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USACE / NAVFAC / AFCEC / NASA UFGS-33 32 13.13 (November 2014)  
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Preparing Activity: NASA Superseding  
UFGS-33 32 13.13 (May 2009)

## UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated April 2016

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#### SECTION 33 32 13.13

#### PACKAGED SEWAGE LIFT STATIONS, WET WELL TYPE

11/14

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### SECTION 33 32 13.13

#### PACKAGED SEWAGE LIFT STATIONS, WET WELL TYPE 11/14

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NOTE: This guide specification covers the requirements for furnishing and installing a package-type underground wet well type sewage-lift station.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable items(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

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## PART 1 GENERAL

### 1.1 REFERENCES

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NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically  
be deleted from this section of the project  
specification when you choose to reconcile  
references in the publish print process.

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The publications listed below form a part of this specification to the  
extent referenced. The publications are referred to within the text by the  
basic designation only.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C110/A21.10	(2012) Ductile-Iron and Gray-Iron Fittings for Water
AWWA C500	(2009) Metal-Seated Gate Valves for Water Supply Service
AWWA C509	(2009) Resilient-Seated Gate Valves for Water Supply Service
AWWA C600	(2010) Installation of Ductile-Iron Water Mains and Their Appurtenances

ASME INTERNATIONAL (ASME)

ASME B16.11	(2011) Forged Fittings, Socket-Welding and Threaded
ASME B16.3	(2011) Malleable Iron Threaded Fittings, Classes 150 and 300

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2013) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A126	(2004; R 2014) Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A36/A36M	(2014) Standard Specification for Carbon Structural Steel
ASTM A615/A615M	(2015a; E 2015) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM C478	(2015a) Standard Specification for Precast Reinforced Concrete Manhole Sections
ASTM C478M	(2015a) Standard Specification for Precast Reinforced Concrete Manhole Sections (Metric)
ASTM C618	(2012a) Standard Specification for Coal Fly Ash and Raw or Calcined Natural

Pozzolan for Use in Concrete

ASTM C989/C989M (2014) Standard Specification for Slag  
Cement for Use in Concrete and Mortars

HYDRAULIC INSTITUTE (HI)

HI M100 (2009) HI Pump Standards Set

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.11 (2012) Standard for Metal-Oxide Surge  
Arresters for Alternating Current Power  
Circuits (>1kV)

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 1940-1 (2003; Cor 2005) Mechanical Vibration -  
Balance Quality Requirements for Rotors in  
a Constant (Rigid) State - Part 1:  
Specification and Verification of Balance

ISO 2858 (1975) End Suction Centrifugal Pump  
(Rating 16 Bar) Designation Nominal Duty  
Point and Dimensions - International  
Restrictions

ISO 5199 (2002) Technical Specifications for  
Centrifugal Pumps, Class II

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 820 (2016) Standard for Fire Protection in  
Wastewater Treatment and Collection  
Facilities

UNDERWRITERS LABORATORIES (UL)

UL 1449 (2014;Reprint Mar 2015) Surge Protective  
Devices

1.2 SUBMITTALS

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NOTE: Review Submittal Description (SD) definitions  
in Section 01 33 00 SUBMITTAL PROCEDURES and edit  
the following list to reflect only the submittals  
required for the project.

The Guide Specification technical editors have  
designated those items that require Government  
approval, due to their complexity or criticality,  
with a "G." Generally, other submittal items can be  
reviewed by the Contractor's Quality Control  
System. Only add a "G" to an item, if the submittal  
is sufficiently important or complex in context of  
the project.

