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| Version | Date | Description of Revisions |
| 1 | November 1, 2011 | Standard Specification Released |
| 2 | April 20, 2015 | General Formatting |
| 3 | August 8, 2017 | Updated form references to 01810 |
| 4 | November 27, 2019 | Removed references to 13933 throughout (BM) |
| 5 | June 13, 2022 | 1.1 Added asset tagging reference (BM) |

NOTE:

This is a CONTROLLED Document. Any documents appearing in paper form are not controlled and should be checked against the on-line file version prior to use.

**For each project the Consultant is responsible for the correct application of the specifications and for updating and modifying all highlighted items, as well as updating and modifying those sections that are directly applicable to the project. All updates and modifications to this standard document are to be highlighted to the Region for review and acceptance on each project.**

**Notice:** This Document hardcopy must be used for reference purpose only.

**The on-line copy is the current version of the document.**

# GENERAL

## General

### The Contractor shall supply and install all instrumentation and control wiring.

### Comply with the requirements of Section 13010 (Process Control General Requirements).

### Comply with the requirements of Division 1.

### Refer to Division 11, Division 15 Mechanical and Division 16 Electrical for additional requirements

### Refer to the Contract Drawings to ensure completeness of installation for all items and that these items are compatible with the control and operational intent of the design of this project.

### Without limitation to the following sections of this Division, the equipment supplied shall be complete with all accessory items, whether specifically mentioned or not, so as to provide completeness of installation, controls and operation as intended. All equipment installation shall be as recommended by the equipment manufacturer or as described in the installation drawing.

### Process control equipment and wiring as specified, or as shown on the Drawings, are sized for the process, electrical and mechanical equipment as specified, or as may be necessary in the future. Any additional expense incurred because of approved substituted process control equipment from that specified shall be borne by the Contractor.

### Provide all necessary equipment, tools, labour, etc., for installing and testing all equipment supplied under this Division.

### Modify and/or remove existing equipment as shown on the Contract Drawings.

### This section provides general requirements for Division 13.

### All instrumentation in Division 13 to be tagged in accordance with Section 01080 – Process Equipment Location Tagging and the individual specification sections.

## Standards of Conformance

### All equipment and workmanship shall conform to the applicable standards established by the following organizations. Where conflicting standards occur, the more stringent standard shall be applied.

#### International Society of Automation (ISA)

#### National Electrical Manufacturers Association (NEMA)

#### Canadian Standards Association (CSA)

#### Ontario Electrical Safety Code (OESC)

#### National Fire Protection Association (NFPA)

#### Electrical Safety Authority (ESA)

### All field devices shall be rated as noted on the Device Data Sheets.

### Comply with all the applicable Municipal, Provincial, and Federal regulations and by-laws including Ontario Building Code, Ontario Electrical Safety Code, Canadian Electrical Code and other applicable regulations. Provide all necessary licenses, permits, approvals and certificates.

### Provide regular inspections and a final inspection with the local Electrical Safety Authority office(s).

## General Requirements

### Equipment shall be selected from an approved manufacturer provided within Division 13 or Equivalent.

### Provide all supplies used during and prior to acceptance of equipment. In addition, provide a one year’s supply of materials necessary for normal operation and scheduled maintenance of all equipment as per the manufacturers recommendations.

#### Supplies shall be furnished in the original sealed containers, correctly identified as to brand and grade, and with reference to the particular piece of equipment for which it is intended.

#### Please see the individual equipment specifications for details on required supplies.

### The equipment specified in the Contract Documents shall generally be an "all electronic" control system, with 4-20mA DC linear outputs from all instruments, unless otherwise noted. Equipment shall be suitable for 120 VAC, 60 Hz, single phase operation, or 24 VDC operation as shown on the Drawings.

### Supply and install all required current isolators, signal conditioners, etc., which are shown on the drawings as required for the entire control and instrumentation system to operate as intended.

