

- B. Operating Levels
The following levels shall guide the operating levels of the floats.

Pumps Off	The Entire Pump Shall be covered at the Off Level
Low Level Alarm	Elevation of Pump Lifting Eye
Lead Pump On	No Less than 1-1/2 Feet above Top of Pump Motor
Lag Pump On	No Less than 2 Feet above Top of Pump Motor
High Level Alarm	No Less than 2-1/2 Feet above Top of Pump Motor and No More than 1-inch Below the 12-inch Pipe to the Detention Tank
Detention Alarm	Set to a Level Equivalent to 75% of the Detention Tank Capacity

- C. Float Leads
Float leads shall be hung with stainless steel kellum grips from a stainless steel cable holder bracket similar to a Halliday Products J4A. The bracket shall be attached to the wet well hatch cover or firmly bolted to the concrete immediately below the hatch cover.

- D. Float Wires
Float wires shall be neatly routed from the wet well directly to the surface to either a junction box or directly to station panel. All above grade wires shall be installed within stainless steel conduits. Wire length on all float wires shall be such that each float may be adjusted to the bottom of the station wet well.

Acceptable Manufacturer: Pump level floats are to be either Flygt model EH-10, or Anchor Scientific type S-Roto floats or equivalent.

- E. Transducer
The submersible level transducer shall be mounted inside of a smooth wall PVC pipe stilling well. The stilling well shall extend from approximately 6" above the bottom of the wet well to a minimum of 1-ft. above the top of the emergency storage tank. The stilling well shall allow for easy access and removal of the transducer.

Manufacturer: Level transmitter shall be as manufactured by Keller America: Levelvat (wastewater applications), or equal.
Warranty shall include lightning damage for transmitters with 4 – 20 ma output.

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6.6 ACCESS HATCHES

The pump and valve chambers access hatches shall be aluminum, rated for a 300 lbs. load. Door size and orientation shall be as indicated on the drawings. The access frame and cover shall be flush with the top of the concrete, complete with hinged and flush locking mechanism, upper guide holder and level sensor cable holder. Frame shall be securely placed, mounted above the pumps. Hatches shall be equipped with form skirts, sized for the slab top thickness and shall include a fall protection grating system. Doors shall be provided with padlock lugs.

All access hatch construction materials and appurtenances shall be manufactured from stainless steel, aluminum or brass.

Signs shall be permanently affixed to both the top and underside of the lift station access cover with the following:

WHEN HATCH IS OPEN FALL PROTECTION SHALL BE PROVIDED IN COMPLIANCE WITH CURRENT OSHA REQUIREMENTS

Signs shall be 1.5" high black letters on a white background. Signs shall be 18 gauge aluminum.

Acceptable Manufacturer: Hatches shall be Halliday Model S1S or S2S, USF Fabrication, or approved equal.

6.7 LOCKING HARDWARE

All equipment enclosures, access hatches, entrance gates and service disconnect arms shall be provided with locks. Locks will be provided to the contractor by the City and shall have 2" high shackles with 5/16" diameter shanks.

6.8 PRESSURE SENSOR UNITS

Pressure sensors shall be of the full flange design with through boltholes or one-piece wafer style with carbon steel flanges. Sensors shall clamp between standard ANSI pipeline flanges. All exposed surfaces shall be epoxy painted or of a non-corrosive material. Sensor shall be flow through design with flexible Buna-N elastomer sensing ring around the full circumference.

Sensors shall be provided to the installer, assembled complete, from the supplier. The units shall be filled with a 50/50 ethylene glycol and water mixture and have no entrapped air in the system. The supplier shall pre-test the unit at the minimum operable sensing level of the switch prior to delivery to the installer.

Pressure switches shall have Nema-7 Housings with Single Pole Double Throw, snap action switching elements. Switches shall be wired normally closed, with adjustable pressure settings. The pressure range shall be specified for each specific installation.

Acceptable Manufacturers:

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Gauges: 2-1/2" dial, Span Model LFS 220 with 1/4" connection.
Switches: "NEO-DYN Model 132P4-8C6"
Pressure sensors: "Red Valve" Series 40 flanged or Series 48 wafer sensor or EVR type PWS
Accessory piping: 1/2" or 1/4" Parker Hex stainless steel with reducing fittings where necessary to connect instruments.

Note that pressure sensors shall have a local reading at the lift station or a secondary gauge will need to be installed to provide a local reading.

6.9 INTRINSIC BARRIERS

The wet well area of the pump station is considered by the NFPA to be a hazardous area. Therefore, intrinsic barriers shall be installed where the level floats terminate in the control panel to help prevent any explosions from occurring due to electrical arcing in the wet well area.

