

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 - Common Work Results for Electrical.

**1.2 REFERENCES**

- .1 Definitions:
  - .1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit WHMIS MSDS in accordance with Construction and Hazardous Materials Section.
- .3 Shop drawings:
  - .1 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.
  - .2 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
- .4 Certificates:
  - .1 Provide CSA certified equipment and material.
  - .2 Where CSA certified equipment or material is not available, submit such equipment and material to authority having jurisdiction for approval by a certified agency of Standard Council of Canada (SCC) before delivery to site.
  - .3 Submit test results of installed electrical systems and instrumentation.
  - .4 Permits and fees: in accordance with General Conditions of contract.
  - .5 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.
- .5 Manufacturer's Field Reports: submit to Departmental Representative manufacturer's written report, within 3 days of review, verifying compliance of Work of electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

**1.4 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

- .2 In addition to technical data the Electrical Contractor shall also include:
  - .1 Names, addresses and phone numbers of local supplier for items included in the maintenance manual
  - .2 Copy of reviewed shop drawings.
  - .3 Names, addresses and phone numbers of Electrical Sub-contractors.
  - .4 Inspection certificates and verification reports.
  - .5 Letter or certificate of warranty.

### **1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Material Delivery Schedule: Provide Departmental Representative with schedule within 2 weeks after award of contract for all long delivery items.
- .3 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .4 Storage and Handling Requirements:
  - .1 Store materials indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect materials from damage to finish or material.
  - .3 Replace defective or damaged materials with new.

### **1.6 ADDENDA AND REVISIONS**

- .1 All addenda, instructions and revisions issued during the tendering period shall become part of the Contract Documents and shall be included in the Tender, and shall take precedence over the previous instructions.
- .2 The Owner and Departmental Representative reserve the right to make revisions to the drawings during the period of construction and these shall take precedence over previously issued drawings. All revisions to the work shall be executed by duly authorized change orders with the amount of addition or deduction to the contract amount approved by the Departmental Representative before the execution of any work associated with the revision is undertaken.

### **1.7 SUBSTITUTIONS**

- .1 It is the intent of these drawings to establish the required quality of materials. Where manufacturer names or catalogue references are used, it is done in order to establish the required quality, style, size or function. Products of other manufacturers will not be permitted after the signing of the contract. The decision as to suitability shall rest with the Departmental Representative.
- .2 Should the contractor propose to furnish material and equipment other than those specified, they shall submit a written request for any or all substitutions prior to the tender closing date. Such a request shall be accompanied by a complete description including manufacturer, brand name,

catalogue number and technical data for all items. If requested by the Departmental Representative, the contractor shall submit for inspection a sample of the proposed item.

- .3 All material not meeting the specifications above shall not be allowed on the project site.
- .4 Substitutions affecting the design will not be permitted. Additional costs to any other trade as a result of a change or substitution by this contractor shall be the responsibility of this contractor.
- .5 The listing of a manufacturer as acceptable does not imply acceptance of all products of that manufacturer and only products meeting the specifications will be accepted.

## **1.8 SCOPE OF WORK**

- .1 The Electrical Contractor shall furnish all labour, material, tools, appliances and equipment to entirely complete and provide the operation of the process systems.
- .2 The overall intention is to provide a functioning complete electrical installation in all aspects, and all items reasonably inferable as called for by the drawings and specifications, and by normally accepted good practice, notwithstanding that every item necessarily required may not be particularly mentioned. This Contractor shall fulfill his obligation and not take advantage of any unintentional errors or omissions, should any exist, to the detriment of the Owner's interest. The work shall include but not be limited to:
  - .1 Supply and installation of Control conduit and wire.
  - .2 Control panel complete
  - .3 Instrumentation terminations
  - .4 PLC programming
  - .5 HMI Programming
  - .6 Gateways and configuration
  - .7 Ethernet network and switches
  - .8 Ethernet patch cables
  - .9 Supply an installation of gas detectors
  - .10 Supply and Installation of Room Temperature Sensors
  - .11 Coordination with other trades. See also Mechanical specifications and drawings (process controls).

