Section 8
Grinder Pumps

A. General

1. Grinder pumps are to be used if it is intended that low-pressure sewers, as described in Section 6, are to be installed. Developers and individuals who wish to install grinder pumps must familiarize themselves with the Authority's "Individual Grinder Pump Management Plan". The proposed use of grinder pumps will be reviewed on a case-by-case basis.

2. Simplex (single) grinder pump units shall be used at residential property locations, and simplex or duplex (double) grinder pump units shall be used at commercial or industrial properties. Additionally, provision of a spare pump and a standby power supply are recommended for non-residential uses. In certain cases, a simplex installation may be permitted for a non-residential use. Such exceptions will be reviewed on a case-by-case basis and must have the approval of the Authority.

3. Grinder pump units shall be installed in either concrete, high-density polyethylene or fiberglass-reinforced polyester basins for outdoor installations only. Indoor installations will not be permitted.

4. The grinder pump package shall consist of the basin, grinder pump(s) and motor(s), quick disconnect, pump removal system, junction box, start-stop level controls, motor high temperature shutoff, motor seal leak alarm, high water alarm, shutoff valve, pump check valve and redundant check valve, anti-siphon valve, discharge piping and fittings, and all internal wiring terminating in a junction box.

5. The location of the grinder pump package and control panel shall be determined by the property Owner or Developer.

6. The following NEMA ratings are required for the specified areas:

    a. Outdoors, within 10 feet of the pump basin – NEMA 4X

    b. Outdoors, at least 10 feet from the pump basin – NEMA-4 or NEMA 4X

7. Provision of bollards to protect the structure and/or control panel is recommended in areas where there is potential for traffic.

B. Materials and Equipment

1. Grinder Pump Unit

   a. The pump unit shall consist of a centrifugal or positive displacement grinder type pump with accessories as specified herein. The pumps shall comply with the following characteristics:

   b. Pumps shall be of sufficient horsepower to perform the intended work and shall be a minimum of 1 horsepower.

      (1) Residential

         (a) Maximum Flow = No greater than 50 gpm at 10 feet Total Head

         (b) Minimum Flow = 10 gpm at 90 feet Total Head

         (c) Minimum Shutoff Head = 105 feet

      (2) Non-Residential

         (a) Maximum Flow = to be determined based on application

         (b) Minimum Flow = 10 gpm at 90 feet Total Head

         (c) Minimum Shutoff Head = 105 feet

   c. Submersible Pump and Motor

      (1) The grinder pump and motor are to be specifically designed and manufactured so they can operate completely submerged in wastewater. Electrical power cord is to be sealed, with individual conductors additionally sealed, thus eliminating water entering the motor by following individual conductors inside the insulation. Wire sizing and voltage drop associated with run lengths over 100 feet shall comply with NEC rules.

      (2) The combination pumping elements and grinder unit shall be attached to a common motor and pump shaft made of stainless steel. The grinder unit shall be on the suction side of the pump impeller inlet leaving no exposed shaft to permit packing of ground solids. Both stationary and rotating cutters shall be made of hardened and ground stainless steel. The full diameter impeller shall be provided.

(3) The pump-motor shaft shall be sealed by mechanical carbon and ceramic-faced seals or similar material . An electric sensing probe shall be mounted in the seal chamber to detect any water leakage past the lower seal before damage is done to the motor. The seal probe circuit sensitivity shall not be affected by cable length between the motor and the seal probe circuitry in the control panel. This probe shall be connected to an indicator light in the control panel.

(4) The shaft shall be supported by two radial and thrust ball bearings and a lower bronze radial sleeve guide bushing for radial load from grinder impeller. Ball bearings shall be designed for 50,000 hours B-10 life.

(5) The rotor winding and rotor are to be mounted in a sealed, submersible type housing which is filled with clean high dielectric oil or air as pump design dictates. A heat sensor or thermostat shall be located in the motor winding and shall be provided to detect over temperature and stop the pump. When the temperature drops to a safe level, the pump will automatically reset.

(6) For residential applications, submersible motor shall be constant speed, suitable for operation on a 240 Volt, 60 HZ, single-phase service. Submersible motors for non-residential applications shall be constant speed, suitable for operation on a 240 Volt, single-phase service or a 120/208 or 480 Volt, three-phase service. The motors shall be of proper size to drive the pump at any point on the pump curve. Thrust bearings shall be of the ball type. The motor shall be a capacitor start-capacitor run type with high starting torque.