Acceptable Manufacturer: MTL 5016 dual channel or approved equal.

6.10 FLOW METER

A flow meter shall be installed with a control system capable of measuring flows in the pipe and interface with the communication system to provide remote monitoring and reporting.

- Provide a flow meter with 4 – 20 mA transmitter providing instantaneous flow indication for installation by the contractor. Flow transmitter shall be provided for installation in the control panel mounted to the subpanel with 120 vac surge suppressor and 4 – 20 ma surge suppressor. Where the flow transmitter is installed separately from the flow tube, two types of cable (standard cable and special cable) shall be supplied for installation between the flow tube and flow transmitter. Where the flow tube is to be installed in an area where it may become wet or submerged (such as in a metering vault), a submersible kit shall be provided.
- Equipment shall be as manufactured by Siemens, series 5000, or pre-approved equal.
- Provide equipment for the following flows:
 - Station Flow

A spool piece of pipe shall be provided to the city of the same size as the flow meter. Spool piece shall be utilized if the flow meter is removed for maintenance.

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SECTION 7 - ELECTRICAL

This section shall apply to NON-VFD pump systems, usually using 3-phase Utility Service, 480Y/277 volt or 208Y120 volt, 3-phase, 4-wire power and FVNR (full voltage, non-reversing) or SSRV (solid state reduced voltage soft start) starters for pumps depending on horsepower rating of the motors, float control of pumps, connection to a continuous level transducer and a magnetic flowmeter for monitoring and trending only, SCADA monitoring, and standby generator with automatic transfer switch as backup to Utility power. 480 volt systems are preferred.

Another option included in this specification is for the Utility-supplied single-phase source and use of VFDs as phase converters. This should be a fairly rare case and should only be used if 3-phase power cannot be obtained at the site without very excessive cost. The VFD used as a phase converter shall operate at a single pre-set speed as if it was a FVNR starter. Use of this option must receive Owner authorization prior to design.

Another option is for the Utility-supplied 3-phase source and using VFD starters for pump speed control and controlling the pump operation with SCADA and continuous level sensing with backup control using floats. This option is not included in this specification. Design of such a "smart pump station" will need to be carefully coordinated between Owner, Engineer, and System Integrator.

7.1 PUMP CONTROL PANEL

- The pump control panel shall be the responsibility of a single manufacturer/supplier, hereafter designated as the Systems Integrator. All aspects of the system including fabrication, component installation, programming, start-up, and testing and training shall be by one entity. Sub-letting of work shall not be accepted. The Systems Integrator shall provide a fully complete system operating in a satisfactory manner.
 - Systems Integrator/control panel manufacturer shall be a UL 508 certified control panel manufacturing facility and shall be regularly engaged in the manufacture of controls for the municipal water/wastewater industry. Components shall be UL listed. The system specified herein shall be the product of a manufacturer having at least ten (10) years' experience in the construction of such control equipment.
- Refer to SECTION 8 of this Specification for SCADA MONITORING & ALARM SYSTEM
- Systems Integrator shall provide
 - Pump Control Panel with PLC/telemetry unit to match existing system, radio, antenna, disconnect and overcurrent protective devices, motor starters, pressure/flow transmitter(s) (where required), level transducers (where required), and other peripheral equipment as detailed in this specification and on the drawings.
 - Engineering services for design, startup, training, operation manuals shall be included. If alternate equipment is proposed, the contractor shall be responsible for any additional design, labor, and material costs associated with revisions to provide a functional system. No additional compensation

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- shall be allowed to accommodate this requirement.
- It is the intent of these specifications that all motor control and control components be supplied by a single supplier. Controls shall not be assembled on site.
- SCADA equipment shall be made an integral part of the control panel being manufactured by the Systems Integrator. All SCADA system components shall be fully compatible with the Owner's existing SCADA system.
- All SCADA/PLC programming/configuration/documentation/start-up/training for the addition of the "site" to the existing SCADA/PLC network. This work to be performed by the City Programmer.
- Required height of antenna pole.

