

SECTION 40 95 00

COMPONENT SPECIFICATIONS

PART 1 GENERAL

1.01 I&C COMPONENTS

A. A3 Conductivity Element and Transmitter:

1. General:
 - a. Function: Measure, indicate, and transmit conductivity of noted process liquid.
 - b. Sensor Type: Probe with either electrode or electrodeless sensor, as specified.
 - c. Transmitter Type: Either two wire or four wire, as specified.
 - d. Parts: Element, transmitter, interconnecting cable, junction box (if specified) and expendables.
2. Performance:
 - a. Process Liquid: As noted.
 - b. Process Range: As noted.
 - c. Accuracy: Plus or minus 0.5 percent of measured range.
3. Features:
 - a. Temperature Compensation: Automatic thermocompensator for process liquid temperatures 0 degrees to 200 degrees C.
4. Element:
 - a. Type: Electrode, unless otherwise noted.
 - b. Electrode Material: Type 316 stainless steel, unless otherwise noted.
 - c. Other Wetted Parts: Nonmetallic synthetic materials; manufacturer to confirm compatibility with process liquid.
 - d. Probe Constant: As noted.
 - e. Process Connection: Insertion, 3/4-inch NTP, unless otherwise noted.
 - f. Mounting Hardware: As recommended by manufacturer for specific application and/or as shown on Drawings.
5. Transmitter:
 - a. Type: Four wire, unless otherwise noted.
 - b. Features:
 - 1) Indicator: LCD digital display.
 - 2) Scale Range: As noted.
 - 3) Contact Setpoint: Setpoint adjustable from 0 percent to 100 percent of full range, initial setting as noted.
 - c. Signal Interface:
 - 1) Output: Isolated 4 mA to 20 mA dc for load impedance 0 ohm to 500 ohms minimum for 24V dc supply without load adjustments.
 - 2) Digital communications: As noted
 - 3) Contacts:
 - a) When noted or shown, SPST rated 3A continuous at 120V ac, minimum.
 - b) Three separate contacts each adjustable for high, low, or fail alarm.

- d. Enclosure:
 - 1) Type: NEMA 4X.
 - 2) Mounting:
 - a) Wall, unless otherwise noted.
 - b) Mounting brackets.
- e. Power:
 - 1) Four-wire: 115 Vac, unless otherwise noted.
 - 2) Two-wire: Loop powered.
- 6. Cable: Length as required to accommodate device locations.
- 7. Junction Box (weather proof): If noted.
- 8. Expendables (for Each Unit Provided): One 16-oz bottle of 2,000 microS/cm conductivity standardizing solution if appropriate for noted range.
- 9. Manufacturers (Four-Wire Units):
 - a. Rosemount Analytical:
 - 1) Electrode Type: Model 400 series conductivity element and Model 54eC transmitter.
 - 2) Electrodeless Type: Model 228 series electrodeless conductivity element and Model 54eC transmitter.
 - 3) Or equal.
 - b. Foxboro:
 - 1) Electrode Type: Model 871CR contacting conductivity element and Model 875CR transmitter.
 - 2) Electrodeless Type: Model 871EC electrodeless conductivity element and Model 875EC transmitter.
 - 3) Or equal.
 - c. Hach - GLI International
 - 1) Electrode Type: Model 3400 series contacting conductivity element and Model C53 series transmitter.
 - 2) Electrodeless Type: Model 3700E series electrodeless conductivity element and Model E63 series transmitter.
 - 3) Or equal.
 - d. Endress+Hauser
 - 1) Electrode Type: Model W/H CLS XX contacting conductivity element and Model Mycom S CLM 153 transmitter.
 - 2) Electrodeless Type: Model InduMax P CLS 50 electrodeless conductivity element and Model Mycom S CLM 153 transmitter.
 - 3) Or equal.
- 10. Manufacturers (Two-Wire Units):
 - a. Rosemount Analytical:
 - 1) Electrode Type: Model 400 series conductivity element and Model 5081C transmitter.
 - 2) Electrodeless Type: Model 228 series electrodeless conductivity element and Model 5081T transmitter.
 - 3) Or equal.
 - b. Foxboro:
 - 1) Electrode Type: Model 871 CR series contacting conductivity element and Model 870ITCR series transmitter.
 - 2) Electrodeless Type: Model 871 EC series electrodeless conductivity element and Model 870ITEC transmitter.
 - 3) Or equal

- c. Hach GLI International
 - 1) Electrode Type: Model 3400 series conductivity element and Model si792 C transmitter.
 - 2) Electrodeless Type: Model 3700E series electrodeless conductivity element and Model si792 E transmitter.
 - 3) Or equal.
 - d. Endress+Hauser
 - 1) Electrode Type: Model W/H CLS XX series conductivity element and Model Mypro CLM 431 transmitter.
 - 2) Electrodeless Type: Model InduMax P CLS 50 series electrodeless conductivity element and Model Mypro CLM 431 transmitter.
 - 3) Or equal.
- B. A5 ORP Element and Transmitter:
- 1. General:
 - a. Function: Measure, indicate, and transmit ORP of process fluid.
 - b. Parts: Element, analyzer/transmitter, interconnecting cable, and noted ancillaries.
 - 2. Performance:
 - a. Element:
 - 1) Process Range: As noted.
 - 2) Range: Minus 1500 to plus 1500 mV.
 - 3) Operating Temperature: 32 degrees F to 185 degrees F.
 - 4) Operating Pressure: 100 psig maximum at 149 degrees F.
 - b. Analyzer/Transmitter:
 - 1) Range: Minus 1400 mV to plus 1400 mV.
 - 2) Accuracy: Plus or minus 1 mV.
 - 3) Repeatability: Plus or minus 1 mV.
 - 4) Stability: Plus or minus 1 mV per month, noncumulative.
 - 5) Operating Temperature: Minus 32 degrees F to plus 122 degrees F.
 - 6) Operating Humidity: 95 percent maximum; relative humidity, noncondensing.
 - 3. Element:
 - a. Process Connection: 1-inch MNPT.
 - b. Body Style: Convertible with 1-inch NPT on both ends.
 - c. Process Fluid: As noted.
 - d. Wetted Materials: Compatible with process fluid.
 - e. No field-replaceable parts, unless otherwise noted.
 - f. Electrode Type: Flat glass or general purpose, unless otherwise noted.
 - g. Integral Preamplifier: Required, unless otherwise noted.
 - h. Mounting/Process Connections: As shown on Drawings or as noted from among the following:
 - 1) Submersion:
 - a) Sensor handrail assembly.
 - b) Handrail mounting kit.
 - 2) Flow-through:
 - a) 3/4-inch NPT PVC tee.
 - b) 1-inch NPT PVC tee.
 - c) 1-1/2-inch NPT PVC tee.
 - 3) Insertion.

- 4) Hot-Tap Retractable:
 - a) Suitable for 64-psig line pressure, unless otherwise noted.
 - b) 1-1/4-inch ball valve kit, unless otherwise noted.
 - c) Titanium Tube: 21 inches (12-inch insertion), unless otherwise noted.
 - i. Suitable for installation in Class I Div 2 hazardous locations: If noted or shown.
 - 1) Install in accordance with manufacturer's instructions and applicable codes.
 - 4. Analyzer/Transmitter:
 - a. Display: Graphic LCD, with backlighting.
 - b. Signal Interface:
 - 1) Analog Outputs: Two isolated 4 mA to 20 mA dc outputs (ORP and temperature).
 - 2) Discrete Outputs:
 - a) Process Alarms: Two SPSTs minimum, normally open.
 - b) Sensor/Analyzer and Process Fault Alarm: SPDT.
 - c) Contact Rating: 120 volts, 5 amps, resistive.
 - c. Enclosure.
 - 1) Type: NEMA 4X.
 - 2) Suitable for panel, 2-inch pipe, or wall mounting.
 - a) Wall and 2-inch mounting kit, unless otherwise noted.
 - d. Power: 115V ac, 50/60-Hz, unless otherwise noted.
 - e. Interconnecting Cable: Length as required.
 - f. Suitable for installation in Class I Div 2 hazardous locations: If noted or shown.
 - 5. Expendables (for each unit provided):
 - a. Chemicals:
 - 1) ORP reference solution.
 - 2) 32 ounces, minimum.
 - 6. Accessories:
 - a. Junction Box: If noted.
 - 1) NEMA 4X box for cable extension.
 - 7. Manufacturers and Products:
 - a. Rosemount Analytical; Model 399 (water), Model 396P (wastewater), or Model 396R (retractable) sensor and Model 54e ORP analyzer.
 - b. Hach; Digital Differential ORP sensor and sc100 controller.
 - c. Foxboro; 871A series ORP sensor and Model 875PH Intelligent Analyzer.
 - d. Or equal.
- C. A7 pH Element and Transmitter:
- 1. General.
 - a. Function: Measure, indicate, and transmit pH of process fluid.
 - b. Parts: Element, analyzer/transmitter, interconnecting cable, and noted ancillaries.
 - 2. Performance:
 - a. Element:
 - 1) Range: 0 pH to 14 pH.

- 2) Operating Temperature: 32 degrees F to 158 degrees F.
- 3) Operating Pressure: 80 psig maximum at 149 degrees F.
- b. Analyzer/Transmitter:
 - 1) Range: 0 pH to 14 pH units.
 - 2) Accuracy: Plus or minus 0.02 pH units.
 - 3) Repeatability: Plus or minus 0.05 pH units.
 - 4) Stability: Plus or minus 0.01 pH units per month, noncumulative.
 - 5) Operating Temperature: Minus 4 degrees F to plus 104 degrees F.
 - 6) Operating Humidity: 5 percent to 95 percent; relative humidity, noncondensing.
3. Element:
 - a. Process Connection: 1-inch MNPT.
 - b. Body Style: Convertible with 1-inch NPT on both ends.
 - c. Process Fluid: As noted.
 - d. Wetted Materials: Compatible with process fluid.
 - e. No field-replaceable parts, unless otherwise noted.
 - f. Electrode Type: Flat glass or general purpose, unless otherwise noted.
 - g. Integral Preamplifier: Required, unless otherwise noted.
 - h. Mounting/Process Connections: As shown on Drawings or as noted from among the following:
 - 1) Submersion:
 - a) Sensor handrail assembly.
 - b) Handrail mounting kit.
 - 2) Flow-through:
 - a) 3/4-inch NPT tee.
 - b) 1-inch NPT tee.
 - c) 1-1/2-inch NPT tee.
 - 3) Insertion.
 - 4) Hot-Tap Retractable:
 - a) Suitable for 64-psig line pressure.
 - b) 1-inch ball valve kit.
 - c) Titanium Tube: 21 inches (12-inch insertion).
4. Analyzer/Transmitter:
 - a. Display: Graphic LCD, with back-lighting.
 - b. Signal Interface:
 - 1) Analog Outputs: Two isolated 4 mA to 20 mA dc outputs (pH and temperature).
 - 2) Discrete Outputs:
 - a) Process Alarms: Two SPSTs minimum, normally open.
 - b) Sensor/Analyzer and Process Fault Alarm: SPDT.
 - c) Contact Rating: 120V, 5 amps, resistive.
 - c. Enclosure.
 - 1) Type: NEMA 4X.
 - 2) Suitable for panel, 2-inch pipe, or wall mounting.
 - d. Power: 115V ac, 50/60-Hz, unless otherwise noted.
 - e. Interconnecting Cable: Length as required.
5. Expendables (for each unit provided):
 - a. Chemicals: 1 pint each of buffer solution for pH 4, pH 7, and pH 9.
6. Accessories:
 - a. Junction Box: If noted.

- 1) NEMA 4X box for cable extension.
 7. Manufacturers and Products:
 - a. Rosemount Analytical; Model 399 (water), Model 396P (wastewater), or Model 390R (retractable) sensor and Model 54e pH analyzer.
 - b. Hach; Digital Differential pH sensor and sc100 controller.
 - c. Foxboro; 871A series pH sensor and Model 875 pH Intelligent Analyzer.
 - d. Or equal.
- D. A16 Turbidity Element and Transmitter:
1. General:
 - a. Function: Continuously measure, indicate, and transmit a signal proportional to turbidity of a sample stream of process fluid.
 - b. Type: Light scatter detection measurement using a 90-degree scatter photocell detector.
 - c. Parts: Element, transmitter (controller), interconnecting cable, mounting hardware, and expendables.
 2. Performance:
 - a. Complies with US EPA Method 180.1.
 - b. Range: 0 NTU to 100 NTU.
 - c. Displayed Resolution:
 - 1) 0.0001 NTU up to 10 NTU.
 - 2) 0.001 NTU for 10 NTU and greater.
 - d. Repeatability: Plus or minus 1 percent or plus or minus 0.002 NTU, whichever is greater.
 - e. Initial Response Time: Within 75 seconds for a full-scale step change.
 - f. Required Flow: 200 ml to 750 ml per minute.
 - g. Sample Temperature: minus 20 C to 60 degrees C.
 - h. Operating Temperature:
 - 1) Single Sensor System: 0 degrees C to 50 degrees C.
 - 2) Dual Sensor System: 0 degrees to 40 degrees C.
 - i. Operating Humidity: 5 percent to 95 percent, noncondensing.
 - j. Accuracy:
 - 1) From 0 NTU to 40 NTU: Plus or minus 2 percent of reading or plus or minus 0.015 NTU, whichever is greater.
 - 2) From 40 NTU to 100 NTU: Plus or minus 5 percent of reading.
 3. Element:
 - a. General: Flow-through body using focused light and submerged photocell to measure 90-degree scattered light within the fluid.
 - b. Submerged photocell that does not require glass windows and flow cells.
 - c. Internal bubble trap and vent.
 - d. Polystyrene body.
 - e. Optical components mounted in a sealed head assembly that is removable without disturbing sample flow.
 - f. Dimensions: 10 inches by 13 inches by 16 inches, nominal.
 - g. Fittings:
 - 1) Sample Inlet: 1/4-inch NPT female, 1/4-inch compression fitting.

