CITY OF FORT WAYNE MASTER UPDATED: 3/20/2017

SECTION 40 61 13

PROCESS CONTROL SYSTEM (PCS) GENERAL PROVISIONS

1. – GENERAL

NTS: This section is written for use on system supplier contract projects. When used without a system supplier, some editing of this section may be necessary.

* 1. DESCRIPTION
		1. Scope:
			1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish, install, calibrate, test, start-up and place in satisfactory operation a complete process control system (PCS).
			2. The process instrumentation and control Work includes, but is not limited to, the following:
				1. Panels and panel-mounted instruments and devices.
				2. Field-mounted instruments and devices.
				3. Programmable logic controllers (PLC) and software.
				4. Remote telemetry units.
				5. Telemetry system communication hardware.
				6. Personal computers and human-machine interface (HMI) software.
				7. Local area network hardware and software.
				8. Uninterruptible power supply.

NTS: Consult with owner for appropriate network (EtherNet/IP, Modbus, DNP3, etc)

* + - * 1. Field instruments network communication hardware and software required for interfacing various systems to provide a fully-integrated system.
		1. PCS shall monitor, store, display, and log process and equipment operating information; perform various process control functions; and generate various reports.
		2. The Contract Documents describe the required PCS and PCS functions and operational requirements.
		3. Coordination
			1. Process Controls:
				1. Providing central computer system, instruments, and controls are part of the Work. Programming of control logic and configuration of human machine interface (HMI) software is part of the Work. CONTRACTOR shall program and configure the software. Functional description of process system and associated equipment is included in Section 40 61 16, Process Control System Narrative.
				2. Some panels and equipment are furnished under other Specification Sections. Under this Contract, and computer system hardware and software are provided by computer system contractor retained by OWNER. CONTRACTOR shall coordinate with Suppliers of panels and equipment to provide fully functional system complying with the Contract Documents and that interfaces with the process control network.
				3. Computer system input/output list identifies inputs and outputs required and is part of this Section. Input/output list is for coordinating signals between equipment provided by other Suppliers and computer system Supplier, and identifying signals to be programmed by CONTRACTOR. Provide Work for CONTRACTOR-furnished control options not on the input/output list at no additional cost to OWNER.

NTS: Paragraph “2” below is written assuming that a system supplier will be used on the Project. Engineer to name system supplier in Section “1.3”.

* + - 1. System Supplier Subcontract
				1. The Owner will name the System Supplier and identify the price for providing the Process Instrumentation and Control System Work.
				2. Contractor shall solely use the System Supplier named for the Process Instrumentation and Control System as specified herein and as shown on the Drawings.
				3. Contractor shall finalize the terms and conditions of the subcontract with the System Supplier.
				4. Contractor shall be responsible for scheduling and coordinating the PCS installation with regard to all other Work on the Site and in accordance with the provisions of the General Conditions.
				5. Contractor shall retain the System Supplier to undertake the responsibilities specified. However, execution of these specified duties by the System Supplier shall not relieve Contractor of the ultimate responsibility for the components of the PCS.
			2. System Supplier’s Responsibilities:
				1. Preparing all process control equipment submittals in accordance with the Contract Documents.
				2. Proper interfacing of instrumentation and control equipment with field equipment, instruments, devices, and panels, including required interfacing with packaged control systems furnished by other equipment Suppliers, and required interfacing with the Site’s electrical system.
				3. Review and coordination with manufacturers, other Suppliers, and other contracts of Shop Drawings and other CONTRACTOR submittals for equipment, valves, piping, and appurtenances for ensuring proper interfacing of hardware, and locations and installation requirements of inline devices and instrument taps.
				4. Direct, detailed oversight of installation of instruments, panels, consoles, cabinets, wiring and other components, and related wiring and piping connections.
				5. Calibrating, source quality control, field quality control, and start-up of the system.
				6. Responsibility for correction period obligations for the PCS.
				7. Training operations and maintenance personnel in operation and maintenance (including calibration and troubleshooting) of the PCS.
	1. SUMMARY

NTS: List below only sections covering process instrumentation and control system work that a user might expect to find in this section, but are specified elsewhere. Do not list administrative and procedural division 01 sections. Sections listed below might not be used for a project, add/delete sections as necessary.

* + 1. Process Instrumentation and Control System Work is specified under the following Specification sections:
			1. Section 40 61 13 – Process Control System (PCS) General Provisions
			2. Section 40 61 16 – Process Control System (PCS) Narrative
			3. Section 40 61 63 – Process Control System – Training
			4. Section 40 61 93 – Process Control System – Input/Output List
			5. Section 40 64 00 – Programmable Logic Controllers
			6. Section 40 67 03 – Control System Equipment Panel Construction
			7. Section 40 67 06 – Miscellaneous Control Panel Devices

NTS: The below sections do not have a City Master Specification. Add/Delete sections as necessary.

