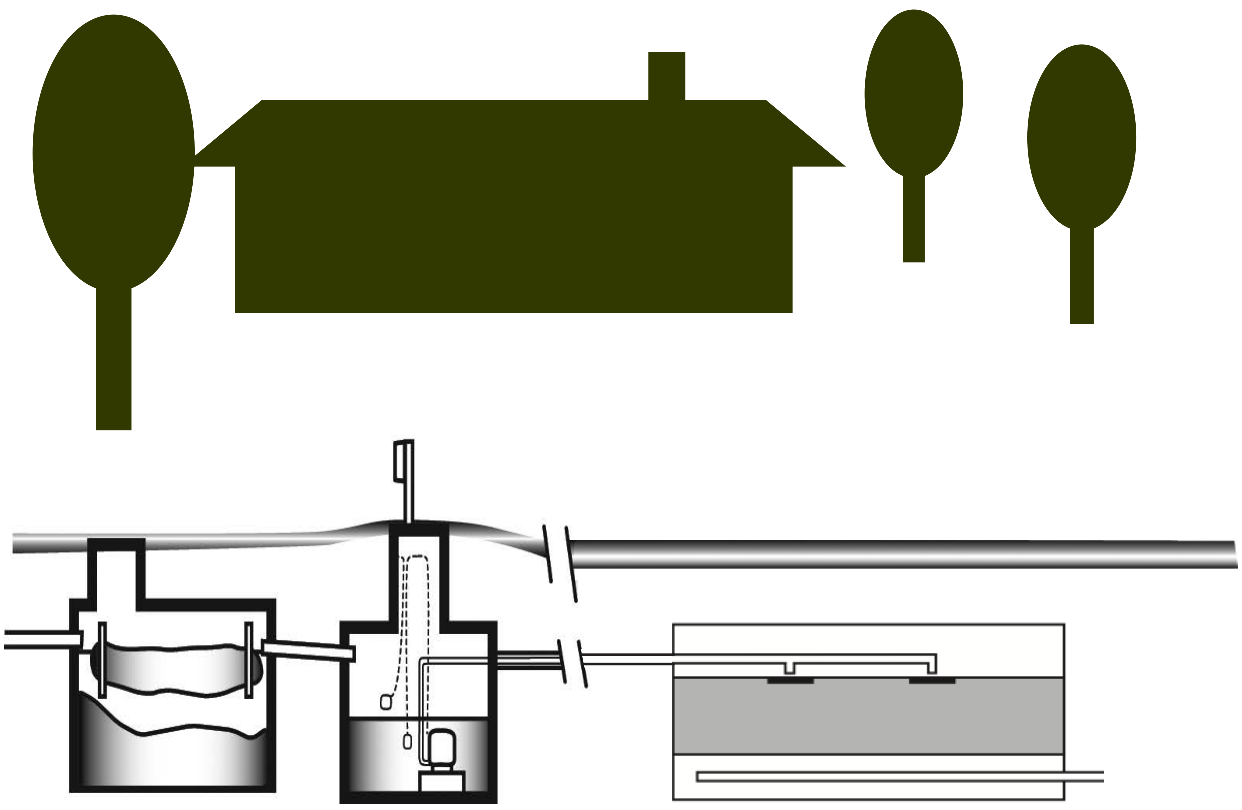
Bulletin 829.1

OHIO STATE UNIVERSITY EXTENSION

Sand and Media Bioreactors:

Pressure Distribution of Wastewater

Design and Construction in Metric Units



THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

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About this bulletin

Sand bioreactors are actually old technology forgotten for a good part of the twentieth century. Sand beds have been used to treat wastewater in communities since the late 1880s (Mancl and Peeples 1991). Sand bioreactors are easy to construct and operate, highly efficient in treating many types of wastewater, and have low operating and maintenance costs.

This bulletin presents a step-by-step design process for the dosing tank and distribution system that conveys septic tank effluent into the sand and/or media bioreactors for treatment before dispersal. The discussions on design and construction are intended to enable engineers, soil scientists, sanitarians and installers to design, construct and inspect pressure distribution systems for sand and media bioreactors.

What are the components of a dosing system?

Septic tank effluent is distributed onto the surface of the bioreactor through a series of perforated pipes. Septic tank effluent accumulates in a small tank, often called a dosing tank, up to a minimum dosing volume. A pump placed in the dosing tank is used to deliver the septic tank effluent to the pipe network on the top of the sand bioreactor. Thus the pressure distribution system for a sand bioreactor consists of four components:

1. Dosing tank collecting septic tank effluent
2. Dosing tank pump to deliver effluents from dosing tank to bioreactors in doses
3. Manifold and main pipes to connect pump and laterals
4. Perforated lateral pipes to evenly distribute wastewater to bioreactor under pressure

The pressurized dosing systems have several advantages. Applying wastewater in several small doses throughout the day, significantly improves the performance of a sand bioreactor. Ohio State University research shows that dosing reduces sand clogging. Intermittent doses allow both the wastewater and air to infiltrate the sand, keeping the system aerobic. Because the pump only operates a few minutes each day, the system uses very little electricity.

Lateral pipes

The pressure distribution system consists of small-diameter perforated pipes with small diameter holes. With this approach, the system can be easily pressurized, allowing about the same amount of water to be sprayed out of each hole. The goal is even distribution of the wastewater over the entire bioreactor surface. Uneven distribution of septic tank effluent causes clogging and ponding in the sand, and decreases bioreactor performance.

To achieve the goal of even distribution, each lateral pipe hole needs to be as identical as possible. The pipe diameters and hole diameters must be carefully sized to achieve uniform distribution.

A perforated lateral begins at the manifold delivering the wastewater under pressure. The lateral ends with a drain hole and turns up to a valve for access and flushing to keep the small holes from clogging.

PVC pipe and fittings are commonly used in pressure distribution systems. Holes are drilled perpendicular to the pipe in a straight line along the top of the pipe. A sharp drill bit will drill a more uniform perforation. Any burrs or rough edges must be removed from the holes so they do not collect debris and clog. One way to remove burrs is to slide a rod or a smaller diameter pipe along the inside of the lateral pipe. Upon installation, the pipe must be clean and clear of debris and PVC cuttings that can clog holes.

How to use this bulletin

Following are a series of steps to design a wastewater distribution system. With each step are the equations, tables or graphs needed to determine the pipe diameter, hole diameter and hole spacing for a pressure distribution system. Along with the steps is an example of a typical distribution system for a small sand bioreactor system.

Step 1: Configure the distribution area

The size and dimension of the distribution area of a sand bioreactor can be calculated based on Ohio State University Extension Bulletin 876, *Sand and Media Bioreactors for Wastewater Treatment for Ohio Communities*. Copies of Bulletin 876 are available from Ohio county OSU Extension offices or at **estore.osu-extension.org**.