For submittals requiring Government approval on Army

projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

An "S" following a submittal item indicates that the submittal is required for the Sustainability Notebook to fulfill federally mandated sustainable requirements in accordance with Section 01 33 29 SUSTAINABILITY REPORTING.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

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Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability Notebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-01 Preconstruction Submittals

Material, Equipment, and Fixtures List[; G[, [\_\_\_\_]]]

#### SD-02 Shop Drawings

Fabrication Drawings[; G[, [\_\_\_\_]]]

Erection/Installation Drawings[; G[, [\_\_\_\_]]]

#### SD-03 Product Data

Spare Parts Data[; G[, [\_\_\_\_]]]

Manhole Chambers[; G[, [\_\_\_\_]]]

EPA-CPG Compliance[; G[, [\_\_\_\_]]]

Entrance Covers[; G[, [\_\_\_\_]]]

Pumps[; G[, [\_\_\_\_]]]

Pump Controls[; G[, [\_\_\_\_]]]

Impellers[; G[, [\_\_\_\_]]]

Couplings[; G[, [\_\_\_\_]]]

Bearings[; G[, [\_\_\_\_]]]  
Stuffing Boxes[; G[, [\_\_\_\_]]]  
Gate Valves[; G[, [\_\_\_\_]]]  
Check Valves[; G[, [\_\_\_\_]]]  
Blowers[; G[, [\_\_\_\_]]]  
Dehumidifier[; G[, [\_\_\_\_]]]  
Electric Motors[; G[, [\_\_\_\_]]]

SD-05 Design Data

Motor/Pumps[; G[, [\_\_\_\_]]]

SD-06 Test Reports

Pump Test[; G[, [\_\_\_\_]]]  
Hydrostatic Pressure Test[; G[, [\_\_\_\_]]]  
[ Pressure Sensor Test[; G[, [\_\_\_\_]]]  
][ Float Test[; G[, [\_\_\_\_]]]

] SD-07 Certificates

Listing of Product Installations[; G[, [\_\_\_\_]]]  
Recycled Material Content[; G[, [\_\_\_\_]]]  
Manhole Chambers[; G[, [\_\_\_\_]]]  
Entrance Covers[; G[, [\_\_\_\_]]]  
Pumps[; G[, [\_\_\_\_]]]  
Gate Valves[; G[, [\_\_\_\_]]]  
Check Valves[; G[, [\_\_\_\_]]]  
Blowers[; G[, [\_\_\_\_]]]  
Dehumidifier[; G[, [\_\_\_\_]]]  
Electric Motors[; G[, [\_\_\_\_]]]

SD-08 Manufacturer's Instructions

Manhole Chambers[; G[, [\_\_\_\_]]]  
Entrance Covers[; G[, [\_\_\_\_]]]  
Pumps[; G[, [\_\_\_\_]]]

Pump Controls[; G[, [\_\_\_\_]]]  
Gate Valves[; G[, [\_\_\_\_]]]  
Check Valves[; G[, [\_\_\_\_]]]  
Blowers[; G[, [\_\_\_\_]]]  
Dehumidifier[; G[, [\_\_\_\_]]]  
Electric Motors[; G[, [\_\_\_\_]]]  
Special Tools[; G[, [\_\_\_\_]]]  
Posted Instructions[; G[, [\_\_\_\_]]]

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals[; G[, [\_\_\_\_]]]  
Preventative Maintenance and Inspection Procedure[; G[, [\_\_\_\_]]]

SD-11 Closeout Submittals

Warranty[; G[, [\_\_\_\_]]]

1.3 QUALITY CONTROL

Submit a listing of product installations similar to the package lift station being installed.

Verify conformance of materials and equipment for package lift station to the referenced publications or as specified. Verify that the manufacturer is regularly engaged in the manufacture of such products.

Submit manufacturer's data indicating percentage of recycled material content in packaged sewage lift stations to verify affirmative procurement compliance.

Fly ash is required as an admixture and is to conform to ASTM C618, Class [F][C]. Fly ash replacement of cement is not to exceed 20 percent (maximum one part fly ash to four parts cement) by weight.

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**NOTE:** Ground granulated blast furnace slag and fly ash are materials listed in the EPA's Comprehensive Procurement Guidelines (CPG) (<http://www.epa.gov/cpg/>). If the Architect/Engineer determines that use of certain materials meeting the CPG content standards and guidelines would result in inadequate competition, do not meet quality/performance specifications, are available at an unreasonable price or are not available within a reasonable time frame, the Architect/Engineer may submit written justification and supporting documentation for not procuring designated items containing recovered material. Written justification may be submitted on a Request for Waiver Form to the NASA Environmental Program



Manager for approval. The Request for Waiver Form  
is located in the NASA Procedures and Guidelines  
(NPG 8830.1) (<http://nodis3.gsfc.nasa.gov>).

