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ADDENDUM NO. 7

CONTRACT RFB-RC-SWR-CIP 2020-02
MAIN PUMP STATION UPGRADE PROJECT

ROCKLAND COUNTY SEWER DISTRICT NO. 1
ROCKLAND COUNTY, NEW YORK

September 13, 2021

The attention of all proposers is directed to the following changes, additions, and/or substitutions affecting the above-referenced project. This Addendum shall be included in and become part of the RFP for this project. Acknowledge receipt of this addendum in the space provided in this Addendum. This section must be signed and submitted with the bid proposal. Failure to do so, may subject the bidder to disqualification.

Item No. 1 – Questions

Below are the questions that have been submitted with responses from the Owner:

Question 1:

Please provide a specification for the Pressure Transmitters that are required on the discharge header. Refer to contract drawing M-003.

Response:

Delete Specification 17095 and Replace with Attachment 2.

Question 2:

Specification 01540, section 1.05.N.2 reads: "Provide temporary portable primary generator and additional backup secondary generator adjacent to bypass pumps at suction location. Generators shall be capable of powering all pumps necessary to meet peak flow." We propose to use a combination of electric and diesel pumps to achieve the desired bypass flow requirements. The electric pumps will be powered from Substation #4, which we assume is backed up by the plant generator. So, the inclusion of two additional generators seems unnecessary. Please confirm if we should include the costs of the two temporary generators.

Response:

Cost for backup generators shall be included. Refer to Specification 01540, Article 1.05 N.2.

Question 3:

Specification 01540, section 2.01.A indicates that hot-dipped galvanized rigid pipe with ball and socket-type joints is acceptable. This pipe has a pressure rating of 50 psi. Section 2.01.C indicates that HDPE DR-9 with working pressure of 200 psi is acceptable. There is HDPE pipe with a 50 psi rating to match the rigid pipe in paragraph A. Please advise if this pipe would be acceptable.

Response:

50 psi HDPE pipe is not acceptable. Delete Specification 01540, Article 2.01 A. Refer to Question 14 in Addendum No. 5.

Question 4:

Contract Drawing E-015 shows three sets of go/no-go lights and horns connected to the HVAC Alarm Relay Cabinet. Please provide specifications for the HVAC Alarm Relay Cabinet.

Response:

The HVAC Alarm Relay Cabinet is to be provided as shown on Drawing E-015 and it shall conform to the requirements of Specification 16131.

Question 5:

Addendum #3, response to Question #15 is "The Contract Documents include multiple requirements for manholes." It is unclear from the documents where new manholes are required. Please clarify.

Response:

There are no new manholes that will be part of the finalized project.

Question 6:

Please provide a specification for the Pressure Switches that are required on each pump discharge. Refer to contract drawing M-002.

Response:

Delete all pressure switches on Contract Drawing M-002.

Question 7:

Please provide an acceptable Manufacturer of Non-Metallic Conduit. Reference Spec Section 16130-4 2.04 A. Carlon and Appleton no longer manufacture the Conduit, they only provide the Fittings and Conduit Bodies.

Response:

Cantex and Allied Tube are acceptable manufacturers.

Question 8:

Please provide location of Photocells specified in 16510-4 para-F.

Response:

Photocells are required only for the Type B fixtures as scheduled on Drawing E-016.

Question 9:

Are new Fixtures required in the Wet Well Area Class 1, Div1, Group D Area as specified in 16510-2 para. 2.01 B.? Drawings E-008 and E-007 Wet Well 1 and 2 do not show new fixtures.

Response:

The scope of work does not include new wet well lighting.

Question 10:

Are lighting Contactors required as per spec section 16510-3 para. F. 1.?

Response:

No new lighting contactors are required per the drawings.

Question 11:

The Fire Alarm Control Panel is removed on Drawing E-005. Is it replaced by the HVAC ALARM RELAY CABINET shown on E-015?

Response:

The existing fire alarm system is to be demolished as shown on the drawings. The HVAC alarm relay cabinet is to be provided as shown on the drawings for code required HVAC alarm functionality.

Question 12:

Please provide Specification Sections 283111 and 283112 shown in Spec Section 15720- 9 para. B. c.

Response:

Specifications are not required; replacement of the fire alarm system is not in the scope of work.

Question 13:

Please provide Spec Section 03451 shown in 04900-10 para. 3.10 A.

Response:

Delete Specification 04900, Article 3.10 and Replace with:

3.10. LINTELS

A. Concrete Lintels: ASTM C 1623, matching CMUs in color, texture, and density classification, and with reinforcing bars indicated. Provide concrete lintels with a compressive strength not less 3,000 psi.

B. Provide concrete lintels where shown and where openings of more than 12-inches for brick-size units and 24-inches for block-size units are shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

Question 14:

Drawing E-005 requires us to Remove 300kva Isolation Transformers, do these transformers contain Hazardous Material?

Response:

The existing isolation transformers are dry-type transformers and are currently not known to contain hazardous materials.

Question 15:

Drawing E-005 requires the removal of the telephone, does the telephone get replaced?

Response:

The telephone is not shown to be replaced per the drawings.

Question 16:

Drawing E-005 DEMOLITION PLAN requires the removal and replacement of the PA HORN and Wiring. Drawing E-012 calls out the removal and replacement of the PA Horn, no mention of the cable being replaced. Is the Cable to be replaced? If so, please provide a location as to where it originates.

Response:

The extent of PA wiring to be replaced is within the main pump station. If the wiring leaves the building, it may remain and be reconnected to.

Question 17:

Please confirm when Bids date?

Response:

Bids will be received on **Thursday, September 16, 2021 until 11:00 a.m.**, local time, in the offices of Rockland County Sewer District No. 1, 4 Route 340, Orangeburg, NY, at which time and place they will be publicly opened and read aloud. These bids will be for the furnishing of all tools, equipment, materials and labor for all contracts, all complete, in place, tested and ready for use.

Item No. 2

Add the following Article to Specification 15100:

"2.15 CUSTOM FABRICATED STEEL FITTINGS

A. Fabricated steel fittings for the surge valve connection in pump discharge header shall be a custom fabricated steel tee 24"x 12".
B. Design calculations, shop drawings (details), and shop tests shall be submitted.
C. Fittings shall be fabricated to 250 psi rating in accordance with ANSI/AWWA C200 and AWWA M11.
D. All fittings shall be hydrostatically shop tested prior to shipment. Testing on steel fittings shall be done at 100 psi for two hours. Refer to Section 15060, Aboveground Process Piping, for pipe testing requirements.
E. Fittings shall be fabricated with flange connections to connect to Ductile Iron Pipe.
    a. Insulating joints shall be provided when connecting to DIP; electrical resistance test shall be performed after insulation; resistance shall at least be 10,000 ohms; results shall be submitted to the Engineer."

Item No. 3

Add the following to Special Contract Condition:

"8. Once demolition work on the Main Pump Station and/or Temporary Bypass Pumping begins, Contractor takes full Operational and maintenance responsibility of the Pump Station and Screenings Room, including maintaining power to the Screenings Building and other buildings powered form the Pump Station."

Item No. 4

Delete Specification 16480 and Replace with Attachment 1.

Item No. 5

Delete all pressure switches on Contract Drawing M-002.

Item No. 6

Delete Specification 17095 and Replace with Attachment 2.

ACKNOWLEDGMENT

Print Name:_____
Name of person responsible for this solicitation

I acknowledge the receipt of _____addendums.

Signature:_____

Email Address:_____

Direct Phone Number:_____

Fax Number:_____

Date:_____

_____ Date: September 13, 2021

Martin J. Dolphin, P.E.
Assistance Director

ATTACHMENT 1

SECTION 16480

VARIABLE FREQUENCY DRIVES

PART 1 GENERAL

1.01. DESCRIPTION

A. This Section covers the requirements for variable frequency drives (VFDs) for the pumping system provided by the Contractor. Six (6) VFDs for the 250 HP vertical centrifugal pumps shall be furnished and mounted by the Contractor. The specified motor is 250 HP, 332 FLA, 480V; the VFDs shall be oversized and rated for 300 HP, 398 FLA, 480V as required by this specification. The VFDs shall be provided as a packaged system with the vertical centrifugal pumps and the main pump control panel to ensure compatibility.

B. The Contractor shall furnish, install, terminate, and test all required conduit and wiring for power, controls, and field mounted devices.

C. Provide the hereinafter specified equipment as part of the systems called for in the Specifications and the Contract Drawings.

1.02. RELATED SECTIONS

A. Section 01300 – SUBMITTALS

B. Section 01640 - EQUIPMENT-GENERAL

C. Section 01660 – TESTING AND STARTUP

D. Section 11300 – PUMPING EQUIPMENT GENERAL

E. Section 11306 – VERTICAL CENTRIFUGAL PUMPS

G. Section 17095 – CUSTOM CONTROL PANELS AND INTEGRATION

1.03. REFERENCES

A. The latest revisions of the following standards and specifications are incorporated herein by reference and form a part of this Specification to the extent that sections or portions of section are applicable hereto.

1. National Electric Code (N.E.C.)

2. Underwriter's Laboratories, Inc. (U.L.) - U.L. 508.

3. National Electrical Manufacturers Association (NEMA)

   a. NEMA - 1C-1

   b. NEMA ICS 3.1

   c. NEMA 250

4. American National Standards Institute (ANSI)

5. Standards for Industrial Control (J.I.C.)

6. Institute for Electronic and Electrical Engineering (IEEE) - IEEE 519.

1.04. SYSTEM DESCRIPTION

A. Performance Requirements

1. Manufacturer shall provide performance affidavits for each drive or system of drives in accordance with Section 01640.

B. Harmonic Filters

1. Manufacturer shall provide harmonic filters integral to the VFD for each drive which shall reduce harmonic distortion below levels specified in IEEE STD. 519.

2. Manufacturer shall provide dedicated low-harmonic filters within the VFD enclosure. An LCL filter, line side converter and motor side inverter shall be provided.

3. Manufacturer shall submit design calculations with the VFD shop drawing submittal proving compliance with IEEE STD. 519. Contractor shall obtain from the plant's existing arc flash study for service and transformer data required for harmonic analysis.

4. The Contractor shall coordinate (with the Engineer and Owner) the location and installation of harmonic filters external to supplied VFDs, should they be required as determined by the manufacturer. The Contractor shall provide all interconnecting conduit and wiring between VFDs and these external harmonic filters.

1.05. SUBMITTALS

A. Submittals shall be made in accordance with Sections 01300, and 16010.

B. Submit performance affidavit and operation and maintenance manuals as per Section 01640.

C. Submit harmonic analysis (calculations) and electrical utility approval of proposed VFD installation.

D. Submit written description of sequence of operation for each set of VFDs.

E. Submit dimensional data for each VFD. Include as a minimum: height, width, depth, distance from bottom of enclosure to center line of disconnect handle, conduit openings, size and location of cooling vents.

