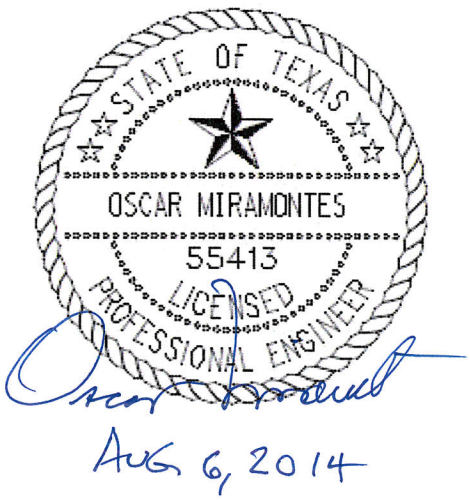
EVANS PZ 11A BOOSTER STATION IMPROVEMENTS PROJECT
SAWS JOB NO. 13-6003

San Antonio Water System

ADDENDUM NO. 3

DIVISION #13 – Instrumentation and Controls
DIVISION #16 – Electrical



AUG 6, 2014

SAN ANTONIO WATER SYSTEM
Evans PZ 11A Booster Station Improvements Project
SAWS Job No. 13-6003
Solicitation No. B-14-052-MF

ADDENDUM NO. 3
August 6, 2014

TO BIDDER OF RECORD:

The following changes, additions, and/or deletions are hereby made a part of the Contract Documents for the Evans PZ 11A Booster Station Improvements Project, for the San Antonio Water System, San Antonio, Texas, Dated July 2, 2014, as fully and completely as if the same were set forth therein.

PART 1 – TECHNICAL SPECIFICATIONS

1. Replace Section 13000 with modified new Section, attached. Changes to original document are depicted in Red.
2. Replace Instrument List of Section 13310 with modified new Table, attached. Three pressure gages have been added. Changes to original document are depicted in Red.
3. Include new Section 13327 for Panel Mounted Equipment.
4. Include new Section 13328 for single phase UPS.
5. Replace Section 13330 with modified new Section, attached. Main changes include replacement of Schneider Quantum PLC with M340 PLC family and addition of Rockwell Automation CompactLogix. Various other changes are included in the body of the text. Changes to original document are depicted in Red.
6. Include new Section 13515 for Communications Interface Equipment.
7. Include new Section 16060 for Acceptance Testing and Calibration.

PART 2 – DRAWINGS

1. Replace Drawing E-101 with modified attached drawing. Energy Reducing Switches are required for all MV breakers.
2. Replace Drawing PID-101 with modified attached drawing. Addition of missing labels to pressure gages is included. Changes are indicated with a cloud and a triangle indicating the revision number.
3. Replace Drawing I-110 with modified attached drawing. Existing to remain instruments are identified.

Oscar Miramontes AUG 6, 2014

Oscar Miramontes, P.E.
San Antonio Water System

ACKNOWLEDGEMENT BY BIDDER

THE UNDERSIGNED ACKNOWLEDGES RECEIPT OF THIS ADDENDUM NO. 3 AND THE BID SUBMITTED HEREWITH IS IN ACCORDANCE WITH THE INFORMATION AND STIPULATION SET FORTH.

Date Signature of bidder

END OF ADDENDUM NO. 3

SECTION 13000
INSTRUMENTATION GENERAL PROVISIONS

PART 1 GENERAL

1.1 SUMMARY

A. The Contractor shall procure the services of a pre-qualified Process Control Systems Integrator (PCSI) to furnish all materials, equipment, labor and services, except for those specifically excluded, as required to achieve a fully integrated and operational Process Control System (PCS) as specified herein, in specification Sections listed below and as further detailed in the Contract Drawings. The PCSI shall have qualifications as described herein.

B. The PCSI shall procure the services of an Application Services Provider (ASP) for all work as specified in Section 13340. The ASP shall have qualifications as described herein. The ASP shall coordinate with the Contractor, Owner, Engineer and PCSI, for all scheduling, installation, testing, startup and training services.

C. This Specification includes General Requirements for Instrumentation.

D. The PCSI Contractor shall provide all hardware, software, and configuration and integration associated with the PLC based Instrumentation and Process Control system. Furnish a complete and operational system in accordance with these Contract Documents:

1. Furnish, calibrate, install & commission all instruments shown in P&ID and "I" drawings and specified in Division 13 specifications (Contract Documents).

2. Furnish control panels as shown on the drawings.

3. Provide a complete integrated, tested, functional system. Any additional hardware or software required to meet the functional system requirements shall be provided at no additional cost to the OWNER.

1.2 PROCESS CONTROL SYSTEMS INTEGRATOR (PCSI)

A. The Contractor shall provide the services of a pre-approved Process Control Systems Integrator (PCSI) for work under this division and other divisions, as described in this division and other divisions.

B. The Contractor shall name the proposed PCSI on the bid documents. Only approved suppliers, as listed herein, will be accepted.

C. Qualifications

1. The PCSI shall be a "systems house," regularly engaged in the design and installation of control and instrumentation systems and their associated subsystems as they apply to the municipal water or wastewater industry. For the purposes of this and other applicable divisions, a "systems house" shall be interpreted to mean an organization that complies with all of the following criteria:

2. Employs a registered professional Control Systems Engineer or Electrical Engineer in

the state of Texas to supervise or perform the work required by this Specification Section.

3. Employs personnel on this project who have successfully completed manufacturer's training courses on the hardware configuration and implementation of the specific programmable controllers, computers, and software proposed for this project.

4. The PCSI shall have been in the water/wastewater industry performing the type of work specified herein for a minimum of five (5) continuous years.

5. The PCSI shall maintain a fully equipped office/production facility with full-time employees capable of fabricating, configuring, installing, calibrating, troubleshooting, and testing the system specified herein. Qualified repair personnel shall be available and capable of reaching the facility within 24 hours.

D. The list included next lists PCSI Contractors that are recommended by SAWS for this project:

1. Prime Controls
   1725 Lakepointe Dr.
   Lewisville, TX 75057
   Attn: Gary McNeil
   Phone: 972-221-4849
   Email: Sales@prime-controls.com

2. Control Panels USA, Inc.
   16310 Bratton Lane
   Building 1, Suite 100
   Austin, TX 78728
   Attn: Martin Salyer
   Phone: 512-863-3224
   www.controlpanelsusa.net

3. Schneider Electric
   12121 Wickester, Suite 400
   Houston, TX 77079
   Attention: Keith Collins
   Phone: 713-598-0255
   Email: keith.collins@schneider-electric.com

E. The listing of specific PCSI organizations above does not imply acceptance of their products and capabilities that do not meet the specified ratings, features and functions required herein. PCSIs listed above shall not be relieved from meeting these specifications in their entirety.

1.3 APPLICATION SERVICES PROVIDER (ASP)

A. The PCSI shall provide an Application Services Provider (ASP) for application programming services for Programmable Logic Controllers (PLC) and Human Machine Interface (HMI) computers and devices

B. Qualifications

1. The ASP shall perform all work necessary to configure, customize, debug, install, connect, and place into operation all HMI and PLC software specified within this Division and other related divisions. The ASP shall coordinate with the PCSI all scheduling, installation, and startup services.

2. The ASP shall comply with the following:
   a. Hold an adequate Certificate of Insurance for the project work specified herein and in other related Sections.
   b. Employ personnel who have completed and hold certificates for required training
   c. Submit a team organization chart upon request by Engineer
   d. Employ personnel who have previously completed five projects of this size or larger in dollar value.
   e. Employ personnel who can demonstrate five years of experience working on projects in the water and wastewater industry
   f. Provide project references including project name, client name, scope of work, date of work executed and reference contact upon request by Engineer
   g. ASP shall have an Electrical or Control Systems professional engineer, licensed in the State of Texas, on staff.
   h. ASP shall provide 24-hour Service Contract for the length of the warranty period.
   i. The list included next lists ASP Contractors that are recommended by SAWS for this project:

      a. Signature Automation
         14679 Midway Rd., Suite 205
         Addison, TX 75001
         Attention: Rick Hidalgo
         Phone: 469-619-1241
         Email: info@sig-auto.com

      b. Prime Controls
         1725 Lakepointe Dr.
         Lewisville, Texas 75057
         Attention: Gary McNeil
         Phone: 972-221-4849
         Email: sales@prime-controls.com

      c. Control Panels USA, Inc.
         16310 Bratton Lane
         Building 1, Suite 100
         Austin, TX 78728
         Attn: Martin Salyer
         Phone: 512-863-3224
         www.controlpanelsusa.net

      d. Schneider Electric
         12121 Wickester, Suite 400
         Houston, TX 77079
         Attention: Keith Collins

Phone: 713-598-0255
Email: keith.collins@schneider-electric.com

e. Transdyn
4256 Hacienda Drive, Suite 100
Pleasanton, CA 94588
Attention: Peter Smith
Phone: 925-225-1600
Email: psmith@transdyn.com

C. The listing of specific ASP organizations above does not imply acceptance of their products and capabilities that do not meet the specified ratings, features and functions required herein. ASPs listed above shall not be relieved from meeting these specifications in their entirety.

1.4 RELATED WORK

A. Comply with General and Special Conditions, Division 1 Specifications, Division 13 Specifications, and Division 16 Specifications of these Contract Documents.

1.5 QUALITY ASSURANCE

A. Should there be a conflict between various standards, codes, specifications, and contract drawings, bring the matter immediately to the attention of the OWNER's Representative.

B. Reference Standards:

1. American Society of Testing Materials:
   - A269 Seamless and Welded Austenitic Stainless Steel Tubing for General Service
   - B 68 Seamless Copper Tube
   - D 1047 Polyvinyl Chloride Jacket for Wire and Cable
   - A 36 Specification for Structural Steel Zinc Coating (Hot-Dip) on Iron and Steel Hardware
2. Research Council on Riveted and Bolted Structural Joints (RCRBSJ)
3. American Institute of Steel Construction (AISC)
4. Steel Structures Painting Council (SSPC): Painting Specifications for weather exposure
5. American Welding Society (AWS): Welding Code D 1.1-75
6. Federal Specifications: Primer, Paint Zinc, Chromate, Alkyd Type, Fed. Spec. TT-P-645a
7. National Electrical Manufacturers Association (NEMA)
8. National Fire Protection Association (NFPA): National Electrical Code (NEC), most recent edition.
9. Instrument Society of America (ISA):
   - RP 3.1-1960 Flow Meter Installations, Seal and Condensate Chambers
   - S5.1-1973 Instrumentation Symbols and Identification
   - RP7.1-1956 Pneumatic Control Circuit Pressure Test
   - S7.3-1975 Quality Standard for Instrument Air
   - RP18.1-1965 Specifications and Guides for the Use of General Purpose Annunciators

S5.4-1976	Instrument Loop Diagrams
S8.1-1968	Instrument Enclosures for Industrial Environments
RP12.1-1960	Electrical Instruments in Hazardous Atmospheres
RP20.1, 20.2	Specification Forms for Instruments
S39.1-1972	Control Valve Sizing Equations
539.2-1972	Control Valve Capacity Test Procedures
S51.1	Process Instrumentation Terminology

10. American Petroleum Institute (API):

API RP 550	Manual on Installation of Refinery Instruments and Control Systems
API RP 520	Recommended Practice for the Design and Installation of Pressure-Relieving Systems in Refineries

11. Scientific Apparatus Makers Association (SAMA):

PM 20.1-1973	Process Measurement and Control Terminology
RC5-10-1963	Resistance Thermometers

12. Underwriters' Laboratory (UL): Subject 13, Subject 1227
13. Factory Mutual (FM)
14. American National Standard Institute (ANSI)
15. Supplement to C37.90-1971, Relays and Relay Systems Associated with Electric Power Apparatus (IEEE Std. 313-1971), C37.90a-1974
16. National Bureau of Standards (NBS)
17. Institute of Electrical and Electronics Engineers (IEEE): Tray Fire Tests, IEEE 383

1.6 GUARANTEE

The CONTRACTOR shall provide guarantees for a period of one year after final acceptance by the OWNER.

1.7 DEFINITIONS

The terms used in this specification conform to definitions in ISA S51.1, SAMA PMC 20.1-1973 and RC 5-10-1963, except as modified below.

1. Device: An electronic or mechanical apparatus designed to perform a specific measurement or control function.

2. Equipment: The machinery used in a process, e.g., pumps, fans, etc.

3. Interchangeability error: The algebraic difference between the indication and true value of the measured variable as a result of exchanging a device with a replacement.

4. Loop: Any combination of interconnected transmitters, receivers, switches, alarms, indicators, controllers, computers, or final control elements.

5. Operating accuracy: Conformity of indicated value to accepted standard value or true value throughout specified operating conditions with a confidence level of 95 percent includes, but is not limited to, hysteresis, linearity, and operating influence of temperature, pressure, supply voltage, and transmitter power supply. Operating accuracy for loop is defined as root-mean-square (RMS) of individual device operation accuracies.

6. Process: A progressively continuing operation that consists of a series of controlled actions systemically directed toward a particular result, e.g., a process to mix, filter, heat, and/or cool air to a particular condition.

7. Response: The results of the act, or process of measuring the time difference between the time of a change in an input signal or a measured variable, and the time when the output, display, and final control element in the loop has changed to at least 60 percent of the change which should result from the input change.

8. Subsystem: A discrete subdivision of a system and an assemblage of parts, devices, or software modules designed to perform one or more of the specific tasks required for the system to accomplish its functions.

9. System: An assemblage of sometimes diverse parts, devices, or software modules serving a common set of measurement or control functions.

10. Time resolution: The result of the act or process of rendering distinguishable events occurring at nearly the same time. Expressed as a measurement of time in seconds.

11. Unit: Any combination of equipment items interconnected in a predetermined manner, performing one or more controlled actions toward a particular result. A discrete subdivision of a process.

12. Concealed - Accessible: Out of general sight, but can be easily reached by removing panels or access doors.

13. Concealed - Inaccessible: Out of general sight and cannot be easily reached except by removing a permanent part of the building or using special tools.

14. Exposed: Open to general view without removing panels, access doors, or a permanent part of the building.

15. Field termination point: Termination of a run of raceway from an instrument panel to the vicinity of a field instrument. Field termination point is usually within five horizontal feet from the field instrument.

16. Analog device: Any sensor, transmitter, indicator, recorder, controller, computing relay, or control valve which transmits or receives an analog signal. Excludes the analog portion of a digital system or I/O subsystems.

1.8 SUBMITTALS

A. Shop drawings and product data:

1. Submittals shall be in accordance with Section 01300 – SUBMITTALS and Section 16000 – ELECTRICAL GENERAL PROVISIONS.

2. Give sufficient detail to permit system configuration, installation, and wiring without reference to design drawings. Refer to Division 1 - General Provisions.

3. As a minimum, shop drawings shall include a bill of materials with original

MANUFACTURER's name and catalog number (re-labeled component information is not acceptable), original MANUFACTURER's catalog cut sheets, front views, assembly drawings, nameplate schedules, electrical schematics, electrical connections diagrams, and piping connection diagrams.

4. Electrical, piping, and interconnection diagrams shall show all terminations of equipment, complete with conduit, cable, and equipment designations, and shall include terminal identification information.

5. Include size of all conduits, pipe, cables, and conductors.

6. Physical arrangement drawings shall include operating and servicing clearance requirements, cooling requirements, electrical power requirements, and cabling information.

7. Operator console configuration drawings shall include specific location of all keys and pushbuttons.

8. Logic drawer drawings shall show used space and expansion space.

9. Show appropriate tag numbers on all product data.

B. Technical Manuals:

1. Supply six (6) sets of technical manuals with software specifications to OWNER's REPRESENTATIVE no later than the equipment shipment date. Each set shall be bound in a standard size, three-ring, loose-leaf, vinyl plastic, hard-cover binder suitable for bookshelf storage. Binder ring size shall not exceed 2.5 inches.