Design example: Sand bioreactor to treat 1.36 m^3 /day

Dimension of the distribution area: 3 m wide x 11 m long

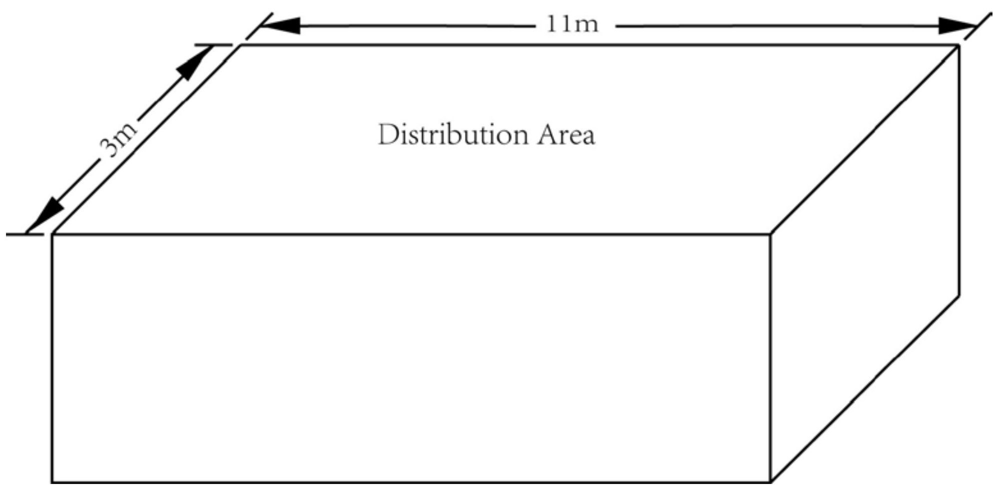


Figure 1. Distribution area for a sand bioreactor is the sand surface area.

Selected parameter

(1) Width of distribution area: 3 m

(2) Length of distribution area: 11 m

Step 2: Length of laterals and distance between laterals

Determine the length of the lateral and distance between laterals. All lateral lines are to be on the same elevation to avoid uneven distribution. The length of laterals is measured from the distribution manifold to the end of the lateral. A center manifold is preferred because it can provide uniform distribution to laterals on both sides and minimize the lateral length. So for center manifold, the lateral length is approximately half the length of the distribution area. A shorter lateral can achieve more even distribution, thus consider splitting the manifold on long sand bioreactors to keep lines short.

Laterals should be between 0.3 and 0.75 meters apart to assure uniform wastewater application.

Design example

Length of laterals = Distribution area length / 2

Length of laterals = 11 m / 2 = 5.5 m

Distance between laterals = 0.75 m

Total lateral number = 8 with center manifold connection

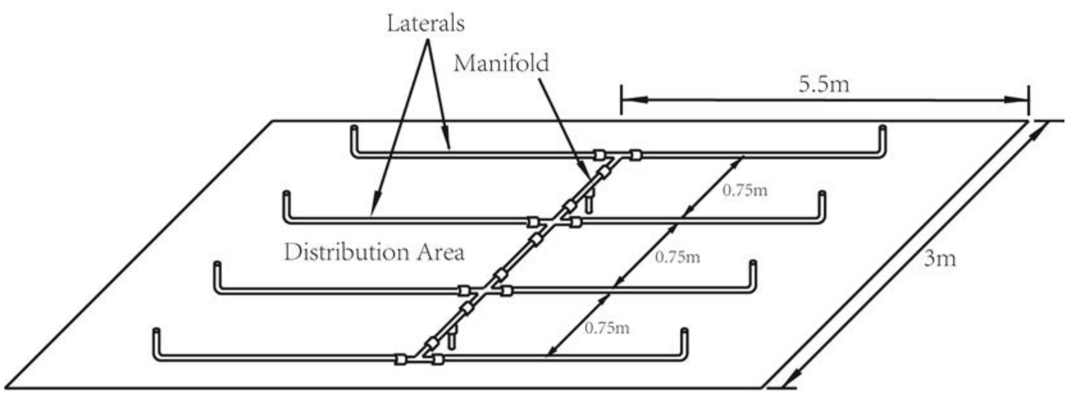


Figure 2. Network configuration for the distribution area.

Selected parameter

(3) Length of laterals: 5.5 meters

(4) Distance between laterals: 0.75 meters

(5) Total lateral number: 8

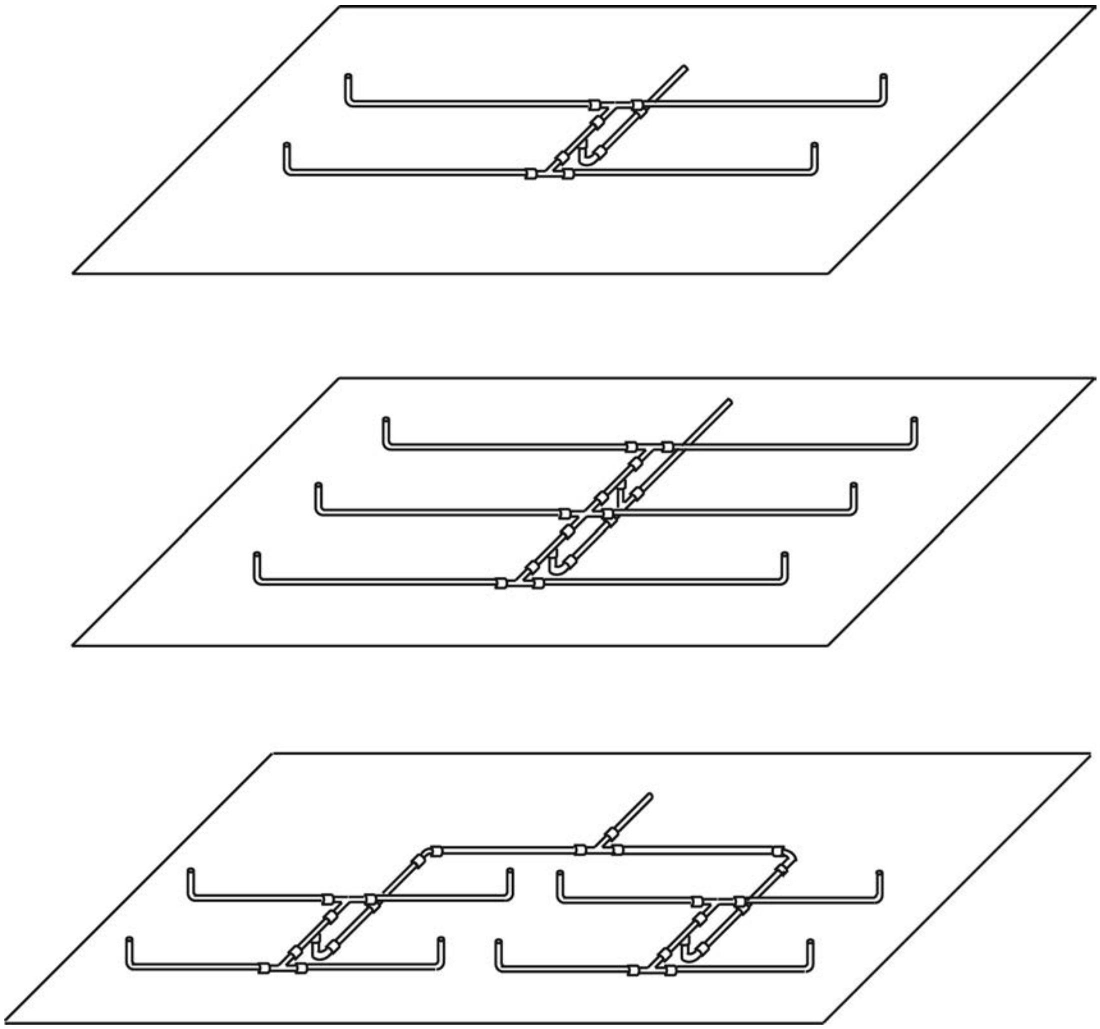


Figure 3. Alternative manifold designs for distribution systems.