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Ground granulated blast furnace slag [is required] [used] as an admixture [and] is to conform to ASTM C989/C989M, Grade [120] with between 25 to 50 percent maximum cement replacement by weight. Submit certificate to verify EPA-CPG compliance.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

Inspect materials delivered to site for damage. Unload and store with minimum handling. Store materials on site in enclosures or under protective covering. Do not store materials directly on the ground. Keep inside of pipes, fittings, [valves] [and] [\_\_\_\_\_] free of dirt and debris.

Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the trench in sound undamaged condition. [Take special care not to damage linings of pipe and fittings; if lining is damaged, make satisfactory repairs. ]Carry, do not drag, pipe to trench.

#### 1.5 WARRANTY

Provide a manufacturers' warranty for [pumps], [float switches], [control panel] [\_\_\_\_\_]. Create a list or reference all specific operation and maintenance procedures that are required to keep the warranty valid.

### PART 2 PRODUCTS

#### 2.1 SYSTEM DESCRIPTION

Provide each station with two pumps with controls capable of operating the pumps either simultaneously or individually, depending on the load conditions.

Furnish and install each lift station as a complete unit with necessary appurtenances[, installed within a pump chamber[ and a vertical entrance tube cover and access ladder], all] designed for the following:

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**NOTE: Pump capacity, head, and service life is to  
be as required by the project and specified.**

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Service life - [15] [\_\_\_\_\_] years

Pump capacity - [\_\_\_\_\_] liter [\_\_\_\_\_] gallons per minute (gpm)

Total head - [\_\_\_\_\_] meter [\_\_\_\_\_] feet

Submit fabrication drawings after receiving tentative approval of the equipment and the materials list but before installation. Submit drawings covering necessary or recommended changes to accommodate the equipment offered. Show on the drawings the design of the chamber, with dimensions, types, and thicknesses of materials, and elevation levels with reference to those elevations indicated.

Submit erection/installation drawings for the manhole chamber with the

required equipment and accessories. Provide precast reinforced concrete manhole sections conforming to ASTM C478M and ASTM C478. Show the design of the chamber, with dimensions, types, and thicknesses of materials, and elevation levels with reference to those elevations indicated.

Provide the following motor/pumps design information prior to final turnover - number of motor rotor bars and stator slots; number of cooling fan blades; RPM of motor; bearings, bearing manufacturer, bearing type, bearing style and number of balls/elements; number of commutator bars and commutator brushes; SCR firing frequencies; and number of pump impellers.

#### 2.1.1 Design Requirements

##### 2.1.1.1 Pump Construction

Fabricate castings in cast iron or steel free from injurious defects. Design castings to permit easy replacement of parts. Gasket all joints to prevent leakage. Design and install passageways to permit the smooth flow of sewage and free from sharp turns and projections. Provide pump castings with cleanout plates in the suction line and drain plugs.

##### a. Electric Motors

Provide 60-hertz, 3-phase motors.

##### b. Impellers

Fabricate impellers in cast iron, cast steel, or an alloy suitable for the service required. Provide free flowing impellers which permit objects in the sewage that enter the pump to pass into the discharge pipe. Provide each impeller keyed, splined, or threaded on the shaft and locked in such manner that lateral movement is prevented and reverse rotation can not cause loosening.

##### c. Couplings

Provide heavy-duty flexible type couplings, keyed to the shaft. Provide universal type couplings for vertical pumps.

##### d. Shaft Sleeves

Protect the shaft from the liquid being pumped, points in contact with the stuffing boxes, and other wearing parts with sleeves designed in bronze or a suitable alloy.

##### e. Stuffing Boxes

Grease-seal stuffing boxes with a seal ring, designed to ensure tight packing without excessive wear or friction on the shafts, and prevent the leakage of air or water. Provide split type glands which can be easily removed for repacking.