## **1.9 ELECTRICAL DRAWINGS**

- .1 The electrical drawings which constitute an integral part of this contract shall serve as working drawings. They indicate the general layout of the complete electrical system arrangements of feeders, circuits, outlets, switches, controls, panelboards, service equipment, communications, fire alarm systems, underground duct banks, power center, etc..
- .2 Field verification of scale dimensions on drawings is directed since actual locations, distances, and levels will be governed by the field conditions.
- .3 All discrepancies related to the electrical work shall be promptly brought to the attention of the Departmental Representative for clarification.

### **1.10 EXISTING CONDITION AND EXAMINATION OF DRAWINGS**

- .1 The Electrical Contractor shall become completely familiar with the drawings and specifications, as well as construction methods of other trades related to the work to avoid possible interferences on the project. Should drastic changes be necessary to resolve such conflicts, this Contractor shall notify the Departmental Representative and secure written approval and agreement on the necessary adjustments before the installation is started.
- .2 Before submitting the tender, this Contractor shall visit the site and become familiar with site conditions, availability of storage space and all other factors that might influence the tender submittal.
- .3 The contractor shall determine all working conditions and rigidly comply. Conditions that require special consideration include but not limited to: Dust, Noise, Vibration, Water, Working hours, Continuity of power, Access to area of work, Physical protection of Owner's facility and equipment.
- .4 No extras will be allowed due to failure to account for site conditions or working conditions.
- .5 The exact rough in dimensions and connection points shall be determined from shop drawings and on site measurements.

### **1.11 DISCREPANCIES**

- .1 Bidders in preparing their tender, finding any errors, omission, or discrepancies in the drawings, specifications or other documents, or having any doubt in the intent or meaning of any part thereof, shall immediately notify the Departmental Representative, who will send written instructions or clarification to all bidders. Where such discrepancies exist and it is evident that this Contractor could not have properly tendered without clarifications and where such clarification was not requested, not extra to the contract will be considered in order to have the installation properly made. The Owner and Departmental Representative will not be responsible for oral instruction.

## **Part 2 Products**

### **2.1 DESIGN REQUIREMENTS**

- .1 Operating voltages: to CAN3-C235.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
  - .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .3 Language operating requirements: provide identification nameplates and labels for control items in English and French.
- .4 Use one nameplate or label for both languages.

### **2.2 MATERIALS AND EQUIPMENT**

- .1 Provide material equipment in accordance with Section 01 61 00 - Common Product Requirements.

- .2 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, for approval by a certified agency of Standard Council of Canada (SCC) before delivery to site and submit such approval as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .3 Factory assemble control panels and component assemblies.

### 2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.
- .2 Control wiring conduit: in accordance with Section 26 05 34 – Conduit, Conduit Fastenings and Conduit Fittings. All wiring and connections below 50 V which are related to control systems specified in mechanical sections or as shown on mechanical drawings shall not be the responsibility of this contractor unless otherwise noted.

### 2.4 WARNING SIGNS

- .1 Warning Signs: in accordance with requirements from inspection authorities and Departmental Representative.
- .2 Decal signs, minimum size 175 x 250 mm.

### 2.5 WIRING TERMINATIONS

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

### 2.6 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates as follows:
  - .1 Nameplates: plastic laminate lamacoid 3 mm matt white finish face, black core, lettering accurately aligned and engraved into core mechanically attached with self-tapping screws. Sizes as follows:

NAMEPLATE SIZES			
Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

- .2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.
- .3 Wording on nameplates to be approved by Departmental Representative prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per nameplate.

- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .6 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .7 Terminal cabinets and pull boxes: indicate system and voltage.
- .8 Transformers: indicate capacity, primary and secondary voltages.

## **2.7 WIRING IDENTIFICATION**

- .1 Identify wiring with permanent indelible identifying markings, numbered on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour coding: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

## **2.8 CONDUIT AND CABLE IDENTIFICATION**

- .1 Colour code conduits, boxes and metallic sheathed cables.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.
- .3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour. Confirm colour coding scheme with owner.

## **2.9 FINISHES**

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
  - .1 Paint outdoor electrical equipment "equipment green" finish.
  - .2 Paint indoor switchgear and distribution enclosures light gray to EEMAC-2Y-1.