Step 3: Hole spacing and number of holes in the laterals

This step determines the hole spacing and number of holes in each lateral. Because the goal is even distribution of wastewater, consider a maximum area per hole of **0.6 m^2/hole**. Hole spacing, therefore, should be less than 1.2 m. The higher the hole density, the more uniform the wastewater distribution. If possible, the holes should be staggered between adjacent laterals. A drain hole should always be drilled at the bottom at the end of pipe.

A hole diameter of 6 millimeters is sufficient. Larger holes require larger pipe diameter and pumps. Smaller holes can more easily clog.

Design example

Required hole numbers = Total distribution area, m^2 (width, m x length, m) / Maximum coverage area per each hole (0.6 m^2/hole)

Total distribution area, m^2 (width, m x length, m) = 3 m x 11 m = 33 m^2

Required hole numbers = 33 m^2 / (0.6 m^2 /hole) = 55 holes

Hole spacing, m = Lateral length, m / Number of holes in each lateral

Number of holes in each lateral = required number of holes / Lateral numbers
= 55 holes/ 8
= 6.9 (round up to 7 holes)

Hole spacing, m = 5.5 m / 7 = 0.8 m = 80 cm

Checking: 0.8 m hole spacing is less than 1.2 m, so OK!

Selected parameter

(6) Hole diameter: 6 mm

(7) Total number of holes: 56

(8) Number of holes per lateral: 7

(9) Hole spacing: 0.8 m

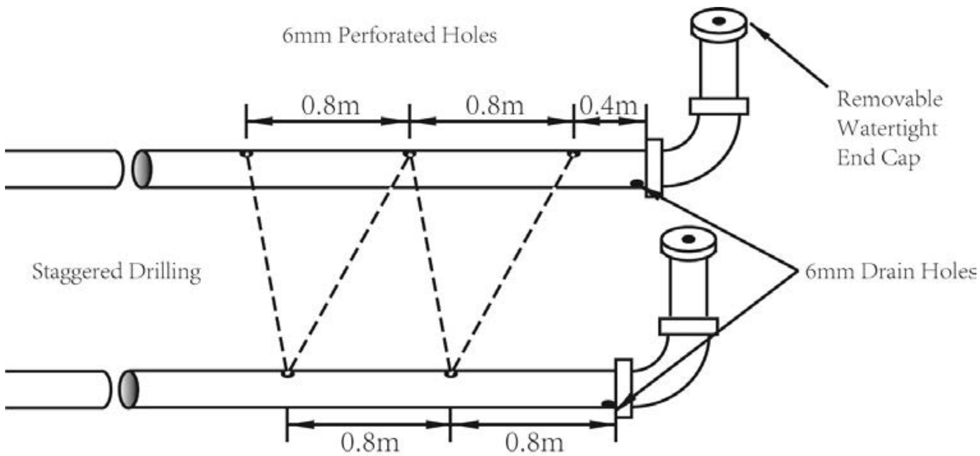


Figure 4. Hole spacing in distribution system with staggered hole placement.

Step 4: Lateral diameter

Determine the lateral diameter. The lateral diameter selection is based on the hole size, hole spacing and lateral length. Use Figure 5 to help select minimum lateral diameters between DN25 (25 mm) and DN40 (40 mm). The proper lateral diameter can be selected as the area between the lines where the hole spacing intersects with the lateral length on the graph.

Design example

Diameter from Figure 5 = **DN25 (25 mm)** based on hole spacing 0.8 m and 5.5 m lateral length

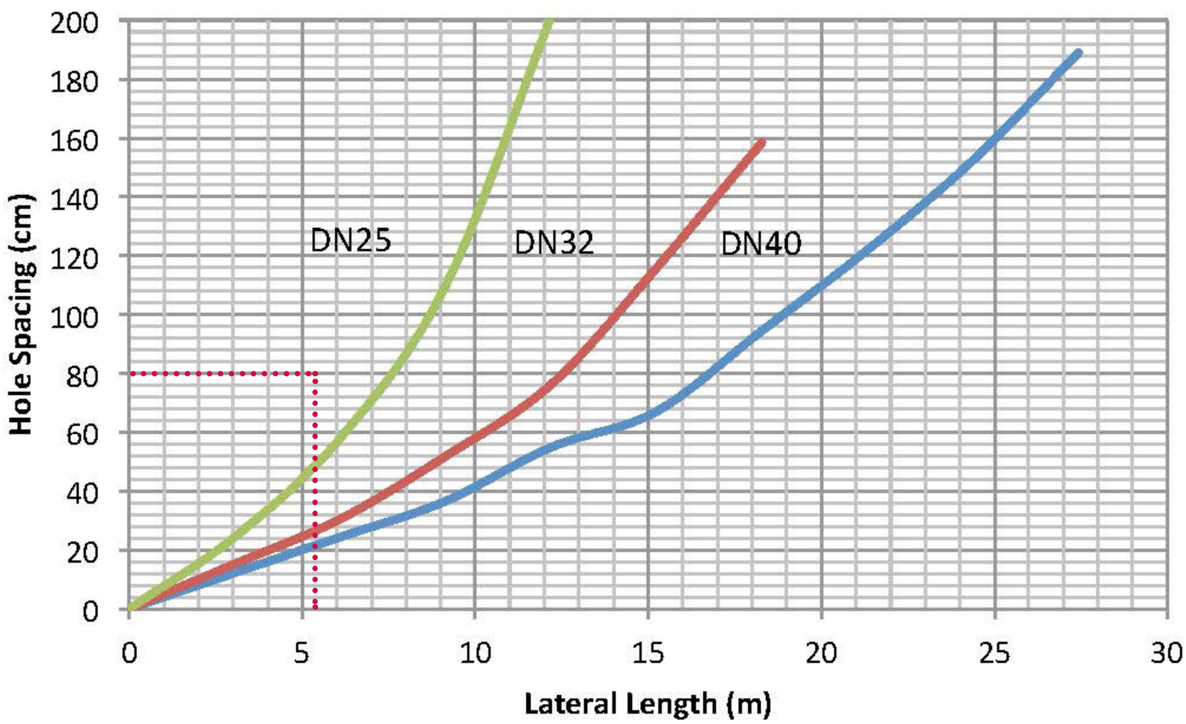


Figure 5. Minimum lateral diameters of PVC pipe for lateral lengths versus spacing for 6 mm hole diameter (derived from Otis, 1982). Select the diameter between the lines.

