

Section 13446

PRIMARY INSTRUMENTATION DEVICES

Part 1 GENERAL

1.01 SUMMARY

This Section includes the furnishing and installation of Analyzer Transmitters, Control Power Transformers, Flow Elements/Recorders/Switches/Transmitters, Level Probes/Recorders/Float Switches, Phase/Voltage Monitor Relays, Control Valve Position Transmitters, Pressure Switches/Differential Pressure and Pressure Transmitters with Transducers, Solenoid Valves, Surge Protection and Suppression Devices, Mechanical Thermostat, Terminal Blocks, Ultra-Sonic Level Controllers/Transmitters, Vibration Switches/Transmitters, 4-20 mA Instrumentation Loops and accessories.

1.02 MEASUREMENT AND PAYMENT

No separate measurement or payment for Work performed under this Section. Include cost of same in Contract price bid for Work of which this a component part.

1.03 REFERENCES

This specification references the following publications in their current editions. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

- A. ASME B40.100: Pressure Gauges and Gauge Attachments
- B. IEEE C62.41.1: Guide on the Surges Environment in Low-Voltage (1000 V and Less) AC Power Circuits
- C. IEC 62305-1: Protection against lightning – Part 1: General Principles
- D. IEC 61643-341: Components for Low-Voltage Surge Protective Devices - Part 341: Specification for Thyristor Surge Suppressors (TSS)
- E. NEMA ICS 1: Industrial Control and Systems: General Requirements
- F. NEMA ICS 2: Industrial Control and Systems: Controllers, Contactors, and Overload Relays Rated 600 Volts
- G. NEMA ICS 3: Industrial Control and Systems: Medium Voltage Controllers Rated 2001 to 7200 Volts AC
- H. NEMA ICS 6: Industrial Control and Systems: Enclosures
- I. NFPA 70: National Electrical Code (NEC)

- J. Underwriters Laboratories, Inc. (UL)
- K. UL 506: UL Standard for Safety Specialty Transformers
- L. UL 1449: UL Standard for Safety Surge Protective Devices
- M. UL 1561: Standard for Safety Dry-Type General Purpose and Power Transformers

1.04 SUBMITTALS

- A. Submit the following in accordance with Sections 01330 – “Submittal Procedures” - Submittals and 01782 - "Operations and Maintenance Data:"
 - 1. Manufacturer’s product name and number
 - 2. Tag number, if applicable
 - 3. Description of construction and features
 - 4. Performance data
 - 5. Service requirements, e.g., power, water, etc.
 - 6. Dimensions
 - 7. Calibration data and curves for instruments and other items which require factory calibration
 - 8. Mounting details for all items
 - 9. Process connection details for all process connections
 - 10. Unit elementary diagram with numbered terminal points for interconnection with other units
 - 11. Layout of completed assemblies
 - 12. Interconnecting cabling
 - 13. Weights
- B. Submit product data for each component specified
- C. Submit manufacturer's certificate that all equipment meets or exceeds specified requirements. Submit manufacturer's installation instructions.
- D. Operation and Maintenance Data

1. Provide at a minimum:
 - a. Equipment operational instructions
 - b. Preventive maintenance instructions
 - c. Troubleshooting instructions
 - d. Complete listing of repair parts and model numbers
 - e. Calibration method and procedure
 - f. Manufacturer's installation statement that the meters are properly installed and adjusted or description of any deficiency and recommended corrective action
 - g. Corrected Shop Drawings as called for above
- E. Project Record Documents
 1. Accurately record actual locations of controller cabinets and input and output devices connected to system. Include interconnection piping, wiring and cabling information, and terminal block layouts in controller cabinets.
 2. During drawing submittal phase, submit detailed programming information consisting of ladder logic and line code of proposed program, and complete input, output, relay, register and controller identification labels.
 3. Submit factory testing procedures proposed to verify input, output, PID loop and register operations, system logic verification, and spare memory capacity

1.05 RELATED REQUIREMENTS

- A. Section 01330 – “Submittal Procedures”
- B. Section 01782 – “Operations and Maintenance Data”
- C. Section 16051 – “Electrical Construction”
- D. Section 16195 – “Electrical Identification”
- E. Related work as called for on Plans or specified elsewhere in this or other Specifications Sections.

1.06 QUALITY ASSURANCE

- A. Manufacturer:

Manufacturer shall be a company specializing in manufacturing the products specified in this Section, and having at least 3 years documented experience maintaining service facilities within 100 miles of project.

