



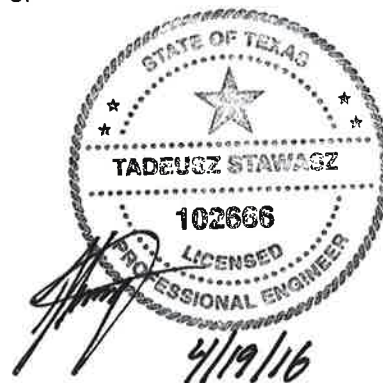
**SAN ANTONIO WATER SYSTEM
WECO DISINFECTION SYSTEM- SAWS
SAWS Job No. 14-6004
Solicitation No. CO-00025**

ADDENDUM NO. 3

April 19, 2016

To: All Document Holders of Record

Addendum No. 3 consists of 26 items outlined in 7 pages. In addition to these pages, Addendum No. 3 includes a revised specification Section 17000 (Revised 04-18-16) which becomes part of the bid documents for a total of 26 pages for Addendum No. 3.



ADDENDUM NO. 1

A. GENERAL CLARIFICATIONS

1. The Contractor will not be allowed to use the existing on-site generator during construction, testing, and system start-up. The Contractor shall provide a generator as needed to run the temporary chlorine feed system during startup of the new disinfection system equipment.
2. The Contractor shall furnish, install and place into service the temporary chlorine gas feed system within eight-four (84) calendar day from Notice to Proceed.
3. Construction of the Booster Pump Station **will** be included in this project.

B. QUESTIONS

4. Question: What needs to be submitted for qualification documentation in order to quote items listed in this solicitation as Bid Item #4 SCADA Programming” Also, items listed under the scope of the PCSS (Process Controls System Supplier) and CSS (Chemical Systems Supplier)?

Response: No qualification documentation is required to be submitted with the bids for Bid Item #4, the PCSS and the CSS. The Contractor shall provide qualified personnel or be responsible to engage the services of sub-contractors that meet the qualifications and experience outlined in the technical specifications.

5. Comment: Depending on the double walled containment system spec'd it will be difficult to install that system inside of a 6" or even larger 3rd containment pipe. We would recommend a 3" or 4" double wall system with a 1" or ¾" carrier hose pulled through this system.

Response: Hose will not be allowed as the carrier pipe on this project.

6. Question: Please provide a specification for the 1" and ¾" Double wall piping system to be used on this project. Section 15061 does not have a spec for double wall containment pipe.

Response: Paragraph 2.04 Secondary Contained Process Pipe and Fitting System has been added to Section 15061 of the contract documents. See Item 13 in Section C. Specifications of this Addendum.

7. Question: Spec 15061 3.01.E calls for expansion joints to be installed in the triple contained pipe system. We need more information and drawings to understand what type of expansion joints will work with a triple wall system?

Response: Paragraph 2.05 PVC Expansion Joints has been added to Section 15061 of the contract documents. See Item 14 in Section C. Specifications of this Addendum.

8. Question: Spec 15256 2.02A calls for pipe 12" and larger to be heat traced and insulated, drawing C-3 calls 2" and less to be heat traced and insulated. Please clarify?

Response: Spec 15256 2.02A calls for pipe smaller than 12" exposed outdoors to be heat traced and insulated. Note on drawing C-3 is being corrected in this Addendum to match the specification for outdoor piping. See Item 23 in Section D. Drawings of this Addendum.

For the triple contained sodium hypochlorite lines from the AST to the Conex Building and from the Conex Building to the Injection Point the Contractor shall insulate and heat trace the 6" pipe only. The double walled pvc pipe installed within the 6" pvc does not receive insulation nor heat tracing.

9. Question: Please confirm that the insulation will be installed on the outer pipe of the triple containment system, currently 6" pipe.

Response: Yes, the insulation for the sodium hypochlorite lines from the AST to the Conex Building and from the Conex Building to the Injection Point shall be installed on the 6" pvc pipe.

10. Question: Spec 15061 2.02.C calls for Hastelloy C-276 nuts and bolts for flanged connections. Section 3.02.C calls for 316 SS nuts and bolts. Please clarify which are to be used.

Response: Nuts and bolts shall be Hastelloy C-276. Spec 15061, Paragraph 3.02.C is being corrected to require Hastelloy nuts and bolts. See Item 15 in Section C. Specifications of this Addendum

11. Question: Drawing C-3 Note 7- As discussed in the pre-bid, please confirm that the PW booster pump system will be required?

Response: Confirmed, the PW booster pump system will be required for the project. The Special Conditions are being corrected to modify SC8 from the contract documents. See Item 16 in Section C. Specifications of this Addendum. Note 7 on Drawing C-3 is being removed from the contract documents. See Item 24 in Section D. Drawings of this Addendum

12. Question: The specifications mention modifying and improving the HMI system, please provide details of the existing HMI system, i.e. hardware and software manufacturer.

Response: The Contractor shall provide a new PLC Panel. Drawing I04 is being modified to reflect this change. See Item 25 in Section D. Drawings of this Addendum.

C. SPECIFICATIONS

13. In Specification Section 15061, Page 15061-3 insert the following after Paragraph 2.03:

2.04 SECONDARY CONTAINED PROCESS PIPE AND FITTING SYSTEM

- A. PVC primary and secondary pipe and fittings for the double containment process piping systems installed below grade shall be Schedule 80 joined by the solvent cement joining method. Pipe and fittings shall be manufactured of polyvinyl chloride (PVC). Material shall safely convey flow streams up to 140° F (60° C) at a pressure rating of 150 PSI.
- B. Any custom fittings which may need to be fabricated due to field conditions or requirements of horizontal and/or vertical dimensioning shall conform to the standards of this specification.
- C. Secondary Contained Process Pipe shall be manufactured by the following:
 - 1. Spears Manufacturing Company
 - 2. GV Piping Systems
 - 3. Approved Equal

14. In Specification Section 15061 add the following paragraph:

2.05 PVC EXPANSION JOINTS

- A. Expansion joints shall consist of two (2) telescoping PVC tubes conforming to ASTM D1784 with triple (3) EPDM O-ring seals including a center pressure seal and outer debris seals.
- B. Expansion joints ends shall be of a socket weld design conforming to ASTM D2467.
- C. Expansion Joints shall be designed to meet the pressures and temperatures for the system and be capable of 6 inch axial movement.
- D. PVC Expansion Joints shall be manufactured by the following
 - 1. Flexicraft
 - 2. Approved Equal

