BROADBAND ACCESS POINTS AND
PROGRAMMABLE LOGIC CONTROLLERS
REPLACEMENT – PHASE 4 PROJECT
Solicitation Number: CO-00602
Job No. 21-6006

ADDENDUM 1
June 2, 2023

To Bidder of Record:

This addendum, applicable to the work referred to above, is an amendment to the bid proposal, plans, and specifications, and as such will be a part of and included in the Contract Documents. Acknowledge receipt of this addendum by entering the Addendum number and issue date on the space provided in submitted copies of the bid proposal.

RESPONSES TO QUESTIONS

1. Can you have the following bid specifications issued as an addendum to this project? The following is referenced in specification 40 68 00 1.2 A.

   Refer to Section 40 61 00, Process Control and Instrumentation Systems - General Provisions, for additional submittal, meeting, coordination and functional requirements.

   Reply: Section 40 61 00 has been issued in this addendum. Reference Changes to Specifications number 2.

CHANGES TO THE SPECIFICATIONS

1. Remove bid packet in its entirety and replace with the revised bid packet checklist attached to this addendum.
2. Add Section 40 61 00 Process Control and Instrumentation Systems - General Provisions in its entirety.
3. Remove the table in Section 40 63 00 (PLC Hardware and Software) Article 2.2-C and replace with the following:

Description	Manufacturer	Part Number
Power Supply Module	Allen Bradley	5069 (Integrated)

Description	Manufacturer	Part Number
CPU (Processor)	Allen Bradley	5069-L330ERM & 5069-RTB64-SCREW (minimum, CPU shall be sized by CONTRACTOR)
16 Channel Digital Input Module	Allen Bradley	5069-IB16 & 5069-RTB18-SCREW
16 Channel Digital Output Module	Allen Bradley	5069-OB16 & 5069-RTB18-SCREW
8 Channel Analog Input Module	Allen Bradley	5069-IF8 & 5069-RTB18-SCREW
4 Channel Analog Input Module	Allen Bradley	5069-IY4 & 5069-RTB18-SCREW
8 Channel Analog Output Module	Allen Bradley	5069-OF8 & 5069-RTB18-SCREW
Ethernet module for distributed I/O	Allen Bradley	5069-AENTR

4. Section 5.13.5 of Article V - Contract Responsibilities of the Supplemental Conditions is deleted in its entirety and replaced with the following:

Supplemental Conditions

ARTICLE V - CONTRACT RESPONSIBILITIES

Section 5.13.5 shall be amended to take out the last sentence and to add the following:

The Bidder is required to submit a detailed baseline schedule within one (1) business day if they are the apparent low bidder. The baseline schedule shall be a detailed, precedence-style critical path management schedule in Microsoft Project or Primavera format. The baseline schedule must encompass the entire contract duration from Notice to Proceed to the Contract End Date. This baseline schedule must show a completion date that corresponds to the Contract End Date. The baseline schedule must be inclusive of all work necessary to complete the project including sufficient time necessary for submission and review of submittals, permits, etc. The schedule must be in adherence with the Right-of-Entry durations and deadline dates. For the purpose of preparing this baseline schedule, all bidders shall assume a notice to proceed date of August 15, 2023. Failure to include this baseline schedule by the apparent low bidder as requested by SAWS may result in the bidder being considered non-responsive.

The remaining sections of Article V shall remain the same.

END OF ADDENDUM

This Addendum, including these three (3) pages, is twenty eight (28) pages with attachments in its entirety.

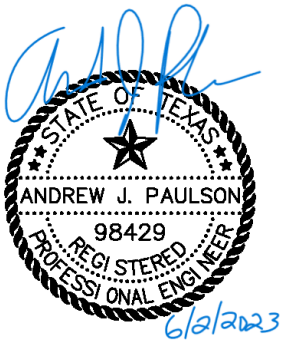
Attachments:

- Revised Bid Packet Checklist (1 page)

- Specifications Section 40 61 00 Process Control and Instrumentation System - General Provisions (24 Pages)

Andrew Paulson

Signature Automation, LLC



BID PACKET CHECKLIST
BROADBAND ACCESS POINTS AND PROGRAMMABLE LOGIC CONTROLLERS REPLACEMENT – PHASE 4 PROJECT
SAWS Job No. 21-6006
SAWS Solicitation No. CO-00602

This checklist is a required document that must be utilized and submitted with the Bid Packet. The Bid Packet should include the following items in this order:

- ☐ List of Bid Items
- ☐ Signed Bid Proposal Signature Page, Acknowledgement of All Addendums and Executive Order
- ☐ Bid Packet Checklist
- ☐ Signed Proposal Certification
- ☐ Bid Bond
- ☐ Good Faith Effort Plan

Items to be submitted <u>Upon Request</u> by SAWS from the Apparent Low Bidder within one (1) day of the bid opening:

- ☐ Conflict of Interest Questionnaire - Form CIQ *(Rev. 11/30/2015)*
- ☐ Proof of Insurability (Letter from Insurer or Sample Certificate of Insurance)
- ☐ Company Information Packet
- ☐ Statement regarding ability to complete the project
- ☐ W-9
- ☐ Statement of Bidder's Experience
- ☐ Detailed Baseline Schedule (Using August 15, 2023 Notice to Proceed date)

***And, if bid was submitted electronically <u>without a Bid Bond</u>:**

- ☐ Cashier's Check or Certified Check

SECTION 40 61 00

PROCESS CONTROL AND INSTRUMENTATION SYSTEMS - GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Process Control System Integrator (PCSI)

1. The General Contractor shall procure the services of a single PCSI to investigate, field verify, select, furnish, configure, customize, debug, install all equipment, materials, and labor and connect, calibrate, and place into operation all instrumentation and control hardware and software, except for those services and materials specifically noted, required to achieve a fully integrated and operational system as specified herein and in other Specification sections listed below and as shown on the drawings.
2. Equipment furnished as a part of other Divisions and shown on the Electrical Drawings shall be integrated into the overall Process Instrumentation and Control System under this Division. Instrumentation specified in other Divisions shall meet the Specification requirements of this Division.
3. The PCSI shall perform all Applications Systems Programming (ASP) work including:
   a. PLC programming, testing of PLC logic, and start-up/training activities associated with programmed portions of the PLC.
   b. Connecting the existing Human Machine Interface (HMI) to the new PLCs, database development, and start-up/training activities associated with the configured portions of the HMI system.
   c. Historian programming to add historical data collection, trending, and calculations.
4. The PCSI/ASP shall coordinate, and schedule all required construction activities including startup, testing, inspection and training with the General CONTRACTOR, OWNER, and ENGINEER.

