

Specifications – RELAY LOGIC PANELS

RELAY LOGIC CONTROL PANEL

GENERAL

Contractor shall furnish all labor, materials, equipment, and incidentals required to provide (simplex, duplex, multiplex) pump control panel as specified herein.

The pump control panel shall be assembled and tested by a shop meeting UL standard 508A for industrial controls. Each control panel shall receive a factory test to ensure proper operation prior to shipment.

CONSTRUCTION

The controls for the pump shall be contained in a (painted steel, fiberglass, stainless steel, aluminum) enclosure meeting NEMA (1, 12, 3R, 4, 4X) requirements with hinged door.

The enclosure shall have provisions for padlocking. A nameplate shall be permanently affixed to the panel and include the voltage, phase, hertz, pump full load ampere rating, and pump horsepower rating. A warning label stating the power should be disconnected before servicing shall appear on the panel.

An aluminum back panel shall be provided. Should the panel size be larger than 36"x 30", a 12 gauge steel back panel finished with nonconductive white polyester powder paint shall be provided.

For each pump a run light and a hand-off-auto switch shall be provided. Run lights and hand-off-auto switches shall be mounted on (inner door, outer door, aluminum switch bracket). The run lights and hand-off-auto switches shall be properly labeled as to function. The hand-off-auto switches shall be toggle type. The run lights shall match the hand-off-auto switches in appearance. Run lights shall be green.

The incoming power shall be (115, 208, 230, 460, 575) volts, (single, three) phase (50/60) hertz service. Terminal blocks with box type lugs shall be supplied to terminate all wiring for floats, heat sensors, and seal sensors for the pump, if required. The pump leads shall be terminated at box type terminal blocks.

A circuit breaker shall be used to protect from line faults and to disconnect the pump from the incoming power. Circuit breakers shall be thermal magnetic and sized to meet NEC requirements for motor controls.

The magnetic starter shall include a contactor with a minimum mechanical life of 3,000,000 operations and a minimum contact life of 1,000,000 operations. The magnetic starter shall include an overload relay that is IEC rated, ambient temperature compensated, and bimetallic. The overload relay shall be capable of being set in either a manual or automatic reset mode. In the manual mode, only the operator shall accomplish reset. Overload relays shall be Class 10 type, meaning at 6 times the full load amperes the overload relay shall trip within 10 seconds.

Control voltage shall be 120VAC and may be accomplished by the means of a transformer should the input voltage be unable to produce a 120VAC signal. Control fuse(s) and an on-off switch/circuit breaker shall protect and isolate the control voltage from the line.

Wire ties and/or wire track shall be used to maintain panel wiring in neat bundles for maintenance and to prevent interference with operating devices. All wiring shall be color-coded to facilitate maintenance and repair of the control panel. Where a color is repeated, number coding shall be added. A schematic shall be permanently attached to the inside surface of the front door.

All ground connections shall be made with fork terminals and star washers to assure proper ground.

Control panel shall include an alternating circuit, which alternately switches the lead pump when pump on-off cycle is completed. (N/A for simplex)

OPTIONS

Panel may be equipped with the following additional features:

- UL 698A labeled with intrinsically safe circuit extensions for floats (Hazardous location pumps only)
- High-level alarm light (flashing, nonflashing)
- High-level alarm (piezo, horn, bell) with push-to-silence switch
- Auxiliary dry contacts for alarm conditions
- Telemetry unit
- Low water alarm (w/redundant off float)
- Power on indicator light
- NEMA rated starters
- NEMA rated Class 20 ambient compensated overload relays
- NEMA rated Class (10, 20, 30) melting alloy overload relays
- Variable frequency drives
- Soft starts
- Elapsed time meter (per pump)
- Cycle counter (per pump)
- Seal failure light(s)
- Over temperature light(s)
- Anticondensate heater with thermostat
- Heat sensor – manual reset
- Voltage monitor
- Phase monitor (3 phase only)
- Lightning arrestor
- Surge suppressor (capacitor)
- Lead pump selector switch
- Lag pump on time delay
- 24 hour time clock, adjustable to 15 minute intervals to control pump operation
- 120VAC, 15 amp GFCI convenience outlet with circuit breaker
- Fused/Nonfused disconnect with inner door interlock handle
- Main breaker
- Generator receptacle
- Manual transfer switch
- Swing dead front inner door
- Pedestal mount for enclosure; up to 36"x 30"
- 22mm oil tight lights and switches
- 30mm oil tight lights and switches