##### f. Balance

Balance rotating parts of the equipment mechanically and hydraulically to operate throughout the required range without excessive end thrust, vibration, and noise. Conform allowable vibration limits with ISO 1940-1, Table 1. Existence of defects that cannot be eliminated by adjustment will be sufficient cause for rejection of the equipment.

g. Shafts

Provide high-grade steel shafts of a size and strength to perform the work required.

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**NOTE: Specify sealed bearings on motors. Properly  
installed sealed bearings with warranty for minimal  
maintenance requirements.**  
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h. Bearings

Provide ball or roller type main bearings to withstand radial and end thrust. Pumps dependent upon hydraulic balance are prohibited.

i. Lubrication

Provide [grease type lubrication with fittings for a grease gun and, if not easily accessible, with grease tubing extending to convenient locations.][the pump manufacturer's standard type grease fittings.] [self lubricating, permanently sealed bearings.]

2.2 COMPONENTS

Submit a material, equipment, and fixtures list of all major components including manufacturer's catalog numbers, specification and drawing reference number, warranty information, and fabrication site.

2.2.1 Chamber

[Fabricate chamber, including base, walls, and entrance tube with [\_\_\_\_][35] Megapascal [\_\_\_\_][5000] psi precast concrete designed to form an integral unit. ][Fabricate wet well as an integral part of the unit with a separate manhole entrance. ]Include ladder, pipe supports, brackets, and other miscellaneous components of steel conforming to ASTM A36/A36M, ASME B16.3, ASME B16.11 and hot-dipped galvanized in accordance with ASTM A123/A123M.

2.2.2 Wet Well Base Material

Provide crushed stone as indicated and specified in Section 31 00 00 EARTHWORK. Provide polyethylene vapor barrier as indicated and specified in Section 03 30 00 CAST-IN-PLACE CONCRETE.

2.2.2.1 Wet Well[ and Valve Vault]

Provide [fiberglass reinforced polyester resin basin][concrete wet well [and valve vault]] with inside diameter [as indicated][of [\_\_\_\_] mm [\_\_\_\_] inch]. [Precast structures may be provided in lieu of cast-in-place structures.]

2.2.3 Entrance Covers

2.2.3.1 Access Hatch Cover

Provide [aluminum][\_\_\_\_] access hatch cover as indicated. Include lifting mechanism, automatic hold open arm, slam lock with handle, and flush lift

handle. Use automatic hold open arm that locks in the 90 degree position. Use access hatch cover capable of withstanding a live load of 1500 kg/sq. meter 300 lbs./sq. ft. Provide stainless steel cylinder lock with two keys per lock. Key all the locks the same.

#### 2.2.4 Manhole Chamber

Submit information on manhole chambers, including: base, entrance tube, air ducts, and similar structural parts, with [steel conforming to ASTM A36/A36M, ASTM A615/A615M] [reinforced fiberglass]. Protect steel from corrosion by means of hot-dip galvanizing conforming to ASTM A123/A123M epoxy-resin coatings.

#### 2.2.5 Pumps

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**NOTE: Pump capacity is to be as required by the project and specified.**  
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Provide pumps of the nonclogging, centrifugal type designed to pump unscreened sewage. Provide pumps with a rated capacity as specified and is capable of passing 75 millimeter 3-inch solids. Conform to the requirements of ISO 2858 and ISO 5199 HI M100.[ Pump speed is not to exceed [1,800][\_\_\_\_\_] revolutions per minute.]

##### 2.2.5.1 Alternator

Provide an alternator control switch to operate in connection with each float. Use an alternator control switch to alternate the operation of the pumps and operate both pumps if the water level rises above the second high water level. Incorporate time delay function and devices in the alternator controls such that both sewage pumps cannot be started simultaneously for an adjustable period of 10 to 120 seconds after shutdown. Use the delay function designed to operate in any condition of start-up in either normal or emergency operational mode.