* + - 1. Section 40 62 17 – Operator Interface Unit
			2. Section 40 66 00 – Network and Communication Equipment
			3. Section 40 67 09 – Uninterruptible Power Supply (UPS)
			4. Section 40 67 11 – Miscellaneous Control System Field Devices
			5. Section 40 70 00 – Instrumentation of Process Systems
			6. Section 40 71 00 – Flow Measurement
			7. Section 40 72 00 – Level Measurement
			8. Section 40 73 00 – Pressure Measurement
			9. Section 40 74 00 – Temperature Measurement

NTS: Designer shall edit sections “C” through “F” below with types of Contracts selected by Owner and incorporated

* + 1. The Contractor shall include in the Base Bid Price the price of the Process Instrumentation and Control System Work established by Addendum as indicated in the Bid Form
		2. The Contractor shall include in the Base Bid Price the price of the Telemetry and Radio Communications Work established by Addendum as indicated in the Bid Form
		3. The Contractor shall include in the Base Bid Price the price of the Access Control and Security Systems Work established by Addendum as indicated in the Bid Form
		4. The Contractor shall include in the Base Bid Price the price of the Programming Work established by Addendum as indicated in the Bid Form
		5. Payment for Process Instrumentation and Control System Work will be made in the Contract Price Schedule in the Agreement.

NTS: Insert at (--1--) through (--4--) Owner selected system supplier. If system supplier is not known at the time of the bid an addenda will be issued at a later date. If system supplier is not used for a project delete lines A. – XX. below and replace with “NOT USED”

* 1. SYSTEM SUPPLIER
		1. (--1--) (Process Instrumentation and Control System Work)
		2. (--2--) (Telemetry and Radio Communications Work)
		3. (--3--) (Access Control and Security Systems Work)
		4. (--4--) (Programming Work)
		5. No Substitute Permitted.
	2. REFERENCES

NTS: Retain applicable standards and add others as required.

* + 1. Underwriters Laboratory (UL).
		2. National Electrical Manufacturers Association (NEMA).
		3. Instrument Society of America (ISA).
			1. ISA 5.4, Instrument Loop Diagrams.
			2. ISA 20, Specification Forms for Process Measurement & Control Instruments, Primary Elements & Control Valves.
		4. ANSI/ASQ Z1.4, Sampling Procedures and Tables For Inspection By Attributes.
		5. NFPA 79, Electrical Standard for Industrial Machinery.
	1. DEFINITIONS
		1. Process Instrumentation and Control Equipment (Equipment): Control and monitoring components such as field elements, panels, process control systems and associated electrical and electronic accessories.
		2. Process Instrumentation and Control System (System): Materials, equipment and work required to implement a complete and operating system of instrumentation and control equipment.
		3. Process Control System: That portion of a Process Instrumentation and Control System consisting of industrially hardened, panel-mounted Personal Computers (PC) loaded with automation software serving as Human/Machine Interface Unit (HMI) working in conjunction with Programmable Logic Controller (PLC) based data acquisition and control panels. Includes associated I/O subsystems, Data Highway and Local Area Network Equipment, and PLC programmer unit.
		4. Instrument Manufacturer: Manufacturer of Process Instrumentation and Control Equipment.
		5. System Supplier: An organization, under subcontract of the Contractor, who shall provide engineering; hardware and software; application software programming and TCP/IP addressing; testing; troubleshooting; training; and adjusting, documenting, and starting-up of the complete Process Instrumentation and Control System.
	2. SUBMITTALS
		1. Field Instruments:
			1. Manufacturer’s product name and complete model number of devices proposed for use, including manufacturer’s name and address.
			2. Instrument tag number in accordance with the Contract Documents.
			3. Data sheets and manufacturer’s catalog literature. Provide data sheets in accordance with ISA 20 and annotated for features proposed for use. ISA 20 shall be submitted in Microsoft Excel and editable. For instruments not included in ISA 20, submit data sheets using a format similar to ISA 20. Reference Exhibit 40 61 13 - 1 at the end of the specification for an example.
			4. Description of construction features.
			5. Performance and operation data.
			6. Installation, mounting, and calibration details; instructions and recommendations.
			7. Service requirements.
			8. Dimensions of instruments and details of mating flanges and locations of closed tanks, pipe sizes for insertion instruments, and upstream/downstream straight run pipe lengths required.
			9. Range of each device and calibration information
			10. Descriptions of materials of construction and listing of NEMA ratings for equipment
			11. Field Quality Control Submittals:
				1. Submit the following prior to commencing system checkout and start-up.

