

6.5 FLOODS AND SETTINGS

A. General

Floats shall be located near the flow of incoming sanitary lines. All floats shall be located away from the turbulence of the incoming flow. Sewage shall not rise to the level of the incoming gravity lines or the detention pipes during normal pump operation.

B. Float Levels

The following levels shall guide the setting of float levels.

Off Float	The entire pump shall be covered at the Off Level
First Pump	No less than 1-1/2 feet above the top of pump motor
Second Pump	No less than 2 feet above the top of pump motor
High Level Alarm	No less than 2-1/2 feet above top of pump and no more than 1-inch below detention tank pipe

C. Float Leads

Float leads shall be hung with stainless steel kellum grips from a stainless steel bracket supplied by Halliday. 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 to the valve through the access sleeve, without excessive wire strain or pull. 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.

6.6 ACCESS HATCHES

The pump and valve chambers access hatches shall be aluminum, rated for a 300 lb 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 hinges and 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. Doors shall be provided with padlock lugs.

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

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

6.7 SAFETY POST

On the top two ladder rungs under the access provide stainless steel or aluminum safety extension post manufactured by Halliday or approved equal. All bolts and hardware shall be stainless steel. The safety post shall be manufactured so that the safety post can be attached to top two rungs. Contractor shall verify required spacing.

6.8 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. This will prevent any explosions from occurring due to electrical arcing in the wet well area.

Acceptable Manufacturer: Sym Com Model ISS-105, Macromatic ISDUR4 or approved equal

SECTION 7 - ELECTRICAL

7.1 ELECTRICAL

The selected pump supplier shall be directly responsible for all panel fabrication and component installation. The pump control panel shall meet the following specifications:

A. Panel Configuration

The pump controls shall be housed within a NEMA-3R, enclosure, constructed from 12 gauge 304 stainless steel, with a #4 finish. The enclosure will consist of three sections in an "H" shape cabinet, with a total overall dimension of 64" high by 70" wide by 24" deep. 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 interior of section #1 shall be sub-divided into two smaller compartments, 1a and 1b. The bottom of sub-compartment #1b 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 1/2" (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 EDPM 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. All outer compartment 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.

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 UL 508.

All hardware on the panel exterior shall be stainless steel with the exception of the temporary lifting eyes.

B. Section #1 Panels

Section #1 shall be a one door NEMA 3R enclosure with a full inner barrier between sections 1a and 1b. 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", to provide a 1" stiffening perimeter around the sides of section #1a and #1b.

Section #1a shall be accessed through the Section #1 exterior door. This compartment shall be used for installation of the Mission Cellular Dialer.

Section #1b shall be accessed through the Section #1 exterior door. This section shall have an open bottom with a 2" x 2" x 1/2", 304 stainless steel angle iron support frame surrounding the bottom interior opening. This compartment shall 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.

C. Section #2 Panel

Section #2 shall be accessed through it's own exterior door, which shall be hinged from the left-hand side. The compartment interior shall include a 12 gauge mild steel continuous hinged inner door painted white unless using converter option (Section 7.5). 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 and event meters, GFI receptacles, indicator lights and circuit breaker toggles, shall be mounted on the hinged inner door. An opening shall be cut from each side of section #2 to provide access into sections 1a, 1b and 3 when the adjacent corresponding sub-panels are removed. The size of the cut outs shall be 38"x10", to provide a 1" stiffening perimeter around the sides of section #2. This compartment shall be performed per NFPA, NEC 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.

D. Section #3 Panel

Section #3 shall be accessed through it's 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 Lexon plastic window with lead with the electric meter to be read from outside the cabinet. The window shall be a Hoffman #A-PNK95NFSS. 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"x10", 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 1/2" (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.
- Pump motor conduit from power junction box in valve chamber.

E. 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. Combination circuit breaker and overload mechanism shall not be allowed.

