SECTION 406700 - CONTROL SYSTEM EQUIPMENT PANELS AND RACKS

Note that this section has only been edited for NYSOGS standardization and has not been technically edited. The designer shall make all technical edits specific to the project for this section.

This Section includes pump control panel and accessories for a duplex wastewater lift station.

1. GENERAL
   * + 1. SUMMARY
          1. Section includes pump control system including power disconnect, pump alternation, intrinsically safe control, lightning protection, push buttons, indicating lights, and control relays.
          2. Related Sections:

Section 260519 - Low-Voltage Electrical Power Conductors and Cables.

Section 260533 - Raceway and Boxes for Electrical Systems.

* + - 1. REFERENCES

List reference standards included within text of this section. Edit the following for Project conditions.

* + - * 1. National Electrical Manufacturers Association:

NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

* + - * 1. Underwriters' Laboratories

UL 508 - Industrial Control Equipment.

* + - 1. PERFORMANCE REQUIREMENTS

Use this article carefully; restrict statements to identify system performance requirements or function criteria only.

* + - * 1. Sequence of Operation:

Operate two pumps in lead/lag mode.

Control pumps by individual Hand-Off-Auto selector switches located on pump control panel. Provide manual start-stop control of pumps using "hand" and "off" positions of each Hand-Off-Auto switch. Automatically control pumps in "auto" position with float switches as follows:

When liquid level in wet well rises to elevation of "lead pump start" float switch, start lead pump. When lead pump is started, run pump until liquid level in wet well is drawn down to "pump stop" float switch, and then shut down lead pump.

When lead pump cannot keep up with influent flow, liquid level in wet well rises to "lag pump start" float switch that starts lag pump. When lag pump is started, run pump until liquid level in wet well is pumped down to "pump stop" float switch and shut down lead and lag pumps.

Automatically alternate lead and lag status of pumps after each pumping cycle. Provide manual selection of lead pump.

When liquid level in wet well rises to elevation of "wet well high level" float switch, energize "Wet Well High Level" alarm light located on pump control panel.

When liquid level in wet well is pumped down to elevation of "wet well low level" float switch, energize "Wet Well Low Level" alarm light located on pump control panel and shut down pumps.

When thermal switches are provided in motor windings to detect high temperature in motor, wire switch to relay located in pump control panel. Provide normally open contact on relay wired in series with pump starter, and normally closed contact on relay wired to "Motor High Temperature" alarm light located on control panel. When high temperature occurs in motor windings, shut down pump and energize high temperature alarm light.

When pump seal leak sensor is provided and located in pump housing, wire sensor to seal failure relay located in pump control panel. Wire normally open contact on relay to "Seal Failure" alarm light located on control panel. When seal leak occurs, energize seal failure alarm light.

Provide dry contacts in pump control panel for each of following:

Power Failure.

Pump No. 1 Motor High Temperature/Seal Failure.

Pump No. 2 Motor High Temperature/Seal Failure.

Wet Well High Level.

Wet Well Low Level.

[**Wire these contacts to terminal strip in panel for wiring to automatic telephone dialer.**]

* + - 1. SUBMITTALS

Only request submittals needed to verify compliance with Project requirements.

* + - * 1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
        2. Manufacturer’s installation instructions shall be provided along with product data.
        3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
        4. Shop Drawings: Submit complete bill of materials, wiring diagrams and panel layout drawings showing dimensions to devices.
        5. Product Data: Submit catalog information and descriptive literature for components.
        6. Test Reports: Submit certified factory test report indicating control panel successfully performs functions specified.
        7. Manufacturer's Installation Instructions: Submit instructions on installation and field wiring connections.
        8. Manufacturer's Certificate: Certify [**Products**] <**\_\_\_\_\_\_\_\_**> meet or exceed [**specified requirements**] <**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**>.
        9. Manufacturer's Field Reports: Submit certification after installation that control panel has been installed in accordance with manufacturer's instructions and has been successfully field tested.
      1. CLOSEOUT SUBMITTALS
         1. Project Record Documents: Record actual locations of control panel and final wiring diagrams and connections.
         2. Operation and Maintenance Data: Submit operation and maintenance instructions for components and devices.
      2. QUALITY ASSURANCE
         1. Perform Work in accordance with UL 508.
         2. Provide components compatible with functions required to form complete working system.
         3. Provide UL 508 label on complete assembly.
         4. Perform Work in accordance with [**State**] [**Municipality**] of <**\_\_\_\_\_\_\_\_**> [**Highways**] [**Public Works**] [**standard**].

Include the following paragraph only when cost of acquiring specified standards is justified.