2. Each set of technical manuals shall include a general and detailed description, a theory of operation description, detailed schematic drawings, specifications, and installation, connection, calibration, operating, troubleshooting, preventive maintenance, and overhaul instructions in complete detail with a clear and specific description of the steps the operators must take to perform each of the tasks and modes of operating specified.

3. These manuals shall provide the OWNER with comprehensive information on all systems and components to enable operation, service, maintenance and repair. Exploded or other detailed views of all instruments, assemblies, and accessory components shall be included together with complete parts lists and ordering instructions. These manuals are in addition to all applicable requirements of Division 1- General Requirements.

PART 2 PRODUCTS

2.1 INFORMATION ON DRAWINGS

A. The following information is indicated on the drawings:

1. Diagrams are schematic in nature and intended only as a guide to work to be performed.

2. Approximate location of primary elements, instrument panels, and final control

elements.

3. Location of electrical distribution panel boards for instrument electrical power.

4. Location of equipment having alarms and equipment status contacts.

5. Location of equipment being controlled by system.

B. The following information is not shown on drawings, but shall be the responsibility of the CONTRACTOR to determine, furnish, and coordinate with other divisions based upon systems specified. Show this information on project record drawings.

1. Instrument loop drawings per ISA S5.4 minimum, desired and optional items.

2. Location of electrical distribution panel boards supplying power to any device supplied under this Contract.

3. Detailed enclosure and instrument panel layouts, PLC enclosure layouts, Fabrication details and wiring diagrams.

4. Detailed system configuration.

5. Raceway and cable routing for instrumentation wiring.

2.2 OPERATING CONDITIONS

A. 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 equipment may be subjected to ambient temperatures from -5 to 50°C with direct radiation and relative humidity from 45 to 100 percent with condensation.

C. Power supply will be 117 VAC, 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 specified in the Contract Documents. Power supplies shall be provided in the panels as specified in the Contract Documents or required for a complete system.

2.3 MATERIALS AND EQUIPMENT

A. Provide equipment of solid-state construction utilizing second source semiconductors, unless otherwise specified. De-rate 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 two mils of solder-compatible conformal coating complying with MIL-1-46058B. Alignment and adjustments shall be noncritical, 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.

B. 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.

2.4 SPECIAL PROJECT REQUIREMENTS

A. As a part of this Contract, the instrumentation systems CONTRACTOR shall coordinate with OWNER and 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 Contract Documents and that the necessary tie-ins and interface signals with the existing system are provided as specified or required.

B. Provide the OWNER's staff with all required training and operating procedures, at no extra cost to the OWNER. The training schedule shall be coordinated with the OWNER's REPRESENTATIVE.

C. The calibration, testing, and start-up of all the instruments whether existing or provided new, shall be done by the MANUFACTURER's field technician in the presence of the OWNER. The CONTRACTOR shall provide a list of all manufacturers whose technicians will perform this work. The CONTRACTOR shall also provide a certified calibration report stating that each instrument shown or specified in the Contract Documents has been installed, tested and calibrated per MANUFACTURER's recommendations and per these Contract Documents.

D. Follow-up Services: After the acceptance of the system, the CONTRACTOR shall make four (4) trips to the project site for calibration and adjustment of all the instruments and devices, including the In-Plant SCADA system. The first trip shall be three months after acceptance of the complete system, and thereafter every three months for a total of four trips. These trips are in addition to all warranty items, and shall be at no extra cost to the OWNER. The CONTRACTOR shall provide the services of a trained technician for each trip with appropriate calibration and testing instruments. All defects shall be immediately remedied. The trips shall be coordinated with the OWNER.

E. In addition to commissioning the equipment being supplied under this contract, the CONTRACTOR shall be responsible to make adjustments to existing equipment and top-end software as needed to integrate the entire system.

END OF SECTION

SECTION 13310

INSTRUMENT LIST

Tag #	Description	Size/Range
FIT –PRV-11A	Flow Meter, Service Level 11A PRV	12”/0-15 MGD
PIT-PRV-11A	Pressure Transmitter, Service Level 11A PRV	12” PIPE/0-200 PSIG
PI-01-PRV	Pressure Gage, Service Level 11A PRV	12” PIPE, 6” GAGE/0-200 PSIG
PI-02-PRV	Pressure Gage, Service Level 11A PRV	12” PIPE, 6” GAGE/0-200 PSIG
PIT-01-11A	Pressure Transmitter, Discharge Pump Manifold, Service Level 11A	42” PIPE/0-XX PSIG
PI-01-11A	Pressure Gage, Suction of HSP-01-11A	20” PIPE, 6” GAGE/0-60 PSIG
PS-01-11A	Pressure Switch, Suction of HSP-01-11A	0-10 PSIG, Set @ 5 psi
FIT-01-11A	Flow Transmitter, Discharge of HSP-01-11A	16” PIPE/0-10 MGD
PI-02-11A	Pressure Gage, Suction of HSP-02-11A	20” PIPE, 6” GAGE/0-50 PSIG
PS-02-11A	Pressure Switch, Suction of HSP-02-11A	0-10 PSIG, Set @ 5 psi
FIT-02-11A	Flow Transmitter, Discharge of HSP-02-11A	16” PIPE/0-10 MGD
PI-03-11A	Pressure Gage, Suction of HSP-03-11A	20” PIPE, 6” GAGE/0-50 PSIG
PS-03-11A	Pressure Switch, Suction of HSP-03-11A	0-10 PSIG, Set @ 5 psi
FIT-03-11A	Flow Transmitter, Discharge of HSP-0-11A	16” PIPE/0-10 MGD
PI-01B-11A	Pressure Gage, Service Level 11A HSP-01-11A	16” PIPE, 6” GAGE/0-200 PSIG
PI-02B-11A	Pressure Gage, Service Level 11A HSP-02-11A	16” PIPE, 6” GAGE/0-200 PSIG
PI-03B-11A	Pressure Gage, Service Level 11A HSP-03-11A	16” PIPE, 6” GAGE/0-200 PSIG

Instrument set points and ranges listed in table need to be coordinated with the process engineer AND the Owner prior to purchasing equipment and prior to making final adjustments.

END OF SECTION

SECTION 13327

PANEL MOUNTED EQUIPMENT

PART 1 GENERAL

1.1 SCOPE OF WORK

A. This section of the specifications describes the requirements for miscellaneous equipment to be furnished under other sections of the specifications as listed in the related work paragraph of this section.

B. All equipment described herein shall be submitted and furnished as an integral part of equipment specified elsewhere in these Specifications.

1.2 RELATED WORK

A. Section 13300 Instrumentation and Controls General Provision

1.3 SUBMITTALS

A. Submittals for equipment specified herein shall be made as a part of equipment furnished under other sections.

1.4 REFERENCE CODES AND STANDARDS

A. The equipment in this specification shall be designed and manufactured according to latest revision of the following standards (unless otherwise noted):

1. NEMA/ISCI 109 Transient Over voltage Withstand Test
2. IEEE Std. 472/ANSI C37.90.2 Withstand Capability of Relay Systems to Radiated Electromagnetic Interference from Transceivers.
3. IEC 255.4 Surge Withstand Capability Tests
4. NEMA/ICS 1 General Standard for Industrial Control Systems
5. NEMA/ICS 4 Terminal Blocks for Industrial Use.
6. NEMA/ICS 6 Enclosures for Industrial Control Systems
7. NEMA LS 1 Low Voltage Surge Protective Devices
8. UL 1449 Third Edition – Surge Protective Devices

B. All equipment shall comply with the requirements of the National Electric Code and Underwriters Laboratories (UL) where applicable.

C. Each specified device shall also conform to the standards and codes listed in the individual device paragraphs.

PART 2 PRODUCTS

2.1 MODE SELECTOR SWITCHES, PUSHBUTTONS AND INDICATING LAMPS

A. Subject to compliance with the contract documents, the following manufacturers are acceptable:

1. Allen Bradley
2. Cutler Hammer
3. GE
4. Square D

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

C. Construction:

1. 30mm Diameter
2. Corrosion resistant
3. NEMA 4/4X/13 without booted covers
4. “Finger safe” contact blocks, 10A rating
5. Function indicating colors per NFPA 79 unless otherwise shown on the drawings
6. Engraved corrosion resistant nameplates
7. LED lamps
8. Mode selector switches shall have 1 spare set auxiliary contacts
9. Indicator lights to be Push-to-Test
10. Potentiometer ratings to match I/O devices connected

2.2 TERMINAL BLOCKS:

A. Subject to compliance with the contract documents, the following manufacturers are acceptable:

1. Phoenix Contact

2. Entrelec

3. Weidmuller

4. Allen Bradley

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

C. Terminal Blocks:

1. Terminal blocks shall be DIN-rail-mounted one-piece molded plastic blocks with tubular-clamp-screw type, with end barriers, dual side terminal block numbers and terminal group identifiers. Terminal blocks shall be rated for 600 volts except for control and instrumentation circuits, or 4-20 mA analog signal conductors.

2. Provide 600 volt rated terminal blocks for any conductor carrying any voltage over 120 volts to ground.

3. Provide 600 volt rated strap screw terminal blocks for any power conductors carrying over 20 amps, at any voltage. Terminals shall be double sided and supplied with removable covers to prevent accidental contact with live circuits.

4. Power conductors carrying over 20 amps, at any voltage shall be terminated to strap-screw type terminal blocks with crimp type, pre-insulated, ring-tongue lugs. Lugs shall be of the appropriate size for the terminal block screws and for the number and size of the wires terminated. Do not terminate more than one conductor in any lug, and do not land more than two conductors under any strap-screw terminal point.

5. Terminals shall have permanent, legible identification, clearly visible with the protective cover removed. Each terminal block shall have 20 percent spare terminals, but not less than two spare terminals.

6. Do not land more than two conductors per terminal point. Use the manufacturer's provided bridge connectors to interconnect terminal blocks terminating common or ground conductors.

7. Twisted shielded pair or triad cables shall have each individual

conductor and shield drain wire landed on individual terminal blocks. Use the manufacturer's provided bridge connectors to interconnect terminal blocks terminating the shield drain wire conductors.

8. Control circuits, 120 volts and below, and 4-20 mA analog signal conductors shall be terminated with manufacturer's recommended ferrules. Ferrules shall be provided with plastic sleeves.

9. Provide an AC ground bar bonded to the panel enclosure, if metal, with 20 percent spare terminals.

10. Provided ground terminal blocks for each twisted-shielded pair drain wire.

2.3 WIRE TROUGHS:

A. Subject to compliance with the contract documents, the following manufacturers are acceptable:

1. Panduit

2. Taylor

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

C. All wiring shall be enclosed in PVC wire trough with slotted side openings and removable cover. Plan wire routing such that no low voltage twisted shielded pair cable conducting analog 4-20 mA signals or communications low voltage analog signals are routed in the same wire trough as conductors carrying discrete signals or power

2.4 DIN RAILS:

A. Subject to compliance with the contract documents, the following manufacturers are acceptable:

1. Phoenix Contact

2. Entrelec

3. Weidmuller

4. Allen Bradley

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and

functions.

Manufacturers listed above are not relieved from meeting these specifications in their entirety.

C. Standard 35 mm rails shall be made of steel zinc-plated and chromated. Rails shall have be 7.5 mm tall and meet standard EN 60715: 2001.

2.5 SIGNAL ISOLATORS, BOOSTERS, CONVERTERS

A. Subject to compliance with the contract documents, the following manufacturers are acceptable:

1. Phoenix Contact
2. Acromag Inc.
3. Moore Industries

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety:

1. Type:
   a. Externally powered solid state electronic type/ Loop powered devices are not acceptable.
2. Functional/Performance:
   a. Accuracy: 0.15 percent
   b. Inputs: Current, voltage, frequency, temperature, or resistance as required
   c. Outputs: Current or voltage as required
   d. Isolation: There shall be complete isolation between input circuitry, output circuitry, and the power supply
   e. Adjustments: Zero and span adjustment shall be provided
   f. Protection: Provide RFI protection
   g. 24 VDC power input
3. Physical:
   a. Mounting Suitable for DIN Rail mounting in an enclosure or instrument rack
4. Options/Accessories Required:

a. Mounting rack or general purpose enclosure as required.

2.6 POTENTIOMETER / RTD TRANSMITTERS

A. Subject to compliance with the contract documents, the following manufacturers are acceptable:

1. Phoenix Contact
2. Moore Industries

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

C. Design and fabrication:

1. Solid state electronics
2. Transmit analog signal directly proportional to measured impedance input.
3. Power source: 24 VDC.
4. Input: 0-1000 ohms.
5. Output signal: 4-20 mA DC.
6. Accuracy (maximum error): ±o.25 percent.
7. Ambient temperature range: 0-140 deg F.

2.7 PANEL DISPLAYS

A. Subject to compliance with the contract documents, the following manufacturers are acceptable:

1. Precision Digital
2. Red Lion
3. Moore Industries

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

C. Design and fabrication:

1. 4-20 mA, ± 10 V, TC & RTD Inputs
2. Rating: NEMA 4X, IP65 without the use of a separate cover.
3. Shallow Depth Case 3.6" Behind Panel
4. Power Supply: 85-265 VAC
5. Optional features to be supplied: two relays providing form A contacts, software settable at independent values.
6. Output: analog 4-20 mA
7. Display: minimum digit height of 2.5 inches; sunlight readable

2.8 MULTI-CHANNEL PANEL DISPLAYS

A. Subject to compliance with the contract documents, the following manufacturers are acceptable:

1. Precision Digital - Consolidator PD940

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

C. Type:

1. Four (4) simultaneous displays and bar graphs
2. Nine (9) form C relays with dry contacts rated 10A

D. Function Performance:

1. Function: To display independently each input and re-transmit each input variable with 4-20 mA signals.
2. Generate alarms and status contacts from input signals.
3. Input Power: 120 Volts AC.
4. Programmable from buttons on front of unit, menu driven

E. Physical:

1. Mounting as shown on plans

F. Options/Accessories Required:

1. Provide stainless steel hardware

2. Communication link as shown on the drawings

2.9 RELAYS AND TIMERS

A. Subject to compliance with the contract documents, the following manufacturers are acceptable:

1. Square D

2. IDEC

3. Potter-Broomfield

4. Allen-Bradley

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

C. Type:

1. Relays shall be double pole, double throw, octal plug in type with a transparent dust cover. The relay shall be equipped with an indicating light to indicate when its coil is energized.

2. Units shall be of the general purpose plug-in type.

D. Functional/Performance:

1. Coil voltage shall match supply voltage.

2. Contact arrangement/function shall be as required to meet the specified control function.

3. Mechanical life expectancy shall be in excess of 10,000,000 cycles.

4. Duty cycle shall be rated for continuous operation.

5. Units shall be provided with integral indicating light to indicate if relay is energized.

6. Solid state time delays shall be provided with polarity protection (DC units) and transient protection.

7. Time delay units shall be adjustable and available in ranges from .1 second to 4.5 hours.

8. Plug-in general purpose relay.

9. Blade connector type

10. Contact material: Silver cadmium oxide

11. Relay sockets are DIN rail mounted

12. Internal neon or LED indicator is lit when coil is energized

13. Clear polycarbonate dust cover with clip fastener

14. Operating temperature: -20 to +150 Deg F

15. UL listed or recognized

E. Ratings:

1. For 120VAC service provide contacts rated 10 amps at 120VAC, for 24VDC service provide contacts rated 5 amps at 28VDC, for electronic (milliamp/ millivolt) switching applicator provide gold plated contacts rated for electronic service.