- 2) Drain: 1/2-inch NPT female, 1/2-inch hose bib.
 - 4. Transmitter:
 - a. Features:
 - 1) Signal Average Time: User selectable from 6, 30, 60, 90 seconds with a 60-second default.
 - 2) Four-digit LCD display.
 - 2) Mounting: Wall and floor stand.
 - 3) Accepts either one or two elements.
 - 4) Data logging for 15 minutes, 1 hour, 24 hours, 30 days or 180 days.
 - b. Enclosure:
 - 1) NEMA 4X (indoor).
 - 2) Dimensions, Nominal: 6 inches by 6 inches by 6 inches.
 - 3) Mounting: Wall, pole, panel, and floor stand.
 - c. Signal Interface:
 - 1) Analog Output:
 - a) Two 4 mA to 20 mA dc suitable for load impedance of up to 500 ohms.
 - b) Span configurable over any portion of the 0 to 100 NTU range.
 - c) Output Span: As noted.
 - 2) Alarm Contacts: Three independent alarm setpoints, each SPDT and rated 5A continuous at 230V ac, minimum. Each setpoint adjustable over full range.
 - 3) Digital Communications:
 - a) MODBUS/RS485, MODBUS/RS232, LonWorks protocols: If noted.
 - 4) Wireless Communications: IR port supports MODBUS communication with a computer or directly into a Personal Digital Assistant (PDA).
 - 5. Power Supply: Input: 100V ac to 230V ac, 50-Hz to 60-Hz, auto-selecting, 40 VA.
 - 6. Cabling: As required.
 - 7. Accessories and Expendables:
 - a. Calibration Kits:
 - 1) Stablcal Verification Standards:
 - a) 1 liter of 20 NTU calibration standard.
 - b) 1 liter of 1 NTU verification standard.
 - c) Quantity: One each for each turbidimeter.
 - d) Two Stablcal calibration cylinders, minimum.
 - 2) Formazin Calibration Standard:
 - a) Kit including 0.5 liter of 4000 NTU Formazin, pipet, and calibration cylinder.
 - b) Quantity: One for each turbidimeter.
 - 3) Order expendables just before startup.
 - b. Verification Module: 1 NTU, unless otherwise noted.
 - 8. Manufacturer and Product: Similar to Hach Company; Model 1720E low range turbidimeter with sc100 controller.
- E. A19 Ammonia/Monochloramine Analyzer/Transmitter, Colorimetric:
- 1. General:
 - a. Function: Measure total ammonia, free ammonia and monochloramine at wavelength of 650nm.
 - b. Type:
 - 1) Modified Phenate method to colorimetrically monitor total ammonia, free ammonia and monochloramine for drinking water .

- 2) Measurement can colorimetrically measure monochloramine and with addition of Hypochlorite reagent obtains total ammonia values. The instrument then derives free ammonia values.
 - c. Parts: Analyzer/transmitter, reagent, and accessories.
 - 2. Performance:
 - a. Species Measured: Monochloramine and Total ammonia, unless otherwise noted.
 - b. Range: 0.02 to 2 mg/l as nitrogen or 0.1 to 10mg/l as chlorine.
 - c. Resolution: 0.01 mg/l.
 - d. Performs complete sample analysis every 2.5 minutes.
 - e. Accuracy: Whichever is greater:
 - 1) Better than plus or minus 5 percent of reading.
 - 2) 0.02 ppm asN.
 - f. Repeatability: Within plus or minus 0.01 ppm.
 - g. Response Time:
 - 1) For a full scale step change: 100 percent response within 5.0 minutes.
 - h. Sample Inlet Pressure:
 - 1) 2.5 to 100 psig at Filter.
 - 2) 0.5 to 30 psig, maximum, at sample inlet block.
 - i. Sample Flow Required: 20 to 1000 ml per minute.
 - j. Sample Temperature Range: 5 to 50 degrees C.
 - 3. Features:
 - a. Automatic self-testing diagnostics.
 - b. LED display.
 - 4. Enclosure:
 - a. NEMA 4X industrial plastic.
 - b. Mounting: Wall.
 - 5. Signal Interface:
 - a. Analog Output: two 4 to 20 mA dc output with 130V isolation from earth ground.
 - b. Discrete Outputs:
 - 1) Two alarm outputs.
 - 2) Each with SPDT contacts rated at 5 amp resistive at 230V ac.
 - 6. Process Connections:
 - a. Sample Inlet: 1/4-inch OD tubing.
 - b. Drain Connection: 3/4-inch hose bib.
 - 7. Power: 115/230V ac, 60 Hz, switch selectable.
 - 8. Accessories:
 - a. Flowmeter.
 - b. 1-year maintenance kit.
 - c. Reagents: 12 reagent kits (includes Indicator solution, Buffer Solution and Hypochlorite Solution), each sufficient for 30 days' operation.
 - d. Standard 1 solution (0mg/l NH₃) and Standard 2 solution (2.0 mg/l NH₃).
 - 9. Manufacturer and Product: Similar to HACH Company; Ammonia Monochloramine Analyzer, Model APA 6000.
- F. A24 Chlorine Residual Analyzer, Colorimetric:
- 1. General:
 - a. Function:
 - 1) Measure and indicate residual chlorine (free or total, as noted) of sample.
 - 2) Transmit proportional analog (and, if noted, network) signal.

- b. Type: Aqueous buffered colorimetric indicator (DPD).
 - c. Parts: Analyzer/transmitter, reagent, and accessories.
2. Performance:
- a. Species Measured: Free residual chlorine, unless otherwise noted.
 - b. Service: Water treatment plant, unless otherwise noted.
 - c. Process Range: As noted.
 - d. Analyzer Range: 0 mg/L to 5 mg/L residual chlorine.
 - e. Accuracy: Whichever is greater:
 - 1) Plus or minus 5 percent of reading or 0.05 mg/L.
 - f. Minimum Detection: 0.035 mg/L.
 - g. Batch Analysis Cycle Time: 2.5 minutes.
 - h. Sample Inlet Pressure:
 - 1) To Instrument: 1 psig to 5 psig with 1.5 psig optimum.
 - 2) To Sample Conditioning System: 1.5 psig to 75 psig.
 - i. Sample Flow Required: 200 ml to 500 ml per minute.
 - j. Sample Temperature Range: 41 degrees F to 104 degrees F.
 - k. Operating Temperature Range: 41 degrees F to 104 degrees F.
 - l. Operating Humidity: 90 percent at 104 degrees F.
 - m. Interferences:
 - 1) Other oxidizing agents.
 - 2) Hardness greater than 1,000 mg/L as CaCO₃.
3. Features:
- a. Conversion from free to total by changing reagents.
 - b. Automatic self-testing diagnostics.
 - c. LCD Display:
 - 1) Three-digit measurement readout.
 - 2) Six-character alphanumeric scrolling text line.
 - d. Linear peristaltic pump.
 - e. Sample cell/mixing system.
 - f. Light Source:
 - 1) Class 1 LED with a peak wavelength of 520 nm.
 - 2) 50,000 hours estimated minimum life.
4. Enclosure:
- a. IP62 (indoor use) industrial plastic with two clear polycarbonate windows.
 - b. Mounting: Wall.
 - c. Dimensions: 14W by 17H by 8D inches, nominal.
5. Signal Interface:
- a. Analog Output:
 - 1) 4 mA to 20 mA dc isolated output suitable for a load impedance up to 500 ohms.
 - 2) Minimum and maximum span values operator programmable.
 - b. Discrete Outputs:
 - 1) Two alarm outputs.
 - 2) Each with SPDT contacts rated at 5 amp resistive at 230V ac.
 - c. Aquatrend Network Ready: If noted.
6. Process Connections:
- a. Sample Inlet: 1/4-inch OD tube, quick-disconnect fitting.
 - b. Drain Connection: 1/2-inch flexible hose and hose barb.
 - c. Air Purge: If noted.

- 1) 1/4-inch OD tubing.
 7. Power: 115/230V ac, 50 Hz, switch selectable.
 8. Accessories:
 - a. Flowmeter.
 - b. 1-year maintenance kit with pre-assembled tubing.
 - c. Sample Conditioning Kit: Allows analyzer to function with inlet pressure up to 75 psig.
 - 1) Water Treatment Plants: 1/4-inch tubing.
 - 2) Wastewater Treatment Plants: 1/2-inch tubing.
 - d. Reagents: 12 reagent kits (free or total chlorine, as applicable), each sufficient for 30 days' operation.
 - 1) Each kit consists of:
 - a) DPD Indicator Powder.
 - b) Chlorine Buffer Solution, 500 ml.
 - c) Chlorine Indicator Solution, 500 ml.
 9. Manufacturer and Product:
 - a. Hach Company; Model CL17.
 - b. Or equal.
- G. A30 Chlorine and Sulfite Residual Analyzer
1. General:
 - a. Function: Dual measurement of chlorine residual and sulfite residual in water, with center zero for use in dechlorination applications.
 - b. Type: Amperometric.
 - c. Parts: Analyzer/transmitter, reagent and accessories.
 2. Performance:
 - a. Process Range: As noted.
 - b. Analyzer Range: Selectable from five standard ranges:
 - 1) 0.5 mg/L sulfite - 0 - 0.5 mg/L chlorine.
 - 2) 1.0 mg/L sulfite - 0 - 1.0 mg/L chlorine.
 - 3) 2.5 mg/L sulfite - 0 - 2.5 mg/L chlorine.
 - 4) 5.0 mg/L sulfite - 0 - 5.0 mg/L chlorine.
 - 5) 10.0 mg/L sulfite - 0 - 10.0 mg/L chlorine.
 - c. Accuracy: Plus or minus 5 percent of full scale.
 - d. Sensitivity: 2% of full scale.
 - e. Repeatability: 0.001 mg/L or 1 percent of full scale, whichever is greater.
 - f. Stability: Plus or minus 5 percent of full scale for one month.
 - g. Response Time: 90 sec. with 2 rpm pump motor.
 - h. Sample Requirements: Approximately 2 to 5 gpm.
 - i. Maximum Pressure: 125 psi, throttled to 5 psi at the analyzer inlet Y-strainer.
 - j. Sample Temperature Range: 26 degrees F to 125 degrees F.
 - k. Operating Ambient Temperature Range: 35 degrees F to 125 degrees F.
 - l. Salinity: Fresh to seawater.
 3. Features:
 - a. Three electrode measuring cell.
 - b. Bare electrodes.
 - c. LCD Display:
 - 1) 4-digit numeric display and 16-character alphanumeric display.
 - 2) Five display menus.
 - d. Integral Sample Pump: 2 rpm, unless otherwise noted.
 - e. Mounting: Wall or Panel, unless otherwise noted.
 - f. Modular Cabinet: Structural foam ABS.
 4. Enclosure (Electronics): NEMA 4X.