Selected parameter

(10) Lateral diameter: DN25

Step 5: Pressure head

Select a reasonable pressure head for the system. It should be between 0.6 m and 1.2 m. By using the selected head and the hole diameter, the flow rate per hole can be determined from Table 1. By multiplying the flow rate per hole by the number of holes in the lateral, the lateral flow rate can be calculated.

Design example

Flow rate per hole for 6 mm at 1.2 m (from Table 1) = 0.082 l/s

Number of holes per lateral = 7 holes

Flow rate per lateral = Flow rate per hole x Number of holes per lateral

= 0.082 l/s x 7 =0.57 l/s

Table 1. Flow rate per hole for 6 mm holes and various network pressures (Otis et al., 1982).

Head (m)	Pressure (bar)	Flow rate (l/s)
0.3	0.03	0.041
0.6	0.06	0.058
0.9	0.09	0.071
1.2	0.12	0.082

Selected parameter

(11) Head at end of laterals: 1.2 m

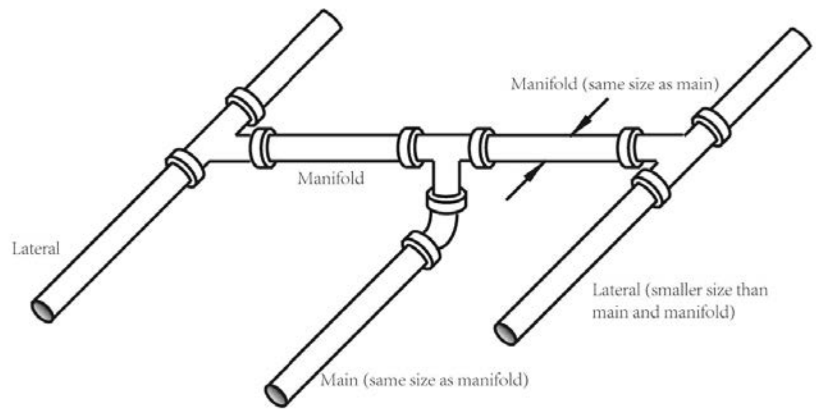
(12) Flow rate per hole: 0.082 l/s

(13) Flow rate per lateral: 0.57 l/s

About the manifold and main

The manifold and main pipes connect the sand and media bioreactor to the dosing tank. The manifold is piping that connects the laterals and distributes the septic tank effluent to each lateral. The main delivers the septic tank effluent from the dosing tank to the manifold. Schedule 40 (SCH40) PVC pipes and joints are the most commonly used pipes for mains and manifolds.

The main should be sloped back to the dosing tank without the pipe sagging so that it can drain back between doses. The manifold should be the same diameter as the main. The sizing and connection of the manifold and main are presented in steps 6 through 7.



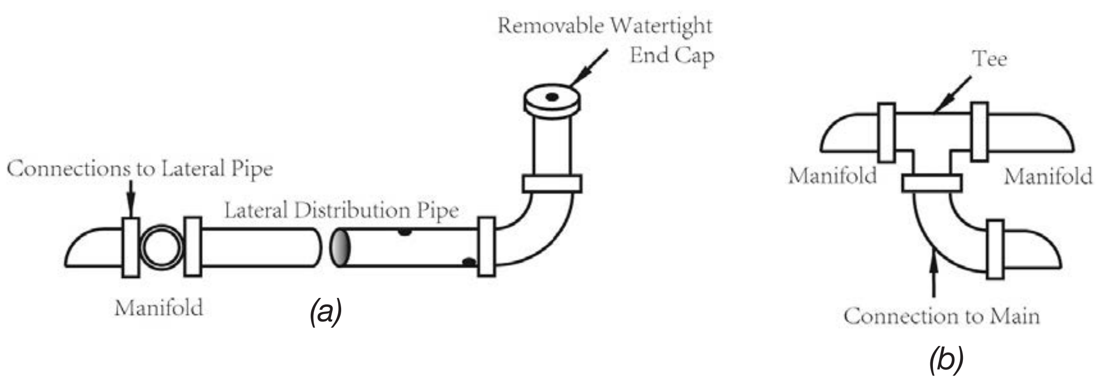


Figure 6. Examples of manifold to lateral connections: (a) center connection with tee and (b) ell fitting connection between the manifold and main.

Step 6: Manifold length, size and connection

Determine the configuration of the connection between the manifold and laterals, and the manifold and the main. The manifold length is determined by the distance between each lateral.

Design example

Connection between the manifold and the laterals: center

Connection between the main and the manifold: tee-to-tee

Manifold length: 0.75 m between the laterals

Manifold size: the same size as main

Selected parameter

(14) Connection between the manifold and the laterals: center

(15) Connection between the main and the laterals: tee-to-tee

(16) Manifold length: 0.75 m between the laterals

(17) Manifold size: the same size as main

Step 7: Main diameter associated with the system flow rate

Determine the main and the manifold diameter. The main diameter is dependent on the system flow rate. Use Table 2 to find pipe diameters and head losses for the system flow rate.

Design example

System flow rate = Flow rate per lateral x Numbers of laterals

= 0.57 l/s x 8 laterals = 4.6 l/s

From Table 2, 100 mm and 80 mm pipe would work. The head loss for each is

100 mm – 0.0034

80 mm – 0.0089

Choosing the smaller sized main pipe has a reasonable head loss and keeps dosing volume small. From Table 2, DN80 pipe is selected.

Main and manifold size: DN80 (80mm)

Selected parameter

(18) System flow rate: 4.6 l/s

(19) Main size: DN80

(20) Manifold size: DN80

Table 2. Head loss in PVC pipe (Water and Wastewater Design Manual, 2002).

Flow	Pipe Diameter (mm)							
	DN15	DN25	DN32	DN40	DN50	DN80	DN100	DN150
l/s	hydraulic gradient (m/m)							
0.05	0.0080							
0.1	0.0275							
0.15	0.0564	0.0033						
0.2	0.0940	0.0055	0.0020					
0.25	0.1400	0.0082	0.0029					
0.3	0.1930	0.0113	0.0040					
0.35	0.2540	0.0148	0.0053	0.0016				
0.4	0.3210	0.0188	0.0067	0.0021				
0.45	0.3960	0.0232	0.0083	0.0026				
0.5	0.4770	0.0279	0.0100	0.0031				
0.55		0.0331	0.0118	0.0037	0.0012			
0.6		0.0386	0.0137	0.0043	0.0014			
0.65		0.0445	0.0158	0.0049	0.0016			
0.7		0.0507	0.0181	0.0056	0.0019			
0.75		0.0573	0.0204	0.0063	0.0021			
0.8		0.0643	0.0229	0.0071	0.0024			
0.85		0.0716	0.0255	0.0079	0.0026			
0.9		0.0792	0.0282	0.0088	0.0029			
0.95		0.0872	0.0311	0.0096	0.0032			
1		0.0955	0.0340	0.0106	0.0035			
1.25		0.1420	0.0505	0.0157	0.0052	0.0009		
1.5		0.1960	0.0698	0.0217	0.0072	0.0012		
1.75		0.2580	0.0918	0.0285	0.0094	0.0016	0.0006	
2		0.3270	0.1160	0.0361	0.0119	0.0020	0.0008	
2.25			0.1440	0.0595	0.0147	0.0025	0.0010	
2.5			0.1730	0.0536	0.0177	0.0030	0.0011	
3			0.2390	0.0741	0.0245	0.0042	0.0016	
4				0.1230	0.0408	0.0070	0.0026	0.0004
5				0.1830	0.0606	0.0104	0.0039	0.0007
6					0.0838	0.0143	0.0054	0.0009
7					0.1100	0.0188	0.0071	0.0012
8						0.0238	0.0090	0.0015
9						0.0294	0.0111	0.0018
10						0.0354	0.0134	0.0022
12.5						0.0526	0.0199	0.0033
15						0.0727	0.0275	0.0046
17.5							0.0361	0.0060
20							0.0457	0.0076