(7) Motor shall be amply rated for the head and capacity values specified, on continuous duty, without exceeding 1.0 service factor load at the minimum capacity design point, and without exceeding the motor full service factor load at any head between shutoff and 10 feet TDH, which is the minimum expected dynamic head to be found in this installation.

(8) For non-residential installations, the use of explosion-proof motors and the provision of a spare pump are recommended.

2. Level Controls

Sealed float-type mercury switches shall be supplied to control sump level and alarm signal. The mercury type switches shall be sealed in a solid polypropylene float for corrosion and shock resistance. The support wire shall have a heavy neoprene jacket. A weight shall be attached to the cord above the float to hold switch in the sump. The weight shall be above the float to effectively prevent sharp bends in the cord when the float operates. Two float switches shall be used to control level: one for pump turn-on and one for

pump turn-off. A third switch shall be provided for high water alarm and redundant pump turn-on (in the case of a duplex installation). The float switch shall hang in the sump and be supported by a stainless steel bracket and cord snubber that will give positive support to the controls and allow flexibility in the setting of levels. All mounting structures and hardware shall be stainless steel.

3. Operation of System

   On sump level rise, lower mercury switch shall first be energized, then upper level switch shall next energize and start pump. With pump operating, sump level shall lower to low switch turn-off setting and pump shall stop. If level continues to rise when pump is operating, alarm switch shall energize and activate the alarm. All level switches shall be adjustable for level setting from the surface. Duplex systems shall also have a lag pump on switch.

4. Corrosion Protection

   All materials exposed to wastewater shall have inherent corrosion protection, i.e., cast iron, fiberglass, stainless steel or PVC. Galvanized steel is not acceptable. Any interior steel surfaces are to be suitably protected against corrosion. All fasteners shall be stainless steel.

5. Junction Box

   a. The junction box shall be constructed of fiberglass for corrosion resistance at residential properties and NEMA 7 at commercial/industrial properties. The enclosure shall be of adequate thickness and properly reinforced to provide good mechanical strength. The junction box shall have a fully gasketed cover that is held in place by four stainless steel captive screws with slotted/flat sided heads total encapsulated in PVC so that no metal parts are exposed. The cover shall be connected to the body with stainless steel chain.

   b. An adequate number of sealing type cord grips shall be supplied for incoming pump and switch cords. The cord grips shall be made of non-corrosive material, such as PVC or nylon, and shall have rubber compression bushing that will make an effective seal around the wire jackets. The cord grip shall also seal to the junction box wall with an o-ring, gasket or other effective means.

   c. The hub shall be of a corrosion resistance material and shall be of adequate size to accommodate the number of wires required to operate the pump.

   d. A method for sealing the incoming wires in the junction box shall be supplied by the manufacturer so that condensation from the conduit or

ground water will not enter the enclosure; or, an explosion-proof conduit seal shall be required. Duct seal shall not be used.

e. Wires shall be connected within junction box by means of wire nuts and the connections further protected by non-hardening sealant.

f. Electrical cable for power and control wiring between the junction box and each pumping unit shall be supplied. Wire size shall be selected in accordance with amp capacities required by the National Electric Code.

6. Valves

a. Check Valves

The pumps shall be equipped with a factory-installed integral ball check valve built into the discharge pipe. This valve shall provide a full-ported passageway when open, and shall introduce a friction loss of less than six inches of water at maximum rated flow. The valve body shall be made of cast iron. Ball check valves shall include a corrosion resistant non-metallic ball and rubber-sealed seat.

b. Ball Valve

The pump shall be equipped with an isolation ball valve which shall be of PVC (Schedule 80), bronze or stainless steel construction, three-piece design, full port, with TFE seals and seat valves shall have screwed end connections and shall be lever-operated with an extension handle extended vertically to a supporting bracket fixed not more than twelve (12) inches below finished grade. Valves shall be as manufactured by Jamesway Corporation, Worcester Controls or approved equal.

c. Redundant Check Valve

(1) All pumps shall include one additional separate check valve per unit for installation in the discharge line inside the pump basin to ensure maximum protection against backflow.

(2) The valve shall be gravity operated, ball type. The check valve shall provide a full-ported passageway when open and shall introduce a friction loss of less than six inches of water at maximum rated flow. Working and internal parts shall be at least equal to those specified above for the check valve.

(3) The valve body shall be a high gloss, injection molded part made of PVC Type I-II with hub and socket compatible with 1-1/2" PVC pressure pipe, SDR 21.