RELAY LOGIC CONTROL PANEL PLUS

GENERAL

Contractor shall furnish all labor, materials, equipment, and incidentals required to provide (simplex, duplex, triplex) pump control panel as specified herein.

The pump control panel shall be assembled and tested by a shop meeting U.L. standard 508A for industrial controls. Each control panel shall receive a factory test to ensure proper operation prior to shipment.

A complete wiring diagram and installation instructions shall be provided.

ENCLOSURE

The controls for the pump shall be contained in a durable NEMA 4X enclosure, made from polycarbonate material and intended for indoor or outdoor use primarily to provide a degree of protection against corrosion, windblown dust and rain, splashing water, and hose directed water.

The enclosure shall be undamaged by the formation of ice. It shall also include a flame retardant so as to meet the flammability requirements of U.L. 94V-O. Heat distortion shall not occur until 350°F and the enclosure shall be resistant to ultraviolet light.

The enclosure shall have a non-metallic hinged door with stainless steel latches that include provisions for padlocking. A nameplate shall be permanently affixed to the panel and include the voltage, phase, hertz, pump full load ampere rating, and pump horsepower rating. A warning label stating the power should be disconnected before servicing shall appear on the panel.

The enclosure shall include a non-conductive, molded inner-door, which isolates the user from energized components and dangerous line voltage, while saving space and making the controls more easily accessible.

A non-conductive, injected molding back panel shall be provided. The back panel shall have a raised platform for mounting circuit breakers, a heavy-duty parallel ground lug, a housing for motor contactors, and an elevated terminal strip, which provides installer friendly field installation.

A quick disconnect circuit board shall be mounted on the back of the inner-door so as to provide easy replacement and troubleshooting. Spare fuses for alarm and control fuses shall be provided.

STANDARD CONTROL FEATURES

The incoming power shall be (115, 208, 230, 460) volts, (single, three) phase (50/60) hertz service. Terminal blocks with box type lugs shall be supplied to terminate all wiring for floats, heat sensors, and seal sensors for the pump, if required. The pump leads shall be terminated at box type terminal blocks.

A circuit breaker shall be used to protect from line faults and to disconnect the pump(s) from the incoming power. Circuit breakers shall be thermal magnetic, sized to meet NEC requirements for motor controls, and accessible through the inner-door.

All features shall be integrated on a single control board with scope for future expansion. The compactness of the control board shall eliminate the need for several discrete components resulting in ease of serviceability, reduction in probability of failure, and lower heat generation. The plug-ins feature of the control board shall enhance ease of serviceability by eliminating the need for all manual wiring. The control board shall operate on a low voltage DC as compared to the mains thereby making it inherently safe.

For each pump a run light and a hand run pushbutton shall be provided. The run lights and hand run pushbuttons shall be properly labeled as to function. Run lights shall be green. Should the high level float or the redundant off float be triggered, the hand run pushbuttons become momentary contact and must be held down to maintain a closed position.

(HPGR/HPD) The motor starter(s) shall be of the definite purpose type and shall provide electrical start/stop control for each pump. The coil shall have an operating voltage of 120VAC.

(HPG) The motor starter(s) shall be of the IEC rated type and shall provide electrical start/stop control for each pump along with overload protection. The coil shall have an operating voltage of 120VAC.