F. Mercury Level Sensors (Float Switches)

Four (or 2 if using level transducer) mercury level sensors or floats shall be provided with sufficient length cord to extend uninterrupted to the valve chamber control junction box. The four float levels shall be: Pump Off, Lead Pump On, Lag Pump On, and Wet Well High Water Alarm. All floats shall be connected to an intrinsic safety barrier located in the pump control panel.

G. Fluorescent Work Light and Panel Heaters

A 12-inch fluorescent work light with a safety lens shall be mounted inside the top of the control panel without penetrating the panel outer skin with screws or fasteners. The light shall be operated with an on/off switch mounted on the inner door. Low wattage strip heaters shall be installed on the inner compartment doors 1a, 2 and 3 to prevent the accumulation of condensation.

Acceptable Manufacturer: Cabinet heaters shall be Watlow #02012096A-40 notec on drawing.

H. Wiring

All wires in the pump control panel shall be numbered with either clip sleeve or heat shrink markers. Wrap on or adhesive type wire markers shall not be allowed. Control panel schematic shall show wire and terminal numbers. All rungs shall be numbered with relay contacts referenced by these numbers. Relay contacts shall have socket terminals noted on drawing.

I. Lightning Arrestor

A silicon oxide varistor type lightning arrestor shall protect the pump station. The arrestor shall be sized for the incoming power service voltage. This arrestor shall be located in the pump control panel externally mounted to the service entrance disconnect switch enclosure.

J. Phase Sequence and Loss Monitor

A phase sequence and loss monitor shall protect all stations supplied with AmerenUE or CREC three-phase power. This monitor/relay shall be a single pole, plug-in-type with automatic reset. The relay shall interrupt the control circuit immediately after the control fuse.

Acceptable Manufacturer: The relay shall be a Diversified Electronics SLA series or approved equivalent.

K. Relays

For pump stations supplied with AmerenUE or CREC three-phase power, all control and time delays shall be at a minimum DPDT 8 or 11 pin octal base D.I.N. rail mounted.

Acceptable Manufacturer:

Control Relays	IDEC	RR2-JULAC120Time Delay
Relays	IDEC	RTE-P11-120VAC
	Diversified	TBC-120-ABA

L. Main Terminal Strip

The main terminal strip at the lowest portion of the sub panel shall have a minimum clearance of six inches to the bottom of the section 2 enclosure.

M. Control Power

The control power shall be 120 volts. If 120 volt, single-phase is not available, a minimum 3 KVA transformer shall be supplied with primary and secondary protection. Individual 120-volt circuit breakers shall be provided for each separate power requirement. Provide a 5-ampere fuse on the load side of the control circuit breaker. Three (3) spare control fuses shall be provided in a separately mounted three-pole fuse-block. The Mission Dialer shall be powered from a separate dedicated 15-amp circuit breaker, fed from the control circuit. A 15-amp Ground Fault Interrupter receptacle shall be mounted on the inner door of the control panel.

N. Control Panel Name Plate

All pump control panels shall have a 4"x6" phenolic name plate firmly fastened to the lower right front side of the cabinet inner door in either the AmerenUE or CREC power option or the back panel in the converter option. The nameplate shall include the following:

- Manufacturer's job number
- Manufacturer's name, location, phone number
- Site name
- Pump model, pump serial numbers, horsepower, voltage, amperage

7.2 THREE PHASE MOTORS

- All pumps will operate using 240 or 480 VAC three-phase power.
- Any station requiring pumps greater than 15 horsepower must be supplied with AmerenUE or CREC three-phase power.
- Any station requiring pumps 15 horsepower or less may use the single-phase power source option upon District approval. Allowance of such a system will depend on the cost analysis presented by the designer/owner. Allowance will be determined on a case-by-case basis. The AmerenUE or CREC three-phase power is the preferred source.

7.3 ELECTRICAL OPTIONS

There are two possible avenues for the electrical distribution at the pump station. The preferred option is an AmerenUE or CREC supplied 3-phase source and the other is the AmerenUE or CREC supplied single-phase source. The following is a list of the basic electrical requirements for each.

