GEOFLOW, INC. MAINTENANCE AND OPERATION GUIDELINES

Adapted from Geoflow Design and Installation Manual dated Feb 2001.
See complete Design and Installation Manual online at www.geoflow.com or
telephone 800-828-3388 for a free copy.

SYSTEM COMPONENTS :
A typical drip system installation will consist of the elements listed below:
1. Wasteflow® Dripline
WASTEFLOW lines carry the water into the dispersal/reuse area. Wasteflow lines are connected to the supply and return with Compression or Lockslip fittings. Standard spacing between lines and emitters is 24" on center. The dripline has no joints that may pull apart during installation and is ideal for tractor mounted burying machines. It is sold in 500 ft rolls. Fe export 400-m rolls are available. Rolls of alternative lengths may be special ordered.
Wasteflow dripline features:
a) Rootguard®
The risk of root intrusion with an emitter slowly releasing nutrient rich effluent directly into the soil is well known to anyone who has observed a leaking sewer pipe. Geoflow has an exclusive license for rootguard, to protect emitters from root intrusion. Rootguard carries a 15-year warranty against root intrusion.
b) Turbulent flow path
Wasteflow drip emitters are pre-inserted in the tube 6", 12" or 24" apart with 24" being the most popular. Angles in the emitter flow path are designed to cause turbulence in order to equalize flow between emitters and keep the emitters clean. Geoflow emitters boast large flow paths, which, coupled with turbulent flow, have proven over the years to be extremely reliable and dependable.
c) Antibacterial
Geoflow s Wasteflow has an inner lining impregnated with a antibacterial, Geoshield DM-50, to inhibit bacterial growth on the walls of the tube and in the emitter.
d) Wasteflow Classic and Wasteflow PC Dripline
For Wasteflow Classic the flow rate delivered by the emitter is a function of the pressure at the emitter. Wasteflow PC will have a constant flow rate at all pressures from 7 to 60 psi - to ensure a long life the recommended operating range is 10 to 45 psi.
WASTEFLOW Classic Specification
The dripline shall consist of nominal sized one-half inch linear low density polyethylene tubing, with turbulent flow, drip emitters bonded to the inside wall. The drip emitter flow passage shall be 0.053" x 0.053" square. The tubing shall have an outside diameter (O.D.) of approximately .64-inches and an inside diameter (I.D.) of approximately .55-inches. The tubing shall consist of three layers; the inside layer shall be a bacterial protection, the middle layer shall be black and the outside layer shall be purple striped for easy identification. The dripline shall have emitters regularly spaced 24" (or 12") apart. The turbulent flow emitters shall be molded from virgin polyethylene resin. The turbulent flow emitters shall have nominal discharge rates of 1.3 gallons per hour at 20 psi. The emitters shall be impregnated with Treflan® to inhibit root intrusion for a minimum period of 15 years and shall be guaranteed by the manufacturer to inhibit root intrusion f or this period. WASTEFLOW Classic dripline shall be Geoflow model number WF16-4-24 or WF16-4-12.
WASTEFLOW PC Specification
The dripline shall consist of nominal sized one-half inch linear low density polyethylene tubing, with turbulent flow, drip emitters bonded to the inside wall. The drip emitter flow passage shall be 0.032" x 0.045" square. The tubing shall have an outside diameter (O.D.) of approximately .64-inches and an inside diameter (I.D.) of approximately .55-inches. The tubing shall consist of three layers; the inside layer shall be a bacterial protection, the middle layer shall be black and the outside layer shall be purple striped for easy identification. The dripline shall have emitters regularly spaced 24" (or 12" or 6") apart. The pressure compensating emitters shall be molded from virgin polyethylene resin with a silicone rubber diaphragm. The pressure compensating emitters shall have nominal discharge rates of 0.53 gallons per hour. The emitters shall be impregnated with Treflan® to inhibit root intrusion for a minimum period of ten years and shall be guaranteed by the manufacturer to inhibit root intrusion for this period. WASTEFLOW PC pressure compensating dripline shall be Geoflow model number WFPC16-2-24 or WFPC16-2-12 or WFPC16-2-06.
2. Controllers
Controllers are used for time dosing and auto-flushing of the filter and dripfields. GEO controllers include a programmable logic control interface for field modifications. They can be used on systems ranging in size from one to four zones at the time this manual was printed. All controllers include a surge arrestor, elapsed time meter and counter. For larger systems please inquire about our Wasteflow Manager controller that has monitoring and telemetry capabilities.
Controller Description
The following have been used in the standard GEO controller. Refer to paperwork supplied with controller for more detailed operating instructions.
Panel Components:
Programmable logic module for timing and controls.
Contractor and circuit breaker for pump (see panel description for max hp ratings and other specifications).
