

Specification: Pumpak Express Series B Pump Controller:

Simplex, Duplex, Triplex Pump Constant Speed

Engineer's Guide Specification

Control Type: Pump Down Control

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Critical Notes – Read This First

1. The following allows you to tailor the specification to the Available Options of a Series B Pumpak Express.
2. Standard features include; Running, Seal Failure, Over Temperature, High Level, Low Level and Backup Active pilot lights. Alarm conditions are indicated on the Micro-VPAC IIT LCS controller. All alarms are time and date stamped when they occur and when they clear/reset.
3. **Modification of this specification beyond the available options defined in this specification turn this into a custom control panel.**
4. Horsepower Limitations
 - a. Three Phase
 - i. 25 HP @ 208 volt
 - ii. 30 HP @ 240 volt
 - iii. 50 HP @ 480 volt

Standard Equipment Outline

1. UL Type 3R Stainless Steel Enclosure with Gasket
2. UL 698A Label
3. Main Power Terminal Block
4. GFI Duplex Receptacle
5. NEMA Rated Starter – Circuit Breaker, Contactor and Solid State Overload
6. Aluminum Inner Door for HOA's, ETMs & Pilot Lights
7. Phase Loss Protection
8. Lightning Arrestor
9. Enclosure Heater (Required where ambient temperature reaches 32 F or lower)
10. ETMs
11. HOAs
12. Seal failure (call factory if using with Flygt, KSB, Hydromatic or ABS pumps)
13. Motor Over Temperature with Indication and Manual Reset
14. Control Power Circuit Breaker
15. Micro-VPAC IIT LSC controller
16. 40 watt Red External Alarm Light
17. Alarm Horn with Silence Button
18. 30 amp field terminal (#10 - # 26AWG)

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19. Intrinsic Safety Barriers

Optional Equipment Outline

1. Type 4X 304 Stainless Steel or Type 3R Steel Enclosure
2. Freestanding Legs and Skirts
3. Battery Backup (24VDC)
4. Submersible Transducer (75' Cable is standard)
5. Two Float switches

Specification Modification Instructions

1. In general when you see a ____ line we are expecting you to insert a number or finish a word in the case of ____ plex the word should end up being simplex or duplex.
2. Instructions are shown in *italics*. Instructions are provided to help you select options. In general they should be deleted when you are finished with the specification.

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1. General

01. Intent

- A. It is the intention that this specification that the Contractor shall furnish, install, and place a _____ volt, _____ phase, _____ wire, _____ HP (*Pick One -Simplex, Duplex, Triplex*) Lift Station electrical control system into successful operation. System shall be as hereinafter described and all necessary appurtenances which might normally be considered a part of the complete electrical system for this installation. All of the automatic control equipment is to be supplied by one manufacturer. It shall be factory assembled, wired and tested and covered by complete electrical drawings and instructions.
- B. The control panel will be powered from a protected power source. Metering equipment and main interrupt breaker are existing or to be furnished by others.

02. References

- A. The entire system shall be constructed in strict accordance with the latest published standards of NEMA, IEEE and ANSI. Wherever possible, control system components shall be Underwriters Laboratory listed. All control hardware and software shall be factory assembled, wired and thoroughly tested prior to shipment.

03. 3rd Party Approval

- A. The control panel shall be in compliance with UL 698A “Industrial Control Panel Relating to Hazardous Locations with Intrinsically Safe Circuit Extensions”.. Each control panel shall bear a serialized label showing compliance. The control panel submittal shall contain a copy of the front page of the control panel builders UL508A and 698A standard that shows their UL file number. The name on the front page of the UL Standard shall match the name in the title block of the control panel submittal.
- B. While the use of U.L. listed components is encouraged, their use alone and/or the alternate use of a U.L. 508A – “Enclosed Industrial Control Panel” serialized label will not be considered an acceptable or satisfactory alternate to the “Enclosed Industrial Control Panel Relating to Hazardous Locations with Intrinsically Safe Circuit Extensions” serialized label specified above.

04. Experience

- A. All of the equipment listed herein shall be furnished by a single supplier with at least ten (10) years experience in furnishing comparable systems and shall be of the latest and most modern design. The supplier shall be responsible for the correct operation of the equipment as specified.
- B. Panel manufacture shall be Control Systems Integrator Association (CSiA) Certified, guaranteeing high quality workmanship, timely performance, corporate stability, technical knowledge and long term support. Integrators that are simply a member of CSiA but not certified, shall be considered non-compliant to the intent of this specification.