About the pump selection

In sand and media bioreactor systems, the functions of the pump are delivering septic tank effluent to the top layer of bioreactor and pressurizing the lateral system to provide uniform wastewater distribution. Submersible pumps are often used to pump sewage. Effluent pumps are appropriate for septic tank effluent, which are designed to operate in the corrosive environment of sewage systems.

The pump size is selected based on the system flow rate and the total dynamic head. The total dynamic head is determined by adding together:

- the elevation difference between the pump outlet and the laterals
- the head loss in the pipe and fitting
- the desired head at the end of the laterals times 1.3 for network losses

The pump selection procedure for a pressure distribution system follows the general pump selection process. Using pump performance curves, select the pump that best matches the required flow rate at the operating head. Do not choose an undersized pump. Oversized pumps will be more costly.

The next few steps serve as a guide to determine the pump size based on flow rate and required head.

Step 8: System flow rate and total dynamic head

The needed pump capacity is the system flow rate (m^3/h) that is determined when sizing the main. The pump is sized based on the system flow rate in m^3/h and the total dynamic head (TDH) in meters.

Because pump curves from different manufacturers use different units for flow rate, you may have to convert m^3/hour to l/s.

The conversion factor for l/s to m^3/hour is 3.6.

Design example

System flow rate = 4.6 l/s = 16.56 m^3/h

Total dynamic head = Static lift + Main pipe loss + Network loss

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Selected parameter

(21) System flow rate: 16.56 m^3/h

Step 9: Configuration of main pipes and static lift

To decide on the required head, we need to figure out the relative position of the bioreactor and the dosing tank. Figure 9 shows the elevation difference between the pump outlet and the laterals. This is called the static lift.

Minimizing 90° angle fittings is an important goal. Choose where possible 2 x 45° angles (Figure 6) to gradually move the wastewater from the pump to the laterals. The 90° angle fittings make it difficult to clear the pipe if clogged.

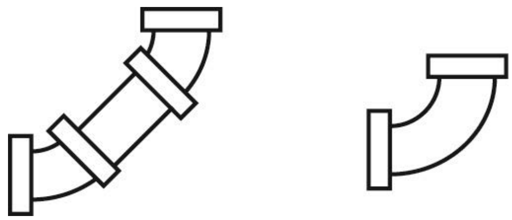

Figure 7. Illustration of two 45° fittings compared to 90° fitting.

Figure 8. Photo of two 45° fittings.

Design example

Static lift (elevation between the pump outlet and the laterals) = 2 m

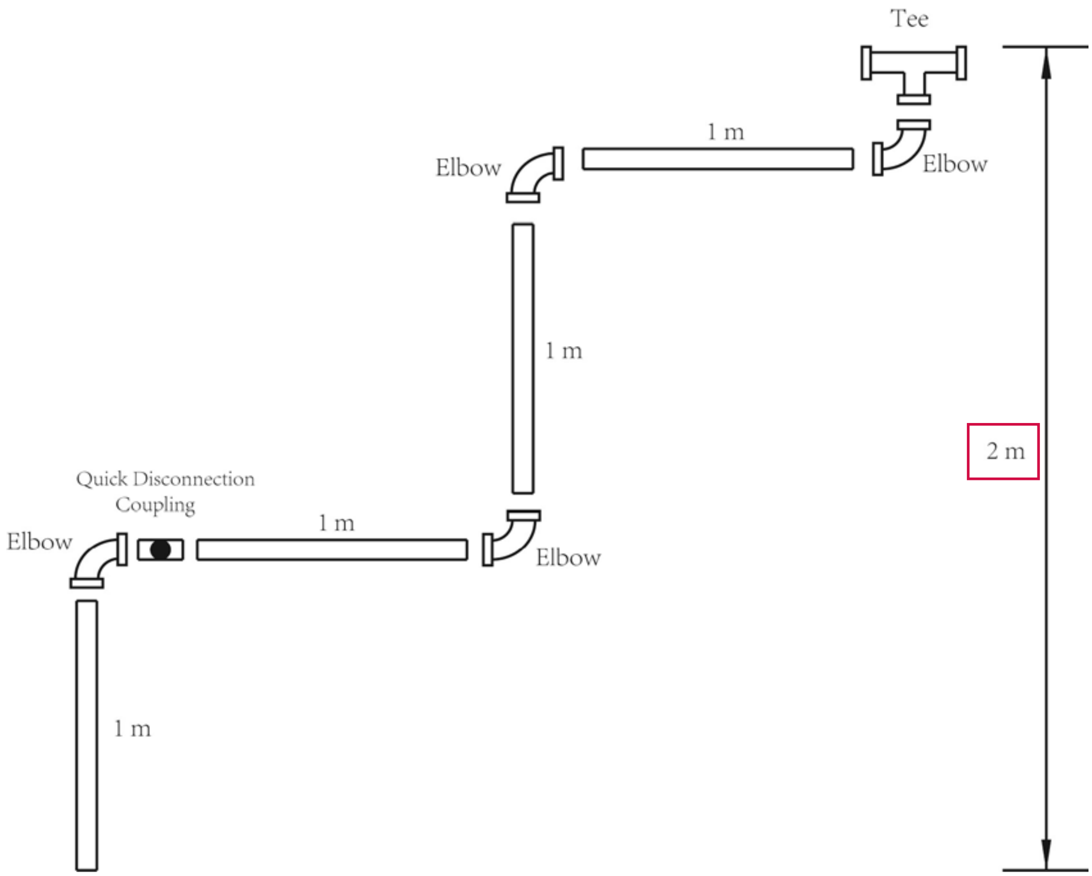

Figure 9. Main length and fittings from dosing tank to bioreactor.

Selected parameter

(22) Static lift: 2 m

Step 10: Head loss in main pipes and fittings

The head loss in pipes and fittings also contributes to the total dynamic head of the pump. Determine the length of the main pipe and the types and number of fittings. The friction loss due to the fittings is expressed as the equivalent length of pipe. Add to the length of the main the equivalent lengths of pipe for each fitting, as given in Table 2. Using the equivalent lengths of all pipes and fittings, the head loss can be calculated as:

Head loss = hydraulic gradient x equivalent length of pipe

Hydraulic gradient is provided in Table 2.