B. System Coordination:

Contractor is to be responsible for all details necessary to properly install, adjust, and place in operation a working system.

1.07 SYSTEM DESCRIPTION (NOT USED)

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in factory-sealed containers. Provide sufficient protection to ensure arrival in undamaged condition.
- B. Upon delivery, inspect products for damage.
- C. Store products in clean, dry area; maintain temperature in compliance with NEMA ICS 1.

1.09 PROJECT/SITE CONDITIONS

- A. Inside
 - 1. Temperature: 60 to 85°F
 - 2. Relative Humidity: 95% maximum
- B. Outside
 - 1. Temperature: 0 to 105°F
 - 2. Relative Humidity: 100% maximum
- C. Process Fluid Temperature: 50 to 85°F
- D. Maintain area free of dirt and dust during and after installation of products

1.10 – 1.12 (NOT USED)

1.13 WARRANTY

- A. Provide Owner with 25 Year unlimited, free replacement unit or replacement parts for all malfunctioning TVSS/SPD devices.
- B. Provide Owner with manufacturer's warranty guaranteeing all other components to be free from defects for five (5) years from date of Substantial Completion.

Part 2 PRODUCTS

2.01 MANUFACTURER(S)

A. Analyzer Transmitters

Refer to equipment specifications for requirements of transmitters to be supplied

B. Control Power Transformers

1. Square D - 9070 series
2. Eaton Type MTE and MTK
3. G. E. Type IP
4. Or Approved Equal

C. Flow Elements, Recorder, Switches and Transmitters

1. Flow Elements and Transmitters

Refer to equipment specifications for requirements of sensors and transmitters to be supplied

2. Flow Recorders

- a. Foxboro - Model 740R (740RA-A3300)
- b. Or Approved Equal

3. Flow Switches

- a. McDonnell & Miller - Type FS4-3S
- b. Dwyer - Series FS-2
- c. Or Approved Equal

D. Level Probes, Recorders and Switches

1. Level Probes

- a. Warrick - Model 3F and 3G
- b. Or Approved Equal

2. Level Recorders
 - a. Foxboro - Model 740R (740RA-A3300)
 - b. Or Approved Equal
3. Level Float Switches
 - a. Siemens - Model 9G-EF (Mercury free)
 - b. APG - Model FT-100 (Mercury –free)
 - c. Or Approved Equal
- E. Phase/Voltage Monitor Relays
 1. ATC Diversified Electronics Inc. - Model PBD Series
 2. Or Approved Equal
- F. Control Valve Position Switches/Transmitters

Refer to equipment specifications for requirements of switches and transmitters to be supplied
- G. Pressure Switches, Differential Pressure and Pressure Transmitters with Transducers
 1. Pressure Switches
 - a. Dwyer Series DA/DS
 - b. Or Approved Equal
 2. Differential Pressure Transmitters and Pressure Transmitters with Transducers
 - a. Rosemount - Model 3051S
 - b. Siemens - Sitrans P500 series
 - c. Honeywell - SmartLine ST and STD700 series
 - d. Or Approved Equal
- H. Solenoid Valves
 1. ASCO
 2. Or Approved Equal
- I. Surge Protection and Suppression Devices

1. Main Power Panel
 - a. ERICO CRITEC TDX 100 M Series
 - b. Dehn, Dehnguard P-R Series
 - c. Phoenix Contact, Combo Trab SYS FT+CT-VAL 480,277 rail kit
 - d. Or Approved Equal
 2. Secondary Power Panel
 - a. ERICO CRITEC TDS M Series
 - b. Dehn, Dehnguard Series
 - c. Phoenix Contact, Plugtrab PT2-PE/S 120AC-ST with PT-BE/FM base
 - d. Or Approved Equal
- J. Mechanical Thermostat
1. Johnson Control A2AA (Mechanical 2-stage Thermostat)
 2. Or Approved Equal
- K. Terminal Blocks
1. Eaton
 2. Phoenix Contact
 3. General Electric Company
 4. Weidmuller
 5. Allen Bradley
 6. Or Approved Equal
- L. Ultra-Sonic Level Controllers and Transmitters
1. Siemens Hydro Ranger 200 with Echomax transducer XPS series (Echomax material of construction to be compatible with chemicals in tanks)
 2. Or Approved Equal
- M. Vibration Sensors, Switches and Transmitters

Refer to equipment specifications for requirements of sensors, switches and transmitters to be supplied

