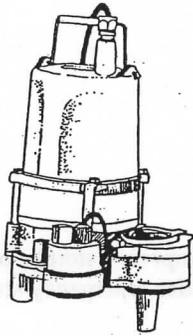


TYPES OF SEWAGE PUMPS

Effluent Pumps:



Effluent pump.

Effluent pumps are the pumps most often used in small on-site systems. They are designed to pump effluent, the effluent flowing out of a septic tank. This effluent is relatively clear liquid because the solids have settled out in the septic tank. Effluent pumps can pump to higher levels and are more efficient than the other types of sewage pumps because these pumps do not have to handle sewage solids.

- Effluent pumps are often used where the sewage effluent from the septic tank has to be pumped to a leaching system located at a higher elevation than the septic tank or where pressurized distribution is used.
- Most effluent pumps look like sump pumps. They are short and compact with an inlet on the bottom of the pump housing and a single stage or single impeller. The pump and motors are hermetically sealed so that they can operate completely submerged. The short, compact type of effluent pumps can lift large volumes of sewage effluent to moderate heights.
- Effluent pumps are made much differently from the usual sump pump. The materials in the effluent pump can withstand the very corrosive septic tank effluent and the pump can handle some solids. Sump pumps are not made to resist the corrosion of septic tank effluent and they cannot handle solids.

Solids Handling Pumps:

These pumps, also called sewage ejector pumps, are made to pump raw sewage. Raw sewage contains too many solids for most pumps, so only solids-handling pumps should be used where raw sewage has to be pumped.

- These pumps have a special impeller and space between the impeller and housing to allow the solids to pass through without clogging the pump.
- Solids-handling pumps can be installed in tanks outside the building to pump the raw sewage to a septic tank and leaching system that is far from the building.
- In some sensitive areas, such as lakefront property, solids-handling pumps can be used to pump raw sewage to an on-site system located away from the lake.

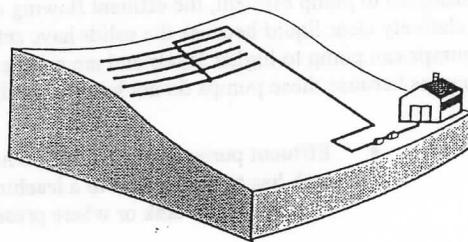
Grinder Pumps:

A grinder pump is much like a solids-handling pump in that it can pump raw sewage. The difference is that the grinder pump has rotating blades, like a garbage grinder, that cut and grind the solids into small particles before the sewage is pumped.

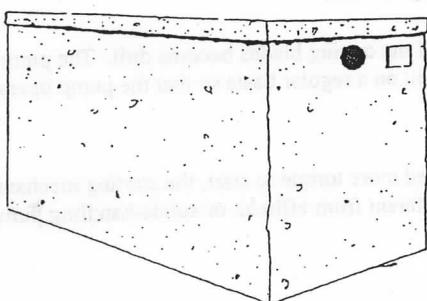
- Grinder pumps are used for some community on-site systems where raw sewage is pumped from individual homes to small-diameter gravity or pressurized collector sewers. The sewage is treated and disposed at a common treatment and disposal site.
- A grinder pump can clog if the cutting blades become dull. The pump should be replaced or rebuilt on a regular basis so that the pump operates well.
- Because grinder pumps need more torque to start, the starting mechanism for the electric motor is different from effluent or solids-handling pumps.

Effluent Pump Systems

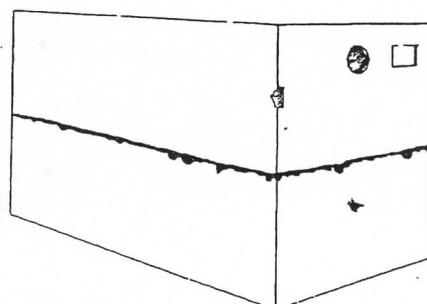
- If an on-site system must use a pump, try to locate the septic tank and pump tank so that *only septic tank effluent is pumped*. Fewer problems, clogs, and pump burnouts are involved in pumping effluent because the solids and grease have been removed in the septic tank. Locate the septic tank and pump chamber near the house/building and pump the effluent to the leaching system, rather than pumping raw sewage to a septic tank far from the house/building.