Completed calibration sheets for each installed instrument showing five-point calibration (zero, 25, 50, 75, 100 percent of span), signed by factory-authorized serviceman.

* + - * 1. Field calibration reports
				2. Field testing reports.

Submit written report of results of each visit to Site by Supplier’s service technician, including purpose and time of visit, tasks performed, and results obtained. Submit within two days of completion of visit to the Site.

* + 1. Panels, Consoles, and Cabinets:
			1. General
				1. Layout drawings that include:

All drawings shall be prepared using dwg. Format

Submit 11”x17” .pdf copy. Retain 11”x17” hard copy for use in the field.

Nameplate location and legend including text, letter size and colors to be used.

Layouts and sizes of operator interface terminal (OIT) display panels and alarm annunciator panels.

Location of anchorage connections.

Front, rear, and internal panel views to scale.

Product information on panel components.

Location of external wiring and piping connections.

Mounting and installation details, coordinated with actual application.

Terminal strips shall be easily readable and on a separate drawing sheet.

Calculations substantiating panel heating and cooling provisions proposed.

Subpanel layouts and mounting details for items located inside control panels.

* + - * 1. Product information on panel components including:

Manufacturer’s product name and complete model number of devices being provided, including manufacturer’s name and address.

Instrument tag number in accordance with the Contract Documents.

Data sheets and catalog literature. Submit data sheets as shown in ISA 20 and annotated for features proposed for use. ISA 20 shall be submitted in Microsoft Excel and editable. For instruments not included in ISA 20, submit data sheets with format similar to ISA 20. Reference Exhibit 40 61 13 - 1 at the end of the specification for an example.

Description of construction features.

Performance and operation data.

Installation, mounting, and calibration details; instructions and recommendations.

Service requirements

* + - * 1. Wiring diagrams, including the following:

Name of each panel, console, or cabinet.

Wire sizes and types.

Terminal strip and terminal numbers.

Wire color coding.

Functional name and manufacturer’s designation for components to which wiring are connected.

NTS: In paragraph “6)”, below, coordinate the ground connection for the lightning/surge protection ground in the panel with the project electrical engineer and show on electrical drawings

Lightning and surge protection grounding.

* + - * 1. Electrical control schematics in accordance with NFPA 79. Control schematics shall be in accordance with convention indicated in Annex D of NFPA 79. Standardized wiring diagrams that do not accurately reflect actual wiring to be furnished are unacceptable. Tables or charts for describing wire numbers are unacceptable. Relay contact (normally open/normally closed) line number shall be indicated on the control schematic at the location where the coil is energized.
				2. Stock list or bill of materials for each panel including tag number (reference designator), functional name, manufacturer’s name, model number, owner local vendor name, and quantity for components mounted in or on the panel or enclosure.
				3. Detail showing anchorage plan of wire bundles between subpanels and front panel mounted devices.

NTS: Specifier shall identify each control panel that will be modified or designed. Insert at (--1--) the individual control panel(s). Add lines as necessary.

* + - 1. Preliminary Submittals
				1. Control panels modified or designed

(--1--)

Contractor shall submit for each control panel (including PLC, pump protection, control station, etc.) that is modified or designed for the Project. There should be a separate submittal for each control panel.

* + - 1. Control Panel Testing Start Up Submittal
				1. Control panels modified or designed

(--1--)

* + - * 1. Contractor shall submit for each control panel (including PLC, pump protection, control station, etc.) that is modified or designed for the Project. There should be a separate submittal for each control panel.
				2. Submit red-line Shop Drawings with Contractor markups during installation to the Owner.
			1. As-Builts / Final Completion
				1. Control panels modified or designed

(--1--)

* + - * 1. Contractor shall submit for each control panel (including PLC, pump protection, control station, etc.) that is modified or designed for the Project. There should be a separate submittal for each control panel.
				2. Submit electronic copy in dwg. format to Owner’s electrical controls and instrumentation program manager.
				3. Submit electronic copy in pdf. format to Owner’s electrical controls and instrumentation program manager.
		1. Factory Acceptance Test
			1. Execution:
				1. Contractor to provide:

 Minimum of (1) table and (2) chairs.