5. Signal Interface:
 - a. Analog Output: 4 mA to 20 mA dc isolated output suitable for a load impedance up to 500 ohms.
 - b. Discrete Outputs:
 - 1) Three alarm outputs, configurable for high and low alarms and for analyzer fault.
 - 2) Each with SPDT contacts rated at 5 amps resistive at 230V ac and 5 amps at 30V dc resistive.
 6. Process Connections: 1/2-inch female NPT sample line, 3/8-inch and 1-1/4-inch drain hose connections.
 7. Power: 120 Vac, 60 Hz, unless otherwise noted.
 8. Accessories:
 - a. Flushable Y-strainer; manual throttling valve; shutoff valve; inlet flow pressure reducing valve; tubing for inlet, drain, and reagent connections; reagent bottles, and mounting hardware.
 - b. Reagents: Sufficient reagent for 1 year of monitoring configuration (4 months to 6 months operation in control configuration), including:
 - 1) pH 4 Buffer.
 - 2) Potassium iodate crystals.
 - c. Amperimetric titrator with back titrator capability for calibration of unit: If noted.
 9. Manufacturer and Product:
 - a. Similar to Siemens Wallace and Tiernan Deox/2000 with SFC electronics.
 - b. Or equal.
- H. A35 Fluoride Analyzer
1. General:
 - a. Function: Measurement of fluoride concentration in water.
 - b. Type: Ion-selective electrode.
 - c. Parts: Analyzer/transmitter, reagent and accessories.
 2. Performance:
 - a. Process Range: As noted.
 - b. Operating Range: From 0.1 to 10.0 mg/L fluoride.
 - c. Accuracy: Plus or minus 10 percent.
 - d. Precision: Plus or minus 7 percent.
 - e. Cycle Time: 5 minutes maximum.
 - f. Sample Requirements: 200 to 500 mL/min.
 - g. Maximum Pressure: Throttled to 1 to 10 psi at the analyzer inlet.
 - h. Sample Temperature Range: 41 degrees F to 104 degrees F.
 - i. Operating Ambient Temperature Range: 41 degrees F to 104 degrees F.
 - j. Humidity: 5 to 90 percent, non-condensing.
 3. Features:
 - a. Flow cell with heater block.
 - b. LCD Display:
 - 1) 3-1/2 digit numeric display and 6-character alphanumeric display.
 - 2) Keypad for menu navigation, for instrument setup and calibration.
 - c. Mounting: Wall or Panel, unless otherwise noted.
 - d. Modular Cabinet: Structural ABS plastic.
 4. Enclosure: NEMA 12.
 5. Signal Interface:

- a. Analog Output: 4 mA to 20 mA dc isolated output suitable for a load impedance up to 500 ohms.
 - b. Discrete Outputs:
 - 1) Two alarm outputs, configurable for high and low alarms.
 - 2) Each with SPDT contacts rated at 5 amps resistive at 230V ac.
 - 6. Process Connections: 1/4-inch polyethylene sample inlet tubing, 1/2-inch barb drain hose connection.
 - 7. Power: 120 Vac, 60 Hz, unless otherwise noted.
 - 8. Accessories:
 - a. Reagent: Sufficient reagent for 1 year of monitoring.
 - b. Standards: Sufficient reagent for 1 year of monitoring.
 - 9. Manufacturer and Product:
 - a. Similar to Hach CA610 Fluoride Analyzer.
 - b. Or equal.
- I. A99 Automatic Sampler

- 1. General:
 - a. Function: Collect and refrigerate water samples for sequential and composite sampling.
 - b. Type: Refrigerated.
 - c. Parts: Auto sampler and accessories.
- 2. Construction:
 - a. Cover, Exterior, and Base: Resin transfer molded fiberglass reinforced plastic with a UV-resistant gel-coat, resistant to corrosion and weathering.
 - b. Refrigerator Interior: Food-grade ABS plastic for easy cleaning and to inhibit bacterial growth.
 - c. Refrigeration Lines: Copper, protected with polyester tubing or phenolic resin.
 - d. Condenser Coil: Powder-coated with polyester for additional corrosion resistance.
 - e. Refrigerator Evaporator Plate: Aluminum with food-grade epoxy powder-coating to resist corrosion.
 - f. Refrigerant: Non-CFC refrigerant with an ozone depletion potential of zero.
 - g. Insulation:
 - 1) Sides: 1-1/2 inches of rigid foamed-in-place urethane insulation.
 - 2) Top: 3 inches of rigid urethane insulation.
 - 3) The insulation shall use a non-CFC foaming agent.
 - h. Exposed Metal: Stainless steel or coated aluminum.
 - i. Cover: Lockable fiberglass.
 - j. Refrigerator Door: Magnetic gasket seal; lockable.
- 3. Refrigerator Operation:
 - a. Controls: Temperature control knob with solid state thermostats.
 - b. Temperature Sensors: Ambient air, evaporator plate, and internal temperature.
 - c. Function: Temperature sensors control operation of compressor, built-in heaters, and self-defrosting cycle of the evaporator plate. Heaters prevent collected samples from freezing when ambient air is below freezing.
 - d. Compressor Horsepower: 1/5 minimum.

4. Sampler Operation:
 - a. Collection: Peristaltic pump, capable of lifting a sample 28 feet. Pump constructed of high strength Noryl plastic.
 - b. Suction Line Purge: Automatic air purge before and after each sample.
 - c. Sample Volume Accuracy: Plus or minus 10 percent, or plus or minus 10 ml, whichever is greater.
 - d. Sample Volume Repeatability: Plus or minus 5 percent, or plus or minus 5 ml, whichever is greater.
 - e. Sample Volume: Adjustable from 10 to 9,990 ml in 1 ml increments.
 - f. Liquid Detector: Used to verify presence of sample. Sample sequence retry up to three times if no liquid is detected.
5. Environment:
 - a. Enclosure: NEMA 4X, suitable for outdoor use.
 - b. Ambient Temperature Range: Minus 20 to plus 120 degrees F.
6. Controller:
 - a. Display: 4-line, 80 character showing sampler status and program information.
 - b. Programming Modes: Standard and extended.
 - c. Standard Programs Available:
 - 1) Time Pacing: Built-in real-time clock to provide time and date information. Uniform time-paced samples collected at programmed interval adjustable from 1 minute to 99 hours, 59 minutes.
 - 2) Flow Pacing: Sampler accepts dry contact pulse from flow meter or external control system. Programmable for number of pulses received to initiate a sample collection.
7. Accessories:
 - a. Process Connection: 3/8-inch vinyl suction line.
 - b. Collection Containers: Two polyethylene containers, 2-gallon capacity.
8. Power: 120 Vac, 60 Hz.
9. Manufacturer and Product:
 - a. Similar to Teledyne Isco 6712FR Fiberglass Refrigerated Sampler.
 - b. Or equal.

J. F4 Flow Element and Transmitter, Electromagnetic:

1. General:
 - a. Function: Measure, indicate, and transmit the flow of a conductive process liquid in a full pipe.
 - b. Type:
 - 1) Electromagnetic flowmeter, with operation based on Faraday's Law, utilizing the pulsed dc type coil excitation principle with high impedance electrodes.
 - 2) Full bore meter with magnetic field traversing entire flow-tube cross section.
 - 3) Unacceptable are insert magmeters or multiple single point probes inserted into a spool piece.
 - c. Parts: Flow element, transmitter, interconnecting cables, and mounting hardware. Other parts as noted.
2. Service:
 - a. Stream Fluid:

- 1) As noted.
- 2) Suitable for liquids with a minimum conductivity of 5 microS/cm and for demineralized water with a minimum conductivity of 20 microS/cm.
- b. Flow Stream Descriptions: If and as described below.
3. Operating Temperature:
 - a. Element:
 - 1) Ambient: Minus 5 to 140 degrees F, typical, unless otherwise noted.
 - 2) Process: Minus 5 to 140 degrees F, typical, unless otherwise noted.
 - b. Transmitter:
 - 1) Ambient: Minus 5 to 140 degrees F, typical, unless otherwise noted.
 - 2) Storage: 15 to 120 degrees F, typical, unless otherwise noted.
4. Performance:
 - a. Flow Range: As noted.
 - b. Accuracy: Plus or minus 0.5 percent of rate for all flows resulting from pipe velocities of 2 to 30 feet per second.
 - c. Turndown Ratio: Minimum of 10 to 1 when flow velocity at minimum flow is at least 1 foot per second.
5. Features:
 - a. Zero stability feature to eliminate the need to stop flow to check zero alignment.
 - b. No obstructions to flow.
 - c. Very low pressure loss.
 - d. Measures bi-directional flow.
6. Process Connection:
 - a. Meter Size (diameter inches): As noted.
 - b. Connection Type: 150-pound ANSI raised-face flanges; AWWA C207, Table 2 Class D; or wafer style depending on meter size, unless otherwise noted.
 - c. Flange Material: Carbon steel, unless otherwise noted.
7. Power (Transmitter): 120V ac, 60-Hz, unless otherwise noted.
8. Element:
 - a. Meter Tube Material: Type 304 or 316 stainless steel, unless otherwise noted.
 - b. Liner Material:
 - 1) Teflon, unless otherwise noted.
 - 2) For potable water service, must have appropriate approvals.
 - c. Liner Protectors: Covers (or grounding rings) on each end to protect liner during shipment.
 - d. Electrode Type: Flush or bullet nose as recommended by the manufacturer for the noted stream fluid.
 - e. Electrode Material: Type 316 stainless steel or Hastelloy C, unless otherwise noted.
 - f. Grounding Ring:
 - 1) Required, unless otherwise noted.
 - 2) Quantity: Two, unless otherwise noted.
 - 3) Material: Type 316 stainless steel, unless otherwise noted.
 - g. Enclosure: NEMA 4X, minimum, unless otherwise noted.
 - h. Submergence:
 - 1) Temporary: If noted.
 - 2) Continuous (up to 10 feet depth), NEMA 6P/IP68: If noted.

- i. Direct Buried (3 to 10 feet): If noted.
 - j. Hazardous Area Certification:
 - 1) Class 1, Division 2, Groups A, B, C, D: If noted.
 - 2) Class 1, Division 1, Groups A, B, C, D, and FM approved: If noted.
 - 3) Class 1, Division 1, Groups C, D, and FM approved: If noted.
9. Transmitter:
- a. Mounting: Integral, unless otherwise noted.
 - b. Display: Required, unless otherwise noted.
 - 1) Digital LCD display, indicating flow rate and total.
 - 2) Bi-directional Flow Display: Required, unless otherwise noted.
 - a) Forward and reverse flow rate.
 - b) Forward, reverse and net totalization.
 - c. Parameter Adjustments: By keypad or non-intrusive means.
 - d. Enclosure: NEMA 4X, minimum, unless otherwise noted.
 - e. Empty Pipe Detection:
 - 1) If noted.
 - 2) Drives display and outputs to zero when empty pipe detected.
10. Signal Interface (at Transmitter):
- a. Analog Output:
 - 1) Isolated 4 mA to 20 mA dc for load impedance from 0 ohm to at least 500 ohms minimum for 24V dc supply.
 - 2) Supports Superimposed Digital HART protocol: If noted.
 - b. Discrete Outputs: If noted.
 - 1) Two discrete outputs, typical, rated for up to 30 volts, typical.
 - 2) Programmable as noted for the following typical parameters:
 - a) Totalizer pulse, high/low flow rates, percent of range, empty pipe zero, fault conditions, forward/reverse, etc.
 - c. Discrete Input: If noted.
 - 1) Contact closure, configured as noted for the following typical parameters: reset totalizer, change range, hold output constant, drive output to zero, and low flow cutoff, etc.
 - d. Other: As noted.
11. Cables:
- a. Types: As recommended by manufacturer.
 - b. Lengths: As required to accommodate device locations.
12. Built-in Diagnostic System:
- a. Features:
 - 1) Field programmable electronics.
 - 2) Self-diagnostics with troubleshooting codes.
 - 3) Ability to program electronics with full scale flow, engineering units, meter size, zero flow cutoff, desired signal damping, totalizer unit digit value, etc.
 - 4) Initial flow tube calibration and subsequent calibration checks.
13. Factory Calibration:
- a. Calibrated in an ISO 9001 and NIST certified factory.

- b. Factory flow calibration system must be certified by volume or weight certified calibration devices.
 - c. Factory flow calibration system shall be able to maintain calibration flow rate for at least 5 minutes for repeatability point checks.
14. Factory Ready for Future In situ Verifications: If noted.
- a. Original meter parameter values available from vendor by request.
15. Accessories:
- a. In situ Verification System: If noted.
 - 1) Quantity: One complete system provided for the project.
 - 2) Verifies quantitatively that the meter and signal converter's present condition is the same as originally manufactured.
 - 3) Physical access to the flow-tube not required.
 - 4) Meet standards established by the National Testing Laboratory.
 - 5) Tests and stores over 50-meter parameters related to primary coils, electrodes, interconnecting cable and signal converter.
 - 6) Verification standard shall be plus or minus 1 percent of wet calibration for meters produced using the calibration verification service, or plus or minus 2 percent for standard meters.
 - 7) Windows-based software
 - b. Primary Simulation System: If noted.
 - 1) Quantity: One complete system provided for the project.
 - 2) Verifies proper operation of the signal converter by simulating the flow meter's output signal.
 - a) Generates pulsed dc excitation signal with a reference voltage of 70 mV.
 - b) Generated signal ranges from 0 to 99 percent (0 to 32.8 feet per second) with a resolution of 0.1 percent.
 - c) Switch selectable for forward, reverse and zero flow rate.
 - 3) Verifies various input and output signals.
16. Manufacturers:
- a. ABB Automation MagMaster (includes Transmitter):
 - 1) 10D1475 Mini-Mag (size: 1/10 to 4 inches).
 - 2) MFE (size: 1/2 to 24 inches).
 - 3) Plus MFF (size: 8 to 84 inches).
 - 4) Or equal.
 - b. Siemens:
 - 1) SITRANS FM series.
 - 2) Or equal.
 - c. Invensys Foxboro (includes IMT 25 Series Intelligent Magnetic Flow Transmitter):
 - 1) 8000A Series Wafer Body (size: 1/16 to 16 inches).
 - 2) 9100A Series Flanged Body Flow Tubes (size: 1 to 78 inches).
 - 3) 9200A Series Flanged Body Flow Tubes (size: 8 to 48 inches).
 - 4) 9300A Series Flanged Body Flow Tubes (size: 8 to 16 inches).
 - 5) Or equal.