2. Relays shall be provided with dust and moisture resistant covers.

F. Physical:

1. DIN Rail mounting base

2. Screw Terminals

G. Options/Accessories Required:

1. Provide mounting sockets with pressure type terminal blocks rated 300 volt and 10 amps.

2. Provide mounting rails/holders as required.

2.10 ANALOG SIGNAL SURGE PROTECTIVE DEVICES

A. Subject to compliance with the contract documents, the following manufacturers are acceptable:

1. AGM Electronics

2. Acromag Inc.

3. Moore Industries

4. Phoenix Contact

5. EDCO

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

C. Type:

1. For devices to be located in control or termination panels, provide DIN Rail mountable type

2. For devices to be mounted at loop-powered transmitters, provide pipe mountable type

D. Minimum Ratings:

1. Peak Surge Current 10 kA

2. Response Time <5 Nanoseconds

3. Voltage Clamp >26 Volts

2.11 POWER SUPPLIES

A. Subject to compliance with the contract documents, the following manufacturers are acceptable:

1. PULS Silverline

2. Phoenix Contact

3. Sola

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

C. Design and fabrication:

1. Converts 120 VAC input to DC power at required voltage.

2. Sized as required by the load/ Minimum 2.4 A output

3. AC input: 120 VAC +10 percent -13 percent; 47 to 63 HZ

4. Provision for output failure alarm contact
5. DIN rail mountable

6. All power supplies shall be furnished in redundant pairs

7. Provide redundancy module for each pair of power supplies.

2.12 SURGE PROTECTIVE DEVICES (SPD UL 1449 TYPE 3)

A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable (Type 3):

1. EDCO SLAC Series

2. Phoenix Contact

3. Brick Wall Model PWOM20

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

C. Construction of Type 3.SPD

1. Fully Integrated Component Design: All of the SPD's components and diagnostics shall be contained within one discrete assembly. SPDs or individual SPD modules that must be ganged together in order to achieve higher surge current ratings or other functionality will not be accepted.

2. Maintenance Free Design: The SPD shall be maintenance free and shall not require any user intervention throughout its life. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries are not acceptable. SPDs requiring any maintenance of any sort such as periodic tightening of connections are not acceptable.

3. Electrical Noise Filter: Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50 dB from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method.

4. Internal Connections: No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be soldered, hardwired with connections utilizing low impedance conductors.

5. Power and ground connections shall be prewired within the protected equipment.

6. Local Monitoring: Visible indication of proper SPD connection and

operation shall be provided. The indicator light shall indicate that the module is fully operable. The status of each SPD module shall be monitored on the front cover of the module.

7. SPD shall be listed in accordance with UL 1449 Third Edition and UL 1283, Electromagnetic Interference Filters.

8. SPD shall be tested with the ANSI/IEEE Category C High exposure waveform (20kV-1.2/50µs, 10kA-8/20µs).

D. Individual Control Panel and Related Equipment Protection (Type 3) Installation

1. Locate the SPD on the load side of the ground and neutral connections.

2. The SPD shall be connected through a disconnect circuit breaker or fuse as or as shown on the drawings. The disconnection means shall be located in immediate proximity to the SPD. Connection shall be made via bus, conductors, or other connections originating in the SPD and shall be kept as short as possible.

3. All monitoring and diagnostic features shall be visible from the front of the equipment.

2.13 NAMEPLATES

A. Furnish nameplates for each device as indicated in drawings. Nameplates shall be engraved, laminated impact acrylic, matte finish, black lettering on a white background, not less than 1/16-in thick by 1/2-in by 1-1/2-in, Rowmark 322402. Nameplates shall be attached to the back plate with double faced adhesive strips, TESA TUFF TAPE 4970, .009 X ½". Prior to installing the nameplates, the metal surface shall be thoroughly cleaned with 70% alcohol until all residues has been removed. Epoxy adhesive or foam tape is not acceptable.

2.14 PANEL INTERFACE CONNECTOR (PIC)

A. Subject to compliance with the contract documents, the following manufacturers are acceptable:

1. Automation Direct

a. Model: Zip Port Series

2. Grace Engineered Products, Inc.

a. Model: GracePort Series

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and

functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

C. For all PLC control panels, provide a Panel Interface Connector (PIC) pass- through unit that will mount to the outside of the control panel to give the capability to interface with the PLC without the need to open the enclosure door.

D. Design and fabrication:

1. Interface shall include the following:

a. UL Recognized and RoHS compliant

b. Housing rating shall match or be of higher NEMA rating than control panel

c. Gasket: thermo-plastic (TPE)

d. One GFCI power outlet with rating of 120 VAC

e. One Ethernet RJ-45 type 10/100 port connected to control panel switch.

f. Cover shall be attached with a continuous hinge and lockable.

g. Provide locks for all interfaces keyed alike.

2. Mounting: Flush panel mounted or wall mounted, as required.

3. PART 3 EXECUTION

3.1 INSTALLATION

A. All equipment specified herein shall be factory installed, field adjusted, tested and cleaned as an integral part of control panels specified elsewhere in these Specifications.

END OF SECTION

SECTION 13328
SINGLE PHASE UNINTERRUPTIBLE POWER SUPPLY

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Section includes:

1. UPS requirements for Switchgear
2. UPS requirements for SCADA Panel
3. UPS sizes shall be calculated by the Contractor and those calculations shall be submitted to the Engineer for review and approval. Allow for spare capacity as indicated in the Drawings and/or respective sections.

1.02 RELATED WORK

A. Section 16000 – Electrical – General Provisions.
B. Section 16141 – Wiring Devices

1.03 SUBMITTALS

A. Submittals shall be in accordance with Sections 13300 and 16000. Submittals shall include shop drawings and product data, for the following:

1. Product brochure
2. Bill of materials listing all components provided.
3. Deviation list indicating all propose exceptions.
4. Power single line and control schematics drawings. All external connections and their terminal block locations shall be fully detailed. All internal wiring shall include terminal numbers and color coding.
5. UPS specifications as follows:
   a. kVA rating
   b. Input and output voltage and phase
   c. Run time at full and half load.
   d. Voltage (output regulation, input tolerance, unbalance, transfer/retransfer voltage, etc.).
   e. Heat rejection
6. Instruction and replacement parts manuals
7. Name, address, and telephone number of the nearest service facility.
8. Battery specifications and warranty
9. Battery sizing calculations

1.04 REFERENCE STANDARDS

A. ANSI/IEEE C62.41- Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits

B. FCC (Federal Communications Commission) Rules and Regulations, Part 15, Subpart J, Class A certified compliance.

C. UL (Underwriters Laboratories) 1778 Listed (Rev. Jan 5, 2000), UL497A
D. CSA 22.2, No. 107.1 M95 AND 107.2
E. IEC 62040-2 Emission and Immunity
F. IEC 62040-3 (Uninterruptible Power Systems, Part 3)
G. EN 60529 Equipment Protection
H. National Electric Code (NFPA-70)
I. ISO 9001

1.05 QUALITY ASSURANCE

A. Submittals shall be in accordance with Sections 13300 and 16000. Submittals shall include shop drawings and product data, for the following:
   1. Product brochure
   2. Bill of materials listing all components provided.
   3. Deviation list indicating all propose exceptions.
   4. Power single line and control schematics drawings. All external connections and their terminal block locations shall be fully detailed. All internal wiring shall include terminal numbers and color coding.
   5. UPS specifications as follows:
      a. kVA rating
      b. Input and output voltage and phase
      c. Run time at full and half load.
      d. Voltage (output regulation, input tolerance, unbalance, transfer/retransfer voltage, etc.).
      e. Heat rejection

   6. Instruction and replacement parts manuals
   7. Name, address, and telephone number of the nearest service facility.
   8. Battery specifications and warranty
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D. CSA 22.2, No. 107.1 M95 AND 107.2
E. IEC 62040-2 Emission and Immunity

F. IEC 62040-3 (Uninterruptible Power Systems, Part 3)
G. EN 60529 Equipment Protection
H. Refer to the Drawings for additional requirements and details.

1.07 DELIVERY, STORAGE AND HANDLING

A. Refer to Electrical Specification Division.
B. Store the equipment indoors in a clean, dry, heated storage facility until ready for installation. Do not install the equipment in its final location until the facilities are permanently weather tight. Furnish, install and wire temporary electric space heaters in the equipment until the permanent heating equipment is operational. Protect the equipment at all times from exposure to moisture and chemicals.

1.08 OPERATING INSTRUCTION

A. After approval, during and after construction, operating manuals covering instruction and maintenance on each type of equipment shall be furnished in accordance with Sections 13300.

1.09 WARRANTY

A. Battery: In addition to the basic warranty, the UPS manufacturer shall warrant the batteries for a period of 36 months from the date of equipment startup or 42 months from date of receipt by end user, whichever occurs first.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. External Battery Enclosure: A separate enclosure shall be provided for housing the additional batteries required to provide the minimum run time as specified. The battery enclosure shall match the main UPS enclosure in style and color.

B. All cabling required to interconnect all components of the UPS system (including but not limited to the maintenance bypass, external battery enclosure, etc) shall be provided by the UPS manufacturer.

C. Battery protection shall be provided an internal circuit breaker disconnect. Battery cabinets shall be protected by an internal circuit breaker.

D. Current limiting circuitry shall protect the inverter output under any load condition. High speed semiconductor fusing shall protect the static bypass in the event of an output short circuit.

E. The AC output neutral shall be electrically isolated from the UPS chassis. The UPS chassis shall have an equipment ground terminal. Provisions for installation of a bonding connector shall be provided.

F. The UPS shall be suitable for installation at the location as shown on the Drawings.

2.02 PERFORMANCE REQUIREMENTS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. APC by Schneider Electric
   2. Liebert
   3. Approved Equal

B. Ratings
   1. Output power: Reference Table above.
   2. Battery runtime: 2 hours at full load.

C. The UPS shall comply with the following requirements:
   1. Environment:
      a. Ambient temperature: 0 to 40° C.
      b. Elevation: Up to 500-ft above mean sea level
      c. Relative humidity: 0 to 95 percent non-condensing

   2. System Input – Primary source:
      a. Single input: Reference table under section 1.01.A
      b. Frequency: 60 Hertz plus or minus 5 percent.
      c. Input Power Factor: 0.96 lag minimum, 50 to 100 percent load.
      d. Input Current Total Harmonic Distortion (THD): <33 percent.
      e. Input Surge Withstand Rating: Per IEEE 587/ANSI C62.41. Category A and B, (6 kV)

   3. System Output:
      a. 120 VAC
      b. Frequency: 60 Hertz plus or minus 3 Hertz.
      c. 100 percent load with 3:1 Crest Ratio
      d. Frequency Slew Rate: 1 Hz/second. (Adjustable at startup)

   4. AC to AC Efficiency: (100 percent load @ rated PF): 91 perce
   5. Acoustical Noise: Noise generated by the UPS under normal operation shall not exceed 65 dBA (60 dBA typical) at one meter from any surface, measured at 25 degrees C (77 degrees F) and full load.
   6. EMI Suppression: The UPS shall meet FCC Rules and Regulation 47, Part 15, Subpart J, for Class A devices.

2.03 MODES OF OPERATION

A. The UPS shall operate as a double conversion on-line, fully automatic system in the following modes:

1. Normal: The critical load shall be continuously supplied with filtered and regulated AC power by the inverter. The rectifier/battery chargers shall derive power from the preferred AC source and supply DC power to the inverter while simultaneously floats charging the batteries.
2. Emergency: Upon failure of the preferred ac power source, the critical load shall continue to be supplied by the inverter. Inverter power shall be supplied without switching from the storage battery. There shall be no interruption to the critical load upon failure or restoration of the preferred ac sources. If neither AC source can be restored before the battery discharges to its low voltage dropout value, the UPS shall automatically shut itself down in an orderly manner.
3. Recharge: Upon restoration of the preferred ac source, the rectifier/battery charger shall power the inverter and simultaneously recharges the batteries. This shall be an automatic function causing no interruption to the critical load.
4. Bypass Mode: The automatic bypass shall transfer the critical load to the commercial AC source, bypassing the UPS' inverter/rectifier, in the case of an overload, load fault, or internal failure.
5. Maintenance Mode: If the UPS is taken out of service for maintenance or repair, the external manual bypass switch shall be operated to transfer the load to the alternate source. This transfer shall occur without interruption.
6. Downgrade: If the batteries alone are taken out of service, they shall be disconnected by battery circuit breakers. The UPS shall continue to function and meet all of the performance criteria specified herein, except for the reserve time capability.

2.04 RECTIFIER/CHARGER

A. The term rectifier/charger shall denote the solid-state equipment and controls necessary to convert incoming AC power to regulated DC power for input to the inverter and for battery charging. The rectifier/charger shall be a solid-state SCR/IGBT power transistor type with constant voltage/current limiting control circuitry.

2.05 INVERTER

A. The inverter shall include all solid-state equipment and controls to convert DC power from the rectifier/charger or battery to a regulated AC power for powering the critical load. The inverter shall use Insulated Gate Bipolar Transistors (IGBTs) in a phase-controlled, pulse width modulated (PWM) design capable of providing the specified AC output.

B. The inverter shall be capable of supplying current and voltage for overloads exceeding 100 percent. The inverter is to provide 150 percent of full load for 30

seconds and 125 percent of full load for 2 minutes. A status indicator and audible alarm shall indicate overload operation. The UPS shall transfer the load to bypass when overload capacity is exceeded.

C. The output voltage shall be maintained to within plus or minus 4 percent.
D. The output voltage total harmonic distortion shall not be greater than 5 percent for all loads. For 100 percent rated load of 3:1 crest factor nonlinear loads, the output voltage total harmonic distortion shall not be greater than 4 percent. The output rating shall not be de-rated in kVA or kW due to the 100 percent nonlinear load with 3:1 crest factor.
E. The inverter shall use software control to adjust the output voltage from plus or minus 5 percent of the nominal value.

2.06 BATTERIES

A. The batteries shall be VRLA (valve-regulated lead-acid), sealed, maintenancefree, high-rate discharge, lead-acid cells suitable for use indoors with no off gassing, water addition requirements. Batteries shall not require special ventilation. The battery shall consist of one or more battery banks with the number of cells required to meet the requirements of the rest of these specifications.

B. Battery Design Life: 5 year

C. Run time operation of the UPS shall be accomplished using batteries mounted within the UPS enclosure and supplemented as required with an external battery enclosure to provide the battery runtime specified.

2.07 STATIC TRANSFER SWITCH

A. A static transfer switch and bypass circuit shall be provided as an integral part of the UPS. The static switch shall be a naturally commutated high-speed static (SCR-type) device rated to conduct full load current continuously. The switch shall have an overload rating adequate to clear a 20-ampere load branch circuit breaker.
B. The static transfer switch control logic shall contain an automatic transfer control circuit that senses the status of the inverter logic signals and operating and alarm conditions. This control circuit shall provide an uninterrupted transfer of the load to an alternate bypass source, without exceeding the transient limits specified herein, when an overload or malfunction occurs within the UPS, or for bypassing the UPS for maintenance.
C. The transfer control logic shall automatically turn on the static transfer switch, transferring the critical AC load to the bypass source, after the transfer logic senses any of the following conditions:
    1. Inverter overload
    2. Critical AC load over voltage or under voltage

3. Battery protection period expired
4. UPS fault condition

D. The transfer control logic shall inhibit an automatic transfer of the critical load to the bypass source if any of the following conditions are present:

1. Inverter/bypass voltage difference exceeding preset limits
2. Bypass frequency out of limits
3. Bypass out-of-synchronization range with inverter output

E. Retransfer of the critical AC load from the bypass source to the inverter output shall be automatically initiated unless inhibited by manual control. The transfer control logic shall inhibit an automatic retransfer of the critical load to the inverter if one of the following conditions exists:

1. Bypass out of synchronization range with inverter output
2. Inverter/bypass voltage difference exceeding preset limits
3. Overload condition exists in excess of inverter full load rating
4. UPS fault condition present

2.08 MAINTENANCE BYPASS

A. Internal Maintenance Bypass Switch

1. A manually operated make-before-break maintenance bypass switch shall be incorporated into the UPS cabinet to directly connect the critical load to the bypass AC input power source, bypassing the rectifier/charger, inverter, and static transfer switch.
2. All energized terminals shall be shielded to ensure that maintenance personnel do not inadvertently come in contact with energized parts or terminals. A means to de-energize the static switch shall be provided when the UPS is in the maintenance bypass mode of operation.
3. With the critical load powered from the maintenance bypass circuit, it shall be possible to check out the operation of the rectifier/charger, inverter, battery, and static transfer switch.

