2 General Equipment Grounding

- A. Ground all electrical equipment, lights, receptacles, etc., with a separate equipment ground wire/conductor installed in the conduit with the power conductors. Provide/install ground wire/conductor in all conduit/raceway compliant per N.E.C.
- B. Install grounding system electrically and mechanically continuous throughout. Do not bond to the system neutral except at the service transformer or service main disconnect switch or breaker.
- C. Install a bonding jumper from the grounding lug on each conduit to the ground bar or bus.
- D. Where the equipment has no facility to attach an equipment ground wire, use a Burndy Quicklug or equal. Clean the metal surface under the lug to bright metal so that good contact can be made. Size general equipment ground wire not less than #10 AWG,

stranded copper; major equipment—panelboard, motors, compressors, etc. ground wire size shall comply per N.E.C. for equipment grounding and/or per the design **DRAWINGS**.

- E. Provide a PVC sleeve where bare ground wire passes through concrete slab at or above ground level, where applicable.
- F. Connect ground wires entering outlet boxes in such a manner that removal of the receptacle will not interrupt the continuity of the grounding circuit. A grounding screw attached to the box, and used for no other purpose, may be used to accomplish this.
- G. Install a separate ground rod for lighting poles. Ground rod to be brought up through light pole foundation into base of light pole accessible via pole base handhole. Make lighting pole ground connection to the ground rod inside the pole base (See **DRAWINGS** detail).
- H. Ground system “resistance” shall measure not more than 2.0 ohms power and not more than 1.0 ohm for instrumentation / communications / computer, network system. Ground system shall be calibrated and tested; provide ground system test data and report/s –compliance per Section 16950 “Calibration and Testing”. Ground system test data and report/s shall be included part of project O & M Manual.

PART 4: MEASUREMENT AND PAYMENT

No separate measurement or payment for work performed under this Section. Include the cost of same in the **CONTRACT** price bid for the project of which this is a component part.

END

FIELD INSTRUMENT/S, CONTROL PANEL/ENCLOSURE/S AND ACCESSORIES**PART 1: GENERAL****1.01 Scope of Work**

- A. Furnish field located instruments and controls –device/s, component/s, etc complete with all accessories and appurtenances in field located panel or enclosure specified herein and per design **DRAWINGS** as required for a satisfactorily operating subsystem part of existing EIC (Electrical, Controls and Instrumentation) controls.
- B. Provide and furnish all supervision, labor, materials, tools, transportation, services, etc. required for the complete fabrication, installation and operation of field instruments and controls panel/enclosure.

1.02 Related Specifications

- A. 01300 Submittals
- B. 01610 Delivery, Storage and Handling
- C. 01650 Facility Startup / Commissioning
- D. 01730 Operations and Maintenance (O&M) Manual/s
- E. 16950 Calibrations and Testing
- F. 16000 DIVISION SECTIONS----Electrical Work
- G. 17000 DIVISION SECTIONS----Instrumentation & Controls (I&C) Work, as may be applicable
- H. Other related work as may be designated, required and/or called for on the **CONTRACT DRAWINGS**, other related **TECHNICAL / EQUIPMENT SPECIFICATIONS** and/or as elsewhere defined or designated.

1.03 Applicable Standards/ Specifications

- A. Codes and Permits

All work shall be performed and all materials shall be in accordance with the National Electrical Code and all applicable Federal, State and local codes, regulations, and ordinances.

- B. Specifications

All electrical, instrumentation, and control equipment shall be manufactured and tested in accordance with the latest edition of the applicable standards of the following: ANSI,

ASTM, AWWA, CSA, FM, IEEE, IEC, ISA, NEC, NEMA, NFPA, UL, FCC, ISO9001/9002.

C. Conformance to Agency Requirements

Where materials or equipment is specified to be approved, listed or labeled by the Underwriters' Laboratories, Inc., U.L., and/or labeled, constructed and/ or tested in accordance with the standards of NEMA and ANSI, the Contractor shall submit proof that specifications conform to such requirements. The U.L. label applied to the item will be acceptable as sufficient evidence that the items conform to such requirements.