Contract specifications and drawings

Sign-off forms

* + - 1. Procedure – submit proposed procedures for factory testing required to comply with the Contract Documents. Test procedure shall include the following
				1. Notification to OWNER and ENGINEER at least 14 days before readiness to begin system checkout for factory acceptance testing. Schedule system checkout on dates acceptable to OWNER and ENGINEER.
				2. Visual inspection of components and assembly.
				3. Description of hardware operational testing.
				4. Description of software demonstration.
				5. Description of testing equipment to be used.
				6. Sign-off sheets to be used at time of testing.
				7. Submit copies of Factory Acceptance Testing Sign-Off documents for approval of format by Engineer.
				8. Results of testing.
		1. Site Acceptance Test
			1. Execution:
				1. Contractor to provide:

 Minimum of (1) table and (2) chairs.

Contract specifications and drawings

Sign-off forms

* + - 1. Procedure: Submit proposed procedures for site testing required to comply with the Contract Documents. Test procedures shall include the following:
				1. Written procedure including control modes (Local, Remote manual, Remote Auto, etc), alarm testing, and device failure testing for system checkout. Submit not less than 14 days prior to starting system checkout.
				2. 21 days prior to starting system checkout submit written procedure for start-up.
				3. Visual inspection of components and assembly.
				4. Description of hardware operational testing.
				5. Description of software demonstration.
				6. Description of testing equipment to be used.
				7. Sign-off sheets to be used at time of testing.
				8. Submit copies of Site Acceptance Testing Sign-Off documents for approval of format by Engineer.
				9. Results of testing.
		1. Field wiring and piping
			1. diagrams, include the following:
				1. Wire and pipe sizes and types.
				2. Terminal numbers at field devices and in panels.
				3. Fiber optic termination designations in the field and in panels.
				4. Color coding.
				5. Locations, functional names, and manufacturer’s designations of items to which wiring or piping are connected.
			2. Product Data
				1. Product data for field wiring and piping provided for instrumentation and control service and not included under other Sections or contracts.
		2. Maintenance of Shop Drawings
			1. Contractor shall update and maintain Shop Drawing redlines daily.
			2. Maintain in control panel, or other approved location, in clean, dry, legible condition, complete sets of the Shop Drawings for use by Contractor, Engineer, Owner and others on site.
			3. Do not use Shop Drawings for purpose other than serving as Project record. Do not remove Shop Drawings from control panel, or other approved area, without Engineer’s approval.
			4. Upon System Start-up, Contractor shall formally submit red-line Shop Drawings with Contractor markups during installation to the Owner.
		3. SCADA System:
			1. Submit the following general information:
				1. Detailed block diagram showing system hardware configu­ra­tion and identifying model numbers of system compo­nents.
				2. Software listings for operating system, applications, and HMI.
				3. Software language and organization.
				4. Format, protocol and procedures for data transmission and communi­cations with in­put/out­put mod­ules and peripheral devices, including wide area network (WAN) or local area network (LAN).
				5. Use Owner provided message blocks between PLC equipment.
				6. HMI interfacing details, licensing structure, and included functions.
				7. Control and failure modes.
				8. Online and offline capabilities for programming, system utilities, and diagnostics.
				9. Input/Output Information:

Input/output (I/O) point listing with I/O module cross-reference identification.

I/O module cross-reference identification based on I/O address list developed by I&C Subcontractor .

* + - * 1. Database listing, including all I/O points.
				2. Alarm list including Alarm Priority shall be approved by OWNER.
			1. Hardware:
				1. Layout drawings showing front, rear, end, and plan views to scale of equipment, I/O components, power supplies, and peripheral devices.
				2. Equipment ventilation and cooling requirements.
				3. Interconnection diagrams, including termination details, cable identifica­tion list, and cable length.
				4. Drawings showing equipment layout.
				5. Installation requirements, instruc­tions, and recom­menda­tions.

NTS: Edit paragraph “f” below with Owner to determine the networks that need to be updated.

* + - * 1. Update the Owner provided SCADA network diagrams. PCN – Process Control Network, BIN – Business Information Network.
				2. Product data for all hardware used.
			1. Software:
				1. System Software Documentation: Submit preliminary soft­ware documentation not later than 14 days prior to scheduled start of factory testing. Software documentation shall include the following:

Complete listing of external and internal I/O address assignments, register assignments and preset constant values with function point descriptions. List unused/undefined I/O and data table registers available.

Copies of all configured HMI and OIT screens.

Copies of communication register tables (Modbus, EtherNet/IP, DNP3, etc)

* + - * 1. Licensing agreement with name of licensee, renewal requirements, release and versions, expiration dates (if any) and upcoming releases scheduled before Project completion. When upcoming releases are expected, provide descriptions, when available, of features that differ from the proposed release.

NTS: Review paragraph “c” with OWNER to determine which licenses are needed.