- K. F125 Flow Switch, Magnetic Sleeve, Safety Shower:
1. General:
 - a. Function: Monitor process liquid flowrate. Provide contact closure when flowrate exceeds setpoint.
 - b. Type: Disc actuated magnetic sleeve.
 2. Service:
 - a. Process Liquid: Potable water, unless otherwise noted.
 - b. Operating Pressure: Up to 400 psig.
 - c. Operating Temperature: 32 to 100 degrees F.
 3. Performance:
 - a. Flow Setpoint: Approximately 4 gpm, rising.
 4. Body Size: 1-1/2 inch, unless otherwise noted.
 5. Features:
 - a. Body Material: Type 316 Stainless Steel, unless otherwise noted.
 6. Signal Interface:
 - a. Switch: Dry contact, unless otherwise noted.
 - b. Contacts: SPDT rated at 13 amps noninductive at 120V ac.
 7. Switch Enclosure: NEMA 4X aluminum, unless otherwise noted.
 8. Manufacturer and Product: Similar to Magnetrol F50 Flow Switch, or equal.
- L. F128 Flow Element and Transmitter, Piston, Low Range
1. General:
 - a. Function: Measure process liquid flow rate.
 - b. Type: Piston positive displacement.
 2. Service:
 - a. Process Liquid: As noted.
 - b. Operating Pressure: Up to 2000 psig for flanged connections.
 - c. Operating Temperature:
 - 1) Ambient: 0 to 55 degrees C.
 - 2) Process Liquid: 5 to 100 degrees C at 30 degrees C ambient.
 - d. Humidity: 0 to 85 percent RH non-condensing.
 3. Performance:
 - a. Flow Range: 10 to 4000 cc/min (0.2 to 60 gallons per hour), unless otherwise noted.
 - b. Accuracy: Varies with viscosity and flow rate, plus or minus 0.75 percent of rate for flows above 60 cc/min.
 - c. Pressure Drop:
 - 1) Less than 3 psid at full scale flow when viscosity is 3 cP or less.
 - 2) 15 psid maximum when viscosity is 1,000 cP.
 4. Element:
 - a. Body Material: Type 316 stainless steel, unless otherwise noted.
 - b. Pistons: Carbon, unless otherwise noted.
 - c. Bearings: Rulon, unless otherwise noted.
 - d. O-Ring: Teflon, unless otherwise noted.
 - e. Process Connections: 3/8 inch NPT, unless otherwise noted.
 - f. Filter: Washable and reusable, 10 micron mesh, stainless steel with Viton seals.
 - g. Output: 5 Vdc pulse rate proportional to flow rate.

- h. Power: 5 to 30 Vdc powered by transmitter.
 - i. Interconnecting Cable: Between element and transmitter, length as required.
5. Transmitter:
- a. Enclosure: Stainless steel NEMA 4X, suitable for mounting on wall or pipe stand.
 - b. Display: LED or LCD.
 - 1) 6 digit rate and 10 digit totalizer.
 - 2) Flow rate scaled for display in Engineering Units matching scaled range as noted.
 - 3) Two totalizer displays, resettable and non-resettable.
 - c. Signal Interface:
 - 1) Rate Output: Optically isolated 4 mA to 20 mA dc.
 - 2) Totalizer Output: Scaled pulse.
 - d. Scaled Range: As noted.
 - e. Power: 120 Vac, 60 Hz, unless otherwise noted.
6. Manufacturer and Product:
- a. Max Machinery, Inc. Model 234 with Model 381 filter and Model 120 transmitter in stainless steel enclosure.
 - b. Brooks Instrument.
 - c. Or equal.
- M. L5 Level Element and Transmitter, Ultrasonic:
- 1. General:
 - a. Function: Continuous, noncontacting level measurement.
 - b. Type: Ultrasonic.
 - c. Parts: Element, transmitter, interconnecting cable, and accessories as noted.
 - 2. Service:
 - a. Application: If and as noted.
 - b. Vapor Space Pressure: Atmospheric, unless otherwise noted.
 - c. Operating Temperature Range:
 - 1) Element: Minus 4 degrees F to plus 149 degrees F.
 - 2) Transmitter: Minus 4 degrees F to 113 degrees F.
 - 3. Performance:
 - a. Range: As noted.
 - b. Zero Reference: As noted.
 - c. Accuracy: Plus or minus 0.25 percent of maximum range or 6 mm, whichever is greater.
 - d. Resolution: 0.1 percent of range or 2 mm, whichever is greater.
 - e. Blanking Distance: Sensor dependent, typically 1 foot.
 - 4. Element:
 - a. NEMA 6P waterproof.
 - b. Housing: PVDF, unless otherwise noted.
 - 1) Other materials subject to Engineer approval.
 - c. Facing: None, unless otherwise noted
 - d. Integral Flange: If noted.
 - 1) Face: PTFE, unless otherwise noted.
 - 2) Size: As noted.
 - e. Process Connection:
 - 1) 1-inch NPT, unless otherwise noted.
 - 2) Top mounted.

- f. Electrically Hazardous Rating:
 - 1) Class I, Div 1, Groups A, B, C, and D: If noted.
 - 2) Class II, Div 1, Groups E, F, and G: If noted.
 - 3) Other Ratings: As noted.
- g. Beam Angle: 12 degrees or less.
- h. Integral temperature compensation.
- 5. Transmitter:
 - a. Display.
 - b. Integral keypad or nonintrusive external programming.
 - c. Enclosure: NEMA 4X polycarbonate, unless otherwise noted.
 - d. Power Supply: 115 volts, 50/60-Hz, unless otherwise noted.
 - e. Isolated Analog Output:
 - 1) One Minimum: 4 mA to 20 mA dc for load impedance of 0 to 750 ohms.
 - f. Digital Communication: As noted.
 - g. Discrete Outputs:
 - 1) Minimum, two relay (SPDT) rated for 2 amps continuous at 230V ac.
 - 2) Assignable and as noted.
- 6. Interconnecting Cable: Weatherproof, UV protected, length as required, and type as recommended by manufacturer.
- 7. Accessories:
 - a. Submergence Shield: If noted.
 - b. Remote Programming Software: If noted.
 - 1) Allows remote programming via computer and echo traces for troubleshooting.
 - 2) One per lot of units furnished.
 - c. Others: As noted.
 - d. If no integral keypad, furnish one handheld programmer per lot of units furnished.
- 8. Manufacturers and Products:
 - a. Siemens; SITRANS L, Model HydroRanger 200 and Sensor.
 - b. Endress & Hauser; Model FMU90 and Sensor.
 - c. Or equal.
- N. L8 Level Switch, Float, Mechanical:
 - 1. General:
 - a. Function: Actuate contact at preset liquid level.
 - b. Type: Direct-acting float with enclosed mechanical switch and integral cable.
 - 2. Service (Liquid): Water, unless otherwise noted.
 - 3. Performance:
 - a. Setpoint: As noted.
 - b. Differential: 3.5 inches, maximum.
 - c. Temperature: 0 degree F to 160 degrees F.
 - 4. Features:
 - a. Entire Assembly: Watertight and impact-resistant.
 - b. Float Material and Size:
 - 1) Polypropylene body; 4.5-inch diameter and 6-inch length.
 - c. Cable:
 - 1) Combination support and signal.
 - 2) Length as noted or as necessary per mounting requirements.
 - 3) PVC cable jacket.
 - d. Mounting: Pipe, unless otherwise noted.
 - 1) Pipe Mounting:

- a) Cable clamp, suitable for connection to 1-inch pipe.
 - b) Pipe-to-wall bracket, suitable for connection to 1-inch pipe.
 - 2) Suspended Mounting (internal weights): If noted.
 - a) Wall mounting bracket, unless otherwise noted.
 - 3) Anchor Mounting Kit: If noted.
 - a) Compatible with pipe-mounted floats.
 - b) 15-pound vinyl-coated cast iron anchor.
 - c) 1/8-inch, Type 316 stainless steel vinyl-coated wire rope.
 - d) Stainless steel cable clips.
 - 5. Signal Interface:
 - a. Switch Type: Mechanical tilt micro-switch.
 - b. Switch Contacts:
 - 1) Isolated, rated 4.5A continuous at 120V ac.
 - 2) Form C contact (one NO, one NC), unless otherwise noted.
 - 6. Accessories: As noted.
 - 7. Manufacturers and Products:
 - a. Conery Manufacturing; 2902-B3-S2.
 - b. Anchor Scientific; Eco-Float.
 - c. Or equal.
- O. L9 Level Switch, Insertion Float Type:
- 1. General:
 - a. Function: Actuate contact at preset liquid level.
 - b. Type: Direct-acting float that actuates contacts.
 - 2. Service: Citric acid, sodium hypochlorite, sodium bisulfite, sodium hydroxide.
 - 3. Performance:
 - a. Set Point: At mounting nozzle as noted on Drawings.
 - b. Temperature: 0 to 180 degrees F.
 - 4. Features:
 - a. Entire Assembly: Watertight and impact-resistant.
 - b. Float Material and Size: Ryton or equivalent in chemical resistance.
 - c. Insertion Length: 6 inches.
 - 5. Mounting:
 - a. Horizontally direct mounted internal service:
 - a) 1 inch MNPT connection.
 - 6. Signal Interface:
 - a. Switch Type: Snap-acting.
 - b. Switch Contacts: SPDT isolated, rated 5A continuous at 120V ac.
 - c. Switch enclosure: Single piece, leak-proof.
 - 7. Manufacturers and Products:
 - a. Dwyer; Flotect Model L8.
 - b. Jo-Bell; Equivalent.
 - c. Or Equal.
- P. L10 Level Transmitter, Direct Sensing, Flange Mounted:
- 1. General:
 - a. Function: Measure level in a process vessel.
 - b. Type:
 - 1) Capacitive differential pressure cell.
 - 2) Diaphragm for process fluid isolation.

- 3) Flange mounting.
- 4) Smart electronics.
- 5) Two-wire device.
2. Service:
 - a. Process Liquid: As noted.
 - b. Process Temperature Range: Minus 20 degrees F to 400 degrees F, unless otherwise noted.
 - c. Ambient Temperature Range: Minus 40 degrees F to 250 degrees F, unless otherwise noted.
 - d. Humidity: 0 percent to 100 percent relative.
3. Performance:
 - a. Range: As noted.
 - b. Accuracy: Plus or minus 0.75 percent of span.
4. Features:
 - a. Zero Suppression or Elevation: As noted.
 - b. Damping: User-selectable; 0 second to 36 seconds time constant of analog output response to step change input.
 - c. Transmitter: Two-wire, powered from external power supply.
 - d. Zero and Span Adjustments: Local, external, noninteractive, unless otherwise noted.
 - e. Process Wetted Parts: Flanged Process Connection (Transmitter High Pressure Side):
 - 1) Flange Size/Type: 2-inch, Class 150, unless otherwise noted.
 - 2) Process Diaphragm: Type 316 stainless steel, unless otherwise noted.
 - 3) Mounting Flange: Stainless steel, unless otherwise noted.
 - 4) Mounting: Flush, unless otherwise noted.
 - 5) Extension Materials (if extension mount noted): Type 316 stainless steel, unless otherwise noted.
 - 6) Extension Length (if extension mount noted): As noted.
 - 7) Process Fill Fluid (High Pressure Side): Dow Corning Silicone 200, unless otherwise noted.
 - f. Reference Process Connection (Transmitter Low Pressure Side) Configuration (Differential, unless otherwise noted):
 - 1) Drain/Vent: Type 316 stainless steel.
 - 2) Flange Adapter: Stainless steel.
 - 3) Diaphragm Material: Type 316 stainless steel, unless otherwise noted.
 - 4) Sensor Fill Fluid (Low Pressure Side): Silicone, unless otherwise noted.
 - g. O-Ring: Glass-filled TFE.
 - h. Flange and Adapter Bolts: Type 316 stainless steel, unless otherwise noted.
 - i. LCD Meter: 5-digit display.
 - j. Integral Transient Protection: If noted.
5. Signal Output Interface:
 - a. 4 mA to 20 mA dc for load impedance 0 ohm to 580 ohms minimum at 24V dc supply voltage without load adjustment.
 - b. Superimposed digital signal based on HART protocol.
6. Enclosure: NEMA 4X, polyurethane-covered aluminum, unless otherwise noted.
7. Manufacturers/Model: Emerson Process Rosemount; 3051L, Liquid Level Transmitter or equal.