## **2.10 PROCESS INTEGRATION**

- .1 The Contractor will be responsible to supply and install of a SCADA system complete with desktop PC and UPS. The following screens for the operation of the new facilities and equipment will be required. Refer to control drawings for full list of equipment:
  - .1 System Overview
  - .2 Influent Screen and Grit Collection Area
  - .3 Effluent and UV Transmittance Area
  - .4 Aeration Blowers
  - .5 Flow Totalizers
  - .6 System Settings (alarm set points and operational settings)
- .2 The Contractor shall incorporate sketches representing the new equipment. Sketches shall be based on actual site configuration, size of equipment. The positioning of the various elements in the

- SCADA interface shall reflect the actual site condition and be in relationship with the actual conditions.
- .3 The SCADA system shall be developed to trend the level or flow measurements for the system, including but not limited to the following:
    - .1 Influent, Effluent and UV Flow meters – flow and totalized
    - .2 Room Temperatures
    - .3 UV Transmittance Level
    - .4 Gas Levels
  - .4 The Contractor shall at least incorporate into its SCADA System the list of data to be monitored, as indicated herein and as shown on the drawings.
  - .5 Electrical pressure gauge, hours of pump/equipment operation, running amps of pumps/fans/blowers, water quality measurements, and UPS.
  - .6 The new equipment sketches shall be dynamic. The following color-coding shall be used:
    - .1 Green: Equipment is in operation
    - .2 Yellow: Equipment is not in operation or on standby (not in fault)
    - .3 Red: Equipment is in fault.
  - .7 Sketches of system shall be dynamic. Flows, UV Transmittance, room temperatures and Gas Levels shall be displayed on the screens and recorded historically.
  - .8 Any changeable data / set point (for alarm purposes) shall be password protected (operator identification and password required to modify data) and be monitored in the existing event log.
  - .9 Require programming to record alarms in the existing alarm log and to record events in the existing event log shall be done by the Contractor. In addition, the Contractor will be responsible to program the SCADA System for alarm calling via text message.
  - .10 The corresponding equipment information shall be included on the page (Voltage, HP, Serial Number, installation date, etc.). This information shall be changeable by the Owner's Staff and password protected.
  - .11 In addition of the sketches, the recorded data shall be displayed on the page. Trend of the recorded data (or trend page) shall be obtained by clicking on the equipment display or selected from the page manager.
  - .12 The Contractor will be responsible to provide proper training of the Owner's staff on all SCADA Systems functions related to the all equipment.
  - .13 Pre-program tags for reports and provide required training to be able to meet operator's reporting requirements.

## **2.11 CONTROL PANEL**

- .1 Provide a control panel as indicated on the drawings to control and monitor the system. The programming of the PLC shall be by the contractor. Minor programming changes during commissioning shall be done a no additional cost to the owner.

- .2 The control panel shall contain the following components:
  - .1 Industrial panel mount UPS.
  - .2 Industrial panel mount 24 volt DC switched mode power supply as required.
  - .3 Programmable Logic Controller (PLC) to provide control of the processing.
  - .4 Control relays, plastic wiring duct and other accessories as required.
  - .5 Terminal blocks for the termination of all external wiring.
  - .6 Unmanaged industrial Ethernet switches as required.
  - .7 Gateways as required
- .3 The control panel enclosure shall be a NEMA type 12/4X painted stainless steel enclosure with inner panel with hinged door and ¼ turn latches. Enclosure shall be sized as indicated on drawings and to fit all components as specified. Ensure all minimum clearances are maintained for heat dissipation of power supply, PLC, UPS and other components.
- .4 The following alarms including but not limited shall be monitored:
  - .1 UPS on Battery
  - .2 Low UV Intensity
  - .3 Low room Temperature high/low
  - .4 Gas Levels High
  - .5 EF-5 VFD faulted
  - .6 And other alarm identified in the system.
- .5 The Programmable Logic Controller (PLC) hardware for the station control panel shall meet the specified I/O requirements.
  - .1 Controller with required 24V DC digital inputs, required quantity of relay digital outputs, two ethernet ports, one USB Port, embedded isolated power supply, real time clock, battery back-up, 750KB user memory. PLC must support relay ladder, structured text, function block and SFC programming language
  - .2 Quantity of analog I/O input modules for current 4-20 mA inputs.
  - .3 Quantity of analog I/O output module for current 4-20 mA outputs.
  - .4 Quantity of discrete I/O module for 12 - 24Vdc inputs.
  - .5 Programming software to be compatible with PLC system software.
- .6 Provide an industrial, DIN rail mount 24 volt DC switched mode power supply with rated output power of 120 watts to supply the 24 volt DC required.
- .7 Provide a hardwired surge filter rated at 5 amps for the 120V supply.
- .8 Provide an industrial, panel-mount, line interactive Uninterruptible Power Supply (UPS) with rated output power of 1000VA and with hardwired input and output terminals. UPS shall have a battery run time of 9 minutes at full load. Connect the alarm output relays to the indicate when the UPS is on battery and low battery.
- .9 Pilot devices shall be NEMA rated 30mm, panel mount, LED illumination type with type 4/4X/13 degree of protection.