15. In Specification Section 15061, Page 15061-5, Paragraph 3.02.C remove the first sentence "Flanged joints shall be made with gaskets suitable for chemical within the pipeline and Type 316 stainless steel bolts and nuts." and replace with: "Flanged joints shall be made with gaskets suitable for chemical within the pipeline and Hastelloy C-267 bolts and nuts."
16. In the Special Conditions, Page SC-2, Special Condition SC8, remove paragraph and replace with: The booster pump station will be required for this project.
17. In Specification Section 01010, Page 01010-1, Remove Paragraph 1.01.C. and replace with the following: "The Contractor shall furnish, install and place into service the temporary gas feed system within eighty four (84) calendar days from Notice to Proceed on the project."
18. In Specification Section 01150, Page 01150-5, Paragraph 1.10.B.1. remove "Section 11600" and replace with "Section 11610."
19. In Specification Section 11610, Page 11610-1, Remove Paragraph 1.01.B. and replace with the following: "The Contractor shall furnish, install and place into service the temporary gas feed system within eighty-four (84) calendar days from Notice to Proceed on the project."
20. In Specification Section 11610, Page 11610-6, Paragraph 2.14.B.1 remove the following sentence: "The building shall be attached to a concrete slab floor with stainless steel concrete anchors through a base flange on all wall sections. All anchors shall be provided by the building manufacturer."
21. In Specification Section 11610, Page 11610-7, Paragraph 2.15.A remove the following sentences: "The FRP building shall be installed on a FRP skid designed to fully support the building and all equipment. The skid and floor must be constructed of FRP. " and replace with the following sentences: "The FRP building shall be installed on a treated timber skid designed to fully support the building and all equipment. The floor of the building shall be constructed of FRP. The FRP building shall be fastened securely to the skid with stainless steel anchors."
22. Section 17000 Instrumentation General Provisions
 - a. Remove Section 17000 Instrumentation General Provisions and replace with the attached Section 17000 Instrumentation General Provision Revised 04-18-16.

D. DRAWINGS

23. Drawing C-3
 - a. Change Note 1 on drawing C-3 to read "Contractor shall provide insulation and heat tracing on all exposed outdoor piping, valve, and gauges that are 12" diameter and smaller".

24. Drawing C-3

a. Remove Note 7 and replace with Note 7: The Contractor shall furnish and install the Booster Pump Station as part of this project.

25. Drawing I04

a. Delete note 2, and replace with: "PROVIDE NEW PLC PANEL AND REPLACE EXISTING PANEL. REUSE EXISTING PLC POWER, CPU, I/O MODULES. REPLACE WITH LARGER PLC BACK PLANE AND PROVIDE REQUIRED NEW IO MODULES PER INSTRUMENTATION IO LIST SPECIFICATION 17910. MODIFY PLC PROGRAM TO PROVIDE FUNCTIONS DEFINED IN CONTROL NARRATIVE SPECIFICATION 17920. REUSE RADIO, ETHERNET SWITCH. PROVIDE NEW PANEL CIRCUIT BREAKERS, 24VDC POWER SUPPLY, TERMINALS, WIRES, PANDUITS AND OTHER REQUIRED PLC PANEL COMPONENTS. PANEL SHALL BE DESIGNED AND BUILT PER SPECIFICATION 17400."

b. On the "SYSTEM ARCHITECTURE" drawing underneath "SAWS SCADA PLC" on drawing, delete "(EXISTING)", and replace with: "(NEW)".

26. Drawing M-3

a. 1 1/2" pvc water supply to the booster pump station (identified as Notes by Symbol No. 9). The connection to the 24" PW line for the 1 1/2" pvc water supply line shall be moved to the south from where it is shown on Drawing M-3 to a location 2'-0" inside the property line.

This addendum, applicable to work referenced above, forms a part of the Contract Documents and modifies the original Contract Documents dated March 2016. Acknowledge receipt of this addendum by entering the addendum number and issue date in the spaces provided on submitted copies of the proposals.

ACKNOWLEDGEMENT BY RESPONDENT

The Undersigned acknowledges receipt of this Addendum No. 3 and the proposal submitted herewith is in accordance with the information and stipulation set forth.

Date

Signature of Respondent

END OF ADDENDUM

SECTION 17000

INSTRUMENTATION GENERAL PROVISIONS

REVISED 04-18-16

PART 1 GENERAL

1.01 SCOPE

- A. The requirements outlined in this section address general hardware, software, and services necessary to provide the control functions specified. More detailed requirements of specific functions and components are presented in other Division 17 sections that follow.

1.02 DEFINITIONS

- A. The definitions of terminology used in the Division 17 specifications or in any Section referencing Division 17, shall be as defined in ISA Standard S51.1 unless otherwise specified. Where terms used are not defined in ISA 51.1 or in these specifications, ANSI/IEEE Standard 100-1984, ANSI/ISA S50.1 or other ISA standards shall apply.
- B. Signal Circuit: Any circuit operating at less than 80 volts AC or DC.
- C. Control Circuit: Any circuit operating at 24 volts AC or DC or more, whose principal purpose is the conveyance of information and not the conveyance of energy for the operation of an electrically powered device.
- D. Power Circuit: Any circuit operating at 12 volts (AC or DC) or more, whose principal purpose is the conveyance of energy for the operation of an electrically powered device.
- E. Two-Wire Transmitter: A transmitter which derives its operating power supply from the signal transmission circuit and therefore requires no separate power supply connections. As used in this specification, two-wire transmitter refers to a transmitter which provides a 4 to 20 milliampere current regulation of signal in a series circuit with an external 24 volt direct current driving potential and a maximum external circuit resistance of 600 ohms.
- F. Electrical Isolation: Pertaining to an electrical node having no direct current path to another electrical node. As used in this specification, electrical isolation refers to a device with electrical inputs and/or outputs which are galvanically isolated from ground, the device case, the process fluid, and any separate power supply terminals, but such inputs and/or outputs are capable of being externally grounded without affecting the characteristics of the device or providing a path for circulation of ground currents. The terms "galvanic isolation," "electrical isolation", "isolation", or similar terms shall mean electrical isolation whenever used in Division 17, or whenever used in specifications for electrical control and instrumentation equipment in any other Divisions of these contract documents. Unless otherwise specified, electrical isolation for analog signal devices shall be rated 250 volts AC continuous; and 1500 volts AC for one minute, in accordance with ANSI/IEEE C39.5-1974.
- G. Panel: An instrument support system which may be a flat surface, a partial enclosure, or a complete enclosure for instruments and other devices used in process control

systems. Unless otherwise specified or clearly indicated by the context, the term "panel" in these contract documents shall be interpreted as a general term which includes flat panels, enclosures, cabinets and consoles.