Hand-Off-Auto (H-O-A) switches for pump and valve operation.
Connections/contacts for normally closed 24 VAC valves. (Contacts for normally open valves special order)
Elapsed time meter and cycle counter for pump monitoring built in to PLC.
Circuit breaker for control power.
Surge arrestor for lightening protection.
12" x 10" NEMA 4 X fiberglass enclosure.
Float functions:
Redundant Off and Low level Alarm Float. It is a secondary off float that will prevent the operation of the pump if the timer on and off float fails. This float turns off the pump when lowered. Pumping will be disabled in both the automatic and manual modes. This float also activates the audible and visual alarm. Pressing the illuminated PUSH TO SILENCE button will silence the audible alarm. The alarm light will remain on until the float is raised. When raised, this float will enable operation of the pump. Timer On & Off float. Activates timer. Timer will control pump cycles, beginning with the off mode.
Over-ride timer On & Off float. Activates the over-ride timer. Over-ride timer will control pump cycles. The over-ride timer will finish at least one complete cycle even if the over-ride float drops.High-level alarm float. Activates the audible and visual alarm when raised. Audible alarm may be silenced by pressing the illuminated PUSH TO SILENCE button. The alarm light will remain on until the float is lowered.
NOTE: We recommend the use of normally open mercury control floats.
Pump and Valve Operation:
Pump dosing cycles are controlled by the timers when the H-O-A switch is in the auto position. Under normal conditions the "primary" timer will control the pump. During high flow conditions, the over-ride timer will control the e pump. The over-ride timer will cycle the pump more frequently than the primary timer. The pump will dose for the same amount of time but the time in between doses, or the over-ride timer "off time", will be one half that of the primary timer "off time". (For example, if your primary timer settings are one hour fifty-four minutes o ff and five minutes on then your over-ride timer settings would be approximately fifty-five minutes off and five minutes on.)
The Vortex Filter flush valve will open for 1 minute (field adjustable) at the end of the pump cycle to allow the filter to self-flush. When the Vortex Filter flush is complete, the pump will remain activated for 15 seconds (field adjustable) to accommodate the opening of the field flush valve.
The field flush valve will open during the 15 seconds the pump i s still activated after filter flush cycle. After the pump is deactivated the flush valve will remain open for one minute (field adjustable) to allow for drainage of the return line.
For severe freezing conditions allow adequate time for the manifold to drain completely.
To periodically flush the drip field, after 10 dosing cycles (field adjustable) the pump will operate for 5 minutes (field adjustable) with the field flush valve opened and the field flush valve will stay open until all zones have been flushed. This operation will also occur after a power outage.
Wiring Control voltage input is 115 VAC for all GEO 1 and GEO 4 series panels. Output to valve(s) is 24 VAC
3. Pumps
Wasteflow dripfields depend on pumps to supply effluent and pressure to the field. These must be sized according to flow and pressure requirements. Look for effluent pumps from a dependable source. Geoflow does not endorse a sing le manufacturer, but does advocate you use a pump that is readily serviced in your area.
4. Filters
Geoflow systems use a self-cleaning Vortex Filter with a stainless screen 150 mesh / or 100 micron filter element. The self-cleaning action is efficient over a range of flow rates depending on the filter size. The clean-out port is at the base and can be opened and closed manually or automatically. If using a manual flush valve, please keep the valve cracked open slightly at all times for continuous flushing. The controller will fully open automatic flush valves.
Filter specification
3/4"ñ Filter. The Y filter body shall be molded from glass reinforced engineering grade black plastic with a 3/4 inch male pipe thread (MIPT) inlet and outlet. The two-piece body shall be capable of being serviced by untwisting and shall include an O-ring seal. An additional 3/4 inch MIPT outlet shall be capable of periodic flushing. The 150-mesh filter screen is all stainless steel, providing a 2 3.4 square inch filtration area. The screen collar shall be molded from vinyl. The filter shall flush flows from 4-11 gpm. The 3/4"h filter shall be Geoflow Vortex Filter model number AP4E-75.1"h Filter. The Y filter body shall be molded from glass reinforced engineering grade black plastic with a 1 inch male pipe thread (MIPT) inlet and outlet. The two-piece body shall be capable of being serviced by untwisting and shall include an O-ring seal. An additional 3/4 inch MIPT outlet shall be capable of periodic flushing. The 150-mesh filter screen is all stainless steel, providing a 28.4 square inch filtration area. The screen collar shall be molded from vinyl. The filter shall flush flows from 7-28 gpm. The 1"h filter shall be Geoflow Vortex Filter model number AP4E-100. 