

ArcSafe® Pump Control Center Typical Specification

In accordance with the plans and specifications, provide a complete pre-fabricated, pre-tested *ArcSafe®* Pump Control Center including all required equipment, accessories, wiring and adjusting as indicated in the project specifications, on the project plan, and installed in accordance with applicable National, State and Local Codes.

PUMP CONTROL CENTER (PCC)

PCC shall be a completely prewired automatic *ArcSafe®* system for pump control and alarming. The entire panel shall be UL Labeled for a SCCR of 35kA minimum. The control system shall be designed to assure operation for wet wells categorized as hazardous - Class I, Division I. The control panel shall be UL listed and labeled. The Pump Control Center shall be Starnet Technologies, Inc. "ArcSafe® PCC"

- Primary controller with Display
- Redundant Float Back-up Controller
- Motor Controllers in separate compartments
- 5kVA Lighting Transformer with branch circuit breakers
- TVSS (65kA) w/ status indicator
- DC UPS
- Automatic Transfer Switch
- Room Heater with Thermostat
- Pre-wired terminals in connection compartments for pump, float, and transducer connections
- Pre-wired terminals in connection compartments for telemetry
- Pre-wired lugs in connection compartments for incoming normal/generator power
- *(Optional)* *ArcSafe®* Bypass System with pre-wired lugs in connection compartment for incoming (50A)fused bypass power

The *ArcSafe®* center specified herein shall be designed to be a stand-alone control center with all included *ArcSafe®* modular units (e.g. PCP, Starters, Breakers, ATS, Etc.) having interconnects, power, and control wiring factory installed & tested. The PCC shall be equipped with lifting eyes, cover plates, and shall be constructed of a single enclosure exterior. Termination compartments shall not contain any exposed current carrying conductors where exposed segment of conductor exceeds 0.125". Total enclosure shall be adequately sized to incorporate all controls specified herein and to include utility and standby power connections, indicating lights, selector switches, pump control logic, motor starters, alarm, etc. Total enclosure sizing shall not exceed 60"W x 81" H x 16" D. All lugs & terminals for line voltage field wiring shall be "finger-safe" (This includes all incoming power and load connections). All current carrying conductors shall be fully insulated. Use of bus bars and/or exposed metal lugs is prohibited. The minimum cabling "gutter" width shall be 5".

The modular units shall be constructed in accordance with the following descriptors:

- 10-gauge steel powder coat painted manufacturer's standard white
- Continuously welded and ground smooth seams.
- Flanged doors & body flange trough
- 3-point latching mechanism operated by padlockable handle
- Oil resistant door gaskets
- Removable 10 gauge steel panels which mount on collar studs
- Control wiring to removable plates and doors shall utilize pull-apart terminals allowing for simple unit replacement.

- Removable doors

The pump control system shall be connected to the level sensors through intrinsically safe barriers and relays.

Multiple conduit entry locations shall allow for incoming power/motor feeds/control wiring from front, side, top, rear or bottom of enclosure.

The control system shall provide total automatic control for the 2(or 3) pumps, and other equipment as indicated.

The control system shall provide FAIL indication and additional dry alarm contacts for all alarm points listed.

Manufacturer shall provide written procedures for servicing in compliance with OSHA 1910 and NFPA 70E.

Manufacturer shall provide Labels for NFPA 70E hazard levels, for each compartment as well as a written procedure.

The control system shall provide for all other process signals, alarm conditions, and control functions indicated on the plans and in the specifications.

The control panel shall include an electrically operated automatic transfer switch pre-installed. Front of panel indicators for Normal Source Available, Standby Source Available, Normal Source Connected, Standby Source Connected shall be provided. These signals shall also be available to the alarm system via dry contacts.

The control panel unit shall be the product of a manufacturer that is authorized by Underwriters Laboratories, Inc. to build products in compliance with UL Standard 698A (Enclosed Industrial Control Panel – Enclosure in Non-Hazardous area with extensions into hazardous area). A UL label shall be affixed to the completed control panel.