- A pump chamber functions differently from a septic tank. The pump chamber provides a temporary storage of effluent for the pump so that the proper volume of effluent can be dosed to the leaching system, and it provides emergency storage during pump failure conditions.
- The liquid level in pump chamber is normally much lower than in a septic tank. This low level can cause several problems:
 - The lower level in the tank is like a large open hole in the ground. Ground water and surface runoff will flow into the tank through cracks or unsealed seams to fill the "open hole".
 - The lower level also leaves more space in the pump chamber for air and corrosive gases. This mixture can cause corrosion of the pump, and exposed surfaces in the chamber.
 - The low level in the tank causes the tank to weigh less than a full tank, which can cause the tank to float if the ground water is high.
- The septic tank and pump chamber should be kept as shallow as possible. Shallow tanks and chambers are much easier to find and maintain. Deep tanks are hard to find, inspect, repair, or pump out; and deep tanks also tend to have more problems with ground water leaking in.
- Whenever the maximum ground water level is above the elevation of the chamber bottom floatation concerns must be addressed. Most PE tanks are relatively light (i.e., 400 lbs.) and are not acceptable when groundwater is above the tank bottom. Although concrete tanks are very heavy (i.e., 8000 lbs.) they can still float if ground water is too high. The weight of the pump chamber (empty) must be greater than the displaced water pressure.
- If the building sewer from a building is deep in the ground, a sump should be installed in the basement to pump the raw sewage up to a normal depth, rather than install the septic tank and pump chamber deep in the ground. The plumbing should be rerouted so that the upper floors flow by gravity to the septic tank and raw sewage is pumped only from the basement
- Sealing pump chambers to prevent ground water infiltration is critical. Many pump systems fail because the pump chambers leaks. Inlet and outlet connections and seams must be made watertight. One-piece tanks (monolithic) can be used to avoid infiltration problems (see drawings below).
- Pump chambers should be tested for leakage if there is any concern with infiltration or leakage. The Technical Standards stipulates the requirements for vacuum tests (vacuum of 2 inches of mercury, 90 % of vacuum held for 2 minutes) and for water pressure test (fill tank, refill after 24 hours, OK if level held for 1 hour).
- Low-pressure pipe (LPP) distribution systems can offer a more uniform distribution of effluent. These systems use a low pressure (2-5 feet) to evenly distribute effluent through a network of small diameter (1-2 inch) perforated (5/32 inch to 1/4 inch holes) PVC pressure pipe placed at shallow depths in narrow trenches. LPP systems are more complex to design, install (requires checking heads in pipes) and can be problematic due to clogging of orifices.