Q. L29 Level Sight Gauge with Switches:

1. General:
 - a. Function: Continuous tank level measurement and local indication.
 - b. Type: Magnetic float chamber and magnetic follower in hermetically sealed tube.
2. Service:
 - a. Fluid: As noted.
 - b. Pressure: Atmospheric.
 - c. Temperature: Minus 10 to plus 50 degrees C.
3. Performance:
 - a. Range: As noted.
 - b. Accuracy: Plus or minus 0.2 inches.
4. Features:
 - a. Indicator: Scale integral to tube; range as noted.
 - b. Alarm Switches: When noted; number and set points as noted; actuated by water meniscus.
 - c. Materials: Wetted parts and body, as indicated.
 - d. Mounting: Tank side.
 - e. Process Connection: As noted.
5. Switches:
 - a. Type: Non-intrusive.
 - b. Output: SPDT relay.
 - c. Mounting: Attached to sight tube.
6. Manufacturer:
 - a. ISE-Magtech LG Series.
 - b. Jogler Single Tube Level Gauge.
 - c. Or equal.

R. L180 Leak Detector Switch, Electro-Optic:

1. General:
 - a. Function:
 - 1) Monitor leak in such spaces as secondary containment and interstitial spaces.
 - 2) Switch.
 - b. Type: Electro-optical level sensing.
 - c. Parts: Sensor/switch and cabling.
2. Performance:
 - a. Accuracy: Plus or minus 1 mm in water.
 - b. Repeatability: Plus or minus 0.5 mm in water.
 - c. Process Temperature: Minus 40 to 194 degrees F.
 - d. Pressure: 150 psi (10 bar) at 25 degrees C.
3. Features:
 - a. Sensor Material: PFA Teflon, unless otherwise noted.
 - b. Sensor Length: Short (0.7-inch immersion length), unless otherwise noted.
4. Power: 12V dc to 36V dc.
5. Process Connection: 3/4-inch NPT, unless otherwise noted.
6. Signal Interface:
 - a. Contacts:
 - 1) One SPST relay.
 - 2) Rating: 60 VA maximum.
 - 3) Suitable for either dc or ac connection.
7. Enclosure: NEMA 6/IP68, submersible.
8. Cabling:
 - a. 10-foot length, five wires.
 - b. Rating: NEMA 6/IP 68.
9. Manufacturer:

- a. Flowline, Switch-Tek, Optic Leak Detection Sensor, LO10 Series.
 - b. Or equal.
- S. M26 Hand Switch and Light, Corrosion, Round:
- 1. General:
 - a. Function: Select, initiate, and display discrete control functions.
 - b. Type: Heavy-duty, corrosion-resistant, industrial.
 - 2. General Features:
 - a. Mounting: 30.5 mm single round hole. Panel thickness 1/16 inch to 1/4 inch.
 - b. Legend Plate: Standard size, square style laminate with white field and black markings, unless otherwise noted. Markings as shown, or as implied by P&IDs.
 - c. Configuration: Light, pushbutton, or switch as noted or shown.
 - 3. Light Features:
 - a. Lights: 6V ac lamps and integral transformer for operation for operation from 120V ac, unless otherwise noted.
 - b. Lens Color: Color as specified, noted, or shown.
 - c. Push-to-test, unless otherwise noted.
 - d. Additional: As noted.
 - 4. Pushbutton Features:
 - a. Operator: Single pushbutton, flush, unless otherwise noted.
 - b. Color: Black, unless otherwise noted.
 - c. Boot: None, unless otherwise noted.
 - d. Contact Arrangement: As required or shown.
 - e. Additional: As noted.
 - 5. Selector Switch Features:
 - a. Operator: Knob, unless otherwise noted.
 - b. Color: Black, unless otherwise noted.
 - c. Boot: None, unless otherwise noted.
 - d. Positions: As required or shown.
 - e. Return: Manual, unless otherwise noted.
 - f. Contact Arrangement: As required or shown.
 - g. Additional: As noted.
 - 6. Signal Interface:
 - a. Contact Block:
 - 1) Type: Standard, unless otherwise noted.
 - 2) Materials: Silver amalgam, unless otherwise noted.
 - 3) Rating: 10 amps continuous at 120V ac, unless otherwise noted.
 - 4) Sequence: Break-before-make, unless otherwise noted or shown.
 - 5) Arrangement: Normally open or normally closed as shown, or to perform the functions noted.
 - 7. NEMA Rating: NEMA 4, watertight, dust-tight, and NEMA 4X, corrosion-resistant.
 - 8. Manufacturers and Products:
 - a. Allen-Bradley; Bulletin 800H.
 - b. Square D Co.; Class 9001, Type SK.
 - c. Eaton Corp.; Cutler-Hammer, Type E34.
 - d. Or equal.

T. M30 Horn, Indoor/Outdoor:

1. General:
 - a. Function: Audible alarm. Produces sound by electro-mechanical vibration of a diaphragm.
2. Performance:
 - a. Temperature, Operating: Minus 65 degrees F to 150 degrees F.
 - b. Sound Output Level: 100 dB nominal at 10 feet (110 dB at 1 meter).
3. Features:
 - a. Dimensions: 4-3/8 inches in height and width, and 2.5 inches in depth, for horn and enclosure.
 - b. Body: Die-cast zinc.
 - c. Diaphragm: Stainless steel.
 - d. Projector: None, unless otherwise noted.
 - e. Listings: UL, cUL listed, FM, CSA approved.
4. Enclosure:
 - a. Type: Cast aluminum with neoprene-gasketed NEMA 4X housing.
 - b. Mounting: Surface mount.
5. Power: 120V ac, 50/60-Hz, unless otherwise noted.
6. Manufacturer: Federal Signal Corp.; Model 350WB.
 - a. Edwards Signaling.
 - b. Or equal.

U. M31 Warning Light, Indoor/Outdoor:

1. General:
 - a. Function: Visual alarm.
 - b. Type: Rotating reflector or flashing bulb.
 - c. Parts: Light and spare bulbs.
2. Performance:
 - a. Temperature, Operating: Minus 35 degrees F to 190 degrees F.
 - b. Flash Rate: Nominally 90 per minute.
3. Features:
 - a. Dome: Polycarbonate.
 - b. Dome Color: Amber, unless otherwise noted.
 - c. Lamp Life: 200 hours.
 - d. Lamp: Incandescent/25 watts.
4. Enclosure:
 - a. Type: IP65 (NEMA 4X).
 - b. Mounting: 1/2-inch pipe, unless otherwise noted.
 - c. Listing: UL listed, CSA certified.
5. Power: 120V ac, 50/60-Hz.
6. Spare Bulbs: Provide two for each light.
7. Manufacturers: Federal Signal; Model 225 or equal.
 - a. Edwards Signaling.
 - b. Or equal.

V. P3 Pressure Differential Transmitter:

1. General:
 - a. Function:
 - 1) Measure differential pressure.
 - 2) Transmit signal proportional to either differential pressure or square root of differential pressure, as applicable.
 - b. Type:

- 1) Electronic variable capacitance or silicon strain gauge.
- 2) Two-wire transmitter; "smart electronics".
- c. Parts: Transmitter and accessories.
2. Performance:
 - a. Range: As noted.
 - 1) Select transmitter's factory upper range limit (URL) such that upper boundary of noted range is as close as possible to 80 percent of factory URL, but does not exceed it.
 - b. Accuracy: Plus or minus 0.10 percent of span, unless otherwise noted.
 - c. Ambient Operating Temperature: Minus 40 degrees F to plus 175 degrees F, with integral meter.
 - d. Process Operating Temperature: Minus 40 degrees F to plus 250 degrees F.
 - e. Humidity: 0 to 100 percent relative humidity.
 - f. Hazardous Location Certifications: If and as noted.
3. Features:
 - a. Linear or square-root output, user-configurable.
 - b. Factory preconfigure for square root output if transmitter tagged as "FT" or "FIT".
 - c. Adjustable damping.
 - d. LCD indicator, unless otherwise noted.
 - 1) Display in either percent or engineering units, field configurable.
 - e. Wetted Metallic Parts: Type 316 stainless steel, unless otherwise noted.
 - 1) Includes drain/vent valves; process flanges and adapters, and process isolating diaphragm.
 - f. Wetted O-Rings: Glass-filled TFE, graphite-filled PTFE, or Viton, unless otherwise noted.
 - g. Bolts and Nuts (if required): Type 316 stainless steel, unless otherwise noted.
 - h. Fill Fluid: Silicone, unless otherwise noted. Halocarbon for corrosive applications such as sodium hypochlorite.
4. Process Connections:
 - a. Line Size: 1/2 inch.
 - b. Connection Type: FNPT.
 - c. Direct/remote Diaphragm Seal: If and as noted.
5. Signal Interface:
 - a. 4-20 mA dc output with digital signal based on HART protocol, unless otherwise noted below.
 - 1) Nominal Maximum Loop Resistance with External 24V dc Power Supply: 550 ohms.
 - b. FOUNDATION Fieldbus Protocol: If noted.
 - c. Profibus: If noted.
6. Enclosure:
 - a. Type: NEMA 4X.
 - b. Materials: Coated aluminum, unless otherwise noted.
 - c. Mounting bracket, unless otherwise noted.
 - 1) Bracket and Accessories: Stainless steel; suitable for mounting transmitter to panel or 2-inch pipe.
7. Accessories:
 - a. Three-valve manifold, unless otherwise noted.
 - 1) Includes one equalization and two isolation valves.
 - 2) Type 316 stainless steel.
8. Manufacturers and Products:

- a. Rosemount; Model 3051 CD.
- b. Foxboro; Model IDP10.
- c. SMAR; LD30XD Series.
- d. Or equal.

W. P4 Pressure Gauge:

1. General:
 - a. Function: Local pressure indication.
 - b. Type: Bourdon tube element.
2. Performance:
 - a. Scale Range: As noted.
 - b. Accuracy: Plus or minus 0.50 percent of full scale.
3. Features:
 - a. Dial: 4-1/2-inch diameter.
 - b. Pointer Vibration Reduction: Required, unless otherwise noted. Use the following method.
 - 1) Liquid filled gauge front, unless otherwise noted.
 - a) Glycerine fill, unless otherwise noted.
 - c. Case Material: Black thermoplastic, unless otherwise noted.
 - d. Materials of Wetted Parts (including element, socket/process connection, throttling device (if specified) and secondary components):
 - 1) Stainless steel, unless otherwise noted.
 - e. Pointer: Adjustable by removing ring and window.
 - f. Window: Glass or acrylic, unless otherwise noted.
 - g. Threaded reinforced polypropylene front ring.
 - h. Case Type: Solid front with blow-out back.
4. Process Connection:
 - a. Mounting: Lower stem, unless otherwise noted.
 - b. Size: 1/2-inch MNPT, unless otherwise noted.
5. Accessories:
 - a. Throttling Device: Required, unless otherwise noted.
 - 1) Type suitable for the intended service.
 - 2) Install in gauge socket bore.
6. Manufacturers and Products:
 - a. Ashcroft; Duragauge Model 1259/Model, 1279/Model, 1279 PLUS!
 - b. Ametek U.S. Gauge; Solfrunt Model 19XX/1981Advantatge.
 - c. WIKA, Type 2XX.34.
 - d. Or equal.

X. P6 Pressure Seal, Diaphragm:

1. General:
 - a. Function: Isolate sensing element from process fluid.
 - b. Type:
 - 1) Diaphragm.
 - 2) Fluid filled between diaphragm and sensing element.
2. Service:
 - a. Pressure: Same as associated sensor.
 - b. Temperature Range: If noted.
3. Performance:
 - a. Pressure:
 - 1) For threaded process connections, at least 2,500 psig at 100 degrees F.

