ENCLOSURES

1. GENERAL

1.1 References - General

.1 Equipment, Products and Execution must meet all requirements detailed in Section 17010.

.2 Panel component, products and execution to meet all requirements detailed in Section 17274

1.2 Shop Drawings

.1 Submit shop drawings for each panel or cabinet assembly. Shop drawings to include: interior layout, exterior layout, and a complete bill of materials for all panel components and sub-assemblies.

1.3 Standards

.1 All electrical materials and equipment shall be CSA approved and manufactured in accordance with Standards established by EEMAC. This approval applies to complete control system assemblies as well as individual components. If CSA certification is not available, it will be the responsibility of the supplier to obtain individual approval and corresponding stickers from the Electrical Inspection Branch prior to shipment to site. **Engineer will not accept Equipment Vendor's supply without CSA certification or Electrical Inspection Branch approval.**

.2 All wiring and conduit systems for instrumentation and controls systems to comply with the Canadian Electrical Code.

2. PRODUCTS

2.1 General

.1 Unless otherwise specified, provide outside finishes on all enclosures in ANSI 61 Grey as specified in Division 9.

.2 The enclosures must be suitable for carrying the weight of the equipment mounted inside the panel and on the doors without any warpage.

2.2 Enclosures

.1 Provide EEMAC type 1A gasketted enclosures in dedicated MCC rooms and control rooms only.

.2 All enclosures for mounting outside of MCC rooms and control rooms to be EEMAC Type 4, watertight except where otherwise specified.

.3 Enclosures for certain equipment in corrosive atmospheres to be EEMAC 4X approved for the classification (e.g., chemical cleaning).

.4 Enclosures for mounting field control indicator lamps and switches in unclassified areas to be Allen Bradley model 800T-xTZ die cast enclosures.

2.3 Floor Mounted Cabinet Enclosures

.1 Fabricate enclosures from 11 gauge steel panels complete with necessary stiffening to form a rigid free-standing lineup. The structures must be suitable for carrying the weight of the equipment mounted inside the panel and on the doors. Provide removable top and bottom cable entry plates.

.2 Provide cabinets with front access only. Doors shall be key lockable and fitted with 3-point heavy duty latching assemblies. Provide a continuous piano hinge and a pneumatic hold open device on each door.

.3 Finish the interior of the enclosure with white paint. Provide a switched fluorescent light fixture and) 120VAC duplex convenience receptacle inside the enclosure.

2.4 Marshaling and Control Panels

.1 Document, layout supply, fabricate, test, and deliver to site fully equipped and functional panel assemblies.

.2 Supply all components contained on or within the panels fully wired under this section of the specification.

.3 The selection of all accessories, materials and methods for fabrication not covered by this specification, but which are necessary to complete the fabrication of the control panels, is the responsibility of the panel fabricator.

.4 Refer to the instrument installation detail drawings for panel dimensions.

.5 Refer to the instrument installation detail drawings for terminal component types and general locations.

2.5 Wiring and Accessories

.1 Provide wiring inside the panels according to the following specifications:

.1 Control wiring to be a minimum of #16 AWG tinned stranded copper; insulation rated at 600 V.

.2 Wiring for power distribution shall be a minimum of #14 AWG tinned stranded copper; insulation rated at 600 V.

.3 Refer to Division 16 for cable routing requirements.

.2 Tag each wire at both ends with a heat shrink sleeve that is machine printed.

ENCLOSURES

.3 Wiring systems with different voltage levels or types shall be suitably segregated within the panel, according to relevant electrical codes.

.4 Run all wiring in enclosed plastic wireways such as Panduit. Size all wireways so that the total cross sectional area of the insulated wire and cable does not exceed 40% of the cross sectional area of the wireway.

.5 Provide a minimum clearance of 40 mm between wireways and any point of wire termination.

.6 Terminate all wiring, incoming and outgoing, at terminal strips mounted inside the panels. Identify each terminal strip with a terminal strip number, defined as follows:

.1 Wire identification to use the connected field device tag name with the wire's corresponding terminal number appended to it.