- N. 4-20 mA Instrumentation Loops
 - 1. ERICO CRITEC UTB30SP (Single Loop) or UTB30DP (Two loops)
 - 2. Dehn, Blitzductor CT-ME-30
 - 3. Phoenix Contact, Plug Trab PT1x2-24DC-ST Plug with PT1x2 base
 - 4. Or Approved Equal
- O. Accessories
 - 1. Plastic Raceway
 - a. Anixter Delaware Industries, Inc.
 - b. Panduit Corp
 - 2. Iboco
 - 3. Or Approved Equal

2.02 MATERIALS AND EQUIPMENT

- A. See the "INSTRUMENT SCHEDULE" in the "ATTACHMENT" for detailed information related to the instruments.
- B. Analyzer Transmitters
 - 1. Analyzer transmitters supplied by the manufacturer shall at the minimum be supplied with at least two analog 4-20 mA outputs with a maximum impedance of 500 ohms.
 - 2. As an option, analyzer shall be supplied with electromechanical, UL rated, SPDT relays (Form C) for user-configurable contacts rated 100 to 230 VAC, 5 Amp at 30 VDC resistive maximum.
- C. Control Power Transformers
 - 1. Transformer:

Machine tool transformer with isolated secondary winding that complies with UL 506 and UL 1561.

2. Power Rating:
250 VA or 200 percent power requirement, whichever is greater
3. Voltage Rating:
480/240 volt primary, 120 volt secondary, single phase

D. Flow Recorders, Switches and Transmitters

1. Flow Elements and Transmitters

Refer to equipment specifications for requirements of sensors and transmitters to be supplied

2. Flow Recorders

a. Description:

Digital circular, 7-day-pen recorder, 2-pin 4-20 mA signals, display indicator, one-year supply of 0-30 foot range or sized to match anticipated flows.

b. Display:

Brilliant 2-line 20-characters per line

c. Input: Two 4-20 mA signals

d. Accuracy:

Display (+/- 0.1% of input span), recording (+/- .25% of input span), supply voltage (less than 0.025% of span within +/- 10% of reference operating supply voltage).

3. Flow Switches

a. Description: Pipe Mounted with direct paddle activated switch with water flowing

b. Enclosure: Switch enclosure NEMA 4X

c. Switch Rating: 7.4 amps at 120 VAC

E. Level Probes, Recorders and Float Switches

1. Level Probes

a. Description: 3-inch flange – top of tank

- b. Enclosure: 316 Stainless Steel
 - c. Number of probe: 7 probes
 - d. Probe Type: Warrick 3R solid 316 stainless steel probes)
2. Level Recorders
- a. Description:

Digital circular, 7-day-pen recorder, 2-pin 4-20 mA signals, display indicator, one-year supply of 0-30 foot range or sized to match depth.
 - b. Display:

Brilliant 2-line 20-characters per line
 - c. Input: Two 4-20 mA signals
 - d. Accuracy:

Display (+/- 0.1% of input span), recording (+/- .25% of input span), supply voltage (less than 0.025% of span within +/- 10% of reference operating supply voltage).
3. Level Float Switches
- a. Description: Direct acting, Mercury Free-Magnetic Reed Switch float switch.
 - b. Construction: Teflon coated 316 Stainless Steel housing
 - c. Switch type: SPST magnetic reed switch rated for 100 Vamp to 250 Volts with cable connection potted in epoxy. Float switch shall have a minimum of 2 pounds of buoyancy in water.
 - d. Switch cable: Multi-stranded, 2 conductor stranded (16 AWG) with ground
 - e. Mounting bracket: 316 stainless steel flange cable mounting bracket to secure float switches and avoid cable stress point

F. Phase/Voltage Monitor Relays

- 1. Description:

All three phases monitored individually for preselected under and over voltage limit phase loss, phase unbalance, phase reversal, frequency shift and phase shift. Automatic reset after adjustable release delay when line conditions return to normal.

2. Indicators:
LED indicators for under and over voltage limit

3. Output Rating:
DPDT, 3 amps resistive at 600 VAC

4. Phase Sequence: ABC

5. Sampling Time: 2 seconds

6. Spare Unit:

In addition to the unit installed, furnish one spare phase/voltage monitor relay.

G. Control Valve Position Switches/Transmitters

1. Position transmitters supplied by the manufacturer shall at the minimum be supplied with at least two analog 4-20 mA outputs with a maximum impedance of 500 ohms.