- .10 Provide PLC programming software the software is to be licensed to owner and installed on SCADA computer.
- .11 Control Panel shall be certified to meet CAN/CSA C22.2 No. 14-10.
- .12 The Control Panel manufacturer's representative shall test and commission the Control Panel at the site and shall do all programming which is required and make all necessary adjustments.
- .13 The Control Panel manufacturer's representative shall provide training and user manuals at the site for the Owner's personnel on the operation and maintenance of the equipment.

## **2.12 SCADA DESKTOP PC**

- .1 Provide a desktop PC with the following Minimum requirements
  - .1 64-bit Windows OS
  - .2 3 GHZ or more quad-core processor
  - .3 Solid state drive
  - .4 1TB free space
  - .5 16GB RAM
  - .6 2 – 1GB Ethernet Ports
  - .7 Wireless keyboard and Mouse
  - .8 Microsoft Excel Latest Edition
  - .9 27" LED-backlit LCD Monitor

## **2.13 UNINTERRUPTIBLE POWER SUPPLY (UPS)**

- .1 Provide 3 UPS's for the following locations:
  - .1 Located in the Lab for the SCADA computer
  - .2 Located in the Electrical room for the network and fiber optic equipment
  - .3 Located in the Station Control Panel
- .2 UPS shall meet the following minimum requirements
  - .1 120VAC, 60Hz
  - .2 1000VA capacity
  - .3 Replaceable batteries
  - .4 Tower configuration
  - .5 LED front panel display
  - .6 LED status indication
  - .7 Programmable relay output contact.3

## **2.14 CH<sub>4</sub> / H<sub>2</sub>S GAS DETECTION**

- .1 3-wire, 4-20 mA, gas detector transmitter for use with directly installed flammable and toxic gas sensors. For the protection of personnel and plant from flammable and toxic gas hazards.

- .2 Certifications: UL - Class I, Division 1, Groups B, C and D, Class I, Division 2, Groups B, C & D, Class II, Division, Groups E, F & G, Class II, Division 2, Groups F & G. -40°C to +65°C
- .3 Epoxy painted aluminum or 316 stainless steel.
- .4 Operating temperature/humidity: -40°C to 75°C, 20-90%RH (non-condensing).
- .5 Wall mounted.
- .6 IP66 in accordance with EN60529:1992
- .7 Accuracy:
  - .1 CH<sub>4</sub>: less than ±1.5% LEL, from 20 to 100% LEL
  - .2 H<sub>2</sub>S: less than ± 1ppm, from 10.0 to 100.0ppm.
- .8 Provide 2 calibration gases kits for each type of gas.