.2 Identify every joint and/or terminal of the above wire run with the same identifier until the wire meets another tagged device, at which point the wire identifier will change to use the new device name and terminal number.

.3 For example, pressure transmitter K4-PT-100A located in the field has a 2CTPSH cable connected to it. The cable runs through a junction box to a marshaling panel. The wire identifiers for the pair of wires would be K4-PT-100A all the way to the marshaling panel.

.4 Identify spare wires by using the destination identifier, i.e., the location and terminal identifier of the opposite end of the wire are combined to form the wire tag.

.7 Provide a 120 VAC panel power distribution system and a 24vdc power distribution system in each panel. Provide a thermal magnetic circuit breaker on each main power circuit and a fused terminal block for each branched circuit off the main.

.8 Provide disconnect type terminal blocks Wieland WK4TSK/U type to isolate field wiring that is powered sourced from the panel.

.9 Provide sufficient terminals so that not more that 2 wires are connected under the same terminal. Provide 20% spare terminal capacity at each terminal block assembly.

.10 Terminals shall be Wieland Type WK4/U color coded as follows:

Red	Positive 24VDC
Black	0VDC common and analog signal plus
White	Analog signal common and VAC neutral
Grey	120VAC
Green	Ground
Yellow	Shield

.11 Provide nameplates for each device on or within the panels and enclosures. Nameplates shall be black lamicoid with white lettering, a minimum of 25mm x 75mm in size with up to three lines of 3mm lettering. Securely fasten nameplates in and situate them in a visible location.

2.6 Panel Grounding

.1 Provide a ground system for the instrumentation circuits, isolated from the main power system ground to each marshaling panel.

.2 Provide grounding lugs for each panel, suitable for termination of up to #2 AWG copper grounding conductor.

.3 Provide in each marshaling panel an isolated grounding buss bar 6 x 25 x 600 mm, equipped with necessary lugs for accepting two #2 AWG grounding conductors.

.4 Firmly bond all panel mounted devices on or within the panels to ground. Provide supplementary bonding conductors for backpanels and doors. Attach a separate bonding conductor to all devices that are not firmly fastened to the panels with screws for such devices as case mounted instruments, meters, etc.

3. EXECUTION

3.1 References - General

.1 Refer to Section 17010, Part 3.

3.2 Mounting Heights

.1 Unless otherwise specified or a conflict exists, mount all panels, starters and disconnects 2000 mm to top of cover.

END OF SECTION

INSTRUMENTATION CABLE

1. GENERAL

1.1 Product Data

.1 Submit product data in accordance with Division 1 and Division 16.

1.2 Related Work

.1 Refer to Division 16.

.2 All instrumentation cabling is to be run in conduit. Conduit products and execution to conform with Division 16 requirements.

1.3 Inspection

.1 Provide adequate notice to the Engineer so that all cable installations can be inspected prior to connecting equipment.

1.4 Standards

.1 All wire and cable shall be CSA approved.

2. PRODUCTS

2.1 Twisted Pair Shielded Cables (TPSH)

.1 TPSH shall be constructed as follows:

.1 Copper conductors, stranded, minimum #18 AWG, PVC insulated, twisted in nominal intervals of 50 mm.

.2 Insulated for 300V, 90°C.

.3 100% coverage aluminum foil or tape shield.

.4 Separate bare stranded copper drain wire, minimum #18 AWG.

.5 Overall flame retardant PVC jacket to CSA-C22.2.

.6 The entire cable assembly to be suitable for pulling in conduit or laying in cable tray.

.7 Belden, CSA Type 22646 or approved equivalent.

.2 Where multiconductor TPSH cables are called for, each pair shall be individually shielded, continuous number coded, and the cable assembly shall have an overall shield and overall flame retardant PVC jacket.

2.2 RTD And Multi Conductor Shielded Cable

.1 RTD cables shall be CSA approved and shall be constructed as follows:

.1 3 or more copper conductors, stranded, minimum #18 AWG.