B. External Maintenance Bypass Switch

1. A matching external make-before-break maintenance bypass switch installed in a separate cabinet shall be provided to enable the UPS module to be completely isolated from the electrical system while the critical load is powered through the external maintenance bypass line.
2. This maintenance bypass switch shall provide make-before-break operation for transfers to and from the external maintenance bypass line with a single rotary switch.
3. The following components shall be included: input and output circuit breakers, single rotary switch with auxiliary contacts, inter-cabinet wiring, casters, and

leveling feet. Voltage matching transformers and isolation transformers shall be included as required for proper system operation.

4. This matching cabinet shall bolt to the side of the UPS module with a barrier shield to separate the two cabinets. Only front access shall be required for installation and service.

2.10 CONTROLS

A. Microprocessor-controlled circuitry: Fully automatic operation of the UPS shall be provided through the use of a microprocessor-based controller. All operating and protection parameters shall be firmware-controlled. The logic shall include system test capability to facilitate maintenance and troubleshooting. Startup, battery charging, and transfers shall be automatic functions. The UPS shall be capable of being programmed for auto-restart.

B. Graphical Display: The UPS control panel shall utilize an LCD graphical display for all UPS control, monitoring, alarming, configuration and diagnostic functions. The graphical display shall have the following features:
   1. System mimic diagram with an outlined power path and current operating mode.
   2. Menu driven display with pushbutton or soft key navigation
   3. Real time clock display (time and date)
   4. Alarm history display (with time and date stamp) for displaying a historical log of the latest 500 system events
   5. Configuration, setup and system information: Display serial communication port configuration, firmware revision and other system setup and statistic information.

C. Controls: As a minimum, the following operational controls and indicators shall be provided on the UPS control panel:
   1. UPS On/Off control
   2. Emergency Power Off control
   3. Alarm reset control
   4. Battery in operation status
   5. Rectifier / charger in operation status
   6. Load on Inverter status
   7. Load on By-Pass status
   8. UPS malfunction alarm

D. Metering: The following parameters shall be provided with 1 percent minimum accuracy metering on the UPS control panel:
   1. AC input voltage (line to line)
   2. AC input current (each phase)
   3. AC input power (kW, KVA and power factor)
   4. DC battery voltage

5. Battery current (charge and discharge)
6. AC output voltage (line to line and line to neutral)
7. AC output current (each phase)
8. AC output frequency
9. AC output power (kW, KVA and power factor)

E. Diagnostic Alarms: Specific details for all UPS alarms and status parameters shall be indicated on the graphical panel for diagnosis. As a minimum, the following parameters shall be provided in user friendly text format:
   1. Input power out of tolerance
   2. Battery charger problem
   3. Battery failed test
   4. Low battery warning
   5. Low battery shutdown
   6. DC bus over voltage
   7. Bypass frequency out of range
   8. Load transferred to bypass
   9. Excessive retransfers
   10. Static bypass switch failure
   11. UPS output not synchronized to bypass power
   12. Output under voltage
   13. Output over voltage
   14. Output over current
   15. System overload
   16. Over temperature
   17. AC input current (each phase)
   18. External shutdown control activated

F. Each UPS shall provide Ethernet connectivity to tie into the Plant Control System network. Status alarm and performance information shall be integrated with the HMI for alarming and indication purposes.

2.10 BATTERY RUNTIME/HEALTH MONITORING

A. Battery Runtime Monitoring: UPS shall monitor battery and provide status to end user of battery run time via front panel, serial communications, or both. Run time calculation to be based on load demand and analysis of battery health.

B. Battery Health Monitoring: UPS shall continuously monitor battery health and the UPS will provide warnings visually, audibly and/or via serial communications when battery capacity falls below 80% of original capacity. Battery testing may also be user-initiated via the front panel or serial communications.

2.11 FACTORY TESTING

A. Prior to shipment, the complete UPS system shall undergo the manufacturer's standard factory test.

B. Certified factory tests shall be submitted for review and approval before shipment. Certified tests shall include the UPS equipment serial number.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install and connect the equipment in accordance with the manufacturer's instructions.

B. Remove temporary lifting angles, lugs and shipping braces.

C. Touch up damaged paint finishes.

3.02 FIELD TESTING

A. Perform the following minimum test and checks before the manufacturer's field service technician is called for testing and adjustment:
   1. Verify that all connections are completed in accordance with shop drawings.
   2. Verify supply voltage and phase sequence are correct.
   3. Check mechanical interlocks for proper operation.
   4. Test ground connections for continuity and resistance.
   5. Check control circuit interlocking and continuity.

B. Submit the test plan for review and approval.

C. In the event of an equipment fault, notify the Engineer and Owner immediately. After the cause of the fault has been identified and corrected, a joint inspection of the equipment shall be conducted by the PCSI, the Contractor and the equipment manufacturer's factory service technician. Repair or replace the equipment as directed by the Construction Administrator.

3.03 ADJUSTMENT

A. Make all UPS adjustments necessary for manual and automatic operation of the entire system.

3.04 CLEANING

A. Remove all rubbish and debris from inside and around the equipment. Remove dirt, dust, or concrete spatter from the interior and exterior of the equipment using brushes, vacuum cleaner, or clean, lint-free rags. Do not use compressed air.

3.05 TRAINING

A. Provide training in accordance with Section 13303.

END OF SECTION

SECTION 13330
SUPERVISORY CONTROL AND DATA ACQUISITION SYSTEM (SCADA)

PART 1 GENERAL

1.1 SCOPE

A. This section specifies the reconfiguration of the existing SCADA panel at Evans Pump Station (Pump Station). The existing PLC and all associated PLC hardware such as power supplies, input/output modules and racks, back planes, and all other PLC related hardware and software shall be replaced with a new PLC system. All existing racks, input/output modules, connectors, connector cables, PLC power supply, and related hardware shall be replaced with a new and complete PLC system.

B. Furnish, install, test, and start-up operations of a complete control sub-system as indicated in the Plans and as specified herein. The system shall be totally integrated with the existing top-end SCADA system. The system shall be configured to operate as a distributed control system having an-open system architecture.

C. The Process Control Systems Integrator (PCSI) shall provide all hardware, software, and configuration and integration associated with the PLC based Instrumentation at the Pump Station, and PLC programming and SCADA programming modifications at the existing Control Center at Main Building. The Application System Provider (ASP) shall develop all control and monitoring code for the PLC and perform software modifications to the Top End Software (Transdyn system). The Contractor, assisted by the PCSI and ASP shall be responsible to furnish a complete and operational system in accordance with these Contract Documents:

1. Furnish, calibrate, install & commission all instruments shown in the "PID" and "I" drawings and specified in Division 13 specifications (Contract Documents).

2. Modify existing SCADA Panel by removing and replacing the existing PLC system and replacing it with a new PLC System. Perform testing of the PLC per TEST procedures in Division 13 Specifications.

3. Furnish, install and commission complete 900 MHz communication system at the Pump Station.

    a. A Schneider Electric Trio Radio, Point to Multi Point, shall be utilized for communication between the Pump Station SCP and Control Center at Main Building. Refer to Section 13515.

    b. Radio equipment and services shall be provided by the CONTRACTOR to provide communications between the P ump Station and the Control Center at Main Building. The CONTRACTOR shall install 900 MHz radio equipment including, but not limited to, radios, antennas, cables, power supplies, etc. to make the system fully operational to achieve the desired communication.

    c. CONTRACTOR shall do a path study and radio propagation study to determine the exact antenna height and orientation required for a clear line of sight and good

reliable communication path between the existing Control Center at Main Building and the Pump Station. The minimum height acceptable for the antenna shall be 50-feet regardless of the radio path study. Locating the antenna on top of the existing water storage reservoir will not be acceptable. In addition, the CONTRACTOR shall coordinate with the Owner and determine if radio signal path can be routed through existing repeaters in the SCADA network. Furnish path study and radio propagation study calculations for OWNER/ENGINEER review.

4. Furnish all required labor, materials, programming software – Schneider M340 programming software OR Rockwell Automation CompactLogix programming software AND PLC programming /configuration to connect the PLC via the radio system at the Pump Station to the existing Control Center at Main Building.

5. Perform PLC IO check out, test and commission the PLC system.

6. Furnish instruments operation and maintenance data, PLC hardware and software, and 900 MHZ communication system training plan (minimum of 3 days) to train OWNER's staff.

D. Onsite Requirements – The PCSI and ASP shall have technical staff on site as required to provide a complete and operating system.

E. Reference Standards:

1. American National Standards Institute (ANSI)/Institute of Electrical and Electronic Engineers (IEEE):

   a. C37.90.1, IEEE Standard Surge Withstand Capability (SWC) Tests for Protective Relays and Relay Systems.

   b. C37.90.2, Trial Use Standard Withstand Capability of Relay Systems to Radiated Electromagnetic Interference from Transceivers.

2. Electronic Industries Association (EIA):

   a. RS-232-C, Interface between Data Terminal Equipment and Data Communication Equipment Employing Serial Binary Data Interchange.

   b. RS-422-A, Electrical Characteristics of Balanced Voltage Digital Interface Circuits.

3. National Electrical Manufacturers Association (NEMA):

   a. ICS 1, General Standards for Industrial Control and Systems.

   b. ICS 1.1, Safety Guidelines for the Application, Installation and Maintenance of Solid State Control.
   c. ICS 4, Terminal Blocks for Industrial Use.
   d. ICS 6, Enclosures for Industrial Controls and Systems.

   e. Publication No. 250, Enclosures for Electrical Equipment (1000 V maximum).
4. National Electrical Code

5. ISA Standards

6. IEC 2 KV Isolation test

7. IEEE472/ANSI C37-90A Surge withstand capability test. 8. IEEE 802.3

F. Lightning/Surge Protection

1. Lightning/Surge protection shall be provided to protect the Supervisory Control and Data Acquisition system from induced surges propagating along the communications, signal and power supply lines. The protection systems shall not interfere with normal operation, but shall be lower than the surge withstand level for the device they are protecting and be maintenance free and self-restoring.

2. All wiring, hardware, and connections means shall comply with the National Electrical Code and/or applicable local codes.

3. Lightning/surge protection devices shall be mounted as close to the equipment they are protection as possible. Mounting guidelines will be followed as indicated in installation instructions provided by the MANUFACTURER. Wires shall be attached by means of a cable-clamping terminal block activated by a screw. Connections shall be gas-tight, and the terminal block shall be fabricated on non-ferrous, non-corrosive materials. All wiring points and plug connections shall be "touch safe" with no live voltages that can make contact with a misplaced finger.

4. Panel mounted lightning/surge protection devices shall consist of two parts; a base terminal block and a plug protection module. Base shall directly connect to DIN rail. Replacing a plug shall not require the removal of any wires nor shall it interrupt the signal. Base and plug shall have the ability to be coded to accept only the correct voltage plug. Field mounted lightning/surge protection devices shall be contained in NEMA 4X Housings.

G. Path Study for Radio Communications

1. Prior to purchasing any equipment associated with the Pump Station and Control Center at Main Building communication system, the CONTRACTOR/PCSI shall do a path study to determine the exact antenna height required for a clear line of sight and good reliable communication path between the Control Center at Main Building and the Pump Station.

2. A radio propagation study shall be included. The study shall include physically transmitting a calibrated radio signal from the Control Center at Main Building and the Pump Station. The transmitting antenna shall exhibit the same overall gain as the proposed system locating the antenna in its proposed location and height.

3. The results of the study shall be submitted to the OWNER/ENGINEER as an official submittal for approval prior to purchasing any equipment.

4. Any interference shall be noted in path study.

1.2 SUBMITTALS

A. Submittals shall conform to the requirements set forth in Section 01300 – SUBMITTALS. Preliminary submittals shall be provided within thirty days of the notice to proceed.

B. Loop diagrams shall be prepared according to ISA Standard ISA-S5.4 and using loop numbers.

C. Schematic ladder diagrams shall include all terminal blocks, hardware devices, software interlocks, software data links, and control.

D. Interconnection diagrams of all devices. Interconnection diagrams shall include terminal blocks and wire tags.

E. PLC panel layout, plans, elevations, sections, details, bill of materials, and cutsheets clearly identifying equipment being provided.

F. A schedule defining all I/O, database reference, and point of origin or destination, and PLC system internal address.

G. Submit written description of functions, loops, and logic.

H. Submit all SAMA Logic and Wiring Diagrams and ISA Logic Diagrams for all equipment requiring programming at the PLC's, with all set points and ranges indicated.

I. Complete parts list with catalog and part numbers and quantities.

J. Radio Path Study results.

K. UPS Battery Sizing Calculations. Establish UPS requirements by adding all connected loads and adding a 50% contingency factor then select next higher available size.

L. Factory Test Reports.

M. Equipment Installation Report.

N. Provide submittals for all other information requested in this specification including test forms.

1.3 QUALITY ASSURANCE

A. Suppliers Qualifications: The complete system shall be configured, programmed, and installed by one PCSI.

B. Tests: Factory Acceptance Test (FAT) and Site Acceptance Test (SAT) shall be witnessed by OWNER'S REPRESENTATIVE and also the ENGINEER. The PCSI shall test Instruments, the SCP at t h e Pump Station, Instrument Loops, 900MHz Radio systems located at Pump Station and Control Center at Main Building, PLC modifications at Pump Station panel , and SCADA (LOOKOUT) modifications at Control Center at Main Building.

C. Standards: All applicable NEC, ISA, IEEE, NEMA, UL, ANSI, IEC, FCC, FM standards shall apply. All equipment shall be new and UL listed and labeled.

D. Assembly, Storage, and Handling: The complete system, including all individual electronic component units, shall be assembled and stored in air- conditioned and heated facilities with low humidity. Once assembled and tested, the system shall be stored in air-conditioned and heated rooms.

1.4 CONTRACTOR'S QUALIFICATIONS

A. The PCSI's personnel shall have a minimum of Five years of prior experience in furnishing, installation, testing, programming, debugging, start-up, and training for systems at least as large and similar to the one in this Contract. The system installer shall have employees who are qualified technicians for the duration of the contract.

B. The CONTRACTOR shall submit for evaluation within one week of Notice to Proceed, his PCSI and ASP company résumés complete with company history, project lists, locations, owner, costs, type of system installed, and references with phone numbers. PCSI and/or ASP not meeting these qualifications shall not be accepted.

C. As a part of this contract, the instrumentation system PCSI shall assume complete system responsibility, including coordination and interfacing with the ASP and all subsystems and equipment suppliers and manufacturers.

D. The PCSI shall actively be involved in control system integration industry for the last five years. The PCSI shall not act as a broker for the project; he shall provide and be responsible for all hardware, interfacing software, training, testing, and extended warranties.