Design example

Total equivalent length of pipe = Main pipe length + Sum of equivalent of pipe for fitting

Main pipe length = 1 m + 1 m + 1 m + 1 m = 4 m

Equivalent length of pipe for four 90° Std. Elbow = 4 x 3.66 = 14.64 m

Equivalent length of pipe for quick disconnection coupling = 1.22 m

Equivalent length of pipe for tee = 5.18 m

Total equivalent length of pipe = 4 m + 14.64 m + 1.22 m + 5.18 m = 25.04 m

Total head loss in 80 mm main pipes and fittings = 25.04 X 0.0089

= 0.22 m

Table 3. Head loss through plastic fittings in terms of equivalent lengths of plastic pipe (Clemons, 1991).

Normal Size Fittings and Pipe (mm)						
Type of fitting	DN32	DN40	DN50	DN65	DN80	DN100
Equivalent Lengths of Pipe (m)						
90° Std. Elbow	2.13	2.44	2.74	3.05	3.66	4.27
45° Std. Elbow	0.91	0.91	1.22	1.22	1.83	2.44
Std. Tee	2.13	2.74	3.35	4.27	5.18	6.71
Check Valve	3.35	3.96	5.18	6.40	7.92	10.06
Coupling or Quick Disconnect	0.30	0.30	0.61	0.91	1.22	1.52
Gate Valve	0.27	0.34	0.43	0.52	0.61	0.70

Selected parameter

(23) Main pipe and fittings head loss: 0.22 m

Step 11: Network losses

The network losses are the head losses after the main to the end of distribution system. The losses are estimated by multiplying the desired head at the end of the laterals (from step 5) by 1.3. The value, 1.3, is a multiplier that includes the friction losses in the manifold and laterals when they are all sized correctly.

Design example

Network loss = head at end of laterals x 1.3

= 1.2 m x 1.3 = 1.56 m

Selected parameter

(24) Network loss: 1.56 m

Step 12: Total dynamic head (TDH)

Step 9 through 11 calculated all the components of total dynamic head including the elevation difference, the head loss in the main pipe and fittings, and the network head losses.

Design example

Total dynamic head (TDH) = Static head + Main pipe loss + Network loss

= 2 m + 0.22 m + 1.56 m = 3.78 m

Selected parameter

(25) Total dynamic head: 3.78 m

Step 13: Pump selection

With the total dynamic head and total flow rate calculated, a pump can be selected that provides sufficient head and flow yet falls in the highly efficient range of the pump curve. When choosing a pump, stay within the middle 2/3 of the pump curve. Select a pump where the point is just on or just below the curve. Smaller pumps may not provide the head and flow rate combination needed, while large pumps are not efficient and economical. Each pump manufacturer provides the pump curve indicating the high efficiency range and suitable working condition.

Submersible pumps are used in dosing tanks because they are simple to install and maintain.

Design example

Depending on the pump performance curve given by manufacturer, select the suitable pump with design flow rate and total dynamic head. In this example, take a performance curve with a series of pump models. Based on the design flow rate: 4.6 l/s = 276 l/min, and dynamic head: 3.78 m, find that model D75SA can provide sufficient head at the necessary flow rate.

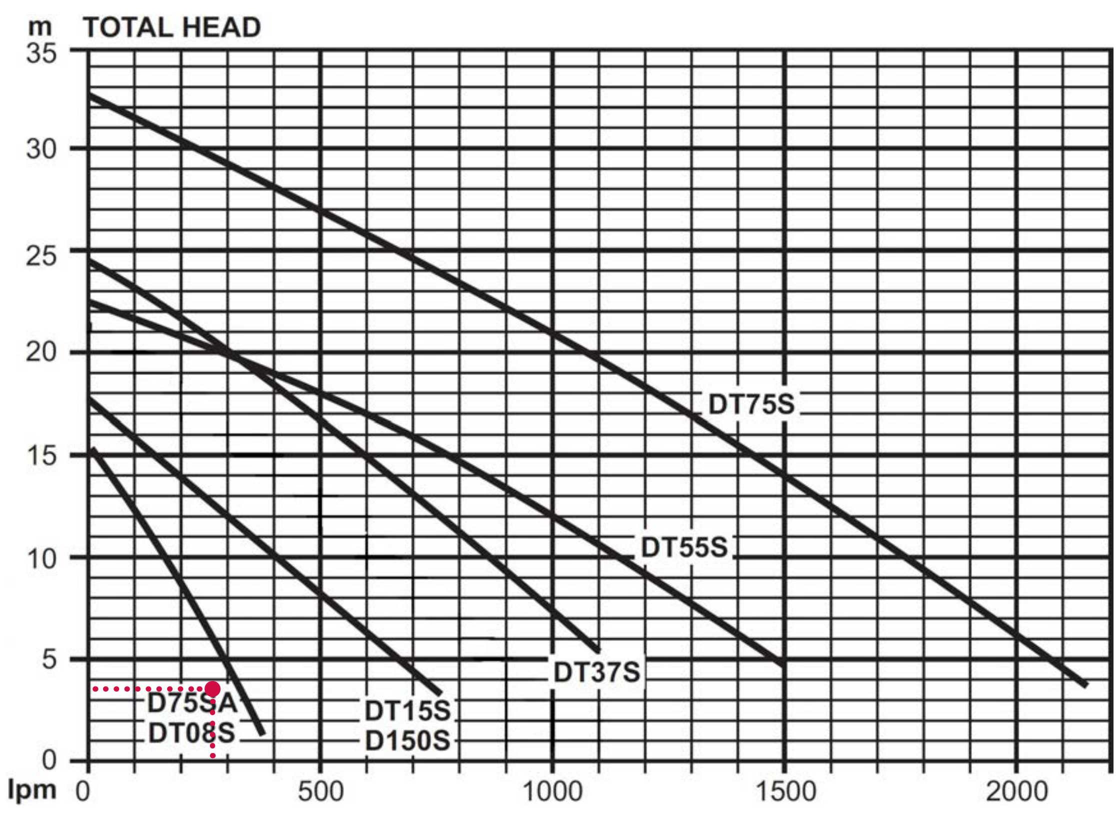

Figure 10. Pump performance curve (Davey Water Products PTY.LTD, 2014).

Figure 11. Submersible effluent pump.

How to select dosing tank

The dosing tank is placed between the septic tank and the bioreactor to accumulate septic tank effluent to be periodically dosed to the bioreactor. Once the accumulated effluent reaches a preset volume level, the effluent is pumped to the laterals in the bioreactor by an electrical control system. Proper dosing tank construction, placement and sizing must be considered to ensure reliable system operation.

The dosing tank construction requirements are similar to septic tanks. The tank must be watertight and must withstand soil loads and buoyancy of groundwater. The corrosive environment in and out of the dosing tank means no metal parts or fittings should be used. With a high seasonal or permanent water table, anchoring the dosing tank against flotation is critical. Common methods for anchoring can be used, such as a concrete anchor pad or deadmen anchors for fiberglass and plastic tanks. Burying the tank with 0.5–1 m soil cover over concrete tanks can also be helpful.