B. The work shall include furnishing, installing and testing the equipment and materials detailed in the following sections:

Section	Title
27 15 23	Fiber Optic Equipment
40 61 00	Process Control and Instrumentation Systems - General Provisions
40 61 00A	Attachment A – PLC and Radio Sites Scope of Work
40 61 21	Process Control System – Testing
40 61 21A	Attachment A – Standard Testing Forms – I/O Testing
40 61 26	Process Control System – Training
40 61 93	Process Control System - Input Output List
40 61 96	Process Control System - Control Descriptions
40 61 96A*	Attachment A - Secondary PS Control Descriptions
40 61 96B*	Attachment B - Booster PS Control Descriptions

Section	Title
40 61 96C*	Attachment C – Storage Tank Control Descriptions
40 61 96D*	Attachment D – Pressure Point Control Descriptions
40 64 96E*	Attachment E – Outfall Control Descriptions
40 63 00	Process Control System – PLC Hardware and Software
40 63 00A	Attachment A – PLC Hardware Schedule
40 66 00	Network Equipment
40 66 00A	Attachment A - Network Equipment Schedule
40 66 43	Radio Equipment And Systems
40 66 43A	Attachment A - Radio Equipment Schedule
40 66 66	Communication Towers
40 67 00	Control Panels and Components
40 67 00A	Attachment A - Control Panels Schedule
40 67 63	Uninterruptible Power Supplies
40 68 00	Process Control System - Applications Engineering Services

C. The work of this project includes, but is not necessarily limited to the following:

1. Furnish and install new and modified PLC Panels to replace existing panels as shown on the contract drawings.
2. Furnish and install all communications network devices required per the Contract Drawings.
3. Coordinate all PCSI work giving consideration to specified construction sequencing constraints.
4. Make connections, including field connections and interfacing between instrumentation, controllers, control devices, control panels and instrumentation furnished under other Divisions.
5. Auxiliary and accessory devices necessary for system operation or performance to interface with existing equipment or equipment provided by other suppliers under other Sections of these specifications shall be included whether or not they are shown on the Drawings. These devices include but are not limited to, transducers, current isolators, signal conditioners or interposing relays.
6. Equipment shall be fabricated, assembled, installed, and placed in proper operating condition in full conformity with detail Drawings, Specifications, engineering data, instructions, and recommendations by the equipment manufacturer as approved by the ENGINEER.
7. Actual installation of the instrumentation system need not be performed by the PCSI's employees; however, the PCSI, as a minimum, shall be responsible for the technical supervision of the installation by providing on-site supervision to the installers of the various components.
8. The PCSI shall furnish equipment which is the product of one manufacturer to the maximum practical extent. Where this is not practical, all equipment of a given type shall be the product of one manufacturer.

9. All materials, equipment, labor, and services necessary to achieve the monitoring and control functions described herein shall be provided in a timely manner so that the monitoring and control functions are available when the equipment is ready to be placed into service.
10. Provide all electrical relocation work associated with the relocation of equipment for the existing and new facilities, including disconnecting all existing wiring and conduits and providing new wiring and conduit to the relocated equipment.
11. Coordinate the sequence of demolition with the sequence of construction to maintain operation. Remove and demolish equipment and materials in such a sequence that the existing and proposed station will function properly with no disruption of water service.
12. Modifications to existing instrumentation and control systems as required to new and existing equipment to maintain the station in operation.
13. All bidders shall become familiar with the project sites and scope, prior to submitting a bid, and satisfy themselves as to any question that they might have, relating to existing equipment, condition or construction. The PCSI shall plan for sufficient field time at each site to confirm the design and existing system information provided with actual field conditions for the purpose of work planning, panel design, programming, documentation, and other work required to meet the project intent and functional requirements.

1.2 RELATED WORK

A. General provisions of the Contract are included in Division 01 of the Specifications.

B. Specific control system and instrumentation materials and requirements are included in related sections of Division 40.

C. Electrical equipment, conduit, cabling, and other requirements of the electrical contractor are included in Division 26, Electrical Specifications.

1.3 SUBMITTAL REQUIREMENTS

A. General

1. Refer to Division 01 for general submittal requirements.
2. Other Division 40 Sections may have additional submittal requirements.
3. Both electronic and hard submittals shall be bound separately in sections according to the submittal list below, with an index page and section dividers. Electronic copies shall be in Adobe PDF and/or AutoCAD format. Hard copy sets shall include five (5) sets of reproducible, signed and sealed, full-size Drawings and five sets of Specifications. Hard submittals shall be assembled in three-ring binders, up to 3 inches wide, with a maximum of 11x17 (inch) size pages folded down to 8.5x11 (inch) size.
4. Shop drawing and manufacturer data sheet submittals shall be complete, an accurate representation of equipment to be delivered, documented fully, and demonstrate that equipment and services comply with Specification requirements.
5. PCSI/ASP Drawing submittals shall include a title block with, as a minimum, the PCSI/ASP's registered business name and address, PCSI/ASP project manager's name, OWNER and project name, Drawing title, sheet number, Drawing revision number/description, and personnel responsible for the content of the Drawing.

6. Exceptions to the Specification and Drawing requirements shall be clearly identified and defined by the PCSI/ASP and located within a separate section of each submittal. Definitions of exceptions shall be presented for OWNER/ENGINEER approval and include, at a minimum, Specification/Drawing reference location, description of exception and proposed substitution, reason for exception, and details of any Contract financial credits offered. Acceptance of "or Equal" substitutions and/or exceptions shall be at the discretion of the OWNER/ENGINEER.
7. Partial, incomplete, or non-compliant submittals will be returned to the PCSI/ASP without review.
8. The CONTRACTOR shall check shop drawings for accuracy and compliance with the requirements of the Contract Documents prior to submittal to the ENGINEER. Errors and omissions on approved shop drawings shall not relieve the CONTRACTOR from the responsibility of providing materials and workmanship required by the Specifications and Drawings. Shop drawings shall be stamped with the date checked and a Statement indicating that the shop drawings conform to Specifications and Drawings. Only one Specification Section submittal will be allowed per transmittal unless it has been indicated that grouping is permitted in the individual sections.
9. Material shall not be ordered or shipped until the shop drawings have been approved. No material shall be ordered or shop work started if shop drawings are marked "FURNISH AS CORRECTED," "REVISE AND RESUBMIT (RETURNED FOR CORRECTION)," or "REJECTED."
10. Separate submittals shall be supplied as listed below:

Item	Submittal Title	Submittal Number	Specification Number
a.	Project Plan	40 61 00-01	40 61 00
b.	Hardware and Software	40 61 00-02	40 61 00
c.	Network Devices and Components	40 66 00-01	40 61 00 40 66 00
d.	Control/Network Panel Drawings	40 67 00-01	40 61 00 40 63 00 40 66 00 40 67 00 40 67 63
e.	Radio Equipment and System	40 66 43-01	40 61 00 40 66 43
f.	Radio Communication Diagrams	40 66 43-01	40 61 00 40 66 43 40 66 66
g.	Communication Towers	40 66 66-01	40 66 66
h.	Fiber Optic System	27 15 23-01	27 15 23
i.	Applications System Programming	40 68 00-*	40 68 00, 40 61 96
j.	PCSI Testing Plan	40 61 21-01	40 61 21 40 68 00
k.	PCSI Training Plan	40 61 26-01	40 61 26 40 68 00
l.	Spares, Expendables, and Test Equipment	40 61 00-03	40 61 00

Item	Submittal Title	Submittal Number	Specification Number
m.	Final System Documentation	40 61 00-07	40 61 00 40 68 00

* Refer to indicated Specification Section or associated paragraph in this Section for details of submittal requirements and quantities.