1.04 Quality Assurance

A. Material Quality

1. The materials and equipment supplied shall be new and of the best quality used in this type work. Where materials, equipment, apparatus, or other products are specified by brand name, manufacturer type, or catalog number, such designation is to establish standards of quality and style and shall be the basis of the bid. The Contractor shall submit any substitutions to the Engineer for consideration. In making such submittal, the Contractor shall bear the responsibility and all costs for any changes in the design necessitated by use of the substitution. All materials shall conform to NEMA or ANSI Standards, or both, where applicable.
2. All materials shall also bear the Underwriters Laboratory, U.L., label where such is available for the particular type product furnished. All materials shall be of domestic (U.S.A.) manufacture. Workmanship shall be of the highest grade throughout and in accordance with the best standard practice.
3. All equipment shall be of the latest and most modern design and shall have the overall accuracy as guaranteed by the manufacturer or specified herein. All like components devices, and instruments shall be furnished by one manufacturer.
4. All instruments shall be factory-tested and calibrated.
5. All electrical panel components shall be manufacturers' current model, with parts availability guarantee for at least eight years.

B. Guarantees and Warranties

1. Guarantee, for a period of one year, the electrical, instrumentation and controls (EIC) work installed to be free from defects of workmanship and material, and furnish and pay for all labor and materials required to fulfill this guarantee. The guarantee period shall begin with the date of the OWNER'S final acceptance.
2. Manufacturer shall guarantee to correct any and all deficiencies at no cost to the OWNER as long as the warranty is in effect. Cost of shipment and installation shall be included in the warranty.

1.05 Submittals

A. General

1. As soon as practical after the official award of the Contract, the Contractor shall submit six (6) copies of manufacturer data sheets/ brochures, shop DRAWINGS, wiring diagrams. Contractor to provide catalog number of unit to be provided if the specified model is listed. If alternative item is used complete data sheets showing ratings, sizes, etc. must be provided.
2. Comply per Section 01300 "Submittals", Section 016100 "Electrical – General" and here-in.

B. Shop DRAWINGS

1. Submit shop DRAWINGS in accordance with the following, as applicable:

Submit shop DRAWINGS detailing the entire FIELD INSTRUMENT & CONTROLS PANEL/ENCLOSURE. Shop DRAWINGS to show point to point wiring, wire labels, terminal block numbers, and device labels. The DRAWINGS shall include the following as a minimum:

- a. Bill of materials
- b. Dimensions
- c. Wiring diagrams
- d. Control schematics
- e. Interior and exterior panel layout

2. Submit the following data:

- a. Manufacturer's product name and complete product/part number.
- b. Functional name.
- c. Description of construction and features.
- d. Performance data and ratings.
- e. Service requirements, e.g., power, water, etc.
- f. Dimensions and weight.
- g. Calibration data and curves for instruments and other items which require factory calibration and field adjustment and setting.

3. Submit the requested data for each item below, as applicable:

- a. Enclosure.
- b. Panel wiring.
- c. Breakers.
- d. Interior light.
- e. Interior heater.
- f. Control relays.
- g. Timing relays.
- h. Pilot lights.
- i. Switches.
- j. Push buttons.
- k. Alternator.
- l. Elapse time meter.
- m. Voltmeter and voltmeter switch / Ammeter and ammeter switch.
- n. Terminal blocks.
- o. Light switches and receptacles.

- p. Motor thermal sensory protection; where applicable motor moisture and temperature sensory protection.
- q. Auxiliary Power Distribution panelboard.
- r. Motor starters.
- s. Circuit Breakers –including Motor Circuit Protector, MCP type.
- t. Three phase power monitor.
- u. Surge Protection.
- v. Grounding.
- w. Branch circuit breaker/s, thermostat and interior panel space heater element.
- x. Instrument/controls panel piping/plumbing, fittings, and related appurtenances, etc.
- y. All other furnished and installed related accessories and appurtenances.

