SWITCHES, RELAYS, AND INDICATOR LAMPS

1. GENERAL

1.1 References - General

.1 Refer to Section 17010.

2. PRODUCTS

2.1 General

.1 Use normally closed contacts for alarm actuation which open to initiate the alarm.

.2 Use normally open contacts to control equipment. The contacts close to start the equipment.

.3 Contacts monitored by solid state equipment such as programmable controllers or annunciators to be hermetically sealed and designed for switching currents of 2A@ 125 VAC, minimum.

.4 Contacts monitored by electro-magnetic devices such as mechanical relays to be rated NEMA ICS 2, designation B300.

.5 Provide double barriers between switch elements and process fluids such that failure of one barrier will not permit process fluids into electrical enclosures.

.6 Switch electrical enclosures to be rated EEMAC 4, minimum.

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 800E 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 800H series items, or approved equal.

.3 All key switches to be NEMA 4X Allen Bradley 800E series, or approved equal and come with 10 keys. All exterior doors and key switches to be keyed alike.

2.3 Limit Switches

.1 Door position limit switches to be Allen Bradley 802B precision limit switches comes with roller lever actuator and rated for Class 1 Zone 2 Group D atmospheres, or approved equal.

2.4 Relays

.1 All relays to be Weidmuller PRS series, DIN rail mounted, 2 contact, plug-in type, complete with operation indicator, or approved equal.

.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 was originally specified.

.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 800E series comes with LED lamps and push to test feature.

3. EXECUTION

3.1 References - General

.1 Refer To Section 17010.

END OF SECTION

GAS DETECTION SYSTEMS

1. GENERAL

1.1 Description

.1 This section specifies the supply, installation, testing and commissioning of gas detection systems.

.2 Use this specification in conjunction with Section 17010.

1.2 Reference Standards

.1 Conform to the following reference standards in accordance with Division 1:

.1 CSA C22.2 No. 152, Combustible Gas Detection Instruments

.2 Canadian Standards Association (CSA) - C22.1

1.3 Shipment and Storage

.1 Ship and store equipment in accordance with the requirements of Division 1.

.2 Store gas detection instruments in their original shipping containers in a dry location free of fumes or vapors. Never store an instrument in an area where desensitizing agents (such as paints or silicones) may be present.

2. PRODUCTS

2.1 Function

.1 General

.1 Refer to Section 17010, Part 2.

.2 Provide gas detection systems which include:

- Field mounted sensors/transmitters.

.2 Alarm beacons and horns.

.3 Horn Silence Push Buttons at doors where horns are located.

.4 Room entrance alarm panels.

.3 Provide field elements that are certified Class I, Division I.

.2 Details

.1 The gas detection system will monitor for concentrations of:

- Combustible gas CH_4 (gasoline vapors, etc) (0-100% LEL) and to alarm at 20% and 40% LEL.

.2 H_2S concentrations of (0-100ppm) and to alarm at 10ppm and 50 ppm.

.2 Each sensor shall be capable of providing 3 alarm contacts, 1 each for High Alarm, High High Alarm, and device fail alarm.

.3 In event on of the redundant sensors failure, the HMI will indicate the device status, and the alarms will not sound. In event both of the redundant sensors fail all associated alarm horns and beacons will be activated.

.4 Provide sensors and calibrators as specified on the Instrumentation Specification Sheets (ISS), Section 17701.

.5 Provide combustible gas sensor with dual conduit and a sensor guard to allow the sensors to be ceiling mounted and the sensor electronics to be at maintenance level. The sensor guard will be piped to the maintenance level with polypropylene. Refer to the Instrument Installation Details, Section 17704.

.6 Alarm beacons and horns will operate on 120 V, 60 Hz. Beacons mounted in the process area will be classified Class I, Division I. Beacons mounted outdoors will be EEMAC 4X.

.7 Power gas monitors from separate breakers in power panel and connect to dedicated UPS power supply in the electrical room. Refer to Specification Section 17130 Power Supplies.

.8 Refer to the requirements of Section 17010 for instrument and wiring identification.

.9 Provide 75 mm x 250 mm nameplates in sensor locations engraved "CAUTION: PAINT OR SILICONE COMPOUNDS WILL DAMAGE SENSOR".