Control voltage shall be 120VAC and may be accomplished by the means of a transformer should the input voltage be unable to produce a 120VAC signal. Control fuse(s) and an on-off switch/circuit breaker shall protect and isolate the control voltage from the line.

Wire ties shall be used to maintain panel wiring in neat bundles for maintenance and to prevent interference with operating devices. All wiring shall be color-coded to facilitate maintenance and repair of the control panel.

A schematic shall be permanently attached to the inside surface of the front door.

FLOAT SWITCH CONTROL OPERATION

The control panel shall provide terminal strip inputs for: pump off, pump on, lag on (duplex only), and alarm float controls.

(Simplex) When the water level rises to the pump on float level, the pump shall turn on and lower the water level to the pump off float level. Should the water level reach the high water alarm level, a flashing red alarm light shall activate and an audible alarm shall sound.

(Duplex) When the water level rises to the lead pump on float level, the lead pump shall turn on and lower the water level to the pump off float level. Should the water level reach the lag pump on float level, both pumps shall operate. If the water level reaches the high level alarm float level, a flashing red alarm light shall activate and an audible alarm shall sound.

(Simplex/Duplex) Should there be a redundant off float and the pump continues to operate after the water has reached the pump off float level, the pumps shall be locked out, the flashing red alarm light shall activate, and the audible alarm shall sound. (Redundant off optional)

The controller shall provide float switch status indicator lights. The indicator LED's shall activate to indicate the closure of each of the float switches, and shall flash to indicate float switch failure. The out-of-sequence or float failure indicators shall remain activated until the next pump down sequence after the fault has been corrected. A chirping audible alarm shall also be activated when a float switch failure or out-of-sequence operation is detected.

ALARM / INDICATORS / MISC

Panel shall include a top-mounted, high intensity, flashing red alarm light.

Panel shall include an audible piezo alarm, 95dB within 2', with a side mounted touch-to-silence pad and circuitry as a standard feature. Optional horn or bell is available.

(HPG only) Panel shall provide a means for connecting the seal failure probe(s) from the pump. The panel shall incorporate a seal failure warning light that provides a visual indication of moisture entry into the motor. The seal failure circuitry shall not stop the pump.

(HPG only) Panel shall provide a means for connecting the motor heat sensor from the pump. The heat sensor shall be wired in series with the motor contactor coil to disable the circuit should an overheat condition exist.

Panel shall have individual fuses for the control and alarm circuits. Spare fuses shall be provided and mounted on the inner-door. Each fuse shall have a fuse blown indicator light for simple troubleshooting.

Panel shall have the ability to add (by plug-in) the Digital Display center capable of providing an elapsed time meter, cycle counter, and making available a time dosing option for both simplex and duplex systems.

An optional alarm circuit breaker can be provided to protect the 120 volt alarm circuit and shall be accessible through the inner-door. In addition, an auxiliary alarm contact can be provided for remote alarm applications.

Specifications – NOVUS 2000

NOVUS 2000 CONTROL PANEL

GENERAL

Contractor shall furnish all labor, materials, equipment, and incidentals required to provide (simplex, duplex) pump control panel as specified herein.

The pump control panel shall be assembled and tested by a shop meeting UL standard 508A for industrial controls. Each control panel shall receive a factory test to ensure proper operation prior to shipment.

CONSTRUCTION

The controls for the pump shall be contained in a (painted steel, fiberglass, stainless steel, aluminum) enclosure meeting NEMA (1, 12, 3R, 4, 4X) requirements with hinged door.

The enclosure shall have provisions for padlocking. A nameplate shall be permanently affixed to the panel and include the voltage, phase, hertz, pump full load ampere rating, and pump horsepower rating. A warning label stating the power should be disconnected before servicing shall appear on the panel.

An aluminum back panel shall be provided. Should the panel size be larger than 36"x 30", a 12 gauge steel back panel finished with nonconductive white polyester powder paint shall be provided.