1.06 Manufacturer's Services

Provide the services of factory-trained technical representatives of the various components to assist in start-up. At a minimum, the following services are to be provided:

- A. Inspect the complete installation to assure that it is installed with manufacturer's recommendations.
- B. Make adjustments necessary to place the system in trouble-free operation.
- C. Instruct operating personnel in the proper care and operation of the equipment.
- D. Provide required assistance during startup of the applicable system.

PART 2: PRODUCT

2.01 General

- A. Provide all items specified –where applicable and/or designated per the design **DRAWINGS** and/or required for proper functional operation, provide the items, devices, components, etc for the fabrication and implementation of field instruments and controls panel/enclosure.
- B. Panel wiring arrangement:
 1. Field instruments and controls panel/enclosure shall be completely assembled and wired at the factory in a manner that installation can be accomplished by connecting field wiring to the panel mounted terminal blocks.
 2. Wiring raceway/s shall be bottom (preferred) and/or side entry; refrain or limit top entry---where applicable top raceway entry shall be gasketed, watertight installation. All exterior/field wiring shall terminate on panel enclosure terminal blocks prior to being connected to any panel device. All panel internal wiring shall be completed before shipment. All wiring and terminations shall be clearly/permanently marked and wiring schematics furnished. All panel wiring shall be neatly/orderly bundled, laced together and routed as required.

- C. Instruments/controls devices, etc. mounted on the panel/enclosure back panel; instruments/controls devices, etc. shall be labeled on the front of the device and on the back panel. All panel devices and field wiring shall be wire tagged and labeled –comply per Section 16205 "Wire and Cable Tagging".
- D. Where applicable or designated per the design **DRAWINGS**, controls (i.e. pilot light, switches, breaker/switch handle, starter overload reset, pump run time indicators and/or switches adjustments, level/pressure indicators, gauges, etc.) shall be on the front of the swing-out inner panel .
- E. The controls shall be accessible between 3 and 6 feet above the surface of the floor or finished grade---exception taken where designated per the design **DRAWINGS**. Where applicable, all electrical raceways, entrances, etc. from classified hazardous area(s) to any and all electrical power and/or control enclosure(s) shall be sealed to comply with explosion-type seals and fittings in compliance with NEC.

2.02 FIELD INSTRUMENT & CONTROLS PANEL/ENCLOSURE

FIELD INSTRUMENT & CONTROLS PANEL/ENCLOSURE shall contain all designated controls and instrumentation equipment, wiring, materials, etc. to accomplish the intent of the controls and instrumentation requirements as designated per the design **DRAWINGS** and as specified herein. Layout and arrange power equipment orderly, in a workmanlike manner, best fit to accomplish its functional operation.

A. Terminal Blocks

Terminal blocks shall be 600 volt rated, Rail mounted capable of accepting #22 to #12 wires. Terminal blocks shall be Cutler Hammer/Westinghouse type TBA or approved equal. Comply per Section 16200 "Wires, Conductors, Cables – 600V and Below".

B. Ground Bus

Provide and install dedicated ground bus with multiple splice connectors. Comply per Section 16450 "Grounding".

C. Receptacles

Comply per Section 16140 "Wiring Devices".

2.05 Related Controls and Instrumentation Requirements

- A. Furnish and install instrumentation as designated per the design **DRAWINGS**, as specified herein and/or elsewhere designated. Instrumentation shall provide controls and monitoring requirements; instrumentation shall interface to the existing RTU system for telemetered control and monitoring requirements. Reference "Instrumentation List" for instrument devices and RTU I/O's herein or per the P & I D Drawing of the design **DRAWINGS**.

B. Level Transmitter, LIT-100

Provide and install field mounted level transmitter: LIT-100 (level transmitter shall be rated and calibrated for tank operating level for the Jollyville Reservoir).