B. PCSI Project Plan Submittal

1. The PCSI Project Plan submittal shall be submitted prior to scheduling the PCSI/ASP Kickoff Meeting. The OWNER/ENGINEER will not accept subsequent submittals until the PCSI Project Plan submittal is approved.
2. The Project Plan submittal shall include, at a minimum:
   a. Overview of the proposed control system in clear text format describing the PCSI understanding of the project work, preliminary system architecture drawing, interfaces to other systems, schedule, startup, switchover, and coordination.
   b. PCSI project schedule including meetings, milestones, submittals, procurement, fabrication, shipment, installation, testing, commissioning, training, and other related work tasks.
      1) The project schedule shall be prepared using Microsoft Project scheduling software in Gantt chart format, and shall clearly indicate task links and critical path items.
      2) PCSI schedule shall be based from and coordinated with the General Contractor's and ASP's project schedule to meet all overall project milestones. PCSI milestones shall include the following, as applicable to the project:
         a) All subsequent project submittals shall be scheduled. Include in the time allotment the time required for CONTRACTOR submittal preparation, OWNER/ENGINEER's review time, and a minimum of two complete review cycles.
         b) Proposed dates for all project coordination meetings.
         c) Hardware purchasing, fabrication, and assembly (following approval of related submittals).
         d) Software purchasing and configuration (following approval of related submittals).
         e) Shipment of all instrument and control system equipment.
         f) Installation of all instrument and control system equipment.
         g) Testing: Schedule for all testing. Testing schedule shall include submittal of test procedures a minimum of 30 days prior to commencement of testing. Schedule shall also include submittal of completed test procedure forms for review and approval by the OWNER/ENGINEER prior to shipment, startup, or subsequent project work.
         h) Schedule for system cutover, startup, and/or going on-line for each major system. At a minimum, include the schedule for each process controller and HMI server/workstation provided or modified under this Contract.
         i) Schedule for all training, including submittal and approval of O&M manuals, factory training, and site training.
   c. PCSI/ASP project organization chart including list of key personnel (project manager, ENGINEER, lead technician, quality assurance reviewer, etc.); resumes; and written commitment to this Project.

d. List of Exceptions to the Specifications and Drawings, based on a paragraph-by-paragraph and Drawing-by-Drawing review of the Contract Documents and Specifications. PCSI shall state their acceptance of all contractual Specification and Drawing requirements outside of any Exceptions listed. If there is no statement by the PCSI, then it is acknowledged that no exceptions are taken.

C. Hardware and Software Submittal

1. General
   a. Submittals including only general sales literature will not be accepted.
   b. Shop Drawing and manufacturer data sheet submittals shall be complete, fully demonstrating compliance with all Specification requirements and features.
   c. Selected features and options shall be clearly indicated by highlighting, circling, or pointing arrows to each selection that makes up the manufacturer ordering/model number code.
   d. Physical details shall include, at a minimum, physical layout and dimensions, construction details, NEMA rating, hazardous area rating, electrical power requirements and consumption, communication ports, signal connection ports, heat dissipation and installation requirements.
   e. Functional details shall include, at a minimum, details of internal features such as communication protocols, control functions, programming parameters, jumper settings, software features, and licensing requirements.
2. Software
   a. Provide a complete software list or Bill of Materials (BOM) including all software items and quantities to be supplied by the PCSI.
   b. Details of all stand-alone computer software packages required by the Specifications.
   c. System Software
      1) Submit details of the process controller, local operator graphic panel, and HMI software application packages to be used for each piece of equipment. All standard and optional features to be provided shall be indicated.
   d. Other Software
      1) Submit details of all other required software packages to be provided, including but not limited to network/communication utility (OPC, SNMP, UPS); field instrument utility (HART, Fieldbus, etc.); and computer software (MS Office, Adobe Acrobat, etc.).
   e. Licensing
      1) Provide details of all software license agreements indicating quantities and assignment of licenses to the OWNER.
   f. Software Support
      1) Provide details of all software support license agreements indicating quantities and assignment of licenses to the OWNER.

3. Hardware
    a. Provide a complete hardware list or Bill of Materials (BOM) including all hardware to be supplied by the PCSI. For each hardware component indicated below, submit a cover page that lists, at a minimum, date, specification number, product name, manufacturer, model number, location(s), and power required. Preferred format for the cover page is ISA S20, general data sheet; however, other formats will be acceptable provided they contain all required information.
    b. Catalog cuts for supplied Programmable Logic Controller (PLC), process controller equipment, remote telemetry units (RTU), including central processing units, redundancy units, memory, input modules, output modules, modems, network interface modules, mounting racks, and power supplies. Submit descriptive literature for each hardware component that fully describes the units being provided.
    c. Process Controller Memory Sizing Calculation
        1) Submit calculations for controller program memory including additional memory beyond the memory available for process control applications. This includes scratch pad or "housekeeping" programs, additional overhead for programming formats, redundancy, etc.; and shall be included in the total memory sizing calculation. Submit calculations verifying that the total memory provided will be adequate for the specified requirements.
    d. Power Supply Sizing Calculations:
        1) Submit calculations to show compliance with specified power supply sizing requirements of the Specifications.
    e. Battery Backup UPS Sizing and Runtime Calculations
        1) Submit calculations to show compliance with specified UPS capacity sizing and battery runtime requirements of the Specifications.

D. Control/Network Panel Drawings Submittal
1. Provide a complete list of all panels to be supplied by the PCSI.
2. Panel drawing submittals shall be complete, fully demonstrating compliance with all specification requirements and features. Panel drawings shall include, but not be limited to, the following for each panel supplied:
    a. Panel Layout and Bill of Materials
    b. Panel Power Wiring Schematics
    c. Panel Input/Output Wiring Diagrams
3. Drawings shall be furnished for all panels, consoles, and equipment enclosures specified in related sections. Panel assembly and elevation drawings shall be drawn to scale and detail all equipment in or on the panel. Panel drawings shall be at least 11x17 (inch) print size. As a minimum, the panel drawings shall include the following:
    a. Interior and exterior panel elevation drawings to scale.
    b. Nameplate schedule.
    c. Conduit access locations.
    d. Panel construction details.

e. Cabinet assembly and layout drawings to scale. The assembly drawing shall include a bill of material on the drawing with each panel component clearly defined. The bill of material shall be cross-referenced to the assembly drawing so that a non-technical person can readily identify any component of the assembly by manufacturer and model number.

f. Fabrication and painting specifications including color (or color samples).

g. Panel control schematics and interconnection diagrams detailing the electrical connections of all equipment in and on the panel. Diagrams shall include power and signal connections, UPS and normal power sources, all panel ancillary equipment, protective devices, wiring and wire numbers, and terminal blocks and numbering.

h. Point to point I/O wiring diagrams depicting wiring within the panel as well as connections to external devices. The diagram shall identify all device terminal points that the system connects to, including terminal points of equipment not supplied by the PCSI, Wiring labeling used on the drawings shall match that shown on the Contract Documents or as developed by the PCSI and approved by the OWNER/ENGINEER. Field device wiring shall include the device ISA-tag and a unique numeric identifier. PLC I/O wiring shall be numbered with rack number, slot number, and point number. Two-wire and four-wire equipment shall be clearly identified and power sources noted. Submit final wire numbering scheme for approval by the OWNER/ENGINEER. Point-to-Point drawings shall be 11x17 (inch) minimum in size.

i. Submit construction details, NEMA ratings, intrinsically safe barrier information, gas sealing recommendations, purging system details, etc. for panels located in hazardous locations or interfacing to equipment located in hazardous areas.

j. Heating and cooling calculations for each panel supplied indicating conformance with cooling requirements of the supplied equipment and environmental conditions. Calculations shall include the recommended type of equipment required for both heating and cooling.

k. Submit evidence that all control panels shall be constructed in conformance with UL 508 and bear the UL seal confirming the construction. Specify if UL compliance and seal application shall be accomplished at the fabrication location or by field inspection by UL inspectors. All costs associated with obtaining the UL seal and any inspections shall be borne by the CONTRACTOR and included in the Contract.

l. Submit seismic calculations and anchoring requirements in conformance with Division 01.