- H. Data Sheets: Data sheets as used in this specification shall comply with the requirements of ISA S20.
- I. Field: When used to refer to locations at the treatment facility or in the transmission system, shall mean all outdoor locations, as well as all process and equipment areas. Unless otherwise specified, all areas shall be considered "field" locations except for: administration and other office areas; control rooms; motor control centers and other electrical equipment rooms; dedicated HVAC rooms; and maintenance buildings.
- J. Control Room: An environmentally controlled room intended for housing digital control equipment, computers, large control panels, etc., and generally intended to be regularly occupied by operators.
- K. Division 17 Work: Whenever the terms "Division 17 work", "specified under Division 17" or "provided under Division 17" are used, they shall be interpreted as referring to all materials, labor, products, services, systems, etc., specified in Sections 17000 through 17999, inclusive, unless equipment shown or specified is clearly labeled as being provided under other parts of the contract.
- L. UPS: Uninterruptible Power Supply.
- M. HMI: Human-Machine-Interface. The control system hardware and software associated with providing the Monitor-based interface between system users and the control system.
- N. PLC: Programmable Logic Controller. Field installed unit which monitors and controls devices, located within the plant. The PLCs contain all logic necessary to monitor and control the system process located at the PLC location.
- O. SCADA: Supervisory Control and Data Acquisition.
- P. RTU: Remote Terminal Unit. Field installed unit which monitors and controls devices, located away from the plant at remote locations. The RTUs contain all logic necessary to monitor and control the system process located at the remote location.
- Q. DCS: Distributed Control System.

1.03 REFERENCE STANDARDS

- A. This subsection references the latest revisions of the following standards. They are a part of Division 17 as specified and modified. In case of conflict between the requirements of this section and those of the listed standards, the requirements of this section shall prevail.

<i>Standard</i>	<i>Title</i>
ANSI/NEMA ICS 6	Enclosures for Industrial Control and Systems

API RP550	Manual on Installation of Refinery Instruments and Control Systems Part I – Process Instrumentation and Control
ISA S5.4	Instrument Loop Diagrams
ISA S20	Specification Forms for Process Measurement and Control Instrumentation, Primary Elements, and Control Valves
ISA S50.1	Compatibility of Analog Signals for Electronic Industrial Process Instruments
ISA S51.1	Process Instrumentation Terminology

1.04 WARRANTIES, MAINTENANCE, AND SUPPORT SERVICES

- A. Warranty
- B. The manufacturer shall provide an all-inclusive two (2)-year warranty for the equipment from the date of final acceptance by the Owner.
- C. Preventive Maintenance
- D. The **Process Control System Supplier (PCSS)** shall provide the services of factory-trained service technicians, for the period from Notice To Proceed to Final Acceptance, for the purpose of performing preventive maintenance. All equipment shall be systematically inspected, cleaned, aligned, adjusted, lubricated, calibrated and otherwise serviced as required to assure proper performance. Equipment manufacturer service recommendations shall be followed where applicable. The preventive maintenance service interval (time-between-service activities) for each piece of equipment shall be that recommended by the equipment manufacturer in accordance with industry practice or six months, whichever is less. The cost to provide preventive maintenance during this period including parts, labor, travel, and subsistence, shall be included in the contract price. Prior to start of in-service use of each part of the Control System, The PCSS shall provide to the OWNER a schedule for this maintenance service. All preventive maintenance activities shall be documented with service reports which shall identify the equipment being serviced, state the condition of the equipment, describe all work performed, and list materials used. The report shall also include the name of the technician performing the work and his signature, and a new certified calibration. A copy of all service reports shall be delivered to the OWNER on the day the work is performed.
- E. All preventive maintenance procedures shall be planned and accomplished in such a manner as to minimize disruption of water distribution system operation. No preventive maintenance procedure shall be allowed to jeopardize the OWNER's ability to monitor and control system operation.
- F. At the OWNER's option, OWNER's maintenance personnel may participate in any preventive maintenance procedures.
- G. Corrective Maintenance

- H. The PCSS shall provide the services of factory-trained service technicians for the purpose of performing corrective maintenance on all system hardware and software. The period of coverage for each piece of equipment shall begin upon initial equipment purchase or manufacture and shall continue for two years after final acceptance or until expiration of the manufacturer's warranty, whichever period is longer.
- I. The PCSS shall provide a 24-hour, 7-day/week service hotline for telephone notification of system malfunctions. Within 2 hours from notification by the OWNER of defective Control System operation, the PCSS shall have a qualified service representative establish telephone contact with the OWNER's maintenance personnel to discuss short-term corrective measures. If it is not possible to correct the defective operation as a result of the telephone contact, the PCSS shall have a qualified service representative at the location of the installed Control System within 24 hours from initial notification. The service representative shall perform all necessary inspections and diagnostic tests to determine the source of the defect and to establish a corrective action plan. The corrective action plan shall be developed such that the defect is corrected as quickly as possible and with the least impact on the operation of the OWNER's facilities. Prior to beginning any repair or replacement procedure, the PCSS shall review the corrective action plan with the OWNER in order to inform him of the planned course of action and to allow assessment of any impact that course of action might have on the operation of the OWNER's facilities. At OWNER's option, OWNER maintenance personnel may participate in any corrective maintenance procedures.
- J. If possible, the service representative shall effect replacement or repair of the defective component before leaving the site using replacement parts from the spare parts inventory delivered with the system. Otherwise, the corrective action plan shall include a detailed schedule for the planned course of action. Once the defect has been corrected, the corrective action plan shall be updated indicating the source of the defect and specific corrective action taken. A copy of the updated corrective action plan shall be delivered to the OWNER on the day the work is performed. Any spares from the onsite supply of spares used by the PCSS in correcting the system malfunction shall be replaced within 15 days.
- K. If 24-hour response time is not provided, or other corrective maintenance requirements are not met by the PCSS, the OWNER shall have the right to obtain corrective maintenance from other sources and charge the PCSS reasonable costs of the alternative maintenance services, including parts, labor, travel, and subsistence.
- L. The OWNER, at the OWNER's option, may elect to employ its own maintenance staff to locate and remove a defective component. In this case the OWNER will return the defective component to a repair location as instructed by the PCSS. The PCSS shall repair or replace the defective component and return the properly working unit to the OWNER within 15 days.