. Comply per Section 16903 "Pressure/Level Indicator Transmitter, PIT/LIT". Where designated and/or required, utilize existing field mounted level transmitter---remove, reinstall/remount, and re-calibrate accordingly. Coordinate with OWNER for actual required calibration and loop operation/performance check.

C. Pressure/Level Gage Indicator, LI-100

Provide and install field mounted pressure and/or level gage indicator(s): Level: LI-100 full scale for 0 – 30 PSI (0 - 70 FT); revise pressure/level gage scale reading to designate/reflect the correspond to the working level span of the elevated storage tank--per elevations 949' to 1015' (corresponding 0 – 66 FT span tank operating level for the Jollyville Reservoir).

1. Pressure/level gage indicator shall have 4-1/2 inch diameter dial and scale; scale shall be calibrated for full scale designated units of measure PSI and FT .
2. Gage indicator shall have minimum accuracy of +/- 2% of full scale.
3. Gage indicator case shall be constructed of stainless steel with Bourdon tube element of bronze construction with brass socket and proof pressure seal; process connection, bottom of case, size shall be 1/2 inch MNPT. (Furnish fluid filled gage, silicon oil or better, where applicable for vibration, pulsing, oscillation service.)
4. Furnish gage indicator as manufactured by Ashcroft, Dwyer or ENGINEER/OWNER approved equal.

D. Level Transmitter Instrumentation and Installation

1. Enclosure
 - a. Mount and install level indicator/transmitter, LIT-100, Level Indicator (gage) LI-100 and related, associated accessories and appurtenances in a dedicated panel/enclosure, tagged CP-LIT-100. Enclosure shall be rack mounted with all required tubing and electrical raceways installed in a workmanlike manner per the design **DRAWINGS**.
 - b. Enclosure shall be rated NEMA 4X, 316 stainless steel construction with 2 or 3-point door latch mechanism and single door handle. Enclosure shall have installed a full size back panel for instrument device, equipment and terminal block mounting; back panel shall be white enamel.
 - c. Enclosure door shall be equipped with a heavy duty clear polycarbonate window, flush mounted and sealed for form and maintain water tight/dust tight assembly for NEMA 4X rating.
 - d. Furnish and install panel/enclosure interior automatic freeze protection and process line (valve, etc.) automatic heat trace freeze protection -- tank's tap point to enclosure. 1) Instrument panel/enclosure shall have a 150W (minimum rating), thermostatically controlled space heater and

operated at 120VAC. Wire thermostat/space heater with branch circuit breaker (20A/SP, #12 AWG conductors) and install per use of terminal blocks. Thermostat shall have adjustable dial set-point with lower range set-point adjustable to 30°F (set adjustment to 40°F). 2) The process line--valve/s, fittings, etc shall be completely insulated and sealed using ty-wrap straps with 120VAC, self regulating (thermostat) thermal heat trace wiring under insulation for process line automatic heat trace freeze protection. Wire thermal heat trace wiring on same circuit breaker as panel/enclosure space heater.

- e. Enclosure shall be unit manufactured by Hoffman Concept Enclosure with its accessories; Rittal Enclosure with its accessories; or approved equal.

2. Tubing, Block Valves and Fittings

- a. Instrument device connection shall be per process connection tubing and fittings. Tank or process tap connection shall have 1 inch FNPT, 316 stainless steel, full port ball valve. Reduce fittings to instrument service metal tubing. Metal tubing construction shall be 1/2 inch, 316 stainless steel and all its related appurtenances for instrument installation. Tubing fittings shall be swage ferrule design, 316 stainless steel. [Flare and ball sleeve compression type fittings are NOT APPROVED.]
- b. Instrument block valves (each service to instruments and the drain service in the panel) shall be two way, full port ball valve, '1/2 inch FNPT, 316 stainless steel trim and body with Teflon seats and packing. Process tubing connection shall be bulkhead type entry to the panel/enclosure as well as the drain service tubing existing the panel/enclosure. Instrument block valves shall be as manufactured by Parker CPI, Hoke, or approved equal.