2.2 Spare Parts/Tools and Training

.1 Provide a calibration kit including a one-year supply of all gases to calibrate all sensors and sensor types. The calibration kit must include, but not be limited to, all regulators and equipment required to perform regular on-site calibrations.

.2 Provide one of each type of detector/transmitter assemblies.

.3 Provide training to owner's personnel to ensure knowledge of calibration and service procedures.

3. EXECUTION

3.1 General

.1 Refer to the requirements of Section 17010, Part 3 for additional execution details.

3.2 Device Mounting

.1 Install detection devices at manufactures recommended mounting heights.

.2 Mount all detection devices in service accessible locations.

.3 Provide and install splash covers as required for detection devices to ensure detectors are not damaged by use of floor wash facilities.

3.3 Wiring

.1 Wire devices as shown on the installation details and the cabling diagrams.

.2 Wiring methods must comply with the area classification, CSA C22.2 No. 152 and the requirements of Division 16.

3.4 Field Testing and Inspection

.1 Refer to the requirements of Section 17010, Part 3 for additional details.

.2 Provide an inspection of the gas detection system and all related components. The inspection will comprise of the following:

.1 That the system functions as intended including equipment shutdowns and startups, alarms, reset, calibration, etc.

.2 That the wiring connections to all equipment components show that the installer undertook to observe CSA requirements.

.3 That equipment has been installed in accordance with manufacturer's recommendations and that all signaling devices of whatever manufacture have been operated or tested to verify their operation.

3.5 Commissioning & Start-up

.1 Commissioning and start-up to be in accordance with CSA Standard C22.2 No. 152 and the requirements of Section 17010, Part 3.

3.6 Certification

.1 Inspection certification: on completion of the inspection and when all of the above conditions have been complied with, the consulting engineer will be issued:

.1 A copy of the inspecting technician's report showing location of each device and certifying the test results of each device.

.2 A certificate of verification confirming that the inspection has been completed and showing the conditions upon which such inspection and certification have been rendered.

END OF SECTION

CONTROL PHILOSOPHY

1.0 PROCESS DESCRIPTION AND OPERATIONAL OVERVIEW

It is the intent of the design team that the entire Lift Station #1 will be controlled utilizing a Programmable Logic Controller (PLC) with a Human Machine Interface (HMI). The overall lift station process is depicted on the Process and Instrumentation Diagrams (P&ID). Additionally the PLC will monitor and control a number of other facility functions.

It is intended that Lift Station #1 be capable of operating on a continuous basis and in an automatic mode. When the lift station is called to start and all equipment is in automatic mode, the Main PLC will control and operate the facility. Various conditions of alarms will be detected and reported to the Main PLC, some will turn on back-up equipment and others will generate operator dial out alarms. This control philosophy will outline all alarms including set points, normal operation, abnormal operation and manual controls.

2.0 RAW WASTEWATER PUMPING/LIFT STATION

2.1 Normal Operation

The raw wastewater pumping will be controlled through the facility PLC.

Under normal operation, the lift station pumps P-101 and P-102 are to operate in a lead/lag configuration. The lead/lag pumps will be started and stopped based on fixed level points in the wastewater lift station, detected by a level transmitter monitoring the lift station wet well fluid level. The RWW lift station level transmitter will communicate the analog level value for wastewater in the lift station to the PLC. The PLC will start the lead RWW pump at a set level and then throttle the speed of the variable frequency drive (VFD) for the lead pump to maintain a level set point. When inlet flow exceeds the capacity of the lead lift pump the level in the will rise. When the level rises to the set level for lag lift pump start the PLC will start the lag pump and will divide the VFD output control signal evenly between the two operating pumps to maintain the level set point.

Under normal operation when the inlet flow is less that the capacity of the lead and lag lift station pumps operating at minimum speed, the level in the lift station will fall. When the level falls to the lag pump stop set level the PLC will stop the lag pump and then throttle the speed of the VFD for the lead pump alone to maintain a level set point. Should the inlet flow further decrease to a volume where the lead pump alone, operating at minimum speed, not be able to maintain the level set point the level will fall to the lead pump stop set level and the PLC will shut down the lead pump. At this inlet flow volume the control system will wait for the level to rise to the lead pump start level and the above sequence will be available to repeat.

Should the lift station level rise to the point that level switch high high (LSHH) 104 close and the pumps are not running, the lead pump will start and run at full speed for XX minutes (This run time to be determined at commissioning) This redundant control is intended to operate in event of a level transmitter failure.