E. The PCSI shall have a local office within 200 miles of the City of San Antonio.

1.5 SYSTEM DESCRIPTION

A. Furnish and install a programmable controller-based supervisory control and data acquisition system configured as a distributed processing network as defined by the Contract Documents. Control functions shall include digital logic control, PID control, and setpoint control. Include all hardware, firmware, software, and application programming and configuration, as necessary, to make the system completely functional and operational in accordance with the Contract Documents. All necessary components and equipment which are not specifically described in the Contract Documents, but which are necessary to configure an operational distributed control system as described herein, shall be identified, furnished, and installed by the PCSI. The system provided shall be the vendor's standard; a prototype system shall not be accepted.

B. The intent is to house the new PLC in the existing cabinet but outages to install the PLC and perform any wiring needed are to be kept to less than 3-days AND will require advanced coordination and written authorization. At Contractor’s option, to minimize labor in the field, the Contractor may replace the existing cabinet with a fully assembled unit. Approved shop drawings will be required. No additional payment allowed for providing a new enclosure.

C. PCSI shall coordinate with OWNER for information to be read over data networks.

1.6 **WARRANTY**

A. The PCSI and the CONTRACTOR shall warrant to the OWNER that the equipment delivered with reference to this specification complies with this specification. The PCSI and the CONTRACTOR shall warrant the equipment as to defects in material and workmanship for a period of one year from the date of final acceptance of the project. Vendor shall include a copy of his special equipment warranty with the shop drawings. The warranty specified by this specification shall be exclusive, and in lieu of all other warranties whether written, implied, orally presented, or statutory. The AST shall warrant the integrity of the software developed and/or altered by the AST for a period of 1-year from final acceptance. During this period of Warranty, the AST shall make any changes deemed necessary to either the PLC logic and/or the Top End software including repairing or enhancing any reports or screen control/monitoring graphics.

B. Warranty for equipment shall be through the equipment MANUFACTURER and shall include the option to purchase additional service agreements/extended warranties after the initial warranty for up to five years.

C. CONTRACTOR is ultimately responsible for all requirements of this specification. PCSI shall be specifically responsible for items noted as requiring the PCSI's qualifications.

PART 2 PRODUCTS

2.1 **PROGRAMMABLE LOGIC CONTROLLERS (PLC)**

A. PLC CENTRAL PROCESSING UNIT (CPU)

1. The existing PLC and all associated PLC hardware shall be replaced with a new PLC family structured around either the Schneider M340 PLC or the Rockwell CompactLogix PLC family. Refer to Paragraph C below for acceptable part numbers.

2. Minimum memory configuration shall be 8M bytes RAM.

3. The PLC processor shall be a separate module unit capable of unit plug-in and removal from PLC backplane. The CPU shall perform and execute the logic control functions based upon the programmed logic stored in memory utilizing integral built-in preprogrammed and/or defined standard and enhanced function blocks, features, and/or options. Minimum/basic control functions, function blocks, features and/or options shall include, but not be limited to the following:

    a. Function blocks (**ladder control logic not acceptable**)
    b. latch/unlatch relays
    c. timers and counters
    d. data comparisons
    e. data transfers
    f. block data transfers or moves
    g. synchronous shift registers
    h. transitional outputs

i. master control relay
j. Bit control—read, write,
k. I/O forcing
l. BCD to binary conversion
m. Binary to BCD conversion
n. Immediate I/O update
o. Run-mode programming
p. Extended communications function/s
q. Modbus TCP/IP protocol

4. The PLCs shall be solid-state electronic units of programmable design. The PLCs shall have a stand-alone restarting capability, i.e., no reloading of programs for common logic, communications, and I/O processing at the PLC shall be required to resume operation following a loss of power. Therefore, all PLC programs shall be resident in battery backed up RAM with at least a five year battery life.

5. Solid state RAM shall be utilized for data buffering, change of state information, calculation parameters, and local control algorithms.

6. Processor shall be provided with at least one (1) Ethernet Port and it shall support Modbus TCP protocol.

B. ENHANCED FUNCTIONS

1. The following comprise the features, options, etc. for the PLC's enhanced functionality as a minimum:

a. Asynchronous shift registers, integer and floating point math calculations function blocks

b. Process control function block – (P, I, PID, etc.)

c. Matrix array/block data transfer, math functions and data compression

d. Automatic communications update

e. Remote communications – capable of operating via modem communications and local networking

f. Batch process programming supporting sequencing and scheduling programming

C. CPU BASIC SPECIFICATIONS

1. Model: Schneider M340 PLC Family OR Rockwell CompactLogix PLC family

Acceptable PLC Equipment		
Description	Schneider M340	Rockwell CompactLogix
CPU	BMXP342020	1769-L30ER
Power Supply	BMXCPS3500	1769-PA4
8-Channel Analog Current/Voltage Input Module	BMXAM10810	1769-IF8

4-Channel Analog Input with HART Protocol (Current or Voltage)		1769SC-IF41H
4-Channel Analog Current/Voltage Output Module	BMXAM0410	1769-OF4
4-Channel Analog output with HART protocol (Current only)		1769SC-OF4IH
32-Point 24 VDC Input Module	BMXDDI3202	1769-IQ32
32-Point 24 VDC Output Module	BMXDDO3202	1769-OB32
Right End Cap Terminator		1769-ECR
		IF8 IFM
Feed-Through 8-Channel Analog IFM, 3 Terminals per Input	ABE-7CPA02	1492-AIFM8-3
Select a Prewired Cable (Includes Cable Connectors at both ends)	BMXFTA300	1492-ACAB025EB69
		OF4 IFM
40-Point Feed Through Analog IFM, 3-terminals per channel	ABE-7CPA21	1492-AIFM4-3
		IQ32 IFM
40-Point Feed Through Digital IFM, Standard	ABE-7H16R21	1492-IFM40F
Prewired Cable for 1769-IQ32 Module, 40 Conductors, #22 AWG, (2) 1769-RTBN18 with 40 Pin IFM Connector, length 2.5 meters (8.2 feet)	BMXFCC303	1492-CAB025J69
		OB32 IFM
	ABE-7H16R21	1492-IFM40F
Prewired Cable for 1769-OB32 Module, 40 Conductors, #22 AWG, (2) 1769-RTBN18 with 40 Pin IFM Connector, length 2.5 meters (8.2 feet)	BMXFCC303	1492-CAB025K69
		ProSoft MVI69 Hart
Pro-Soft Technology HART Multidrop Option if Spectrum not chosen for HART		MVI69-HART

D. PLC INPUT/OUTPUT CHARACTERISTICS

1. Discrete Input Module

   a. Number of Points: 32 points in four groups of 8

   b. Input Voltage Range: -3 to 30 VDC

   c. Input Current (per point):

      1) ON: 2.0 mA min

      2) OFF: 0.5 mA max

   d. Response Time:

      1) Off/On: 1.0 msec max

      2) On/Off: 1.0 msec max

e. Model & Qty: To be furnished by PCSI.

2. Discrete Output Module

   a. Number of Points: 32 points in four groups of 8

   b. Output Voltage: 24 VDC

   c. Current Capacity: 0.5A per point, 4.0A per group, 16.0A per module
   d. Response Time:

      1) Off/On: <0.1msec

      2) On/Off: <0.1msec

   e. Model & Qty: To be furnished by PCSI.

3. Analog Input Module

   a. Number of Points: 16 channels isolated

   b. Input Type: 4-20 mA DC

   c. Data Format: 16 bit signed (twos complement)

   d. Resolution: 15 bits

   e. Channel to Channel Isolation: 750 VDC

   f. Conversion Time:

      1) Entire Module: 10 msec Max

   g. Model & Qty: To be furnished by PCSI.

4. Analog Output Module

   a. Number of Points: 8 channels isolated

   b. Output Type: 4-20 mA DC

   c. Resolution: 12 bits

   d. Channel to Channel Isolation: 500 VDC

   e. Update Time: <2 msec

   f. Model & Qty: To be furnished by PCSI

5. Backplane and Power Supply:

a. 16 Slot Backplane

b. Power Supply

c. Model & Qty: To be furnished by PCSI.

6. Miscellaneous Components:

The components described above show the major components of the PLC system. The PCSI shall supply all required additional components to support the CPU, I/O, and communications modules recommended by the PLC manufacturer. These components may include, but are not limited to terminal connectors, connector sets, Modbus taps, cabling, etc.

2.2 PLC CONFIGURATION AND PROGRAMMING SOFTWARE

A. All control code shall be developed, implemented, installed tested by the ASP.

2.3 SCADA PROGRAMMING

A. Top-end SCADA programming and development of graphics screens shall be performed by the ASP.

2.4 SURGE SUPPRESSORS

A. Surge suppressor for AC power circuits shall be UL listed or recognized. Suppressor shall be designed to withstand a maximum 10 kA test current of a 8/20 pS waveform according to ANSI/IEEE C62.41 Category C Area. Suppressor shall consist of a multistage hybrid circuit with staging inductors or resistors to properly coordinate the components. Surge protection modules shall have a visual indication of circuit integrity. Devices shall include a SPDT contact rated for at least 120 VAC, 1 amp, for remote failure indication. AC power surge suppressor shall be Phoenix Contact Mains-Plugtrab Series or approved equal.

B. Coordinate with Section 13327.

2.5 POWER SUPPLY

A. The power supply shall be fully enclosed and provide screw terminations by means of a cable clamping terminal block activated by a screw. Connections shall be gas-tight, and the terminal block shall be fabricated of non-ferrous, non-corrosive materials. All wiring points shall be touch-safe with no live voltages that can make contact with a misplaced finger. Power supply shall have integral metal mounting feet to attach to 35-mm DIN-rail.

B. The power supply shall conform to UL 508C standards allow use at the full rated current. The power supply shall have a visual indicator for applied power. Operating temperature range shall be -25°C to 70°C. Power supply shall have means of limiting DC current in case of short circuit and shall automatically reset when fault is corrected. Power supply shall be

able to be run in parallel mode without external circuitry to provide redundancy. Residual ripple shall not exceed 150 mV peak to peak.

C. Coordinate with Section 13327.

2.6 PLC CABINET

A. Modify existing cabinet in the field. At Contractor's option, to minimize labor in the field, the contractor may supply a new, fully assembled cabinet including all devices and functions needed. No additional payment will be considered for a new console.
B. Develop a complete set of shop drawings identifying all items needed for a complete and functional system. Identify any existing item which is to remain.
C. Clearly indicate all new and reused equipment.
D. Drawings included in this bid set are diagrammatic in nature and do not include all details.
E. Install new switches, lights and labels in front panel as indicated in the Drawings
F. Outages to perform modification will be allowed but they shall be coordinated with the Owner. Submit an implementation schedule at least 5-weeks in advance. Request outages in writing at least 3-weeks prior.
G. Remove existing PLC equipment and replace with new system. All PLC related equipment shall be new.
H. The reuse of existing relays will be permitted. However, the Contractor shall make sure all existing relays are in good working condition.
I. New interposing relays, as needed, shall be SPDT, shall have 24 VDC coils, shall each have a pilot light indicating energized coil, and shall each be mounted in a plug in socket with relay retainer clip and screw terminals. Relays shall be Square D KU13M1P14 or approved equal.

J. Instrument panel wiring shall be as follows:

    a. Single conductor wire shall be stranded, tinned 18 AWG and MTW insulation, as manufactured by American Insulated Wire or approved equal. Color-coding shall be purple for ungrounded conductors and white for grounded conductors.

    b. Pair shielded cable for 4-20 mA DC loops shall be as specified in Specification Section 16120 – 600 VOLT WIRES AND CABLES.

    c. Each conductor terminated under a screw head shall have a crimp-on spade terminal applied to its end prior to its termination.

    d. Each conductor has its own number, and no number is used more than once.

    e. The number of each wire is placed at both ends of the wire next to its end according to wire tagging instructions as specified in Specification Section 16120 – 600 VOLT WIRES AND CABLES.

    f. The wire numbers, as actually installed, match the numbers on the shop drawings, O&M manuals, wiring diagrams and interconnection diagrams for this instrument panel.

    g. Wiring shall be run enclosed in plastic wireway wherever possible. Wireways shall be installed as required to enclose panel wiring. Where the use of plastic wireway is

not practical, conductors shall be bundled and run open. Conductors run open shall be bundled and bound at regular intervals not to exceed 6 inches with nylon ties, or approved equal. Wires within a bundle are to be run parallel to one another and not twisted. Bundles shall have a uniform appearance, circular cross section, and shall be securely fastened to the panel framework. Conductors carrying different voltages that are from the same source may occupy the same wireway provided all are insulated for the maximum voltage of any conductor in the wireway. Wiring carrying voltages that originate at different sources shall not run in the same wireway.

h. Terminal blocks shall be installed for wire terminations and shall be capable of mounting on a 35mm DIN-rail. Terminal blocks shall have a method of labeling for easy identification. Typewritten labels shall denote terminal block numbers and shall match numbers shown on shop drawings, O&M manuals and wiring diagrams. Twenty-five percent additional terminals, not including spare terminals associated with future I/O (future pump motors, pressure switches and transmitters, valves and flow meter) points, shall be provided for OWNER's use. Terminal blocks shall be available with screw clamp technology and be made of a non-corrosive material. The metal body shall contain a serrated pressure plate that will provide a gas-tight connection with the conductor. All terminal block wiring points shall be "touch safe" with no live voltages that can make contact with a misplaced finger.

K. Terminal blocks shall be Phoenix Contact UT Series, Allen Bradley 1492- H1 Series or approved equal.

L. Before completion of the project, develop a set of drawings, 11-inch x 17-inch control schematic and an 11-inch x 17-inch wiring diagram or diagrams and furnish to the Owner. The wiring diagram shall contain all wire numbers, device names and terminal numbers. Drawings shall be laminated in clear plastic for preservation of the drawings. All printed text shall be 1/16” in height or larger.

M. Enclosure shall be provided with an enclosed switched fluorescent light and 120 VAC grounded duplex receptacle.

N. All equipment shall be mounted in such a manner that all maintenance may be accomplished with easy access through the SCP cabinet doors.

O. Provide Hoffman or equivalent enclosures in the event that existing SCADA panel is replaced.

P. Cabinets shall be painted standard manufacturers color on top of a primer coat. Primer coat without paint is not acceptable.

PART 3 EXECUTION

3.1 INSTALLATION

A. All work shall be in accordance with MANUFACTURER's recommended practices. Care shall be exercised to avoid damage to equipment during installation. Damaged equipment shall be replaced by CONTRACTOR at no expense to the OWNER.

B. System equipment shall be installed where indicated in the CONTRACT documents. Power and signal connections between components shall provide the specified functions. Install according to equipment MANUFACTURER's instructions.

3.2 PROGRAMMING

A. All programming will be developed at the Application Services Provider (ASP) shop by qualified technicians or engineers.
B. All software shall be tested and simulated at the ASP's office prior to being installed in system.
C. Testing of software and control graphic screens shall be demonstrated to the Owner prior to integration into overall SCADA system.

3.3 DOCUMENTATION

Following delivery of the equipment MANUFACTURER, in the presence of the ENGINEER, shall demonstrate operation of the complete system.

3.4 TESTS

A. The PCSI shall assemble and test all systems and subsystems at his shop whenever possible.

B. All elements of the SCADA system, both hardware and software, shall be tested to demonstrate that the total system satisfies all of the requirements of the Specifications.

C. The PCSI and the CONTRACTOR shall furnish and install the field instruments, PLC, input/output Modules, and interface equipment in a schedule to meet the construction sequencing.

D. As a minimum, the testing shall include the following:

1. Operational Readiness Test (ORT)

2. Factory Acceptance Test (FAT)

3. 7-Day Site Acceptance Test (SAT)

E. Each test shall be in the cause and effect format. The person conducting the test shall initiate an input (cause) and, upon the system's or subsystem's producing the correct result (effect), the specific test requirement will have been satisfied.