.2 PVC insulated for 600V.

.3 100% coverage aluminum foil or tape shield.

.4 Separate bare stranded copper drain wire.

.5 Overall flame retardant PVC jacket to CAS-C22.2.

2.3 Teck Cables

.1 As per Division 16.

2.4 Wire

.1 As per Division 16.

3. EXECUTION

3.1 Analog Signals

.1 Use TPSH cable for all low level analog signals such as 4-20 mA, 1-5 VDC, 0-10 VDC, pulse type circuits 24 VDC and under, and other signals of a similar nature.

.2 Use RTD cable for connections between RTDs and transmitters or DCS RTD inputs.

3.2 Discrete Signals

.1 Use TPSH cable for all low level input (24V and below) and output signals to/from the PLC.

.2 Use Teck cable or wire and conduit for power to instruments, for 120V signals other than those mentioned above and as otherwise indicated on the drawings. Use stranded wire and cable to supply power to instruments (#12 AWG).

3.3 Installation

.1 Install instrumentation cables in conduit systems or in cable trays. Use a minimum of 300 mm length of liquid tight flexible conduit to connect the field sensors to the conduit.

.2 Where non-armoured instrumentation cables are installed in cable trays, provide barriers in the tray to separate instrumentation cables from power cables.

.3 At each end of the run leave sufficient cable length for termination.

.4 Do not make splices in any of the instrumentation cable runs. Where splices are required, obtain approval from the Engineer prior to installing the cable. Do not splice cables to gas detection heads.

.5 Where splices are necessary in instrumentation cables other than coaxial cables, perform such splices on terminal blocks in terminal boxes. Keep splices in instrumentation cable to a minimum and separated physically from power circuits. Cable shields shall be terminated on insulated terminals and carried through to the extent of the cable.

.6 Where splices are made to coaxial cables, use standard coaxial cable connectors

.7 Ground cable shields at one end only. Unless otherwise specified, ground the shields at the marshalling panel.

.8 Protect all conductors against moisture during and after installation.

3.4 Conductor Terminations

.1 All equipment supplied shall be equipped with terminal blocks to accept conductor connections.

.2 Instrumentation conductors, where terminated at equipment terminals other than clamping type terminal blocks, shall be equipped with Burndy-YAE-2 or STA-KON, self-insulated, locking type terminators, sized as required to fit conductors and screw terminals.

3.5 Testing

.1 Test all conductors for opens, shorts, or grounds. Resistance values shall not be less than those recommended by the cable manufacturer.

3.6 Identification

.1 Identify all instrumentation cables.

.2 Identify each conductor with wire numbers using a machine printed heat shrink wire marker, similar to Raychem TMS or equivalent.

END OF SECTION

POWER SUPPLIES

1. GENERAL

1.1 References - General

.1 Refer To Section 17010.

2. PRODUCTS

2.1 Power Supply and Conditioning Equipment

.1 General

.1 Provide all DC power supplies as required for all instrument circuits. All circuits to be powered from the marshalling panels. Power supplies to be equal to Hammond, Phoenix contact, or Omron, complete with an over voltage protection module.

.2 Provide redundant configurations for power supply equipment serving more than one instrument loop, so that failure of a single unit will not disable all or any shared part of the instrumentation and communication system. Provide diode isolation for redundant direct current supply units, and ground the negative terminal of the power supply.

.3 Power supplies and transmitters feeding circuits that run in non-armored cable in cable tray shall meet the requirements for Class 2 circuits as defined under Section 16 of the CEC Part I.

.4 Unless otherwise required, all DC power supplies to be rated 28VDC, adjustable plus or minus 5%, and set to provide 26.4 volts on the panel direct current bus. Size the power supply for two times the connected load, minimum size is 5 amps.

2.2 Noise Suppression

.1 Provide power conditioners in each panel to power AC instrumentation and control loads. Power conditioners are Oneac Series CX.