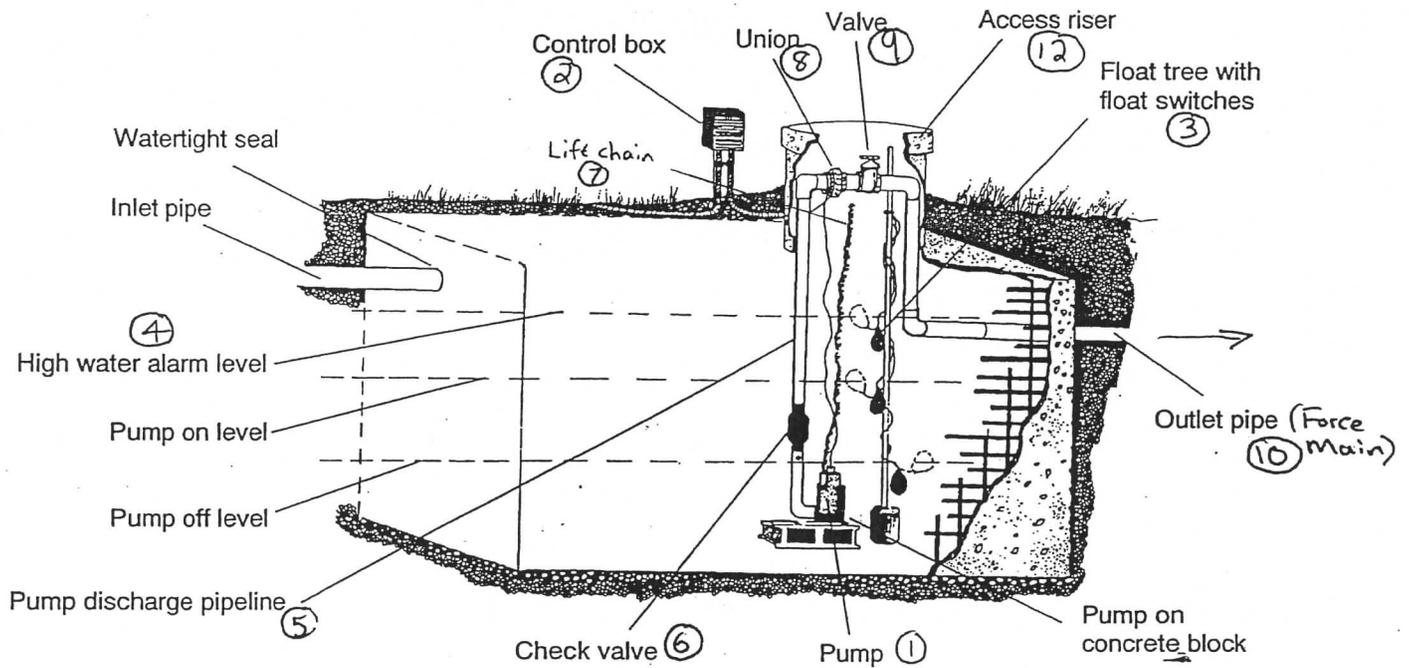


One-piece tank with sealed lid.



Two-piece tank with sealed middle seam.

PUMP CHAMBER COMPONENTS



1. **Pump:** The effluent pumps usually used are single stage centrifugal pumps capable of passing $\frac{1}{2}$ inch solids. The centrifugal motion of an impeller that is spun by an electric motor moves the liquid. The flow rate and the total dynamic head (TDH) are the two most important characteristics in specifying a pump.
2. **Pump control box:** Electrical controls are used to turn the pump on and off and to signal if the sewage level in the pump chamber is too high. Pump control switches typically have 3 positions: hand, off, auto. Enclosures (NEMA Type 4x or equal) must provide a degree of protection against corrosion, rain, external ice formation, etc. All electrical wires must be installed in waterproof, gas-proof, and corrosion-proof conduit. Conduits must be sealed with duct seal, wire grips, or other sealant around the wire and the conduit holes in pump tank and control box. Electrical connections are not recommended in the pump tank to prevent explosions from gas build-up, and to prevent corrosion of electrical switches and wires.
3. **Pump float switches:** Pump should be turned on and off by float switches (i.e., mercury float switches) attached to a non-corroding float tree (i.e., 1-inch plastic pipe). Use of the pump discharge pipe as the float tree prevents easy float adjustment/replacement. Off switch is typically set so that pump remains submerged after pump is turned off and there is at least 12 inches of effluent in the tank. This helps keep pump cool, prevents pump corrosion, and stops the pump from picking up solids and pumping them to the leaching field.
4. **High level alarm:** Alarm must sound warning signal and turn on alarm light to notify users that liquid is above pump on-level. Alarm should be seen and heard by system users. Alarm should be no more than 6 inches above pump on level, and must be on a separate electrical supply ahead of fuses or circuit breakers for pump.
5. **Piping:** All piping, fittings, and valves must be corrosion-resistant material (Schedule 40 PVC or stronger).
6. **Check valve:** Check valves typically are required to prevent backflow. Some pump warranties may be voided if check valve is not installed. Check valves should be used if the volume in the force main is more than 25 % of the dosing volume.
7. **Pump lift chain:** A non-corroding rope or chain (i.e., nylon rope, stainless steel wire rope or chain) should be attached to pump and to the riser for easy pump removal.
8. **Union:** The pump discharge pipe must have a union, flange, or other device to allow the pump to be disconnected quickly from the pipe. The union/flange should be readily accessible.
9. **Gate valve:** A turn-off valve is typically placed after the union or disconnecting device. The valve can be closed to prevent effluent from flowing on the installer when the union is disconnected.
10. **Force main:** PVC (or equal) pressure pipe must be the same size as the discharge of the pump, or larger. In order to ensure sufficient fluid velocity (2 feet per second) to carry any solids present SSPMA recommends the following pipe sizes: 1 inch pipe with flows of at least 5 gpm; $1\frac{1}{4}$ inch pipe with 8 gpm; $1\frac{1}{2}$ inch pipe with 12 gpm; 2 inch pipe with 21 gpm; $2\frac{1}{2}$ inch pipe with 30 gpm; and 3 inch pipe with 46 gpm.
11. **Anti-siphon hole:** Siphoning can occur if the leaching system is located at a lower elevation than the liquid level in the pump chamber. This can flood the leaching system. Siphon action can be stopped by drilling a $\frac{3}{16}$ -inch hole in the discharge pipe above the pump and below the check valve.
12. **Access riser:** Large diameter (i.e., 24 inch ID) riser to grade with tamper resistant cover (59 lbs. min. or lockable). Riser extension 6 inches above grade prevents ground water and surface water from entering tank.
13. **Weep hole:** Shallow force mains (no dips) can be drained back to the pump chamber to prevent freezing. Weep holes (i.e., $\frac{3}{16}$ inch) following the check valve will drain line. Avoid backsiphonage from the leaching system.