F. All tests shall be conducted in accordance with ENGINEER-approved procedures and documented. Each specific test to be performed shall be described and a space provided after it for Sign-off by the appropriate party after its satisfactory completion.

G. Copies of Sign-off test procedures, forms, and checklists will constitute the required test documentation.

H. Provide all special testing materials and equipment. Wherever possible, perform tests using actual process variables, equipment, and data. Where it is not practical to test with real

process variables, equipment, and data, provides suitable means of simulation. Define these simulations techniques in the test procedure.

I. Coordinate all testing with other Trades, the OWNER, and the ENGINEER.

J. The OWNER's ENGINEER and/or designated electricians will actively participate in many of the tests. The OWNER and/or ENGINEER reserves the right to test or retest any and all specified functions whether or not explicitly stated in the approved test procedures. The OWNER and/or ENGINEER reserve the right to observe and/or inspect the work during any phase.

K. The OWNER's decision shall be final regarding the acceptability and completeness of all testing.

3.5 OPERATIONAL READINESS TEST (ORT)

A. General: Prior to start-up, the installed system shall be certified (inspected, tested, and documented) that it is ready for operation. Download all databases on job computers from this test onwards. The OWNER and ENGINEER shall be notified when ORT starts. Copies of ORT forms that have been signed off by the CONTRACTOR/PCSI shall be copied and sent to the OWNER and ENGINEER on a daily basis for record purposes only. No signature by the ENGINEER or OWNER is required for ORT forms.

B. Loop/Component Inspections and Tests: The system shall be checked for proper installation, calibrated, and adjusted on a loop-by-loop and component-by-component basis to ensure that it is in conformance with related submittals and these specifications. Actual real-time signals generated from the field devices shall be used. Simulation of field signals shall not be permitted. This test is intended to actually operate the entire process and to find and correct all real-time operational deficiencies.

1. The Loop/Component Inspections and Tests shall be implemented using ENGINEER-approved forms and checklists.

a. Each loop shall have a Loop Status Report to organize and track its inspection, adjustment, and calibration. These reports shall include the following:

1) Project name
2) Loop number
3) Tag number for each component
4) Check-offs/sign-offs for each component
   a) Tag/identification
   b) Installation
   c) Termination – wiring
   d) Termination – tubing
   e) Calibration/adjustment
5) Check-offs/Sign-offs for the loop
   a) Panel interface terminations
   b) I/O interface terminations
   c) I/O signal operation
   d) Inputs/outputs operational: received/sent, processed, adjusted
   e) Total loop operational

f) Space for comments
g) Space for Sign-off by CONTRACTOR/PCSI

b. Each active analog subsystem element and each I/O module shall have a Component Calibration Sheet. These sheets shall include the following:

1) Project name
2) Loop number
3) Component tag number or I/O module number
4) Component code number analog system
5) Manufacturer (for analog system element)
6) Model number/serial number (for analog system)
7) Summary of functional requirements, for example:
   a) For indicators and recorders: Scale and chart ranges
   b) For transmitters/converters: Input and output ranges
   c) For computing elements: Function
   d) For controllers: Action (direct/reverse) control modes (PID)
   e) For switching elements: Unit range, differential
   f) (fixed/adjustable), reset (auto/manual)
   g) For I/O modules: Input or output
8) Calibrations; for example:
   a) For analog devices: Required and actual inputs and outputs at 0, 25, 50, and 100 percent of span, rising and falling
   b) For discrete devices: Required and actual trip points and reset points
   c) For controllers: Mode settings (PID)
   d) For I/O modules: Required and actual inputs or outputs of 0, 10, 50, and 100 percent of span, rising and falling
9) Space for comments
10) Space for Sign-off by the CONTRACTOR/PCSI.

2. Maintain the Loop Status Reports and Component Calibration Sheets at the jobsite and make them available to the ENGINEER and OWNER upon request.

3. These inspections and tests do not require witnessing. However, the ENGINEER will review the Loop Status Reports and Component Calibration Sheets and spot-check their entries periodically and upon completion of the Operational Readiness Test. Any deficiencies found shall be corrected.

3.6 FACTORY ACCEPTENCE TEST (FAT)

A. The Witnessed Factory Acceptance Test shall be performed on the new control panels.

B. The purpose of the test shall be to verify the functionality, performance, and stability of the hardware. The system must operate continuously for 100 hours without failure before the test shall be judged successful. Successful completion of this test, as determined by the ENGINEER, shall be the basis for approval of the system to be shipped to the site. NOTE: Prepare and submit for approval a test procedure to define this 200-hour burn-in test.

C. The various tests performed during the Factory Acceptance Test shall be designed to demonstrate that hardware and software fulfill all the requirements of the Specifications and Contract drawings. The test conditions shall resemble, as closely as possible, the actual

installed conditions. Any additional hardware or software that may be required to successfully verify system operation shall be supplied at no cost to the OWNER.

D. Tests to be performed shall include, but not be limited to, the following:

1. Demonstrate operability of all equipment

2. 100 percent point check of I/O, including wiring

3. Demonstrate the ability for each device to read and write to and from designated files from other workstations on the LAN

4. Demonstrate communication failure and system restart

5. Demonstrate the ability of each workstation to print alarm/events on the local printer.

E. During the test for a period of time equal to at least 20 percent of the test duration, the ENGINEER's and/or OWNER's REPRESENTATIVE shall have unrestricted access to the system.

F. All deficiencies identified during these tests shall be corrected and retested prior to completing the Factory Acceptance Test as determined by the OWNER/ENGINEER.

G. The following documentation shall be made available to the ENGINEER at the test site both before and during the Factory Acceptance Test:

1. All Contract Drawings and Specifications, addenda, and change orders

2. Master copy of the test procedure

3. Bill of material of the computer/PLC/LAN equipment to be tested Including make, model, and serial number

4. Design-related hardware submittal applicable to the equipment being tested

I. All test data and procedures followed during testing shall be logged and certified copies of the logs shall be provided to the ENGINEER and OWNER.

J. Two SAWS employees will witness shop tests at the Contractor's expense and inspect and check the testing equipment used. The manufacturer shall include in the total price of his equipment the costs of air transportation from San Antonio International Airport to the test facility, a rental car, lodging for two people in separate rooms. Any part of the day shall be taken as a full day. Manufacturer shall determine the total number of days required to witness the factory tests and any required retests. The Owner will deduct the total amount for witnessing the factory test and any required retests from the total compensation due to the Contractor through a Change Order. Contractor shall furnish Owner an Agenda and test plan at least 21 days in advance of the time that each shop test will be made. If the system fails to operate properly or fails to meet the specified conditions or requirements during testing, the CONTRACTOR/PCSI shall make adjustments and modifications as required and run the tests again. The Contractor will be responsible for any expenses incurred by Owner's personnel to witness equipment that does not pass.

3.7 **14-DAY SITE ACCEPTANCE TEST**

A. All database errors must be corrected prior to the start of the 14-Day Site Acceptance Test. The 14-Day Site Acceptance Test will not be considered successful until all database items are correct.

B. Any malfunction during the test shall be analyzed and corrections made by the CONTRACTOR/PCSI. The ENGINEER and OWNER will determine whether any such malfunctions are sufficiently serious to warrant a repeat of the test. The cost of a retest shall be borne by the CONTRACTOR as specified.

C. After completion of the Functional Demonstration Test and Plant Start-up, the CONTRACTOR/PCSI shall be responsible for operation of the entire System for a period of 30 consecutive days, under conditions of full plant process operation, without single non-field repairable malfunction.

D. During this test, CONTRACTOR's/PCSI's personnel shall be present as required. The CONTRACTOR/PCSI shall provide personnel for this test who have an intimate knowledge of the hardware and software of the system and also are familiar with the overall plant process. The SUPPLIER shall be on call during the 14-Day Site Acceptance Test.

E. While this test is proceeding; the OWNER shall have full use of the system. Only plant operating personnel shall be allowed to operate equipment associated with live plant processes.

F. Any malfunction, during this 14 consecutive day test period, which cannot be corrected within 24 hours of occurrence by the CONTRACTOR's/PCSI's personnel, or more than two similar failures of any duration, will be considered as a non-field-repairable malfunction.

G. Upon completion of repairs, by the SUPPLIER, the test shall be repeated as specified herein.

H. In the event of rejection of any part or function, the SUPPLIER shall perform repairs within 5 days or replacement within 14 days.

I. Upon successful completion of the 14-Day Site Acceptance Test, approval of all as-built drawing and O&M Manuals, completion of all related OWNER training, and delivery of all spare, expendable, and test equipment, the systems shall be considered substantially complete and the warranty period shall commence.

3.8 **ON-SITE SUPERVISION**

The SUPPLIER shall provide, on-site, an experienced resident engineering manager to supervise and coordinate all of the on-site activities. This resident engineering manager shall be on-site as required during the total period to affect all the activities relating to the project.

3.9 **START-UP AND TESTING TEAM**

The SUPPLIER shall provide, on-site, a team of experienced engineering, technician, trades personnel, and software/configuring personnel during the total construction period to:

1. Thoroughly check the installation, termination, and adjustment of all the subsystems and their components.

2. Perform and complete all on-site tests.

3. Provide start-up assistance.

END OF SECTION

SECTION 13515

COMMUNICATIONS INTERFACE EQUIPMENT

PART 1 GENERAL

1.1 SCOPE OF WORK

A. This section of the specifications describes the requirements for communications interface equipment to be furnished, installed, commissioned and tested.

B. All equipment described herein shall be submitted and furnished as an integral part of assemblies specified in Division 13 Instrumentation and Controls sections and elsewhere within other specifications.

1.2 RELATED WORK

A. Section 13300 Instrumentation and Controls-General Provisions

B. Section 13325 Instrumentation and Controls Control Panels

1.3 SUBMITTALS

A. Submittals for equipment specified herein shall be made as a part of equipment furnished under other sections. Individual submittals for equipment specified herein will not be accepted and will be returned un-reviewed.

B. Submit catalog data for all items supplied from this specification Section as applicable. Submittal shall include catalog data, functions, ratings, inputs, outputs, displays, etc., sufficient to confirm that the equipment provides every specified requirement. Any options or exceptions shall be clearly indicated and located in the beginning of the submittal package.

1.4 REFERENCE CODES AND STANDARDS

A. Instrumentation equipment, materials and installation shall comply with the National Electrical Code (NEC and with the latest edition of the following codes and standards:

1. NEMA ICS 1-101 Diagrams, Designations and Symbols
2. ANSI/ISA-5.06.01-2007 - Functional Requirements Documentation for Control Software Applications.
3. ISA-TR20.00.01-2001 - Specification Forms for Process

Measurement and Control Instruments Part 1: General Considerations Updated with 27 New Specification Forms in 2004-2005.

4. ISA-5.4-1991 Instrument Loop Diagrams.

5. The International Society of Automation (ISA)

6. Underwriters Laboratories (UL)

7. UL 508, the Standard of Safety for Industrial Control Equipment

8. The following shall apply for broadband radio devices specified in this section:

	3.3-3.8 GHz	4.9 GHz	5.2-5.3 GHz	5.4 GHz	5.8 GHz
FCC	FCC part 90	Part 90	Part 15	Part 15	Part 15
ETSI	EN 302 326-2	ETSI 301 893	ETSI 301 893	ETSI 301 893	ETSI 302 502
Canadian	RSS 192	RSS-111	RSS-210	RSS-210	RSS-210

B. All equipment and installations shall conform to applicable federal, state, and local codes.

C. All equipment shall comply with the requirements of the National Electric Code and Underwriters Laboratories (UL) where applicable.

D. Each specified device shall also conform to the standards and codes listed in the individual device paragraphs.

1.5 QUALITY ASSURANCE

A. The manufacturer of this equipment shall have produced similar equipment for a minimum period of five (5) years. When requested by the OWNER/Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

B. Equipment submitted shall fit within the space or location shown on the Drawings. Equipment which does not fit within the space or location is not acceptable.

C. For the equipment specified herein, the manufacturer shall be ISO 9001 2000 certified.

1.6 WARRANTY

A. The Contractor shall warrant the equipment to be free from defects in material and workmanship for 2 years from date of acceptance of the equipment containing the items specified in this Section. Within such period of warranty the PCSI shall promptly furnish all material and labor necessary to return the equipment to new operating condition. Any warranty work requiring shipping or transporting of the equipment shall be performed by the PCSI at no expense to the OWNER.

PART 2 PRODUCTS

2.1 MODULAR INDUSTRIAL ETHERNET SWITCH LAYER 3 (PLC Control Panels)

A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:

1. Cisco
   a. Model: IE3000 Series

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

C. Environmental

1. Operating temperature: -40° F to 167° F
2. Operating humidity: 10 – 95% non-condensing
3. Storage temperature: -13 to 185° F
4. Electrical classification: intrinsically safe for UL 1602 Class I Division 2 A-D locations

D. Physical

1. Enclosure: NEMA TS-2.
2. Fully modular construction
3. Power supply: 120 VAC from UPS source
4. Microprocessor-based managed type.
5. DIN rail mountable capability.

E. Functional Performance

1. Per port status LED indication

2. Port based Ethernet MAC security individually port configurable

3. Wire speed switching, 16 Gigabit switching fabric

4. HSRP protocol support

5. Cisco Express Forwarding Hardware Routing Architecture

6. SNMPv1, SNMPv2c, and SNMPv3 Support

7. 802.1d Spanning Tree Protocol Support

8. HTTPS accessible

9. Common Industrial Protocol (CIP) Management Objects SupportSmart Templates for EtherNet/IP

10. PROFINET v2 certification

11. Alarm contacts for external fault notification

12. POE Ports shall be furnished at all well sites for security equipment supplied under separate package.

13. 10/100 BaseT ports with RJ-45 connectors for Category 6 cabling

14. Switch configuration on removable/ configurable via Flash Memory module

15. LC type fiber optic connectors for 100BaseFX, 1000BaseSX for multimode fiber and 1000BaseLX for single mode fiber as shown on the drawings

16. Fully managed switch capability

F. Options and accessories required:

1. Provide maximum installation space for additional future modules for each switch location.

2. Provide twenty (20) percent spare port capacity for each port type.

G. Spare Assemblies

1. Provide 1 spare module of each type used

2.2 INDUSTRIAL SERIAL TO ETHERNET/ PROTOCOL CONVERTER

A. Subject to compliance with the contract documents, the following manufacturers are acceptable:

1. Digi One IAP Series

2. Moxa MGate 5105-MB-EIP Series

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

C. Environmental

1. Operating temperature: 32° F to 104° F

2. Operating humidity: 20 – 95% non-condensing

3. Storage temperature: -40 to 158° F

D. Physical

1. Power supply: 24 VDC

2. Microprocessor based managed type.

3. DIN rail mountable.

4. Class 1 Division 2 rated

E. Functional Performance

1. Per port status LED indication

2. Wire speed switching.

3. 10/100BaseT ports with RJ-45 connectors for Category 6 cabling.

4. ST or SC type fiber optic connectors for 100BaseFX, 1000BaseSX for multimode fiber and 1000BaseLX for single mode fiber as shown on the drawings

5. RS-485 ports with terminals. Selectable link termination (100 ~120 Ohms)

F. Options and Accessories Required:

1. The protocol interface shall implement the following:

a. Transfer of basic I/O data via User Datagram Protocol (UDP)- based implicit messaging

b. Uploading and downloading of parameters, set points, programs and recipes via TCP (i.e., explicit messaging.)

c. Polled, cyclic and change-of-state monitoring via UDP, such as RPI and COS in Allen Bradley's ControlLogix control systems

d. One-to-one (unicast), one-to-many (multicast), and one-to-all (broadcast) communication via TCP

e. Use of well-known TCP port number 44818 for explicit messaging and UDP port number 2222 for implicit messaging

2. The media protocol converter shall meet the following criteria:

a. The converter shall support 10/100Base-T Ethernet. The serial port speed (baud rate) shall support 230 kbps. The protocol shall support Modbus TCP, EtherNet/IP, DF1, and Modbus RTU/ASCII. Protocol shall be Web Browser configurable.