2.3 Signal Booster / Isolators / Splitters

.1 Provide 4-20mA signal booster/splitters for all analog loops where the connected load(s) are greater the 80% of the transmitters rated output load.

.2 Signal booster splitters are to be DIN rail mounted in the main control cabinet.

.3 Signal booster splitters to be; Moore Industries ECT-DIN.

.4 Signal Isolators to be; Moore Industries ECT-DIN.

2.4 UPS Power Supply

.1 Provide uninterruptible power supply or supplies (UPS) in each panel to power PLC, alarm dialers and Datalogging equipment.

.2 Size UPS standby capacity for 1 hour at full load rating.

.3 Provide on-line units from Exide, Oneac, Toshiba or Best.

3. EXECUTION

3.1 References - General

.1 Refer To Section 17010, Part 3.

END OF SECTION

PROCESS TAPS AND PRIMARY ELEMENTS

1. GENERAL

1.1 References - General

.1 Equipment, Products and Execution must meet all requirements detailed in Section 17010.

2. PRODUCTS

2.1 Process Taps

.1 Provide thermal flow switch, pressure switch, pressure gauge, pressure transmitter, thermowell, and analyzer sample point taps. Coordinate requirements with Division 13.

.2 Process taps for pressure gauges, pressure transmitters, and analyzer sample points are to be fitted with two valve manifold blocks (isolation and drain).

.3 Process taps for differential pressure instruments are to be fitted with five valve manifold blocks (process isolation X2, equalization X2, and drain).

.4 Two valve manifold blocks to be Swagelok, Wika, or Alco.

.5 Five valve manifold blocks to be Swagelok, Wika, or Alco.

2.2 Primary Elements

.1 Provide primary elements and transmitters as specified on the Instrumentation Specification Sheets (ISS) of Section17701.

.2 Provide written assurance that the instrument manufacturer approves the selection of materials of primary elements, which are in contact with the specified process fluid and inert to the effects of the process fluid.

.3 Provide diaphragm seals on any fluid other than clean water or glycol.

.4 When diaphragm seals are specified with a pressure gauge or a pressure switch provide the assembly filled with ethylene glycol and calibrated by the manufacturer.

.5 Provide ethylene glycol filled assembly calibrated by the manufacturer when in-line pressure sensors are specified with a pressure gauge or a pressure switch or in combination.

2.3 Process Connections

.1 Pipe, fittings, valves, tubing, tube fittings, etc. required under this section of the contract to be Swagelok or equivalent and rated for the service in which they are to be employed. Tubing and fittings to be made of stainless steel.

.2 Dimensions:

.1 Process connections 12 mm (nominal) O.D. tubing.

.2 Pneumatic output/signal 10 mm (nominal) O.D. tubing.

.3 Air supply 12 mm pipe (nominal) to isolation valves and 10 mm O.D. tubing (nominal) from isolation valves to end devices (e.g., valves).

.3 Provide a continuous support channel or raceway for all tubing.

3. EXECUTION

3.1 Tubing and Fitting Installation

.1 Group instruments logically together. Orient instrument air and process connection isolation valves to provide consistent handle indication of normal open/closed status.

.2 Complete final location of field instruments to provide sufficient clearance for access to all maintenance settings, to provide unobstructed viewing of instrument indicators and to permit instrument calibration and maintenance during normal operation of the site.

.3 Slope tubing installations 20 mm per 2 meters of run down to process connection.

.4 Support tubing in channel or raceway if exposed or in close proximity to rotating equipment or high traffic areas otherwise do not exceed 1 m between tubing supports.

.5 Field bend all turns with a minimum bending radius of 50 mm.

.6 Avoid non-terminal connections in tubing runs.

.7 Use teflon tape on all pipe threaded fittings. Do not apply tape on the first two threads.

.8 Tubing shall terminate at devices with fittings or 90° bends, to allow removal of tubing without disturbing the device mounting.

END OF SECTION

TRANSMITTERS AND INDICATORS

1. GENERAL

1.1 References - General

.1 Equipment, products and execution must meet all requirements detailed in Section 17010.