For each pump, a run light and a hand-off-auto switch shall be provided. Run lights and hand-off-auto switches shall be mounted on the inner door. The run lights and hand-off-auto switches shall be properly labeled as to function. The run lights shall match the hand-off-auto switches in appearance. Run lights shall be green.

The incoming power shall be (115, 208, 230, 460, 575) volts, (single, three) phase (50/60) hertz service. Terminal blocks with box type lugs shall be supplied to terminate all wiring for floats, heat sensors, and seal sensors for the pump, if required. The pump leads shall be terminated at box type terminal blocks.

A circuit breaker shall be used to protect from line faults and to disconnect the pump from the incoming power. Circuit breakers shall be thermal magnetic and sized to meet NEC requirements for motor controls.

The magnetic starter shall include a contactor with a minimum mechanical life of 3,000,000 operations and a minimum contact life of 1,000,000 operations. The magnetic starter shall include an overload relay that is IEC rated, ambient temperature compensated, and bi metallic. The overload relay shall be capable of being set in either a manual or automatic reset mode. In the manual mode, only the operator shall accomplish reset. Overload relays shall be Class 10 type, meaning at 6 times the full load amperes the overload relay shall trip within 10 seconds.

Control voltage shall be 120VAC and may be accomplished by the means of a transformer should the input voltage be unable to produce a 120VAC signal. Control fuse(s) and an on-off switch/circuit breaker shall protect and isolate the control voltage from the line.

Wire ties and/or wire track shall be used to maintain panel wiring in neat bundles for maintenance and to prevent interference with operating devices. All wiring shall be color-coded to facilitate maintenance and repair of the control panel. Where a color is repeated, number coding shall be added. A schematic shall be permanently attached to the inside surface of the front door.

All ground connections shall be made with fork terminals and star washers to assure proper ground.

A pump controller shall be provided for control logic. It shall be a dedicated, solid-state controller, which is easily replaceable with unpluggable terminal blocks on all wiring inputs and outputs. Controller shall be surface mounted on the back panel, shall be UL listed, and shall operate on 120VAC $\pm 10\%$, 50–70 Hz, with an operating temperature of -10°C to 60°C .

(Simplex) The controller shall have inputs for 3 normally open float switches; they shall be Off, On, and Alarm (High Level). The float inputs shall be not more than 12VDC when open, and not more than 100mA when closed.

(Duplex) The controller shall have inputs for 4 normally open float switches; they shall be Pumps Off, Pumps On, Lag On, and High Level. The float inputs shall be not more than 5VDC when open, and not more than 2mA when closed.

The controller shall have an input for connecting each pump's motor seal fail (moisture) sensors. The controller shall measure the resistance between the moisture probes. When the resistance falls below 50,000 ohms, the seal fail LED for the specified pump motor and the seal fail relay output shall activate. This shall not disable the pump. The pump with seal fail shall be demoted to lag pump (duplex only).

The controller shall have an input for connecting each pump's motor heat sensor. Should this input sense an open circuit to ground, the temp fail light will illuminate and the corresponding pump shall be disabled.

The controller shall have an input for the auxiliary contact of each motor contactor. When the controller calls for the pump, the pump call light will activate. Once the input on the controller is shorted by the auxiliary contact of the motor starter closing, the pump run light shall activate.

The controller shall have an LED indicator that activates when the high level float closes. This indicator shall be red. In addition to the alarm LED, there shall also be an alarm test push-button on the controller that, when pressed, simulates a high level condition, activates the external alarm light, and sounds the audible alarm, if applicable.

The controller shall have a 3-position switch that chooses among Pump 1 run as lead, Pump 2 run as lead, and automatic alternation of the lead pump.