E. Testing Plan Submittal

1. PCSI Testing Plan shall incorporate Section 40 68 00, Process Control System - Applications Engineering Services, for ASP testing requirements.
   a. Refer to Section 40 61 96, Process Control System - Control Descriptions.

2. Test Procedure Submittals: Submit the procedures proposed to be followed for each test. Procedures shall include test descriptions, forms, and checklists to be used to control and document the required tests. Include sign-off forms for each testing phase or loop with sign-off areas for the PCSI, ENGINEER, and OWNER. Refer to Division 40, Section 40 61 21, Control System – Testing for specific testing requirements, and submit separate procedures for each specified test phase.
3. Test Documentation: Upon completion of each required test, document the test by submitting a copy of the signed-off test procedures. Testing shall not be considered complete until the signed-off test procedures have been submitted and favorably reviewed. Submittal of other test documentation, including "highlighted" wiring diagrams with field technician notes, are not acceptable substitutes for the formal test documentation.
4. Each loop shall have a Loop Status sign-off form to organize and track its inspection, adjustment, and calibration. These forms shall include the following information and check-off items:
    a. Project Name.
    b. Loop Number.
    c. Detailed test procedure indicating exactly how the loop will be tested including all required test equipment, necessary terminal block numbers, and simulation techniques required.
    d. Tag Number for each component.
    e. Check-offs/sign-offs for each component.
        1) Tag/identification.
        2) Installation.
        3) Termination – wiring.
        4) Termination – tubing.
        5) Calibration/adjustment.
    f. Check-offs/sign-offs for the loop.
        1) Panel interface terminations.
        2) I/O interface terminations.
        3) I/O signal operation.
        4) Inputs/outputs operational: received/sent, processed, adjusted.
        5) Total loop operation.
        6) Space for comments.
        7) Sign-off and date fields for the CONTRACTOR, the OWNER/ENGINEER, and the PCSI.
5. Each active analog subsystem element shall have a Component Calibration form. These forms shall have the following information including space for data entry:
    a. Project Name.
    b. Loop Number.
    c. ISA Tag Number and I/O Module Address.
    d. Manufacturer.
    e. Model Number/Serial Number.
    f. Summary of Functional Requirements; for example:

1) For Indicators: Scale ranges.
2) For Transmitters/Converters: Scale and chart ranges.
3) For Computing Elements: Function.
4) For Controllers: Action (direct/reverse) control modes (PID).
5) For Switching Elements: Unit range, differential (FIXED/ADJUSTABLE), reset (AUTO/MANUAL).
6) For I/O Modules: Input or output.

g. Calibrations; for example:
1) For Analog Devices: Required and actual inputs and outputs at 0, 50, and 100 percent of span.
2) For Discrete Devices: Required and actual trip points and reset points.
3) For Controllers: Mode settings (PID).
4) For I/O Modules: Required and actual inputs or outputs for 0, 50, and 100 percent of span.

h. Space for comments.
i. Sign-off and date fields for the CONTRACTOR, the OWNER/ENGINEER, and the PCSI.

6. Inspection and Punch List Form
a. Testing forms shall include an inspection and punch list form to be filled out by ENGINEER/OWNER.

F. Training Plan Submittal
1. PCSI Training Plan shall incorporate Section 40 68 00, Process Control System - Applications Engineering Services.
a. Refer to Section 40 61 26, Process Control System – Training.
2. Training Plan Submittal
a. Upon receipt of the ENGINEER's comments on the preliminary training plan, submit the specific proposed training plan. The training plan shall include:
1) Definitions, objectives, and target audience of each course.
2) Schedule of training courses including proposed dates, duration, and locations of each class.
3) Complete copy of all proposed handouts and training materials. Training information shall be bound and logically arranged with all materials reduced to a maximum size 11x17 (inch), then folded to 8.5x11 (inch) for inclusion into the binder.

G. Spares, Expendables, and Test Equipment Lists Submittal
1. This submittal shall include for each Subsystem:
a. A list of, and descriptive literature for, spares, expendables, and test equipment as specified in Division 40.
b. A list of, and descriptive literature for, additional spares, expendables, and test equipment recommended by the manufacturer.
c. Unit and total costs for the additional spare items specified or recommended for each subsystem.

H. Final System Documentation

1. Submit in accordance with Division 01 O&M requirements.
2. The Final System Documentation shall consist of operations and maintenance manuals as specified herein. The manuals shall be bound in three-ring binders, maximum size of 3 inches, with drawings reduced to 11x17 (inch), then folded to 8.5x11 (inch) for inclusion. Each section shall have a uniquely numbered tab divider, and each component within each section shall have a separate binder tab divider.
3. The operations and maintenance manuals shall be prepared specifically for this installation and shall include catalog data sheets, drawings, equipment lists, descriptions, parts lists and operating and maintenance instructions, at a minimum, contain the following information:
    a. Table of Contents
        1) A Table of Contents shall be provided for the entire manual with the specific contents of each volume clearly listed. The complete Table of Contents shall appear in each volume.
    b. Instrument and Equipment Lists
        1) The following lists shall be developed in Excel and provided not only as a hard copy in O&M, but also electronically on a CD.
        2) An instrument list for all devices supplied including tag number, description, specification section and paragraph number, manufacturer, model number, serial number, range, span, location, manufacturer phone number, local supplier name, local supplier phone number, completion year replacement cost, and any other pertinent data.
        3) An equipment list for all non-instrument devices supplied listing description, specification section and paragraph number, manufacturer, model number, serial number, location, manufacturer phone number, local supplier name, local supplier phone number, completion year replacement cost, and any other pertinent data.
    c. Data Sheets with Vendor Operations and Maintenance Information
        1) ISA S20 style data sheets shall be provided for all field instruments.
        2) Cover page for each device, piece of equipment, and OEM software that lists, at a minimum, date, specification number, product name, manufacturer, model number, location(s), and power required. Preferred format for the cover page is ISA S20, general data sheet; however, other formats will be acceptable provided they contain all required information.
        3) Final vendor O&M documentation for each device, piece of equipment, or OEM software shall be either new documentation written specifically for this project, or modified standard vendor documentation. All standard vendor documentation furnished shall have all portions that apply clearly indicated with arrows or circles. All portions that do not apply shall be neatly lined out or crossed out. Groups of pages that do not apply at all to the specific model supplied shall be removed.
        4) For any component requiring dip switch settings or custom software configuration, that information shall be included along with the corresponding data sheets and O&M information.
        5) Complete parts list with stock numbers, including spare parts.
    d. Operations and Maintenance manuals shall be constructed in accordance with Division 01 and shall include the following information:

1) Manufacturer's contact address and telephone number for parts and service.
2) Instruction books and/or leaflets
3) Recommended renewal parts list
4) Record documents for the information required by the Submittals section above.

e. Software Programs
   1) Provide native backup files of the programming code for each new controller.
      a) Programming code shall be fully annotated with comments describing the functionality of each section and group of coding.
   2) Provide native backup files of any modified PCS HMI software files.

f. Communication Equipment
   1) Provide documentation and backup files for all communications programming code, including all parameter settings.