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05. Submittal

- A. The Contractor shall submit six (6) complete sets of the following information for the Engineer's approval:
 - 1. Dimension drawings, wiring and/or hydraulic drawings for field and pipeline mounted equipment.
 - 2. Fabrication and nameplate legend drawings
 - 3. Internal wiring and piping schematic drawings
 - 4. System operational description

06. Equipment Supplier

- A. The control system described hereafter is a Pumpack Series B as manufactured by ICS Healy-Ruff of Plymouth, MN. The naming of a manufacturer of equipment in this specification is not intended to eliminate competition or prohibit qualified manufacturers from offering equipment. Rather, the intent is to establish a standard of excellence for the material used, and to indicate a principle of operation desired. The contractor's bid shall be based on the use of ICS Healy-Ruff equipment. Unless the bidder clearly indicates in his bid that he is offering an equal product approved by the engineer via a pre-bid submittal, his bid shall be considered as providing the brand name product referenced in the specifications above.
- B. It is important for all bidding contractors to note that if alternate proposals based on substituted systems are to bid, they must be prequalified by the consulting engineer fifteen (15) days in advance of the bid date. In the event a prequalified system is installed by the Contractor and does not meet the specified intent of this specification with regard to reliability, efficiency, functional capability, or other system parameters, the Consultant may reject the alternate system. In such instance, the ICS Healy-Ruff system originally specified must be furnished. The Owner or the Consultant may exercise this option at any time during the project tenure. Project tenure is defined as beginning the date the project bids and ending on the date the system has operated satisfactorily for one year after final acceptance.
- C. The Engineer will issue an addendum describing acceptable equipment prior to the bid date. The bidder shall include all expenses necessitated by use of non-specified equipment in his bid price.
- D. Presubmittal data shall include, but not be limited to, the following requirements to be submitted to the Engineer not less than 15 days prior to bid date:
 - 1. Full description and performance data on all substitute items proposed with references for verification of performance for such equipment already in service, all data in triplicate.
 - 2. Detailed description of how the proposed substitute differs from that specified including but not limited to materials of construction, fabrication, operation,

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warranty, service, corrosion protection, power consumption, maintenance requirements, etc.

3. Detailed discussion of why the proposed substitute is equal or superior to that specified in material of construction, fabrication, operation, warranty, service, corrosion protection, power consumption, maintenance requirements, etc.
 4. Tracings and four copies of revised prints reflecting in detail any and all changes in arrangements for materials, equipment, piping, fabrication, erection, maintenance, power supply, etc.
 5. Name and telephone number of person(s) to contact to answer questions or supply additional information.
- E. Failure to name an approved manufacturer in each space provided in the proposal, will constitute grounds for declaring the bid irregular, or if the Owner chooses, will give the prerogative of equipment selection solely to the Owner. If more than one manufacturer is named in any space it will declare that the Bidder has no preference and will give the prerogative of equipment selection solely to the Owner.

07. Construction Standards

- A. Wire Numbers – Each wire in the control panel shall be marked with a wire number that corresponds to the page and ladder rung of the schematic diagrams. A unique wire number shall be provided between component contacts and coils. Wire markers shall be Brady Thermal Transfer Self-Laminating Vinyl or equal by Grafoplast or Thomas & Betts.
- B. Color Coding – Wires shall also be color-coded as follows: 120 VAC Line = black; Neutral = white; Ground = green; Switched 120 VAC = red; DC current carrying conductor = blue, DC non-current carrying conductor = white with blue stripe, Foreign voltage = yellow, Intrinsically safe = light blue.
- C. Component Identification – Each component in the system shall be identified by a unique number that corresponds to its coil's page and ladder rung location on the schematic drawings.
- D. Wire – AC control conductors shall be 600 volt and a minimum of 18 gauge. DC control conductors shall be a 300-volt and a minimum of 18 gauge. Control conductors shall be UL Type MTW rated for 105° C. Analog conductors shall be 22 gauge shielded twisted three conductor rated for 300 volts. Wire shall be Beldon 8771 or equal. Shields shall be grounded at the PLC or panel location. Power conductors shall be sized per UL and NEC standards and rated for 600 volts. Conductors shall be UL Type MTW, THHN or THWN rated for 90° C.

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E. Control Terminals – All field control conductors shall be connected to terminal blocks. Terminals shall have machine marked wire numbers. Connection of field control conductors directly to control panel components will not be allowed. Terminal blocks shall be rated for 30 amps at 600 volts. They shall be screw terminal type capable of terminating 10 to 26 gauge wire. Terminal bridge bars shall be provided when it is necessary to bridge multiple like terminals together. Terminals and accessories shall be Phoenix Contact “Clipline” or equal by Allen Bradley or Weidemueller.