1.5"h Filter. The Y filter body shall be molded from glass reinforced engineering grade black plastic with a 1.5 inch male pipe thread (MIPT) inlet and outlet. The two-piece body shall be capable of being serviced by untwisting and shall include an O-ring seal. An additional 3/4"h MIPT outlet shall be capable of periodic flushing. The 150-mesh filter screen is all stainless steel, providing a 60.8 square inch filtration area. The outer support shell shall be woven stainless steel wire, and the inner screen shall be made of stainless steel cloth. The inner and outer screens shall be soldered together. The screen collar shall be molded from vinyl. The 3hole filter shall flush flows of 34-42 gpm and the 4-hole filter shall flush flows of 45-55 gpm. The 1.5"h filter shall be Geoflow model number AP4E-150-3 or AP4E-150-42"h Filter. The Y filter body shall be molded from glass reinforced engineering grade black plastic with a 2 inch male pipe thread (MIPT) inlet and outlet. The two-piece body shall be capable of being serviced by untwisting and shall include an O-ring seal. An additional 3/4"h MIPT outlet shall be capable of periodic flushing. The 150-mesh filter screen is all stainless steel, providing a 60.8 square inch filtration area. The outer support shell shall be woven stainless steel wire, and the inner screen shall be made of stainless steel cloth. The inner and outer screens shall be soldered together. The screen collar shall be molded from vinyl. The 3-hole filter shall flush flows from68-84 gpm and the 4-hole filter shall flush flows of 90-110 gpm. The 2"h filter shall be Geoflow model number AP4E-200-3 or AP4E-200-4.
5. Supply Manifold
This carries the water from the dosing tank to the dispersal area. Rigid PVC is usually used and must be designed to slope back to the pump tank in freezing conditions. The velocity in the manifold should be between 2 feet per second and 5 feet per second (fps). Refer to PVC pipe sizing chart in the appendix to determine the best diameter for your application.
6. Return Manifold
In order to help clean the system, the ends of the drip lines are connected together into a common return line, most often made of rigid PVC. This line will help equalize pressures in the system. Flushing should be done frequently during the installation period. Periodic flushing under full system pressure will guarantee a long system life.
The return manifold should be installed to drain the line back to the pretreatment tank in freezing climates.
7. Pressure Regulator
Pressure regulators fix the inlet pressure at a given rate and are recommended with Wasteflow Classic. Under normal operating conditions, pressure in the drip lines should be: 10 psi to 45 psi for Wasteflow Classic and 7 psi to 60 psi for Wasteflow PC.
8. Air Vacuum Breaker
Air vacuum breakers are installed at the high points to keep soil from being sucked into the emitters due to back siphoning or back pressure. This is an absolute necessity with underground drip systems. They are also used for proper draining of the supply and return manifolds in freezing conditions. Use one on the high end of the supply manifold and one on the high point of the ret urn manifold. Additional air vents may be required depending on terrain. Maximum flow per vacuum breaker is 50 gpm. Freezing conditions require the air vacuum breaker be protected with insulation.
Air Vacuum Specification
The air vacuum relief valve provides instant and continuous vacuum relief and non-continuous air relief. Both the body and the removable dirt cover shall be constructed of molded plastic. The body and the dirt cover shall be connected with a 3/4 inch hose thread. The ball shall be constructed of low density plastic and the internal seat shall be constructed of vinyl. The air vacuum relief valve shall seal at 5 psi. Inlet size shall be a 1-inch male pipe thread. The air vent shall be
Geoflow item number AFVBK-1
9. Filter Flush Valves
Used to flush debris from the filter cleanout port back to the pretreatment tank, this can be an electronically activated solenoid valve or a manual ball valve. If manual, it should be opened for a full flushing at least every six month s and left cracked open slightly to continuously. Cracking open a manual valve may be used to increase flow through the system to be within the efficient flow rate of the filter and/or pump, if necessary. Certain States may require automated electronic flushing. Please refer to your State codes.
Flush valve specification and description