### The entire system has been designed for operation on UPS power. All instrument components shall have ample margin to withstand transient and other surge voltages which may occur, including transient periods under change over conditions.

### All equipment mounted outdoors shall be installed in enclosures as identified in Contract Drawings, NEMA 4X service, with heaters, and be suitable for operating in temperatures from -30ºC to +50ºC.

### All instrument local indicators shall be in metric engineering units unless specified otherwise in the Contract Drawings.

### All panels and instruments shall be complete with factory applied finishes. Repaint all damaged factory applied finishes.

### Provide instruments complete with all necessary mounting hardware, floor stands, wall brackets or instrument racks as required by the manufacturer.

### In hazardous areas, meet the OESC Class, Group, and Division (or Class, Zone) as shown or specified in the Contract Documents. Provide intrinsically safe relays (ISRs) as required for instruments mounted in hazardous locations. ISRs are to be mounted in a separate panel as identified in the Contract Documents.

### Electronic configuration files for all smart instruments are to be provided to the Region after successful commissioning of each instrument.

## Site Specific Requirements

### Major site specific requirements to be undertaken by the Contractor are listed in this Section. Contractor shall review the complete Specifications and Drawings for a complete understanding of the scope of work involved under this project.

### [Consultant to identify and summarize major work]

## Submittals

### Comply with the provisions of Section 01300 – Submittals and Division 13.

### Submit the following for each instrument provided:

#### Shop Drawing Submittals:

##### Manufacturers design and performance specification data and descriptive literature.

##### Complete manufacturer model number, identifying all required and optional accessories to be provided.

##### Instrument Data Sheets with all fields completed. Contractor to provide Instrument Data Sheets using the typical Instrument Data Sheets, provided in Division 13 of the Specifications.

##### Catalog literature edited to indicate specific items provided.

##### Equipment dimensioning, installation requirements and recommendations

##### Mounting details for all typical installation requirements and special details for non-typical applications.

##### Methods and materials required for installation. Include power and signal connection details.

##### Electrical/pneumatic signal and power connection diagrams.

##### Other specific submittal information as specified in the particular instrument specification.

#### List of recommended spare parts and spare parts to be provided.

##### List of optional accessories.

#### As-Built Documentation:

##### Operation and maintenance documentation for each type instrument after Product approval.

##### Calibration certifications from the manufacturer for each calibrated instrument.

##### Provide electronic configuration file for all smart instruments.

##### Update Shop Drawings, Instrument Data Sheets, calibration reports and “As Built” drawings including: P&ID, control schematics and electrical drawings as required to match field conditions.

### Submit the following documents prior to conducting the Instrument Acceptance Testing:

##### Calibration Procedure(s) to be followed in the test. The calibration method and tools will not cause greater than +/- 0.5% error in any test;

##### Any special Procedure(s) to be followed in the test;

##### Identify Site verification, set-up and calibration to be done by the equipment manufacturers.

### Electronic and hard copies of all Shop Drawings are to be provided.

## Quality Assurance

### Provide instrumentation of rugged construction designed for the site conditions. Provide only new materials throughout, and so marked or labeled, together with manufacturer’s brand or trademark.

### Use one manufacturer for each instrument type. Use the same manufacturer for different instrument types whenever possible. Instruments to be purchased through the local authorized distributor/representative located in Ontario.

### Instruments to be commissioned by the manufacturer or the manufacturer’s local authorized distributor/representative located in Ontario. Authorized distributor representative must be factory trained by the manufacturer. Supporting documentation to be provided if requested.

### Coordinate instrumentation to ensure proper interface and system integration. Provide signal processing equipment, to include, but not be limited to, process sensing and measurement, transducers, signal converters, conditioners, transmitters, receivers, surge suppressors, and power supplies.

## Delivery, Storage, and Handling

### Provide and securely attach the tag number as per the control panel Shop Drawings approved by the Consultant and instructions for proper field handling and installation to each instrument prior to packaging.