F. Submit drawings showing interior enclosure layout and panel door layout.

G. Submit elementary diagrams and block diagrams for each VFD system. Indicate how/where remote equipment is wired to each VFD system.

H. Submit manufacturer's literature containing information needed to prove conformance with these Specifications.

I. Seismic considerations: the Building Code of the State of New York, latest edition (including amendments) shall be in effect. Submit shop drawings for all electrical supports and anchors that include seismic restraint calculations and details as required to meet earthquake design data indicated on the structural drawings. Calculations and details, if required, shall be designed and stamped by a New York registered professional engineer retained by the Contractor.

1.06. QUALIFICATIONS

A. Manufacturer - Company specializing in manufacturing the products specified in this Section with minimum three years documented experience.

B. The VFD manufacturer shall have service facilities within 100 miles of the site.

1.07. DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle equipment to site under provisions of Section 01600.

B. Deliver in 48-inch maximum width shipping splits, individually wrapped for protection and mounted on shipping skids.

C. Store in a clean dry space. Maintain factory wrapping or provide a heavy canvas or heavy plastic to protect units from dirt, water, debris, and traffic. The Contractor shall replace any equipment damaged during shipping, handling, or storage.

1.08. SPARE PARTS

A. The following spare parts shall be furnished for each size VFD provided.

1. Six (6) of each type of control fuse used.

2. Six (6) of each type of power fuse used.

3. One spare of each type of door mounted keypad.

4. One complete power semiconductor assembly (VFD) for each size supplied.

5. All other spare parts normally recommended.

1.09. WARRANTY

A. The VFD and all equipment provided by the VFD supplier shall be provided with a two-year warranty. The warranty period shall begin upon delivery to the site. The warranty shall cover all parts and labor necessary to repair equipment which is inoperable due to defects in material or workmanship.

PART 2 PRODUCTS

2.01. MANUFACTURERS

A. Whenever possible, all VFDs provided shall be by the same manufacturer.

1. Design Basis – Allen-Bradley PowerFlex 755TL low-harmonic, enclosed drive controllers.

2. Or approved equal.

B. All materials and equipment furnished shall be current products of manufacturers regularly engaged in the manufacturer of VFD and for which replacement parts are available.

2.02. PULSE-WIDTH MODULATED VARIABLE FREQUENCY DRIVE

A. General

1. The Contractor shall furnish and install the complete variable frequency drive (VFD) system(s) described in this specification and as shown on the Contract Drawings.

2. Drives shall be microprocessor controlled with digital display and programming/status key pad.

3. The VFDs shall be rated for the full horsepower and full load amperes and rpm of the equipment as indicated. Motor service factors shall be minimum 1.0, unless otherwise specified in respective equipment Sections. VFDs shall be specifically designed to provide continuous speed adjustment of three phase, inverter duty, NEMA design 'B' squirrel cage motors.

   The VFD applications shall be for the systems listed in Table 16480-1 at the end of this Section.

4. Complete configured VFD system shall be U.L. listed per U.L. 508.

5. Minimum efficiency shall be 95 percent at motor full load. Unit service factor shall be minimum 1.0.

6. All VFDs shall be provided by the pump manufacturer.

B. Construction

1. The VFDs shall be housed in NEMA 12, ventilated enclosures, as noted above. Provide replaceable, cleanable filters in enclosure cooling fan/vent openings. Each VFD enclosure shall also house other components, such as control power transformers, relays, circuit breakers, by-pass contactors, thermal overloads, and other devices when such are necessary to achieve conformance to the specified system.

2. The MAXIMUM dimensions of the VFD enclosure shall be 48" wide, 37" deep, 92" high as shown on the drawings.

3. An input circuit breaker or fusible disconnect switch shall be supplied for the VFD. The circuit breaker or fusible disconnect switch shall have an external operator with lockout. Interlocking provisions shall prevent unauthorized opening of the enclosure door while the handle is in the "on" position. A defeater shall be provided. When a bypass contactor/starter is used, provide separate disconnecting means for both the VFD and the bypass contactors.

4. The VFD shall be capable of converting 480 volt, 3 phase, 60 Hertz power to a fixed potential DC bus level. The DC voltage shall be inverted to an adjustable frequency pulse width modulated (PWM) sine coded output waveform. The drive shall utilize solid state full wave diodes and IGBT power transistors.

5. Manufacturer shall provide dedicated harmonic filters for each drive installed within the VFD enclosure. An LCL filter, line side converter and motor side inverter shall be provided.

6. The VFD shall be insensitive to the phase rotation of the AC line and shall not cause displacement power factor of less than 0.95 lagging under any speed or load condition.

7. The VFD shall have the following ratings:

   a. Minimum efficiency of 95 percent at rated load.

   b. Overload Rating

      1) Constant Torque - 150 percent rated current for 1 minute.

      2) Variable Torque - 110 percent rated current for 1 minute.

   c. Ambient operating temperature of 0 degrees C to 40 degrees C continuously, without derating.

   d. Operating humidity of 5 to 90 percent, non-condensing.

8. The following control features shall be provided standard on each VFD:

   a. Manual-Off-Auto Switch - When this switch is in the "Manual" position, the VFD shall start and stop using pushbuttons located on the VFD enclosure. When this switch is in the "Off" position, the VFD shall be off. When this switch is in the "Auto" position, the VFD shall start and stop via remote contacts from the Main Control Panel (MCP). VFDs shall be capable of both 3 and 4 wire control for remote starting and stopping.

b. Local-Remote Switch - When this switch is in the “Local” position, the speed of the VFD shall be controlled by a potentiometer on the VFD. When this switch is in the “Remote” position, the speed of the VFD shall be capable of being controlled by a remote 4-20mA signal from the MCP.

c. VFD/Pump Sequence of Operation:

1) When the VFD is in “Auto” and “Remote” operation, the VFD shall output an “In Remote” signal to the MCP.

2) Upon a pump start command, the VFD shall start the pump, and ramp up to speed. Speed control shall be as described above.

3) When the VFD receives a pump stop command, the VFD shall ramp the pump speed down to a stop.

4) The VFD shall monitor Motor Winding-temperature, Pump Thrust Bearing-temperature, Intermediate Shaft Bearing Over-temperature, Pump Vibration Switch, and Motor Vibration Switch. When receiving any of these inputs, the respective alarm pilot light shall be lit, the pump shall be stopped, and the common pump/VFD alarm shall be output. A reset pushbutton shall be provided on the door of the VFD to reset the alarm conditions.

5) Emergency Stop – upon activation of an emergency stop input, the pump shall be stopped immediately and inhibited from running until manually reset.

d. Unidirectional operation, programmable acceleration and deceleration, restart into spinning loads. Implementation of the programmable acceleration and deceleration ramping shall be achieved without the programming of devices external to the VFD. The manufacturer shall provide acceleration and deceleration ramp programming as requested by the Engineer during system startup.

e. Full time torque limit, adjustable. Reduces speed to shed load when over current conditions exists.

f. Programmable torque performance from 4 to 60 Hertz. Contractor shall coordinate with manufacturer of each motor controlled by a VFD. Program minimum VFD speed per motor manufacturer’s recommendations to avoid overheating the motor.

g. Integral or remote AC power line reactors or isolation transformers. See paragraph 1.04.B.

h. Frequency stability of 0.5 percent for 24 hours with voltage regulation of $\pm$2 percent of maximum rated output voltage.

i. Status indication for the following:

1) Power on.
2) Run.
3) Motor direction.
4) Overcurrent.

5) Overtemperature.
6) High and low phase loss.
7) Current limit.
8) Ground fault.
9) Pump fail.

j. Control power transformer (CPT) for 120 volt AC power for operator devices.

k. Motor slip dependent speed regulation.

l. Minimum one cycle logic power carry-over during loss of power.

m. Programmable automatic restart upon the return of power following a power outage.

n. Automatic restart after fault, minimum three attempts and shutdown with manual reset.

o. Critical frequency rejection or lockout.

p. Programmable preset speeds, minimum of three.

q. Local speed potentiometer and speed indication, configurable in either rpm, percent of full speed, or hertz.

r. Fault log for minimum of last three faults.

s. Isolated process instrument follower input signal of 4-20mA DC, grounded or ungrounded.

t. 4-20mA DC output proportional to 0 to 100 percent speed.

u. Provide auxiliary run output contacts for remote run indication. Run output contacts shall be wired to an interposing relay. The interposing relay shall be provided with a minimum of two normally open and two normally closed contacts, rated for 10 amps at 120 volts.

v. All wiring connections to the VFD shall be made on labeled terminal strips in accordance with Section 16161.

w. Common local and remote start/stop contacts, and protective automatic shutdown contacts/switches shall be used by the control circuits of both the VFD and the bypass contactor/starter, if required.

9. The following protective features shall be provided standard on each VFD:

a. AC input line current limiting fuses for short circuit fault protection of AC to DC converter sections.

b. Electronic over current trip for instantaneous or timed overload protection

c. Undervoltage and phase loss protection.

d. Over frequency protection.

e. Overtemperature protection.

f. Surge protection from AC line transients.

g. Electrical isolation between power and logic circuits.

h. Ground fault protection.

i. VFD enable terminals. Normally closed, field mounted protective devices, (such as auxiliary contacts on disconnect switches, emergency stop pushbuttons, high discharge pressure switch, low suction pressure switch, high motor temperature switches - see Contract Drawings and system specifications) shall be wired in series across the enable terminals.

j. Provide a minimum of three sets of programmable output contacts for remote alarm indication. Programmable VFD output contacts shall be wired to interposing relays. The interposing relays shall be provided with a minimum of two normally open and two normally closed contacts, rated for 10 amps at 120 volts.

k. LCD or LED diagnostic display.

l. Password protection for VFD programming.

10. The following VFD operating parameters shall be capable of being independently adjusted on the VFD:

a. Minimum speed - 4 to 40 hertz.

b. Maximum Speed - 40 to 90 hertz.

c. Acceleration Time - 2 to 300 seconds.

d. Deceleration Time - 2 to 300 seconds.

e. Low Frequency Boost - Up to 46 volts.

f. Volts per hertz.

g. Current limits up to 110 percent for variable torque VFDs, up to 150 percent for constant torque VFDs.

h. Starting torque up to 150 percent.

i. Programmable Constant Torque - Variable torque switching. Drives which require physical modifications to accomplish this are not acceptable.

11. The following, manufacturer installed options shall be furnished with the VFDs as specified:

    a. AC output contactors.

    b. Motor overcurrent relay on VFD and on bypass contactors/starters.

    c. Bypass contactors/starters when specified.