2.3 ETHERNET RADIO

A. Subject to compliance with the contract documents, the following manufacturers are acceptable:

1. Schneider Electric, J-Series Ethernet Trio Radio
2. Model #: TBURJR900-00002EH0, No exceptions

B. FCC/IC Listed

C. AES CSA License Free band 902-928 MHz

D. Encryption Enabled

2.4 ETHERNET AND RADIO SYSTEM COMMUNICATION CABLES

A. Subject to compliance with the contract documents, the following manufacturers are acceptable:

1. Belden

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

C. Cables for Ethernet: Category 5e Above Grade Cable: Sunlight and Oil

Resistant U/UTP 003 Cable, non-plenum.

1. Conductors: 4 bonded pair 24 AWG Bare Copper
2. Insulation: Polyolefin
3. Jacket: PVC with 600 volt rated color of jacket to match SAWS IS color code as follows.
    a. Green: Primary SCADA
    b. Yellow: Secondary SCADA
    c. Blue: Corporate Network, including VOIP Phones
    d. White: Security System
4. Red: Fire Alarm-Related
5. Transmission Standards: ANSI/TIA568C
6. Nominal Velocity of Propagation: 69%
7. Flame Test Method: CMR Regulatory Compliance
8. Manufacturers: Belden 7957A

D. Cables for Ethernet: Category 6 Above Grade Cable: Sunlight and Oil Resistant U/UTP 003 Cable, non-plenum.

1. Conductors: 4 bonded pair 23 AWG Bare Copper
2. Insulation: Polyolefin
3. Overall Cabling Separator Material of Foamed Polyolefin Tape
4. Jacket: PVC with 300 volt rated Color of jacket to match SAWS IS color code.
    a. Green: Primary SCADA
    b. Yellow: Secondary SCADA
    c. Blue: Corporate Network, including VOIP Phones
    d. White: Security System
    e. Red: Fire Alarm-Related
5. Transmission Standards: Category 6 - TIA 568.C.2
6. Nominal Velocity of Propagation: 72 %

7. Flame Test Method: UL1666 Vertical Riser

8. Manufacturers: Belden 7940A

E. Cables for Ethernet: Category 5e Below Grade Outdoor and Under grade locations Cable: Sunlight and Oil Resistant Category 5e U/UTP 003 Cable, non- plenum.

1. Conductors: 4 pair 24AWG Bare Copper

2. Insulation: Polyolefin

3. Shield: 100 percent aluminum foil polyester tape with drain wire

4. Jacket: LLPE (Linear Low Density Polyethylene) with 300 volt rated and manufacturer's identification

5. Misc.: NEMA WC-63.1, listed for outdoor and wet locations use

6. Manufacturers: Belden 7937A

2.5 ETHERNET AND RADIO SYSTEM SURGE PROTECTOR

A. Subject to compliance with the contract documents, the following manufacturers are acceptable:

1. Transtector

2. PolyPhaser

3. Phoenix Contact

4. Cooper Bussman

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

C. Environmental

1. Operating temperature: -40° F to 176° F

2. Operating humidity: 95% non-condensing for indoor applications

3. Storage Temperature: -40 to 176° F

D. Physical

1. DIN rail mountable indoors

2. I/O connectors: RJ-45

3. Power over Ethernet POE+ to IEEE802.3 at up to 57 VDC

E. Functional Performance

1. Protection: handles 100 or more lightning strikes at surge levels of 8/20uSec at 6kV/3kA

2. Standard: Compliant to IEC61000-4-5.

2.6 ANTENNA

A.	Type:	Yagi
B.	Frequency:	890-960 MHz
C.	Gain:	12 dBi
D.	Impedance:	50 ohms
E.	VSWR:	<1.5:1 maximum (1.35:1) typical
F.	Front-to-back ratio:	>20 dB
G.	Maximum Input Power:	100 watts (at 50 deg C)
H.	H-Plane beamwidth:	48 degrees (1/2 power)
I.	E-Plane beamwidth:	40 degrees (1/2 power)
J.	Connector:	N Female
K.	Weight:	3 lb
L.	Dimensions:	28X10X4.5 inches
M.	Windload	at 93 mph
N.	Front/side:	3 lbf/4 lbf
O.	Manufacturer:	Kathrein or approved equal
P.	Model:	TY-900

2.7 RADIO TOWER

A. Subject to compliance with the contract documents, the following manufacturers are acceptable:

1. Rohn 65G
2. Sabre 1800 series
3. Approved equal

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

C. Provide radio towers as shown on the drawings. At a minimum, the towers provided shall be as follows:

1. Each section shall be double bolted constructed of ASTM 123 hot dipped galvanized steel.

2. 50-foot minimum height.

3. 90 MPH rating (no ice)

4. Free standing and self-supporting.

5. Tower sections shall have a 12-½" face.

6. Tower shall be made up of a base section, midsection and top sections.

D. The radio tower shall be a self-supporting structure. The final tower and base design shall be performed by the contractor and is to be certified by a Professional Engineer licensed in the State of Texas to be compliant with TIA-222-G, Structural Standard for Antenna Supporting Structures and Antennas. The tower and base design, along with this certification, shall be submitted by the contractor.

E. Furnish and install ground wire, ground lugs & clamps, ground rods as required to meet or exceed the manufacturer's grounding recommendations.

F. Options and Accessories Required:

1. Provide Class A safety climb equipment for each tower.

2.8 SPARE PARTS

A. Provide the following spare parts for each communication panel in the quantities specified:

1. One box replacement fuses, all types and sizes used.

2. One replacement port interfaces and patch cables of each type used.

B. Spare parts shall be boxed or packaged for long term storage. Identify each item with manufacturer's name, description and part number on the exterior of the package.

PART 3 EXECUTION

3.1 INSTALLATION

A. All equipment specified herein shall be factory installed in an overall assembly, field adjusted, tested and cleaned as an integral part of equipment specified elsewhere in these Specifications.

B. Coordinate with Antenna manufacturer and submit grounding equipment and methods and submit to Engineer for approval prior to installation.

END OF SECTION

SECTION 16060

ACCEPTANCE TESTING AND CALIBRATION

PART 1- GENERAL

1.1 WORK INCLUDED

A. This section provides the guidelines for testing of electrical equipment, cable, protective relays, circuit breakers, motor control centers, motors, and related apparatus to be used for the site electrical distribution system. This specification does not release the Contractor or vendor from any further testing required for safe commissioning of the equipment. All test results shall be completely recorded in a legible and neat format and submitted to Engineer/Owner for approval (see Part 1.03).

B. Contractor will provide and pay the cost of electrical testing by an independent testing firm. Testing firm shall have a minimum of five years of experience in providing acceptance testing for water/wastewater treatment plants. Testing shall be performed per the latest InterNational Electric Testing Association Standards (NETA) standard. This cost will be included in the Contract Bid.

C. The Contractor shall immediately correct all deficiencies discovered during testing by the independent firm. The independent testing firm has the final say on the acceptance of the equipment, if testing determine the equipment is deficient, contractor shall be responsible to fix the deficiency even if the manufacturer said the equipment is satisfactory.

D. The Contractor to update the protective device settings with the final power system study acceptance.

1.2 REFERENCE STANDARDS

A. InterNational Electric Testing Association Standards (NETA) for acceptance testing of Electrical Distribution Apparatus, Publication 2.001, and IEEE Publication No. 141, are hereby made a part of this section, unless otherwise modified herein.

B. Related equipment specification in all section of Division 16.

C. NETA Maintenance Testing Specifications for electrical power distribution equipment and system (latest edition).

1.3 SUBMITTAL

A. The testing result shall be summarized in a final report certified by the testing technician and sealed by an engineer licensed in the State of

Texas. Report shall be submitted per division 1 requirement.

B. The report shall include the following sections:

1. Description, purpose, basis and scope of the work.

2. Field data sheet showing all visual, mechanical and electrical inspection done on the equipment. The data sheet shall show check mark and values of all the testing done, a description of the instrument used for testing.

3. A summary of the deficiency, concern, repairs and recommendation.

4. A table showing the final settings of all the adjustable equipment tested.

5. All the testing values shall be in accordance with the latest NETA standard.

C. Literature and drawings describing the equipment in sufficient detail, including parts list and materials of construction, to indicate full conformance with the Specifications.

D. Submit a letter certifying full and complete compliance with the Specifications, Drawings and other project requirements. The letter shall list any exceptions or deviations from specified requirements, if any and reasons for same. Exceptions or deviation shall also be clearly marked in a separate color in submittals.

PART 2- PRODUCTS - NOT APPLICABLE PART 3- EXECUTION

3.1 TESTS

A. All tests, other than Low Voltage Systems and Equipment, shall be supervised by the Engineer/Owner and the contractor. Contractor shall give a one week notice of all scheduled tests to the Engineer/Owner in writing.

B. Contractor shall notify the Engineer/Owner of scheduled dates of electrical equipment installation completion. Equipment testing shall be coordinated at this time by Contractor with Engineer/Owner and appropriate Manufacturer's Representatives.

C. Under this specification the Contractor shall perform the electrical tests on specified equipment and as specified under Part 3, Execution. The Contractor shall supply all equipment required to perform all testing responsibilities.

3.2 EXECUTION

A. Preparatory Work

1. Prior to the testing of any specific piece of equipment, the Contractor shall remove all shipping hardware and inspect for broken or missing parts and proper connections in accordance with the manufacturer's instructions.

B. Visual and Mechanical Inspection

1. Prior to any electrical testing Contractor shall perform a visual and Mechanical inspection as specified in the latest NETA standard.

C. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan on each major part piece of equipment (MCC, transformer tap box, VFD). Remove front panels so joints and connections are accessible to portable scanner. Infrared testing shall be performed on loaded equipment.

1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan 11 months after date of Substantial Completion.

2. Instruments, Equipment, and Reports:
   a. Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

3. Prepare a certified report that identifies equipment included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.3 DEVICE

A. Air switches – Low voltage

1. Perform insulation-resistance tests on each pole, phase-to- phase and phase-to-ground for one (1) minute. Test voltage and minimum resistances should be in accordance with NETA Standard.

2. Perform contact-resistance test across each switch blade and fuse holder, or perform thermographic survey in accordance with the lastest NETA Standard.

B. Motor Control Centers

1. Perform resistance measurements through bolted connections with a low- resistance ohmmeter, if applicable, in accordance with NETA Standard.

2. Perform tests on each circuit breaker as described below.

C. Transformers – Dry-type

1. Inspect for physical damage, broken insulation, tightness of connections, defective wiring, and general condition.

2. Thoroughly clean unit prior to making any tests.

3. Perform insulation-resistance test. Calculate polarization index. Measurements shall be made from winding-to-winding and windings-to- ground. Test voltages and minimum resistance shall be in accordance with NETA Standard. Results to be temperature corrected in accordance with NETA Standard.

4. Verify that the transformer is set at the specified tap.

D. Cables – low-voltage, 600V maximum

1. Perform resistance measurements through bolted connections with low- resistance ohmmeter, if applicable, in accordance with latest NETA standard.

2. Perform insulation-resistance test on each conductor with respect to ground and adjacent conductors. Applied potential shall be 500 volts dc for 300 volt rated cable and 1000 volts dc for 600 volt rated cable. Test duration shall be one minute.

3. Perform continuity tests to insure correct cable connection.

E. Surge Protection Devices:

1. Perform resistance measurements through bolted connections with a low- resistance ohmmeter, if applicable, in accordance with NETA Standard.

2. Perform an insulation-resistance test at voltage levels in accordance with NETA Standard.

3. Test grounding connection in accordance with NETA Standard.

F. Circuit Breakers – Insulated Case/Molded Case

1. Perform resistance measurements through bolted connections with a low- resistance ohmmeter, if applicable, in accordance with lateset NETA standard.

2. Perform insulation-resistance tests on each pole, phase-to-phase and phase-to-ground with the circuit breaker closed and across each open pole for one minute. Test voltage shall be in accordance with manufacturer's published data or latest NETA standard.

3. Perform a contact/pole-resistance test.

4. Perform adjustments for final setting in accordance with coordination study.

5. Determine long-time pickup and delay by primary current injection.

6. Determine short-time pickup and delay by primary current injection.

7. Determine ground-fault pickup and time delay by primary current injection.

8. Determine instantaneous pickup by primary current injection.

9. Perform minimum pickup voltage test on shunt trip and close coils in accordance with latest NETA standard.

10. Verify correct operation of any auxiliary features such as trip and pickup indicators, zone interlocking, electrical close and trip operation, trip-free, and antipump function.

11. Verify operation of charging mechanism.

G. Circuit breakers – Air, low voltage, power

1. Perform resistance measurements through bolted connections with a low- resistance ohmmeter, if applicable, in accordance with latest NETA standard.

2. Perform insulation-resistance tests on each pole, phase-to-phase and phase-to-ground with the circuit breaker closed and across each open pole for one minute. Test voltage shall be in accordance with manufacturer's published data or latest NETA standard.

3. Perform a contact/pole-resistance test.

4. Make adjustments to the trip settings in accordance with the coordination study.

5. Determine minimum pickup current by primary current injection.

6. Determine long-time pickup and delay by primary current injection.

7. Determine short-time pickup and delay by primary current injection.

8. Determine ground-fault pickup and time delay by primary current injection.

9. Determine instantaneous pickup by primary current injection.

10. Perform minimum pickup voltage test on shunt trip and close

coils in accordance with latest NETA standard.

11. Verify operation of charging mechanism.

H. Instrument Transformers

1. Electrical Tests – Current Transformers

a. Electrically confirm that CT secondary circuits are intact.

b. Perform a ratio verification test of each current transformer. This shall be performed using the voltage method or current method in accordance with ANSI C57.13.1 (IEEE Guide for Field Testing of Relaying Current Transformers).

c. Perform insulation-resistance tests on current transformer secondary winding. Value of test voltage on secondary wiring shall be 1000 volts dc for one (1) minute. Do not perform this test with solid-state devices connected.

2. Electrical Tests – Voltage Transformers

a. Perform insulation-resistance tests on voltage transformers, winding- to-winding and windings-to-ground. Value of test voltage on secondary wiring shall be 500 volts dc for one (1) minute. Do not perform this test with solid-state devices connected.

b. Electrically confirm proper secondary voltage.

c. Perform a dielectric withstand test on the primary windings with the secondary windings connected to ground. The dc dielectric voltage shall be in accordance with NETA Standard.

I. Metering

1. Check calibration of meters at all caradinal points.

2. Calibrate watthour meters to within manufacturer's published accurance.

3. Verify all instrument multipliers.

4. Electrically confirm that CT and VT secondary circuits are intact.

J. Grounding Systems

1. Perform fall-of-potential test or alternative per IEEE Standard No. 81- 1991 on the main grounding electrode or system.

2. Perform point-to-point test to determine the resistance between the main grounding system and all major electrical equipment frames,

system neutral, and/or derived neutral points.

K. AC motors

1. Electrical Tests - Induction Motors

a. Perform insulation-resistance tests in accordance with ANSI/IEEE Standard 43.