### Package instrumentation to provide protection against shipping damage, dust, moisture and atmospheric contaminants.

### Include a shipping label which contains the following information:

#### Tag number and description as per the control panel Shop Drawings approved by the Consultant.

#### Instructions for unloading, transporting, storing and handling at the site.

### Unload, transport, store and handle instrumentation at the site. Inspect instrumentation for damage in shipment and return damaged instrumentation to the manufacturer.

### Do not store instrumentation out-of-doors. Provide dry, clean, and warm storage facilities.

## Warranty

### Refer to the General Conditions of the Contract for warranty requirements. Where additional warranty information is provided in Division 13, the more stringent terms are to be provided.

### The Consultant will arrange and conduct, with the Region and the Contractor, a warranty inspection at the site prior to the expiration of the warranty period. Any deficiencies or outstanding work identified during this inspection shall be remedied by the contractor forthwith at no cost to the Region.

### Contractor shall provide Warranty period as per Article A-6 of the Articles of Agreement.

## Measurement and Payment

### The work of this Section will not be measured separately for payment. All costs associated with the work of this Section shall be included in the Contract Price.

# PRODUCTS

## Manufacturers

### Approved manufacturers are indicated within each instrument specification and are located in the sections per the following table.

|  |  |  |
| --- | --- | --- |
| **Section#** | **Instrument** | |
| 13110 | Level (Analog) | Ultrasonic |
| 13260 | Level (Analog) | Bubbler |
| 13170 | Level (Analog) | Sludge Blanket Level |
| 13130 | Level (Switch) | Float |
| 13250 | Level (Analog)/(Switch) | Capacitance |
| 13285 | Level (Analog) | Depth and Level Pressure Transmitter |
| 13120 | Flow (Analog) | Magnetic |
| 13240 | Flow (Analog) | Ultrasonic |
| 13230 | Flow (Analog) | Thermal Mass |
| 13160 | Temperature (Analog) | Process Temperature |
| 13200 | Pressure (Analog) | Gauge pressure |
| 13140 | Pressure (Analog) | Differential Pressure |
| 13150 | Pressure (Switch) | Pressure |
| 13195 | Analyzer (Analog) | Chlorine Residual |
| 13180 | Analyzer (Analog) | Turbidity |
| 13210 | Analyzer (Analog) | Fluoride |
| 13220 | Analyzer (Analog) | Dissolved Oxygen |
| 13185 | Analyzer (Analog) | pH/ORP |
| 13190 | Analyzer (Analog) | Gas Detectors |
| 13215 | Analyzer (Analog) | Chlorine Gas Detector |
| 13280 | Weight (Analog) | Weigh Scale |
| 13290 | Level (analog)/(Switch) | Conductive |
| 13295 | Analyzer (Analog) | Suspended Solids Analyzer |

### Provide the following availability and local support for approved manufacturer:

#### Replacement electronics, sensors and transmitters must be stocked locally, within two hours delivery.

#### Other hardware must be available in no longer than 5 days.

#### On-site technical support within 24 hours must be available.

# EXECUTION

## Installation

### Install instruments as shown on the typical installation detail drawings in Division 13. Contractor shall use installation detail as applicable to the project requirements.

### The instrument installation details furnished with the specification are not to scale and are to be used as a guideline for installation.

### Where the instrument installation details furnished with the specification conflict with the manufacturer’s installation detail mount the instrument in accordance with manufacturer’s specifications and instructions.

### Instruments on liquid service shall be specified to be mounted below sensing lines, with process tapping points taken from the side of the process line.

### Install instruments where indicated on the Contract Drawings.

### Install the instrumentation and auxiliary devices such that they are accessible for operation and maintenance.

#### Generally, install instrumentation to be accessible from floor level or grade.

#### Locate indicators such that indicator display is readily readable at eye level (1500mm –1600mm) from floor elevation.

#### Locate transmitter with adequate clearance and accessibility for service. For pipe/rack mounted instruments they are to be mounted at least 1000 mm distance/ clearance to the wall.