The enclosure shall have a separate hinged door with interlocked pad-lockable disconnect handle for each individual motor starter compartment. Disconnects shall include flexible cable mechanisms to operate circuit breakers in separate breaker compartment. Units shall be designed such that ALL power (including at line-side lugs) is removed from each starter compartment when disconnect is open. All control wiring in motor starter compartments shall be 24 VDC or lower, and sourced from the starter control power supply such that All circuits within the compartment are de-energized by the disconnect.

The PCC shall include a separate low voltage Pump Control Panel (PCP) compartment with pad-lockable door. All Voltages within the PCP compartment shall be 24 Volt or lower. It shall be possible to remove all voltage from the PCP by switching a breaker, front mounted in a separate compartment. Thru-wall pull-apart terminal strips shall be used for interconnects. The PCP shall house the Primary Pump Controller, Backup Pump Controller, Intrinsic-Safe Barriers, 24VDC UPS, and associated controls.

The PCC shall include separate line voltage compartments marked for access by qualified personnel only. The line voltage compartments shall house the transfer switch, transformer, 65kA TVSS, electric heating unit, pump breakers, transformer breakers, and associated wiring.

The PCC shall also include a separate 120VAC controls compartment which contains no higher than 120 Volts. This separate compartment shall contain 120/24 volt power supplies to feed the PCP, 120 volt breakers (for Generator, TVSS, GFCI Receptacle, PCP power, Entry Alarm and room heater), 120 Volt neutral bar, TVSS "OK" light, GFCI Receptacle, ATS Door Mount Exercise Controller, and 24 Volt PCP interconnect terminals.

All legend plates/name plates and equipment designations shall be engraved type with white text on black field.

All control wiring shall be provided by manufacturer as specified herein. All control wiring shall be alphanumerically labeled in reference to manufacturers standard wiring schematics with minimum 10pt

font. Control wiring labels shall be high performance matte white polyester type 0.5" x 1.0". Control wiring labels shall be thermal transfer type. All Control Wiring Labels shall be UL recognized, CSA approved, and AGA approved. Terminal blocks shall be identified by both number and graphic symbols, which clearly indicate the purpose of each terminal block.

All 480V wiring within enclosure shall be provided by manufacturer as specified herein. 480V wiring shall be alphanumerically labeled in reference to manufacturers standard wiring schematics. 480V wiring labels shall be heat-shrink irradiated polyolefin, non-smudge/ non-fade, type. 480V wiring labels shall conform to UL224, MIL-DTL-23053/5 Class 1, MIL-M-81531, MIL-STD-202F, and METHOD 215 standards.

Control panel terminal blocks shall be provided and labeled to interface with audible alarm, external visual alarm, flasher for visual alarm, power monitor, pump monitors, and pump motor starters.

RAW SEWAGE PUMP CONTROL SEQUENCE

The two raw sewage pumps shall be controlled as described below.

The wet well shall be monitored by a submersible level sensing transducer.

Each pump shall have a on-off-auto selector switch, elapsed time meter, run and fail indicators.

The control system shall provide fully automated pump control despite failure in an individual pump, or manual selection of an OFF status. Alternation shall continue in the programmed sequence with the next pump in sequence replacing the failed or off pump.

After power failure, delay shall precede the sequential start of the pump cycle with no two (2) pumps starting within 30 seconds of each other.

The control system shall allow for the following setpoints:

- Redundant High Level Float and Alarm
- Start Lag Pump
- Start Lead Pump
- Stop Lag
- Stop Lead
- Redundant low level Alarm float (Stop all pumps and alarm)

The pumps shall alternate after each pumping sequence if the alternation selection switch is in the "AUTO" position.

Each pump shall be disabled until manually reset if its respective overload relay or motor overtemperature switch trips.

The level sensing transducer and float switches shall be separated from the control panel by intrinsically safe barriers.

PRIMARY PUMP CONTROLLER (PPC)

The Primary Controller shall be Allen-Bradley Micrologix 1400, no exceptions. The Interface for the Primary Controller shall be an Allen-Bradley Panelview+ 700 Touch Screen, no exceptions. Alarms shall consist of high alarm, low alarm and input signal out of range. Monitor functions shall include control power and normal system operation. The controller shall have 24 inputs which include 20 digital and 4 analog, 14 outputs which include 12 digital and 2 analog, and capability of up to seven future expansion modules. The overall accuracy of the analog ports shall be greater than or equal to 1% of full scale. The controller shall display status of Power, Run, Fault and Force.