* + - * 1. Provide information of number of run, client, and development licenses as well as I/O point count limit per license.
				2. Standard technical and instructional documentation covering software for utility, system support, system docu­mentation, display, communications, data logging and storage and diagnostic functions. Submit this information as electronic files.
				3. Standard technical documentation cov­ering all aspects of the computer system software functions and capabil­ities, including instruction set description and programming procedures related to monitoring, display, log­ging, reporting and alarming functions.
				4. Detailed functional descriptions of application pro­grams explaining con­trol, display, logging and alarming features to be provided and functions to be performed.
			1. Documentation describing memory type, size and struc­ture and listing size of system memory, I/O and data table memory and size of memory available for control programs.
			2. Documentation of communication messaging (PLC-field device, PLC-PLC, PLC-SCADA, etc)
			3. System I/O Loop Wiring Diagrams: Prepare Shop Drawings on module-by-module basis and include the following informa­tion:
				1. Rack numbers, module type and slot number, and module terminal point numbers. Include loca­tion and identification of intermediate panel and field terminal blocks and terminal numbers to which I/O wiring and power supply wiring is connected. Identify power supply circuits with designation numbers and ratings.
				2. Wiring types, wire numbers, and color coding.
				3. Location, functional name, tag numbers and manufac­turer’s module numbers of panel and field devices and instru­ments to which I/O wiring will be connected.
				4. Prepare loop wiring diagrams in accordance with ISA 5.4.
			4. Complete point-to‑point interconnection wiring diagrams of field wiring associated with the system. Diagrams shall include the following:

NTS: Add Contractor or System Supplier at (--1--) below depending on the delivery of the Project.

* + - * 1. Field wiring between each equipment item, panel, instru­ments, and other devices, and wiring to control stations, panelboards, and motor starters. Some of this equipment may be specified in other Divisions. (--1--)is responsible for providing complete point-to-point interconnection wiring diagrams for control and monitoring of that equipment. Coordination with the Generals sub-contractors will be required to complete.
				2. Numbered terminal block and terminal identification for each wire termina­tion.
				3. Identification of assigned wire numbers for intercon­nections. Assign each wire a unique number.
				4. Schedule showing the wiring numbers and the conduit number in which the numbered wire is installed.
				5. Junction and pull boxes through which wiring will be routed.
				6. Identification of equipment in accordance with the Contract Documents.
		1. Closeout Submittals: Submit the following:

NTS: Edit Section “b.” if Section 40 61 83 Process Control System – O&M Data is not included. If section is NOT included, O&M information will need to be included in this Specification.

* + - 1. Operations and Maintenance Data:
				1. Submit in accordance with Section 01 78 23, Operation and Maintenance Data.
				2. Process Control System - Submit in accordance with Section 40 61 83 Process Control System – O&M Data.
				3. Include complete up-to-date system software documentation. Provide editable electronic copy.
			2. Submittal Procedures, operation and maintenance data submittals shall be provided in tabbed, booklet format including:
				1. Tabs under which all field mounted components and control panels provided in this section are located.
				2. Tabs under which associated Instrument Manufacturer’s catalog information and product data sheets are located.
				3. Tabs under which associated drawings, schematics, installation details and parts lists are located.
				4. In addition to Master Index Sheet , each tab section shall be individually indexed.
			3. Record Documentation:
				1. System Supplier shall prepare complete and comprehensive electrical Record Drawings including terminal-to-terminal wiring for equipment such as in-line metering devices, transmitters and associated sensors, and remote interlocking with motor control equipment.
				2. Prepare and submit record documents in accordance with Section 01 78 39, Project Record Documents.
				3. Software:

Submit programming and configuration files developed specifically for the Project in accordance with Section 01 78 23, Operations and Maintenance Data.

NTS: Review with owner and edit spare parts and test equipment requirements to suit the project. (critical to do this step). Modify other 40 xx xx specifications to work in concert with these materials.

* + - 1. Spare Parts and Test Equipment
				1. General

Furnish the spare parts and test equipment in accordance with the Contract Documents, identical to and interchangeable with similar materials and equipment provided for the PCS under the Contract.

Provide source quality control for spare parts as part of factory testing prior to shipment of process control system equipment.

For process sensors and other analog instruments, Supplier shall submit a separate quotation for recommended list of spare parts and test equipment. Separately list and price each item recommended. Spare parts quotation shall include a statement that prices quoted are valid for a period of one year from date of equipment installation and that Supplier understands that OWNER reserves the right to purchase none, any, or all parts quoted. Upon request, Supplier shall submit documentation that stock of spare parts and test equipment is obtainable within 48 hours of receipt of OWNER’s order.