The Solenoid Valve is electrically operated and used to flush the dripfield and Vortex filter. It is normally closed, and in the event of a power failure the valve closes. Unique Dual Ported Diaphragm greatly minimizes clogging. In operation, the diaphragm ports constantly flex, inhibiting sand, silt and debris from blocking the valve action. The porting design also permits equal pressure on both sides of the diaphragm wall, regardless of line pressure when valve is not operating, and nearly equal pressure across the wall when operating. The DW Valve diaphragm is made of nylon fabric reinforced Buna-N rubber; a grooved rib interlocks with cover and body to prevent leakage. Nylon exhaust orifice is non-corrosive and has an opening sized larger than the diaphragm ports so that any pieces of sand or silt passing through the diaphragm will not be trapped beneath the solenoid actuator. The solenoid is constructed of molded epoxy resin having no carbon steel components exposed thereby eliminating possible external corrosion and deterioration. Solenoid is completely waterproof, with an O-ring seal, and complies with NEC Class II circuit requirements for 24V a.c. operation (also operates on 12 volts d.c. up to 75 psi). The actuator is teflon coated stainless steel and brass with a molded-in place rubber exhaust port seal; a stainless steel spring assures positive seating. High strength plastic glass-filled body and cover designed to operate in heavy duty commercial applications. Stainless steel 1/4 inch cover bolts and mating brass body inserts make re-assembly easy. Shock cone on diaphragm seat eliminates water hammer in all except extreme cases.
Flow control. A brass, non-rising type flow control stem for throttling the valve from full open to close positions.
Manual bleed lever. An easy-to-use, hand operated control bleeds valve to downstream; has stops for open and closed positions.
Cold water working pressure: 150 psi
10. Field Flush valves.
Used to flush out fine particles which have passed through the filter and accumulate on the bottom of the tube at the end of each h lateral. The field flush valve can be manual or electronic. If manual, it should be opened for full flushing at least every six months and left cracked open slightly to flush continuously and provide for drainage of the flush line in freezing conditions. Cracking open a manual valve can also be used to increase the flow through the system to be within the efficient flow rate of the filter and/or pump if nec ssary. Certain States do require automated electronic flushing. Please refer to your State codes.
Flush valve specification and description
See specifications and description for filter flush valves above.
FREEZING OPERATIONS
Buried drip systems are not prone to frost damage because, in their design, vacuum release and drain valves are provided. Please adhere to the following precautions:
a) Manifolds, supply lines and return lines must be sloped back to their respective dosing or treatment tanks. Under extreme conditions return and supply manifold should be insulated or buried below frost line. Be sure drain valve on flush line remains open long enough for entire field to drain.
b) Remove the check valve at the pump or provide alternate method for draining supply manifolds. Check with pump manufacturer before removing check valve from pump to be sure that it does not affect warranty.
c) Insulate equipment boxes, including Headworks box or filter and field flush valve boxes as well as zone dosing valves, pressure regulator and air vacuum relief valves. Use closed-cell insulation such as perlite in a plastic bag.
d) The top of air vacuum relief valves must be no higher than soil surface.
e) If using an index valve to split field zones, be sure it is capable of self-draining.
f) WASTEFLOW lines will self-drain through the emitters into the soil. If the cover crop over the drip field is not yet adequately established, add hay or straw over the field for insulation.
g) Mark the valve box with a metal pin so you can find it in t he winter when covered in snow.
h) If using manual filter flush valves or manual field flush valves, they should be left cracked open slightly to provide for quick and complete drainage of the flush line in freezing conditions.
SYSTEM MAINTENANCE:
The best way to assure years of trouble free life from your system is to consistently monitor the system and perform regular maintenance functions. For large systems or systems with a BOD > 20 mg/l automation of maintenance is essential.
For smaller systems with a BOD < 20 mg/l semi-annual inspection and maintenance is adequate.
1) Remove the spin filter and install a clean cartridge. Clean the used filter cartridge back at the shop with a pressure hose. The filter cartridge should be cleaned from the outside inwards. If bacteria buildup is a problem we advise first trying lye, and if the problem persists, soak it in a chlorine bath. Soak the filter cartridge in a mixture of 50% bleach and 50% water.
2) Open the field flush valve.
3) Manually turn on the pump.
4) Flush the system for approximately five minutes.
5) Close the field flush valve.
6) Check for proper pressures in the field and if a ball valve is used reset the field flush valve for 1-psi loss.
7) Remove the lids on the vacuum breaker and check for proper operation.
8) Visually inspect the field for any irregularities.
9) Turn off the pump and reset the controller for auto mode.
10) Periodically remove and clean the field flush and filter flush valves.
ROOTGUARD® is a registered trademark of A.I.Innovations.