#### Allow sufficient clearance for cover removal and adjustment of switches.

#### Provide adequate clearance (50mm minimum) from piping and other obstructions for operation of valve handles.

#### Provide safe access to the sensor.

### Coordinate with Division 15 and 16 disciplines to provide power, conduits, process pipe-fittings, clearances and devices required for installation.

### Route signals in flexible, armored conduit for up to a meter (as appropriate to allow removal of the sensor) and thereafter in rigid steel conduit unless otherwise indicated on the drawings.

### Support sensor heads and electronic enclosures with a separate support bracket where the:

#### Process pipe or tank is not adequate to support the additional weight.

#### Process pipe or tank vibrates excessively (beyond manufacturer’s recommendation).

#### Instrument head extends more than 200mm from the pipe or tank wall.

### Where vibration of the process piping is excessive (beyond manufacturer’s recommendation), connect instruments using flexible tubing.

### Wall mounted supports are preferred over free-standing stands.

### For all gas detectors, the gas sensors are not to be supplied, installed and calibrated, until substantial completion.

### Use the PCS Instrumentation Checklist (01810A-21 PCS Instrumentation Checklist) attached in 01810A Equipment Testing and Commissioning Forms to document test results. Electronic copies will be provided.

## Calibration

### After the instrument is fully installed, (including mounting, process connections, signal connections and power connections) and after the process is put into test mode or actual operation, perform preventative maintenance tasks and calibrate the instrument. Calibration of each instrument must be repeated again four (4) weeks after Substantial Performance of the Contract.

### Completed test procedures for Equipment Testing and Calibration shall be submitted for approval to Consultant prior to commencement of testing and calibration.

### Calibrate measurements over the range of the instrument including zero, full range and five (5) intermediate points at 0%, 25%, 50%, 75% and 100% in both increasing value and decreasing value during calibration. Repeat three (3) times.

### Demonstrate alarms by varying process conditions. Repeat three (3) times.

### Prepare instrumentation installation and calibration certification sheet for each primary element sensor and electronic indicator/analyzer/transmitter for each instrument uniquely specified.

### For each certification sheet include the following information:

#### Project name.

#### Tag number and description.

#### Manufacturer.

#### Model and serial number.

#### Date, time and person who performed calibration.

#### Calibration data to include:

##### Input, output, and error at 0, 25, 50, 75, and 100 percent of span for analog instruments.

##### Switch setting, contact action, and deadband, if applicable, for discrete elements.

#### Space for comments.

#### Certification by installer and acknowledgment by contractor and date.

### In the Instrument Data Sheet(s), document the results of the calibration and note any settings or adjustments made.

### Electronic copies to be provided to Region.

### All parameter settings for each instrument to be provided.

### A Calibration Certificate must be provided from a certified manufacturer’s representative who actually performed the calibration and a sticker indicating the date of calibration must be placed on the instrument.

### A Calibration Certificate must be provided indicating the calibration of the calibrating equipment used in the calibration process.

### Calibration must be repeated four (4) weeks after Substantial Performance of the Contract.

### Calibration certificates for tools and standards are to be provided.

### Use the PCS Instrumentation Checklist (01810A-21 PCS Instrumentation Checklist) attached in 01810A Equipment Testing and Commissioning Forms to document test results. Electronic copies will be provided.

## Testing Scope

### The instrument and equipment testing confirms in detail that the field instruments and other equipment are supplied and installed in accordance with the Contract Documents. Testing includes:

#### Confirmation that the units have been correctly installed.

#### Confirmation that the units have been correctly calibrated.

#### Confirmation that all discrete and analog signals (both new and existing) to be transmitted to and from the units are available and functioning correctly.