- 2) Glycerin Fill: Suitable only for pressure (not vacuum applications).
 - b. Temperature:
 - 1) Dependent upon fill fluid.
 - a) Glycerin (food grade): Zero to 400 degrees F.
 - b) Silicone: Minus 40 degrees F to plus 600 degrees F.
 - c) Silicone (food grade): Zero to 375 degrees F.
 - d) Halocarbon: Minus 70 degrees F to 300 degrees F.
 - 4. Features:
 - a. Materials:
 - 1) Lower Housing: Type 316 stainless steel, unless otherwise noted.
 - 2) Diaphragm Material: Type 316 stainless steel, unless otherwise noted.
 - 3) Top Housing: Steel, unless otherwise noted.
 - b. Diaphragm: Welded to upper housing, unless otherwise noted.
 - c. Filling screw in upper housing.
 - d. Fill Fluid:
 - 1) As noted.
 - 2) Or approved equal.
 - 3) Factory assembled and filled.
 - e. Flushing Connection: 1/4-inch NPT in lower housing.
 - f. Diaphragm Seal Displacement: 0.1 cubic inch, nominal.
 - 5. Connections:
 - a. Instrument: 1/2-inch female NPT, unless otherwise noted or shown.
 - b. Process: 1/2-inch female NPT, unless otherwise noted or shown.
 - 6. Manufacturers:
 - a. Ashcroft; Type 201.
 - b. Ametek; Mansfield and Green Division; Type SG.
 - c. WIKA; Type L990.10.
 - d. Or equal.
- Y. P8 Pressure Switch, Fixed Deadband:
- 1. General:
 - a. Function: Monitor pressure.
 - b. Type: Diaphragm actuated switch.
 - 2. Performance:
 - a. Setpoint:
 - 1) As noted.
 - 2) Repeatability: Plus or minus 1 percent.
 - b. Range: Noted setpoint shall fall between 20 percent and 80 percent of range.
 - c. Overpressure Proof Pressure: At least 400 percent of rated maximum static pressure.
 - d. Operating Temperature Range:
 - 1) Dependent on actuator seal materials.
 - 2) For Buna-N seal, 0 degrees F to 150 degrees F.
 - 3. Features:
 - a. Actuator Seal: Buna-N, unless otherwise noted.
 - b. Differential (deadband): Fixed.
 - c. Reset: Automatic, unless otherwise noted.
 - d. Mounting: Surface, unless otherwise noted.
 - 4. Process Connection:

- a. 1/4-inch NPT female connections, unless otherwise noted.
 - b. Materials: 316 stainless steel, unless otherwise noted.
 5. Enclosure: NEMA 4X.
 6. Signal Interface:
 - a. Contact Type:
 - 1) DPDT, unless otherwise noted.
 - 2) Rated for 10 amps minimum at 120V ac.
 - b. Hermetically Sealed Switch: If noted.
 7. Manufacturers and Products:
 - a. Ashcroft; Type 400, B Series.
 - b. United Electric; 400 Series.
 - c. Or equal.
- Z. P9 Pressure Transmitter:
 1. General:
 - a. Function: Measure pressure and transmit signal proportional to pressure.
 - b. Type:
 - 1) Electronic variable capacitance or silicon strain gauge.
 - 2) Two-wire transmitter; "smart electronics".
 - c. Parts: Transmitter and accessories.
 2. Performance:
 - a. Range: As noted.
 - 1) Select transmitter's factory upper range limit (URL) such that upper boundary of noted range is as close as possible to 80 percent of factory URL, but does not exceed it.
 - b. Accuracy: Plus or minus 0.075 percent of span, unless otherwise noted.
 - c. Ambient Operating Temperature: Minus 40 degrees F to plus 175 degrees F, with integral meter.
 - d. Process Operating Temperature: Minus 40 degrees F to plus 250 degrees F.
 - e. Humidity: 0 to 100 percent relative humidity.
 - f. Hazardous Location Certifications: If and as noted.
 3. Features:
 - a. Type: Gauge pressure, unless otherwise noted.
 - b. Adjustable damping.
 - c. LCD indicator, unless otherwise noted.
 - 1) Display in either percent or engineering units, field configurable.
 - d. Wetted Metallic Parts: Type 316 stainless steel, unless otherwise noted.
 - 1) Includes drain/vent valves; process flanges and adapters, and process isolating diaphragm.
 - e. Wetted O-Rings: Glass filled TFE, graphite filled PTFE, or Viton, unless otherwise noted.
 - f. Bolts and Nuts (if required): Type 316 stainless steel, unless otherwise noted.
 - g. Fill Fluid: Silicone, unless otherwise noted. Halocarbon for corrosive applications such as sodium hypochlorite.
 4. Process Connections:
 - a. Line Size: 1/2 inch.
 - b. Connection Type: FNPT.
 - c. Direct/remote Diaphragm Seal: If and as noted.
 5. Signal Interface:

- a. 4-20 mA dc output with digital signal based on HART protocol, unless otherwise noted below.
 - 1) Nominal Maximum Loop Resistance with External 24V dc Power Supply: 550 ohms.
 - b. FOUNDATION fieldbus protocol: If noted.
 - c. Profibus: If noted.
6. Enclosure:
- a. Type: NEMA 4X.
 - b. Materials: Coated aluminum, unless otherwise noted.
 - c. Mounting bracket, unless otherwise noted.
 - 1) Bracket and Accessories: Stainless steel; suitable for mounting transmitter to panel or 2-inch pipe.
7. Accessories:
- a. Two-valve (isolate and vent) Stainless Steel Manifold: If noted.
8. Manufacturers and Products:
- a. Gauge Pressure Units:
 - 1) Rosemount; Model 3051 TG.
 - 2) Foxboro; Model IGP20.
 - 3) SMAR; LD30XM Series.
 - 4) Or equal.
 - b. Absolute Pressure Units:
 - 1) Rosemount; Model 3051 TA.
 - 2) Foxboro; Model IAP20.
 - 3) SMAR; LD30XA Series.
 - 4) Or equal.

AA. P15 Pressure Seal, Annular:

- 1. General:
 - a. Function:
 - 1) Sense pressure in a process line and transfer to pressure monitoring device.
 - 2) Protect attached pressure monitoring device from sludge or slurry.
 - b. Type: Annular fluid-filled device that senses pressure through flexible sleeve around full pipe circumference.
- 2. Performance:
 - a. Operating Conditions: Suitable for line pressures up to pipe flange rating.
- 3. Features:
 - a. Construction:
 - 1) In-line, 8 Inches and Smaller: Full-faced thru-bolted with outside diameter same as mating flanges, unless otherwise noted.
 - 2) In-line, 10 Inches and Larger: Wafer style.
 - 3) Offline: Threaded, unless otherwise noted.
 - b. Materials:
 - 1) Body: Carbon steel, unless otherwise noted.
 - 2) Flanges (where applicable): Carbon steel, unless otherwise noted.
 - 3) Flexible Sleeve: Buna-N, unless otherwise noted.
 - 4) Fill Fluid: Ethylene glycol/water or propylene glycol, unless otherwise noted.
 - c. Factory Filled System:
 - 1) Filled and assembled with pressure monitoring device(s).
 - 2) Coordinate attached pressure monitoring device(s) with system integrator. Seal vendor's

- standard pressure monitoring device(s) only acceptable if it meets specification of the related pressure monitoring device.
4. Process Connections:
 - a. Mounting: In-line or offline, as noted or shown.
 - b. Pipe Size:
 - 1) In-line: As noted or shown.
 - 2) Offline: 2 inches, unless otherwise noted.
 - c. Connections:
 - 1) In-line, Full-faced through-bolted: ASME B16.5, 150-pound flanges.
 - 2) In-line, Wafer style: Compatible with Classes 150/300 flange drilling.
 - 3) Offline: Female NPT Threaded, unless otherwise noted.
 5. Manufacturers and Products:
 - a. Red Valve Company; Series 40, Series 42/742, Series 48.
 - b. Dover/OPW Engineered Systems; Iso-Ring.
 - c. Or equal.
- BB. P111 Pressure Differential Indicator:
1. General:
 - a. Function: Pressure differential indication.
 2. Performance:
 - a. Range:
 - 1) As noted.
 - 2) Available Ranges:
 - a) 3, 5, 10, 15, 30, 60, 100, 160, 200, 300 psid.
 - b) 30, 60, 100, 200 inches water column.
 - b. Accuracy: Plus or minus 1.6 percent of full scale.
 - c. Static Pressure Rating: 580 psi unless otherwise noted (3625 psi rating available).
 3. Features:
 - a. Case:
 - 1) Stainless steel.
 - 2) Weatherproof/hermetically sealed, unless otherwise noted.
 - b. Dial Size: 4 inches, unless otherwise noted (6-inch also available).
 - c. Pointer:
 - 1) Black painted aluminum.
 - 2) External adjust feature (to 25 percent of range).
 - d. Window: Shatterproof glass.
 - e. Diaphragm Material:
 - 1) Type 316 stainless steel for ranges 15 psi and above.
 - 2) Cobalt alloy for ranges 10 psi and below.
 - f. Diaphragm Fill Fluid: None, unless otherwise noted (available are glycerin or silicon fill).
 - g. 3-way manifold.
 - h. Housing: Type 316 stainless steel with Viton O-ring.
 4. Process Connection:
 - a. 1/2-NPTF, unless otherwise noted (1/4 NPTF also available).
 - b. Lower connection.
 5. Mounting:
 - a. Pipe, unless otherwise noted (wall or stem also available).

6. Other Available Options (if noted):
 - a. Hastelloy C diaphragm with Type 316 stainless steel housing.
 - b. Monel diaphragm with Type 316 stainless steel housing.
 - c. Hastelloy C diaphragm and housing.
 - d. Electric warning contacts.
 7. Manufacturer and Product:
 - a. Ashcroft, Type 5503 Differential Pressure Gauge.
 - b. Or equal.
- CC. S24 Isolator, Current:
1. General:
 - a. Function: Isolate an analog current signal.
 - b. Type:
 - 1) Solid state with external power supply.
 - 2) Three-way isolation of the input signal, output signal, and external power supply.
 - c. Parts: Isolator plus DIN rail strip.
 2. Performance:
 - a. Isolation:
 - 1) Three-way isolation between input, output, and power circuits for common mode voltages up to 250V ac, or 354V dc of ground, on a continuous basis.
 - 2) Able to withstand 1500Vac dielectric strength test for 60 seconds without breakdown.
 - b. Output Ripple: Less than plus or minus 0.1 percent of maximum output span.
 - c. Accuracy: Plus or minus 0.1 percent of output span.
 - d. RFI Resistance: Less than plus or minus 0.5 percent of output span with RFI field strengths of up to 10V/meter at frequencies of 27, 151, and 467 MHz.
 - e. EMI resistance: Less than plus or minus 0.25 percent of output span effect with switching solenoids or commutator motors.
 - f. Ambient Temperature, Operating: Minus 13 degrees F to plus 185 degrees F.
 3. Features:
 - a. Zero and span trim adjustments using 15-turn potentiometers.
 - b. Calibration independent of load.
 4. Signal Interface:
 - a. Input:
 - 1) 4 to 20mA dc.
 - 2) Impedance: 75 ohms.
 - b. Output :
 - 1) 4 to 20 mA dc.
 - 2) Drives output load impedance up to 1050 ohms independent of supply voltage to isolator.
 5. Enclosure:
 - a. NEMA 1, unless otherwise noted.
 - b. Mounting: DIN Rail, unless otherwise noted.
 6. Power: 115Vac, unless otherwise noted.
 7. Accessories: 3-inch Type T DIN rail strip.
 8. Manufacturer:
 - a. Acromag Model Flat Pack 330I/430I Isolators.
 - b. Rochester Model SC-1302 Voltage/Current Transmitter.
 - c. AGM Model PTA 4000.
 - d. Or equal.

DD. S27 Indicator, Digital Panel:

1. General:
 - a. Function: Digital indication of analog signal.
 - b. Type: 3.5-digit LED display.
2. Performance:
 - a. Accuracy: Plus or minus 0.05 percent of full scale plus or minus one count.
 - b. Display Update Rate: 2.5 second minimum.
 - c. Operating Temperature Range: 0 degree C to 60 degrees C.
 - d. Relative Humidity: 0 percent to 90 percent noncondensing.
3. Features:
 - a. Display:
 - 1) LED.
 - 2) At least 3.5-digits.
 - 3) 0.56-inch height.
 - b. Overrange indication.
 - c. Input Impedance: 100 ohms maximum.
4. Enclosure:
 - a. 1/8 DIN, high impact plastic.
 - b. Nominal Maximum Dimensions: 2.5 inches high by 4.7 inches wide by 4 inches deep.
 - c. Nominal Cutout Dimensions: 1.8 inches high by 3.6 inches wide.
 - d. Suitable for panel mounting.
 - e. Maintains NEMA 4X Panel Rating: If noted.
 - 1) Furnish accessories as required.
5. Power: 115V ac, unless otherwise noted.
6. Signal Interfaces:
 - a. Process Inputs:
 - 1) Field Selectable: 4 mA to 20 mA, 1 volt to 5 volts.
 - b. Loop Power Supply: If noted.
 - 1) 24V dc, at least 25 mA.
7. Manufacturer and Products:
 - a. Newport Electronics, Santa Ana, CA; Model 202A-P.
 - b. Precision Digital, Natick, MA; Model Trident Model PD765.
 - c. Or equal.

EE. T3 Temperature Element and Transmitter, Resistance:

1. General:
 - a. Function: Measure the temperature of a process fluid, and transmit analog signal proportional to temperature.
 - b. Type: RTD.
 - c. Parts: Element, thermowell, and transmitter.
2. Service:
 - a. Process Fluid: As noted.
 - b. Process Temperature Range: As noted.
3. Element:
 - a. Type:
 - 1) Single-element, unless otherwise noted
 - 2) Three-wire, RTD.
 - 3) Platinum, 100 ohm nominal at 0 degrees C.
 - b. Performance:
 - 1) Accuracy: Greater of plus or minus 4 degrees F or plus or minus 0.75 percent of reading.