GEOFLOW MAINTENANCE GUIDELINES (FROM GEOFLOW)

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8) Visually inspect the field for any irregularities.
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THESE DOCUMENTS ARE FROM THE COUNTY'S ONSITE MANUAL

F. MANAGEMENT REQUIREMENTS

Recommended minimum procedures and frequency for inspection, maintenance, monitoring and reporting activities for subsurface drip dispersal systems are outlined in **Table DD-2.**

Table DD-2. Drip Dispersal System Management Requirements

	Work	Frequency
Inspection	• Conduct routine visual observations of drip field, downslope area and surrounding for wet areas, pipe leaks or damage, soil erosion, drainage issues, abnormal vegetation, gophers or other problems. • Conduct routine physical inspections of system components, including valves, filters, and headworks box(es). • Perform special inspections of drip field at time of any landscaping work or other digging in drip field area. • Perform inspections of dosing pump(s) and appurtenances (per O&M manual and Performance Evaluation Guidelines, Part 5 of this Manual). • Record observations.	• Every 6 to 12 months.
Maintenance	• Manually remove and clean filter. • Clean and check operation of pressure reducing valves. • Clean flush valves and vacuum release valves.	• Clean filter every 6 months. • Other maintenance annually.
Water Monitoring & Sampling	• Measure and record water levels in dispersal field monitoring wells, as applicable, per permit requirements. • Obtain and analyze water samples from dispersal field monitoring wells, as applicable, per permit requirements.	• According to permit conditions, if applicable.
Reporting	• Report findings to DEH per permit requirements. • Standard report to include dates, monitoring well and other data collected, work performed, corrective actions taken, and performance summary. • Report public health/water quality emergency to DEH immediately.	• According to permit conditions, typically every 1 to 2 years, depending on system size, usage, history, location.