Another critical point is watertightness. This includes prevention of groundwater leaks in and wastewater leaks out. Make sure the gaps around the pipes that enter and exit the dosing tank are perfectly sealed.

Dosing tanks can be round or rectangular. A riser to the ground surface is needed for access to the pump. Make sure the riser is also watertight. Joints in risers can be a source of ground or surface water infiltration.

Any maintenance work should be made from outside of the dosing tank—**never enter the tank**. The anoxic environment inside the tank may produce toxic gas. When working on the tank, make sure the area is well ventilated and **never work alone**.

The pump in a dosing tank should be set several centimeters off the tank bottom to provide storage space for solids that may have carried over from septic tanks. A brick or a concrete block makes a good pedestal for the pump. Whenever the septic tank is pumped to remove solids, the dosing tank should be pumped empty.

The minimum size of dosing tank is the sum of the dosing volume, the volume for submerging the pump, and emergency storage volume in case of pump failure. The dose volume equals the volume that drains back to the dosing tank plus 5 times the volume that drains through the holes. A minimum of one-day emergency storage above the high water alarm should also be provided. Avoid using a large dosing tank since it is difficult to get an adequate depth gap for float switch control.

Step 14: Volume of pipe for calculation of dose volume

Determine the volume of pipe, which includes the laterals that will drain through the holes and the volume of the delivery pipes, manifold and main that will drain back into the dose tank. This volume is determined by the style of manifold/lateral connections. In tee-to-tee connections, the manifold drains back to the dosing tank. A constant of 7.85×10^{-7} is used to calculate this volume.

Design example

For the tee-to-tee connections, the lateral volume drains through the holes and the manifold and main volumes drain back to the dosing tank.

Lateral diameter and total length = DN25 and 44 m

Manifold and main diameter = DN80

Manifold and main total length = 4 m + 0.75 m = 4.75 m

Volume drains through the lateral holes = Total length (m) x pipe diameter (mm) x pipe diameter (mm) x 7.85×10^{-7}

Volume drains through the lateral holes = Total lateral length X 25 X 25 X 7.85×10^{-7}
= 44 m X 25 X 25 X 7.85×10^{-7} = 0.022 m^3

Volume drains through the manifold and main = Total length X 80 X 80 X 7.85×10^{-7}
= 4.75 m X 80 X 80 X 7.85×10^{-7} = 0.024 m^3

Volume drain back to the dosing tank (laterals + manifold and main) = 0.022 m^3 + 0.024 m^3
= 0.046 m^3

Selected parameter

(26) Volume drains through the lateral holes: 0.022 m^3 or 22 l

(27) Volume drain back to the dosing tank: 0.046 m^3 or 46 l

Step 15: Dose volume

For dose volume design, use five times the volume that will drain through the holes plus the volume that drains back to the dosing tank.

Design example

Dose volume = [volume that drains through holes (l) X 5]
+ [volume that drains back to dosing tank (l)]
= (22 l X 5) + 46 l = 156 l

Selected parameter

(28) Dose volume: 156 l

Step 16: Dosing chamber size

The sizing of the dosing tank should include these volumes:

- sum of the dosing volume,
- one-day emergency storage volume,
- storage space volume for the pump along with concrete cushion and pipes.

Design example

Dosing chamber size = pump storage volume + sum of the dosing volume
+ one day emergency storage volume
= (based on tank dimensions Step 17) + 156 l + 1400 l
≈ 1600 l = 1.6 m^3

Selected parameter

(29) Dosing chamber size: 1.6 m^3

Control and power supply of the pump

The dosing tank serves to store septic tank effluent, and when the volume in the dosing tanks reaches a certain level, the pump should be turned on to deliver one dose of wastewater to the bioreactor, and shut off until the next dose. The simple way to control the pump for this purpose is by using float switches suspended in the tank. A third switch is needed to trigger the alarm when the effluent collected in the dosing tank reaches twice the dose amount (emergency level). The settings for the switches are determined based on the dosing volume and the size dimension of the tank.

A float switch system is a simple and reliable approach to pump power control, and is suitable for household systems that receive wastewater constantly through the day. They are low-cost, and easy to maintain and repair.

Electronic control panels are now available with timers to equalize flow to the bioreactor throughout the day. This is a good choice for commercial systems that need to adjust for high flow and low flow periods.

Step 17: Switches setting

The float switches can signal the pump to turn on and off and activate the alarm controls. The height of the on and off float depend on the size and shape of the dosing tank. The distance between the on and off switch is the volume of one dose. Sometimes a combination switch is used where the swing of the switch dictates both the on and off level. With the base area of the dosing tank the volume of water in the tank for a certain depth can be determined.

To calculate the volume per meter in a circular tank use:

Volume per m = tank diameter (m) x tank diameter (m) x 0.785 m

To calculate the volume per meter in a rectangular tank use:

Volume per m = tank width (m) x tank length (m) x 1 m

Design example

The volume (m^3) per meter in a 1.5 m diameter circular tank

= 1.5 X 1.5 X 0.785 m

= 1.77 m^3/m

Switch separation = (dose volume) / (volume per meter)

= (156/1000) m^3 / 1.77 m^3/m

= 0.09 m = 9 cm

Selected parameter

(30) Tank shape: circular

(31) Tank diameter: 1.5 m

(32) Switch separation: 0.09 m

Electrical power supply and controls

The wastewater distribution system requires electrical power and control system. They are critical for safe and reliable extended outdoor use of the distribution system. In all cases, installation must follow the local electric code or any other prevailing code, materials should be purchased that meet or exceed these standards based on availability. Contact a local electrical contractor who is qualified to perform the installation. This bulletin will only give an introduction of some basic components and also do's and don'ts.

Outdoor wiring

Unlike indoor wiring, outdoor wiring must be able to withstand exposure to water, weather and corrosive environments. This is especially important for wiring pumps and controls for septic system dosing tanks.

Wiring materials

Two different methods are generally used for outdoor wiring. One is to place electrical wires inside a conduit. The other is to use cable. In either case, protection from physical damage, water and corrosion must be provided.

Control switches for pump

Control switches sense the water level in the dosing tank and signal to the pump or alarm system. Failure of the switches can cause damage to the dosing tank and back flow of wastewater to septic tanks. Thus it is crucial to keep the control switch fully functional.

To make the control switch more reliable, choose a good quality float switch. Also if possible, make no electric connections inside the dosing tank. If this is inevitable, the wires should be located in a watertight, corrosion-resistant junction box with watertight, corrosion-resistant fittings and a gasket cover.

An alarm system is used to alert the homeowner to a pump malfunction. Thus the alarm system should use a separate circuit to pump circuit in case the pump circuit fails. The alarm can be turned off manually without losing power to the pump.

Pump and alarm control center

The control center switches the pump switch and alarm. Different control settings can be included for various scenarios as well as manual override for testing. The control center should either be inside a weatherproof box or on a post near the entrance port to the dosing tank. Locating the control center inside a nearby building is also acceptable, but they should be accessible for service and inspection. Never place the control system inside the dosing tank or access passageway. The moisture in the dosing tank will cause corrosion and system failure.