#### 2.2.6 Valves

##### 2.2.6.1 Gate Valves in Valve Vault

Conform to AWWA C500 for gate valves with outside-screw-and-yoke rising-stem type with double disc gates and flanged ends. Conform to AWWA C509 for valves with outside-screw-and-yoke rising-stem type with flanged ends. Provide valves with handwheels that open by counterclockwise rotation of the valve stem. Bolt and construct stuffing boxes to permit easy removal of parts for repair. Use valves from one manufacturer.

##### 2.2.6.2 Check Valves Less than 100 mm 4-Inch Diameter

Provide neoprene ball check valve with integral hydraulic sealing flange, designed for a hydraulic working pressure of 1.21 MPa 175 psi.

##### [2.2.6.3 Check Valves 100 mm 4-Inch and Larger Diameter

Provide nonclogging swing check valve rated for not less than 1.21 MPa 175 psig working pressure capable of passing 76-mm 3-inch diameter solids. Cast iron conforming to ASTM A126. Buna-N disc and integral seat. Flanged ends conforming to AWWA C110/A21.10.

Provide a positive horizontal, swing check type check valves. Provide valves that permit a free flow of sewage forward and a positive check against backflow. Provide iron body valves with a removable cover for inspection and removal of the gate assembly. Provide [bronzel][\_\_\_\_\_] gate, gate seats, shaft, studs, and nuts.

#### 2.2.7 Piping

Provide force mains in accordance with Section 33 34 00 FORCE MAINS AND INVERTED SIPHONS; SEWER.

##### 2.2.7.1 Piping Connections

Provide pump suction and discharge with flanged connections of the proper size for the pump type and capacity. Provide between pipes of dissimilar metals a rubber gasket or other approved type of insulating joint or dielectric coupling to effectively prevent metal-to-metal contact between adjacent sections of piping.

##### 2.2.7.2 Accessories

Provide flanges, connecting pieces, transition glands, transition sleeves, and other adapters as required.

##### 2.2.7.3 Flexible Flanged Coupling

Provide flexible flanged couplings applicable for sewage as indicated. Use flexible flanged coupling designed for a working pressure of 2.41 MPa 350 psi.

##### 2.2.8 Ventilating Blower

Ensure blowers maintain air changes in accordance with[ NFPA 820][ every [5] [\_\_\_\_\_] minutes]. Mount a manual and automatic switch on the side of the entrance tube for operation of the blower. Provide vent to atmosphere with covers and screens to prevent the entrance of rain, insects, and rodents. Automatically actuate blower upon opening the entrance tube cover, unless overridden by the manual control.

##### 2.2.9 Dehumidifier

Furnish and install a packaged dehumidifier in accordance with lift station manufacturer's recommendations. Include in controls a humidistat and low-temperature cutout/discharge condensate to the wet well.

##### 2.2.10 Nameplates

Provide the manufacturer's name or trademark on a corrosion-resistant identification plate or cast integrally, on each item of equipment, stamped, or otherwise permanently marked in a conspicuous place. Include on the pump identification plate the pump capacity in liter per minute gpm, pump head in meter feet and speed of rotation. Cast on the body of the pump the direction of rotation.

## 2.2.11 Pump Controls

### 2.2.11.1 General

Pump operating controls [provided by the pump supplier and ]are the automatic type including all necessary components to function reliably. Mount controls in a NEMA 3R rated [stainless steel][\_\_\_\_\_] control panel. Ensure equipment subject to contact with sewage or sewage gases is corrosion-resistant metal. Provide an electronic controller that automatically activates and alternates the pump operation. If the liquid level continues to rise to the plans-specified level, the controller engages both pumps to operate simultaneously until both shut off at the specified low level. Provide hand-off-auto switches to choose the mode of operation for each pump. Provide controls with a 12 VDC powered float switch connected to the alarm contact of the battery charger to activate high-level alarms.

Protect pumping stations from lightning and transient voltage surges and equip with phase protection.

Provide the station with a three-wire, 4-pole (grounding) receptacle for a portable generator in case there is an external power outage.

Design the control system to operate two (2) pumps at power characteristics as shown on the plans. Ensure all controls and wiring meet or exceed the requirements of the National Electrical Code (NEC), Latest Edition.