2.03. SYSTEM-SPECIFIC CONTROLS AND ALARMS

A. General

1. Field-mounted equipment (remote from the VFD enclosure) such as control panels, start/stop pushbuttons, potentiometers, auxiliary contacts on disconnect switches, etc., are shown on the Contract Drawings.

2. Provide the following inputs and outputs on each VFD.

    a. Pump start input.

    b. Pump running output.

    c. Common pump/VFD failure output.

    d. In Remote output.

    e. Pump speed analog input (4-20mA).

    f. Pump speed feedback analog output (4-20mA).

    g. Motor Winding High Temperature input.

    h. Pump Thrust Bearing High Temperature input.

    i. Intermediate Shaft Bearing High Temperature input.

    j. Pump High Vibration Switch input.

    k. Motor High Vibration Switch input.

    l. Motor Winding High Temperature output.

    m. Pump Thrust Bearing High Temperature output.

    n. Intermediate Shaft Bearing High Temperature output.

    o. Pump High Vibration Switch output.

    p. Motor High Vibration Switch output.

    q. Motor Amperage analog output (4-20mA).

3. The following controls/indicators shall be mounted on the door of each VFD.

   a. Hand-Off-Automatic switch.

   b. Pump Running pilot light (green).

   c. Pump Stopped pilot light (red).

   d. Pump/VFD Failure pilot light (yellow).

   e. Local/Remote speed selector switch.

   f. Speed potentiometer.

   g. Motor Winding High Temperature pilot light (white).

   h. Pump Thrust Bearing High Temperature pilot light (white).

   i. Intermediate Shaft Bearing High Temperature pilot light (white).

   j. Pump High Vibration pilot light (white).

   k. Motor High Vibration pilot light (white).

   l. High Motor Amperage Alarm (white).

   m. No Flow Alarm (white)*

   n. High Discharge Pressure Alarm (white)

   o. Reset pushbutton.

* No Flow Alarm shall be triggered by the VFD's internal motor no load sensing.

PART 3 EXECUTION

3.01. GENERAL

A. Supply the VFD(s) with the controls specified herein and shown on the Contract Drawings.

B. The Contractor shall arrange for the VFD manufacturer or supplier to furnish the services of a qualified representative to check and supervise the installation and the preliminary testing for not less than two days, to supervise final testing for not less than two days, and to instruct the owner's operator(s) in proper operation at the time of final acceptance for not less than two days. The representative shall also provide an additional two days of training during the warrant period at a date requested by the Owner. A day is defined as eight hours. All days are actual on-site time. Travel and subsistence is the responsibility of the manufacturer's/supplier's representative.

C. The Owner's training shall be video recorded (DVD) with a copy left for the Owner. A full complete session may be made for one system that is typical for all systems. Any specifics which may vary for individual systems shall be covered separately on the video.

D. Three copies of a complete operations and maintenance manual shall be submitted to the engineer per Section 01640.

E. Field wiring shall be per manufacturers' recommendations.

3.02. FIELD TESTING

A. Field testing shall be in accordance with Section 01640 and as specified herein.

B. The Contractor shall coordinate VFD testing such that both the Owner and the Engineer are available to witness the testing. The Contractor shall contact both the Engineer and the Owner two weeks prior to the proposed test date. The representative of the equipment run by the VFD (pumps, fans) shall be present during VFD testing.

C. Shop drawing shall be available during testing.

D. A copy of the operations and maintenance manual shall be available during testing.

E. The Contractor shall verify that all systems have been electrically connected and that equipment is ready for operation.

F. Testing/Verification/Documentation

1. General explanation of each system shall be made.

2. Contractor/manufacturer/supplier shall have a written tabulation of all adjustable/settable parameters as set from the factory. In a separate column, all of the actual field adjusted/set values shall be shown.

3. Demonstrate the following and show how each is set/changed.

a. Manual operation both local/remote.

b. Minimum or default speed to be set for specific equipment operation.

c. Maximum set speed.

d. Adjust acceleration/deceleration times for proper equipment operation.

e. Restart after power outage.

f. Demonstrate starting into rotating motor (shut off circuit breaker and turn right back on).

g. Overcurrent/overvoltage (simulate with test equipment).

h. Overtemperature/low voltage (simulate with test equipment).

i. Phase Loss - Remove on fuse on supply voltage.

j. Auto operation (from input current or voltage signal).

k. Output contacts for alarm/run/status, etc., operate as required, simulate with test lights.

l. Units with bypass contactors/starters shall be operated in “bypass mode” demonstrating operation including shutdowns from remote devices.

G. Unit(s) shall operate without unusual or undue noises or vibrations.

TABLE 16480-1

VARIABLE FREQUENCY DRIVE APPLICATIONS

Units	HP (Each)	FLA (Each)	Type*	NEMA Enclosure	Bypass	Input Voltage
Main Sewage Pumps (Typical For Pump Nos. 1 through 6)	300	398	5	NEMA 12 with Fan Filter	No	480V, 3 phase

*Type Drive:
1 Variable torque centrifugal pumping application.
2 Variable torque drive and conveyor application.
3 Variable torque air fan application.
4 Constant torque air pumping application.
5 Constant torque pumping application.
6 Constant torque drive application.

END OF SECTION

ATTACHMENT 2

SECTION 17095

CUSTOM CONTROL PANELS AND INTEGRATION

PART 1 GENERAL

1.01 DESCRIPTION

A. It is the intent that the Contractor will work with a system integrator to successfully fulfill the requirements herein and shown on the Contract Drawings to provide a complete and operable control system (fully integrated) with the intent specified and shown on the Contract Drawings.

1. Note, this section is part of the General Construction Contract.

B. System integrator referenced throughout this specification is referring to the panel provider.

C. Main pump control panel (MPCP) specified herein is to be provided as a packaged system with the variable frequency drives and vertical centrifugal pumps.

1.02 SECTION INCLUDES

A. Main Pump Control Panel (MPCP)

1. Fully redundant control system

B. Bubbler Wet well Level Detection Systems

C. Wet well Float Switch

D. Software

E. Integration Services, Programming, and Screen Development

F. Commissioning, Startup Services, and Training

G. I/O Table

H. Pressure Transmitter Main Discharge Header

1.03 REFERENCE STANDARDS

A. All control systems as specified herein shall be provided in accordance with the latest additions of the NEC and IEC.

B. All wiring shall be in complete conformance with the National Electrical Code, State, local and NEMA electrical standards. All incoming and outgoing wires shall be connected to numbered terminal blocks and all wiring neatly tied and fastened to chassis as required.

C. All control panels shall be UL 508A listed or UL 698A listed whichever may be applicable. The UL 508A/698A “sticker” shall be clearly displayed in the appropriate location within the panel. Third party substitutions of UL 508A/698A listed equipment shall be strictly prohibited.

D. All equipment and installations shall satisfy applicable Federal, State, and local codes.

E. Furnish products listed and classified by Underwriters Laboratories (UL), CSA, or FM approval as suitable for purpose specified and indicated.

F. Auxiliary and accessory devices necessary for system operation or performance, such as transducers, relays, signal amplifiers, intrinsic safety barriers, signal isolators, software, and drivers to interface with existing equipment or equipment provided by others under other Sections of these specifications, shall be included whether they are shown on the Drawings or not.

G. Use the equipment, instrument, and loop numbering scheme shown on the Drawings and specifications in the development of the submittals. Do not deviate from or modify the numbering scheme without the Engineer's approval.

1.04 RELATED SECTIONS

A. Contractor to coordinate sequence of operation with the Engineer and Owner.

1. Contractor to include two (2) 4-hour meetings with the Engineer and Owner to discuss/finalize sequence of operation in which control system is to be programmed for.

a. Meetings to take place at the project site.

B. Section 11306 – Vertical Centrifugal Pumps

C. Section 16480 – Variable Frequency Drives

1.05 SUBMITTALS

A. The Systems Integrator shall for review, provide to the contractor, for submission to the Engineer, three (3) hardcopy sets and one (1) electronic copy (USB) of the following documentation:

1. Written Sequence of Control System Operation (coordinate as required with the Engineer and Owner).

2. Electrical and Mechanical Schematic Drawings.

3. Bill of Materials.

4. Vendor Data Sheets.

5. System Warranty (see below).

6. System Integrator Qualifications (see below).

B. The Engineer shall have the right to witness the factory tests and inspect any equipment to be furnished under this Section prior to their shipment from place of manufacture.

C. The Contractor shall make all arrangements and pay for all travel and expenses for up to three people from the Owner and Owner’s Engineer to witness the shop tests.

1.06 OPERATIONS AND MAINTENANCE DOCUMENTATION

A. The Systems Integrator shall provide to the contractor, three (3) hardcopy sets and one (1) electronic copy (USB) of the following Operations and Maintenance documentation; all documentation shall be neatly bound in 3-ring binders.

1. Final Written sequence of control system operation (coordinate as required with the Engineer and Owner).

2. As-Installed Electrical and Mechanical Schematic Drawings.

3. Bill of Materials.

4. Vendor Operation, Maintenance and troubleshooting documentation.

5. PLC and OIU program printouts.

6. Back-up Copies of As-installed PLC and OIU programs on CD and USB thumb drive.

1.07 WARRANTY

A. The Systems Integrator shall provide with the above submittals, a written parts warranty against system failure for twelve (12) months from system startup, not to exceed eighteen (18) months from date of shipment from their factory. This warranty period will, except for human negligence or acts of nature such as lightning, floods, etc., provide for repair or replacement of any defective or failed components, at the project site, and at no cost to others.

1.08 QUALITY ASSURANCE

A. The Equipment, controls and accessories covered in this specification section constitute a completely integrated system, designed, constructed, programmed, and tested by one Systems Integrator, accountable for its operation and performance. The Systems Integrator shall be selected based on their ability to Engineer, design and manufacture systems of the type herein specified.

B. The Contractor shall submit to the Engineer the name of the System Integrator to whom they propose to award the work. No Systems Integrator will be approved by the Engineer who cannot furnish satisfactory proof of at least five (5) successful installations which in the judgment of the Engineer are of equal or greater complexity to that described herein.

C. The Systems Integrator shall be a reputable firm that has been in the business of providing automated control systems specifically for the water and wastewater treatment industry for a minimum of ten (10) years. Systems Integrators with less than ten (10) years of experience will not be accepted.

D. The Systems Integrator shall have as a minimum, five (5) full time employees who are experienced in routine and emergency services of the equipment herein specified. The Systems Integrator shall as a minimum provide two (2) direct cell phone numbers in which service personnel can be reached 24 hours, 7 days a week.

E. The System Integrator shall be U.L. approved for manufacturing systems in compliance with UL 508A and/or UL 698A whichever may be applicable. Each assembly and subassembly of the system shall be listed and labeled as U.L. approved. Systems Integrators who outsource panel fabrication services for the purpose of providing UL labeling will not be accepted.