The lift station pumps are also fitted with a 3 contactor bypass and a conventional magnetic starter. Should a VFD fail the starter can be placed into bypass mode and the pump motor will operate off of the magnetic starter. Under this scenario the pump will run using on off control, starting and stopping at the above described set points.

The lag pump is to be fitted with a 1 minute start delay to ensure that both the lead and lag pumps do not attempt to start simultaneously.

The PLC/HMI system will be configured to allow each of the raw wastewater lift station pumps, P-101and P-102, to operate as the lead or lag pump. In event of a lead lift station pump failure the PLC will alarm the pump as failed on the HMI system, and assign the lag pump to operate as the lead pump This condition will also generate an autodialer call.

The lift station inlet is fitted with a grinder. The HMI system will monitor the grinder status from the grinder control panel and indicate the grinder status as running or stopped. The grinder control panel will also generate a fault alarm contact (YA-100) in event of a grinder failure. This alarm will be indicated on the HMI.

The RWW discharge from the lift station will be measured using the magnetic flow meter, FE/FIT-101, located on the discharge side of the lift station pumps on the 200 mm diameter discharge forcemain.

2.1.1 Normal Equipment Status

Equipment Tag #	Description	Status
P-101	Lift Station Pump (VFD)	In Auto Lead or lag HMI indication running or stopped
P-102	Lift Staion Pump (VFD)	In Auto Lead or lag HMI indication running or stopped
G-100	Grinder	HMI indication running or stopped
FIT-101	RWW Flowmeter	HMI indicates instantaneous flow and totalizes flow
LIT-101	Level Transmitter in Lift Station wet well	HMI indicates level value

2.1.2 Sequence of Normal Operation

Refer to hydraulic profile on Drawing P-1

Lift Station Level	Action
3.20m above lift station floor	Level alarm high high as detected by LSHH-104 PLC to confirm RWW lift pumps running and start if not running. (refer to next table)
2.60m above lift station floor	Level alarm high as detected by LIT-101 PLC to confirm RWW lift pumps running and start if not running.
2.10m above lift station floor	Lag pump start level as detected by LIT-101 Lag pump in VFD or bypass mode
1.90m above lift station floor	Lead pump start level as detected by LIT-101 Lead pump in VFD or bypass mode
1.45m above lift station floor	VFD control set point as detected by LIT-101
1.00m above lift station floor	Lag pump stop level as detected by LIT-101 Lag pump in VFD or bypass mode
0.60m above lift station floor	Lead pump stop level as detected by LIT-101 Lead pump in VFD or bypass mode
0.40m above lift station floor	Level alarm low PLC to confirm RWW lift pumps stopped and stop if running.

2.2 Abnormal Operation

Abnormal Condition	Action	Alarm	Annunciation
Lead pump VFD fails	Start Lag pump as the lead pump	Alarms	HMI
Lag pump VFD fails	Lag Pump Fails (No pumps available)	Alarms	HMI and Dial Out
Lead pump Bypass starter fails	Start Lag pump as the lead pump	Alarms	HMI
Lag pump Bypass starter fails	Lag Pump Fails (No pumps available)	Alarms	HMI and Dial Out
No flow measured by FIT-101 when the	If no flow after 1 min lead pump	Lead pump fail	HMI

Abnormal Condition	Action	Alarm	Annunciation
lead pump called to run. Flow status to be checked 1min. after pump start	failed Start Lag pump (as above)	alarm	
LAL in RWW lift Station	Shutdown and inhibit all pumps from running	LAL Alarms	HMI and Dial Out
LAHH in RWW Lift Station LSHH-104	Lead pump to run at full output for XX min. and stop. Pump to repeat the sequence when LSHH is activated again	LAHH Alarms	HMI and Dial Out

2.3 Lift Station Pumps on the HMI

Lift station pumps are intended to run with the VFD speed controlled by a PID loop which controls on lift station wet well level. In this mode of control the HMI shall indicate level set point, lift pump run status (YI-101a and YI-102a), and lift pump speed indication (SI-101 and SI-102). Each pump shall be configured on the HMI for this type of control. In event of a VFD failure the operator can select the bypass mode on the motor starter which will allow the pump to operate in on/off control based on the Lift station wet well level. In HMI shall indicate which mode of control is being used based on YS-101b and Ys-102b. HMI process displays and alarm screens shall indicate pump failures in either mode (YA-101a, YA-101b, YA-102a, or YA-102b)