g. As-Built Drawings
   1) Complete as-built drawings, including all drawings and diagram specified in this section under the "Submittals" section. These drawings shall include all termination points on all equipment the system in connected to, including terminal points of equipment not supplied by the PCSI.
   2) As-built documentation shall include information from submittals, as described in this Specification, updated to reflect the as-built system. Any errors in or modifications to the system resulting from the Factory and/or Functional Acceptance Tests shall be incorporated in this documentation.

h. Original Licensed Software
   1) Submit original software media of all software provided under this Contract. Submit original paper based and electronic documentation for all software provided. Submit license agreement information including serial numbers, license agreements, User Registration Numbers and related information. All software provided under this Contract shall be licensed to the OWNER at the time of purchase. Provide media in software sleeves within O&M manual.

i. Electronic O&M Information
   1) In addition to the hard copy of O&M data, provide an electronic version of all equipment manuals on CD-ROM or DVD. Electronic documents shall be supplied in Adobe Acrobat (PDF) format.
   2) Provide electronic files for all custom-developed manuals. Text shall be supplied in both Microsoft Office format and Adobe Acrobat format.
   3) Provide electronic files for all drawings produced. Drawings shall be in AutoCAD ".dwg" format and in Adobe Acrobat format. Drawings shall be provided using the AutoCAD eTransmit feature to bind external references, pen/line styles, and fonts into individual zip files along with the drawing file.
   4) Each computer system hardware device shall be backed up onto CD-ROM or DVD after Substantial Completion and shall be turned over to the OWNER.
   5) If specified in the training section, provide digital copies of all training videos. Videos shall be in a format that is readable by standard DVD players and by standard PC DVD drives. Format and shall be a minimum of 800 by 900 pixels and shall include sound.

4. The cover and edge of each volume shall contain the following information:

Project Name (refer to Contract Documents) Contract Number (refer to Contract Documents)
Instrumentation and Control System Hardware[or Applications Engineering] Operations and Maintenance Manual Specification Sections _____, _____, _____
Subcontractor Name Date Volume X of Y (Where X is the volume number and Y is the number of volumes)

1.4 KICK-OFF/COORDINATION MEETINGS

A. Refer to Division 40, Section 40 68 00, Process Control System - Applications Engineering Services for ASP work related meeting and workshop requirements.

B. PCSI Kick-off Meeting

1. A project kick-off coordination meeting shall be held within two weeks after submitting the Project Plan and Schedule Submittal. The purpose of the meeting shall be to discuss the PCSI's Project Plan and Schedule Submittal, to summarize the PCSI's understanding of the project; discuss any proposed substitutions or alternatives; schedule testing and delivery deadline dates; provide a forum to coordinate hardware and software related issues; and request any additional information required from the OWNER. Prepare and distribute an agenda for this meeting a minimum of one week before the scheduled meeting date. The meeting will last up to one-half (1/2) business day.
2. The PCSI kick-off meeting shall include ASP kick-off meeting requirements from Section 40 68 00, Process Control System - Applications Services.

C. PCSI Coordination Meeting

1. The PCSI shall schedule and administer a minimum of four mandatory Coordination Meetings during the submittal phase of the project. The PCSI shall make arrangements for the meetings and prepare and send a proposed agenda to all participants at least one week before scheduled meetings. The PCSI shall be responsible for promptly preparing and distributing meeting minutes to all attendees.
2. The PCSI shall prepare meeting minutes and distribute them to all attendees and others affected by any decisions made at the meetings. The meeting minutes shall be distributed within one week following the meeting.
3. The meetings shall be held at the OWNER's facility, General Contractor's field office, or at the project site (as coordinated with the ENGINEER and OWNER) and shall include, at a minimum, attendance by the OWNER, ENGINEER, General Contractor's project engineer, PCSI/ASP project engineer, and the electrical subcontractor.
    a. The First Coordination Meeting shall be held in advance of the first Shop Drawing submittal. The purpose of the first meeting shall be for the PCSI to:
        1) Summarize their understanding of the project.
        2) Discuss any proposed deviations, substitutions, or alternatives.
        3) Present the PCSI project schedule.
        4) Schedule testing and delivery milestone dates.
        5) Provide a forum for the PCSI to coordinate hardware and software related issues.
        6) Request any additional information required from the OWNER and/or ENGINEER.

7) The PCSI shall bring a draft version of shop drawings to the meeting to provide the basis for the OWNER/ENGINEER's input into their development.

b. The Second Coordination Meeting shall be held after the Control Panel submittals have been reviewed and returned to the PCSI. The purpose of the second meeting shall be for the PCSI to:
   1) Discuss comments made during submittal process.
   2) Refine schedule milestone dates.
   3) Coordinate installation activities.
   4) Discuss any remaining coordination requirements.

c. The Third Coordination Meeting shall be held no more than one month prior to chlorine site testing. The purpose of the third meeting shall be to discuss any remaining coordination needs and requirements.

d. The Fourth Coordination Meeting shall be held no more than one month prior to PLC/radio site testing. The purpose of the fourth meeting shall be to discuss any remaining coordination needs and requirements.

e. A typical agenda may include, but shall not be limited to, the following:
   1) Review minutes of previous meetings.
   2) Review of work progress.
   3) Field observations, problems, and decisions.
   4) Identification of problems which may impede planned progress.
   5) Review of submittal schedule and submittal status.
   6) Review of offsite fabrications and delivery schedules.
   7) Maintenance of progress schedule.
   8) Corrective measures to regain projected schedules.
   9) Planned activities for subsequent work period.
   10) Coordination of projected progress.
   11) Maintenance of quality and work standards.
   12) Effect of proposed changes on progress schedule and coordination.
   13) Other business relating to work.

1.5 REFERENCE STANDARDS

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

1. SAWS HMI and PLC Programming Standards Documents
2. National Electrical Safety Code (NESC).
3. Occupational Safety and Health Administration (OSHA).
4. American Petroleum Institute (API).
5. American Society for Testing and Materials (ASTM):
   a. ASTM A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
6. International Society of Automation (ISA).
7. Insulated Cable Engineers Association (ICEA).
8. National Electrical Manufacturers Association (NEMA).

9. National Fire Protection Agency (NFPA):
    a. NFPA 70E, National Electrical Code (NEC).
    b. NFPA 79, Electrical Standard for Industrial Machinery.
10. Underwriters Laboratories, Inc. (UL):
    a. UL 508, the Standard of Safety for Industrial Control Equipment.
    b. UL 508A, the Standard of Safety for Industrial Control Panels.
    c. UL 50, the Standard of Safety for Enclosures for Electrical Equipment.
11. Factory Mutual (FM).
12. City of San Antonio, Texas Electrical Code.
13. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) handbooks and standards.
14. Sheet Metal and Air Conditioning Contractors National Association (SMACNA) standards.
15. American Society of Plumbing Engineers (ASPE) design guides.
16. Texas Commission on Environmental Quality (TCEQ).
17. American Water Works Association (AWWA).
18. All equipment and installations shall satisfy applicable Federal, State, and local codes.
19. All meters, relays and associated equipment shall comply with the requirements of the National Electric Code and Underwriters Laboratories (UL) where applicable.
20. Each specified device shall also conform to the standards and codes listed in the individual device paragraphs.