F. For serviceability reasons the system integrator's service facility shall be located within 100 miles of the project site. In addition, they must possess a factory trained, service staff experienced in routine and emergency service of the type of equipment herein specified who are located within a maximum of two (2) hours of the project site.

G. Control panels shall be fabricated with the following features as a minimum:

1. All sub panel wiring shall be run in plastic wire duct sized with 50% spare space, AC and DC wiring shall be run in separate wire ducts.

2. All power supplies shall be sized for an additional 50% spare ampacity over expected load. Each power supply shall include an AC input fuse and independent output fuses for each device requiring DC power.

3. All field terminations shall be made on compression type terminal blocks labeled according to wire number, separate terminal strips shall be provided for AC and DC signals. A minimum of 20% spare terminals shall be provided.

4. Wiring to door mounted components shall be neatly bundled wiring harnesses protected by plastic spiral wire wrap when crossing door hinge. Wiring harnesses shall have adequate stress loops and be fastened at both sides of hinge crossing.

5. All wiring shall be wire numbered at both ends with plastic Brady type labels.

6. All nameplates shall be engraved on lamacoid material providing black lettering on a white background. Lettering shall be no smaller than 1/8 of an inch in height.

7. Twenty percent spare mounting space is required for future modifications.

H. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.

1.09 ENVIRONMENTAL CONTROL OF PANELS

A. Panels shall be provided with louvers, sun shields, heat sinks, forced air ventilation, or air conditioning units as required to prevent temperature buildup inside of panel. Internal temperature of all panels shall be regulated to a range of 45 Deg F to 104 Deg F under all conditions. Under no circumstances shall panel cooling or heating equipment compromise the NEMA rating of the panel.

B. Except for panels mounted with their backs directly adjacent to a wall, louvers shall be in the rear of the panels, top and bottom, and shall be stamped sheet metal construction.

C. For panels mounted with their backs directly adjacent to a wall, louvers shall be on the sides.

D. Forced air ventilation fans, where used, shall provide a positive internal pressure within the panel, and shall be provided with washable or replaceable filters. Fan motors shall operate on 120-volt, 60-Hz power.

E. For panels with internal heat that cannot be adequately dissipated with natural convection and heat sinks, or forced air ventilation, an air conditioner shall be provided.

F. Outdoor enclosures and enclosures located in unheated areas indoors or in areas subject to humidity and moisture shall be provided with an integral heater, fan, and adjustable thermostat to reduce condensation and maintain the minimum internal panel temperature. Mount unit near bottom of the enclosure with discharge away from heat-sensitive equipment. Heater shall be 120V, 60Hz, and sized per manufacturer/system integrators recommendations.

1.10 DESCRIPTION OF OPERATION

A. Overview

1. The System Integrator shall supply for contractor's installation the control panel specified herein. The control panel shall through communications and/or hardwired status and alarm signals monitor/control the operations of process equipment, vendor supplied equipment, and all equipment/devices pertinent to the operations of the pump station.

2. The Main Pump Control Panel shall provide local alarm monitoring by door mounted common alarm lights, momentary pushbutton (for alarm acknowledgement, reset, and horn silence) alarm horn and Operator Interface Unit (OIU).

3. Refer to the Contract Drawings for intent and all equipment/components that control panel are to interface with.

4. Provide all hardware/software, programming, and services as herein specified to provide one (1) completely factory assembled and programmed main pump control panel.

5. System integration, programming, screen development, and startup services are to be provided as part of this contract/specification.

6. Contractor and Systems Integrator to provide two (2) 4-hour meetings with the Owner/Engineer at the project site to discuss control panel programming, sequence of operation, and overall intent to ensure specified control panel is programmed properly.

    a. Coordinate meeting with Owner/Engineer two weeks in advance and prior to submittal documentation submission.

7. Pressure Transmitter Main Discharge Header – MPCP to monitor pressures transmitter and display pressure on HMI screen.

B. Sequence of Operations

1. The main pump control panel to be PLC based and completely factory programmed as required to provide the following control strategies. All control strategies to be fully coordinated with the Owner and Engineer. Refer to above required meetings to review sequence and finalize programming requirements.

a. Wet well Level Monitoring (typical of two wet wells):

1) Primary wetwell level detection to be by means of a bubbler system. Since the wetwell is dual chamber, there will be two (2) independent bubbler systems described below (one per chamber). In addition to the primary wetwell level detection systems there will be a high level float in each chamber of the wet well for alarming purposes.

a) Bubbler System – wet well level shall be measured by a pressure-to-current (P/I) transmitter located in the MPCP. Major system components shall consist of the P/I transmitter, low pressure air supply, and two air-lines extending into and terminating near the bottom of each wetwell. An air selector valve shall be provided to allow either of the two wetwell levels to be monitored. The air supply shall continuously purge the selected airline. P/I transmitter outputs shall be 4-20mA DC proportional to wetwell level and shall be connected to the main pump control panel PLC through an analog input. The MPCP shall utilize this signal for control, monitoring, trending, and alarming. Ancillary air bubbler system components shall include, but not be limited to, the following: two (2) air pumps, one (1) air flow indicator, air pump selector switch, wetwell airline selector switch, 1/4” & 1/2" air piping, and two (2) 3” PVC air bells for installation within each chamber of the wet well.

b) High Level Float – A single high level float switch to be installed above wetwell grating for alarming purposes. As level rises to the high level float a signal is to be relayed to the MPCP and an alarm process initiated.

b. Level Control Mode Selection:

1) A level control mode selection (Primary Bubbler / auto / Secondary Bubbler) switch to be provided on the MPCP door. Each mode to operate as follows:

a) Primary Bubbler – MPCP system logic provides constant level control of wetwell level by use of associated main pump VFDs as described below. Control mode remains in primary bubbler level mode regardless of wet well level readings.

b) Auto – MPCP system logic provides constant level control of the wetwell level by use of associated main pump VFDs as described below. The primary bubbler system is utilized for level control of the pumping system unless the below scenario occurs. The MPCP is to decipher wetwell level readings from both the primary and the secondary bubbler systems. In the event the primary and secondary bubbler system level readings differentiate by 12 inches or more for a period of at least 20 seconds, the MPCP is to initiate an alarm process and automatically default to the higher bubbler system level reading for control of the main pumping system (MPCP to include bubbler comparison logic). Level differential and time delay settings to be fully adjustable via the MPCP door mounted operator interface unit.

c) Secondary Bubbler – MPCP system logic provides constant level control of wetwell level by use of associated main pump VFDs as described below. Control mode remains in secondary bubbler level mode regardless of wet well level readings.

c. Wet well Level Control (Constant Level):

1) As level in the wetwell rises above an adjustable Lead Pump “ON” setpoint, system logic shall start the lead pump by use of an associated VFD. The VFD shall ramp up in speed as required to control the wetwell level to the desired level setpoint. The wetwell level setpoint shall be fully adjustable via the MPCP door mounted Operator Interface Unit (OIU).

2) Should wet well level continue to increase while the lead pump is operating, system logic shall ramp the lead pump VFD speed up to maintain the desired level setpoint. Should influent flow (wetwell level) exceed the capacity of the lead pump, system logic shall automatically stage on the first lag pump after the lead pump has been operating at its maximum speed for a programmable time delay. Once running, the first lag pump VFD shall ramp up in speed to match that of the lead pump. System logic shall then control the speed of both pumps simultaneously as required to control wetwell level to the desired level setpoint. The lead pump maximum speed and time delay setpoints for staging on the first lag pump shall be fully adjustable via the MPCP door mounted OIU.

3) Should the wet well level decrease while both pumps are operating, system logic shall ramp both pump VFD speeds down simultaneously as required to control the wetwell level to the desired setpoint. Should the wetwell level decrease to a point that both pumps are operating at their minimum speeds for a programmable time delay system logic shall shutdown the first lag pump. The lead pump speed shall then be controlled as required to control the wetwell level to the desired setpoint. The minimum speed and time delay setpoints for staging off the first lag pump shall be fully adjustable via the MPCP door mounted OIU.

4) The lead pump shall continue to operate, controlling the wetwell level to the desired setpoint, should wetwell flow decrease to a point that system logic ramps the lead pump VFD down to its minimum speed (programmed in the VFD) and wetwell level continues to drop below the Lead Pump “OFF” setpoint, system logic shall shut down the lead pump. The lead pump shall remain off until wetwell level once again rises above the Lead Pump “ON” setpoint initiating the next pump down cycle.

5) Should influent flow exceed the capacity of the lead and first lag pumps, system logic shall automatically stage on the second lag pump after the initial two pumps have been operating at maximum speed for a programmable time delay. Once running, the second lag pump VFD shall ramp up in speed to match that of the initial two pumps. System logic shall then control the speed of all three pumps simultaneously as required to control wetwell level to the desired level setpoint. The lead/lag pumps maximum speed and time delay setpoints for staging on the second lag pump shall be fully adjustable via the MPCP door mounted OIU.

6) Should the wet well flow decrease while all three pumps are operating, system logic shall ramp all pump VFD speeds down simultaneously as required to control the wetwell level to the desired setpoint. Should the flow decrease to a point that all three pumps are operating at their minimum speeds for a programmable time delay system logic shall shutdown the second lag pump. The initial two pump speeds shall then be controlled as required to control the wetwell level to the desired setpoint as described above. The minimum speed and time delay setpoints for staging off the second lag pump shall be fully adjustable via the MPCP door mounted OIU.

7) Like that described above, if influent flow exceeds the capacity of the initial three pumps, system logic shall automatically stage on the third lag pump and then the fourth lag pump as wetwell level continues to rise. System logic shall then shutdown the pumps in similar fashion described above as wetwell level falls and pumps have been operating at their minimum speeds for a programable time. Note, five (5) pumps maximum can be called to run at the same time with the sixth pump being a standby. Minimum speeds, maximum speeds, time delays, etc. are to all be user adjustable at the MPCP door mounted OIU.

8) Operator adjustable high and low level alarm setpoints shall be provided for alarm annunciation of an abnormally high or low wetwell level condition. Alarm setpoints and associated time delays for high and low level alarms shall be fully adjustable via the MPCP door mounted OIU. All level alarms shall be annunciated on the MPCP door mounted OIU, common alarm light and alarm horn.