The control circuits shall be forced OFF by activation of the external inhibit input or upon power loss. Upon power restoration, or removal of the inhibit input, the controller shall enable its outputs in an

adjustable time-step sequence as required to meet the demand.

The controller shall continuously indicate the status of the selected alternation sequence, pumping direction, and control modes. The controller shall provide 1st On/ 1st Off, Fixed, and Auto Rotate alternation sequences.

A submersible level transducer shall be provided. The transducer shall function as the PPCs wet well level monitoring device.

Integral span, offset, and damping adjustments for the wet well level input signal shall be easily adjustable. The controller shall have the ability to select from 1 to 40 seconds of input signal averaging/damping. The controller shall have a configurable security lockout feature.

The controller shall be powered by 24 VDC. When applied as an RTU and operation on battery backup, the controller shall continue to provide communication with the host controller.

The controller shall contain a level simulation function that allows manual manipulation of the wet well level. While simulating, the controller shall display both the actual process level and the simulated level.

It is the specific intention of this functional requirement that a standard program shall be provided with features as described herein. Additionally, this controller shall be an integrated assembly with door mounted interface. That is, the furnishing of similar functions using extensive relay/timer logic to accomplish control sequences, etc., is specifically precluded by this specification and is not acceptable.

BACKUP CONTROLLER

A backup controller shall be provided. Pump control shall automatically switch to backup float control in the event of primary control system failure.

The controller shall be loaded with a factory standard program which provides communications to the primary controller. The controller shall be hard wired to each Pump Starter Compartment (Via relays as necessary) for operation and communications. (All voltage controlling these relays shall have its origin from its respective Pump Starter Compartment so that voltage is not being fed, in origin, from the PCP to the Pump Starter Compartment.

The intent of the specification is that a standard controller be provided, with standard documentation. A custom written Description of Operation is not acceptable.

The backup controller shall include field adjustable delay timer. Timer settings are password protected and shall allow delay between pump calls to be (0. 1-9.9 minutes).

The system shall allow prevention of simultaneous pump starts and shall allow limiting the maximum number of pumps when operating on standby power. These features as well as the time delays listed above shall apply when operating on primary or backup controller. The backup controller shall auto rotate pumps.

Five (5) displacement level sensors or equal shall be furnished providing redundant pump stop/low alarm, redundant pump start/high level alarm.

The high level float elevation shall be above normal transducer operation. The low level float elevation shall be below normal transducer operation. The backup controller shall permit locating of all remaining floats within the normal transducer operating range.

The backup controller will monitor for abnormal float conditions. If such a condition exists, the controller will alert to this. The backup controller will decide the best way to proceed based on the type of float failure. No single float failure in the five float system shall prevent automatic operation of all pumps.

A hardware selector switch for controlling backup activation will be provided. This switch will allow the following selections:

- Force Backup
- Disable Backup

- Automatic Selection

The backup level controller shall be locked in until manually reset. High and low level alarms shall be locked in until manually reset. An alarm contact shall also be provided to indicate that the backup system is in operation.

FULL VOLTAGE STARTERS COMPARTMENTS

Full-Voltage-Non-Reversing motor starters shall be provided in the PCC for the raw sewage pumps. Each starter shall be installed in an electrically isolated compartment with door-interlocked disconnect. Circuit breaker shall be remote mounted and connected via flexible cable mechanism to the Starter Compartment disconnect operator.

Motor starters shall be Allen-Bradley NEMA Type. Each starter shall include the following:

- Nameplate showing NEMA size, HP, voltage, replacement contact part number and renewal parts publication number.
- On/Off/Auto Selector Switch
- Electronic Overload with door mounted Reset pushbutton.
- Run Light
- Fail Light
- ETM
- Pump Protection Module (Seal Leak / Overtemperature)
- Thermal-Magnetic Circuit Breaker
- Separate Control Power Transformer & 24VDC Power Supply
- Thru-wall Pull-Apart Connection Terminals for interconnect wiring
- Finger safe Class J fuses w/ blown fuse indicators in series with Starters
- Single Pump Controller. The SPC shall communicate with the PPC via Ethernet and have hard wired signals to the BPC. The SPC shall be able to withstand short power losses of up to 3 seconds without affecting the operation of the controller. The controller shall have timer on and off delays. The controller shall display status of Power, Run and Fault.