E. MANAGEMENT REQUIREMENTS

Recommended minimum procedures and frequency for inspection, maintenance, monitoring and reporting activities for proprietary treatment systems are outlined in **Table P-1** below.

Table P-1. Proprietary Treatment System Management Requirements

	Work	Frequency
Inspection	• Inspection to be in accordance with manufacturer specifications.	• According to permit conditions, typically every 6 to 12 months, depending on system size, usage, and history.
Maintenance	• Perform all maintenance as required and in accordance with equipment manufacturer specifications.	• According to permit conditions, typically every 6 to 12 months, depending on system size, usage, and history.
Water Monitoring & Sampling	• Monitoring to be in accordance with manufacturer specifications.	• If required, according to permit conditions, typically every 6 to 12 months, depending on system size, usage, and history.
Reporting	• Report findings to DEH per permit requirements. • Standard report to describe findings, analyze performance, and detail actions taken. • Report crisis or failure conditions to DEH immediately.	• According to permit conditions, typically every 1 to 2 years, depending on system size, usage, history, location.

Maintenance Agreement

The applicant must demonstrate that a written maintenance agreement with a qualified service provider has been obtained for the proposed proprietary treatment unit to ensure satisfactory post-construction operation and maintenance. A maintenance agreement must be maintained valid for the life of the treatment unit.

Operating Permits.

A County-issued operating permit is required for all alternative systems. Operating permits are intended to serve as the basis for verifying the adequacy of alternative system performance and ensuring on-going maintenance, including requirements for system inspection, monitoring and reporting of results to the DEH, along with the requirement for permit renewal, typically on **an annual basis.**

Performance Monitoring and Reporting.

Performance monitoring and reporting is required for all alternative OWTS in accordance with conditions established by the DEH at part of the operating permit.

CONTRACTOR SHALL OBTAIN AND INSTALL PROPER ANCHORING SYSTEM FOR ALL TANKS

XERXES®
a ZCL company

Tank Anchoring System
An engineered solution

Xerxes recognizes that the components of a tank anchoring system can be critical to a reliable, long-term tank installation. A large percentage of today's underground tank installations are anchored, whether site conditions mandate it or not. Use of inferior components, such as improperly designed or undersized concrete deadmen, can lead to disastrous results. As a solution, we designed and began supplying each of the components essential to proper tank anchoring, prefabricated deadmen, galvanized turnbuckles and extruded fiberglass hold-down straps. Providing a safe, dependable anchoring solution is not our only objective. The Xerxes anchoring package is also designed to provide installers with a quick, easy to install package of components that expedites the overall installation. The Xerxes tank anchoring system is yet another example of product innovations that Xerxes has been offering customers for more than three decades.

Consider the following features and benefits:

Flexible Design – Xerxes prefabricated deadmen were engineered with ease of shipping and installation in mind. With their unique and patented design, which incorporates adjustable galvanized steel anchor points, installers can properly align each anchor point and hold-down strap after the tank and deadmen have been set in place.

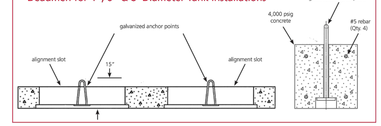
An Engineered Product – Tank installers and owners can have the confidence that prefabricated deadmen, an often overlooked yet critical component of an anchored tank installation, have been properly engineered and sized for each tank. Xerxes precast deadmen are fabricated to meet American Concrete Institute (ACI) design standards, which establishes such things as proper steel reinforcement, concrete psi specifications and adequate cure time.

Transportation – An additional feature of Xerxes deadmen is that their geometry and dimensions allow them, in most cases, to be placed on the same shipping trailer as the tank. For installers, this means that the components of the anchoring system arrive with the tank, avoiding the potential for jobsite delays.