- c. Features:
 - 1) Dimensions: 1/4-inch diameter.
 - 2) Length to accommodate thermowell insertion and extension lengths.
 - 3) Spring-loaded element when well is used.
 - 4) Sheath
 - a) Type 316 Stainless Steel, unless otherwise noted.
 - b) Process Operating Temperature Range: minus 320 to 900 degrees F, unless otherwise noted.
 - 5) Terminal Connection Head:
 - a) General purpose, NEMA 4 weatherproof, unless otherwise noted.
 - b) Maximum Temperature: 220 degrees F, unless otherwise noted.
 - 6) Thermowell Connection: Union Coupler, unless otherwise noted.
 - 7) Sensitive Length: 1.6 inch minimum, measured from closed end.
- 4. Thermowell:
 - a. Features:
 - 1) Inside Diameter: Sized to match thermocouple.
 - 2) Material: Type 304 stainless steel, unless otherwise noted.
 - 3) Insertion Length: As noted.
 - 4) Extension Length: 3 inches, unless otherwise noted.
 - b. Process Connection: 1-inch NPT connection, unless otherwise noted.
 - c. Well Type: Plain, threaded solid, unless otherwise noted.
- 5. Transmitter:
 - a. Ambient Operation Conditions.
 - 1) Temperature: minus 20 to 158 degrees F, with display.
 - 2) Relative Humidity: 0 to 100 percent, noncondensing.
 - b. Type: Two-wire, powered by a remote power supply.
 - c. Performance:
 - 1) Accuracy: Greater of plus or minus 0.7 degree F or plus or minus 0.06 percent of span.
 - 2) Response Time: 1.2 second 90 percent response time for 80 percent input step, with minimum damping.
 - d. Electrical Safety: Standard unless otherwise noted.
 - e. Features:
 - 1) Indicator: Three line LCD, unless otherwise noted.
 - 2) Automatic reference junction compensation.
 - 3) Failsafe Mode:
 - a) User configurable ON, unless otherwise noted.
 - b) Downscale, unless otherwise noted.
 - 4) Electric damping: 1.2 seconds.
 - f. Signal Interface: 4 to 20 mA dc
 - g. Power: 24V dc external power supply.
 - h. Digital Communication: HART.
 - 1) One HART communicator to be supplied for all HART capable transmitters, if not already supplied under another specification section.

- i. Enclosure:
 - 1) Materials: Epoxy coated, low-copper aluminum, unless otherwise noted.
 - 2) Type: NEMA 4X.
 - 3) Mounting: Wall, pipe stand, or integral to thermowell, as noted.
 - a) For wall or pipe stand, provide stainless steel mounting set, unless otherwise noted.
 - b) For integral thermowell mount, provide zinc-plated steel union coupling, unless otherwise noted.
 - 6. Manufacturers and Products:
 - a. Foxboro; RTT20 Series Transmitter with PR Series RTD and Thermowell.
 - b. Rosemount; Series LTS Thermowell, 78 Series Platinum RTD and Model 644H Transmitter.
 - c. Or equal.
- FF. T33 Room Temperature Element and Transmitter:
- 1. General:
 - a. Function: Measure the temperature of a room, and transmit analog signal proportional to temperature.
 - b. Type: RTD sensor.
 - c. Parts: Element and transmitter.
 - 2. Service:
 - a. Measurement: Ambient room air temperature.
 - b. Temperature Range: 32 to 122 degrees F, unless otherwise noted.
 - 3. Element:
 - a. Type:
 - 1) Single-element.
 - 2) Two-wire, RTD.
 - 3) Platinum, 100 ohm or 1000 ohm nominal at 0 degrees C.
 - b. Features:
 - 1) Accuracy: Plus or minus 0.9 degrees F.
 - 2) Mounting: Integral to transmitter case.
 - 4. Transmitter:
 - a. Ambient Operation Conditions:
 - 1) Temperature: Minus 40 to 185 degrees F.
 - 2) Relative Humidity: 0 to 95 percent, non-condensing.
 - b. Type: Two-wire, powered by a remote power supply.
 - c. Performance:
 - 1) Accuracy: Element accuracy (plus or minus 0.9 degree F) plus or minus 0.1 percent of calibrated span.
 - 2) Response Time: No more than 1.2 seconds for 90 percent response time with 100 percent input step.
 - d. Signal Interface: 4 to 20 mA dc, two-wire.
 - e. Power: 24V dc external power supply.
 - f. Enclosure:
 - 1) Materials: Plastic decorative box.
 - 2) Type: Vented for room air sensing.
 - 3) Mounting: Wall.
 - 5. Manufacturers and Products:
 - a. Moore Industries; T2X-DWB.
 - b. Honeywell; TEH-LL-0/50.
 - c. Or equal.

GG. W210 Weight Scale, Element and Transmitter, 55-Gallon Drum:

1. General:
 - a. Function: Measures weight of a horizontal 55-gallon drum that rests on a dolly.
 - b. Type:
 - 1) Load cells on platform scale.
 - 2) Electronics package that displays and outputs analog signal. Available packages can measure up to two drums.
 - c. Parts: Platform scale with load cells, weight indicator and transmitter, interconnecting cable.
2. Performance:
 - a. Range: 0 to 1,000 pounds.
 - b. Accuracy:
 - 1) Platform Scale: 0.1 percent of full scale.
 - 2) Overall System Accuracy (including transmitter): 0.25 percent of full scale.
3. Platform Scale:
 - a. Suitable to weigh 55-gallon drum that rests horizontally on dolly.
 - b. Welded steel construction.
 - c. Coating:
 - 1) Minimum 80-mil thickness.
 - 2) Resistant to moisture, chemicals, abrasion, impact, and UV light.
 - d. Four shear beam load cells.
4. Transmitter:
 - a. Number of Channels: One, unless otherwise noted.
 - b. Features:
 - 1) Display:
 - a) Displays in pounds, kilograms, gallons, liters.
 - b) Displays in 0.1-pound increments when displayed in pounds.
 - c) Dual line; 16 characters per line, alphanumeric.
 - d) 4.5-digit LCD with 0.5-inch high characters.
 - 2) Zero/Tare Adjustment: Sealed 10-turn potentiometer.
 - 3) Ambient Operating Temperature: 32 degrees F to 122 degrees F.
 - c. Enclosure:
 - 1) NEMA 4X, UL listed, structural foam molded.
 - 2) Mounting: Wall or surface.
 - d. Signal Interface:
 - 1) Analog Output: 4 to 20 mA dc per channel.
5. Power Supply: 120V ac/240V ac.
6. Overall Nominal Dimensions:
 - a. Platform Scale: Plan View: 32 inches by 32 inches.
 - b. Transmitter: 8 inches high by 9 inches wide by 5 inches deep.
7. Accessories.
 - a. Interconnecting Cable: Length as required.
8. Manufacturer and Product: Force Flow; 55-Gallon Drum Scale and Weighing System with the following major parts:
 - 1) Drum Scale: Model 27-DR10DS-HA4.
 - 2) Weight Indicating Transmitter:
 - a) Solo SR1000-1, for single channel units.
 - b) Solo SR1000-2 for dual channel units.
 - c) Or equal.

HH. Y40 Uninterruptible Power Supply System:

1. General:
 - a. Function: Provides isolated, regulated uninterrupted ac output power during a complete or partial interruption of incoming line power.
 - b. Major Parts: Inverter, battery charger, sealed battery.
2. Performance:
 - a. Capacity: As noted.
 - b. Input Power:
 - 1) 120 Vac single phase, 60-Hz, unless otherwise noted.
 - 2) Connections: Manufacturer's standard, unless otherwise noted.
 - c. Output Power:
 - 1) 120 Vac single phase, 60-Hz, unless otherwise noted.
 - 2) Connections: Manufacturer's standard, unless otherwise noted.
 - d. On-line Efficiency: 85 percent minimum, unless otherwise noted.
 - e. Backup Runtime:
 - 1) Full Load: 9 minutes minimum, unless otherwise noted.
 - 2) Half Load: 20 minutes minimum, unless otherwise noted.
 - f. Continuous no-break power with no measurable transfer time.
 - g. Sine-Wave Output Voltage Total Harmonic Distortion (THD): Plus or minus 6 percent or less.
 - h. Input Voltage Range: Plus 15 percent, minus 20 percent.
 - i. Output Voltage Regulation: Plus or minus 3 percent nominal.
 - j. Operating Temperature: 0 degrees to 40 degrees C (32 degrees to 104 degrees F).
 - k. Operating Relative Humidity: 5 percent to 95 percent without condensation.
 - l. Lightning and Surge Protection:
 - 1) Pass lightning standard IEEE C62.41 Categories A and B tests.
 - 2) 2000 to 1 attenuation of input spike.
3. Features:
 - a. Bypass Switches: As noted.
 - b. Enclosure:
 - 1) Tower, unless otherwise noted.
 - 2) If rack-mount noted, unit to be suitable for mounting in a 19-inch rack.
4. Manufacturers and Products:
 - a. Powerware; FERRUPS FE/Rackmount Uninterruptible Power System.
 - b. Controlled Power Company.

II. Y71 SCADA Server

1. General:
 - a. Note: Computer component specified herein is based on the state-of-the art at the time of design. Provide the latest state-of-the art hardware available at the

- time of submittal. Provide computer hardware and software compatible with Owner's HMI software.
- b. Function: Communicate with PLC network, maintain HMI real-time database, communicate with HMI Clients, provide data to Historical Server.
 - c. Type: Rack-mount.
2. Features:
- a. Processor: Quad Core Intel Xeon L5410, 2x6MB Cache, 2.33GHz, 1333MHz FSB, ES
 - b. Memory: 8GB 667MHz (4x2GB), Dual Ranked DIMMs, Energy Smart.
 - c. Hard Drives:
 - 1) Controller: PERC 6, 3 Gbps SAS RAID controller.
 - 2) Configuration: Integrated SAS/SATA RAID 1.
 - 3) Type: Hot-swappable 10,000 RPM Serial Attached SCSI 3GBps.
 - 4) Array Size: Two drives, 146GB each drive.
 - d. Power Supply: Energy Smart 750W auto-switching redundant power supply, 120 Vac.
 - e. Ethernet Network Interface Cards: Dual (two) cards, Gigabit Intel PRO 1000PT 1GbE Dual Port NIC, PCIe-4.
 - f. CD/DVD Drive: DVD-ROM, SATA, Internal.
 - g. Chassis: 2U rack mount.
 - h. Ports:
 - 1) Rear: Two USB 2.0; one DB9 serial; one video.
 - 2) Front: Two USB 2.0; one video.
 - i. Keyboard/Video/Mouse (KVM):
 - 1) One shared rack-mounted set for all SCADA Servers and Historical Server.
 - 2) Standard keyboard and optical mouse, 17-inch energy efficient flat panel VGA color monitor.
 - 3) KVM Switch: Rack-mounted.
3. Software:
- a. Operating System: Windows Server 2003, Standard Edition.
 - b. Antivirus: Match Owner's standard.
4. Environmental:
- a. Operating Temperature: 50 to 95 degrees F.
 - b. Storage Temperature: Minus 40 to 149 degrees F.
 - c. Operating Relative Humidity (non-condensing twmax=29C): 20 to 80 percent non-condensing.
 - d. Maximum humidity gradient: 10 percent per hour, operational and non-operational conditions.
 - e. Storage Relative Humidity: 5 to 95 percent non-condensing (twmax=38C)
 - f. Operating Vibration: 0.26G at 5Hz to 350Hz for 2 minutes.
 - g. Storage Vibration: 1.54Grms Random Vibration at 10Hz to 250Hz for 15 minutes.
 - h. Operating Shock: 1 shock pulse of 41G for up to 2ms.
5. Support Agreement:
- a. Onsite Hardware Support: 7 day/ 24 hour, next business day onsite service, 3 years.
6. Manufacturer and Product:
- a. Similar to Dell PowerEdge 2950 III Energy Smart.
 - b. Or equal.