F. Enclosure

1. All control and power equipment shall be mounted in a 14-gauge, *(Pick one -NEMA 3R Painted (ANSI 61 Gray) Steel w/Drip Shield, NEMA 3RX 304 Stainless Steel w/Drip Shield, NEMA 4X 304 Stainless Steel)*, enclosure. A gasket shall be provided for each outer door. All internal components shall be mounted on a painted steel back plate. An aluminum inner door shall be provided for mounting of the operator interface, HOAs, ETMs, pilot lights, and reset buttons. A padlock hasp shall be provided on the enclosure door. Enclosure mounting tabs shall be provided.
2. Enclosure shall be sized sufficiently to allow for easy access to all internal equipment and to accommodate future equipment. Enclosure shall be not less than 48” High x 36”Wide x 12” Deep.
3. *Opt. – Control panel shall have (Pick one - 12”, 18”) leg Stands and skirts allowing free stand mounting of the control panel.*

G. Power Entry

1. Terminal blocks shall be provided to accommodate a single source power feed. The terminals shall be sized as required to accommodate the maximum power load(s) serviced by the control panel.

H. Lightning Arrestor

1. The control panel shall be protected from electrical surges caused by lightning and high current/voltage surges. A surge Protector shall be installed and connected to each leg of incoming service. The surge arrestor shall meet the following requirements:
 - a. Designed to meet ANSI/IEEE C62.11-1987 requirements.
 - b. Rated for not less than 10,000 amp surge current.
 - c. Response time of not more than 50 nanoseconds.
 - d. Three LED Indicators for visual indication of the devices operational status
 - e. Built in fuses
 - f. Maintenance free, long life design.

I. Control Power Transformer *(Required if Incoming Service Voltage is 240 3 Phase 3 Wire or 480)*

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1. A control power transformer shall be provided, if required, to provide 120 VAC power to internal control system equipment. Transformer shall be sized to accommodate the control panel 120 VAC power requirements with at least 50% spare capacity. Minimum size shall be 1000 VA.
2. The control power transformer shall be rated for 230/460-120 VAC single phase at 2 KVA with Class 105 Deg. C insulation and shall be UL Listed. The control power transformer shall be supplied with primary and secondary fusing. Fuses shall be rated for load and 200,000 AIC.
3. The control power transformer shall be of single epoxy resin impregnated construction to eliminate the possibility of moisture, dust, dirt, and industrial contaminants from affecting operation and shortening transformer life. The unit shall have Integrally molded barriers between terminals and transformer to protect against electrical coupling.

J. Control Power Circuit Breaker

1. A 1P1T circuit breaker shall be provided to provide additional short circuit protection and to allow control power on/off. Unit shall be rated 10,000 AIR or higher.

K. Power Monitor

1. A power monitor shall be provided and connected to the incoming power to the panel to detect incoming service abnormalities including loss of phase, phase reversal, under voltage (90%), over voltage, voltage (110%) unbalance (2-8%), and Rapid Cycling.
2. Each phase input to the phase monitor shall be in wired in compliance with UL specified wiring standard 508 part 18.2.1
3. Unit shall have a built in adjustment allowing an unbalance phase detection of 2 to 8% minimum.
4. An adjustable 0-30 second time delay shall be provided to prevent momentary voltage and unbalance power fluctuations from affecting system operation. In the event a sustained deviation from normal power is detected the power monitor will provide an output indicating a power failure. Loss of phase will trip unit within 1 second. The unit will remain in this mode until power is restored to normal levels. An adjustable 1 to 500 second reset time delay shall be provided to allow for power to stabilize before releasing the power fail output. Other adjustments include a 1-30 second trip delay, a 1-500 second restart delay, and a 2-8% voltage unbalance trip point adjustment.

L. Heater Condensation/Freeze

1. A thermostatically controlled heater shall be provided to prevent condensation and maintain the control panel internal temperature above freezing. The heater shall be minimum 100-watt with a long life heating element.
2. Heater shall in no event reach an external temperature of more than 428 Deg. F. The heater shall be mounted at the base of the enclosure in a fashion to allow for the maximum heat transfer to the interior and away from any equipment, wire

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way, or other materials that could lose their integrity or be adversely affected by the heat source.

3. A separate and remote mounted thermostat shall be provided to control the heater and maintain the enclosure temperature above 32 degrees F. during all local weather conditions. In the event panel temperatures exceed 70 Deg F. the heater will not be allowed to operate.
4. Heater shall be protected by its own circuit breaker allowing for overcurrent protection and a means to switch the heater off.

M. GFCI Duplex Receptacle

1. A GFCI Duplex power receptacle shall be mounted inside the enclosure to provide a power source for use by an operator.
2. The GFCI duplex receptacle shall include a 10 amp circuit breaker to provide cutout on an overcurrent condition.
3. Unit shall incorporate GFCI fault test button and reset on the face of the unit.
4. Unit shall detect and indicate via face mounted LED if the line/load wiring is reversed.
5. Internal circuitry shall monitor the condition of the GFCI and will trip unit if a malfunction is present. Unit will not permit reset if the GFCI is not able to provide the necessary protection.