* + - * 1. Maintain [**one copy**] <**\_\_\_\_\_\_\_\_**> [**copies**] of [**each**] document on site.
      1. QUALIFICATIONS
         1. Manufacturer and Fabricator: Company specializing in manufacturing and assembling products specified in this section with minimum [**three**] <**\_\_\_\_\_\_\_\_**> years [**documented**] experience.
      2. PRE-INSTALLATION MEETINGS
         1. Convene minimum [**one**] <**\_\_\_\_\_\_\_\_**> week prior to commencing work of this section.
      3. DELIVERY, STORAGE, AND HANDLING
         1. Inspect for damage.
         2. Store in areas protected from weather, moisture, or possible damage; do not store directly on ground; handle to prevent damage to wiring and components.
      4. COORDINATION
         1. Coordinate work and component requirements with controlled pumps.
      5. EXTRA MATERIALS
         1. Furnish the following spare parts:

[**4**] <**\_\_\_\_\_\_\_\_**> pilot light bulbs.

[**1**] <**\_\_\_\_\_\_\_\_**> 24 volt DC power supply for each size utilized.

[**4**] <**\_\_\_\_\_\_\_\_**> fuses for each type and size utilized.

[**1**] <**\_\_\_\_\_\_\_\_**> general purpose relay for each type utilized.

[**1**] <**\_\_\_\_\_\_\_\_**> intrinsically safe relay.

1. PRODUCTS
   * + 1. PUMP CONTROL PANEL

In this article, list manufacturers or fabricators acceptable for this project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8847&mf=04&src=wd):

designer to provide two manufacturers and approved equivalent for all listed products.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Furnish materials in accordance with [**State**] [**Municipality**] of <**\_\_\_\_\_\_\_\_**> [**Highways**] [**Public Works**] [**standards**].
      1. COMPONENTS
         1. Control Panel Enclosure:

Furnish NEMA 250 Type 12 enclosure fabricated of 10 gage steel with continuously welded seams.

Enclosure door gasketed with neoprene.

Heavy-duty three-point latching mechanism.

Power: 120/240 volt, 3 phase, 4 wire open delta service.

Identify control panel components with engraved nameplate mounted on inside of panel.

Mount components, not mounted on front of panel, on removable back panel secured to enclosure with collar studs.

Install wiring in neat, workmanlike manner and group, bundle, support and route horizontally and vertically for neat appearance.

Terminate wires leaving panel at terminal strips inside enclosure.

Identify terminals and wires in accordance with panel wiring diagrams.

Furnish copper grounding plate inside control panel for terminating ground wires.

* + - * 1. Transient Voltage Surge Suppressor: Furnish three phase transient voltage surge suppressor in pump control panel to protect panel components from potential damage from transient voltages caused by lightning or surges on incoming power line. Furnish indication light to indicate unit is functioning.
        2. Three Phase Monitor:

Furnish three phase monitor in pump control panel to monitor incoming power and sense loss of any one of three phases.

Inhibit pump operation when phase loss occurs.

Surface mounted.

* + - * 1. Motor Circuit Protector Type Circuit Breakers:

Furnish properly sized motor circuit protector type molded case circuit breaker for each pump motor starter.

Type: Quick-make, quick-break, individually mounted.

Minimum Interrupting Capacity: 22,000 amperes rms symmetrical at 240 volts.

* + - * 1. Pump Motor Starters:

Furnish across-the-line magnetic type rated in accordance with NEMA standards, sizes and horsepower ratings. Size for pump motor horsepower.

Furnish each motor starter with three pole overload relay. Furnish heater element in each phase of relay, sized for motor nameplate full load amps.

Furnish overload reset button for each motor starter.

* + - * 1. Control Transformer: Furnish 240 volt to 120 volt control transformer in pump control panel to provide 120 VAC control power. Size transformer to power connected devices and protect with primary and secondary fusing.
        2. Circuit Breakers:

Furnish quick-make, quick-break thermal-magnetic molded case type, individually mounted and identified.

Furnish individual circuit breakers for each of the following:

Pump Control Circuit.

[**Duplex Receptacle (located outside of panel).**]

[**Automatic Telephone Dialer (located outside of panel).**]

[**Emergency Generator Water Jacket Heater.**]

<**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.**>

* + - * 1. Selector Switches:

NEMA Type 4X, 30.5 mm, heavy-duty, non-illuminated, maintained contact type with double-break silver contacts.

* + - * 1. Push Buttons: NEMA Type 4X, 30.5 mm, heavy-duty, non-illuminated, momentary contact type with double-break silver contacts.
        2. Pilot Lights:

NEMA Type 4X, 30.5 mm, heavy-duty, transformer type.

Voltage Rating: 120 volts AC.

Color Caps: Green for "run" and red for "alarm."

Furnish "run" pilot light for each pump. Energize each light through auxiliary contact on pump motor starter.

Furnish "motor high temperature" and "seal failure" alarm pilot light for each pump.

Furnish wet well "high level" and "low level" alarm pilot lights.

* + - * 1. Legend Plates for Pilot Devices:

Furnish 2-1/4 inch square plastic legend plate for each selector switch, push button and pilot light.

Color: Gray with white lettering.