ADJUSTABLE FREQUENCY DRIVES (AFD) COMPARTMENTS

AFD's shall be provided in the PCC for the raw sewage pumps. Each AFD shall be installed in an electrically isolated compartment with door-interlocked disconnect. Circuit breaker shall be remote mounted and connected via flexible cable mechanism to the Starter Compartment disconnect operator. Each Drive Compartment shall include:

- Nameplate showing size, HP, voltage, replacement contact part number and renewal parts publication number.
- On/Off/Auto Selector Switch
- Electronic Overload with door mounted Reset pushbutton.
- Run Light
- Fail Light
- ETM
- Pump Manufacturer Pump Protection Module (Seal Leak / Over-temperature)
- The primary and backup controllers shall monitor and activate alarms for Seal Leak & Over-temp.
- Pumps shall be locked out in the event of an Over-temp. alarm until reset

- Thermal-Magnetic Circuit Breaker
- Separate Control Power Transformer & 24VDC Power Supply
- Thru-wall Pull-Apart Connection Terminals for interconnect wiring
- Finger safe Class J fuses w/ blown fuse indicators in series with AFDs
- Mechanically Interlocked Output Contactor(s) for AFD/ Bypass w/ Electronic Overload as an intermediary between both (AFD & Bypass) Contactors
- 3% Impedance Line and Load Reactors in series with AFD, sized appropriately for pumps HP
- Single Pump Controller. The SPC shall communicate with the PPC via Ethernet and have hard wired signals to the BPC. The controller shall have a LCD Display Keypad, RS-232C Connector, LCD Display, Indicator LED Panel, RJ45 Connector, RS-232C/RS-485 Connector, all 24 Volt, or lower, terminals. The interface shall be remote panel mounted, connected via Ethernet, and include 6.5" Touch screen. The controller shall display status of Power, Run and Fault.

REDUCED VOLTAGE SOLID-STATE STARTER (RVSS) COMPARTMENTS

RVSSs shall be provided in the PCC for the raw sewage pumps. Each RVSS shall be installed in an electrically isolated compartment with door-interlocked disconnect. Circuit breaker shall be remote mounted and connected via flexible cable mechanism to the Starter Compartment disconnect operator.

Starters shall be Allen-Bradley SMC series soft starters, no exceptions.

Starter Compartments shall include:

- Nameplate showing size, HP, voltage, replacement contact part number and renewal parts publication number.
- On/Off/Auto Selector Switch
- Electronic Overload with door mounted Reset pushbutton.
- Run Light
- Fail Light
- ETM
- Pump Protection Module (Seal Leak / Over-temperature)
- Thermal-Magnetic Circuit Breaker
- Separate Control Power Transformer & 24VDC Power Supply
- Thru-wall Pull-Apart Connection Terminals for interconnect wiring
- Finger safe Class J fuses w/ blown fuse indicators in series with RVSS
- Single Pump Controller. The SPC shall communicate with the PPC via Ethernet and have hard wired signals to the BPC. The SPC shall be able to withstand short power losses of up to 3 seconds without affecting the operation of the controller. The controller shall have timer on and off delays. The controller shall display status of Power, Run and Fault.

BREAKER/ TRANSFORMER COMPARTMENT

Circuit breakers shall be provided in the PCC for each motor starter and for control power transformers. Breakers shall be thermal-magnetic type. Pump and Transformer breakers shall have a short circuit interrupting capacity of 35kA at 480V. Circuit Breakers shall be UL Listed.

Lighting Transformer shall be 5kVA open type iron core. Transformer Breaker shall be accessible to switch on/off thru-door. Transformer secondary shall feed remote front mount breakers in separate 120

Volt compartment.