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.
    1. All material and equipment, for which a UL standard exists, shall bear a UL label. No such material or equipment shall be brought onsite without the UL label affixed.
    2. If the issue of priority is due to a conflict or discrepancy between the provisions of the Contract Documents and any referenced standard, or code of any technical society, organization, or association, the provisions of the Contract Documents shall take precedence if they are more stringent or presumptively cause a higher level of performance. If there is any conflict or discrepancy between standard specifications, or codes of any technical society, organization or association, or between Laws and Regulations, the higher performance requirement shall be binding on the CONTRACTOR, unless otherwise directed by the OWNER/ENGINEER.
    3. In accordance with the intent of the Contract Documents, the CONTRACTOR accepts the fact that compliance with the priority order specified shall not justify an increase in Contract Price or an extension in Contract Time, nor limit in any way the CONTRACTOR's responsibility to comply with all Laws and Regulations at all times.
    4. All control panels shall be constructed and the labeling shall be affixed in a UL 508 facility.

1.6 QUALITY ASSURANCE

A. The Process Control System Integrator (PCSI) shall be a "systems integrator" regularly engaged in the design and the installation of instrumentation systems and their associated subsystems as they are applied to the municipal water and wastewater industry. For the purposes of this Specification Section, a "systems integrator" shall be interpreted to mean an organization that complies with all of the following criteria:

a. Employs personnel on this project who have successfully completed ISA or manufacturer's training courses on general process instrumentation and configuration and implementation of the specific programmable controllers, computers, and software proposed for this project. Key personnel shall hold ISA CCST Level 1 certification or have a minimum of 10 years of verifiable plant start-up experience. Key personnel shall include, as a minimum, the lead field technician.

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. Has successfully completed work of similar or greater complexity on at least three previous projects within the last five years. Successful completion shall be defined as a finished project completed on time, without any outstanding claims or litigation involving the PCSI. Potential references shall be for projects where the PCSI's contract was of similar size to this Project.
4. Has been in the water/wastewater industry performing the type of work specified in this specification section for a minimum of five continuous years.

B. The PCSI shall maintain a permanent, fully staffed and equipped service facility within 200 miles of the project site with full-time employees capable of designing, fabricating, configuring, installing, calibrating, and testing the systems specified herein. At a minimum, the PCSI shall be capable of responding to on-site problems within 12 hours of notice. Provide an on-site response within four hours of notification starting at two months before scheduled start-up to two months after start-up completion.

C. PCSI shall hold a valid UL 508 certification for their panel fabrication facility.

D. The following Instrumentation/Controls and PCS programming contractors, listed in no particular order, have been pre-approved for this work:

1. Prime Controls
   Contact: Brian Poarch
   Address: 1725 Lakepointe Dr., Lewisville, Texas 75057
   Phone: (972) 221-4849
2. Control Panels USA, Inc.
   Contact: Martin Salyer
   Address: 16310 Bratton Lane, Suite 100, Austin, Texas 78728
   Phone: (512) 852-8280
3. Richardson Logic Controls
   Contact: Michael Cunningham
   Address: 8115 Hicks Hallow, McKinney, Texas 75071
   Phone: (972) 542-7375
4. TESCO Controls, Inc.
   Contact: Brian Adams
   Address: 8000 Jetstar, Suite 150, Irving, Texas 75063
   Phone: (817) 948-3726

E. Only approved suppliers will be accepted.

1.7 APPLICATION SERVICES PROVIDER (ASP)

A. The Contractor shall provide an Application Services Provider (ASP) for application software programming for Programmable Logic Controllers (PLC) and Human Machine Interface (HMI) computers and other equipment as specified in Section 40.

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 meet the following qualification and/or submit the following documentation as specified:
   a. Shall secure an independent performance bond and provide documentation of same from a bonding agency.
   b. Shall present an adequate Certificate of Insurance.
   c. Shall submit resumes of team members who have completed training and certifications within the last three (3) years.
   d. Shall submit a team organization chart.
   e. The Programmer Shall have completed five (5) projects of this size or larger in dollar value and shall provide project names, Owner name, and valid and recently verified reference contacts name and contact information for each project.
   f. Shall demonstrate five (5) years of experience working on projects in water or wastewater plant work.
   g. Shall provide project name, Owner name, time period of work and valid and recently verified reference contacts for each project.
   h. Proposed staff shall have the following certifications:
      1) Allen-Bradley CompactLogix PLCs and programming.
      2) The programmer, not the company, has worked with Studio 5000 version 32 or higher.
      3) The programmer, not the company, has worked with PlantPAX version 4.5 or higher.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Delivery, storage, and handling shall be in accordance with Division 01, General Requirements.

B. Equipment shall be installed in its permanent, finished location shown on the Drawings within seven calendar days of arriving onsite. If the equipment cannot be installed within seven calendar days, the equipment shall not be delivered to the site, but stored offsite, at the CONTRACTOR's expense, until such time that the site is ready for permanent installation of the equipment.

C. Shipping Precautions

1. After completion of shop assembly, factory test, and approval of all equipment, cabinets, panels, and consoles shall be packed in protective crates and enclosed in heavy duty (5 mil) polyethylene envelopes or secured sheeting to provide protection from damage, dust, and moisture. Dehumidifiers shall be placed inside the polyethylene coverings. The equipment shall then be skid-mounted for final transport. Lifting rings shall be provided for moving without removing protective covering. Boxed weights shall be shown on shipping tags together with instructions for unloading, transporting, storing, and handling at the job Site.
2. Manufacturer's special instructions for field handling, storage, and installation required for protection shall be securely attached to the packaging for each piece of equipment prior to shipment. The instructions shall be stored in resealable plastic bags or other means of protection. Two copies of these instructions shall be included with the equipment at time of shipment, and shall be made available to the CONTRACTOR and OWNER.

3. If any apparatus has been damaged, such damage shall be repaired at no additional cost to the OWNER.

1.9 NOMENCLATURE AND IDENTIFICATION

A. Panel/Enclosure Nameplates

1. Nameplates shall be engraved, laminated impact acrylic, black lettering on a white background, matte finish, not less than 1/16-inch thick by 3/4-inch by 2-1/2-inch, Rowmark 322402. Nameplates shall be 316 SS screw mounted to all enclosures, except for NEMA 4 and 4X. Nameplates for NEMA 4 and 4X enclosures shall be attached with double faced adhesive strips, TESA TUFF TAPE 4970, .009 X ½-inch. Prior to installing the nameplates, the metal surface shall be thoroughly cleaned with a 70% alcohol solution until the metal surface residue has been removed. Epoxy adhesive or foam tape is not acceptable.
2. See Instrumentation and Controls – Control Panels and Equipment Section.

1.10 WARRANTY

A. Where longer warranties are not identified in the individual equipment specifications , provide warranty per Division 01, Warranties and Bonds, and as specified herein.

B. The Manufacturer shall warrant the equipment to be free from defects in material and workmanship for the period specified in Division 01, Warranties and Bonds from the date of acceptance of the equipment containing the items specified in this Section. Within such period of warranty the Manufacturer shall promptly furnish all material and labor necessary to return the equipment to new operating condition. Any warranty work requiring shipping or transporting of the equipment shall be performed by the CONTRACTOR at no expense to the OWNER.

1.11 PROJECT/SITE REQUIREMENTS

A. Environmental Requirements. Refer to Division 26, Electrical and the Electrical drawings for specific environmental and hazardous area classifications.