N. Power Supply Systems

1. The control panel shall be supplied with a DC power supply.
 - a. Power supply will be sized so that under normal conditions, no more than 60% of its rated wattage output is used.
 - b. The DC power outputs shall be protected by separately mounted replaceable fuses
2. Optional – An Uninterruptable Power Supply (UPS) System shall be furnished. The UPS shall supply both regulated 24 VDC and 12 VDC power for powering control and sensor equipment.
 - a. Unit shall be sized to provide battery back-up operation for a minimum of 4 hours during an incoming service power interruption.
 - b. System will allow controller, sensors and telemetry equipment to remain operational under battery back-up
 - c. The UPS shall monitor battery life and provide indication via LED to replace battery. n indicator
 - d. The battery shall be no maintenance gel type cell and easily replaceable. UPS will not be damaged in the event the battery is connected in reverse polarity.
 - e. The DC power outputs shall be protected by separately mounted replaceable fuses.

O. System Control

1. General Operation

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- a. A microprocessor based pump controller shall be provided to monitor wet well level via remote sensor as specified elsewhere and provide (*Pick One – Simplex, Duplex, Triplex*) pump down mode pump control. The pumps shall start and stop as required to maintain an acceptable level.
- b. (*Simplex*) When the level in the wet well rises to the lead pump start set-point, the lead pump shall be started. If the capacity of the lead pump is greater than the influent flow, the lead pump shall stop when wet well level falls to the lead pump stop set-point.
- c. (*Duplex*) If the capacity of the lead pump is less than the influent flow, the lag 1 pump shall be called to start. If the capacity of both pumps running in parallel is greater than the influent flow, the lag shall stop when the wet well level falls to the lag pump stop setpoint. The lead pump will continue to run.
- d. (*Triplex*) If the capacity of the lead and Lag 1 pump is less than the influent flow, the lag 2 pump shall be called to start. If the capacity of both pumps running in parallel is greater than the influent flow, the lag 2 shall stop when the wet well level falls to the lag 2 pump stop setpoint. The lead and lag 1 pumps will continue to run until they reach their respective off levels.
- e. If the capacity of the lead pump is greater than the influent flow, it shall stop when the level falls to the lead pump stop setpoint. The pumps shall alternate after each complete operating cycle if alternation is enabled.

P. Microprocessor Based Controller

1. The Lift Station Controller shall be an off-the-shelf, preprogrammed, dedicated to the application, microprocessor based controller capable of monitoring process variable inputs and automatically control up to three constant speed pumps. Systems using a one of a kind, non-standardized, custom programming generic controller represent additional complexity and unproven operation and thus are not in conformance to the intent of these specifications and will not be acceptable.
2. Controller shall be configured for the number of pumps to be controlled at this lift station as per these specifications.
3. The operator interface shall display the current level in feet and represent the level in bar graph form, which dynamically updates based on the level in the wet well.
 - a. An active/dynamic graphical representation of each pump and its status shall be displayed on the same screen along with flow in gallons per minute. Pump graphic shall change state to indicate – “Off”, “Called”, “Running”, and “Failed/Out of Service”.
 - i Touching an active pump on the home screen takes you to the respective pump status screen.

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- b. A trend screen showing, a minimum of, the last 2 hours of wet well level fluctuations shall also be available.
 - c. The operator interface shall have a display area not less than 3.5" with 160 x 128 pixel resolution, Transflex touch screen graphic display viewable in direct sunlight.
 - d. The operator interface shall be suitable for Type 12, 4 & 4X environment. Additionally, the display shall be manufactured from a UV resistant polyester substrate.
- 4. To prevent the loss of data during an extended power outage, longer than 4 hours, the controller shall have a built in replaceable battery system to keep volatile memory active for approximately 10 years.
- 5. The controller shall come standard with herein specified inputs and outputs. The controller shall also have the ability to accommodate additional expansion I/O without the need to replace hardware or upgrade the controller.
 - a. The controller shall be configured to monitor the following discrete input status signals:
 - i Pump 1, 2 & 3 Running
 - ii Pump 1, 2 & 3 HOA In Auto
 - iii Pump 1, 2 & 3 Seal Failure
 - iv Pump 1, 2 & 3 Overtemp
 - v Pump 1, 2 & 3 Overload
 - vi Backup Active
 - vii High Level Float
 - viii Low Level Float
 - ix Control Power Failure
 - x Generator Running
 - xi Phase Failure
 - xii Station Intrusion
 - xiii Flow Pulse
 - xiv Temp Alarm High/Low
 - b. The controller shall provide the following discrete output signals:
 - i Pump 1, 2 & 3 Call
 - ii Pump 1, 2 & 3 Failure
 - iii Common Alarm
 - iv Alarm Horn
 - v Alarm Horn Silence
 - vi Backup Reset
 - c. The controller shall monitor the following (4-20 mA) process signals:
 - i Wet Well Level
 - ii *(Optional) Station Flow*
- 6. A two level security system shall be provided for operators (OPER) and supervisors (SUPER). Without being logged in, screens are view only.