(4) Dimensions for hub and socket shall be in accordance with commercial standards C5-272-65.

d. Anti-Siphon Valve

The pump shall be constructed with a positively-primed flooded suction configuration. As added assurance that the pump cannot lose prime even under negative pressure conditions in the discharge piping system, the pump shall be equipped with an integral anti-siphoning, air relief valve in the discharge piping. This valve shall be of PVC and shall be mounted horizontally in the discharge piping, between the redundant check valve and the shut off valve. The anti-siphon valve will automatically close when the pump is running and open to atmosphere when the pump is off.

7. Flexible Discharge Coupling

The pump discharge piping within the pump basin and the discharge force main shall be connected with a flexible discharge coupling to accommodate differential settling of the force main and the pump basin. Flexible discharge couplings shall be made of an inner corrugated hose sheathed in an outer braid. Flexible discharge couplings shall be constructed of stainless steel and shall be rated for 345 psi.

8. Basins

a. General

(1) Either concrete, high-density polyethylene or fiberglass basins may be provided. However, concrete basins shall be used in areas subject to traffic loadings. All basins shall register a minimum 4" above finished grade to prevent infiltration of surface water. The basin shall be located in an area not subject to ponding or flooding.

(2) For residential installations, SLSA recommends the basin have a minimum net effective storage volume of 140 gallons between the pump shut-off elevation and the invert of influent line from the connected structure.

(3) For non-residential installations, SLSA recommends a minimum operating tank volume of 140 gallons, or 24 hours of storage, whichever is greater, be provided. If anticipated daily sewage flow exceeds the available storage volume, the owner should perform backup calculations for the anticipated flow rate. Non-residential storage requirements may be reduced by provision of a back-up power source and a spare pump.

(4) The basin shall be provided with a concrete anti-flotation collar (minimum of 1 cubic yard (cy) of concrete) to prevent flotation of the basin at high groundwater elevation when the basin is empty.

(5) Watertight seals are required for all power and control connections within the basin as follows:

(a) between control panel motor feeders and junction box

(b) between junction box and motor leads

(c) between motor leads and pump housing

(d) for all control device conduits/leads and junction boxes inside basin

b. Concrete Basin

(1) Precast reinforced concrete chambers shall conform to ASTM Specifications C-478 (Latest Revision) and shall be of watertight construction. Joints between sections shall be provided with preformed plastic joint sealing material such as Ram-Nek as manufactured by K.T. Snyder Co.

(2) The preformed joint sealer shall be protected by a removable two-piece wrapper and shall be applied in strict accordance with the manufacturer's recommendations. The chemical composition of the sealer shall meet the following requirements: bitumen - ASTM D-4-52, Inert Ash Mineral AASHTO T-111-42, Volatile Matter ASTM D-6-39T.

(3) Mixing water for mortar and concrete shall be clean and free from oil, acid, alkali, sewage or other deleterious substances.

(4) Portland cement shall conform to ASTM Specification C-150, Type I. Where specifically authorized or required, high early strength (Type 3) shall be used.

(5) Concrete shall have a compressive strength of not less than 3,000 psi after 28 days (tests to be in accordance with ASTM Specification C-39, Latest Revision). Aggregate shall be of quality, gradation and proportions as approved by Engineer after submission of test results on the design mix. Each cubic yard of concrete shall contain no less than 6 bags of Portland cement. Slump of concrete shall not exceed 4 inches. Ready mixed concrete shall conform to ASTM Specification C-94 (Latest Revision).

(6) Reinforcing steel shall be clean and free from rust, scale or coatings that will reduce bond.

(7) The exterior of concrete basins shall be coated with bitumastic no less than twenty (20) mils in thickness. The coating shall be Bitumastic Super Service Black as manufactured by Koppers or approved equal.

(8) The interior of concrete basins shall be lined with PVC or HDPE to prevent hydrogen sulfide corrosion as specified in Section 5 – Manholes.

(9) Concrete basins shall be equipped with access frame and cover assembly of extruded aluminum with aluminum or stainless steel fittings. Each cover shall be provided with a lifting handle, safety catch to hold the cover and locking hasps. The cover surface shall be of a non-skid checkered pattern and shall be provided with a keyed lock in traffic areas or padlock in all other areas. The padlock shall be of the solid corrosion-proof case design with hardened steel shackle and zinc coating. In paved/traffic areas, basins shall meet the loading requirements of H-20 or H-25 as appropriate.

c. High-Density Polyethylene

(1) The basin shall be high density polyethylene, with a grade selected to provide the necessary environmental stress cracking resistance.