7.4 THREE-PHASE SUPPLY CONTROL OPTION

All three-phase installations shall meet the following requirements:

A. Magnetic Motor Starters

Magnetic across the line horsepower rated motor starters shall be supplied for each pump under 20 horsepower. Pumps 20 horsepower and larger shall be supplied with soft starters with bypass contactors.

Acceptable Manufacturer: Cutler Hammer series CE-15 with series C-316 overloads and 120 volt coils or DCSD approved equal.

B. Soft Starters

The solid-state reduced voltage starter shall be UL and CSA listed and consist of an SCR based power section, logic board and parallel bypass contactor.

The SCR based power section shall consist of six (6) back-to-back SCRs and shall be rated for a minimum peak inverse voltage rating of 1,500 PIV. Units using triacs or SCR/diode combinations shall not be acceptable. Resistor/capacitor snubber networks shall be used to prevent false firing of SCRs due to dv/dt characteristics of the electrical system.

The logic board shall be mounted for ease of testing, service and replacement. It shall have a quick disconnect plug-in connectors for current transformer inputs, line and load voltage inputs and SCR gate firing output circuits. The logic board shall be identical through all ampere ratings and voltage classes and shall be conformally coated to protect from environmental conditions.

The paralleling bypass contactor shall energize when the motor reaches full speed and close/open under 1x motor current. The contactor shall be fully rated for across the line starting duty should this be desired. The contactor shall utilize an energy balanced contact closure to limit contact bounce and an intelligent coil controller which optimizes coil voltage during varying system conditions. The coil shall have a lifetime warranty.

The overload protection shall be electronic and be based on an inverse time/current algorithm. Overload protection shall be adjustable and Class 10/20 shall be selectable. Units using bimetal overload relays are not acceptable. Over temperature protection (on heat sink) shall be standard.

The solid-state logic shall be phase sensitive, and shall inhibit starting on incorrect rotation. Improper phase rotation shall be indicated on the starter.

Starters shall protect against a phase loss/unbalance condition shutting down if a 35% current differential between any two phases is encountered.

A normally open (NO) contact shall annunciate fault conditions, with contact ratings of 60 VA resistive load and 20 VA inductive load. In addition, an LED display shall indicate type of fault (current trip, phase loss, phase rotation).

The following adjustments are required:

- Ramp time: 1-45 seconds
- Initial torque: 100-200% current
- Current limit: 100-500% current
- FLA of motor: 4-1 range of starter

Smooth stopping shall be available to provide a linear voltage deceleration. It is to be adjustable from 1-45 seconds.

Acceptable Manufacturers: ABB, Square D, or Cutler Hammer

C. Pump Control Circuits and Indicator Lights

Individual pump control circuits shall be provided with H-O-A switches, elapsed time meters and re-settable event counters for monitoring pump cycles. Also provide amber pump running lights, green power available light and individual red indicator lights to alarm seal leaks and pump failures. Indicator lights shall be 30 mm full-voltage type or DCSD approved equal. L.E.D. type lights or L.C.D. type counters will not be acceptable.

The above switches, lights, meters and counters shall be mounted on the inner door of Section #2 of the control panel.

D. NOT USED

E. Device Identification

All devices mounted flush on the inner cabinet door shall be identified with phenolic legend plates. All switches, pumps, lights, breakers, relays, and auxiliary devices mounted to the sub-panels shall be identified with engraved phenolic legend plates.

7.5 PHASE CONVERTER OPTION

Because of the higher probability of electrical failure from using a phase converter, this type of system shall only be considered after investigating the feasibility of having three-phase power brought onto the job site. AmerenUE or CREC supplied three-phase power shall be used unless installation cost justifies the installation cost of a converter. All phase converter installations will meet the following requirements:

A. Single Phase 240 Volt Power Source

The AmerenUE or CREC supplied single-phase 240-volt source shall be stepped up to single phase 480 volts to operate the pump motors that are above 15 horsepower. The power transformer shall be shielded, isolated, and sized to handle 1.5 times the total pump load requirement.