1.05 PCSS'S QUALIFICATIONS

- A. The PCSS shall perform all work necessary to select, furnish, configure, customize, debug, install, connect, calibrate, and place into operation all hardware and software specified within this section.
- B. The PCSS shall be a "systems house," regularly engaged in the design and the installation of computer systems and their associated subsystems as they are applied to the municipal water or wastewater industry. For the purposes of this specification

section, a "systems house" shall be interpreted to mean an organization that complies with all of the following criteria:

- C. Employs a registered professional Control Systems Engineer or Electrical Engineer to supervise or perform the work required by this specification section.
- D. Employs personnel on this project who have successfully completed a manufacturer's training course on the configuration and implementation of the specific programmable controllers, computers and software proposed for this project.
- E. Has performed work of similar or greater complexity on at least three (3) projects within the last five (5) years and has implemented and completed at least one of these three projects with the proposed HMI software.
- F. Has been in the water/wastewater industry performing the type of work specified in this specification section for the past five (5) continuous years.
- G. The PCSS shall maintain a fully equipped office/production facility with full-time employees capable of fabricating, configuring, installing, calibrating, troubleshooting, and testing the system specified herein. Qualified repair personnel shall be available and capable of reaching the facility within 24 hours.
- H. Actual installation of the system need not be performed by the PCSS's employees; however, the PCSS shall provide the on-site technical supervision of the installation.
- I. The recommended Process Control System Supplier (PCSS) shall be one of the following:
 - 1. Prime Controls
1725 Lakepointe Dr. Lewisville, Tx 75057
 - 2. Schneider Electric
Business Development, Water Wastewater Competency Center
 - 3. Control Panels USA
16310 Bratton Lane, Ste100, Austin, Texas 78728
 - 4. Hierholzer Engineering, Inc
P.O. Box 300 Seguin, Texas 78156
 - 5. No approved equals
- J. The PCSS shall furnish equipment which is the product of one manufacturer to the maximum practical extent. Where this is not practical, all equipment of a given type shall be the product of one manufacturer.
- K. The PCSS is responsible for providing all applications programming and configuration services to the OWNER's existing SCADA, PLC, and HMI systems to accomplish the control and monitoring functions as described in the Contract Documents. The PCSS shall provide all programming functions including, but not limited to, control strategies and communications for the field locations PLCs controllers and HMI. The PCSS will obtain from the OWNER copies of all existing PLCs configurations. The PCSS shall also provide all applications programming and configuration services necessary to produce the HMI (graphic displays, reports, trends, historical archive, etc.) as described in the contract specifications and drawings.

1.06 SUBMITTALS

- A. General
- B. Submittals shall be made in accordance with the requirements of this section, the requirements of Division 1, and the requirements of individual Division 17 Sections. The PCSS shall submit to the OWNER technical data and drawings for all equipment, materials, software, assemblies, and installations prior to fabrication and installation. All submittals shall be made in accordance with the submittal procedures and requirements in Division 1 - Project Submittals and Review. The PCSS shall be responsible for the accuracy and completeness of all submittals, including information and drawings provided by other suppliers or subPCSSs providing equipment, materials, software or services to the PCSS.
- C. In all instances in which submittals are required by the Specifications, the PCSS shall not proceed with the associated work until the submittal has been successfully reviewed.
- D. Each submittal shall be complete, with all required information provided together at one time, and submitted in a sequence that allows the OWNER to have all of the information necessary for checking and approving a particular document at the time of the submittal. The specified timing requirements for each submittal are minimum requirements. The PCSS Supplier shall be responsible for planning and making all submittals as necessary to avoid delays or conflicts in the work.
- E. See Division 1 for requirements on quantities of documents to be submitted for review. Once documents have been successfully reviewed, the PCSS shall issue them in the quantities shown in the table labeled "Documentation Requirements".
- F. Submittal Categories: Project submittals are divided into the following general categories:
- G. Design Submittals
- H. **Application Services Submittals**
- I. System Documentation Submittals
- J. Software Manual Submittals
- K. Record document Submittals
- L. Testing Document Submittals
- M. Testing Submittals
- N. Training Submittals
- O. The following paragraphs define the specific contents of each of these submittal categories. The requirements outlined for each of these submittals shall apply to all equipment and services specified in all sections of Division 17. Additional submittal requirements may be found in specific sections of Division 17.
- P. Design Submittals

Q. Hardware Submittal

1. Product information shall include, but not be limited to: catalog cuts, data sheets, performance surveys, test reports, equipment lists, material list, diagrams, pictures, and descriptive material. The product information shall cover all items including mechanical devices, mounting components, wiring, terminal strips, connectors, accessories, and spare parts. The submittal information shall show the standard and optional product features, as well as all performance data and specifications.
2. Prior to commencement of manufacture (or shipment for stock items), the PCSS shall submit for review product information for all equipment and material specified in Division 17, or required to support equipment, or systems specified in Division 17. Specific requirements for the form and content of product information submittals are included in the individual section that defines the equipment requirements.

R. Connection Diagrams

1. Connection diagrams shall show the placement, labeling and wiring of components within panels, cabinets and consoles. Components shall be shown arranged in the physical layout (not necessarily to scale) as it would appear to a person servicing the equipment. Connection diagrams shall include all internal wiring of the panel; this shall include AC and DC power wiring and multi-conductor cables from PLC card to rewired termination blocks. Wires shall be shown as a continuous line between their termination points. Each wire label designation shall be shown. The wire label designations on each end of a single wire must be identical. All wire termination point numbers shall be shown. Each wire color shall be shown. Signal and DC circuit polarities shall be shown. All jumpers, shielding and grounding details shall be shown.
2. The PCSS shall submit connection diagrams for all new panels, cabinets and consoles. Connection diagrams shall be Successfully Reviewed prior to the start of panel assembly.
3. The PCSS shall furnish drawings in paper and MicroStation V8 XM electronic format.

S. Panel Fabrication and Layout Drawings

1. Panel fabrication drawings are scaled drawings that shall show the physical dimensions, materials, and construction of panels, cabinets, terminal boards, consoles, or other electrical or mechanical equipment enclosures. These drawings show the physical arrangement and mounting of all components in or on a panel, terminal board, cabinet, console, or enclosure. These drawings show the physical dimensions, and the space and mounting requirements of mechanical, electrical, control and instrumentation devices or pieces of equipment. Other information provided may include ventilation requirements, locations of connections, weight, and paint color, material and dry film thickness.
2. As a minimum, panel fabrication and layout drawings shall include a bill of materials; front, back, and section views; the locations of all components to be mounted in or on the panel, cabinet, console, enclosure or assembly; drawing scale; nameplate engraving schedule; and structural materials and supports. All drawings shall be scaled. Overall dimensions and minimum clearances shall be shown. Sufficient detail shall be included to demonstrate material choices, outward appearance, construction methods, and seismic force resistance.
3. Complete shop drawings shall be prepared and submitted for all panels, cabinets, and consoles which are custom fabricated or modified for this project. The OWNER shall have the right to make modifications to the interior and exterior layouts of panels as part of the shop drawing review. No additional compensation will be

provided to the PCSS for changes that result. The PCSS shall include in his bid price one redesign of the panel layout to incorporate the OWNER's modifications to the locations of specified components in or on each panel, cabinet, console, or enclosure.