(Duplex only) The controller shall feature delays for each pump turning on and off, preventing both pumps from turning on and/or off at the same time. Once one pump turns on, there shall be a time period of 8 seconds, in which the second pump cannot turn on. When a pump turns off, there shall be a time period of 4 seconds, in which the second pump cannot turn off. This protects against power surges and the water hammer effect.

(Duplex only) The controller shall demote to lag pump, a pump with the seal fail (moisture) condition activated.

OPTIONS

Panel may be equipped with the following additional features:

- UL 698A labeled with intrinsically safe circuit extensions for floats (Hazardous location pumps only)
- High-level alarm light (flashing, nonflashing)
- High-level alarm (piezo, horn, bell) with push-to-silence switch
- Auxiliary dry contacts for alarm conditions
- Telemetry unit
- Power-on indicator light
- NEMA rated starters
- NEMA rated Class 20 ambient compensated overload relays
- NEMA rated Class (10, 20, 30) melting alloy overload relays
- Soft starts
- Elapsed time meter (per pump)
- Cycle counter (per pump)
- Seal failure light(s)
- Over-temperature light(s)
- Anticondensate heater with thermostat
- Heat sensor – manual reset
- Voltage monitor
- Phase monitor (3 phase only)
- Lightning arrester
- Surge suppressor (capacitor)
- 120VAC, 15amp GFCI convenience outlet with circuit breaker
- Fused/Nonfused disconnect
- Main breaker
- Generator receptacle
- Manual transfer switch
- Pedestal mount – up to 36" x 30"
- Floor stand kit
- 22mm oil tight lights and switches
- 30mm oil tight lights and switches

Specifications – NOVUS 3000

NOVUS 3000 CONTROL PANEL

GENERAL

Contractor shall furnish all labor, materials, equipment, and incidentals required to provide duplex pump control panel as specified herein.

The pump control panel shall be assembled and tested by a shop meeting UL standard 508A for industrial controls. Each control panel shall receive a factory test to ensure proper operation prior to shipment.

CONSTRUCTION

The controls for the pump shall be contained in a (painted steel, fiberglass, stainless steel, aluminum) enclosure meeting NEMA (1, 12, 3R, 4, 4X) requirements with hinged door.

The enclosure shall have provisions for padlocking. A nameplate shall be permanently affixed to the panel and include the voltage, phase, hertz, pump full load ampere rating, and pump horsepower rating. A warning label stating the power should be disconnected before servicing shall appear on the panel.

An aluminum back panel shall be provided. Should the panel size be larger than 36"x 30", a 12 gauge steel back panel finished with nonconductive white polyester powder paint shall be provided.

For each pump a run light and a hand-off-auto switch shall be provided. These switches shall be mounted on the inner door, shall be properly labeled as to function, and shall match the run lights in appearance. The run lights shall be green.

The incoming power shall be (115, 208, 230, 460, 575) volts, (single, three) phase (50/60) hertz service. Terminal blocks with box type lugs shall be supplied to terminate all wiring for floats, heat sensors, and seal sensors for the pump, if required. The pump leads shall be terminated at box type terminal blocks.

A circuit breaker shall be used to protect from line faults and to disconnect the pump from the incoming power. Circuit breakers shall be thermal magnetic and sized to meet NEC requirements for motor controls.

The magnetic starter shall include a contactor with a minimum mechanical life of 3,000,000 operations and a minimum contact life of 1,000,000 operations. The magnetic starter shall include an overload relay that is IEC rated, ambient temperature compensated, and bimetallic. The overload relay shall be capable of being set in either a manual or automatic reset mode. In the manual mode, only the operator shall accomplish reset. Overload relays shall be Class 10 type, meaning at 6 times the full load amperes the overload relay shall trip within 10 seconds.

Control voltage shall be 120VAC and may be accomplished by the means of a transformer should the input voltage be unable to produce a 120VAC signal. Control fuse(s) and an on-off switch/circuit breaker shall protect and isolate the control voltage from the line.