7.6 STATION INTERIOR WIRING

We wet level control float leads shall be hung with stainless steel kellum grips from a series J Halliday stainless steel cable holder. The holder shall be bolted to the inside of the wet well hatch, immediately below the hatch cover and shall be located to not interfere with the wet well entrance steps. The pump power cables shall be hung with stainless steel kellum grips from the upper pump guide rail brackets. Power and control wiring shall be routed with adequate separation. All excess wires shall be rolled up inside the valve chamber.

Passage of the pump and float wires from the pump chamber to the valve chamber shall be made through two open ended lengths of 4-inch PVC conduit installed between the valve and pump chamber. A minimum of 12" separation should be maintained between the control and power wiring.

There shall be no electrical connections made in the pump chamber. All wiring shall run unbroken from the pump chamber to the valve chamber through the 4-inch PVC conduits and terminated inside a 12"x10"x6" plastic hinged, watertight junction box. There shall be two junction boxes. One for control wiring and one for power cables.

Acceptable Manufacturer: Carlon #CS12106 or DCSD approved equal.

Valve chamber junction box connections are to be made with plastic rubber grommeted portable cord connectors T&B #25xx.

All wiring in the valve chamber shall be routed and fastened securely along the chamber walls with non-corrosive wire straps and fasteners.

7.7 FIELD WIRING SPECIFICATIONS

Control panel wiring shall be as follows:

- All wiring installed on the line and load side of the electric meter shall be THHN copper wire.
- Electric service to the station shall be sized to provide the maximum total station amperage with all installed pumps running under a fully loaded condition.
- All pump station control panels shall be provided with a minimum 100-amp service.

7.8 CONDUIT SPECIFICATIONS

The following conduit sizes are to be used on any combination of pumps with a total station HP of less than 60 HP. For larger HP stations, contact DCSD Pump Station Division for specific conduit sizes.

- A 2-1/2" conduit shall be used to run from AmerenUE or CREC supply source to the electric meter mounted in control panel section #3. The meter and disconnect switch are to be connected together with a rigid steel conduit nipple within section #3 of the panel.
- A 2-1/2" conduit shall be used to run all power wires from the bottom of section #3 in the control panel, to the back of the 12"x10"x6" power junction box in the valve chamber.
- A 2-1/2" conduit shall be used to run all control wires from the bottom of section #1 in the control panel, to the back of the 12"x10"x6" control junction box in the valve chamber.
- If a step up transformer is required, conduit shall be sized in accordance with National Electrical Code requirements.
- All conduits running to or from the control panel shall be run underground at a minimum depth of 18 inches below finished grade.
- All below ground conduit shall be PVC schedule 80, unless a phase converter is utilized. For that option, PVC coated rigid steel conduit shall be used including all fittings and transition points.

7.9 CONTROL 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 4-inch concrete pad (see Section 3.10). The sub-grade of the pad should be 95% compacted.
- Conduits shall be run into the power supply chamber 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 bottom panel bottom.
- The control panel shall be firmly anchored to the concrete mounting pad with six, 3/8-inch stainless steel Wej-It stud anchors. Anchor holes in the concrete pad shall be drilled to the manufacturer's recommended depth.

Acceptable Manufacturer: Anchors shall be Hilti Quick Bolt Two or DCSD approved equal.

SECTION 8 - ALARM SYSTEM

8.1 SYSTEM REQUIREMENTS

Each pump station shall have a Mission Remote Alarm System.

SECTION 9 - SITE REQUIREMENTS

9.1 SITE AND ACCESS ROAD PAVEMENT

Pavement will be required at the pumping station as follows:

A. Station Area

All pump and valve chambers shall have a 6' (minimum width) paved apron placed around the pumping structures. The pavement shall be sloped so as to permit surface water to drain away from the station.

When fencing is required around the station area, the pavement shall be extended an additional foot beyond the fencing perimeter.