4. The PCSS shall furnish drawings in paper and Microstation V8 XM electronic format. The Drawings must match the format of the example supplied as an attachment at the end of this document. This is to ensure all new panels match existing panel drawings.
 5. Each panel shall have its own complete set of drawings. The set of drawing shall include drawing cover sheet and sheet index. Provide panel bill of material table on panel layout sheet. The bill of material shall include product manufacturer and model number.
- T. Interface Cables: The PCSS shall submit for review interface cable pin-out/cable makeup diagrams. This includes all network cables, radio to PLC/RTU cables, computer to PLC cables and printer cables. Submittal shall include copies of the actual hardware documentation. All cables shall either be standard cables from the manufacturer or custom-made, without the use of gender changers, 9-25 pin converters, null modem adapters, etc.
- U. Interconnection Diagrams: Interconnection diagrams shall include typical wiring diagrams for each type of product. Wires shall be shown as a continuous line between their termination points. Each wire label designation shall be shown. The wire label designations on each end of a single wire must be identical. All wire termination point numbers shall be shown. Each wire color shall be shown. Signal and DC circuit polarities shall be shown. All jumpers, shielding and grounding details shall be shown.
- V. Installation Drawings: Installation drawings shall show installation arrangements for all provided equipment, mounting and anchoring details, conduit entries into cabinets, and Control System electrical power supply distribution conduit and wiring. Data sheets and/or catalog cuts for mounting devices, anchors, wire and other incidental installation materials shall be included.
- W. System Documentation Submittals
- X. Application Services Submittals
- Y. Pre-submittal Conference
1. Prior to the Submittal Process, the PCSS shall hold workshops, in which the ENGINEER and OWNER may observe the displays and control strategies prior to submitting database, trends, graphics, reports, and control strategies. No display generation, programming, etc. shall begin until standards have been accepted/approved.
 2. Prior to commencement of any applications work, the PCSS shall submit and receive approval/acceptance from the OWNER and ENGINEER for all required I/O Lists.
- Z. Submittal Process
1. Submittals shall be made in accordance with the requirements of Division 1 and as specified herein.
 2. All electronic submittals shall be submitted in an ISO/IEC 26300:2006 or Comma Separated Values (CSV) readable electronic file format on a CD-Rom and an 8 ½-

inch by 11-inch hard copy. Programs shall be submitted in the native format of the PLC as suggested by the manufacture.

AA. Submittal Content

1. Submittals shall contain the following:
 - a. MODICON M340 Controller Programming
 - (i) I/O List with register assignments.
 - (ii) Diagrams of the process control functions by each strategy.
 - (iii) Listing of inputs to the control function.
 - (iv) A short narrative of each control strategy.
 - (v) Listing of all Operator inputs and outputs to and from the control function. Any special displays related to the function shall be illustrated. A description of the operation of any display shall be described as it relates to the control function.
 - (vi) Cross references of all I/O, showing to which I/O modules or software modules, they are in.
 - (vii) Failure contingencies shall be described in detail.
 - (viii) An annotated program, submitted in both hard copy and electronic format.
 - b. Human Machine Interface Programming
 - (i) I/O List with register assignments.
 - (ii) Displays for each process area including all necessary pop ups.
 - (iii) Listing of data points on each display.
 - (iv) A short narrative of each control usage.
 - (v) Listing of all Operator inputs and outputs to and from the control function. Any special displays related to the function shall be illustrated. A description of the operation of any display shall be described as it relates to the control function.
 - (vi) Cross references of all I/O, showing which software module at each point used.
 - (vii) Failure contingencies shall be described in detail.
 - (viii) A complete listing of all historical points.
 - (ix) Listing of all required configuration files for each SCADA client.
2. Submit a proposed Schedule of Work.”

BB. Operation and Maintenance (O&M) Manuals: The PCSS shall supply O&M manuals for all the equipment and software provided. The O&M manuals shall be developed for personnel at the level of electronic technician. The O&M manuals shall describe the detailed preventive and restorative procedures required to keep the equipment in good operating condition. An O&M manual or a set of manuals shall be furnished for all deliverable hardware, including OEM equipment. O&M manuals for OEM equipment shall contain original printed materials, not copies, and may be provided in the manufacturer’s original format. Manuals shall be provided in electronic format. The O&M manuals shall contain the following information:

CC. Instruction Manual

1. The manual shall be written in English and illustrated in detail to the component level, including assemblies, subassemblies, and components. It shall contain a detailed analysis of each major component so that maintenance personnel can effectively service, inspect, maintain, adjust, troubleshoot, and repair the equipment.
2. Each manual shall include a Table of Contents, arranged in systematic order, and shall be divided into the following sections:

- a. Introduction: The purpose of the manual, special tools and equipment, and safety precautions.
 - b. General Information and Specifications: A general description of the equipment item, and specifications of its major components.
 - c. Listings: Supplier's name, address, and telephone number. Each product shall include name, address, and telephone number of subPCSS, or installer, recommended maintenance PCSS, local source for replacement parts.
 - d. Theory of Operation: The relationship of assemblies, subassemblies, components and interchangeability of components, and explanation and analysis of their functions to the smallest board replaceable components.
 - e. Software: Listing and explanatory text for any software or firmware.
 - f. Operation Procedures: The locations and functional descriptions of all controller indicators, or CRT displays.
 - g. Troubleshooting: A list in tabular format of all symptoms, probable causes of malfunction or improper operation, and probable remedies to the smallest board replaceable components.
- DD. Preventive Maintenance Instructions: These instructions shall include all applicable visual examinations, hardware testing, and diagnostic hardware/software routines. Instructions on how to load and use any test and diagnostic programs and any special or standard test equipment shall be an integral part of these procedures.
- EE. Corrective Maintenance Instructions
1. These instructions shall include guides for locating malfunctions down to the card-replacement level. These guides shall include adequate details for quickly and efficiently locating the cause of an equipment malfunction and shall state the probable source(s) of trouble, the symptoms, probable cause, and instructions for remedying the malfunction. These guides shall explain how to use on-line test and diagnostic programs for all devices and any special test equipment, if applicable.
 2. The corrective maintenance instructions shall include:
 - a. Explanations for the repair, adjustment, or replacement of all items, including printed circuit cards. Schematic diagrams of electrical, mechanical, and parts location, illustrations, photographs, and sectional views giving details of mechanical assemblies shall be provided as necessary to repair or replace equipment. Typical signal waveforms, logic levels, bit patterns, etc., shall be included. For mechanical items requiring field repair, information on tolerances, clearances, wear limits, and maximum bolt-down torques shall be supplied. Information on the loading and use of special off-line diagnostic programs, tools, and test equipment as well as any cautions or warnings which must be observed to protect personnel and equipment shall be included.
 - b. A list of test equipment and special tools required.
 - c. A list of all abbreviations and circuit symbols used.
 - d. Warranties, bonds and maintenance records, including proper procedures in the event of failures and instances which might affect the validity of warranties, bonds, or contracts.
 - e. A parts catalog enumerating every part to the lowest of card replaceable components. The description shall include component symbol, description, ratings, accuracy, manufacturer's name and address, manufacturer's part number, commercial equivalents, and quantity per assembly or subassembly. The parts catalog shall identify the appropriate locations of the parts and shall group each component by assemblies or subassemblies within each

subsystem so that each component can be identified as being part of the next larger assembly.