#### Verification that the units are capable of working as specified.

#### Verification that all panel FAT deficiencies have been completed.

#### Complete facility PAC panel(s) I/O check to verify field wiring from field device to PAC I/O.

#### Complete vendor PAC/PLC panel(s) I/O check to verify field wiring from field device to PAC/PLC I/O.

#### Verification that all hardwired interlocks are functioning as intended and are present in the correct mode of operation.

#### Acceptance of work done by the Contractor.

### The Start Up Team consisting of individuals from the Consultant, Contractor, System Integrator, Region PCS Group and Region Operations Group will jointly develop the testing plan, SAT & Start Up Plan.

### The instrument and equipment testing must be conducted / witnessed by the Start Up Team and instrument suppliers as required.

### The Start Up Team shall review the testing plan, SAT & Start Up Plan and revise, if necessary, at a pre-SAT & Start Up meeting to be scheduled no later than six (6) weeks in advance of the proposed SAT period. The Contractor will be responsible for expanding and providing details for the SAT & Start Up Plan to clearly identify the proposed test procedure for the equipment and software.

### Members of the Start Up Team are to be identified at the pre-SAT & Start Up meeting. These team members will be involved throughout the process and are to be changed only with the approval of the Consultant and Region.

### Where it is identified that the requirements of the Contract have not been met, the Contractor shall rectify all deficiencies immediately to allow re-testing during the same test phase.

### Testing will be deemed complete when all features, functions and information required in the Contract Documents have been verified as present and functioning, and documented as accurate within the anticipated operating range for the process being monitored.

### Region PCS Scope:

#### Region PCS will ensure network switches are programmed/configured. The Contractor will be required to supply and/or install switches as specified in the contract documents.

## Testing Schedule

### Submit testing procedures and schedules of work no less than one (1) month prior to the projected test date for the individual component. This will include specific dates for when the various test procedures are to be carried out and identified assistance from Region’s staff.

### Review of the PAC panel on site to ensure that all panel FAT deficiencies have been corrected must be completed prior to any filed wiring being completed. This review must be coordinated with the Consultant and the sign off sheet completed.

### The Contractor shall conduct their own I/O check and instrument and equipment verification. Contractor completed and signed off I/O Checksheets and instrument and equipment verification sheets must be completed and submitted to the Consultant for review.

### Contractor I/O check must not be completed until no less that 90% of all I/O is wired to each PAC.

### The Consultant may, at their discretion, choose to witness a subsequent I/O check and instrument and equipment verification with the Contractor. Contractor and all required Sub-contractors will participate as required.

### Contractor/Consultant completed and signed off I/O Checksheets and Equipment/Instrument verification sheets must be submitted to the Region for review minimum two (2) weeks prior to scheduling the Region to witness their I/O check and instrument and equipment verification.

### Following the Contractor’s own I/O check and instrument and equipment verification and the Consultant review, the Region must witness an I/O check and instrument and equipment verification with the Contractor and Consultant. Contractor and all required Sub-contractors will participate as required.

### In some cases, testing may be scheduled outside normal business hours to accommodate operating issues and/or low flow conditions.

### Testing may be interrupted by the Region’s staff for emergency process operation.

### Submit test results to the Contract Administrator at the end of each day of testing. Final test reports are to be accepted and signed off by the Consultant, the Contractor’s System Integrator and Region PCS Group.

## Testing Execution

### Provide qualified electrician and/or instrument technician with a minimum 5 years experience to assist in testing and quickly repairing minor deficiencies for re-testing in the same test phase.

### Have the following documents on hand prior to conducting Instrument Acceptance Testing:

#### Reviewed shop drawings, including data sheets, for each instrument installed (multiple copies for multiple installations);

#### “For Construction” P&IDs, process narratives, control schematics and electrical drawings;

#### Configuration and calibration certificates from the manufacturer(s) for each calibrated instrument, where specified in the Contract Documents;

#### PAC panel FAT report identifying deficiencies identified during the panel FAT process;

#### Results of factory performance tests, where specified in the Contract Documents;

#### Instrument field calibration reports, where specified in the Contract Documents;

### Inspect and document that each instrument matches the reviewed Shop Drawing. The inspection shall include, but not be limited to the following (as applicable):