* + - * 1. Relays:

Heavy-duty, general purpose type, with 10 amp contacts.

Blade type terminals that plug-in to socket.

DIN rail mounted to inside of panel enclosure.

Contact Configuration: As required for proper operation of control logic.

Operating Power: 120 volts AC, unless noted otherwise.

Furnish indicator light to indicate relay coil is energized.

* + - * 1. Alternator:

Solid state, plug-in type, with 120 volt AC coil and 10 amp contacts.

Furnish alternator relay plugged into socket, mounted to inside of panel enclosure.

SPDT, suitable for continuous operation, and furnished with integral selector switch to allow operator to select automatic alternation of pumps or to select [**Pump No. 1**] or [**Pump No. 2**] as lead pump.

* + - * 1. Seal Failure Relays: Provide seal failure relay in pump control panel for each pump. Coordinate seal failure relays with controlled pump.
        2. Intrinsically Safe Relays: Furnish intrinsically safe relay in pump control panel for each wet well float switch.
        3. Elapsed Time Meters:

Resettable, time totalizer type.

Furnish synchronous motor to drive set of digit readout wheels to indicate total time pump motor starter is energized.

Readout: Six-digit including 1/10 digit.

Range: 0 to 99999.9 hours.

Voltage Rating: 120 volts.

Furnish elapsed time meter for each pump. Energize each elapsed time meter through auxiliary contact on pump motor starter.

* + - * 1. Terminal Blocks:

Furnish terminal blocks in control panel for field wiring.

NEMA type, rated for 600 volts AC.

Identify with permanent machine printed marking in accordance with terminal numbers shown on panel wiring diagrams.

Furnish twenty percent spare terminal blocks in control panel.

* + - * 1. Wiring:

Furnish pump control panel completely wired by manufacturer.

Furnish wiring, workmanship, and schematic wiring diagrams in compliance with UL 508. Isolate wiring and terminal blocks by voltage levels to greatest extent possible.

Wiring: Stranded copper, Type MTW or THW, 600 volts, color coded as follows:

Line and Load Circuits, AC Power: Black.

AC Control Circuit Less than Line Voltage: Red.

DC Control Circuit: Blue.

Interlock Control Circuits from External Source: Yellow.

Equipment Grounding Conductor: Green.

Current Carrying Ground: White.

Minimum Size of Control Wiring: Number 16.

Tag control wiring at both ends in control panel with legible permanent coded wire marking sleeve. Mark with white PVC tubing sleeves with machine printed black marking. Mark in accordance with wire numbers shown on control wiring diagrams and terminal strip numbers.

* + - * 1. Nameplates:

Furnish laminated phenolic nameplates on front of pump control panel.

Color: White with black engraved letters.

Minimum Size of Engraving: 1/4 inch

* + - 1. LIQUID LEVEL CONTROL SYSTEM
         1. Furnish liquid level control system to monitor wet well level and start and stop pump motors in response to changes in wet well level as set forth herein.
         2. Initiate pump controls (low water level alarm, pump off, lead pump start, lag pump start, and high water level alarm) by individual float switches.
         3. Float Switches:

Furnish five <**\_\_\_\_\_\_\_\_**> float switches in wet well.

Type: Single pole mercury switch in corrosion resistant polypropylene housing.

Furnish each float switch with corrosion resistant clamp for mounting on 1/8 inch 316 stainless steel vinyl coated wire rope.

Furnish stainless steel bracket for supporting wire rope.

* + - 1. SOURCE QUALITY CONTROL AND TESTS
         1. Perform a factory test of completed control panel by demonstrating operation of control functions. Provide certified test results.
         2. Factory assemble and test each control and alarm function.

1. EXECUTION
   * + 1. EXAMINATION
          1. Verify correct power supply is available.
          2. Verify pumps are installed.
       2. INSTALLATION
          1. Install control panel at location indicated on Drawings.
          2. Install control panel in accordance with manufacturer's instructions.
       3. FIELD QUALITY CONTROL
          1. Start-up pump control system by energizing system equipment and testing operation of hardware and process control logic under supervision of manufacturer's representative and in presence of Director’s Representative.
          2. Equipment Acceptance:

Adjust, repair, modify or replace system components that fail to perform as specified and rerun tests. Make final adjustments to equipment under direction of manufacturer's representative.

Document adjustments, repairs and replacements in manufacturer's field services certification.

* + - 1. MANUFACTURER'S FIELD SERVICES
         1. Furnish services of manufacturer's representative experienced in installation of products furnished under this specification for not less than <**\_\_\_\_\_\_\_\_**> work days on-site for installation inspection and field testing, and instructing Director’s Representative personnel in maintenance of equipment.
         2. Certify that equipment has been properly installed and is ready for start-up and testing.
      2. DEMONSTRATION
         1. Demonstrate equipment startup, shutdown, routine maintenance, alarm condition responses, and emergency repair procedures to Director’s Representative personnel.

END OF SECTION 406700