(i) Test duration shall be for one (1) minute with resistances tabulated at 30 and 60 seconds. Calculate the dielectric absorption ratio.

b. Perform insulation power-factor or dissipation-factor tests.

c. Perform surge comparison tests.

d. Perform insulation-resistance test on pedestal per manufacturer's instructions.

e. Perform insulation-resistance test on surge protection device in accordance with NETA Standard.

f. Test motor starter in accordance with NETA Standard prior to re- energizing the motor.

g. Check resistance temperature detector (RTD) circuits for conformance with drawings. Check that metering or relaying devices using the RTD's are of the proper rating.

h. Check that the motor space heater is operating.

i. Perform a rotation test to insure proper shaft direction if the motor has been electrically disconnected.

j. Measure running current and evaluate relative to load conditions and nameplate full-load amperes.

k. Perform vibration tests:

(i) Motors larger than 200 horsepower: Perform vibration base line test. Amplitude shall be plotted versus frequency.

(ii) Motors 200 horsepower and less: Perform vibration and amplitude test.

L. Motor Control Centers/Motor starters, Low Voltage

1. Perform resistance measurements through bolted connections with a low- resistance ohmmeter, if applicable, in accordance with NETA Standard.

2. Perform insulation-resistance tests on each pole, phase-to-phase and phase-to-ground with starter closed and across each open pole for one minute. Test voltage shall be in accordance with manufacturer's published data and NETA Standard whichever is more stringent.

3. Measure insulation resistance of each control circuit-to-ground.

4. Perform insulation-resistance tests on all control wiring with respect to ground. Applied potential shall be 500 volts dc for 300 volt rated cable and 1000 volts dc for 600 volt rated cable. Test duration shall be one minute. For units with solid-state components, follow manufacturer's recommendation.

5. Test motor protection devices in accordance with manufacturer's published data and NETA Standard whichever is more stringent.

6. Test circuit breakers in accordance with NETA Standard.

7. Perform operational tests by initiating control devices.

END OF SECTION

35 KV, 600A 3-WAY SWITCH (EXISTING)

35KV 600A

MV-501 UTILITY (CPS) DROP

35KV 600A — MV-401 — XFMR T1 2000KVA 34.5 KV/ 4.16KV (BY CPS)

35KV 600A — MV-402 — XFMR T2 2000KVA 34.5 KV/ 4.16KV (BY CPS)

MV-301

MV-302

NOTE 1:

Ground Conductor: All medium voltage power circuits in duct, or conduit, shall be paralleled by a grounded conductor intended to minimize fault current in power cable shields. The ground conductor shall be copper, THWN insulation, rated at 600 volts, and the size shall be in accordance with the latest revision of the NEC, or the drawings, whichever is larger.

NOTE 2:

FUSE SIZES ARE TO BE ADJUSTED DEPENDING ON MOTORS FLA AND ON COORDINATION AND ARC FLASH STUDY.

TO MAIN1 CPT — TO MAIN2 CPT — 83 AUTO TRANSFER — SWITCHGEAR MISC. POWER 120 VAC

NOTE 3:

MOTORS USED IN DESIGN CALCULATIONS ARE BASED ON HIGH EFFICIENCY AND HIGH POWER FACTOR (pF>91%) MOTORS. CONTRACTOR MUST COORDINATE WITH MOTOR MANUFACTURER AND ENSURE THE NEW MOTORS WILL NOT LOWER THE OVERALL pF BELOW 90%. IN THE EVENT THAT LOW EFFICIENCY MOTORS OR MOTORS WITH A LOW pF ARE ACCEPTED IN THE PROJECT, POWER FACTOR CORRECTION CAPACITORS SHALL BE INCLUDED WITH EACH MOTOR.

NOTE 4:

PROVIDE A MEANS TO DISABLE THE LONG TIME DELAY AND THE OVERLOAD SETTING FOR ALL MEDIUM VOLTAGE BEAKERS TO COMPLY WITH NEC 2014 240.87. ACCEPTABLE MEANS TO REDUCE ENERGY PRESENT IS BY INCLUDING AN "ENERGY RELEASE MAINTENANCE SWITCH". COORDINATE WITH EQUIPMENT PROVIDER AND INCLUDE SCHEMATIC FOR APPROVAL. ⚠1

MV-201 — 4.16KV 600A — 5 KV, 600A SWGR A — 1200A MAIN1 52 K1 — (3) # — 1200A TIE 52 K1

MV-202 — SWGR B, 5 KV, 600A SWGR — EXISTING ONE-LINE

5 KV, 1200A SWGR C, 50 KAIC — 600A — 1200A TIE 52 K2 SEE NOTE 4 ⚠1

SWGR D, 5 KV, 1200A SWGR, 50 KAIC

LA (3) INT 6 KV

1200A MAIN1 52 K2 SEE NOTE 4 ⚠1

1200A MAIN2 52 K2 SEE NOTE 4 ⚠1

1200A 52 SEE NOTE 4 ⚠1

1200A K2 SEE NOTE 4 ⚠1

4R — 120VAC — .75KVA CPT — 10A — E — 4200:120 — 5A

20E — 10A .75KVA CPT

MV STARTER 400A — SCTB — 469 — PM 820 — 75:5 (3) # — HSP-01-10A 125HP FLA=16.1A

MV STARTER 400A — SCTB — 469 — PM 820 — 75:5 (3) # — HSP-02-10A 125HP FLA=16.1A

200A — XFMR TA 75KVA 4.16KV-208/120V — PANEL A AUX PWR 100A 120/208V

MV STARTER 400A — SCTB — 469 — PM 820 — 75:5 (3) # — HSP-03-10A 150HP FLA=21.0A

200A — XFMR TB 75KVA 4.16KV-208/120V — PANEL B AUX PWR 100A 120/208V

450A — 4R — MV STARTER 400A — 400A BYPASS — SSRV — MV-101 — M RTD (8 SETS) — HSP-01-11A 400HP FLA=48.3A

450A — 4R — MV STARTER 400A — 400A BYPASS — SSRV — MV-103 — M RTD (8 SETS) — HSP-03-11A 400HP FLA=48.3A

1200A 52 SEE NOTE 4 ⚠1 — MV-601 — XFMR TC 75KVA 4.16KV-208/120V — #8 IN ¾" CONDUIT TO ¾"X10' CU-CLAD GND ROD — LV-1201 — PANEL LC AUX PWR 100A 120/208V

450A — 4R — MV STARTER 400A — 400A BYPASS — SSRV — MV-102 — M RTD (8 SETS) — HSP-02-11A 400HP FLA=48.3A

450A — 4R — MV STARTER 400A — 400A BYPASS — SSRV — MV-104 (DUCTS ONLY) — M RTD — HSP-04-11A 400HP FLA=48.3A

1200A 52 SEE NOTE 4 ⚠1 — MV-602 — XFMR TD 75KVA 4.16KV-208/120V — #8 IN ¾" CONDUIT TO ¾"X10' CU-CLAD GND ROD — LV-1202 — PANEL LD AUX PWR 100A 120/208V

LOAD SUMMARY			
LABEL	SIZE	CONNECTED LOAD (FULL LOAD AMPS)	DEMAND LOAD (AMPS)
HSP-01-10A	125 HP	16.1	12.9
HSP-02-10A	125 HP	16.1	12.9
HSP-03-10A	150 HP	21.0	16.8
XFMR TA	75 KVA	10.4	6.2
XFMR TB	75 KVA	10.4	6.2
HSP-01-11A	400 HP	48.3	38.7
HSP-02-11A	400 HP	48.3	38.7
HSP-03-11A	400 HP	48.3	38.7
HSP-04-11A	400 HP	48.3	38.7
XFMR TD	75 KVA	10.4	6.2
XFMR TE	75 KVA	10.4	6.2
25% OF LARGEST MOTOR:		12.1	
TOTAL CONNECTED LOAD:		300.1	
TOTAL CONN. LOAD (KVA):		2162.3	
DEMAND LOAD (AMPS):			222.1
DEMAND LOAD (KVA):			1600.3

JOB NO.
JOB NO.

OSCAR MIRAMONTES 55413 LICENSED PROFESSIONAL ENGINEER
AUG 6, 2014

REVISIONS

No.	Revision	Drawn	Approved	Date
3	ADDENDUM NO. 3			

Date: JUL 2, 2014
Drawn By: OM
Designed By: OM
Checked By: F&N
Scale: AS SHOWN
Approved By: OM
Map No.: N/A

San Antonio Water System

EVANS PZ 11A BOOSTER STATION IMPOVEMENTS PROJECT

ELECTRICAL ONE-LINE DIAGRAM

DRAWING NO.
E-101
4 OF 47

JOB NO.
JOB NO.

FLOW INDICATION & RECORDING
PRESSURE INDICATION & RECORDING
LEVEL INDICATION & RECORDING
FLOW INDICATION & RECORDING
VALVE STATUS CLOSED
VALVE STATUS OPEN
COMMAND CLOSE VALVE
COMMAND OPEN VALVE
PRESSURE INDICATION & RECORDING
FLOW INDICATION & RECORDING
PRESSURE INDICATION & RECORDING

HMI
RADIO COMM
PLC
SCADA FRONT PANEL

EXISTING (TYP. OF 3)
FIT
PIT
LIT
EXISTING
PUMP CONTROLS (TYP. OF 3)
VALVE CONTROLS (TYP. OF 3)
PUMP CONT (TYP OF 4)
VALVE CONTROLS (TYP. OF 4)
OPEN CLOSE OPEN CLOSED HOA
HS ML RVSS ZV

5 MG GROUND STORAGE TANK
PZ9-1125 HGL
INJ VAULT
LIT-01-10A
SEE NOTE 1
SEE NOTE 1 (TYPICAL)

FIT-PRV-11A
FE-PRV-11A
ZSC PRV
ZSO PRV
PI-01-PRV
PIT-PRV-11A
PI-02-PRV
PRV
SERV LVL 11A
PZ11A 1400 HGL

PS-01-11A
PI-01-11A
TO PUMP STARTER
RTD
HSP-01-11A
FIT-01-11A
FE-01-11A
ZSC 01
ZSO 01
PI-01B-11A
MOV-01-11A
PIT-01-11A
TO PLC
TO VALVE CONT.

PS-02-11A
PI-02-11A
HSP-02-11A
FIT-02-11A
FE-02-11A
ZSC 02
ZSO 02
PI-02B-11A
MOV-02-11A

PS-03-11A
PI-03-11A
HSP-03-11A
FIT-03-11A
FE-03-11A
ZSC 03
ZSO 03
PI-03B-11A
MOV-03-11A

PS-04-11A
PI-04-11A
HSP-04-11A
(FUTURE)
FIT-04-11A
FE-04-11A
ZSC 04
ZSO 04
PI-04B-11A
MOV-04-11A

ZSC ALT
ZSO ALT
ALTITUDE VALVE
SUPPLY
SERV LVL 10A

PS-01-10A
PI-01-10A
HSP-01-10A
FE-01-10A
FIT-01-10A
MOV-01-10A
PS-02-10A
PI-02-10A
HSP-02-10A
FE-02-10A
FIT-02-10A
MOV-02-10A
PS-03-10A
PI-03-10A
HSP-03-10A
FE-03-10A
FIT-03-10A
MOV-03-10A
PIT-01-10A

NOTE 1: EXISTING EQUIPMENT BEING CONTROLLED BY EXISTING PLC SHALL BE INCORPORATED INTO NEW PLC SYSTEM. REFER TO SPECIFICATIONS.

OSCAR MIRAMONTES 55413 LICENSED PROFESSIONAL ENGINEER
STATE OF TEXAS
Aug 6, 2014

REVISIONS

No.	Revision	Drawn	Approved	Date
1	ADDENDUM NO. 3			

Date: JUL 2, 2014
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San Antonio Water System

BOOSTER STATION IMPROVEMENTS PROJECT
EVANS PZ 11A

PROCESS AND INSTRUMENTATION DIAGRAM (P&ID)

DRAWING NO.
PID-101
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FIELD WIRING | SCADA PANEL | PLC (SCADA)

RESERVOIR LEVEL TRANSMITTER
LIT-01-10A (EXISTING)
-24 VDC, +24 VDC
TB-A1 1 2 3 4 5
LI-RESV-LVL
RESERVOIR LVL
+ - G N H
N L
TELEFAST CONNECTION BASE (ABE-7CPA02)
ANALOG INPUT

STATION DISCHARGE PRESS
PIT-01-10A (EXISTING)
-24 VDC, +24 VDC
TB-A1 6 7 8 9 10
PI-STN-PRESS
PRESS IND
+ - G N H
ANALOG INPUT

STATION BYPASS FLOW RATE SRV LVL 10
FIT-01-10A (EXISTING)
TB-A1 11 12 14 13
FI-BYPS-FLW
0-9 MGD
+ - G N H
ANALOG INPUT

HSP-01-10 FLOW RATE
FIT-01-10A (EXISTING)
TB-A1 15 16 18 17
FI-HSP-01-10
0-3 MGD
+ - G N H
ANALOG INPUT

HSP-02-10 FLOW RATE
FIT-02-10A (EXISTING)
24VDC+ 24VDC-
TB-A1 19 20 22 21
FI-HSP02-10
0-5 MGD
+ - G N H
100 ANALOG INPUT 200

100 ANALOG INPUT 200 — SPARE

100 ANALOG INPUT 200 — SPARE

100 ANALOG INPUT 200 — SPARE

BMXFTA300
ANALOG INPUT CARD #1 (BMXAMI0810) SLOT 0
L N G

EXISTING INSTRUMENTS FOR SERVICE LEVELS 9 AND 10 ARE TO REMAIN IN PLACE. HOWEVER, SINCE THE PLC IS BEING REPLACE, ALL WIRING FROM THE FIELD TERMINATION TO THE PLC INTERFACE SHALL BE NEW. ONLY FIELD EXISTING FIELD WIRING NOT REQUIRED TO BE REMOVED SHALL REMAIN AND BE USED. (TYPICAL ALL INSTRUMENTATION DRAWINGS)

FIELD WIRING | SCADA PANEL | PLC (SCADA)

FIT
HSP-03-10 FLOW RATE (EXISTING)
TB-A1 23 24 26 25
FI-HSP-03-FLW
0-3MGD
+ - G N H
TELEFAST CONNECTION BASE (ABE-7CPA02)
100 ANALOG INPUT 200

INLET TANK PRESSURE
PIT
SERVICE LEVEL 9 (EXISTING)
-24 VDC, +24 VDC
TB-A1 27 28 29 30 31
PI-TANK-LVL
0-150 PSI
+ - G N H
100 ANALOG INPUT 200

BOOSTER STATION FLOW (EXISTING TO BE REMOVED)
FIT
TB-A1 32 33 35 34
FI-BSTR-FLW
0-5.8 MGD
+ - G N H
100 ANALOG INPUT 200

BOOSTER STATION DISCH PRESS (SERV LVL 11)
PIT
SERVICE LEVEL 9
-24 VDC, +24 VDC
TB-A1 36 37 38 39 40
PI-BSTR-PRESS
0-150 PSI
+ - G N H
100 ANALOG INPUT 200

BMXFTA300
ANALOG INPUT CARD #2 (BMXAMI0810) SLOT 1
L N G

100 ANALOG INPUT 200 — SPARE

100 ANALOG INPUT 200 — SPARE

100 ANALOG INPUT 200 — SPARE

100 ANALOG INPUT 200 — SPARE

JOB NO.
JOB NO.

STATE OF TEXAS
OSCAR MIRAMONTES
55413
LICENSED
PROFESSIONAL ENGINEER
AUG 6, 2014

REVISIONS

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San Antonio Water System

BOOSTER STATION IMPROVEMENTS PROJECT
EVANS PZ 11A

SCADA SCHEMATICS
PANEL INSTRUMENTS
SERVICE LEVEL 10

DRAWING NO.
I-110
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