For pumps specified as explosion proof, have pump power and control installation meets NEC requirements for Class 1, Division 1, Group D Hazardous Location, including intrinsically safe controls. Provide components that are UL listed or FM approved.

Require the control function to provide for the operation of the pumps under normal conditions and alternates the pumps on each pump down cycle.

In the event the incoming flow exceeds the pumping capacity of the lead pump, the offline pumps automatically start to handle the increased flow. As the flow decreases, the pumps cut off at the elevations set on the controller.

### 2.2.11.2 Enclosure

Provide a NEMA 3R rated enclosure manufactured from stainless steel. [The enclosure is a wall mount type suitable for mounting on strut or channel with a minimum depth sized to adequately house all the components. ]Provide a rubber composition door gasket and assures a positive weatherproof seal. Provide a door that opens a minimum of 180 degrees and is equipped with a 3-point latch and padlockable handle.

Provide a dead front mounted in the panel to provide protection of personnel from live internal wiring. Install cutouts for breaker handles to allow operation of breakers without entering the compartment.

Mount all control switches, indicator pilot lights, elapsed time meters, duplex receptacle and other operational devices on the external surface of the dead front.

Ensure the dead front opens a minimum of 150 degrees to allow access to equipment for maintenance.

[Manufacture the back plate from 2.78 mm 12-gauge (minimum) steel and finished with a primer coat and two (2) coats of baked on white enamel.  
]Mount all hardware to the subpanel with machine thread tapped holes. Sheet metal screws are not acceptable. Permanently identify all devices to match the schematic diagram.

Provide an enclosure ventilator located near the top of the enclosure on the opposite side of the generator receptacle. Provide a rain and vermin proof ventilator and made of fire retardant thermoplastic material.

#### 2.2.11.3 Power Distribution

Provide a panel power distribution that includes all necessary components and is completely wired with stranded copper conductors rated at 90 degrees C 194 degrees F. Install all conductor terminations as recommended by the device manufacturer.

Provide a main and emergency circuit breaker in the control panel. Provide a mechanical interlock between the main and emergency breakers to prevent simultaneous operation of both power sources.

[ Provide heavy duty thermal magnetic circuit breakers with a minimum of [\_\_\_\_\_] amps interrupting capacity at [\_\_\_\_\_] volts and [\_\_\_\_\_] amps at [\_\_\_\_\_] volts.

] Size each motor breaker to meet the pump motor operating characteristics. Individually protect the control circuit and the duplex receptacle by circuit breakers.

Install indicating type circuit breakers, providing "On/Off/Trip" positions of the operating handle. When the breaker is tripped automatically, the handle assumes a middle position indicating "Trip".

Provide quick-make and quick-break thermal magnetic breakers on manual and automatic operation and have inverse time characteristics secured through the use of bimetallic tripping elements supplemented by a magnetic trip for instantaneous protection. Design breakers so that an overload on one pole automatically trips and opens all legs. Field installed handle ties are not acceptable.

Ensure motor starters are open frame, across the line, full voltage, NEMA rated with individual overload protection for each phase. Ensure motor starter contact and coil is replaceable from the front of the starter without removing from its mounted position.

Provide motor overload protection via melting alloy type thermal overload relays. Provide overloads that are interchangeable and sized per NEC.

Provide control transformers for 120 VAC requirements in the control panel. Provide fused transformers and the secondaries grounded.

Provide incoming power with both lightning surge arresters (line side, IEEE C62.11) and transient voltage surge suppression (load side, UL 1449). Use solid state devices with LED indicator lights for power and protective status. As a minimum, rate devices for [50,000][\_\_\_\_\_] amps per phase with response time less than 5nSec.

Install a line voltage rated, solid-state, adjustable, plug-in monitor to

sense reversed or loss of a phase. Ensure the control circuit de-energizes upon sensing any of the faults and automatically restores service upon return to normal power.

#### 2.2.11.4 Alarm System

Provide a weatherproof-shatterproof red strobe alarm light fixture rated at [100,000][\_\_\_\_\_] peak candle power, 12 VDC, 80 flashes per minute to indicate alarm conditions.