2. As an option, analyzer shall be supplied with electromechanical, UL rated, SPDT relays (Form C) for user-configurable contacts rated 100 to 230 VAC, 5 Amp at 30 VDC resistive maximum.

H. Pressure Switches, Differential Pressure and Pressure Transmitters with Transducers

1. Pressure Switches

a. Description:

(1) Bourdon tube pressure switch with visible calibrated dial for setting with "ON/OFF" indication.

(2) Adjustable deadband

(3) External switch set point adjustment

(4) UL listed Digital circular, 7-day-pen recorder

(5) 2-pin 4-20 mA signals

(6) Display indicator, one-year supply of 0-30 foot range or sized to match depth.

b. Wetted materials: 316 SS

c. Enclosure Rating: Weatherproof unless otherwise indicated

- d. Repeatability: 1% of full operation range
 - e. Switch Type: SPDT snap switch
 - f. Mounting Orientation: Vertical
 - g. Process Connection: As required
2. Pressure Transmitters with Transducer
- a. Pressure level transmitter to be used on ground storage tank and elevated tank applications. Provide pressure compensator for elevated tank applications.
 - b. Transmitters shall be capable of being calibrated to send a signal in "psi" or in "feet," as required for the application and use.
 - c. Materials:
 - (1) Process-wetted parts 316 stainless steel
 - (2) Process connection: ½ in. NPT
 - (3) 316L stainless steel process diaphragm
 - (4) Utilize manufactures standard liquid fill
 - (5) Housing stainless steel
 - (6) Include two valve manifold for testing/vent/drain
 - (7) Include isolating diaphragm if designated in “ATTACHMENT”
 - d. Fabrication/Design:
 - (1) Output:
4-20 mA DC proportional to pressure
 - (2) Power supply: 24 volts DC
 - (3) Adjustable zero and span
 - (4) Temperature limits:
-20 to 180°F, -4 to 175°F for LCD indicators
 - (5) Overpressure limits:
Withstand 150 percent of stated maximum service pressure

without damage

- (6) Humidity limits: 0 to 100 percent relative humidity
- (7) Damping: Adjustable between 0 and 32 seconds
- (8) Inaccuracy (includes effects of linearity, repeatability and hysteresis): +/-0.10 percent of calibrated span for 15:1 rangeability
- (9) Stability: +/-0.2 percent of upper range limit for 12 months
- (10) Total temperature effect including span and zero errors: +/-0.2 percent of upper range limit per 100°F for minimum 15:1 rangeability

I. Solenoid Valves

1. Material: Brass
2. Operate on 120 VAC, single phase power, normally open or normally closed as indicated.
3. Solenoid valves shall be packless, direct acting with cushioned closing and have an epoxy-resin molded waterproof coil.
4. Valves shall have copper alloy body for use in potable water applications and be rated for 150 psig.

J. Surge Protection and Suppression Devices

1. Definitions
 - a. TVSS: Transient Voltage Surge Suppressor
 - b. SPD: Surge Protection Devices
2. Codes and Reference Standards
 - a. The TVSS/SPD shall comply with the following standards:
 - (1) UL Listed or recognized to UL 1449
 - (2) IEEE C62.41.1 Category C area
 - (3) IEC 62305-1
 - (4) National Electrical Code (NEC)
 - (5) IEC 61643-341

3. General

- a. The TVSS/SPD shall be available in a non-enclosed Din rail mounted version or mounted in a suitable enclosure.
- b. The TVSS/SPD components can be either a self-contained wired in unit or a modular unit with field replacement capability without the removal of any wires.
- c. TVSS/SPD for 4-20ma shall be available in either series or parallel connection depending on the application.
- d. The TVSS/SPD shall be capable of supporting local and or remote alarming for failure notification.

4. Main Power Panel Requirements

Facility incoming voltage of 3 phase 480/277 AC or 3 phase 120/240 AC will require TVSS/SPD protection with the following requirements:

- a. 50 KA per IEC 62305-1 or 100 KA each phase per IEEE C62.41.1
- b. MOV, Arc Chute or Hybrid technology is acceptable
- c. Response time: $1 <$ nanosecond or di/dt rise for lighting strikes
- d. Din Rail mounted or suitable enclosure
- e. Multi-modes of protection (minimum L, N, and G)
- f. Must comply with UL 1449 Type 1 SPD 200 KA SCCR

5. Secondary Power Panel Requirements

Secondary power panels supplying power to single phase 120/ 240 VAC or 120 VAC systems will require TVSS/SPD protection with the following requirements:

- a. 40 KA each leg per IEEE
- b. MOV or Hybrid technology is acceptable
- c. Response time: <1 nanosecond
- d. Din Rail mounted or suitable enclosure
- e. Must comply with UL 1449 Type 2 SPD

6. 4-20 Instrumentation Loops
 - a. Surge current rating of 10 KA per IEEE
 - b. The TVSS/SPD must be base with interchangeable circuit protection
 - c. Din Rail mounted
 - d. Shall have means for field testing

7. Testing Requirement

Vendor shall provide verifiable third party test results of the stated specification of TVSS/SPD.