3.0 FACILITY STATUS AND ALARM MONITORING

3.1 Facility Operation

3.1.1 Building Gas Detection

3.1.2 H2S Detection

Upon detection of 10 ppm or greater of H2S gas by either sensor (AIT 103 or AIT 104) the PLC will activate the red H2S strobe lights above the exterior doors (CA-101). These inputs will also initiate alarm horn (CA-100) and generate an autodialer call. The detection of 10 ppm H2S will also initiate an output signal to the ventilation control system (YS-203) that will subsequently increase the air exchange rate in the building. When the initiating alarm or alarms are cleared the output signals to the ventilation control system (YS-203), the horn (CA-100), and the strobes (CA101) will also reset. The horn may be silenced while the system is in alarm via an operator push button on the HMI. This silence will only turn the horn off for the initiating alarm. Should the other sensor alarm, a higher concentration alarm from the same sensor, or the initiating alarm

reset and re-activate the horn shall remain operational. The status of the input device will also be indicated on the HMI system.

Upon the detection of 50ppm or greater of H2S gas by either sensor (AIT 103 or AIT 104) the PLC will activate above described scheme, thereby providing a redundant initiating scheme for these outputs in case of a failure of the transmitters 10 ppm alarm contacts. The alarm annunciation and reset scheme remain the same as above.

The initiation of the transmitter fail signal by either one of the detectors will result in the signals from that transmitter being removed from the alarm/control sequence outlined above. Should both transmitters simultaneously give a fail signal the space will be presumed to contain a high H2S concentration and the alarm/control sequence will be initiated. Transmitter fail input signals will be indicated on the HMI system and should both of the fail signals be present this alarm will also be dialled out.

3.1.3 Combustible Gas Detection

Upon detection of 20% LEL or greater of combustible gas by either sensor (AIT 105 or AIT 106) the PLC will activate the amber combustible gas strobe lights above the exterior doors (CA-102). The detection of 20% LEL or greater of combustible gas will also initiate an output signal to the ventilation control system (YS-203) that will subsequently increase the air exchange rate in the building. When the initiating alarm or alarms are cleared the output signals to the ventilation control system (YS-203), and the strobes (CA-102) will also reset. The status of the input device will also be indicated on the HMI system.

Upon the detection of 40% LEL or greater of combustible gas by either sensor (AIT 105 or AIT 106) the PLC will activate above described scheme, thereby providing a redundant initiating scheme for these outputs in case of a failure of the transmitters 20% LEL combustible gas alarm contacts. Initiation of either of the 40% LEL combustible gas alarm signals will also an autodialer call. Outputs (YS-203 and CA-102) will reset when all combustible gas alarm inputs are reset. The status of the input device will also be indicated on the HMI system.

The initiation of the transmitter fail signal by either one of the detectors will result in the signals from that transmitter being removed from the alarm/control sequence outlined above. Should both transmitters simultaneously give a fail signal the space will be presumed to contain a high combustible gas concentration and the alarm/control sequence will be initiated. Transmitter fail input signals will also be indicated on the HMI system..

The interior alarm horn (YZ102a and YZ102b) will not be activated by the detection of combustible gas.

3.1.4 Door Security

When the facility is unoccupied the door position switches ZSC-200 and ZSC-201are in the closed position and the doors are monitored. In order to enter the building the exterior spring returned momentary key switch YS-200 must be activated. Once activated the building occupied output signals YS-201 and YS-202 are turned on and the building security output to the autodialer CA-201 is made inactive. Activating outputs YS-201 and YS-202 will increase the building ventilation and turn on the building interior lights respectively. In order to switch the building to unoccupied mode the operator will depress exit momentary pushbutton YS-201. This will deactivate outputs YS-201 and YS-202 and after 5 minutes (provided YS-200 is not re-activated)

the door position switches ZSC-200 and ZSC-201are once again monitored. Should the door position switches ZSC-200 and ZSC-201be opened while monitored the building security output to the autodialer CA-201 will be activated and the HMI alarm screen will record and latch a security alarm.

Door position switches ZSC-200 and ZSC-201are to be installed on the active leaf of the double doors.