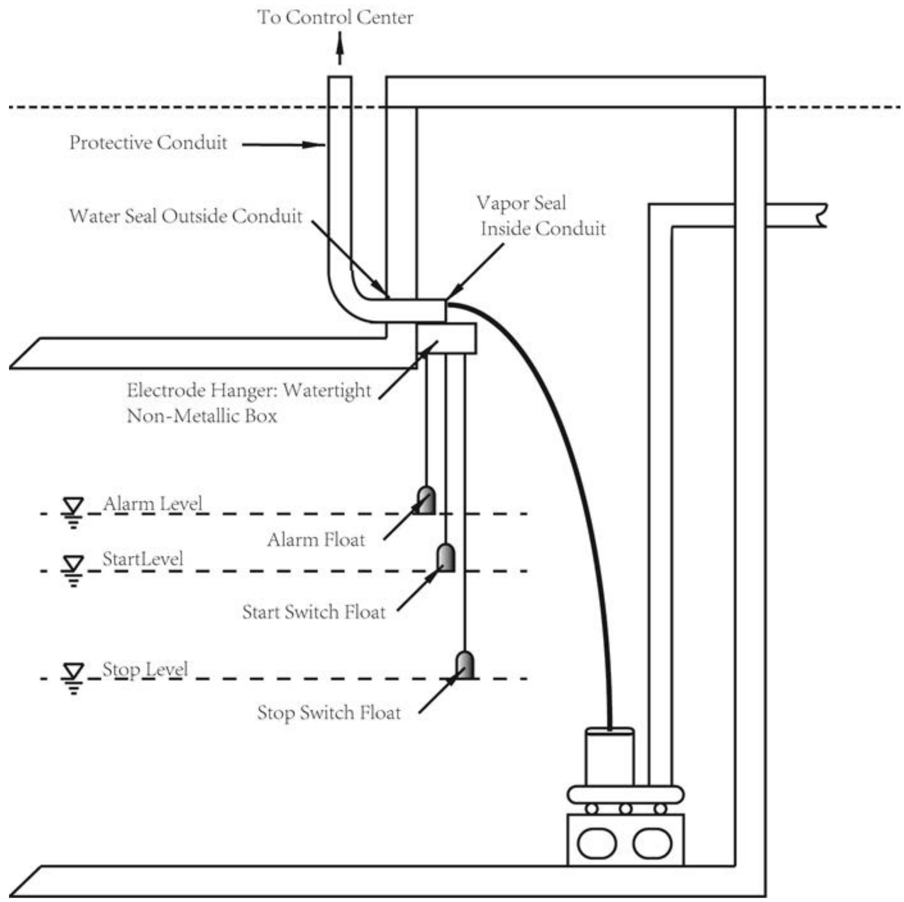

Figure 12. Control system for dosing tank.

Maintenance

After the installation and operation, monitoring and maintenance for the pressure distribution system is required. These include:

1. Check the baseline pressure head before put into use.
2. Check and clean the effluent filter in septic tank to keep small debris from clogging holes in pipes.
3. Look for water leaks into system.
4. Check float and alarm every 6 months.
5. Flush lines and pipes every 6 months.
6. Conduct pressure test every 6 months. If pressure is too high, the pipes could be clogged. If pressure is too low, there might be leaks, breaks or pump wear.

If clogging becomes severe, clean laterals with a brush on a plumbing snake. If cleaning is not effective, lateral pipes may need to be replaced.

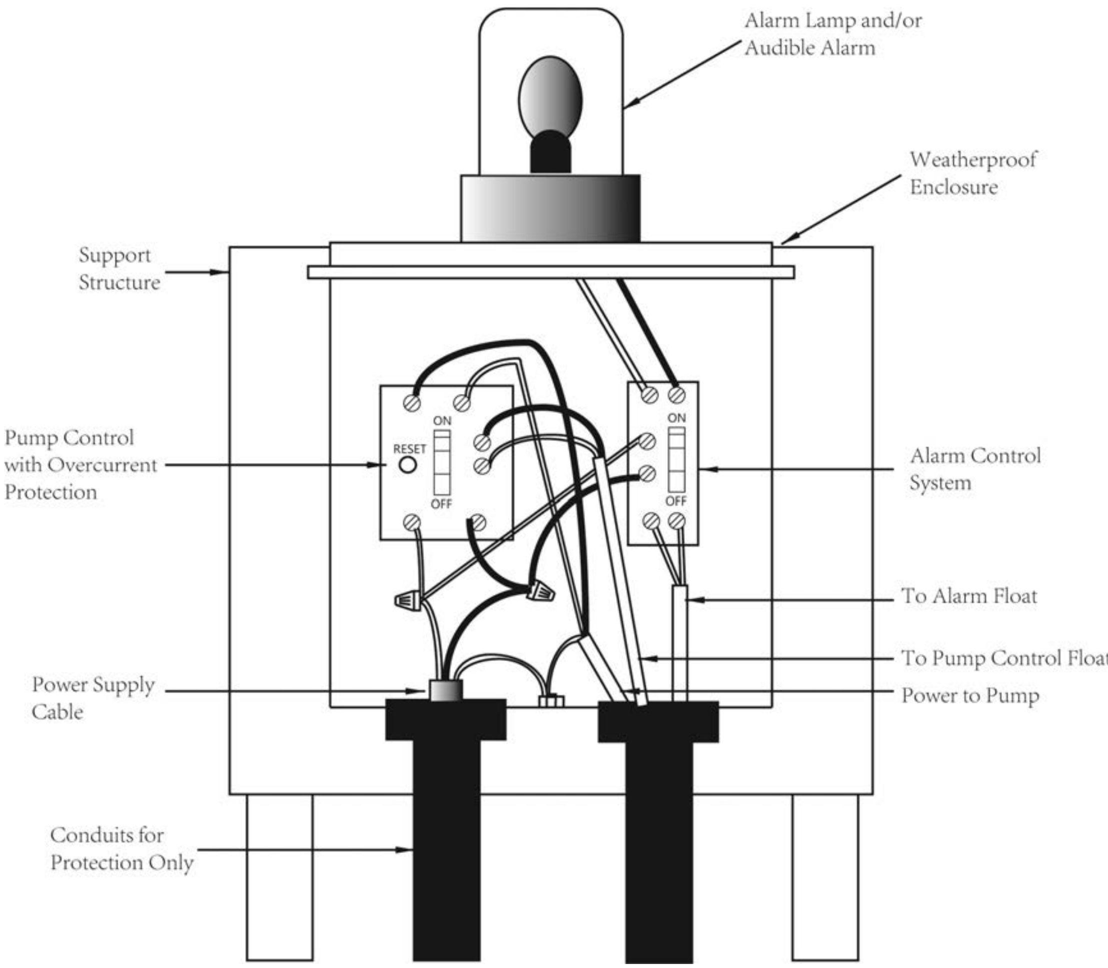

Figure 13. Outdoor control center with built-in dosing pump control.

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