Mount the alarm horn on the exterior of the cabinet. The alarm horn provides a signal of not less than 90db at 3 meters 10 feet. Deactivate the alarm horn with an alarm silence switch, however, the alarm light flashes until the alarm condition ceases to exist. At that time the alarm reset function resets for normal operation.

The alarm circuitry is 12 VDC, powered by a battery operated alarm with charger with plug-in base, solid state circuitry and push to test switch. Battery is rated for 7.0 amp-hours minimum. Alarm horn and light are activated via the battery charger upon either loss of utility power or a high level condition in the wet well.

#### 2.2.11.5 Control System

Provide a control system for the automatic and manual control and alternation of the pumps to maintain a pumped down condition of the wet well.

Provide control of duplex pumps by an electronic alternating controller with digital level display. For locations specified for explosion proof pumps, design system for installation in a Class 1, Division 1, Groups A, B, C, and D hazardous area and be intrinsically safe. Ensure submersible pressure transmitter sends a 4-20mA input to controller.

As the level in the wet well rises, the lead pump as determined by the alternator, starts and pump the station to the "off" position. In the event the incoming flow exceeds the capacity of the lead pump, the lag pump starts and both pumps run to the off level. The alternator switches when the off level is reached.

If the level continues to rise, alarm functions are activated via a high-level float switch (intrinsically safe for Class I, Division 1, hazardous installations).

Suspend the submersible level sensor on its cable, and run inside a 50 mm 2-inch Schedule 40 PVC pipe, which is attached under the lid of the wet well by stainless steel(SS) clamps and SS unistrut. Ensure the pipe reaches to the bottom of the wet well. Perforate the bottom 300 mm 12-inch of pipe with 9.5 mm 3/8-inch holes spaced 25 mm 1-inch apart. Suspend the high level float on its cable from the strut on the top.

#### [2.2.11.6 Float Assembly Description

Use a direct acting float switch consisting of a normally-open mercury switch enclosed in a float. Use pipe mounted float assembly. Use float molded of rigid high-density polyurethane foam, color-coded and coated with a durable, water and corrosion-resistant jacket of clear urethane. Provide connecting cable and support pole in accordance with manufacturers recommendations. Provide a cast aluminum NEMA [Type 4][\_\_\_\_\_] junction box



to connect float assembly. Use box with a gasketed cover with tapped float fitting and conduit entrance pipe threaded opening. Mount floats at fixed elevations as shown. Use floats designed to tilt and operate their switches causing sequential turn-on turn-off of the pump, when the liquid level being sensed rises or falls past the float.

#### ]2.2.11.7 Pressure Sensor Description

Provide the pump station with a submersible pressure type level sensor and an electronic pump controller. Sense levels by a 24 VDC, 1 Percent submersible pressure transmitter provided by controller manufacturer. Construct the system as follows:

- a. The pressure type level sensor is a submersible type, suspended on its cable.
- b. Install the sensor per manufacturer's instructions for wet well installations, including any recommended mounting accessories.
- c. The level sensor is as follows:
  - (1) Select the sensor range based on the wet well depth.
  - (2) The sensor output is 4-20mA proportional to water level, 2-wire type.
  - (3) Construct all exposed parts of [316 Stainless Steel][\_\_\_\_\_]
  - (4) Fill the sensor with Silicon Oil
  - (5) Power the Sensor by 24 VDC output from electronic pump controller.
- d. Mount the electronic pump controller in the starter panel enclosure, and be visible from the front of the swing-out panel, with the enclosure door opened. The electronic pump controller is as follows:
  - (1) Accept a 4-20 mA, 2 wire level signal, and indicate the wet well level digitally in direct engineering units (meters)(feet).
  - (2) Provide pump control outputs, with independent adjustment for each pump starting and stopping setpoint. Indicate each level setpoint digitally in direct engineering units.
  - (3) Power to the unit is 120 VAC.
  - (4) Equip controller with H.O.A. switches and pump on indicating lights (one each per pump).