- f. A list of recommended spare parts that includes all parts necessary to maintain and repair control system components. The list shall identify the specific part or model number, description, manufacturer's name and address, commercial equivalents, unit price, lead time for delivery, and recommended quantity. The spare parts list shall indicate which components (by model and serial number) have been provided with the delivered system as part of the spares inventory.

FF. Drawings

1. O&M Manual drawings (with the exception of those provided by third-party manufacturers) shall not be larger than 11-inches by 17-inches and shall be clearly legible when reproduced using conventional office copying machines. Originals shall be provided for all third-party O&M Manual materials. One reproducible of the O&M Manual drawing original must be supplied for each O&M Manual drawing larger than 11 inches by 17 inches, and must satisfy all drawing requirements specified herein. Those preprinted O&M Manual drawings which are not acceptable, or which must be modified or corrected to show the actual as-built design, shall be redrawn as new specially-prepared shop drawings. Acceptable equipment manufacturer's drawings incorporated into equipment operating and maintenance manuals need not be duplicated or removed from the manuals.
2. The PCSS shall furnish drawings in paper and Microstation V8 XM electronic format. The Drawings must match the format of the example supplied as an attachment at the end of this document. This is to ensure all new panels match existing panel drawings.
3. Each O&M Manual shall be bound in 8 1/2" x 11 inch 3-ring side binders with commercial quality hardback, cleanable plastic covers. Maximum of 3" binder size.
4. Binder covers shall contain the printed title "Operation and Maintenance Instructions", "San Antonio Water System" "Stein-Rogers Well Field Disinfection System Replacement".
5. The manuals shall be internally subdivided with permanent page dividers with tab titling clearly printed under reinforced laminated plastic tabs.
6. Each volume shall have a Table of Contents, with each product or system description identified.

GG. Instrument calibration sheets: The certified calibration sheets shall be included in the O&M submittal.

HH. Software Manuals: The PCSS shall supply Original OEM O&M Manuals in lieu of developing specific O&M Manuals. Only that equipment which lacks proper O&M Manuals would the PCSS be responsible for supplementing the product literature.

II. Record Documents

JJ. After successful Site Demonstration Test, the PCSS shall submit for review the Record Documents (as-built) for all equipment and software installed by the PCSS. All documents which have changed because of the engineering changes, contract changes, or error or omission shall be updated and the revised documentation provided.

KK. The PCSS shall furnish complete as-built sets of:

1. Source tapes, disk pack(s) or other storage media for all custom programs
2. Loadable and executable object disk pack(s) of the software systems

3. All previously delivered documents, with as-built updates
4. OEM standard documentation.

- LL. These media shall include the operating systems, all programs necessary for the operation as well as maintenance of the System, and all programs supplied by the CPU/Microprocessor manufacturers, such as assembler, loaders, editors, compilers and diagnostics.
- MM. The documentation as outlined in this portion of the document, in conjunction with other documentation specified elsewhere in this document, shall be sufficient to allow the OWNER to reconfigure or make additions or deletions to the System without assistance from the PCSS.
- NN. Testing Documentation Submittals
- OO. System test plan requirements are included in Section 17000, Part 3.
- PP. Test procedures requirements are included in Section 17000, Part 3.
- QQ. Test reports requirements are included in Section 17000, Part 3.

PART 2 PRODUCTS

2.01 INFORMATION ON DRAWINGS

- A. The following information is indicated on the drawings:
- B. Loop diagram on flow sheet for each control loop. Diagrams are schematic in nature and intended only as a guide to work to be performed.
- C. Approximate location of primary elements, instrument panels and final control elements.
- D. Approximate location of instrumentation power junction boxes for instrument electrical power connection.
- E. Location of electrical distribution panel boards for instrument electrical power.
- F. Location of equipment having alarms and equipment status contacts.
- G. Location of equipment being controlled by system.
- H. General layout of instrument cabinets.
- I. Instrument installation details.
- J. The following information is not shown on drawings but shall be the responsibility of the PCSS to determine, furnish and coordinate with other divisions, based upon systems specified. Show this information on project record drawings.
- K. Instrument loop drawings per ISA S5.4 minimum, desired and optional items.
- L. Location of electrical distribution panel boards supplying power to any device supplied under this contract.

- M. Detailed enclosure and instrument panel layouts, fabrication details and wiring diagrams.
- N. Detailed system configuration.
- O. Raceway and cable routing for instrumentation wiring.

2.02 OPERATING CONDITIONS

- A. Ambient Conditions: Provide equipment suitable for ambient conditions specified. Provide system elements to operate properly in the presence of radio frequency fields produced by portable RF transmitters with output of five watts operated at 24 inches from instruments; in the presence of plant telephone lines, power lines and electrical equipment; and in the presence of digital data transmission systems.
- B. Field Locations: Field equipment may be subjected to ambient temperatures from -5 to 50° C with direct radiation, relative humidity from 0 to 100 percent with condensation.
- C. Power Supply: Power supply will be 120 volts AC, single- phase, 60-hertz commercial power. Voltage variations will be at least plus or minus 8 percent. Certain loops shall have integral power supply as indicated on the drawings.

2.03 TRANSIENT AND SURGE ISOLATION

- A. Protect all power and communication and transmission/ receiving circuitry from any surge, including spikes up 1,000 volts peak and surges with a rise time of less than one microsecond. Use a combination of current limiting resistors, zener diodes, gas tube surge arresters and a fusible link which melts and shorts the surge to ground before the device circuitry is affected. Provide protection adequate for personnel safety, which will prevent an erroneous output, change in calibration or failure of component other than fuse or fusible link.

2.04 SPARE PARTS

- A. During the system warranty period, the PCSS is expected to make system repairs by initially replacing the defective component with one from the spares inventory. The PCSS shall then replace the spare component

2.05 SPECIAL TOOLS

- A. PCSS shall supply one of each type of special hand tool required to open or operate equipment, to remove or replace replaceable parts, remove or replace cable connectors, or to make required operational or maintenance adjustments. A special hand tool is any tool not readily available from local retail hardware stores.