#### **2.15 ROOM TEMPERATURE SENSORS T-1 to 5**

- .1 Room temperature sensor.
  - .1 Wall mounted
  - .2 3-wire, 4-20 mA
  - .3 Temperature displayed only
  - .4 Temperature Range 0 Deg C to 50 Deg C
  - .5 Intrinsically safe where "EX" indicated on drawings

#### **2.16 OCCUPANCY SENSOR SWITCH LOCATION**

- .1 Ceiling mounted
- .2 12-24 VDC
- .3 NO/NC contacts
- .4 Intrinsically safe where "EX" indicated on drawings

#### **2.17 DOOR CONTACT**

- .1 Mounted to accommodate door
- .2 12-24 VDC
- .3 NO contact
- .4 Intrinsically safe where "EX" indicated on drawings

### **Part 3 Execution**

#### **3.1 INSTALLATION AND PROGRAMMING**

- .1 Loss of AC power is connected to the PLC and when the power fails an alarm is sent immediately to the operation staff.

- .2 UPS on battery and UPS low battery when activated for 2 seconds an alarm is sent to the operation staff.
- .3 Smoke/Heat Detectors are connected to the PLC and when activated for 2 seconds an alarm is sent to the operation staff.
- .4 Intrusion – a screen shall be set-up on the SCADA system to enable/disable the intrusion system. When the intrusion system is activated a timer starts (operator adjustable) to allow someone to enter the facility and go to the computer and disable. If the system is not deactivated in the pre-set time an alarm will be sent to the operation staff and the alarm horn will be pulsed on and off until the alarm is acknowledged or deactivated. When the alarm is re-activated the horn will chirp and start a timer allowing the person to leave the facility. If the person does not exit the facility in time the alarm will be triggered on and the alarm will be sent, and the horn will be activated.
- .5 Heating – Blower building, UV Building and Headworks Building is equipped with an analog temperature sensor. The operator will have the ability to set the on temperature and the temperature dead band to maintain operation of the room temperature. If the Exhaust fan is operating in a specific room the heat will be disabled. For the Headworks building when the fan is operating on Low speed the heaters will be able to operate. When the Headworks Fan goes to High speed the heaters will be disabled.
- .6 Headworks Building Ventilation – the ventilation fan operates in two modes. Mode 1 is continuous low speed operation. Mode 2 the fan will be increased to high speed one of the three conditions are met:
  - .1 occupancy sensor activated
  - .2 manual timer is activated
  - .3 gas detector has been triggered high

When the fan is called for the exhaust air damper is opened, once the damper is proven fully opened the fan is started. The fan speed is controlled through the ethernet connection to the VFD. The operator will have the ability to adjust the minimum speed in Hz and maximum Speed in Hz on the SCADA screen. If the fan is being told to start and the PLC does not receive a running signal after 3 minutes an alarm will be sent to the operation staff.
- .7 UV Building Ventilation – the fan will be operated at a fixed speed (adjustable on the SCADA screen) if any of the following conditions are met:
  - .1 occupancy sensor activated
  - .2 manual timer is activated
  - .3 gas detector has been triggered high
  - .4 room temperature is above setpoint and the heat is not operating. The room temperature setpoint with a dead band is adjustable on the SCADA screen

When the fan is called for the exhaust air damper is opened, once the damper is proven fully opened the fan is started. The fan speed is controlled through the ethernet connection to the VFD. If the fan is being told to start and the PLC does not receive a running signal after 3 minutes an alarm will be sent to the operation staff.

- .8 Aeration UV Building Ventilation – the fan will be operated at a fixed speed. If the room temperature is above setpoint and the heat is not operating. The room temperature setpoint with a dead band is adjustable on the SCADA screen
- When the fan is called for the exhaust air damper is opened, once the damper is proven fully opened the fan is started. If the fan is being told to start and the PLC does not receive a running signal after 3 minutes an alarm will be sent to the operation staff.
- .9 Gas detectors are located on the headworks and UV Building. Each room will have a live value sent to the PLC. There will be an operator adjustable setpoint for each type of gas. When the gas high gas level is reached for 30 seconds the alarm will activate and activate the associated fan.
- .10 Flow Meters scaling shall be 0-xxL/s. Contractor to confirm exact values on site prior to commissioning system.
- .11 The Screener system is equipped with a stand-alone Controller. The statuses indicated on the drawings shall be displayed on the SCADA screens. In the event of a power failure or system failure the PLC will automatically send an “Alarm Reset” to the Screener. The system shall automatically make one attempt after power has been restored to the facility. If the alarm does not reset an alarm will be sent to the operation staff.
- .12 Alarm Horn shall be activated by the alarms. There shall be a screen on the SCADA system that will allow the operator to enable/disable the horn for individual alarms. A list of alarms shall be determined during commissioning.
- .13 All instruments connected to the PLC shall be displayed on the SCADA system including trending, graphs and alarm history.
- .14 All motors are to have the following information available to the SCADA system:
- .1 Running status
  - .2 Amps (if connected to VFD)
  - .3 % Speed (if connected to VFD)
  - .4 Voltage (if connected to VFD)
  - .5 Hours of operation c/w reset button
  - .6 Motor Faults
- .15 All data points shall be illustrated on SCADA computer
- .16 All alarms to be coordinated with operators to ensure priority levels are set and alarms call forwarded for high priority alarms are in place.
- .17 All Data points are to be organized in a contiguous block, so they can be sent to the Ethernet to BACnet gateway for information to be provided to the Facility BMS system.