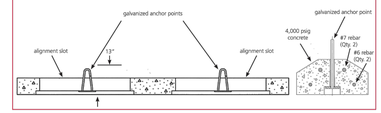
A Complete System – Combined, Xerxes supplied fiberglass hold-down straps, galvanized turnbuckles and prefabricated deadmen provide a complete anchoring package. With each component specifically designed and supplied by Xerxes, facility owners have the added peace-of-mind that in addition to having installed the industries' finest storage tank, they have also installed a reliable anchoring system.

making a lasting difference™

Deadmen for 4'-, 6'- & 8'-Diameter Tank Installations



Deadmen for 10'- and limited 12'- Diameter Tank Installations



Product Specifications

Deadmen for 4'-, 6'- and 8'-Diameter Tanks		
Nominal length	Nominal width x depth	Approximate weight (lbs.)
12'	12" x 12"	1,800
16'	12" x 12"	2,400
18'	12" x 12"	2,700

Deadmen for 10'- and 12'-Diameter Tanks		
Nominal length	Nominal width x depth	Approximate weight (lbs.)
14'	18" x 8 3/4"	1,900
18'	18" x 8 3/4"	2,400
22'	18" x 8 3/4"	3,000
30'	18" x 8 3/4"	5,000

Turnbuckles
Jaw-to-Jaw Style
6'-Diameter Tanks 3/4" x 9" (17" closed, expanding to 26")
8'-Diameter Tanks 3/4" x 12" (20" closed, expanding to 32")
10'- and 12'-Diameter Tanks 3/4" x 18" (26" closed, expanding to 44")

General Notes:
1. Deadmen requirements may vary with tanks 25,000 gallons or larger, and/or based on the number of containment sumps, access risers and burial depth.
2. Consult the Xerxes Installation Manual and Operating Guidelines or your Xerxes sales representative for more information.

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Some general specifications for installation for Xerxes tanks
these are two pages of tank manufacturers website document ***Installation Manual and Operating Guidelines*** - available on line.

⚠ 4-15-2016

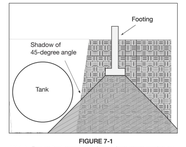

FIGURE 7-1

7.2.4.1. Ensure that downward forces from loads carried by the foundations and supports of nearby structures (constructed before or after tank installation) are not transmitted to the tanks.

7.2.5. Typically, the way to check the placement of the tank in relationship to a nearby structure is to do the following:

7.2.5.1. Determine the depth of burial needed for the tank.

7.2.5.2. Locate the footing of the structure to be considered.

7.2.5.3. Determine the line that would fall into the ground from a 45-degree angle drawn downward from the corner(s) of the footing of the foundation that is closest to the tank.

7.2.5.4. The tank must not fall within the "shadow" of the 45-degree-angle line drawn from the foundation's footing. *See FIGURE 7-1.*

7.2.5.5. If the tank would fall within this "shadow," do one of the following to ensure that the tank does not fall within the "shadow":

7.2.5.5.1. Move the tank away from the existing building.

7.2.5.5.2. Move the foundation of the building to be constructed away from the tank.

7.2.5.5.3. Deepen the footing of the planned building's foundation.

7.3. DEPTH OF EXCAVATION

7.3.1. Typically, the depth of the excavation is determined by:

7.3.1.1. groundwater conditions

7.3.1.2. traffic at the site

7.3.1.3. soft or uneven excavation base

7.3.1.4. codes and regulations.

7.3.2. Groundwater must be considered if the level of water in the ground may rise above the bottom of the tank at any time during the life of the tank.

7.3.3. Traffic loads are considered to be loadings for highway vehicles up to H-20 or HS-20 as defined in the AASHTO Standard Specifications for Highway Bridges.