2.06 TEST EQUIPMENT

- A. The PCSS shall provide a complete list of all tools, test equipment, and commercial software programs necessary for the proper maintenance of the system. This list shall contain the quantity recommended, model number, description, cost, and name and address of supplier.

2.07 MATERIALS AND EQUIPMENT

- A. Materials: Material shall be new, free from defects, and of the quality specified. All instruments with the same specification shall be from the same manufacturer.
- B. Provide equipment of solid-state construction utilizing second source semiconductors, unless otherwise specified. Derate components to assure dependability and long-term stability. Provide printed or etched circuit boards of glass epoxy, hand or wave soldered, of sufficient thickness to prevent warping. Coat printed circuit boards in field-mounted equipment with plasite 7122, or approved equal, to protect against corrosion. Alignment and adjustments shall be non-critical, stable with temperature changes or aging and accomplished with premium grade potentiometers. Do not insert components of specially selected values into standard electronic assemblies to meet performance requirements. Use parts indicated in instruction manuals, replaceable with standard commercial components of the same description without degrading performance of completed assembly. Do not use silver edge connectors or pins.
- C. Use test equipment and instruments to simulate inputs and read outputs suitable for purpose intended and rated to an accuracy of at least five times greater than the required accuracy of device being calibrated. Such test equipment shall have accuracies traceable to the National Bureau of Standards as applicable.
- D. Make equipment located in hazardous areas suitable for applicable classification by use of explosion-proof housings or equipment and barriers approved as "intrinsically safe" by either UL or FM. Locate barriers in cabinets at hazardous area boundaries. Use dual barriers in loops in order to prevent a grounding loop at the barrier.
- E. Provide all special tools necessary for operation, maintenance and calibration of all (instruments) devices, subsystems, and systems supplied.

2.08 SPECIAL PROJECT REQUIREMENTS

- A. As a part of this contract, the instrumentation systems PCSS shall coordinate with all the sub-systems suppliers and manufacturers, during bidding, construction, testing, installation and start-up phases of the project. The coordination is to assure that the instruments, and sub-systems are in compliance with the specifications and the central controls, and that the tie-ins and the interface signals are provided as required.
- B. The calibration, testing and start-up of all the instruments shall be done by the manufacturer's field technician/engineer in the presence of the OWNER. The PCSS shall provide a list of all manufacturers whose technician will perform this work. The PCSS shall also provide a certified calibration report stating that each instrument has been installed per manufacturer's recommendations and per these specifications.

PART 3 EXECUTION

3.01 OVERVIEW

- A. This contract is a PLC equipment supply and installation. The PCSS shall provide a completely operational system.
- B. The PCSS is responsible for the following:

- C. Acquisition and installation of all the hardware, software and instrumentation as defined in this specification and drawings.
- D. Perform the Factory Demonstration Test and I/O Point Checkout as defined in the next section.
- E. Develop the HMI database and operator screens necessary for the monitoring and control of the identified in the I/O list. Provide all required main screens and ancillary screens. Ancillary screens include, but are not limited to, equipment control popup screens, alarm acknowledgement, operator login/logoff, etc. The PCSS shall provide all support screens required by the main screens.
- F. Develop or modify single daily, monthly and yearly report showing the process information associated with the operation of the plant. The PCSS shall coordinate with the OWNER on the definition of the format and specific information required. The report shall be automatically generated every day.
- G. Program the PLCs. The PLC program needs to provide the basic functionality required for the monitoring and control of the equipment identified in the I/O list. This functionality needs to include, at a minimum, alarming of fault conditions, validity checks of analog input signals, failures to start or stop equipment, health monitoring of the PLC itself, time synchronization with the HMI server, and equipment runtime.
- H. The PCSS shall follow the SCADA configuration Conventions that have been developed by the OWNER. These conventions include HMI color conventions, equipment animation, and tag naming conventions. The conventions are available upon request from the OWNER.
- I. Provide start-up installation services for the SCADA HMI system, PLCs and Instrumentation being provided by the PCSS.
- J. Install and demonstrate the control network link between SCADA and new PLC system as defined in the drawings.
- K. Provide training as specified in Section 3.05.

3.02 COORDINATION MEETINGS

- A. The CONTRACTOR shall schedule and administer a minimum of two coordination meetings for the purpose of discussing progress of the work under this Section. The CONTRACTOR shall make arrangements for the meetings and prepare and send a proposed agenda to all participants at least one (1) week before scheduled meetings. The CONTRACTOR shall be responsible for promptly preparing and distributing meeting minutes to all attendees.
- B. The meetings may be held at the SAWS Production Control Room or at OWNER's designated location and shall include, at a minimum, attendance by the OWNER, ENGINEER, CONTRACTOR's Project Engineer.
 - 1. The First Coordination Meeting shall be held in advance of the first Shop Drawing submittal. The purpose of the first meeting shall be to:
 - a. Summarize their understanding of the project
 - b. Discuss any proposed deviations, substitutions or alternatives
 - c. Present the project schedule

- d. Schedule testing and delivery milestone dates
 - e. Provide a forum for the CONTRACTOR and OWNER to coordinate hardware and software related issues
 - f. Request any additional information required from the OWNER and/or ENGINEER.
 - g. The CONTRACTOR shall bring a draft version of shop drawings to the meeting to provide the basis for the OWNER/ENGINEER's input into their development.
 - h. Discuss format of required reports to be developed.
2. The Second Coordination Meeting shall be held after all CONTRACTOR shop drawings have been reviewed and returned to the CONTRACTOR. Attendance by the OWNER, ENGINEER, CONTRACTOR's Project Engineer, and CONTRACTOR may be required. The purpose of the second meeting shall be for the CONTRACTOR to:
- a. Discuss comments made during submittal process
 - b. Refine schedule milestone dates
 - c. Coordinate installation activities
 - d. Discuss any remaining coordination requirements.
3. A typical agenda may include, but shall not be limited to, the following:
- a. Review minutes of previous meetings
 - b. Review of work progress
 - c. Field observations, problems, and decisions
 - d. Identification of problems which may impede planned progress
 - e. Review of submittal schedule and submittal status
 - f. Review of offsite fabrications and delivery schedules
 - g. Maintenance of progress schedule
 - h. Corrective measures to regain projected schedules
 - i. Planned activities for subsequent work period
 - j. Coordination of projected progress
 - k. Maintenance of quality and work standards
 - l. Effect of proposed changes on progress schedule and coordination
 - m. Other business relating to work"

3.03 SYSTEM TEST REQUIREMENTS

- A. General Requirements:
- B. The Control System shall undergo a comprehensive system test process to demonstrate that the system performs as an integrated unit to meet the requirements of this specification. The PCSS, as a normal course of system development, shall conduct all element, subsystem, and system tests necessary to ensure the proper operation of the control system at various stages of system development. This type of testing will normally be not witnessed; however, the OWNER and ENGINEER reserve the right to witness these tests if concerns arise about the progress of system implementation.
- C. Two formal, witnessed tests shall be conducted:
 - 1. Factory Demonstration Test
 - 2. I/O Point Checkout
- D. The following paragraphs describe the requirements for each of these formal tests.
- E. Factory Demonstration Test (FDT)s

- F. Use spare part CPU, power supply, IO rack, and extension modules to simulate the existing PLC for FDT. Refer specification 17300 spare part for spare module requirement.
- G. A FDT and verification for all equipment, software, and associated documentation shall be performed prior to system, subsystem, or major components shipment. The tests shall be performed to verify that the equipment is manufactured and assembled correctly, is operating as designed, and is in compliance with the contractual requirements for the deliverables. The tests shall be performed to verify that the software and hardware will meet the functional and performance requirements of this document.