D. Panel Configuration

- The pump controls shall be housed in a NEMA-3R, enclosure, constructed using 12-gauge 304 stainless steel, with a #4 finish. The enclosure shall consist of three sections in an "H" shape cabinet, with a total overall dimension of no greater than 64" high by 70" wide by 24" to 30" deep. **Note: For some pump station requirements, such as when large pumps or more than two pumps are used, it may be considered to use side-by-side panel sections instead of an "H" style panel. This shall be carefully coordinated with the Owner, Engineer, and System Integrator.** Each section shall be joined together at the exterior seams with a continuous weld, so that a weather-tight seal exists between the three sections. With the exception of inside corner seams, all exterior seams shall be "Mig" welded, ground smooth, and brush finished. The cabinet's exterior inside corner seams, shall be "tig" welded.
- Section #1 and Section #3 shall form the two outer legs of the cabinet, with Section #2 forming the bridge between each leg. Section #2 shall be flush with the sides of Sections #1 and #3 closest to the wet well and valve chamber to allow Section #2 outer panel door to open wider than 90 degrees. The bottom of Section #1 and the bottom of Section #3 shall be of open base construction, with an angle iron support frame welded to the inside bottom of the two sections. The base angle iron shall be 2" x 2" x 1/4" (304) stainless steel. Two removable solid ring 5/8"- 11 tpi. lifting eyes shall be mounted over the top of sections #1 and #3. Gasketed stainless steel 5/8" bolts shall be provided for eye replacement following cabinet installation.
- All compartment exterior doors shall be mounted to the enclosure with stainless steel full-length continuous hinges. Hinges shall be welded to the enclosure. All compartment exterior doors shall be protected with stainless steel drip shields. Self-gripping flange mounted EPDM gasket material with a wire-reinforced base, shall be used to form the seal between the outer doors and the surrounding enclosure flanges. Gasket material shall be EMKA #1011-05 or approved equal. All outer compartments doors shall be secured with three-point interior stainless steel latching mechanism attached to stainless steel exterior mounted handles. The handles must be capable of accepting padlocks. Latching mechanisms shall be Austin #48- 5655XSS or approved equal.
- Full sub-panels shall be mounted within each compartment interior. The sub-panels shall be formed from mild steel. Panel edges shall be turned down to form a 3/4" lip. All panels shall be painted white and mounted on 3/8"-16 standoff studs per NEC and

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- UL 508.
- All hardware on the panel exterior shall be stainless steel with the exception of the temporary lifting eyes.
- All labeling within the control panel shall meet OSHA standards.

E. Panel Section #1

- Section #1 shall be a single door NEMA 3R enclosure. An opening shall be cut from the back of the section #1 compartment to provide access into section #2 when the section #1 sub-panels are removed. The cut out opening shall be 38" x 10" unless specifically noted otherwise.
- The inner door shall be set back 2" from the outer door, hinged from the left side and secured with a single point latch knob. (Door screws are not acceptable). All control switches, hour meters, GFI receptacles, and indicator lights shall be mounted on the hinged inner door.
- This section shall be used for installation of the Supervisory Control and Data Acquisition (SCADA) system. This system will be referred to as SCADA or PLC throughout the remainder of this document. Other control components such as HOA Switches, Intrinsic Safety Barriers, Seal Fail relay interface, and control and time delay relays shall also be located in Section #1.
- This section shall also be used as an entrance point for the following conduits stubbed through the panel's concrete mounting pad:
 - Conduit from the valve chamber control junction box
 - Control conduits to/from Automatic Transfer Switch (ATS) and Generator
 - Radio coax conduit from the antenna
 - Pump motor conduit from power junction box in valve chamber
 - Pump power wires shall pass through section #1 to be terminated in section #2, such that 480 vac power is not exposed in this section.

F. Panel Section #2

- Section #2 shall be accessed through its own exterior door, which shall be hinged from the left-hand side. An opening shall be cut from each side of Section #2 to provide access into Sections #1 and #3 when the adjacent corresponding sub-panels are removed. The size of the cut outs shall be 38" x 10", to provide a 1" stiffening perimeter around the sides of Section #2.
- This compartment shall be the main control compartment and shall house the power terminal blocks, SPD (Surge Protection Device), Circuit Breakers, Starters, Control Power Transformer, and PM (Power Monitor). All panel wiring and equipment layout shall be performed per NFPDA, NEG and UL-508A specifications. N.E.C. gutter spacing shall be observed. A minimum of 6" additional D.I.N. rail shall be provided for future mounting expansion. All component mounting and wiring shall be completed per the given specifications.

G. Panel Section #3

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- Section #3 shall be accessed through its own exterior door, which shall be hinged from the right hand side. Both the electric meter and the service disconnect shall be mounted inside this compartment. The exterior door shall have a Lexan plastic window to allow the electric meter to be read from outside the cabinet. The window shall be a Hoffman #A-PNK95NFSS or approved equal. An opening shall be cut from the back of the section #3 compartment to provide access into section #2 when the section #3 sub-panels are removed. The cut out opening shall be 38" x 10" to provide a 1" stiffening perimeter around the sides of section #3. This section shall have an open bottom with a 2" x 2" x 1/4" (304) stainless steel angle iron frame surrounding the bottom inside opening. This compartment shall be used as an entrance point for the following conduits stubbed through the panel's concrete mounting pad:
 - Power service conduit
 - Power conduits to and from ATS