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- a. OPER – Operator Access
 - i Rights to edit set points and acknowledge alarms
 - b. SUPER – Supervisor Access
 - i All privileges as the OPER
 - ii Right to change the passwords of both SUPER and OPER users
 - iii Right to set lifetime pump runtime and start totals
 - iv Right to toggle communication ports between telemetry communications or local programming modes
 - v Right to set the controller time and date
 - vi Right to access removable media system screen
 - c. Shall be provided with factory default passwords
 - d. To prevent unauthorized controller adjustments, an adjustable 0-999 second delay shall be provided to automatically logoff the current user after the adjustable time period, and no operator screen navigation has been detected.
7. The controller shall be capable of operating pumps in an automatic or fixed mode. In automatic mode, a built in alternator shall be available to equalize motor starts, stops and run time. The alternator shall have the capability of being put into fixed sequence mode at any time. Alternation shall also have the capability to alternate cyclically or following an adjustable period of time.
- a. Alternator shall have pump fail replace logic allowing a failed pump to be detected and the lag pump to be called into service without level increasing to lag start setpoint.
 - i Auto Alternation Mode
 - If the running signal input is not received within 60 seconds (adjustable) of the respective pump being called to start, a pump failure alarm shall be displayed in the alarm banner and the next pump in sequence shall be called to start.
 - ii Fixed Alternation Mode
 - If the running signal input is not received within 60 seconds (adjustable) of the respective pump being called the respective pump shall continue to be called until the level in the wet well reaches the next level setpoint at which point the next pump in the sequence shall be called to start.
8. The following system setpoints shall be provided: (* indicates an associated, user adjustable (0-999) seconds time delay shall also be provided to prevent momentary process fluctuations from impacting alarm or control.)
- | | |
|--|----------|
| a. Wet Well Level High and Low Level Alarm * | xx.x ft. |
| b. Start Lead*, Lag 1*, Lag 2* | xx.x ft. |
| c. Stop Lead*, Lag 1*, Lag 2* | xx.x ft. |
| d. Pump 1, 2 & 3 Failure To Start Delay | xxx sec |
| e. Pump 1, 2 & 3 Seal Failure Delay | xxx sec |
| f. Pump 1, 2 & 3 Over Temp Delay | xxx sec |

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9. The controller shall monitor, display and log the following alarms:
 - a. High or Low Wet Well Level Alarm (Transducer)
 - b. Pump 1, 2 & 3 Seal Failure
 - c. Pump 1, 2 & 3 Over Temp
 - d. Pump 1, 2 & 3 Overload
 - e. Pump 1, 2 & 3 Failure (internal to controller, Call No Run)
 - f. Float Backup Active
 - g. Low Level Cutout (from floats)
 - h. High Level Alarm (from floats)
 - i. Control Power Failure
 - j. Generator Running
 - k. Phase Failure
 - l. *(Optional) Station Intrusion*
 - m. Temp Alarm
10. The controller shall have Pump Status screens that provide the following information and control options:
 - a. Pump 1, 2 & 3 Status (Off, Called, Running, & Failed)
 - b. Pump 1, 2 & 3 Hard and Soft H-O-A Status
 - c. Pump 1, 2 & 3 Seal Failure Status
 - d. Pump 1, 2 & 3 Over Temp Status
 - e. Pump 1, 2 & 3 Overload Status
 - f. Today: Pump 1, 2 & 3 Runtime xx.x Hours
 - g. Today: Pump 1, 2 & 3 Starts xxx
 - h. Yesterday: Pump 1, 2 & 3 Runtime xx.x Hours
 - i. Yesterday: Pump 1, 2 & 3 Starts xxx
 - j. Current (CRNT) Month (MNTH): Pump 1, 2 & 3 Runtime xxx.x Hours
 - k. Current (CRNT) Month (MNTH): Pump 1, 2 & 3 Starts xxx
 - l. Last Month (MNTH): Pump 1, 2 & 3 Runtime xxx.x Hours
 - m. Last Month (MNTH): Pump 1, 2 & 3 Starts xxx
 - n. Total: Pump 1, 2 & 3 Runtime 999999.9 Hours
 - o. Total: Pump 1, 2 & 3 Starts 999999
11. Navigation
 - a. A menu system shall be provided for the user with proper access to change setpoints, setup pump starts, stops, alarms, alarm delays and setup pump alternation. The following parameters shall be provided:
 - i Level and Level Delay Setpoints
 - ii Alternation – Auto or Fixed mode; Timed or Cyclical
 - iii The operator shall have a choice of selecting automatic or a fixed sequence.
 - iv Pump Failure – call, no run
 - v The user shall be able to enter pump failure time for each pump that is enabled. A failed pump will be replaced with the next available pump.
 - vi Seal Failure and Over Temp