(2) Corrugated sections are to be made of a double wall construction with the internal wall being generally smooth to promote scouring. The corrugations of the outside wall are to be a minimum amplitude of 1-1/2" to provide necessary transverse stiffness. Any incidental sections of a single wall construction are to be 0.250" thick (minimum).

(3) All seams created during tank construction are to be thermally welded and factory tested for leak tightness. The tank wall and bottom must withstand the pressure exerted by saturated soil loading at maximum burial depth. All station components must function normally when exposed to 150 percent of the maximum external soil and hydrostatic pressure.

(4) One 4-inch diameter inlet hub shall be provided for each grinder pump unit. The inlet hub shall be suitable for use with 4-inch PVC or Schedule 40 pipe. Hubs shall be field installed to meet field conditions.

(5) One 1-1/2" NPT discharge coupling shall be provided for the grinder pump unit. Internal piping shall be provided to this discharge coupling.

The depth of the discharge coupling (centerline of coupling to finished grade) shall be no less than 42".d.Fiberglass Basin

(1) The basin shall be custom molded of fiberglass reinforced polyester resin using a lay-up and spray technique that will assure that the interior surface is smooth and resin-rich. The basin shall have a nominal wall thickness of 1/4-inch.

(2) The fiberglass basins shall be built in accordance with:

(a) Plastics Laminate ASTM C581 and C582.

(b) Chemical-Resistance Test ASTM C581. Previous tests will be acceptable provided laminates are representative.

(3) The basins shall be free of imperfections, sound, watertight, and of high quality workmanship. Basins shall have lifting lugs or other devices for unloading and installation. All conduit and piping connections shall be plugged for shipment.

(4) One 4-inch diameter inlet hub shall be provided for each grinder pump unit. The inlet hub shall be suitable for use with 4-inch PVC or Schedule 40 pipe. Hubs shall be field installed to meet field conditions.

(5) One 1-1/2" NPT discharge coupling shall be provided for the grinder pump unit. Internal piping shall be provided to this discharge coupling. The depth of the discharge coupling (centerline of coupling to finished grade) shall be no less than 42".

(6) Fiberglass basins shall be equipped with an aluminum or fiberglass cover. The cover shall be bolted to the basin with stainless steel cap screws. Stainless steel nuts for the screws shall be bedded in the fiberglass to prevent turning and for corrosion resistance.

9. Electrical Control Panel

a. General

(1) A separate remote electrical control panel shall be installed as shown on the detail drawings. In addition, the panel shall contain a U.L. listed NEMA sized motor contactor having a guaranteed component life span, without maintenance or contact replacement, of one million operations (definite purpose contactors will not be allowed). The panel shall have an adjustable or non-adjustable 2 pole bi-metallic temperature compensated U.L. listed overload relay meeting NEMA Class 10 tripping characteristics, and the auxiliary contact of the

overload relay must be connected in series with the motor contactor coil to switch off the contactor in event of overload. The panel shall also have lightning protection, elapsed time meter for each pump, and any other items required for proper control of the centrifugal type grinder pump unit. The incoming wires/conduit shall be provided with a water tight seal.

(2) The enclosure shall contain an inner back panel for mounting of the internal components. The enclosure shall be fully gasketed, hinged, and NEMA rated for the applicable location as specified in paragraph A.6 of this section. The enclosure shall be stainless steel or UV-stabilized fiberglass, with combination closing latch and locking hasp.

(3) The control panel shall be fitted with an integral red alarm light on the top.

(4) The light shall be provided with a lamp test switch mounted within the panel. The alarm light shall be flashing type activated by both moisture in the pump seal chamber and high water in the wet well and shall go out when the condition(s) cease.

(5) Inside the control enclosure shall be an LED-style, red 1-inch neon glow lamp high water indication and an amber 1-inch neon glow lamp for moisture leak detection. The flashing light on the enclosure top shall flash when either or both lights within enclosure are activated due to failure.

(6) A nameplate shall be provided above each component with the name of the component inscribed or failure inscribed when labelling the indicator lights.

(7) A "Hand-Off-Auto" selector switch shall be provided within a control panel for operating the pump manually when in "Hand", pump disable when in "Off", and normal operation when in the "Auto" position. The selector switch shall not disable the alarms under any condition.