* + - * 1. Furnish the following spare parts:

Five of each type of input/output relay for each quantity of forty or fraction thereof provided under the Contract.

One of each type of PLC input/output module or card used.

One replacement power supply for each type and size provided under the Contract.

One-year supply of all expendable or consumable materials.

One per quantity of five or fraction thereof of gauges, indicators, and switches provided, complete with diaphragm seals, filled and ready to use.

One per quantity of ten or fraction thereof provided, per range of field instruments including insertion type instruments. No spares are required for inline instruments such as magnetic flow meters and flumes or venturis that include flow tubes through which flow is conveyed.

Twelve of each type and size of fuse used in instruments.

* + - * 1. Furnish the following test equipment:

Three Fluke, Hewlitt-Packard, or equal (latest in series) digital multimeter plus amprobe, high-voltage probe, test leads, case, and other recommended spares and accessories.

One of each set of special tools required to insert, extract, and connect internal or external connectors, including edge connectors.

One set of special calibration equipment required for system calibration.

One thermocouple calibrator, including case.

Two signal simulators (4 to 20 mA DC; 1 to 5 VDC), including case. One simulator shall be battery-powered and shall include charger.

One portable flow meter calibrator, for magnetic flow meter use only.

* + - * 1. Portable computer workstation. Magnetic mount workstation 30lb capacity.

Manufacture

Zelpolla Innovations

Model

Utilshelf-1706

* 1. QUALITY ASSURANCE
		1. Contractor shall engage the services of the System Supplier for the purposes of furnishing the Process Instrumentation and Control System, providing Field Services on the installation of System and certifying the correctness of said installation.
		2. Like items of Equipment shall be end products of single manufacturer to achieve standardization for maintenance, spare parts, operation, and service.
		3. Process Control System components shall be grounded in accordance with National Electric Code (NEC) requirements.
		4. Meetings
			1. Schedule the following meetings:
				1. One (1) I&C Coordination Meetings shall be held to review Project activity, the submittal schedule, documentation requirements, and application software programming requirements for the Process Instrumentation and Control System. During the coordination meeting, the Designer will review the functional description for the System, control narratives, and respond to initial questions raised by the System Supplier as to design intent.
				2. One (1) I&C Flow Chart meeting shall be held to review programmer’s flow chart diagrams of the process and control narratives. During the flow chart meeting, the programmer will present the flow charts and respond to questions about functionality and respond to questions raised by the Designer.
				3. One (1) I&C Graphics and Programming meeting shall be held to review programmer’s program and graphics. Programmer will demonstrate the operator and maintenance staff’s interaction with the process. The Programmer will respond to Owner’s questions and develop a navigation menu path structure at the Owner’s request.
			2. I&C resolution meetings shall be held as required prior to individual startups to resolve outstanding I&C issues.
			3. Meetings shall be held at Site or location specified by Engineer. System Supplier’s designer specifically assigned to Project, Contractor, Owner, Engineer, and Designer shall attend meetings.
			4. When requested by Contractor and/or Engineer, System Supplier’s designer shall attend Monthly Progress Meetings and Weekly Meetings specified in Section 01 31 19.
		5. Qualifications:
			1. Supplier:
				1. System Supplier shall have at least 5 year’s experience in design, manufacture, installation, and successful operation of instrumentation systems similar to those specified herein
				2. Shall be capable of training operations and maintenance personnel in PCS applications, and in operating, programming, and maintaining the control system and equipment.
				3. Shall have UL-approved panel shop.
				4. Supply and support system hardware components and software packages of fully developed and field-proven standardized designs that are not a highly unique, custom, or one of a kind systems.
				5. Offer standard courses in general process control applications, programming, and maintenance of the PCS and equipment at a facility specifically utilized for training. Training facility shall have been in operation continuously for the previous two years, minimum.
				6. Possess a thorough, working knowledge of project processes and control philosophy in accordance with standard practices of the industry.
				7. Possess and maintain a documented program of failure analysis.
			2. Manufacturers:
				1. Manufacturers of instrumentation and control equipment furnished for the PCS shall be experienced producing similar equipment and shall have the following qualifications:

Shall manufacture instrumentation and control system components that are fully-developed, field-proven, and of standardized designs.

Shall have system of traceability of manufactured unit through production and testing in accordance with ANSI/ASQ Z1.4.

Shall have guaranteed availability clause (99.99 percent, minimum for one year) for microprocessor-based components and appurtenances.

Shall have documented product safety policy relevant to materials and equipment proposed for the Work.