H. Panel Mounting

- The station pump control panel shall incorporate the pump controls, alarm system and incoming utility power into one pre-fabricated stainless steel structure. The panel shall be placed as follows:
 - The control structure shall be set on a 6-inch concrete pad (see Section 3.10).
 - Conduits shall be run into the power supply cabinet from beneath the structure per the detail drawing.
 - The panel shall be centered on the concrete pad and set 4-inches in from the rear edge of the pad.
 - Prior to setting and securing the panel to the concrete mounting pad, a strip of 2"x1/4" solid rubber gasket material shall be placed against the bottom angle iron frame to create a seal between the concrete mounting pad and the panel bottom.
 - The control panel shall be firmly anchored to the concrete mounting pad with twelve (12) 3/8-inch stainless steel stud anchors, six (6) for each of sections #1 and #3. Anchor holes in the concrete pad shall be drilled to the manufacturer's recommended depth. There shall be no obstruction preventing full movement of the access door.
 - Acceptable Manufacturer:
 - Hilti Quick Bolt Two
 - approved equal

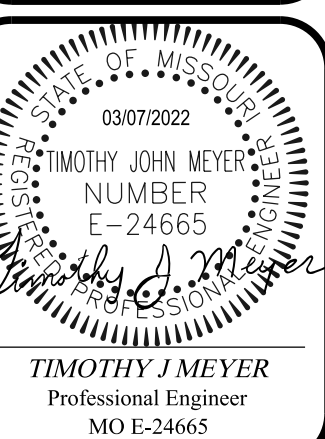
I. Panel Components

- Power Distribution Block
 - Provide a main power distribution block sized for incoming power to the panel. Each pole of the block shall be supplied with a clear cover for operator protection. Power block lugs shall be of the sizes and quantities for the wiring to be connected to them. More than one wire connected under a single lug shall be allowed.
- Surge Protective Device (SPD)

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- The pump station shall be protected by a Surge Protective Device (SPD) sized for the incoming power service voltage and shall be provided in addition to the coaxial Surge Suppressor. This SPD shall be located in the pump control panel and shall have an auxiliary contact indicating SPD Fault for monitoring by SCADA. SPD shall be as manufactured by Innovative Technology, Inc. (314-895-5912) or approved equal.
- Phase Sequence and Loss Monitor (PM)
 - All stations supplied with three phase power shall be protected by a phase sequence and loss monitor. This monitor/relay shall be a single pole, plug-in-type with automatic reset. The relay shall interrupt the control circuit immediately after the circuit breaker that serves the system controls (but not the ACE). There shall be an auxiliary contact indicating that acceptable power is available for monitoring by ACE.
 - Acceptable Manufacturer:
 - Symcom #460-14
 - approved equal
 - Thermal Magnetic Breakers
 - Individual thermal magnetic circuit breakers shall be provided for branch disconnecting service and short circuit protection of all motor and auxiliary circuits and shall be located in the power distribution section of the control panel. Circuit breakers shall have a interrupting rating greater than the available fault current but in no case shall 120/208/230 volt breakers have a rating less than 10,000 AIC and 277/480 volt breakers have a rating less than 14,000 AIC. Combination circuit breaker and overload mechanism shall not be allowed.
 - Motor Controllers
 - Magnetic Full Voltage Non-Reversing (FVNR) across-the-line horsepower-rated motor starters shall be supplied for each pump rated at less than 20 horsepower. (Selection range of motor horsepower for using FVNR vs SSRV starters may be modified for specific pump stations based on overall size of the pump station and the voltage available.)
 - Acceptable Manufacturer:
 - Eaton XTC Series with Overload relay shall be Eaton XTO Series, and 120 volt coils
 - approved equal
 - Soft Starters - Solid State Reduced Voltage (SSRV) soft starters shall be used for pumps rated at 20 horsepower and greater. (Selection range of motor horsepower for using FVNR vs SSRV starters may be modified for specific pump stations based on overall size of the pump station and the voltage available.)
 - The SCR based power section shall consist of six (6) back-to-back SCR's and shall be rated for a minimum peak inverse voltage rating of at least 1,500 PIV. Units using triacs or SCR/diode combinations shall be not acceptable. Resistor/capacitor snubber networks shall be used to prevent false firing of SCR's due to dv/dt characteristics of the electrical system.
 - The logic board shall be mounted for ease of testing, service and

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TIMOTHY J MEYER
Professional Engineer
MO E-24665

INVERNESS

PUMP STATION - DETAILS
1575 BRYAN RD.
01/20/2022
C53
PHASE 3
Project # 22450