9) Operator adjustable pump maximum and minimum speed setpoints shall be full adjustable via the MPCP door mounted OIU.

d. Pump Alternation and Sequence Selection:

1) Pump alternation and sequence selection shall be provided for the main pumps thru the door mounted OIU on the MPCP.

a) Manual Selection – A manual sequence table will be provided on the door mounted OIU. Operator to have the ability to choose which pump becomes the lead pump and the following lag pump sequence.

b) Selection Auto – Lead Pump determined by system logic, alternation between pumps on each pump down cycle, lead pump runtime (adjustable via OIU), or upon lead pump not being available for operation.

e. Pump Availability:

1) A pump shall be considered unavailable for operation when any of the following conditions occur:

a) Respective pump mode of operation selector switch is in the “OFF” position.

b) Respective pump fails to start.

c) Respective pump VFD failure.

d) Wet well low-level condition.

e) Pump high-vibration condition (top of pump bearing frame).

f) Motor high-vibration condition.

g) Motor winding high-temperature condition.

h) Pump high-temperature condition (pump thrust bearing).

i) Pump high-temperature condition (pump intermediate shaft bearing).

f. Additional System Monitoring:

1) In addition to monitoring and controlling the main pumps based upon wetwell level it is anticipated that the MPCP will monitor the following systems:

a) Ventilation system.

b) Space temperature alarms.

c) Refer to Contract Drawings and I/O Table for additional information and I/O that is to be incorporated at the MPCP.

g. Alarm Monitoring:

1) All system alarms shall be annunciated locally via the panel mounted OIU, common alarm pilot light, and alarm horn. Alarm acknowledgement, reset, and horn silence of alarms shall be provided by an MPCP door mounted pushbutton.

h. Future SCADA Connectivity:

1) The MPCP is to be configured with a fiber optic cabling output connection that is extended into the adjacent Bar Screen Control Building for connection into a future SCADA system. Refer to Contract Drawings for additional information.

PART 2 PRODUCTS

2.01 MAIN PUMP CONTROL PANEL (MPCP)

A. The control panel shall be housed in NEMA 12 floor mount enclosure constructed of 12-gauge steel with white polyester powder paint inside, ANSI 61 gray polyester powder paint outside over phosphatized surfaces. The enclosure shall be 72" high by 72" wide by 20" deep. Dimensions provided are maximum. Contractor may utilize smaller enclosure if approved by the Engineer to house the hardware specified and meet the intent of the specification herein.

1. Provide enclosure with 12" floor stand kit.

2. Provide enclosure as double door with 3-point latch system.

3. Provide doors with gasket system.

4. The enclosure to be Hoffman A727220ULPG or approved equal.

B. Control panel shall be UL 508A listed or UL 698A listed whichever is applicable. The UL “sticker” shall be clearly displayed in the appropriate location within the panel. Third party substitutions of UL 508A/698A listed equipment shall be strictly prohibited.

C. Panel Input power shall be 120VAC, 1 Phase, 60Hz. Provide a sufficiently sized main circuit breaker disconnecting means. Interlock main circuit breaker disconnect with the control panel door handle.

D. Refer to Electrical Drawings for additional information/requirements.

E. A 120VAC single phase surge protector shall be provided for the incoming 120VAC supply. The surge protector shall be designed to protect electrical and electronic equipment against transients caused by lightning, induction, load switching, EMP and other sources. Line to neutral, line to ground and neutral to ground protection shall be provided. The surge protector shall have a protection level of 1kV and a maximum discharge current of 140 kA as a minimum. The surge protector shall have a remote signaling device for fault indication to the PLC. The AC surge protector shall be CITEL model DS72RS-120 or approved equal.

F. All communication cabling that exits the building shall have surge protection provided.

G. Short circuit protection of 120VAC input and UPS control power shall be provided by a miniature branch rated circuit breaker with an interruptive capacity of 10K amperes at 240VAC. Circuit Breakers shall be Allen-Bradley 1489 series or approved equal.

H. One print pocket shall be provided on the control panel door. One complete set of electrical control drawings shall be provided in the pocket.

I. Separate circuit breaker disconnects for each load supplied from the control panel shall be provided. All branch circuits shall be short circuit protected.

J. The control panel shall be provided with an Uninterruptible Power Supply (UPS) for protection against power disturbances, noise, and brownouts. Refer to article below for UPS specifications.

K. The main pump control panel shall be provided with a fully redundant Programmable Logic Controller (PLC) system. The PLCs shall be factory programmed, tested, and debugged to meet all the requirements of the applicable process. PLC system to be ControlLogix platform as manufactured by Allen Bradley or approved equal. Refer to article below for additional PLC specifications/requirements.

1. MPCP to be provided with a fully redundant control system. Main pump control panel to be provided with two (2) PLCs that operate in tandem/parallel. In the event one PLC system fails the MPCP shall not miss a beat and automatically switch to the redundant PLC system (hot standby configuration). MPCP to be provided with all required CPUs and associated redundancy modules, including but not limited to the following; redundant Ethernet modules, redundant I/O modules, redundant power supplies, redundant PLCs, and completely redundant rack.

L. The control panel shall be provided with a door mounted 15" Operator Interface Unit (OIU) for system monitoring, setpoint entry/review and alarm annunciation. Communications between the OIU and PLC shall be Ethernet. The OIU shall be color touchscreen. Refer to article below for OIU specifications.

M. The control panel shall be provided with a fully managed industrial Ethernet switch/media converter for network communications and programming. Additional Ethernet ports shall be available for system programming, connectivity to future Local Area Network (LAN), and connection to future Ethernet devices. Refer to article below for fully managed Ethernet switch specifications.

1. To clarify, the communication link between the MPCP and existing Bar Screen Control Building is to be by fiber optic cabling. Control panel to be provided with necessary hardware/devices to terminate fiber optic cable and convert to copper for use within the specified control system. Refer to the contract drawings for additional information.

N. Control panel shall be provided with a DC power supply: a 24V direct current power supply shall be provided to power the PLC, OIU, I/O, and all ancillary equipment. The power supply shall have an operational input range of 85 to 132VAC and shall have a minimum rated output of 24 to 28VDC/240 watts. Power supply shall be PULS QS10.241 or approved equal.

O. The control panel shall provide visual alarm annunciation via common alarm pilot light and OIU alarm screen. Pilot light shall be 30mm, industrial grade, push-to-test type, Allen-Bradley 800T series or approved equal.

P. The control panel shall provide audible alarm annunciation via alarm horn. Alarm horn shall provide a typical sound pressure of 95 + 5 dB(A) at 30VDC, at 24 inches and shall have a built-in volume control providing variable attenuation up to 20 dB(A). The alarm horn shall be Floyd Bell model MC-V09-530-Q or approved equal.

Q. A momentary pushbutton shall be provided for alarm acknowledgment/reset and alarm horn silence, pushbutton shall be 30mm industrial grade, Allen-Bradley 800T series or approved equal.

R. Control panel shall have a single tube, LED light fixture, 10 Watt in size, mounted internally to the ceiling of the panel. Light fixture shall be switched and shall be complete with the lamp.

S. Control panel shall have two (2) specification grade duplex convenience receptacles with ground fault interrupter, mounted internally within a stamped steel device box with appropriate cover. Convenience receptacles shall not be powered from a UPS and shall be protected by a dedicated fuse or circuit breaker. One receptacle to be utilized to provide power to the bubbler system air compressors.

T. AC power fuses shall be provided as required for over current protection of individual AC powered panel components. Single circuit fusible terminal blocks with neon blown fuse indicators suitable for use with ¼" x 1 ¼" glass fuses shall be provided for each circuit requiring fuse protection. Fusible terminal strips shall have a working voltage rating of 100 to 300VAC, and have a current rating of 12 Amps, fuse blocks shall be Allen-Bradley model 1492-H4 or approved equal.

U. DC power fuses shall be provided as required for over current protection of individual DC powered panel components. Single circuit fusible terminal blocks with LED blown fuse indicators suitable for use with ¼" x 1 ¼" glass fuses shall be provided for each circuit requiring fuse protection. Fusible terminal strips shall have a working voltage rating of 10 to 57V AC/DC, and have a current rating of 12 Amps, fuse blocks shall be Allen-Bradley model 1492-H5 or approved equal.

V. Interposing and control relays shall be provided as required. They shall be of industrial grade, plug-in socket type, and shall have 24VDC or 120VAC coils and 2PDT or 4PDT form C relays as required. All relay contacts shall be silver nickel plated, 2PDT relay contacts shall be rated for 10A at 300VAC and 4PDT relay contacts shall be rated for 7A at 300VAC. All relays shall be provided with a standard ON/OFF flag indicator, mounting base and retainer clip. Control relays shall be Allen-Bradley series 700-HC or approved equal.

W. Compression type terminal blocks shall be provided for all field connections, wiring field equipment directly to PLC I/O bases or other panel components is not acceptable. Terminal blocks shall have the following electrical ratings as a minimum:

1. Two Level Terminal Blocks

    a. Rated Voltage: 300V AC/DC

    b. Rated Current: 20 Amp

    c. Wire Size Range: 30-12 AWG

2. Three Level Terminal Blocks

    a. Rated Voltage: 300V AC/DC

    c. Rated Current: 10 Amp

    c. Wire Size Range: 26-14 AWG

3. Terminal blocks shall be Allen-Bradley series 1492 or approved equal.

X. The control panel to be provided with door mounted Elapsed Time Meters (ETMs) for accumulating the pump operational runtimes. The ETMs shall be 24VDC powered and have a six digit counter indicating accumulated runtime to 1/10th of an hour. Typical of six (6) pumps.

Y. The control panel shall be completely factory assembled, wired, configured, and tested prior to being shipped to the project site.

1. The Engineer shall have the right to witness the factory tests and inspect any equipment to be furnished under this Section prior to their shipment from place of manufacture.

2. The Contractor shall make all arrangements and pay for all travel and expenses for up to three people from the Owner and Owner's Engineer to witness the shop tests.

Z. Main pump control panel to be provided with a 6-pair fiber optic patch panel within a NEMA 1 enclosure. Patch panel to accept incoming fiber optic cabling. Fiber optic patch panel enclosure to be item # FE-WM12PP as manufactured by L-com or approved equal. Fiber optic patch panel to be item # FSP-LCD6-BR as manufactured by L-com or approved equal.

AA. The MPCP shall be provided with intrinsically safe barrier(s) for the wetwell float switch inputs. All Intrinsically safe wiring shall be separated from other wiring by a distance of at least 2 inches, secured from conductors and cables of non-intrinsically safe circuits. Physical barriers shall be installed where required to prevent intrinsically safe circuits from coming in contact with non-intrinsically safe circuitry.

AB. The MPCP shall be provided with an aneroid bellows for terminating the bubbler system vent tubes, protecting the equipment, hardware, and transmitter from damage due to moisture.

AC. The MPCP shall be provided with necessary monitoring relays to monitor motor/pump high temperature and vibrations switches. Close coordination with motor/pump equipment manufacturer required.

AD. System to include modbus mapping capability. Coordinate final requirements with the Owner.

2.02 WET WELL FLOAT SWITCH

A. Float switch shall be of the direct acting type, containing a single pole non-mercury switch, which actuates when the longitudinal axis of the float is horizontal, and deactivates when the liquid level falls 1" below the actuation elevation.