2. PRODUCTS

2.1 Transmitters and Indicators

.1 Provide transmitters and indicators as specified on the Instrument Specification Sheets of Section 17701.

.2 Transmitters shall have adequate power output to drive all devices associated with the loop. Provide signal boosters as required to achieve adequate signal strength or to isolate the signal.

.3 Signal boosters to be as specified in Section 17130.

.4 Process analytical transmitters to indicate in appropriate scientific or engineering units.

.5 All transmitters to have local indication scaled in percent. Provide a lamicoid label indicating the calibrated range and engineering units and mount adjacent to the transmitter. Mount the transmitter so the indicator is visible by the operator.

2.2 Indicators

.1 Where the loop specification calls for a transmitter and an indicator to be mounted in the same panel, an indicating transmitter may be considered acceptable, provided the indicator is normally visible from outside the enclosure.

3. EXECUTION

3.1 References - General

.1 Refer to Section 17010.

3.2 Installation

.1 Transmitters may be mounted on adjacent walls provided they are clearly visible and the wall has been reinforced to provide sufficient structural strength to carry the transmitter. In all other locations transmitters are to be mounted on 2" pipe stands visible by the operator. Pipe stands are not to cause obstructions to the movement of material or limit access to equipment.

.2 Where process elements are not clearly visible by the operator remote mount transmitters shall be used. Conductors form the process element to the corresponding transmitter are to be run in conduit

.3 Installation of process connections, impulse lines and or sample tubing systems to comply with specification Section 17211.

END OF SECTION

PANEL INSTRUMENTS

1. GENERAL

1.1 References - General

.1 Equipment, Products and Execution must meet all requirements detailed in Section 17010.

1.2 Standards

.1 All electrical materials and equipment shall be CSA approved and manufactured in accordance with Standards established by EEMAC. This approval applies to complete control system assemblies as well as individual components. If CSA certification is not available, it will be the responsibility of the supplier to obtain individual approval and corresponding stickers from the Electrical Inspection Branch prior to shipment to site. **Engineer will not accept Equipment Vendor's supply without CSA certification or Electrical Inspection Branch approval.**

.2 All wiring and conduit systems for instrumentation and controls systems to comply with the Canadian Electrical Code.

2. PRODUCTS

2.1 Electronic Panel Instruments

.1 Provide panel instruments with the following requirements, unless otherwise specified:

.1 Analog instruments to be miniature-case draw out type nominally 150 mm high by 75mm wide by not more than 350 mm deep.

.2 Make the operator, tuning and configuration adjustments accessible without disconnecting the instrument from the process.

.3 Analog signal indicators to be solid-state, LED or gas-discharge type, including bar-graph displays with not less than 200 segments. Backlit LCD indication is also acceptable.

.4 Analog signal inputs to be 4-20 mA VDC.

.5 Analog signal outputs to be 4-20 mA VDC into a minimum of 500 ohms.

.6 Signal boosters/splitters refer to Section 17130.

.7 Galvanically isolate the signal and power supply from the instrument case.

.2 Panel instruments specified in this section are to be the product of a single manufacturer, and to match and line up to form an integrated appearance and operator interface strategy.

2.2 Indicators, Pushbuttons, Selector Switches, and Key Switches

.1 All control pushbutton switches and selector switches in unclassified or non-corrosive areas to be NEMA 4X Allen Bradley, 800T series items, or approved equal.

.2 All control pushbutton switches and selector switches in classified or corrosive (includes outdoors) areas to be NEMA 4X Allen Bradley 800G series items, or approved equal.

.3 All shut down pushbutton switches in unclassified or non-corrosive areas to be NEMA 4X, 2 position push/pull-twist, Allen Bradley 800T series items, or approved equal. In classified or corrosive (includes outdoors) areas to be NEMA 4X, 2 position push/pull-twist, Allen Bradley 800G series items, or approved equal.

.4 All key switches to be NEMA 4X Allen Bradley 800T series, or approved equal and comes with 10 keys.