Wire ties and/or wire track shall be used to maintain panel wiring in neat bundles for maintenance and to prevent interference with operating devices. All wiring shall be color-coded to facilitate maintenance and repair of the control panel. Where a color is repeated, number coding shall be added. A schematic shall be permanently attached to the inside surface of the front door.

All ground connections shall be made with fork terminals and star washers to assure proper ground.

A duplex pump controller shall be provided for control logic. It shall be a dedicated solid-state controller, which is easily replaceable with unpluggable terminal blocks on all wiring inputs and outputs. Controller shall be flush mounted on the dead front inner door, shall be UL listed, and shall operate on 120VAC $\pm 10\%$, 50–70 Hz, with an operating temperature of -10°C to 60°C .

The controller shall have inputs for five normally open float switches; they shall be Low Level, Pumps Off, Lead Pump On, Lag Pump On, and High Level. The float inputs shall be not more than 5VDC when open, and not more than 26mA when closed. The controller shall have LED indication of float status and a float simulation push-button for each float. The low float simulate button shall simulate the float opening; all other float simulate buttons shall simulate the float closing.

The controller shall perform a series of tests during operation to ensure that the system is operating properly. These tests include:

Float Sequence: The controller shall detect if floats are activated/deactivated in the correct sequence (LOW-OFF-LEAD-LAG-HIGH). Should one of the floats activate/deactivate in the incorrect sequence, the floats out of sequence LED shall be activated.

Fail To Start (optional): When a pump is called for, the controller starts an internal clock. If the start acknowledge input isn't activated before the timer times out, the pump that failed to start shall be disabled, the pump disabled LED shall be activated, the lag pump shall be called, and the condition shall require manual reset.

Over Temperature: The controller shall have inputs for pump motor heat sensors. If this input senses an over-temperature condition, the temperature fail LED and output are both activated; this shall also disable the pump.

Seal Fail (moisture): The controller shall have inputs for pump seal fail (moisture) sensors. If the input senses less than 50,000 ohms across the seal probes, the seal fail LED and output are activated and the pump is demoted to lag pump; this will not disable the pump.

Options for Over Temperature & Seal Fail: If necessary, the controller can be set to latch the motor over temperature alarm condition, so that the reset button must be activated in order to reset the alarm condition. In addition, the seal fail (moisture) input can be set to detect a resistance of greater than 50,000 Ohms instead of less than 50,000 ohms.

The controller shall have a 3-position switch that chooses among Pump 1 run as lead, Pump 2 run as lead, and automatic alternation of the lead pump.

The controller shall have 5 relay outputs rated for 7 amps max. at 120VAC. They shall be four SPST contacts (Pump 1, Pump 2, High Level, Horn/Aux) and one SPDT contact (Low Level). The controller shall have LED indication of the status of each of the relay outputs.

The controller shall feature delays for each pump turning on and off, preventing both pumps from turning on and off at the same time, and also preventing a water hammer effect. There shall be an option to set this delay to either 6 seconds or 12 seconds.

The controller shall have seven open drain FET fault outputs that will drive a maximum of 40mA when activated. The load shall be powered by 12VDC supplied by the controller, and the outputs shall have built-in diode protection to allow connection of a 12VDC relay. These fault outputs shall indicate Seal Failure, Temperature Failure, and Disabled/Failed to Start for each pump, as well as Floats Out of Sequence. The controller shall have LED indication of the status of each of these faults.