B. Elevation: Equipment shall be designed to operate at the project ground elevation.

C. Temperature

1. Equipment located in outdoor areas shall operate between [- 30 to 50 C] degrees ambient minimum.
2. Equipment located in indoor areas shall operate between [10 to 35 C] degrees ambient minimum.
3. Storage temperatures shall range from [0 to 50 C] degrees ambient minimum.
4. Additional cooling or heating shall be furnished if required by the equipment as specified herein.

D. Relative Humidity

1. Air conditioned area equipment shall operate between [20 to 95] percent relative, non-condensing humidity. All other equipment shall operate between 0 to 100 percent relative, condensing humidity.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Auxiliary components necessary for full system operation shall be provided whether they are shown on the Drawings or not. These components include but are not limited to transducers, relays, signal amplifiers, and signal isolators required for interface with existing equipment and/or equipment provided by others within other specification sections of this Contract. The PCSI shall be responsible for coordinating mechanical and electrical interface requirements to the Control System.

B. Equipment fabrication, assembly, procurement, and installation shall fully conform to project specifications, drawings, details, engineering data, instructions, and manufacturer requirements. Substitutions to specified equipment or functionality must be specifically noted and approved by the OWNER/ENGINEER prior to implementation. To the furthest extent possible and to accommodate future operation and maintenance, equipment of similar type shall be from the same manufacturer and match the OWNER's existing install base (unless specifically noted otherwise).

C. All equipment and installations shall comply with applicable Federal, State, and local codes.

D. Equipment, instrument, and loop numbering schemes and PLC I/O addressing shall follow those specified in the SAWS PLC and HMI programming standards. Deviation or modification of numbering schemes will not be acceptable unless approved by the OWNER/ENGINEER.

E. The PCSI shall, at the time of purchasing, review equipment with the OWNER/ENGINEER, manufacturers, and vendors to ensure the latest hardware and software versions are purchased.

F. All instrumentation and electronic equipment shall be of the manufacturer's latest design, utilizing printed circuitry and epoxy or equal coating to prevent contamination by dust, moisture, and fungus. The field-mounted equipment and system components shall be designed for installation in dusty, humid, and slightly corrosive service conditions.

G. All equipment, cabinets, and devices furnished shall be heavy-duty type, designed for continuous industrial service. The system shall contain similar products of a single manufacturer, and shall consist of equipment models which are currently in production. All equipment provided shall be of modular construction and shall be capable of field expansion.

H. All electronic/digital equipment shall be provided with radio frequency interference protection.

2.2 GENERAL REQUIREMENTS – INSTRUMENTATION

A. All instruments shall be provided with mounting hardware and floor stands, wall brackets, or instrument racks unless otherwise noted. Fasteners for securing control panels and enclosures to walls and floors shall be either hot-dipped galvanized after fabrication or stainless steel. Provide stainless steel fasteners only in corrosive areas rated NEMA 4X on the drawings or as defined under Division 26, Electrical. Provide and size anchors in accordance with Divisions 01 and 05 as required per the seismic calculations. Provide minimum size anchor of 3/8-inch.

B. All indicators shall be linear in process units, unless otherwise noted. All transmitters shall be provided with indicators in process units, accurate to 2 percent or better.

2.3 GENERAL REQUIREMENTS – ELECTRICAL

A. Equipment shall operate on a 60 Hertz alternating current power source at a nominal 120 volts, plus or minus 10 percent, except where specifically noted. Regulators and power supplies required for compliance with the above shall be provided between power supply and interconnected instrument loop. Where equipment requires voltage regulation, constant voltage transformers shall be supplied.

B. With the exception for field device network connected devices, all electronic instrumentation shall utilize linear transmission signals of isolated 4 to 20 mA DC (milliampere direct current) capable of driving a load up to 750 Ohms, unless specified otherwise. However, signals between instruments within the same panel or cabinet may be 1-5 VDC (volts direct current).

C. Outputs of equipment that are not of the standard signals as outlined shall have the output immediately raised and/or converted to compatible standard signals for remote transmission. No zero-based signals will be allowed.

D. All switches shall have double-pole double-throw contacts rated at a minimum of 900 VA, unless noted otherwise.

E. Switches and/or signals indicating an alarm, failure, or upset condition shall be wired fail-safe to the SCADA system. A fail-safe condition is an open circuit when in an alarm state.

F. Materials and equipment shall be UL approved. Where components are not available with UL approval, integrate the device with ground fault protective devices, isolation transformers, fuses, or other protective equipment necessary to achieve compliance with UL 508 requirements.

G. All equipment furnished shall be designed and constructed so that in the event of power interruption, the systems specified herein shall go through an orderly shutdown with no loss of memory and shall resume normal operation without manual resetting when power is restored, unless otherwise noted.

H. All transmitter output signals shall include signal and power source isolation.

I. Provide local electrical shutoffs and disconnects for all four-wire field instruments requiring 120 VAC power. Electrical disconnects shall be suitably rated disconnect switches or manual motor starters as specified under Division 26, Electrical.

2.4 LIGHTNING AND SURGE PROTECTION DEVICES

A. General - Surge protection shall be provided to protect the electronic instrumentation system from induced surges propagating along the signal and power supply lines from lightning, utility, or the plant electrical system. The protection systems shall be such that the protective level shall not interfere with normal operation, but shall be lower than the instrument surge withstand level. Protection shall be maintenance-free and self-restoring. Devices shall have a response time of less than 50 nanoseconds and be capable of handling a discharge surge current (at an 8x20µs impulse waveform) of at least 8 kA. Ground wires for all instrumentation device surge protectors shall be connected to a low resistance ground in accordance with Division 26, Electrical.

B. Provide protection of all analog signal (4-20 mA) circuits where any part of the circuit is outside of the building envelope. Circuits shall be protected at both the transmitter and the control system end of the circuit. Protection devices located near the transmitter shall be mounted in a separate enclosure, unless conduit mounted; and shall be Phoenix Contact PT Series, MTL Surge Technologies (Telematic) TP48, Citel TSP-10 series, or equal. Substitution of a single device to protect both 120 VAC and 4-20 mA wires to an instrument is acceptable. Protection devices in

control panels shall be MTL Surge Technologies (Telematic) SD Series, Phoenix Contact PT Series, Citel BP1-24, or equal.

C. Provide protection of all 120 VAC power feeds into control panels, instruments, and control room equipment. Surge arresters shall be Transtector ACP-100BW Series, Phoenix Contact "Mains-PlugTrab", MCG Surge Protection 400 Series, or equal.

1. Provide protection of all 120 VAC power feeds into network panels. Surge arresters shall be Transtector SP50-1201P.

D. Non-Fiber Based Data Highway or Communications Circuits – Provide protection on all communication and data highway circuits that leave a building or are routed external to a building. Circuit protection shall be provided at both ends of the line. Surge protection devices shall be Phoenix Contact PlugTrab Series, Transtector FSP Series, MTL Surge Technologies (Telematic) NP Series, or equal.

E. Inductive Loads – At a minimum, provide coil surge suppression devices, such as varistors or interposing relays, on all process controller outputs or switches rated 120 VA or less that drive solenoid, coil, or motor loads.

2.5 TUBING AND FITTINGS

A. All instrument air header takeoffs and branch connections less than 2 inch shall be 316 stainless steel.

B. All instrument shut-off valves and associated fittings shall be supplied in accordance with the piping specifications and all instrument installation details. The materials for fittings and valves shall be compatible with process fluids. Where metallic fittings and valves are compatible, wetted materials shall be Type 316 stainless steel.