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- vii The user shall be able to enter seal failure and over temp time delays for each respective pump that is enabled.
- viii Miscellaneous Alarms
- ix The user shall be able to enter delays for communications failure, intrusion and high or low temperature.
- x Transducer Range (wet well level)
 - A field shall be provided to scale the transducer in feet to setup the vertical scale on the Home screen and an adjustable offset in feet, shall be provided to compensate for the transducer to be raised off the bottom.
- xi Volumetric Flow Calculation
 - The controller shall provide station flow information based on external flow transmitter or based on high accuracy volumetric process calculations using wet well level excursions as sensed by wet well level transmitter in conjunction with verified pump operations. Systems that do not monitor/use actual pump run feedback in the calculation are deemed unreliable and will not be acceptable.
 - The controller shall provide the following flow related information as a minimum:
 - Station incoming flow rate (Average).
 - Station Effluent Todays flow total.
 - Station Effluent Yesterdays flow total
 - Station Effluent Previous Month Flow Total
 - Station Effluent Current Month Flow Total
- xii Controller shall log the pump run time data, alarms and analog data to the removable memory card.

12. Back Up Control

- a. The controller shall have a built in back system. The backup system shall be configured to allow operation of pumps in the event of primary sensor failure. In this mode, the float switch inputs shall be monitored to detect high or low level. Upon detection of a float switch high or low level, the controller shall indicate an alarm and disable the primary sensor from operating the pumps and will operate pumps on the high and low level float inputs. The controller will stay in this mode until manually reset.

13. Unauthorized Intrusion Detection System

- a. The controller shall have a built in intrusion detection system to provide premises security. The controller shall monitor an external door switch, proximity sensor, limit switch, etc.. to detect door open or closed. When the intrusion system is engaged, the intrusion system shall detect the change of state of the door switch and allow a user adjustable time for an authorized operator to input a security code into the controller operator interface. Successful log in will disable the intrusion system. If unsuccessful, an alarm will be generated. When re-arming the system, a user adjustable time delay will start counting and

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provide time for the operator to vacate the premise and shut any open doors. Once the timer has completed its count, the system shall re-arm itself.

14. Alarms and Historical Events

- a. When an alarm is activated it shall be logged with a time and date stamp and displayed in the alarms summary screen until the operator acknowledges it.
- b. A historical screen shall provide a historical log for the most recent 64 events
- c. An additional screen shall be provided to indicate today's, yesterday's, previous month and current month flow through the pump station.

15. Removable Memory

- a. A removable memory storage device shall be provided to store a backup of the program and historical data. Memory module can be used to copy and install configurations including graphics to like controllers in the system or inserted to like replacement controllers. Removable memory shall be sized to allow a minimum of 5 years of data storage or 78 million time and date stamped process data readings. Data storage rates shall provide sufficient resolution of monitored process signals to provide an accurate historical representation of the process. Data shall be formatted in .CSV format and easily read and importable to Windows based applications including Excel or Access for manipulation or longer term storage of historical data. The memory card shall be easily accessible, without having to remove or disconnect panels, wires or other equipment, allowing for quick removal and replacement.

16. Controller Communications

- a. The controller shall be supplied as telemetry ready.
- b. The controller shall include a minimum of two RS-232/RS-485 serial ports (Operating at up to 115 Kbs) and 1 CAN network port.
- c. Communications protocol shall be configured based on MODBUS RTU open standard protocol.
- d. When enabled, this communication feature shall allow the controller to communicate over optional telemetry equipment including: Phone Line, VHF/UHF/900/Spread Spectrum, Satellite Radio, Fiber Optic and Cellular communication mediums.
- e. A CAN port shall be provided to interface with optional CAN-based remote I/O.

17. Diagnostics

- a. The controller shall have built-in diagnostics allowing for on-site troubleshooting of equipment without the need for a Laptop, special programs or specialized training. Diagnostics shall be viewable from the front of the display. The following minimum set of diagnostics shall be available via a self-test command:
 - i Run and OK status
 - ii Network Status and Usage
 - iii Average Logic Scan rate

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- iv Application Memory Usage
- v Loaded Firmware Versions
- vi Loaded Protocols
- vii Removable media access

18. Certifications

- a. The controller shall be compliant with CE, UL, UL-C and for use in applications requiring Class 1, Division 1 - A, B, C & D classifications.

Q. The Lift Station Controller shall be an LSC Controller as manufactured by ICS Healy-Ruff.

R. Transducer Failure or Primary Controller Failure

- 1. Float switches shall be provided to initiate high and low level alarms. They shall be set at elevations above and below the primary controller high and low level alarm setpoints. The float switches shall also provide backup control should the primary level sensor or controller fail. If either of the float switches becomes active the primary level sensor and controller shall be removed from service and the floats shall control the pumps. A pilot light shall be provided to alert the operator that the back up control system is active. An alarm contact shall also be provided for connection to the SCADA system or alarm dialer.