* + - * 1. Component Supply and Compatibility:

PCS components shall be furnished by a single System Supplier who shall have responsibility for furnishing a complete and integrated system.

System Supplier who shall have responsibility for adequacy and performance of all items furnished.

System Supplier shall prepare, or shall review and approve, all Shop Drawings and other submittals for the PCS.

* + - * 1. Pre-submittal Conference

Prepare items listed below for presentation at pre submittal conference. Submit information to ENGINEER two weeks prior to pre submittal conference.

Proposed PCS network architecture diagram.

Flow chart showing steps to be taken in preparing and coordinating PCS submittals.

General outline of types of tests to be performed to verify that all sensors and transducers, instruments, and digital processing equipment are functioning properly.

* 1. RESPONSIBILITY
		1. System Supplier shall inspect Equipment provided under this Section prior to shipment to Project sites.
		2. System Supplier shall coordinate work with Contactor to insure that:
			1. All components provided under this Section are properly installed.
			2. All components provided under this Section are properly configured.
			3. The proper type, size, and number of control wires with conduits are provided.
			4. Proper electric power circuits are provided for all components and systems
		3. System Supplier shall be responsible for coordination of voltage levels and signal types for signals connected to Process Control System. Provide relays, signal isolators, termination or pull-up resistors, signal conditioners or other devices only as required for proper interfacing and operation of non-compatible devices.
		4. Modifications to existing control equipment.
			1. Provide equipment necessary to affect changes to existing control equipment as shown on
			2. drawings and specified.
			3. Provide interposing relays and current-to-current isolation relays only as required to affect
			4. signal interfacing with non-compatible devices.
		5. Modify documents of existing control equipment to reflect new Record Drawing conditions.
		6. System Supplier shall provide application software programming as specified in Section 40 61 16.
		7. Process Instrumentation and Control Equipment and Control System shall remain the property and responsibility of Contractor during programming, downloading and testing of HMI and PLC application software until Systems Demonstrations specified in Section 01 79 13 have been successfully completed.
		8. Contractor and System Supplier shall immediately correct incomplete or deficient Process Instrumentation and Control Equipment and Control System Work discovered during application software programming, downloading, testing, troubleshooting, and System startup.
		9. Contractor and System Supplier shall obtain from Owner documentation on existing PLCs/control panels affected by work on this project. Provide updated record drawings indicating modifications made on this project.
		10. All field located conduits, wiring and cables shall be provided under Division 26 – Electrical.
	2. APPLICATION SOFTWARE PROGRAMMING
		1. The System Supplier shall provide HMI, OIT, and PLC application software programming. System Supplier shall download and test application software programming after Contractor successfully completes Process Control System Testing specified in Section 40 61 13. Instructional Services specified in Section 01 79 23 and Systems Demonstrations specified in Section 01 79 13 shall not begin until System Supplier has completed application software programming, downloading, and testing. See Section 01 11 00 for specified construction sequences and constraints that affect completion of application software programming, downloading, and testing.
		2. System Supplier shall submit to the Owner a daily documented, modifiable application program in original electronic format for all PLCs and OITs.
	3. DELIVERY, STORAGE, AND HANDLING
		1. Prior to packaging, each manufacturer or Supplier shall securely attach tag number and instructions for proper field handling and installation to each instrument.
1. – PRODUCTS
	1. PCS – GENERAL PROVISIONS FOR PRODUCTS

NTS: Edit requirements under paragraph "A" to suit the project, and delete inapplicable requirements.