K. Mechanical Thermostat

Refer to equipment specifications for requirements of thermostats to be supplied

L. Terminal Blocks

1. Provide isolated fused snap-on type terminal blocks.
 - a. Power Terminals:
 - b. Unit construction type with closed back and tubular pressure screw connectors, rate 600 volts.
 - c. Signal and Control Terminals:
 - d. Modular construction type suitable for channel mounting with tubular pressure screw connectors; 300 volt rating
2. Provide color-coded (green/yellow) ground bus terminal block, with each connector bonded to enclosure.

M. Ultra-Sonic Level Controllers and Transmitters

1. Type
 - a. Electronic pulse input
 - b. Electronic analog output
 - c. Enclosure NEMA 4X, transmitters wall mounted outside shall be provided with stainless steel sun shields

2. Function/Performance

a. Function:

To receive the transducer input and provide a current output.

b. Principal:

To monitor the transducer echo and provide electrical pulses to the transducer.

c. Input Power: 105V to 125V AC, 60Hz

d. Output:

4-20mA analog output signal into 750 ohm maximum load with 0.1% of range. (Maximum 0.25% of range)

e. Accuracy:

Current output 1 percent of selected full-scale range

f. Repeatability: 0.25 percent full scale

g. Communication:

RS-485 modbus DP Communication Protocol with associated function blocks and parameters

h. 3 SPST Form A/1 SPDT Form C contacts.(5 A at 230VAC)

i. LCD indicator in percentage (%) with sun shield

j. Provide program unit for level detector

k. Provide PROFIBUS DP Communication card

l. Power supply to be 100 to 240VAC +/- 15% 50/60 Hz

m. Provide one unit for each tank

n. Provide Echomax cable as required

N. Vibration Sensors, Switches and Transmitters

Refer to equipment specifications for requirements of sensors, switches and transmitters to be supplied

O. Accessories

Plastic Raceway: Plastic slotted wire way with snap-on locking covers

2.03-2.04 (NOT USED)

Part 3 EXECUTION

3.01 GENERAL

- A. Install equipment and components in accordance with the Plans, approved Shop Drawings, and installation instructions furnished by the Manufacturer.
- B. Do not begin installation of field instruments until building construction is completed and major piping and equipment have been installed. Install in-line primary elements when major piping is installed.
- C. Inspect each instrument for damage and defects before installation. Replace deficient items.

3.02 PREPARATION (NOT USED)

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

- A. Furnish complete enclosure, factory tested and ready for installation and field termination.
- B. Terminate wiring with spade lugs at terminal strips corresponding to designations on Plans.
- C. When not installed in plastic wireways, such as along back of door, neatly bundle and support air tubing and internal panel wiring with self-adhesive nylon clips. Provide adequate slack for proper door operation without damage to wiring or tubing.
- D. Identification:

Identifying system components in accordance with Section 16195 – “Electrical Identification.”

- 1. Identify conductors and termination points (device and relay terminals).
 - 2. Identify transmitters, switches and devices with stainless steel tags.
 - 3. Provide nameplates for panel-mounted devices and instruments as shown on Plans.
- E. Electrical
- 1. Power input requirements to be 120 volts AC, single-phase, 60 Hz.
 - 2. AC Power Wiring:

No. 14 AWG (minimum) stranded wire with thermoplastic insulation rated for 600 volts and 75oC. For wiring carrying more than 15 amps, use sizes required by NEC and JIC (Joint Industry Council) standards.

3. Analog Signal Circuits:

300-volt, stranded copper, twisted shield pairs, No. 16 AWG (minimum).

4. Other DC Signal Wiring:

No. 16 AWG (minimum) stranded wire with thermoplastic insulation rated for 600 volts and 75°C.