S. Backup Controller

- 1. During backup control operation the pumps shall be stopped when the level falls below the low level float. They shall not be allowed to start until the level rises to the high level float. When the level reaches the high level float pump No.1 shall be called to start. If the high level float is still active after a 30 second (adjustable) time delay Pump No.2 shall be called to start.
- 2. All pumps shall run in parallel until the low level float opens and stops the pumps. The backup control system shall remain active until a "reset" button is pressed on the touch screen or on the panel.

T. Motor Starters & Circuit Breakers

- 1. Each pump motor shall be provided with a circuit breaker and motor starter. Circuit breakers shall be thermal magnetic, "E" frame or better and rated for a minimum of 10,000 AIC at 240 VAC or 18,000 AIC at 480. Starters shall be NEMA rated and not smaller than size 1. Overloads shall be solid state, ambient compensated, quick trip Class 10. Overload reset operators shall be provided to reset the overloads without opening the enclosure door.
- 2. Each starter circuit shall include an HOA switch, non-reset type ETM (99999.9 hours) and run light as specified elsewhere in these specifications.
- 3. The motor starters and circuit breakers shall be sized to accommodate the following motors

Motor	Voltage	HP
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1		
2		
3		

U. Pilot Devices

1. Selector switches shall include removable 10 Amp, 600-volt double make double break contacts. All pilot lights, selector switches and pushbuttons shall be rated for NEMA/UL 4 applications. They shall be not less than 22.5mm diameter.
2. Contact blocks/terminals shall be finger safe meeting IP20 standards.
3. Operators shall be rated for a minimum life of 500,000 operations with a MTBF of less than 1 fault per 10 million operations.
4. All Pilot devices shall be clearly identified by a phenolic nameplate with black surface and white letters not less than 3/16" in height placed over the associated pilot device.
5. The following Pilot Lights shall be mounted on the inner door:
 - a. Pump 1, 2 or 3 Run
 - b. Pump 1, 2 or 3 Overtemp
 - c. Pump 1, 2 or 3 Seal Failure
 - d. High Level Float
 - e. Low Level Float
 - f. Back Up Active
6. The following Selector Switches shall be mounted on the inner door:
 - a. Pump 1 Hand-Off-Auto
 - b. Pump 2 Hand-Off-Auto
 - c. Pump 3 Hand-Off-Auto
7. The following Push Buttons shall be mounted on the inner door:
 - a. Pump 1 Overtemp Reset
 - b. Pump 2 Overtemp Reset
 - c. Pump 3 Overtemp Reset
 - d. Back Up Control System Reset
8. The following Push Buttons shall be mounted on the side of the control panel:
 - a. Alarm Horn Silence

V. Running Timer Meters

1. An elapsed time meter shall be mounted on the inner enclosure door for each pump. It shall be 6 digit (99999.9 hours) non-reset types.
2. Unit shall have quartz accuracy. Accuracy shall be within +/- .02% over entire range.

W. Relays

1. Relays shall be provided as needed to provide the specified functionality of these specifications.
2. Relays shall be general-purpose plug-in type.
3. Each relay shall be a minimum of 4-pole with contacts rated for 6 amps at 240 VAC resistive load and 3 amps at 240 VAC inductive load.

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4. Each relay shall have a built in LED indicator and illuminate when active.
 5. Minimum mechanical life is 20,000,000 operations AC, 30,000,000 operations DC
- X. Timers shall be 4-pole solid-state plug-in type.
1. Timers shall be provided as necessary to provide the specified functionality of these specifications.
 2. Each timer shall have contacts rated for 3 amps at 220 VAC resistive load and .8 amps inductive load.
 3. All relay and timer sockets shall be of the same type and shall be 14-blade. Timers shall be adjustable from 0 – 6 hours. A "time cycle in progress" and "timed out" indicating LED shall be provided.
 4. Minimum mechanical life is 500,000 operations.
- Y. External Alarm Light
1. Alarms shall be visually annunciated at site via external alarm light.
 2. Alarm light shall be low profile, 40 watt, UL Type 4X light with a red Lexan® lens.
 3. Alarm light shall be top panel mounted and be viewable from any direction.
 4. Active light shall be visible in direct sunlight.
 5. Light shall flash when activated.
 6. Relamping of the alarm light shall be done from the inside of the enclosure.
- Z. Alarm Horn
1. An alarm horn shall be provided to provide audio annunciation of active alarm
 - a. The alarm horn shall produce a minimum of 110 dB sound at 5' shall be mounted on the side of the enclosure.
 - b. Alarm horn shall have a minimum of 8 user selectable alert sounds and 2 user selectable sound output levels.
 - c. Horn shall be tamper resistant.
 - d. A silence pushbutton and relay shall be provided. The silence pushbutton shall be mounted adjacent to the horn. The silence pushbutton shall be as specified elsewhere in these specifications.
- AA. Seal Failure Monitor
1. Seal failure indication shall be provided for each pump on the operator display. Voltage or current sensing relays as required by the pump manufacturer shall be provided to sense seal failure.
 - a. The use of general purpose relays or neon lights for seal monitoring is specifically prohibited.
- BB. Motor Overtemperature
1. Motor Over-temperature indication shall be provided for each pump on the operator display. The alarm light shall remain on and the pump shall not be allowed to restart until the motor has cooled and the reset button has been pressed.