The OWNER (two persons) and the ENGINEER (one person) will witness these factory tests. The supplier of the control system shall provide the following for the OWNER and the ENGINEER.

- 1. Notification four weeks in advance of the tests
 - 2. Air travel to/from the test facility and the San Antonio International Airport
 - 3. Lodging in a hotel
 - 4. Ground transportation
 - 5. Meals
 - 6. Above items if retesting must be performed to obtain satisfactory results
- H. The FDT shall demonstrate compliance to each explicitly stated requirement in the specification. PCSS shall use the Excel spreadsheet program to build a FDT cross reference table that lists each specification paragraph that imposes a uniquely identifiable technical requirement. PCSS shall add to the format a data field for the FDT test number of the test that is going to demonstrate compliance with the requirement. A second version of the table, sorted by test number, shall also be printed. This will make it possible to select any specification paragraph and identify the FDT test that should demonstrate the feature. The version ordered by test number can be used to verify the completeness of each test and shall be used during the FDT to check off the features demonstrated.
- I. The FDT shall include the following:
 - 1. Equipment Test and Verification: The FDT for the equipment (hardware) shall include individual end-item verification and integrated tests of all hardware. These tests shall include visual inspection verification and running the standard hardware diagnostic programs, plus all special diagnostic programs used by the PCSS to demonstrate that the hardware integration task has been completed.
 - 2. System Functional Test: The functional test shall exercise every specified system function and shall include, but not be limited to, the following:
 - a. Rigorous exercising of all devices both individually and collectively.
 - b. Verification of proper scanning and data acquisition of status and data points.
 - c. Demonstration of all required data base management functionality.
 - d. Demonstration of all required software support utilities.
 - e. Demonstration of all system diagnostics, both on-line and off-line.
 - 3. Support Software Tests: The FDT for the support software shall include the following, as a minimum:
 - a. Demonstration of system editing capabilities including the addition and deletion of points in an PLC; the addition, deletion, and modification of monitor displays, the addition, deletion and modification of report formats, the addition, deletion, and modification of control strategies, and the modification of the data base and all data base parameters.

- b. Demonstration of the editing of all system parameters including timers, intervals, etc.
 - c. Demonstration of utility software facilities, including assembling, compiling, appending, and executing new programs. On-line program debug facilities shall also be demonstrated.
- J. I/O Point Checkout
- K. An I/O point checkout shall be performed after all equipment is shipped and installed in the field. The tests shall be performed to verify that the equipment has been installed correctly. The tests shall be performed to verify that the software and hardware will meet the functional and performance requirements of this document.
- L. The OWNER and the ENGINEER will witness these factory tests.
- M. The I/O point checkout shall demonstrate the proper operation of all the field points affected by the installation of the equipment provided by this contract.
- N. The PCSS shall provide an I/O list for each PLC and RTU provided, and a test plan that indicates how the verification will occur.
- O. The I/O Point Checkout shall include, but not limited to, the following:
 1. Exercise each discrete input. Each state shall be verified at an Operator Workstation.
 2. Exercise each analog input. Each input shall be verified at 0, 25, 50 and 100% range of the instrument. Linearity of the signal shall be verified. Each value shall be verified at the Operator Workstation.
 3. Exercise each discrete output. Each state shall be initiated from the Operator Workstation. If necessary, the associated equipment shall be placed into a "safe" state such that the activation of the output will not damage the equipment or cause a safety hazard.
 4. Exercise each analog output. Each output shall be verified at 0, 25, 50 and 100% range of the instrument. Linearity of the signal shall be verified. Each value shall be initiated and verified at the Operator Workstation.
 5. Unless constrained by the operation of the plant, or due to safety reasons, all testing should include the actual equipment, and not use simulated signals.

3.04 INSTALLATION AND STARTUP

- A. Field Testing: Field testing and start-up shall consist of a sequence of activities and tests conducted as the control system components are installed and integrated at the job site. Following is a description of the individual steps that are involved with field testing and cut-over.
- B. Top-End Equipment checkout.
 1. Demonstrate the capability of each piece of equipment to communicate with each other.
 2. Demonstrate the ability of the equipment to operate in the manner defined for each across the network, i.e. Operator Workstations providing HMI screens accessing data from the HMI servers.

3.05 TRAINING

- A. Provide a comprehensive training program covering the operation, troubleshooting, and maintenance of all equipment and systems detailed in this specification.
- B. Training sessions shall be tailored to the specific needs of the class participants. Curricula shall address the training needs of several distinct groups of the Owner personnel specifically: operations, maintenance, and instrumentation staff members.
- C. All training shall be provided at the Owner's facility and scheduled Monday to Thursday between 8:00 am to 4:00 pm. Each training session shall be a minimum of two hours and a maximum of eight hours.
- D. Provide two complete training sessions for the following courses for the Plant Operators:
 - 1. Instrumentation operation and maintenance: 2 hours
 - 2. PLC panel operation and maintenance: 2 hours
 - 3. SCADA HMI operation: 4 hours
- E. Provide one training sessions for the following courses for the Plant Instrumentation Technicians and SAWS Control System Analyst Division:
 - 1. Instrumentation maintenance and troubleshooting: 2 hours
 - 2. PLC configuration, maintenance and troubleshooting: 2 hours
 - 3. SCADA HMI configuration, maintenance and troubleshooting (SAWS Control System Analyst Division): 4 hours.

3.06 SYSTEM APPLICATION CONFIGURATION

- A. Base System Configuration
- B. The PCSS shall perform all system configuration activities necessary for the efficient operation of base control system functions. These activities shall include, but not be limited to: sizing of data tables and queues, tuning of communication subsystem parameters, configuration of console control access definitions, setup of alarm subsystem parameters, Ethernet management devices, etc.

END OF SECTION