2.3 Limit Switches

.1 Limit switches to be Allen Bradley 802B precision limit switches complete with roller lever actuator, or approved equal.

2.4 Relays

.1 120VAC relays to be Weidmuller PRS series, DIN railmounted, 2 contact, plug-in, complete with operation indicator.

.2 Where the contact ratings of the relays listed are insufficient for the application, select an appropriate type from an approved manufacturer with the same quantity of contacts as required. Approved Manufactures include: Omron, Weidmuller, Idec, Schneider.

.3 Provide relay plug-in sockets for DIN mounting, complete with stacked screw clamp terminals.

2.5 Panel Indicator Lamps

.1 All panel indicator lamps to be Allen Bradley 800T series comes with LED lamps and push to test feature.

3. EXECUTION

3.1 References - General

.1 Refer to Section 17010.

END OF SECTION

PLC Equipment

1. GENERAL

1.1 References – General

.1 Equipment, Products and Execution must meet all requirements detailed in Section 17010.

.2 The PLC interconnectivity is shown on drawing I2, detail 6. All PLC and HMI equipment is to be located in the control panel in the process room(as indicated on the drawings).

.3 The contractor will procure all PLC, and related components, and software required for the installation as described on the drawings and within this specification. This includes I/O associated with the future construction of the Lower Base Recirculation and Fire Pump.

.4 Operator Interface terminal is to be owner supplied.

.5 The contractor will procure and co-ordinate required communications components with the packaged equipment vendor in order to complete the installation.

2. PRODUCTS

2.1 PLC and Operator Interface - General

.1 The PLC design and specification has been based on the Allen Bradley SLC500 series product range. This PLC system includes the Facility Control System and the related communications and operator interface components.

.2 The intent of this specification is to ensure **all** system components are of a common manufacture and utilize a common technology platform.

.3 The Contractors bid shall be based on the Allen Bradley specified products. Product options may be proposed under the terms and conditions of Appendix G-2 of the tender form.

2.2 Uninterruptible Power Supplies

.1 The PLC system and modem are to be powered by a suitable sized UPS. Refer to specification section 17130

2.3 Programmable Logic Controller

.1 General

.1 A PLC shall be the primary control processor for the control system. It shall provide the capability to monitor discrete process variables as well as perform interlock logic and sequential control functions. The PLC shall be of modular design. Expansion modules shall be added by ribbon cable or pin and socket connectors. The system shall be complete with an Ethernet communications port for connection to a telephone modem.

.2 The PLC shall have internal diagnostic routines such that no external diagnostic test devices or user-generated code are required to determine the operating status. Indicator lights shall be provided on the processor module to indicate processor status (RUN, FAULT, etc.).

.3 All memory in the system (including processor and other programmable modules) shall be non-volatile or battery-back-up with a minimum retention time of

six months. Batteries shall be replaceable while the PLC is in the running mode, without interruption to the PLC operation or loss of it program.

.4 Power supplies shall be rated for 120 VAC, 60 Hz nominal input voltage. They shall have the capacity to power a completely populated set of modules with any mix of I/O types.

.5 A malfunction of any module (other than the main processor or power supply modules) shall not affect the operation of any other racks or modules in the system.

.6 The PLC shall be provided with all necessary cables and termination hardware to allow the unit to be fully functional including network cabling and accessories. All necessary hardware keys shall also be provided.

.7 The PLC shall be provided complete with all necessary hardware and software tools required for programming. The programming software is to be provided complete with all operating and maintenance manuals as required in specification Section 17010

.2 PLC Processor

.1 The PLC processor shall be fitted with battery backup and programming communications ports.

.2 The processor shall be supplied with adequate user accessible memory for application program development. The memory shall be of sufficient amount to meet current performance requirements and 100% spare capacity for future growth.