B. Station Access Road

The access road shall be:

- Minimum of 12 feet wide
- Be designed to limit the access road grade to a 10% maximum. If the road grade must exceed a 10% slope, a combination of step type sloping and protection barriers will be required.
- Have a turn around area at the station end of the access road large enough to accommodate the turning radius of a 16-foot service van.
- The centerline of the entrance road shall bisect the station gate entrance, security fence, and the valve and wet well structures. If this type entry is not feasible for a particular site, the closest structure to the gate and road shall be the wet well.

C. Pavement Specifications

- Asphaltic Concrete:
 - The access road and area surrounding the station shall be paved with 2" of type "C" asphaltic concrete laid over 6" of type "X" asphaltic concrete. All subgrade shall consist of 6" of well-compacted crushed limestone.
- Poured Concrete:
 - Concrete pavement shall be Class A, 6" thick, six-sac mix with a 4" slump. Pavement shall be reinforced with 8 gauge, 6x6 welded wire mesh. The concrete shall be laid over a well-compacted 4" stone base.

D. Entrance Road Barriers

Stations requiring entrance roads shall have 6-inch high barrier posts installed at the road entrance. Post shall be constructed of 6" concrete filled steel or iron pipe, or 6"x6" cedar posts. Posts shall be set 30" below ground in an 18"x36" poured concrete base. A 5/16" diameter galvanized chain locked on one end and firmly fastened to the other, shall be run between the poles. For safety purposes, a 4"x12" reflective plate shall be attached to the chain at the span center.

9.2 FENCING

Fencing shall be required around all pump station sites unless it can be satisfactorily shown by the designing engineer that no safety hazard or vandalism threat would exist by the absence of fencing. Fencing must be included on the pump station site plan. Elimination or alterations to the approved fencing plans shall only be considered for compliance with municipal requirements.

A. Fencing Specifications

Wire fabric for the fence shall be brown or green vinyl clad 6' high chain link fabric. Wire shall be No. 11 gauge woven in a 2" mesh. Top and bottom salvages shall be barbed.

All posts and other appurtenances used in the construction of the fence shall be brown or green vinyl clad schedule 40 pipe. All posts shall be equipped with tops. Fiberglass or other material fencing components will not be acceptable.

A 12' wide entrance gate will be provided for access to the station grounds.

Posts shall be sized and set as follows:

TYPE	SIZE	PULL
Top Rails & Brace	1-1/4" Nominal (1.66" O.D.)	2,27 lbs./ft.
Line Post & Gate Frame	1-1/2" Nominal (1.9" O.D.)	2,72 lbs./ft.
End Corner or Pull Post	2" Nominal (2.375" O.D.)	5,79 lbs./ft.
Gate Post	3-1/2" Nominal (4" O.D.)	9,11 lbs./ft.

Posts shall be set in the concrete bases so that the pole bottom rests 6" higher than the concrete base bottom.

Horizontal support bars shall be installed half way between the top rail and the ground.

A #7 tension wire shall be installed at the bottom of the fencing fabric and stretched taught enough so as to not allow the bottom of the fencing fabric to be lifted away from the fencing poles and/or ground.

B. Fencing Placement

Fencing shall be located so that:

- There is a 4' space between all auxiliary pump station equipment, panels, generators, etc. and the fence perimeter.
- The access gate shall be located so that hoisting or cleaning equipment can easily access the valve and wet well chambers.

9.3 MAINTENANCE

Temporary erosion control shall be provided in accordance with state and local requirements. Surface water must be directed away from the pump station paved area to prevent debris from washing over the paved area.

9.4 RESTORATION

Restoration shall be in accordance with the DCSD Standard Specification. Final acceptance of the station shall be withheld until the site is restored to the District's satisfaction.



Duckett Creek Sanitary District

PUMP STATION DESIGN REQUIREMENTS

Own By: MSM App By: KLA Detail No. 06-28-21
Ckd By: JAR Date: JAN, 2016 SPEC-2

PUMP STATION NOTES:
SHEET 2

Design By: R/H
Drawn By: R/H
Checked By: R/H

Vote Project # 2074

06-28-21
C46

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