5. Special Signal Circuits: Use manufacturer’s standard cables.

6. Separate and shield DC signal wiring from power and control wiring.

7. Wire Terminations:

a. Analog and Discrete Signal Wires: Terminate at numbered terminal blocks with insulated crimped spade lugs.

b. Wiring for Special Signals:

Terminate communications, digital data, and multiplexed signals using manufacturer’s standard connectors for the device to which the signals terminate.

8. Terminate all wiring at terminal strips

9. Grounding:

Ground all instruments and enclosures in accordance with the National Electric Code. Ground all shield connections.

F. Tubing and Conduit

1. Install tubing and conduit parallel with or at right angles to, structural members, buildings, or process lines. Make vertical runs straight and plumb. Run conduit and tubing to allow clear access to doors, controls, control panels and allow easy removal of mechanical equipment.

2. Cut tubing and conduits square with a sharp cutter, Debur cuts and remove chips. Do not gouge or scratch surface. Blow debris from inside of conduit or tubing.

3. Bends:
 - a. Tool-formed without flattening, and all of same radius;
 - b. Radius:

Equal to or larger than conduit or tubing manufacturers recommended minimum bend radius
4. Do not run liquid filled instrument tubing immediately over or within a 3-foot plan view clearance of electrical panels or motor starters.
5. Straighten all coiled tubing by unrolling on a flat surface; do not pull to straighten.
6. Use lubricating compound or TFE tape on stainless steel threads to prevent seizing or galling.
7. Make up and install fittings to meet installation requirements.

G. Process Connections

1. Comply with piping specifications in making process connections.
2. Make connections at threaded taps or bosses. Do not use service saddles.
3. Install a shut-off valve in each instrument sensing or sample line as close as possible to the process connection.
4. Slope instrumentation piping so that it will drain and/or vent back to the process wherever possible. Slope to a mud leg if necessary and provide a drain valve on mud leg.

H. Mounting of Instruments

1. Mount instruments as shown on Plans and approved Shop Drawings and Manufacturer's printed data.
2. When mounting details are not shown, mount instruments on a pipe or on a wall so that the instrument is easily accessible from a walk or platform and not lower than 3 feet nor higher than 5 feet above the walk or platform.
3. Pressure gauges to be mounted in a vertical axis so that scale can be read left-to-right.

I. Nameplates and Tags

1. Instrument Nameplates:

- a. Provide identification nameplates on the face of all instruments furnished
- b. Materials: adhesive backed, laminated plastic
- c. Letters: 3/16-inch black on white background

2. Wire Identification:

Wires to be numbered and tagged at each termination. Tags to be snap-on or slip-on PVC wire markers with legible machine printed markings and numbers. Adhesive or taped-on tags are not acceptable.

3.04 REPAIR/RESTORATION (NOT USED)

3.05 FIELD QUALITY CONTROL

- A. After start-up, prepare a report on the installation, calibration, and testing of all instruments. Report to be prepared by an experienced technical representative of the instrumentation supplier.
- B. Instrumentation installation and calibration report to include certification that all equipment is properly installed and calibrated, except as noted, and performed satisfactorily during testing.
- C. Upon completion of calibration, prepare a calibration report for submittal to the Engineer certifying that each instrument has been calibrated to its specified accuracy. Include in the report the following information for each instrument:
 1. Specified accuracy
 2. Permissible tolerance at each point of calibration
 3. Calibration readings as finally adjusted within tolerances
 4. Defects noted
 5. Corrective action taken
 6. Corrective action taken
 7. Corrective action still required

3.06 ADJUSTING

Calibrate instruments at 10, 50, and 90 percent of span using test instruments to simulate inputs and read outputs that are rated to an accuracy of at least five times greater than the specified accuracy of the instrument being calibrated. Such test

instruments to have accuracies traceable to the National Bureau of Standards, as applicable.

3.07 CLEANING (NOT USED)

3.08 DEMONSTRATION / TESTING AND INSPECTION

Perform system testing as required by individual component Sections. Calibrate and adjust components for proper operation. Submit 6 copies of Manufacturer's Installation Inspection, Field Calibration and Field Testing Reports. Replace components found to be defective.

3.09 – 3.10 (NOT USED)

ATTACHMENT

[Design Engineer is to complete blanks per site requirements]

Tag No. *	Area	Description	Low Limit	High Limit	Engr Units	Off State	On State	Comments	Instr. Detail	I/O Type	Specification	2, 3, 4 wire	Area Class	Process	Instr. Types	Make - Model	Process Conditions	Accessories

* Tag number is the number identified with the instrument on the Plans.

END OF SECTION