#### ]2.2.11.8 Ancillary Equipment

The control system includes, but not be limited to:

- a. An elapsed time meter for each pump mounted on the dead front door. The meter operates on 120 VAC, and indicate run time in hours, have LCD Display and is not resettable.
- b. A weatherproof generator receptacle rated 100A is required.
- c. Control wire is a minimum 18 AWG. Route all control wires through a

plastic wireway with snap on covers, bundled and tie wrapped to form a neat assembly.

- d. Provide a duplex, 15 amp, GFI receptacle providing 120 volts, 60 hertz, single phase power inside the panel on the deadfront door.
- e. 1-N/O and 1-N/C unpowered contact for high level, power/control power failure, and pump run indication wired to terminal strip.
- f. Identification plate engraved to show white letters on a black background. Letters are uppercase. Identification Plate to indicate "LIFT STATION CONTROL PANEL" system voltage (e.g. 208V, 3PH or 480V, 3PH), and power source.
- g. Pump seal failure indication.
- h. Time delay relay to prevent pumps from starting simultaneously.

## 2.3 PAINT

Treat and paint equipment in accordance with the manufacturer's standard practice for sewage resistance.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Install lift station as indicated, in accordance with drawings and the manufacturer's instructions. Dampen and isolate equipment vibration.

#### 3.1.1 Emergency Overflow

Install a gravity-overflow line from the wet well. Terminate overflow line with a headwall and flap valve.

#### 3.1.2 Protection from Moving Parts

Locate guard belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts in accordance with applicable OSHA standards and so that personnel are properly protected from injury.

#### 3.1.3 Valves

Install gate valves conforming to AWWA C500 in accordance with AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to AWWA C500. Install gate valves conforming to AWWA C509 in accordance with AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to AWWA C509.

[Install check valves in accordance with the applicable requirements of AWWA C600 for valve-and-fitting installation [, except as otherwise indicated].] [ Make and assemble joints to gate valves [and check valves] as specified for making and assembling the same type joints between pipe and fittings.]

#### 3.1.4 Piping

Terminate discharge lines 1.5 meter 5-feet outside the lift station in flanged connections.[ Include the pipe from the wet well manhole in the suction line.]

#### 3.1.5 Miscellaneous

Attach a final as built drawing, laminated in mylar, to the inside of the front door and shown on the as-built drawings. Include a list of all legends. Identify the pump nameplate data on the drawing and on the as-built plans.

Permanently mark all component parts in the control panel and identified as they are indicated on the drawing. Mark on the back plate adjacent to the component. Identify all control conductors with wire markers at each end as close as practical to the end of conductor.

### 3.2 FIELD QUALITY CONTROL

#### 3.2.1 Tests

Perform tests, including hydrostatic pressure test of piping, under a test pressure equal to 50 percent more than the pump discharge pressure or total dynamic head, whichever is greater. Perform a pump test, [pressure sensor test][float test]. Submit the test results to the Contracting Officer.

Test all panels to the power requirements as shown on the plans to assure proper component operation. Activate each control function to check for proper operation and indication.

#### 3.2.2 Field Representative

A representative of the lift station manufacturer is to direct the startup of the station and instruct representatives of the Government in startup and operation procedures.

### 3.3 CLOSEOUT ACTIVITIES

#### 3.3.1 Operation and Maintenance

Submit preventative maintenance and inspection procedure for package lift stations. Include in procedures the frequency of preventative maintenance, inspection, adjustment, lubrication, and cleaning necessary to minimize corrective maintenance and repair.

Supply special tools that are required for maintenance and testing of the package lift stations.

Submit spare parts data, including a complete list of parts and supplies with current unit prices and source of supply. List parts and supplies that are either normally furnished at no extra cost with the purchase of equipment, or specified to be furnished as a part of the contract, and list additional items recommended by the manufacturer to ensure an efficient operation for a period of one year.

Install on or near the package lift stations, a complete package of posted instructions, consisting of labels, signs, and templates of operating instructions.

Submit operation and maintenance manuals for package lift stations, including Equipment Description, Assembly and Installation Procedures, Adjustment and Alignment, Checkout Procedures, Procedures of Operation and Troubleshooting.

-- End of Section --