C. The materials for instrument tubing shall be compatible with process fluids. Where metallic tubing is compatible, tubing shall be fully annealed ASTM A269 Seamless 316 grade free of OD scratches having the following dimensional characteristics as required to fit the specific installation:

1. 1/4-inch to 1/2-inch O.D. by 0.035-inch wall thickness.
2. 5/8-inch to 1-inch O.D. by 0.049-inch wall thickness.
3. 1-inch O.D. by 0.065-inch wall thickness.
4. 1-1/4-inch O.D. by 0.065-inch wall thickness.
5. 1-1/2-inch O.D. by 0.083-inch wall thickness.
6. 2-inch O.D. by 0.095-inch wall thickness.

D. All process connections to instruments shall be annealed 1/2-inch O.D. stainless steel tubing, Type 316.

E. All tube tracks shall be supported by stainless steel and installed as per manufacturer's installation instructions.

2.6 SPARE PARTS

A. Spare parts of the type and quantity as recommended by the manufacturer shall be furnished for all devices furnished under these sections.

B. All spare parts shall be wrapped in bubble wrap, sealed in a polyethylene bag complete with dehumidifier, then packed in cartons and labeled with indelible markings. Complete ordering information including manufacturer's part number, part ordering information including manufacturer, part number, part name, and equipment name and number(s) for which the part is

to be used shall be supplied with the required spare parts. The spare parts shall be delivered and stored in a location directed by the OWNER/ENGINEER.

C. As a minimum, furnish the following spare parts for control panels:
   1. One-half dozen replacement fuses, all types and sizes.

D. The following Spare Parts shall be furnished and utilized as the Application Development System. At the completion of the project the Application Development system shall be turned over to the Owner as spare parts.
   1. PLC Rack
      a. Power Supply.
      b. One CPU of the largest memory size model provided.
      c. One IO Module of each type.
   2. Red Lion Gateway including RS232/485 expansion card and RS232/485 adapter.

2.7 TEST EQUIPMENT

A. Provide all test equipment, instruction manuals, carrying/storage cases, unit battery charger, special tools, calibration fixtures, cord extenders, patch cords, test leads, and miscellaneous items for checking field operation of all supplied equipment.

B. All test equipment shall be wrapped in bubble wrap, sealed in a polyethylene bag with a dehumidifier, then packed in cartons and labeled with indelible markings. Complete ordering information including manufacturer's part number and equipment name shall be supplied. The test equipment shall be delivered and stored in a location directed by the OWNER/ENGINEER.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS – INSTALLATION

A. All equipment and installations shall satisfy applicable Federal, State, and local codes.

B. Instrumentation and accessory equipment shall be installed in accordance with the manufacturer's instructions. The locations of equipment, transmitters, alarms, and similar devices indicated are approximate only. Exact locations of all devices shall be as approved by the OWNER/ENGINEER during construction. Obtain in the field all information relevant to the placing of process control equipment and, in case of any interference with other work, proceed as directed by the CONTRACTOR and furnish all labor and materials necessary to complete the work in an approved manner at no additional cost to the OWNER.

C. All equipment used in areas designated as hazardous shall be designed for the Class, Group and Division as required for the locations as shown on the Drawings and specified in Division 26, Electrical. All work shall be in strict accordance with codes and local rulings.

D. Unless specifically indicated, direct reading or electrical transmitting instrumentation shall not be mounted on process piping. Instrumentation shall be mounted on instrument racks or stands. All instrumentation connections shall be provided with shut-off and drain valves. For differential pressure transmitters, five-valve manifolds for calibration, testing, and blow down service shall also be provided. For chemical or corrosive fluids, diaphragm seals with flushing connections shall be provided.

E. All piping and tubing to and from field instrumentation shall be provided with necessary unions, calibrations and test tees, couplings, adaptors, and shut-off valves. Process tubing shall be installed to slope from the instrument toward process for gas measurement service and from the process toward the instrument for liquid measurement service. Provide drain/vent valves or fittings at any process tubing points where the required slopes cannot be maintained. Process tubing shall be installed rigidly with supports to prevent significant vibrations.

F. Brackets and hangers required for mounting of equipment shall be provided. They shall be installed as shown and not interfere with any other equipment.

G. The shield on each process instrumentation cable shall be continuous from source to destination and be grounded at only one ground point for each shield.

H. Investigate each space in the building through which equipment must pass to reach its final location. If necessary, ship material in sections sized to permit passing through restricted areas in the building. Provide on-site service to oversee the installation, the placing and location of system components, their connections to the process equipment panels, cabinets and devices, subject to the ENGINEER's approval. Certify that field wiring associated with his/her equipment is installed in accordance with best industry practice. Schedule and coordinate work under this section with that of the electrical work specified under applicable Sections of Division 26, Electrical.

I. Installation of fiber optic cable within control panel and console assemblies. Refer to cable manufacturer's specifications for bend radius. Use cable breakout assembly as recommended by the cable manufacturer. Provide wire basket, strain relief as required to meet manufacturer's strain requirements.

J. Provide local electrical shutoffs and disconnects for all four-wire field instruments requiring 120 VAC power. Electrical disconnects shall be suitably rated disconnect switches or manual motor starters as specified under Division 26, Electrical.

K. Provide sunshades for equipment mounted outdoors in direct sunlight. Sunshades shall include standoffs to allow air circulation around the cabinet. Orient equipment outdoors to face to the North or as required to minimize the impact of glare on LED, LCD, or other digital readouts.

L. Loop Tuning

1. All electronic control stations incorporating PID controllers shall be tuned following field installation and calibration of instrumentation and control system components, but prior to commencement of the specified field tests. Field testing will be immediately ‘failed’ if loop tuning for the entire installed system is not complete.
2. Optimal loop tuning shall be achieved either by auto-tuning software or manually by trial and error, Ziegler-Nichols step-response method, or other documented process tuning method. Assigning common PID factors for identical loops following field tuning of a single typical loop is acceptable. However, the Final Documentation Manuals shall include the loop tuning configuration parameters for each loop individually as specified in PART 1 of this section.

M. Determine and configure optimal tuning parameters to assure stable, steady state operation of final control elements running under the control of field-mounted, dedicated PID controllers or software-based PID controllers residing as part of the programmable logic controller system. Each control loop that includes anti-reset wind-up features shall be adjusted to provide optimum response following start-up from an integral action saturation condition.

N. Tune all PID control loops to eliminate excessive oscillating final control elements. Loop parameters shall be adjusted to achieve 1/4 amplitude damping or better. In addition, loop steady state shall be achieved at least as fast as the loop response time associated with critical damping.

O. Loop performance and stability shall be verified in the field following tuning by step changes to setpoint. Submit loop tuning methodology and verification as part of the final system documentation as specified in Part 01.

P. For cascade loops, tune both sets of controllers so that the cascade loop achieves the loop tuning characteristics specified herein.

3.2 GENERAL REQUIREMENTS – TESTING

A. Refer to Division 40 Section 40 61 21, Process Control System – Testing.

3.3 GENERAL REQUIREMENTS – TRAINING

A. Refer to Division 40 Section 40 61 26, Process Control System – Training.

ATTACHMENTS

40 61 00A Attachment A - Division 40 PLC, Radio, Network and Security Sites Schedule

END OF SECTION