B. Each float shall be housed in a chemical resistant polypropylene casing with a firmly bonded electrical cable protruding. One end of the cable shall be permanently connected to the enclosed switch with the entire assembly encapsulated to form a completely watertight and impact resistant unit, provide enough cable length as required to reach the control panel as indicated on the Contract Drawings.

C. Float switches shall be suitable for low-current operation compatible with intrinsically safe barriers and/or PLC inputs.

D. A coated steel anchor assembly with stainless steel chain and float clamps shall be provided for installing the float switch as indicated on the Contract Drawings.

E. Float switches shall be SJE Rhombus Milli-Amp-Master or equal. Typical of one (1) float switch required. Refer to the Contract Drawings for additional information.

2.03 BUBBLER SYSTEM

A. Contractor to provide a complete air bubbler system for monitoring levels of both chambers of the wetwell independently. The air bubbler(s) and all associated appurtenances shall be installed internal to MPCP.

1. Provide adequate vibration isolation within main pump control panel.

2. Intent is to have a compact air compressor system internal to the MPCP.

B. Wet well level shall be measured by a pressure-to-current (P/I) transmitter located in the air bubbler panel (part of MPCP). Major system components shall consist of the P/I transmitter, low pressure air supply, and two air-lines extending into and terminating near the bottom of each wetwell. An air selector valve shall be provided to allow either of the two wetwell levels to be monitored as well as monitor both wetwell levels at the same time. The air supply shall continuously purge the selected airline. P/I transmitter outputs shall be 4-20mA DC proportional to wetwell level and shall be connected to the main pump control panel PLC through an analog input. The MPCP shall utilize this signal for control, monitoring, trending, and alarming.

1. Refer to Contract Drawings for dimensions/depth of wetwell. Contractor responsible for providing a system which monitors level over the entire range (empty - full). Typical of both wet well chambers.

C. Ancillary air bubbler system components shall include, but not be limited to, the following:

1. Two (2) vibrating reed, industrial rated air compressors shall deliver free air at approximately 5 psi at a pressure not to exceed 7 psi. Liquid level control systems utilizing air compressors which deliver greater quantities of air at higher pressures and require pressure reducing valves, air storage reservoirs, and other maintenance nuisance items are not acceptable.

a. Air compressors shall be rated for use on a 120-volt, single-phase, 60 hertz power supply.

b. Provide with back check valve accessory and discharge air filter accessory.

c. Provide with reservoir/pressure tank as required.

d. Provide shelf within MPCP for installation of air compressors.

2. Pressure to current transmitters to be NOSHOCK 100-15-2-1-2-7 or approved equal.

3. Air flow indicators, Dwyer model RMA-5-SSV or approved equal.

a. Air flow indication to be displayed on control panel door.

4. Air compressor selector switch.

5. Wet well airline selector switch, Parker XM40NBG553A or approved equal.

6. Purge valve, isolation valve, check valve, and relief valve as required.

7. Air piping from MPCP to each chamber of wet well.

a. Utilize 1/4" tubing and 1/2" schedule 80 PVC as indicated below.

8. Two (2) 3” PVC air bells for installation within each chamber of the wet well.

    a. Air bells to be shipped loose for Contractor installation within the field.

D. Contractor to provide 1/4” air piping (polyethylene tube) from MPCP internal compressors and transition to 1/2" schedule 80 PVC rigid pipe outside the control panel. Provide fittings to transition from 1/4" air piping to 1/2" PVC pipe. The 1/2" schedule 80 PVC pipe is to then be routed to each of the wet well chambers. All tubing/piping to be sloped towards wet well chambers to allow condensate drainage and tees shall be provided at all changes in direction. All wet well brackets, hardware and supports shall be 316 stainless steel. Contractor shall confirm air piping diameter with air bubbler system requirements. Refer to the contract drawings for additional information.

E. Contractor to provide air bell within each wet well chamber. Air bell to be comprised of 3-foot section of 3” schedule 80 PVC pipe. Provide necessary fittings to reduce/connect 1/2" PVC air pipe to the 3" air bell. Contractor to support/attach air bell to wet well as well as support the 1/2" air piping. Utilize pipe standoff supports within the wet well for support/anchor. Refer to contract drawings for additional information.

1. Air bell to not be supported by 1/2" air pipe. Must be independently supported to wet well.

2. Refer to Contract Drawings for dimensions/depth of wet well. Contractor responsible for providing a system which monitors level over the entire range (empty - full). Provide suitably sized air bell. Typical of both wet well chambers.

F. Contractor to provide all necessary tubing, piping, valves, fittings, connectors, elbows, etc. to place in operation a complete and operable bubbler system for wet well level monitoring (typical of each chamber of wet well.

2.04 UNINTERRUPTIBLE POWER SUPPLIES (UPS)

A. AC Input Parameters

1. Surge Protection: 570J

2. Voltage Range: 84VAC - 140VAC (+/- 10VAC)

3. Frequency Range: 55-64 Hz. (+/- .1 Hz)

4. Input Power Cord: 6 ft. attached, w/NEMA 5-15 P

B. AC Output Parameters

1. Output Receptacles: Battery backup and surge protected Six (6) NEMA 5-15R, Surge protected only Two (2) NEMA 5-15R

2. Voltage Normal Mode: Nominal (110, 120, 127VAC) +/-10%

3. Voltage Battery Mode: 120VAC +/- 8%

4. Output: 1000VA, 8.3A

    a. Contractor to confirm UPS sizing based upon devices shown on Contract Drawings requiring UPS power. Adjust UPS output size/configuration as required to provide UPS power to devices shown on the Contract Drawings.

5. Battery Mode Waveform: Stepped Sinewave.

6. Frequency: 50/ 60 Hz (auto sensing).

7. Overload warning: greater than 100%.

8. Overload shutdown: greater than 110%

C. Data Line

1. RJ11 (1 in/1 out), surge protected.

D. Battery Parameters

1. Battery Type: Valve-regulated, non-spill able, lead acid.

2. Battery Quantity: One (1), user replaceable.

3. Transfer Time: 4 - 6 milliseconds.

4. Back-up Time: Full Load 6 minutes, half Load 13 minutes.

5. Recharge Time: 6 hours to 90% at rated capacity, after full discharge into resistive load.

E. The UPS shall be Liebert, APC (true sine wave) or approved equal.

2.05 PROGRAMMABLE LOGIC CONTROLLERS (PLC)

A. The main pump control panel shall be provided with a fully redundant Programmable Logic Controller (PLC) system. The PLCs shall be factory programmed, tested, and debugged to meet all the requirements of the applicable process. PLC system to be ControlLogix 5580 platform as manufactured by Allen Bradley or approved equal.

1. MPCP to be provided with a fully redundant control system. Main pump control panel to be provided with two (2) PLCs that operate in tandem/parallel. In the event one PLC system fails the MPCP shall not miss a beat and automatically switch to the redundant PLC system (hot standby configuration). MPCP to be provided with all required CPUs and associated redundancy modules, including but not limited to the following; redundant Ethernet modules, redundant I/O modules, redundant power supplies, redundant PLCs, and completely redundant rack.

B. PLC system to have the following built-in communication ports:

1. EtherNet/IP

2. USB

C. PLC system to have the following communications options:

1. EtherNet/IP – 1 gigabit (Gb)

2. USB for firmware download and programming (local programming)

D. PLC system to have an onboard display included.

E. PLC system to have an energy storage module included.

F. PLC system to be provided with associated programming software support. Provide as studio 5000 Logix designer or as recommended by equipment manufacturer.

G. PLC system to have the capacity of storing up to 5MB of user memory.

H. PLC system to have the capacity to support up to 128,000 digital and 4,000 analog I/O points thru use of I/O expansion modules.

1. Provide all I/O modules (discrete & analog) and cards to meet site specific I/O requirements, plus 20% spare I/O points of each type used. Coordinate requirements with the Owner, Contract Drawings, and I/O table.

I. PLC system to be provided with controller, communication, chassis, and power supply as recommended by equipment manufacturer.

J. PLC system shall be capable of stand-alone operation in the event of failure of the communication link to the OIU subsystem.

K. The Programmable Logic Controllers (PLCs) shall be Allen-Bradley ControlLogix 5580 series (model 1756-L82E) or approved equal. Provide duplicate systems for full redundancy as specified.

2.06 OPERATOR INTERFACE UNIT (OIU)

A. Display:

1. Display Type: Color active-matrix TFT.

2. Size: 15-inch, 13.39”W x 9.65”H display area.

3. Resolution: 1024 x 768, 18-bit color graphics.

4. Touch Screen: analog resistive.

B. Operating System:

1. Microsoft Windows CE with extended features and MS Office Viewers.

C. System Memory:

1. 512 MB RAM, 512 MB nonvolatile storage for applications.

D. External Storage:

1. Secure Digital (SD) card, cat. no. 1784-SDx.

2. USB flash drives supported by high-speed, hot-swappable, 2.0 USB host ports.

E. Battery (Real-Time Clock)

1. Battery-backed time clock timestamps critical data. Accuracy +/-2 minutes per month.

F. Environmental Operating Temperature:

1. 0 - 55°C (32 - 131°F)

G. Ratings

1. NEMA 12, 13, 4X, IP66 as classified by UL.

H. USB Ports:

1. Two USB high-speed 2.0 host ports (type A) support removable flash drives for external storage.

I. Ethernet Ports:

1. Two 10/100 Base-T, Auto MDI/MDI-X Ethernet Ports that support Device Level Ring (DLR), linear or star network topologies.

J. Input Power

1. 18-32V DC (24VDC nominal).

K. Standard Software:

1. Software FactoryTalk View Machine Edition software, version 7.0 or later.

2. FactoryTalk ViewPoint software, version 2.6 or later.

3. PDF viewer.

4. Active X Controls.

5. Remote Terminal Control.

6. FTP Server.

L. Additional Software:

1. Provide RSView Studio Development for Machine Edition part number 9701-VWSTMENE or approved equal.

M. The Operator Interface Unit (OIU) shall be Allen-Bradley PanelView Plus 7 model 2711P-T15C22D9P, 15" or approved equal.