E. 24V DC Loop Powered Potentiometer Valve Position Converter/Transmitter (4 – 20mA Output) Instrument

Furnish converter as designated per the design DRAWINGS. The converter shall buffer the input signal and output a 4-20mA loop signal directly proportional to the input signal.

- 1. Converter/transmitter shall be rated for four-wire, internal 115VAC/24VDC power supply mounted on the same chassis as the function module. Converter/transmitter shall be designed for 3-wire, 0-1,000 ohms and/or 0-5000 ohms potentiometer input; output shall be 4-20mA DC and shall have integral output load trim adjustment.
- 2. Converter/transmitter shall have accuracy +/- 0.1% full span. Converter/transmitter shall be designed for RFI/EMI protection.
- 3. Converter/transmitter shall be constructed for surface mounting. Converter/transmitter shall have compression terminal connections for up to #14 AWG conductor.
- 4. Converter/transmitter shall be AGM Electronics #PTA-4003-2, or approved equal.

2.06 Functional Requirements

A. Functional / Test Procedures

1. FIELD INSTRUMENT & CONTROLS PANEL/ENCLOSURE shall be tested for proper, functional operation of the electrical power, control and instrumentation requirements and intent per the design **DRAWINGS** and specifications herein and elsewhere designated. CONTRACTOR shall submit for review and approval a "FIELD INSTRUMENT & CONTROLS PANEL/ENCLOSURE and/or Station Power and Controls System Pre-Testing/Pre-Startup" – a demonstration procedure and schedule preceding the Facility Startup/Commissioning (Section 01650).
2. Provide for testing each instrument and control circuit, alarm circuit, analog signal measurement, etc. for proper function and interface to the station's existing controls and remote communications RTU I/O, programmed data and information for SCADA system performance. Contractor shall coordinate and schedule with ENGINEER/OWNER accordingly---minimum five (5) working days prior to performing work.
3. Controls and alarms, etc. shall be tested for proper operation by activating the primary control elements (i.e. process parameters and switches, transmitter signal or analog simulation, level controllers, panel control switches, pilot/indicator lights, confirming the proper performance of telemetered information and control, etc.
4. These tests shall be witnessed by City of Austin, Austin Water Utility, Facility Engineering Division. City of Austin may request other applicable and related tests be performed. Reference and comply per Section 16950 "Calibration and Testing".

2.07 Spare Parts

The following is a list of spare parts required for the field instrument/controls panel, as applicable:

- A. Fuses (Box of 10 for each size).
- B. Contact block—one for each 10 of each type and rating: 5 minimum.
- C. 115VAC/24VDC, Valve Position Converter/Transmitter --one for each 10 of each style and rating.
- D. Digital Indicator/ Controller / Transmitter--one for each 10 of each style and rating.

PART 3: EXECUTION

3.01 Factory Test

- A. FIELD INSTRUMENT & CONTROLS PANEL/ENCLOSURE shall be factory tested before delivery to project site for installation.

3.02 Field Testing

- A. FIELD INSTRUMENT & CONTROLS PANEL/ENCLOSURE shall be tested upon installation for proper operation and functionality.
- B. Perform and document calibration, adjustments, final settings, etc. required. Submit such data as part of the system startup and inspection, comply per Section 16950 "Calibration and Testing".

3.03 Shipping, Storage and Handling

- A. FIELD INSTRUMENT & CONTROLS PANEL/ENCLOSURE shall be packaged for shipping and delivery to the job site. Provide provisions for protection from damage and from weather conditions.
- B. Store FIELD INSTRUMENT & CONTROLS PANEL/ENCLOSURE up off the ground and keep dry. Store to ensure protection from damage.

3.04 Startup and Operation Training

- A. Provide for instruction and training of OWNER personnel and/or designated representative(s) during the startup period –a minimum of a dedicated training session of 4 hours. Furnish all recommended and/or required training materials, aids, tools, etc. –comply per Section 01650 "Facility Startup/Commissioning".

END