OPTIONS

Panel may be equipped with the following additional features:

- UL 698A labeled with intrinsically safe circuit extensions for floats and/or a zener barrier for the transducer input.
- (Hazardous location pumps only)
- High-level alarm light (flashing, nonflashing)
- High-level alarm (piezo, horn, bell) with push-to-silence switch
- Auxiliary dry contacts for alarm conditions
- Telemetry unit
- Low water alarm (w/redundant off float)
- Power on indicator light
- NEMA rated starters
- NEMA rated Class 20 ambient compensated overload relays
- NEMA rated Class (10, 20, 30) melting alloy overload relays
- Variable frequency drives
- Soft starts
- Elapsed time meter (per pump)
- Cycle counter (per pump)
- Seal failure light(s)
- Over-temperature light(s)
- Anticondensate heater with thermostat
- Heat sensor – manual reset
- Voltage/phase monitor
- Phase monitor (3 phase only)
- Lightning arrestor
- Surge suppressor (capacitor)
- 120VAC, 15amp GFCI convenience outlet with circuit breaker
- Fused/Nonfused disconnect with inner door interlock handle
- Main breaker
- Generator receptacle
- Manual transfer switch
- Pedestal mount for enclosure; up to 36" x 30"
- Floor stand kit
- 22mm oil tight lights and switches
- 30mm oil tight lights and switches

Specifications – NOVUS 4000

NOVUS 4000 CONTROL PANEL

GENERAL

Contractor shall furnish all labor, materials, equipment, and incidentals required to provide (simplex, duplex, triplex) pump control panel as specified herein.

The pump control panel shall be assembled and tested by a shop meeting UL standard 508A for industrial controls. Each control panel shall receive a factory test to ensure proper operation prior to shipment.

CONSTRUCTION

The controls for the pump shall be contained in a (painted steel, fiberglass, stainless steel, aluminum) enclosure meeting NEMA (1, 12, 3R, 4, 4X) requirements with hinged door.

The enclosure shall have provisions for padlocking. A nameplate shall be permanently affixed to the panel and include the voltage, phase, hertz, pump full load ampere rating, and pump horsepower rating. A warning label stating the power should be disconnected before servicing shall appear on the panel.

An aluminum back panel shall be provided. Should the panel size be larger than 36"x 30", a 12 gauge steel back panel finished with nonconductive white polyester powder paint shall be provided.

For each pump, a run light and a hand-off-auto switch shall be provided. These switches shall be mounted on the inner door, shall be properly labeled as to function, and run lights shall match the hand-off-auto switches in appearance. Run lights shall be green.

The incoming power shall be (115, 208, 230, 460, 575) volts, (single, three) phase (50/60) hertz service. Terminal blocks with box type lugs shall be supplied to terminate all wiring for floats, heat sensors, and seal sensors for the pump, if required. The pump leads shall be terminated at box type terminal blocks.

A circuit breaker shall be used to protect from line faults and to disconnect the pump from the incoming power. Circuit breakers shall be thermal magnetic and sized to meet NEC requirements for motor controls.

The magnetic starter shall include a contactor with a minimum mechanical life of 3,000,000 operations and a minimum contact life of 1,000,000 operations. The magnetic starter shall include an overload relay that is IEC rated, ambient temperature compensated, and bimetallic. The overload relay shall be capable of being set in either a manual or automatic reset mode. In the manual mode, only the operator shall accomplish reset. Overload relays shall be Class 10 type, meaning at 6 times the full load amperes the overload relay shall trip within 10 seconds.

Control voltage shall be 120VAC and may be accomplished by the means of a transformer should the input voltage be unable to produce a 120VAC signal. Control fuse(s) and an on-off switch/circuit breaker shall protect and isolate the control voltage from the line.

Wire ties and/or wire track shall be used to maintain panel wiring in neat bundles for maintenance and to prevent interference with operating devices. All wiring shall be color-coded to facilitate maintenance and repair of the control panel. Where a color is repeated, number coding shall be added. A schematic shall be permanently attached to the inside surface of the front door.

All ground connections shall be made with fork terminals and star washers to assure proper ground.

A pump controller shall be provided for control logic. It shall be a dedicated solid-state controller, which is easily replaceable with unpluggable terminal blocks on all wiring inputs and outputs. Controller shall be flush mounted on the dead front inner door, shall be UL listed, and shall operate on 12VAC \pm 10%, 50–70 Hz, with an operating temperature of –10°C to 60°C.