.3 Input/Output Modules

.1 The I/O modules shall meet or exceed the following minimum specifications:

Discrete Inputs:

- 120 VAC or 24 VDC input signals
- individually isolated
- status indicator light for each input

Discrete Outputs:

- normally open contacts
- individually isolated
- 120 VAC, or 24 VDC 1 A rating

  provide interposing relays for higher current loads
- status indicator light for each output

Analog Inputs:

- 24 VDC input signals
- 4-20 mA input current
- individually isolated

status indicator light for each input

Analog Outputs:

- individually isolated
- 24 VDC 195 mA current ratting
- status indicator light for each output.

.2 Contractor to supply all spare I/O required as indicated on PLC schematic diagrams.

.3 All 120 VAC and 24 VDC discrete I/O to be segregated and easily identifiable.

.4 Communications

.1 The PLC shall be provided with all hardware and manufacturer recommended cabling necessary to allow communication with programming terminal, and an Ethernet control network.

.2 Provide an Ethernet communications module or port, c/w cabling into interface with the packaged primary filter control system.

.5 Operator Interface

.1 The owner supplied HMI terminal is a Rockwell Automation Windows CE computer Part# 6182H-15BRH4D.

.2 The operator interface for this system is to be provided via a HMI software interface located on the control panel door.

.3 HMI software is to be Rockwell Automation, RS view.

.4 The operator interface is to be configured to include operations overview screen(s), alarm log screens(s), and process variable trend data screen(s).

.5 HMI system shall also be configurable to provide a full suite of alarm, trend and process variable reports and graphs.

.6 Programming General

.1 The PLC shall be programmed to provide the functionality described in this Section as well as Section 17550 – Control Philosophy.

.2 The programmer shall submit a complete listing of the application programs for inclusion in the Operations and Maintenance Manuals.

.3 Programming Guidelines:

Overview:

.1 This section is intended as a guide to the type and quality of programming functions to be provided. It is not an all-inclusive list.

.2 Provide programming for all input/output points to ensure a complete and operable control system. Emphasis shall be placed on minimizing operator workload by monitoring and alarming equipment malfunctions,

filtering out nuisance alarms, and by performing routine calculations automatically.

.4 Programming Features

.1 The programmer shall allow for a program development meeting with the engineer and the plant operators to ensure that the functional needs of the waste water treatment plant needs will be met. Allow for travel to the engineers office to attend this meeting.

.2 Programmer will be provided with required standards for format of displays, colours, etc, at the above described meeting

.3 The programmer shall also allow for time required to revise the program should functional changes be required that affect up to twenty five I/O points.

.4 The programmer shall allow for the required time on site to commission and field verify all I/O points.

.5 Provide 1 copy per Operation and Maintenance manual of the "As Commissioned" PLC operating program on CD-ROM for the owners use.

2.4 Communications System

.1 The PLC system is to generate discrete output signals to the autodialer for critical alarm reporting.

.2 The PLC will also be remotely accessible via a modem and Ethernet link located in the control panel.

2.5 Software Tools

.1 Provide software tools with all required features to execute the programming of the facility PLC system.

.2 Contractor to provide to the owner a single licensed copy of each of the programming software packages used to generate PLC and or communications programs. This includes the PLC, HMI and communications system.

3. EXECUTION

3.1 Equipment Delivery

.1 Mount PLC within the enclosure and terminate the I/O wiring.

.2 Terminate communications port to Modem and connect processor to the UPS power source.

.3 Energize the PLC and load the operating program.

3.2 Equipment Spares

.1 Provide one spare PLC module of each type used in the facility. The spare Processor module is to be configured with the final operating program for the facility upon completion of commissioning.

3.3 Start-Up and Commissioning

.1 Provide startup and commissioning services as outlined in Section 17010.

3.4 Operation and Maintenance Data

.1 The programming software is to be provided complete with all operating and maintenance manuals as required in specification Section 17010.

.2 All PLC hardware is to be provided complete with all operating and maintenance manuals as required in specification Section 17010.

.3 Provide complete operating and maintenance manuals for the UPS system.

.4 Provide complete operating and maintenance manuals for the modem system.

END OF SECTION