(8) A main disconnect switch integral to the panel shall be provided with padlocking device to de-energize the panel. Toggle switch shall not be considered. From the load side of this switch shall be a two-pole circuit breaker for motor overload and short-circuit protection. Also, and in parallel with the above breaker shall be a circuit breaker for protection of the control circuit.

(9) An electrical wiring diagram shall be supplied and attached to the inside of the panel enclosure. This diagram shall identify wire color,

external connections to a numbered terminal block and shall be arranged in a functional sequence ladder type diagram.

(10) The control panel enclosure shall be provided with padlock. This lock shall be of the solid corrosion proof case design, with a hardened steel shackle and zinc coating.

(11) Wiring shall meet the following requirements:

(a) Minimum size for power wiring shall be #12 AWG

(b) Minimum size for control wiring shall be #14 AWG

(c) Minimum size for signal wiring shall be #18 AWG

(d) Analog signal to be shielded twisted #18 AWG

(e) Insulation to be 600 V XHHW for wet locations and THWN for dry/damp locations

b. Control Panel Supports (for post-mounted installations)

The control panel support for property owner installations shall consist of 3" x 3" x 3/16" gauge structural steel tubing (minimum yield strength 46,000 psi) or 4" x 4" pressure treated wood post, all horizontal support channels and panel connection hardware, coated with baked-on epoxy ASA 61 paint. The length of pipe or post shall be embedded in a concrete foundation to the dimensions shown on the detail drawings.

C. Installation

1. The grinder pump unit shall be installed at a location to be determined by the property Owner or Developer. Generally, the unit will be located in close proximity to the sanitary sewer service line near the building.

2. The depth of the grinder pump unit will be dependent upon the location and depth of the house service line. The minimum total unit depth from the invert of sump pit to top of entry hatch shall be no less than eight feet and no greater than sixteen feet.

3. All grinder pumps shall be installed on a bed consisting of AASHTO No. 8 (PennDOT No. 1B) aggregate and shall have a concrete anti-flotation collar poured around the bottom. The remaining excavated area shall be backfilled with excavated material containing no soil lumps, stones, concrete or foreign objects greater than 3" in maximum dimension. Six inches of topsoil with seed and supplements shall be placed around the surrounding excavated area. The top of the pump basin shall be a minimum of 4 inches above grade and the

surrounding area shall be graded in such a manner as to slope away from the basin to allow water to drain away from the basin. In paved areas, the top of the basin shall be at grade and equipped with a watertight lid. Basins located in traffic areas shall be traffic rated (H-20 or H-25 as appropriate).

4. All electrical installations shall be in accordance with NEC and local codes.

5. Conduits shall be supported/anchored every 3 feet. All conduit straps to be stainless steel.

D. Testing and Inspection

1. It is incumbent upon the Contractor to notify the Authority a minimum of 24 hours in advance to inspect the pump after installation is completed. The Contractor shall provide all pressure gauges and other equipment necessary to perform the tests. The work will be tested and inspected for:

    a. Tank cracks, loose fittings and general workmanship.

    b. Minimum depth of force main and stone bedding.

    c. All specified required fittings, valves and appurtenances.

    d. Hydrostatic pressure test of 50 pounds per square inch for a grinder pump connection to a gravity service lateral, 75 pounds per square inch for a grinder pump connection to a low-pressure service lateral, or as determined by the Engineer, shall be applied to the low-pressure line in accordance with AWWA C-600. There shall be no drop in pressure for a period of 15 minutes.

2. The following electrical testing is required of the applicant before energizing:

    a. Equipment inspection and mechanical operation

    b. Megger all power circuits

    c. Ring all control circuits

    d. Check ground

3. The pipe trench will be backfilled only after the inspection and testing has been completed.

4. The pump shall be run through two normal pump cycle tests to confirm on/off operation as well as the proper sounding of all alarms. Applicant is responsible for providing water for the test. Use of clean water is acceptable.

E. Detail Drawings

Relevant detail drawings are:

11 Typical Low-Pressure Service Line to Gravity Sewer

12 Typical Low-Pressure Service Line to Low-Pressure Sewer Main or Force Main

25 Fiberglass or HDPE Basin for Typical Individual Pump

26 Concrete Basin for Typical Individual Pump

27 Wall-Mounted Control Panel (External Installation)

28 Post-Mounted Control Panel (External Installation)

END OF SECTION