2.07 FULLY MANAGED ETHERNET SWITCH/MEDIA CONVERTER

A. Sixteen (16) port managed industrial Ethernet switch

1. Fourteen (14) 10/100BaseTX RJ-45 Ports

2. Two (2) 100BaseFX Multimode Fiber Ports with SC Connectors

B. -40°C to 70°C Operating Temperature

C. ESD and Surge Protection on all Built-in Ports

D. Auto Sensing 10/100BaseTX, Duplex, and MDIX

E. Store-and-forward Technology

F. Redundant Power Inputs (10-30 VDC)

G. 8000 MAC Addresses

H. Configurable Alarm Contact

I. Configurable Bi-Color Fault Status LED

J. Rugged Industrial DIN-Rail Enclosure

K. Fully Managed Features:

1. SNMP v1, v2, v3 and Web Browser Management
2. N-Ring™ Technology with ~30ms Healing
3. N-Link™ Redundant Ring Technology
4. N-View™ Monitoring Technology
5. EtherNet/IP™ CIP Messaging
6. Web configuration
7. IGMP Auto Configuration
8. 802.1Q tag VLAN and Port VLAN
9. 802.1p QoS and Port QoS
10. Port Trunking
11. Port Mirroring

12. 802.1d, 802.1w, 802.1D RSTP
13. DHCP Server with Option 82 Relay, Option 61, and IP Fallback
14. Local Port IP Addressing
15. 802.1AB-2005 LLDP (Link Layer Discovery Protocol)
16. Port Security - MAC Address Based Filtering

L. The fully managed Ethernet switch/media converter shall be N-TRON model 716FX2-SC or approved equal.

2.08 SPARE PARTS

A. The following spare parts shall be provided:

1. PLC CPU of each type
2. PLC power supply of each type
3. PLC I/O module of each type
4. 24VDC panel power supply of each type
5. Two (2) surge protectors of each type
6. Five (5) fuses of each type
7. Five (5) pilot light bulbs of each type
8. Five miniature circuit breakers of each type/size
9. Two (2) vibrating reed, industrial rated air compressors (used for Bubbler System)

2.09 I/O TABLE

A. The below I/O table is to provide systems integrator with a general idea of I/O quantity. I/O table below lists all signals remote from the MPCP. Typical signals internal to MPCP components (such as UPS failure, power supply failure, etc.) to be included with overall I/O counts (not listed below for clarity). Refer to contract drawings, specifications, and coordinate with Owner/Engineer for final I/O counts. Refer to quality assurance section above for control panel spare capacity requirements.

Equipment	Function	Signal	Homerun
HFS-1 High Level Float	High Level Alarm	Discrete	MPCP
IP-1 VFD Influent Pump 1 VFD	Run Indication	Discrete	MPCP
	Common Failure Indication	Discrete	
	Speed Control	Analog	
	Speed Reference	Analog	
	Start/Stop Control	Discrete	
	In Remote	Discrete	
IP-2 VFD Influent Pump 2 VFD	Run Indication	Discrete	MPCP
	Common Failure Indication	Discrete	

Equipment	Function	Signal	Homerun
	Speed Control	Analog	
	Speed Reference	Analog	
	Start/Stop Control	Discrete	
	In Remote		
IP-3 VFD Influent Pump 3 VFD	Run Indication	Discrete	MPCP
	Common Failure Indication	Discrete	
	Speed Control	Analog	
	Speed Reference	Analog	
	Start/Stop Control	Discrete	
	In Remote	Discrete	
IP-4 VFD Influent Pump 4 VFD	Run Indication	Discrete	MPCP
	Common Failure Indication	Discrete	
	Speed Control	Analog	
	Speed Reference	Analog	
	Start/Stop Control	Discrete	
	In Remote	Discrete	
IP-5 VFD Influent Pump 5 VFD	Run Indication	Discrete	MPCP
	Common Failure Indication	Discrete	
	Speed Control	Analog	
	Speed Reference	Analog	
	Start/Stop Control	Discrete	
	In Remote	Discrete	
IP-6 VFD Influent Pump 6 VFD	Run Indication	Discrete	MPCP
	Common Failure Indication	Discrete	
	Speed Control	Analog	
	Speed Reference	Analog	
	Start/Stop Control	Discrete	
	In Remote	Discrete	
Bubbler Wet Well No. 1	Primary Level Control	Analog	MPCP
Bubbler Wet Well No. 2	Primary Level Control	Analog	MPCP
Mechanical Room High Temperature	Alarm	Discrete	MPCP
Pump Room Low Temperature	Alarm	Discrete	MPCP
Pump Room Ventilation Failure	Common Alarm	Discrete	MPCP
Roof Top Unit 1	Common Alarm	Discrete	MPCP
Roof Top Unit 2	Common Alarm	Discrete	MPCP
Pressure Transmitter Unit 1	Monitoring	Analog	MPCP
Pressure Transmitter Unit 2	Monitoring	Analog	MPCP
HFS-2 Pump Room Flood/Water	Alarm	Discrete	MPCP
Influent Pump 1 Suction Valve Actuator	Open	Discrete	MPCP
	Open Status	Discrete	
	Close	Discrete	

Equipment	Function	Signal	Homerun
	Close Status	Discrete	
Influent Pump 1 Discharge Valve Actuator	Open	Discrete	MPCP
	Open Status	Discrete	
	Close	Discrete	
	Close Status	Discrete	
Influent Pump 2 Suction Valve Actuator	Open	Discrete	MPCP
	Open Status	Discrete	
	Close	Discrete	
	Close Status	Discrete	
Influent Pump 2 Discharge Valve Actuator	Open	Discrete	MPCP
	Open Status	Discrete	
	Close	Discrete	
	Close Status	Discrete	
Influent Pump 3 Suction Valve Actuator	Open	Discrete	MPCP
	Open Status	Discrete	
	Close	Discrete	
	Close Status	Discrete	
Influent Pump 3 Discharge Valve Actuator	Open	Discrete	MPCP
	Open Status	Discrete	
	Close	Discrete	
	Close Status	Discrete	
Influent Pump 4 Suction Valve Actuator	Open	Discrete	MPCP
	Open Status	Discrete	
	Close	Discrete	
	Close Status	Discrete	
Influent Pump 4 Discharge Valve Actuator	Open	Discrete	MPCP
	Open Status	Discrete	
	Close	Discrete	
	Close Status	Discrete	
Influent Pump 5 Suction Valve Actuator	Open	Discrete	MPCP
	Open Status	Discrete	
	Close	Discrete	
	Close Status	Discrete	
Influent Pump 5 Discharge Valve Actuator	Open	Discrete	MPCP
	Open Status	Discrete	
	Close	Discrete	
	Close Status	Discrete	
Influent Pump 6 Suction Valve Actuator	Open	Discrete	MPCP
	Open Status	Discrete	
	Close	Discrete	
	Close Status	Discrete	
Influent Pump 6 Discharge Valve Actuator	Open	Discrete	MPCP
	Open Status	Discrete	
	Close	Discrete	
	Close Status	Discrete	
Influent Pump/Motor 1 (Relayed thru VFD)	Pump High Vibration	Discrete	MPCP
	Motor Amps	Analog	

Equipment	Function	Signal	Homerun
	Motor High Vibration	Discrete	
	Motor Winding High Temperature	Discrete	
	Pump Thrust Bearing High Temperature	Discrete	
	Intermediate Shaft Bearing High Temperature	Discrete	
Influent Pump/Motor 2 (Relayed thru VFD)	Pump High Vibration	Discrete	MPCP
	Motor Amps	Analog	
	Motor High Vibration	Discrete	
	Motor Winding High Temperature	Discrete	
	Pump Thrust Bearing High Temperature	Discrete	
	Intermediate Shaft Bearing High Temperature	Discrete	
Influent Pump/Motor 3 (Relayed thru VFD)	Pump High Vibration	Discrete	MPCP
	Motor Amps	Analog	
	Motor High Vibration	Discrete	
	Motor Winding High Temperature	Discrete	
	Pump Thrust Bearing High Temperature	Discrete	
	Intermediate Shaft Bearing High Temperature	Discrete	
Influent Pump/Motor 4 (Relayed thru VFD)	Pump High Vibration	Discrete	MPCP
	Motor Amps	Analog	
	Motor High Vibration	Discrete	
	Motor Winding High Temperature	Discrete	
	Pump Thrust Bearing High Temperature	Discrete	
	Intermediate Shaft Bearing High Temperature	Discrete	
Influent Pump/Motor 5 (Relayed thru VFD)	Pump High Vibration	Discrete	MPCP
	Motor Amps	Analog	
	Motor High Vibration	Discrete	
	Motor Winding High Temperature	Discrete	
	Pump Thrust Bearing High Temperature	Discrete	
	Intermediate Shaft Bearing High Temperature	Discrete	
Influent Pump/Motor 6 (Relayed thru VFD)	Pump High Vibration	Discrete	MPCP
	Motor Amps	Analog	
	Motor High Vibration	Discrete	
	Motor Winding High Temperature	Discrete	

Equipment	Function	Signal	Homerun
	Pump Thrust Bearing High Temperature	Discrete	
	Intermediate Shaft Bearing High Temperature	Discrete	

2.10 GAGE PRESSURE TRANSMITTERS

A. A gage pressure transmitter shall be provided for monitoring the main discharge header pressure. The transmitter shall provide a 4-20 mAdc signal linear and proportional to measured pressure. The transmitter shall have the following features as a minimum:

1. Transmitter accuracy shall be ±0.075 percent of calibrated span. Includes combined effects of linearity, hysteresis, and repeatability.

2. Operational span limits shall be -14.7 to 150 PSIG.

3. The transmitter shall have integral dampening, adjustable from 0 to 60 seconds.

4. The electronics housing shall be IEC IP66 (NEMA 4X); low-copper aluminum housing with polyurethane finish.

5. The transmitter shall have easily replaceable modular electronics.

6. The transmitter shall have an integral LCD digital indicator with on-board configuration push buttons.

7. The transmitter shall have a ½" NPT process connection.

8. Transmitter sensor material shall be 316 stainless steel.

9. Transmitters shall be Rosemount model 2088 or approved equal.

10. Pressure in the discharge header will be monitored in Control Panel and SCADA.

PART 3 EXECUTION

3.01 INSTALLATION

A. When a change from normal power to emergency power occurs and vice versa all equipment to be restarted automatically. Final requirements to be coordinated with the Engineer. Provide as required.

B. Install equipment at locations indicated on the drawings.

C. Provide all necessary cable, conduits, and fittings as required to provide a fully operable system. All wiring external to control panels shall be in conduit or sealtite. Refer to the raceway schedule on the contract drawings for additional information/requirements.

D. Refer to the contract drawings for all field wiring specifications/requirements.

E. Coordinate all circuitry (conduit & conductor) requirements closely with the Electrical Contractor (Division 16).

1. The Electrical contractor is to provide/install all circuitry from control panel to control panel and from control panel to equipment/devices per the Electrical Drawings. As part of this contract all wiring is to be terminated within the applicable control panel. To clarify, the EC will run the wire and this contract is to terminate all wiring within the specified control panel, as necessary.

F. Point test all PLC I/O to verify that all I/O modules are correctly wired to the terminal strips and that the PLC I/O modules function properly. Testing shall be performed between terminal points on the I/O module to the terminal strip that the field device is terminated on.