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CC. Intrinsically Safe Barriers

1. All float switches and transducers located in the wet well shall be provided with intrinsically safe barriers that meet UL 913 specification, 6th edition and are labeled as such. Each device shall be mounted in an intrinsically safe area that is mechanically protected from non-intrinsically safe wiring.

DD. Submersible Level Sensor

1. A loop powered submersible level transmitter shall be provided to sense the wet well level. The wet well level transducer shall sense wet well level by measuring the hydrostatic head pressure associated with water levels above the base of the diaphragm. A linear and proportional, to hydrostatic head pressure, 4-20 mA signal shall be produced and input to the pump controller. The transducer shall be installed in accordance with manufacturer's instructions.
 - a. The pressure transducer shall be certified by FM, UL, and CSA for installation in a Class I, Division 1, Groups A, B, C, and D, Class II, Division 1, Groups E, F, and G, Class III, Division 1 hazardous location when connected to associated apparatus manufactured by PR Electronics, R.G. Stahl and others. The transducer shall be installed in accordance with manufacturer's instructions.
 - b. The pressure transducer wetted materials shall be 316 SS, Viton®, Polyurethane or Tefzel®.
 - c. Sensing diaphragm shall be 2.75" in diameter and include diaphragm protector allowing the unit to be placed on or near the bottom of the wet well without affecting pressure readings.
 - d. The transducer shall include circuitry that provides protection from overvoltage, reverse polarity and shorted output.
 - e. Transducer overall accuracy shall be 0.25% full scale or better with a resolution of .0001% over the entire range of the wet well.
 - f. The sensing element shall exhibit non measurable hysteresis, withstand overpressures to 200% of rated range without damage.
 - g. Transducer unit shall have a life time warranty
2. The pressure transducer shall be mounted in the wet well and furnished with a minimum of 75 feet of cable.
 - a. The cable shall be .3" outside diameter Polyurethane or Tefzel® material.
 - b. Cable shall have non stretch Kevlar reinforcement strands bundled within the wiring cable to provide additional cable strength. Cable strength shall allow up to 200 lbs of pulling strength.
 - c. A sealed breather tube system shall extend from the top of the cable to the transducer assembly to provide barometric compensation to the transducer.
 - d. Breather system will be sealed and maintenance free. Systems that use gaps in wire cable and or desiccant filters that require periodic replacement shall not be considered.
3. Transducer Mounting

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- a. The transducer shall be suspension mounted in the wet well in an area of the wet well allowing full measurement of the wet well and in such a manner as to not be adversely affected by motor operation or incoming flow streams.
- b. Transducer shall be mounted so that it is approximately 6" above the floor of the wet well.
4. The transducer shall be furnished with a suspension mounting kit made out of stainless steel.

EE. Float Switch – Back Up Control

1. The contractor shall furnish, install, and wire the float switches for back up control as shown on the drawings.
2. Each float shall have molded polyethylene body, internal redundant polyurethane foam flotation, potted switch and cable connections and fine-stranded AWG #18 cable with heavy-duty synthetic rubber jacket in lengths as required to run unspliced to the control panel. The floats shall include internal weight allowing suspended operation without the use of special pipe or suspension mounting systems.
3. The float switches shall be mercury free.

2. Field Supervision

01. The services of a factory trained, qualified representative shall be provided to inspect the completed installation, make all adjustments necessary to place the system in trouble-free operation and instruct the operating personnel in the proper care and operation of the equipment.
02. *(It is required that the existing system be kept on line during the start up phase of the new system. (If Applicable)* After each system has been installed, the Supplier shall demonstrate with simulated I/O the performance of each unit, and document that the system operates properly as specified. Monitoring signals shall register at all required locations and loop checks on all loops shall have been completed and tested. Each station must be tested and accepted by the city prior to proceeding to the next installation

3. Training

01. The Supplier shall provide systems training for operations staff totaling no less than 4 hours.
02. All training shall be at the customers offices located in (*Location*) All travel and per-diem expense for training will be the responsibility of the Supplier.

4. Guarantee

01. All equipment shall be guaranteed against defects in material and workmanship for a period of one year from the date of Owner's final inspection and acceptance to the effect that any defective equipment shall be repaired or replaced without cost or obligation to the Owner.

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