JJ. Y72 Historical Server

1. General:
 - a. Note: Computer component specified herein is based on the state-of-the art at the time of design. Provide the latest state-of-the art hardware available at the time of submittal. Provide computer hardware and software compatible with Owner's HMI software.
 - b. Function: Collect data from SCADA Servers, maintain HMI historical database, send data on request to HMI Clients.
 - c. Type: Rack-mount.
2. Features:
 - a. Processor: Quad Core Intel Xeon L5410, 2x6MB Cache, 2.33GHz, 1333MHz FSB, ES
 - b. Memory: 8GB 667MHz (4x2GB), Dual Ranked DIMMs, Energy Smart.
 - c. Hard Drives:
 - 1) Controller: PERC 6, 3 Gbps SAS RAID controller.
 - 2) Configuration: Integrated SAS/SATA RAID 10.
 - 3) Type: Hot-swappable 10,000 RPM Serial Attached SCSI 3GBps.
 - 4) Array Size: Five drives, 146GB each drive. Fifth drive configured as hot spare to rebuild and replace any failed drive.
 - d. Power Supply: Energy Smart 750W auto-switching redundant power supply, 120 Vac.
 - e. Ethernet Network Interface Cards: Dual (two) cards, Gigabit Intel PRO 1000PT 1GbE Dual Port NIC, PCIe-4.
 - f. CD/DVD Drive: DVD-ROM, SATA, Internal.
 - g. Chassis: 2U rack mount.
 - h. Ports:
 - 1) Rear: Two USB 2.0; one DB9 serial; one video.
 - 2) Front: Two USB 2.0; one video.
 - i. Keyboard/Video/Mouse (KVM):
 - 1) One shared rack-mounted set for all SCADA Servers and Historical Server.
 - 2) Standard keyboard and optical mouse, 17-inch energy efficient flat panel VGA color monitor.
 - 3) KVM Switch: Rack-mounted.
3. Software:
 - a. Operating System: Windows Server 2003, Standard Edition.
 - b. Antivirus: Match Owner's standard.
4. Environmental:
 - a. Operating Temperature: 50 to 95 degrees F.
 - b. Storage Temperature: Minus 40 to 149 degrees F.
 - c. Operating Relative Humidity (non-condensing twmax=29C): 20 to 80 percent non-condensing.
 - d. Maximum humidity gradient: 10 percent per hour, operational and non-operational conditions.
 - e. Storage Relative Humidity: 5 to 95 percent non-condensing (twmax=38C)
 - f. Operating Vibration: 0.26G at 5Hz to 350Hz for 2 minutes.
 - g. Storage Vibration: 1.54Grms Random Vibration at 10Hz to 250Hz for 15 minutes.
 - h. Operating Shock: 1 shock pulse of 41G for up to 2ms.
5. Support Agreement:
 - a. Onsite Hardware Support: 7 day/ 24 hour, next business day onsite service, 3 years.

6. Manufacturer and Product:
 - a. Similar to Dell PowerEdge 2950 III Energy Smart.
 - b. Or equal.

KK. Y73 HMI Client Workstation

1. General:
 - a. Note: Computer component specified herein is based on the state-of-the art at the time of design. Provide the latest state-of-the art hardware available at the time of submittal. Provide computer hardware and software compatible with Owner's HMI software.
 - b. Function: Display data and alarms from SCADA Servers and Historical Server, for use by operations, maintenance, and management staff. Allow operator interaction with plant control functions performed in PLCs.
 - c. Type: Tower.
2. Features:
 - a. Processor: Quad Core Intel Xeon Processor E5506 2.13 GHz, 4M L3, 4.8GT/s.
 - b. Memory: 3GB, DDR3 Memory, 1066MHz, ECC (3 DIMMS).
 - c. Hard Drives:
 - 1) Controller: PERC 6, 3 Gbps SAS RAID controller.
 - 2) Configuration: Integrated SAS/SATA RAID 1.
 - 3) Type: Hot-swappable 15,000 RPM Serial Attached SCSI 3GBps.
 - 4) Array Size: Two drives, 146GB each drive.
 - d. Power Supply: 85-percent Energy efficient 1100W, 120 Vac.
 - e. Ethernet Network Interface: Integrated Gigabit.
 - f. CD/DVD Drive: 16X DVD+/- RW with software.
 - g. Chassis: Tower.
 - h. Ports:
 - 1) Rear: Six USB 2.0; one DB9 serial; one video; one parallel; one IEEE 1394a; one speaker line-out.
 - 2) Front: Two USB 2.0; ; one IEEE 1394a.
 - i. Video:
 - 1) Controller: 256MB ATI FirePro V3750, Dual Monitor, two display ports and one DVI.
 - 2) Monitors: Dual (two) 24-inch UltraSharp 2408WFP Widescreen, Adjustable Stand, VGA/DVI.
 - j. Keyboard: Standard keyboard.
 - k. Mouse: Optical mouse.
 - l. Sound: Integrated sound card and monitor-mounted speakers.
3. Software:
 - a. Operating System: Windows XP, SP2.
 - b. Microsoft Office Basic, latest version.
 - c. Adobe Acrobat Standard, latest version.
 - d. Antivirus: Match Owner's standard.
4. Support Agreement:
 - a. Onsite Hardware Support: 7 day/ 24 hour, next business day onsite service, 3 years.
5. Manufacturer and Product:
 - a. Similar to Dell Precision T7500 Workstation.
 - b. Or equal.

LL. Y74 Laptop Workstation

1. General:
 - a. Note: Computer component specified herein is based on the state-of-the art at the time of design. Provide the latest state-of-the art hardware available at the time of submittal. Provide computer hardware and software compatible with Owner's HMI software.
 - b. Function: Display data and alarms from SCADA Servers and Historical Server, for use by operations, maintenance, and management staff. Allow operator interaction with plant control functions performed in PLCs. Allow maintenance staff to access PLC for programming and diagnostics.
 - c. Type: Portable laptop.
2. Features:
 - a. Processor Intel Core 2 Duo T9550, 2.66GHz, 6M L2 Cache, 1066MHz FSB.
 - b. Memory: 2.0GB, DDR2-800 SDRAM, 2 DIMMS.
 - c. Hard Drive: 250GB Hard Drive, 7200RPM with Free Fall Sensor.
 - d. Power Supply: 9-cell battery, with 120 Vac, 130W power adapter and battery charger.
 - e. Ethernet Network Interface:
 - 1) Hardwired: 10/100/1000 Ethernet.
 - 2) Wireless: 1397 802.11b/g Mini Card.
 - f. CD/DVD Drive: 8X DVD+/- RW with software.
 - g. Style: Portable laptop.
 - h. Ports: Four USB 2.0; one DB9 serial; one video; one IEEE 1394a; one speaker line-out.
 - i. Modem: Internal 56K.
 - j. Video:
 - 1) Controller: NVIDIA Quadro FX 770M, 512 MB.
 - 2) Screen: 15.4-inch WXGA, 1280 x 800 resolution.
 - k. Keyboard: Standard keyboard.
 - l. Mouse: Optical USB mouse.
 - m. Sound: Integrated sound with built-in speakers and microphone.
3. Software:
 - a. Operating System: Windows XP, SP2.
 - b. Microsoft Office Basic, latest version.
 - c. Adobe Acrobat Standard, latest version.
 - d. Antivirus: Match Owner's standard.
4. Support Agreement:
 - a. Onsite Hardware Support: 7 day/ 24 hour, next business day onsite service, 3 years.
5. Manufacturer and Product:
 - a. Similar to Dell Precision M4400 Mobile Workstation.
 - b. Or equal.

MM. Y81 SCADA Ethernet Switch

1. General:
 - a. Function: Ethernet network switch for interconnecting new onsite SCADA network hardware including computers, printers, and PLCs; and for connection to existing offsite SCADA network.
 - b. Parts: Stacked switches and accessories.
2. Features:
 - a. Form Factor: Stackable 1 RU rack mount. Stacked switches act as a single switch.

- b. Architecture: Layer 2 and Layer 3 switching. 10/100/1000 Base Ethernet. Plug and play operation. Auto-sensing, auto-negotiation. Power over Ethernet (PoE).
 - c. Port Configuration:
 - 1) Two stacked 24-port switches for a total of 48 ports.
 - 2) Four SFP ports per 24-port switch, for a total of 8 SFP ports supporting single mode and multi mode fiber optic transceivers.
 - 3) Provide one 1000 Base single mode transceiver per 24-port switch for a total of two single mode transceivers. Provide single mode transceivers compatible with existing offsite SCADA network.
 - 4) Provide three 1000 Base multi mode transceivers per 24-port switch for a total of six multi mode transceivers. Provide multi mode transceivers compatible with new onsite SCADA network switches and hardware.
 - d. Power Supply: Internal, 100 to 240 Vac, 60 Hz.
 - e. Performance:
 - 1) 32-Gbps switching fabric.
 - 2) Throughput: 38.7 Mpps.
 - 3) Memory: 128 MB DRAM and 32 MB Flash.
 - 4) Configurable Capacity: 12,000 MAC addresses, 20,000 unicast routes, and 1,000 IGMP groups and multicast routes.
 - f. Supported Protocols and Standards:
 - 1) Cisco Discovery Protocol for automatic switch discovery.
 - 2) IEEE Standards: 802.1s; 802.1w; 802.1x; 802.3ad; 802.3af; 802.3x; 802.1d Spanning Tree Protocol; 802.1p CoS classification; 802.1Q VLAN; 802.3 10BASE-T; 802.3u 100BASE-T; 802.3ab 1000BASE-T; 802.3z 1000BASE-X.
 - 3) Advanced Quality of Service (QoS).
 - 4) IGMP snooping; IGMP filtering.
 - 5) IP DHCP snooping.
 - 6) IP ARP inspection.
 - 7) Power over Ethernet (PoE).
 - 8) Cisco VLAN Trunking Protocol (VTP).
 - 9) Compatible with existing network support software.
 - g. Safety and Compliance:
 - 1) UL to UL 60950, Third Edition.
 - 2) FCC Part 15 Class A.
 - h. Accessories: Power cable, stack cabling, single mode and multi mode jumper cables.
3. Environmental:
- a. Operating Temperature: 32 to 113 degrees F.
 - b. Storage Temperature: Minus 13 to 158 degrees F.
 - c. Operating Relative Humidity: 10 to 85 percent non-condensing.
4. Warranty: Limited lifetime warranty.
5. Manufacturer and Product:
- a. Similar to Cisco Catalyst 3750 Series Switches.
 - b. Or equal.

NN. Y82 Industrial Ethernet Switch

1. General:
 - a. Function: Ethernet network switch for interconnecting PLCs and Operator Interface Terminals (OITs) to plant SCADA network.
 - b. Type: Managed, store and forward.
 - c. Parts: Switch with built-in copper and multimode fiber optic Ethernet ports..
2. Service:
 - a. Temperature: Minus 4 to 158 degrees F.
 - b. Humidity: 10 to 95 percent, non-condensing.
 - c. Vibration: 50g, 5 to 200 Hz, triaxial.
 - d. Shock: 200 g t 10 ms.
3. Performance:
 - a. IEEE Compliance: Full 802.3.
 - b. EMI Emissions and Safety: FCC Part 15A, UL 1604.
4. Features:
 - a. Number of Ports (Small size):
 - 1) Six 10/100 Base TX copper.
 - 2) Two multimode 100 Base FX fiber optic.
 - b. Number of Ports (Large size):
 - 1) Sixteen 10/100 Base TX copper.
 - 2) One multimode 100 Base FX fiber optic.
 - c. Protocols: All standard IEEE 802.3.
 - d. Port Type: RJ45 copper connection; 10/100 Mbps auto-sensing SC fiber connection.
 - e. Full-Duplex Operation: Automatically switches from half-duplex to full-duplex when full-duplex capable devices are sensed on ports.
 - f. MAC Addresses Supported: 4,000.
 - g. Mounting: DIN rail.
5. Power: 10V to 30V dc.
6. Manufacturers and Products:
 - a. N-TRON; 508FX2 (Small size) and 517FX (Large size).
 - b. Moxa; EDS-508A (Small size) and 516A (Large size).
 - c. Or equal.

OO. Y83 Network Router and Security Firewall

1. General:
 - a. Function: Network hardware and software integrating a broad range of advanced firewall services, preventing unauthorized access to network.
 - b. Type: Modular for Data, Voice, and Video connectivity.
2. Architecture:
 - a. Form Factor: 1 RU 19-inch rack mount.
 - b. Memory: 256 MB DRAM, 64 MB Flash.
 - c. USB Ports: Two.
 - d. LAN Ports: Two 10/100.
 - e. Interface Card Slots: Four slots, each supporting HWIC, WIC, VIC, or VWIC modules.
 - f. Network Module Slots: One, supporting NM and NME type modules.
 - g. PVDM (DSP) Slots: Two on motherboard.
 - h. Modules:
 - 1) Channelized T1/E1: One port channelized E1/T1/ISDN PRI.

- 2) Virtual Private Network: DES/3DES/AES/SSL VPN Encryption/Compression Advanced Integration Module (AIM) with IPv6 encryption..
- 3) Voice Interface: 4-port VIC-FXO (universal).
- 4) Voice Interface: 4-port FXS.
- i. Encryption: Integrated hardware based.
- j. VPN Hardware Acceleration: On motherboard, DES, 3DES, AES 128, AES 192, and AES 256.
- k. Power Supply: Internal, 100 to 240 Vac, 60 Hz.
- l. Supported Protocols and Standards: Capable of GRE encrypted tunnels compatible with Cisco Protocols.
- m. Safety and Compliance:
 - 1) UL to UL 60950.
 - 2) FCC Part 15.
 - 3) FCC Part 68.
- n. Software: Support for all hardware and interface to existing network. Managed interface through Solarwinds Orion. Compatible with existing primary GRE router.
3. Environmental:
 - a. Operating Temperature: 32 to 104 degrees F.
 - b. Storage Temperature: Minus 40 to 158 degrees F.
 - c. Operating Relative Humidity: 5 to 95 percent non-condensing.
4. Manufacturer and Product:
 - a. Similar to Cisco 2811 Integrated Service Router.
 - b. Or equal.

-- END OF SECTION --