* + 1. General:
			1. All electrically-powered equipment and devices shall be suitable for operation on 120-volt plus-or-minus 3 percent, 60 Hertz power. If different voltage or closer regulation is required, provide suitable regulator or transformer.
			2. Provide appropriate power supplies for all two-wire transmitters, loops for monitoring discrete inputs and necessary outputs. Install power supplies mounted in enclosures, and install in appropriate control room or field panel.
			3. Power supplies shall be suitable for minimum of 130 percent of the maximum simultaneous current draw.
			4. Provide power on‑off switch or air circuit breaker for each item requiring electrical power.
			5. Provide isolation transformers, line voltage regulators and power distribution panels for the distributed digital portions of the PCS to eliminate electrical noise and/or transients entering on the primary power line.
			6. Unless otherwise shown or indicated in the Contract Documents, control system shall be furnished to use 4 to 20 mADC analog signals.
			7. Provide signal converters and repeaters where required. Analog inputs to distributed control system shall be through appropriate repeaters to provide signal isolation where series-looped with other devices and to allow loop to maintain integrity even when distributed control system is out of service. Power supplies shall adequate for signal converter and repeater loads.
			8. Signals shall be isolated from ground.
			9. Signals shall not have a transient DC voltage exceeding 300 volts over one millisecond nor a DC component over 300 volts.
			10. PCS and associated input/output wiring will be used in a facility environment where there can be high-energy AC fields, DC control pulses, and varying ground potentials between the sensors/transducers or input contact locations and PCS components. PCS shall be adequate to provide proper protection against interferences from all such possible situations. For inductive loads for solenoids and coils provide appropriate surge protection (MOV).
			11. Instrumentation and PCS components shall be heavy-duty types, suitable for continuous service in the OWNERS environment. Furnish products that are currently in production at the time products are shipped from the factory. All equipment furnished shall be of modular construction and be capable of field expansion through installation of plug‑in circuit cards and additional cabinets as necessary. Logic and control loops shall be fail-safe.
			12. Instrumentation and other PCS components shall return automatically to accurate measurement within 15 seconds upon restoration of power after a power failure, and when transferred to standby power supply.
			13. Devices with monitored alarms shall activate alarms when the device is unpowered.
			14. Provide surge protection for instruments and all other PCS components that could be damaged by electrical surges.
			15. Relays with interconnections to field devices shall be wired through terminal blocks. Terminals as part of the relay base are unacceptable.
			16. Panel mounted instruments, switches, and other devices shall be selected and arranged to present a pleasing coordinated appearance. Front-of-panel-mounted devices shall be of the same manufacturer and model line.
			17. All components furnished, including field-mounted and rear-of-panel instruments, shall be tagged with the item number and nomencla­ture as shown and the instrument index in the Contract Documents or, as applicable, the "data sheets" that are part of the Contract Documents.
			18. Ranges and scales specified in the Contract Documents shall be coordinated to suit equipment actually furnished. Range, scale, and set point values specified in other Sections of Division 40 are for initial setting and configuration. Coordinate specified values with actual equipment furnished to implement proper and stable process action as systems are placed in operation.
			19. Field‑mounted devices shall be treated with an anti‑fungus spray.
			20. Field‑mounted devices shall be protected from exposure to freezing tempera­tures.
			21. Field‑mounted instruments and PCS components shall be suitable for installation in humid and corrosive service conditions. Field-mounted instrument enclosures, junction boxes, and appurtenances shall comply with NEMA 4X requirements, unless otherwise shown or specified.
		2. Refer to remainder of Division 40 specifications for product requirements for materials and equipment that are part of the PCS.
1. – EXECUTION
	1. INSTALLATION
		1. Contractor shall install and wire Equipment and System in accordance with System Supplier’s and Instrument Manufacturer’s written instructions and approved submittals.
	2. FIELD QUALITY CONTROL
		1. Protection during Construction.
			1. Throughout Contract, the Contractor shall provide protection for materials and Equipment against loss or damage and the effects of weather. Prior to installation, store items in indoor, dry locations. Provide heating in storage areas for items subject to corrosion under damp conditions. Specific storage requirements shall be in accordance with the Engineer-reviewed System Supplier's recommendations.
		2. Panels and Panel-Mounted Equipment.
			1. Panels and panel-mounted devices shall be assembled as completely as possible at the System Supplier's factory. No work, other than correction of minor defects or minor transit damage, shall be done on the panels at the job site.
		3. Inspections.
			1. System Supplier shall provide services of qualified service engineer to supervise and inspect Equipment installation to ensure System is installed in accordance with System Supplier's recommendations.
			2. System Supplier shall supervise final power and signal connections to all Equipment provided under this Section. For all Equipment provided under this Section and all other Equipment interfaced by the System, the System Supplier shall verify and certify by written notice to the Engineer, correctness of final signal connections and correctness of adjustment.
			3. System Supplier shall field calibrate Equipment on loop-by-loop basis. Submit calibration certification to Engineer for each piece of Equipment. Make adjustments necessary to place Equipment in satisfactory operation.

NTS: Coordinate with System Demonstration Requirements.

* 1. DEFINITION OF ACCEPTANCE
		1. Prior to Substantial Completion, System Acceptance shall be defined as having been fulfilled when the following requirements have been met:
			1. All submittals and documentation have been submitted, reviewed, and marked by the Engineer to the effect that re-submittal is not required.
			2. The testing of the complete Process Instrumentation and Control System has been successfully completed and all deficiencies resolved.
			3. Application Software Programming Acceptance Testing has been successfully completed and all deficiencies resolved.
			4. All Owner’s staff personnel training programs have been completed.

 + + END OF SECTION + +

NTS: Example ISA 20 shall be added as Exhibit 40 61 13 - 1.