### **3.2 NAMEPLATES AND LABELS**

- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

### **3.3 CONDUIT AND CABLE INSTALLATION**

- .1 Install conduit and sleeves prior to pouring of concrete.
  - .1 Sleeves through concrete: schedule 40 steel pipe sized for free passage of conduit, and protruding 50 mm.
- .2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .3 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

### **3.4 CO-ORDINATION OF PROTECTIVE DEVICES**

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

### **3.5 CO-ORDINATION WITH OTHERS**

- .1 Electrical contractor shall co-ordinate the installation of equipment to minimize inconvenience to Owner and other sub-contractors.
- .2 Work by other contractors will be done concurrently with work in this contract. This contractor shall schedule and arrange the work and store materials in co-operation so as to avoid interference with others.

### **3.6 FIELD QUALITY CONTROL**

- .1 Qualifications: Electrical work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices in accordance with authorities having jurisdiction and as per the conditions of Provincial Act respecting manpower vocational training and qualification.
  - .1 Employees registered in provincial apprentices' program: permitted, under direct supervision of qualified licensed electrician to perform specific task.
  - .2 Permitted activities: determined based on the training level attained and demonstration of ability to perform specific duties
- .2 Health and Safety Requirements: Complete construction in accordance with occupational health and safety regulations.
- .3 Conduct following tests in accordance with Section 01 45 00 - Quality Control.
  - .1 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
  - .2 Systems: fire alarm communications.
  - .3 SCADA communications:
    - .1 Ensure all alarms and screens are active and refreshed at SCADA server.
    - .2 Test alarm notifications with texting/e-mail system to ensure operators receive alarms.

- .3 Test sequences of operation for controlled and non-controlled plants. Test sequence in fail safe mode during a SCADA failure and/or normal power failure.
- .4 Carry out tests in presence of Departmental Representative.
- .5 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .6 Manufacturer's Field Services:
  - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
  - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

### **3.7 SYSTEM STARTUP**

- .1 Instruct Departmental Representative and operating personnel in operation, care and maintenance of systems, system equipment and components.
- .2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.
- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation and ensure that operating personnel are conversant with aspects of its care and operation.

### **3.8 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

### **3.9 RECORD DRAWINGS**

- .1 Refer to Division 1 - General Requirements.

Two sets of white prints shall be maintained for the exclusive purpose of recording deviations from that shown on the contract drawings. One set of prints shall be kept up to date at all times. At the completion of the project the information shall be transferred to the second set of drawings. Both sets shall be turned over to the Owner.

### **3.10 GUARANTEE**

- .1 Guarantee material and workmanship to be free from defect for a period of one (1) year or longer where specified otherwise, after issuing of the certificate of substantial completion.

Make good, at the Owner's convenience, all defects covered by this guarantee without additional cost to the Owner.

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PWGSC  
SEWAGE TREATMENT  
UPGRADES  
SPRINGHILL INSTITUTION  
SPRINGHILL, NS  
PROJECT NO. R.061876.001

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COMMON WORK RESULTS FOR  
PROCESS INTEGRATION

SECTION 40 05 00  
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**END OF SECTION**