3.2 Facility Status Alarms

3.2.1 Building Mechanical Systems

The boiler control panel provided under Division 15 will monitor the boilers, glycol system temperatures and circulation pump status. Alarm conditions from any parameter monitored by this panel will result in a mechanical systems common alarm (CA-200) contact closure. The HMI will display this alarm and the alarm dial out will be activated.

Air flow through the wet well building space will be ensured by providing alarms on the Air Handling Unit (YA-205) and the wet well building exhaust fan (YA-204). The HMI will display these alarms and the alarm dial out will be activated.

To ensure the building mechanical systems are functioning properly both the wet well portion of the building and the mechanical room are monitored by temperature sensors (TI-101 and TI-102). Should the temperature in either space rise above 30° C the HMI shall indicate a high temperature alarm for that space and initiate an alarm dial out. Should the temperature in either space fall below 5° C the HMI shall indicate a low temperature alarm for that space and initiate an alarm dial out.

The fuel storage tank level is monitored by two level switches the first (LAL-101) represents a fuel level of less than 50% of tank volume. This switch will generate a fuel level low warning on the HMI. The second level switch (LALL-101) represents a fuel level of less than 25% of tank volume. This switch will generate a fuel level low alarm on the HMI and generate an autodialer call.

The water storage tank level is monitored by two level switches the first (LAH-102) represents a water level of greater than 90% of tank volume. This switch will generate a level full warning via an exterior fill indicator light. The second level switch (LAL-102) represents a fuel level of less than 25% of tank volume. This switch will generate a water level low alarm on the HMI.

Power systems are monitored for failure of the UPS (YA-201), utility power (YA-203), and the standby generator (YA-202). Any/all of the above alarms will be indicated on the HMI and will generate an autodialer call.

3.3 Fire Alarm System

The fire alarm system will be wired directly to a separate input on the facility autodialer. In event of a fire alarm the autodialer will place a call with a separate and distinct message to indicate the call was initiated by the fire alarm system.

END 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 5. All PLC and HMI equipment is to be located in the control panel in the generator room.

.3 The contractor will procure all PLC, Operator Interface and related components, and software required for the installation as described on the drawings and within this specification.

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

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

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

.4 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 17400 – 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:

.1 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

PLC I/O INDEX

1. GENERAL

1.1 References - General

.1 Refer To Section 17010.

1.2 PLC I/O Index

.1 The following spreadsheet gives an itemized list of the input and output between the PLC and the field devices. It is intended to serve as an aid for determining the cabling requirements for the work specified in this Division.

2. PRODUCTS (NOT USED)

3. EXECUTION (NOT USED)

END OF SECTION

INSTRUMENT INDEX

1. GENERAL

1.1 References - General

.1 Refer To Section 17010.

1.2 Instrument Index

.1 The following spreadsheet gives an itemized list of the instrumentation included as part of this work.

2. PRODUCTS (NOT USED)

3. EXECUTION (NOT USED)

END OF SECTION

INSTRUMENT SPECIFICATION SHEETS

1. GENERAL

1.1 References - General

.1 Refer To Section 17010.

1.2 Instrument Specification Sheets

.1 The following data sheets provide information for instruments included as part of this work.

.2 All instruments described in the instrument specification sheets are to be from a single source. Design has been based on the first named supplier. Acceptable single source suppliers are Moore Products, Bailey, Fisher-Rosemount and E&H.

2. PRODUCTS (NOT USED)

3. EXECUTION (NOT USED)

END OF SECTION

PLC SCHEMATIC DIAGRAMS

1. GENERAL

1.1 References - General

.1 Refer To Section 17010.

1.2 PLC Schematic Diagrams

.1 The following drawings shoe a sample of the type and quality of as-built PLC schematic diagrams that the contractor will produce. Once drawing per I/O module will be completed and submitted for approval prior to substantial completion of the contract.

2. PRODUCTS (NOT USED)

3. EXECUTION (NOT USED)

END OF SECTION

INSTRUMENT STANDARD DETAILS

1. GENERAL

1.1 References - General

.1 Refer To Section 17010.

1.2 Instrument Standard Details

.1 The following drawings show the standard instrumentation installation detail drawings.

2. PRODUCTS (NOT USED)

3. EXECUTION (NOT USED)

END OF SECTION