The pump controller shall indicate float circuit operations using red amber LED indicator lights. LED indicator lights shall provide adequate information so that they can be used for diagnosis in troubleshooting problems located in the float circuits. Each LED shall be permanently labeled on the pump controller as to function.

The controller shall have built-in software that requires no programming. The controller shall have a simple menu structure and a 32 character alphanumeric LCD that displays information for level, status, and set point.

The controller shall include a selector switch that allows the user to choose among Pump 1 run as lead, Pump 2 run as lead, Pump 3 run as lead, or alternate lead pump. This selector switch shall be on the controller itself.

The controller shall include individually selectable on/off set points for up to three pumps.

The controller shall include a 4–20mA input as the main sensor input and shall include a loop power supply for easy connection to most transducers and transmitters with adjustments provided for both scale and offset.

The controller shall have all 115VAC inputs that are internally fused and transient protected. There shall be inputs provided for pump seal fail (moisture) and over-temperature, with red fail lights should these conditions fall out of the specified condition.

The controller shall be user selectable as either a pump up or pump down controller.

At start-up, the controller shall perform a series of self-tests to ensure the controller is working properly. Should the selftests have a problem, a watchdog timer shall expire and reset the controller. Once the tests are complete, a timer is started to keep the controller from operating before the test conditions have cleared.

In pump-down mode only, a single float backup shall be provided. This float shall be placed above the normal operating levels of the transducer. Should the high level backup float be activated, it shall start a 30 second timer and a 60 second timer. After 30 seconds, the lag pump shall be called. After the 60 second timer times out, should there be three pumps, the second lag pump shall be called. If the high level clears before either lag pump is turned on, the timers shall be reset. The backup float indicator light shall require manual reset.

The controller shall include an optional fail-to-start test. Should the auxiliary contact of the starter not close in the user-defined amount of time after pump call, a pump fail condition shall occur and disable the pump. Then, the next pump shall be called. This condition shall require manual reset.

The controller shall include pump-on and pump-off timers which prevent more than one pump turning on or off at the same time. These timers help prevent excess power loads when pumps are being turned on and the water hammer effect when pumps are being turned off.

The controller shall include a user defined “time at set-point” timer, which causes a set-point to be set for a set amount of time before turning on the pump. This time can be set in the menu for the controller. This protects from pump motor short cycling.

The transducer input shall be a max of 0–5VDC, and shall have a level accuracy of $\pm 0.5\%$.

The seal fail (moisture) and over-temperature inputs shall have options to make each automatic or manual reset and shall allow the user to invert the polarity of the input.

OPTIONS

Panel may be equipped with the following additional features:

- UL 698A labeled with intrinsically safe circuit extensions for floats and/or a zener barrier for the transducer input (Hazardous location pumps only)
- Alarm light (flashing, non-flashing)
- Audible alarm (piezo, horn, bell) with push-to-silence switch
- Auxiliary dry contacts for alarm conditions
- Telemetry unit
- Power on indicator light
- NEMA rated starters
- NEMA rated Class 20 ambient compensated overload relays
- NEMA rated Class (10, 20, 30) melting alloy overload relays
- Variable frequency drives
- Soft starts
- Elapsed time meter (per pump)
- Cycle counter (per pump)
- Cycle counter (per pump)
- Seal failure light(s)
- Over-temperature light(s)
- Anticondensate heater with thermostat
- Voltage monitor
- Phase monitor (3 phase only)
- Lightning arrestor
- Surge suppressor (capacitor)
- 120VAC, 15amp GFCI convenience outlet with circuit breaker
- Fused/Nonfused disconnect with inner door interlock handle
- Main breaker
- Generator receptacle
- Manual transfer switch
- Pedestal mount for enclosure; up to 36" x 30"
- 22mm oil tight lights and switches
- 30mm oil tight lights and switches