G. Contractor to perform point-to-point wire testing on all circuitry entering/leaving the MPCP. Verify wire integrity, continuity, and proper transmission of signal. Close coordination with Electrical Contract required.

3.02 GRAPHIC DISPLAYS/SCREEN DEVELOPMENT

A. Systems integrator responsible for developing all screens associated with each control panel specified as part of this section and loading onto control panel as required. Coordinate with the Owner and Engineer.

B. General Requirements:

1. All displays shall contain and continuously update the displayed process variables, date, and time of day. All process values shall be displayed in engineering units. All displays shall incorporate references to both instrumentation tag numbers and plant equipment numbers. All process variables shall be displayed on their associated display(s) with correct engineering units. Process variables shall display their associated data quality flags.

2. All operator commands related to controlling field devices or system attributes shall require multiple keystrokes or mouse actions to protect against inadvertent operations. The operator shall receive confirmation of the selected point to be controlled, at which time a cancellation of the control can be affected.

3. Process graphic displays, shall be based on the P&ID's, site plan drawings, mechanical drawings and electrical drawings included as part of these Contract Documents. The graphic displays shall depict process flow streams, process structures, and all major items of process equipment and control devices in a schematic format.

4. All main graphical screens shall include a title bar, main graphic area, navigational buttons, and alarm summary bar. Title bar shall be displayed on the top of each screen and include display name, description, and time/date. The main graphical area shall contain primary screen data in graphical format. Navigational buttons shall include a minimum of main menu, trends, main alarm summary, and security log in. The alarm summary bar shall display the last three valid alarms on the bottom of each screen.

5. Animation shall be provided to mimic level changes in tanks or vessels, and to mimic rotation of rotating equipment when running. Valve colors shall change when opened and closed.

6. Unless specifically noted, all timers, setpoints, alarm actuation levels, etc., shall be adjustable from the operator interface.

7. The system shall show field conditions with text that can alternate (i.e., OPEN/CLOSE, START/STOP, HIGH/LOW) and change color correspondingly. Field devices that are tri state must be represented in three conditions.

8. Conditions in the field designated as alarm conditions shall report to the operator workstation, actuate an audible alarm, and provide a visual blinking image on the associated graphic page. All alarms and events shall be displayed on the screen and archived.

9. All interlocks that affect equipment operation shall be identified both by alarm and by OIU indication.

10. All analog inputs shall be checked for out of range (via high and low limit checks) and alarmed.

11. All process flow streams shall be labeled and color coded. All structures and equipment shall be identified by name and appropriate equipment and loop tags.

12. Color coding for equipment status and alarms shall be as follows:

    a. Green for on or open.

    b. Red for off or closed.

13. Automatically record all alarm and events should any of the following sequences or events occur:

    a. Date/Time entry

    b. Limit changes

    c. Any commanded or un-commanded change of any point

    d. Alarm conditions

    e. PLC activation or deactivation

    f. Operator login or logout activity

C. Specific Requirements:

1. Water overview screen shall include a site plan representation, indicating the geographic location of each process, and each building.

2. Main menu screen shall be developed to link to all screens and process areas. The screen shall be a complete and logical listing of the names and number of all screens.

3. Overall plant process block flow diagram screen shall show all major processes in block form with flow arrows. Each block shall include a text description of key individual treatment processes. Navigational buttons to the individual treatment processes shall be performed by pressing on the text description.

4. Individual treatment process screens shall graphically screen key process variables and equipment. No operator entries shall be done from these screens. Individual process flow screens for each process shall include all process components, including tanks, pumps, blowers, mixers, drives, flow meters, valves, mechanical devices, as well as manual shutoff and isolation valves. These diagrams shall be generally depicted from the P&ID's and there shall be at least 1 screen per P&ID on average.

5. Individual unit process screens depicted from the P&ID's are used for control and screen of each major item of process equipment, process variables, and control devices, including pumps, blowers, valves, gates, mixers, drives etc. Navigational buttons shall consist of the P&ID's flow arrows to other individual unit processes. The unit process screens shall provide the ability for the operator to go to individual equipment popup screens. These diagrams shall be generally depicted from the P&ID's and there shall be at least 2 screens per P&ID on average.

6. Popup screens shall be provided for each piece of equipment to start/stop equipment, open/close valves, implement automatic control, adjust set points, establish, and adjust tuning parameters, set alarm limits, and initiate a sequence.

7. PLC system diagnostic screens, showing the operational status, and fault conditions of all PLC components, including processors, I/O modules, OIU's, power supplies and UPS units.

8. Communications diagnostic screens, showing the details of network status, communications status of all major components including Operator Workstations, peripheral devices, and network components.

9. Maintenance screens shall screen the raw value for each analog and digital I/O point in the system. They shall also allow the operators/maintenance personnel to enter an override value for an analog point that is then used by the system instead of the value read from the input card / communications link.

10. Trend screens with the capability to screen up to eight, operator assigned, analog and/or digital process variables. Each analog value will be shown on a trend screen.

11. Main alarm summary screen shall screen the following information on each alarm: Time, tag name, description, alarm type, current value, and status. An acknowledge alarm button shall acknowledge all new unacknowledged alarms. The acknowledged and unacknowledged alarms shall be different colors. Acknowledged alarms shall clear automatically after the condition is corrected.

12. Analog variable screens showing a tabular summary of all plant process variables, in operator assigned groupings.

D. Security:

1. The system shall be configured and implemented with security to prevent unauthorized access. The system shall allow authorized changes to system operation through defined user accounts and password verification.

2. Coordinate with Owner user account information, including login name and password for each account.

3. Security levels of "display only", "operator mode", "supervisor mode", and "Engineer mode" shall be available through assignable passwords. On system startup, the "display only" security level shall automatically be entered. In the "display only" mode, information is available to be displayed on the screen, but no changes may be made. In the "operator mode", changes may be made to process set points, times, etc.; however, the overall control concepts may not be modified. In the "supervisor mode", all operator functions can be modified, and any special reports or critical process set points (data can be modified; however, the overall control concepts may not be modified). In the "Engineer mode" level, all user modifiable parameters of the system shall be available for modification.

E. Alarm/Equipment Status Reporting:

1. The alarm log shall display all alarms as they occur. The alarm message shall include the time of occurrence, tag name, tag number, and whether it is a low, high, or failure alarm. When the point in alarm returns to normal, the time, point identification number, and return to normal shall be displayed. All reports shall include the plant equipment number of the associated device.

2. The equipment status shall be logged whenever a change in status occurs (i.e., start, stop). The equipment status log shall include the time, equipment name, tag number, and the change in status.

F. Historical Data Management:

1. Each system point (analog or digital, real or pseudo) shall have the capability of being historically logged. A point shall have the capability of being deleted from historical log at any time. It shall be easy to add or delete system points using minimal keystrokes.

2. All process analogs and all flow totals and run time indications of all primary process equipment motors shall be sampled and stored in the historical data management system.

3. Data Processing: The real time instantaneous values shall be stored in a historical log file on the hard disk at defined sampling rates.

4. Data Correction: Historical data shall be manually modifiable by personnel with appropriate security levels. Such data shall be differentiated from actual monitored values on reports, in the database and in trends.

5. Data Quality: Data Quality flags shall propagate to the next higher level of the history based on user selectable percentage determining tolerance levels for averages and totals. If the percentage of suspect data exceeds the tolerance level, the suspect data flag propagates to the next higher level. Maximums and minimums shall be taken from good data.

6. Manual Input Data Handling: This data shall consist of additional values not obtainable by the system such as laboratory analysis for use in reports. All manually entered data shall be entered and stored in the appropriate engineering units. All data entered shall be displayed for confirmation on the display prior to incorporation to the database.

G. Reports:

1. Quantity and format of reports shall be coordinated with the Owner and as a minimum shall include shift, daily, monthly, and yearly reports. Provide a minimum of 5 reports.

2. The system shall be able to generate reports from on-line historical data files or prompt the user for the appropriate archived data files.

3. Reports shall be initiated automatically based upon time of day or manually upon operator request.

4. User interface displays for report generation shall be developed with easy recall of reports by entering time:day:year target values.

5. User interface displays shall allow the operator to define the destination of the report (e.g., display, printer, computer file, etc.) and when it is to be printed (e.g., immediately, on demand, or automatically at a specified time).

6. It shall be possible to print quality tags alongside the value.

7. Values for which there are no data available shall be identified with a special character. Thus, only values which are zero shall be printed as such.

8. Operational Report Types. The following operational report types shall be provided with the system:

a. Shift Operation Summary Report:

1) An operator-adjustable time interval shift operation report shall summarize plant operation from the start and finish time of operation.

2) The report format shall consist of the following: correct date, plant name, report name, page number, group headings, subheadings, point identification, and engineering units.

b. Daily Operation Summary Report:

1) The daily operation report shall summarize plant operation for the previous day. The printed information shall be the stored values (not averages) including scanned, lab, and manually entered data.

2) The report format shall consist of the following: correct date, plant name, report name, page number, group headings, subheadings, point identifications, and engineering units.

3) The daily minimum, average, maximum, and total where applicable shall also be calculated and printed for each point and stored.

c. Monthly Operation Summary Report:

1) The monthly operation summary report shall summarize plant operation for the previous calendar month.

2) The report format shall be arranged so that the first several pages shall conform to the requirements of the state regulatory agencies and may be separated from the rest of the monthly operation report for transmittal to the regulatory agency.

3) The report format shall be like the daily operation summary report and shall consist of the following: month and year, plant name, report name, page number, group headings, sub-headings, point identifications, and engineering units.

4) Monthly minimum, average, maximum, and totals, where applicable, shall also be printed for each column of points printed.

d. Annual Operation Summary Report:

1) The annual operation summary report shall summarize plant operation for the previous calendar year. The report shall consist of scanned data, lab data, and manually entered data.

2) The format of the report shall be identical with the monthly operation summary report except for replacing month with year in the heading and replacing date with calendar month.

3.03 START-UP SERVICE

A. The system integrator/supplier shall provide the services of a qualified service technician/Engineer to perform the following service duties.

1. Provide a minimum of two (2) days on-site services to provide installation instruction to the contractor on all aspects of equipment installation.

2. Provide a minimum of three (3) days of onsite startup services to provide a final system calibration, programming, and testing after completion of equipment installations.

3. Provide a minimum of one (1) 4-hour session at the job site to provide instruction to facility personnel in the operation, proper maintenance, trouble shooting, and repair of the equipment. Contractor to demonstrate proper operation of system to Owner.

4. Following system startup, contractor is to correct any deficiencies at no additional cost to the Owner.

B. Following completion of the above services, the supplier shall provide an affidavit to the facility, certifying that the system is installed and operating in accordance with the contract documents.

END OF SECTION