#### Verifying that instrument product details match Shop Drawings and Contract Documents, (including Instrument Data Sheets);

#### Confirming soundness of instrument, i.e. without damaged parts;

#### Confirming completeness in all respects as specified for instrumentation;

#### Confirming correctness of setting, alignment, and relative arrangement;

#### Confirm that all PAC panel FAT deficiencies have been corrected;

#### Inspecting power, signal, and grounding wiring identified on the control schematics and documenting the results. All wiring shall be verified for continuity.

## I/O Loop Check

### I/O loop check must be performed for the complete loop where possible by exercising the field device and monitoring the input at the PAC. Some I/O loops may be confirmed during the instrument and equipment calibration and testing when approved by the Consultant.

### Where an instrument loop cannot be checked with the instrument functioning, a current generator shall be used to verify the continuity of the analog loop.

### Where a digital loop cannot be checked with the field device, jumpering is permitted to verify the continuity of the digital loop.

### PAC output loops shall be verified by forcing the corresponding output from PAC program.

### I/O loop check is accepted and signed off when all I/O points pass lop checks.

### Use 01810A Equipment Testing and Commissioning Forms, 01810A-23 Pre-SAT Analog I/O Loop Check or 01810A-24 Pre-SAT Digital I/O Loop Check to document test results. Electronic copies will be provided.

## Instrument Acceptance

### Devices must be tested for their repeatability, accuracy and operation by varying the process and simultaneously measuring and recording the information displayed by:

#### An independent measuring instrument;

#### The local transmitter indicator;

#### All remote digital/mechanical indicators;

#### The 4-20mA (or digital value) measured at terminal blocks in PAC panels and operator panels.

### Compare test results against the instrument calibration reports and planned PAC analog input range. As an example, flow sensors will require testing using a “draw and fill” test of a local container.

### Where no field calibration has been done, perform a calibration test. Go up, down and then back up the instrument range, testing at five (5) points each time: 0%, 25%, 50%, 75% and 100%.

### The instrument switches, such as pressure switches or building flood alarms, are to be tested for their accuracy and operation by varying the process conditions (for example: high then low pressure) and simultaneously measuring and recording the information displayed by:

#### An independent measuring instrument;

#### The instrument switch;

#### All remote lights and indicators;

#### The digital input status measured at both the PAC and operator panels’ terminal blocks.

### Test results are to be compared against the instrument calibration/setting reports and planned PAC discrete input setting.

### Verify that all instrument/equipment interlocks function as intended.

### ISO calibration labels to be applied to instrument following successful calibration and testing.

### Use 01810A Equipment Testing and Commissioning Forms , 01810A-21 PCS Instrumentation Checklist to document test results. Electronic copies will be provided.

## Testing Tools and Equipment

### Protect instruments and equipment that may be damaged by testing. If damages occur, the respective parties shall be fully responsible for replacement of damaged parts and/or components.

### Use calibration tools that will not cause greater than +/- 0.5% error in any test. The accuracy of the calibration tools must be traceable to National Standards. The Region’s preference is the use of electronic calibration equipment that will provide a form of electronic documentation, transferable in a standard spreadsheet format.

### Calibration certificates for tools and standards must be provided.

### Follow the applicable Region’s safety requirements. Provide the proper safety equipment for entering (manholes and other) confined spaces, and hazardous gas locations.

## Training

### Provide comprehensive training session by the manufacturer or the manufacturer’s local authorized distributor/representative for each instrument type to operating and PCS group.

### Provide separate single training sessions for operations and PCS group.

### Contractor to complete and submit the Region’s Training Form (01810A-09 Equipment Supplier's Training Certification Form) for the instrumentation supplied and installed under this contract.

### Refer to Division 1 for training requirements. A minimum of two (2) hours field training for each instrument type shall be provided.

END OF SECTION