7.3.4. Excavations must allow for 12 inches of backfill between the bottom of the tank and the bottom of the excavation or the top of the anchor slab (or any other stabilizing materials used). *See POINT 7.5.3.3. and SECTION 8.6.*

7.3.5. If either an anchor slab or other stabilizing material is used, allow additional depth in the excavation to accommodate their construction.

7.3.6. Typically, no additional depth of bedding is required for the use of a deadman anchoring system.

7.4. DEPTH OF COVER

⚠ CAUTION

In both traffic and nontraffic installations, no truck or equipment loads are allowed over the tank until the backfill is at the minimum specified requirements. Failure to follow this caution may result in minor or moderate injury, and/or damage to the tank.

7.4.1. Xerxes recommends that every site be thoroughly evaluated for the potential of a rise in the local water table or of trapped water (a wet-hole condition). Sufficient overburden and/or an appropriate anchoring system must be present to offset buoyancy of the tank in such conditions.

NOTICE

Failure to provide sufficient overburden and/or an appropriate anchoring system may cause tank failure, or may result in damage to the tank and/or surrounding property.

7.4.2. The tank owner or the owner's technical representative is responsible for determining sufficient overburden and/or appropriate anchoring system.

7.4.3. The minimum depths of cover dimensions given here are important to the successful installation of a tank. They may not be sufficient to counteract buoyancy in wet-hole conditions.

7.4.3.1. Additional depths of cover may be necessary due to federal, state or local regulations, safety requirements or operational requirements.

⚠ WARNING

In a nontraffic installation, ensure that the area above the tank is not subjected to traffic or other types of loads, which could cause damage to the tank, and could result in death or serious injury.

7.4.4. Tanks not subjected to traffic must have a cover depth of 12 inches of backfill. *See TABLE 7-1.*

7.4.5. Tanks subjected to traffic must have a cover depth of one of the following:

7.4.5.1. 36 inches of backfill

7.4.5.2. 18 inches of backfill and 6 inches of reinforced concrete

7.4.5.3. 18 inches of backfill and 8 inches of asphalt.

7.4.6. *See TABLE 7-1* for minimum requirements for tanks other than petroleum tanks.

Depth of Cover
Minimum Requirements for Tanks Other than Petroleum Tanks

No Traffic
- 12" backfill

Traffic Options
- 36" backfill
- 18" backfill + 6" reinforced concrete
- 18" backfill + 8" asphalt

NOTE: The maximum burial depth for standard tanks is 7 feet of cover over the top of the tank.

TABLE 7-1

7.4.7. Tank owner must follow NFPA 30 and 31, as a minimum, for petroleum tanks. See TABLE 7-2 for those requirements.

Depth of Cover
Minimum Requirements for Petroleum Tanks

No Traffic Options
- 24" backfill
- 12" backfill + 4" reinforced concrete
- 12" backfill + 6" asphalt

Traffic Options
- 36" backfill
- 18" backfill + 6" reinforced concrete
- 18" backfill + 8" asphalt

NOTE: These are NFPA 30 and 31 requirements.

TABLE 7-2

7.4.8. The maximum burial depth for standard tanks is 7 feet of cover over the top of the tank. However, tanks can be designed for a deeper burial.

7.4.8.1. Call your Xerxes representative for a special quotation prior to tank purchase if the burial depth is to be greater than 7 feet.

7.4.8.2. If you are installing a tank and need to consider a deeper burial than that given for the tank that was ordered, contact your Xerxes representative to discuss available options.

7.4.8.3. Prior written authorization from Xerxes is required to deviate from a standard tank's maximum burial depth.

7.4.9. Surface asphalt and concrete pads must extend a minimum of 12 inches beyond the tank in all directions.

7.4.10. If there is an unattached riser, it must not transmit load from the concrete slab to the tank. A minimum space of 6 inches must exist between the bottom of the riser and the top of the tank.

7.4.11. Traffic loads from the top slab must not be transmitted to a containment sump or a riser. A minimum space of 3 inches must exist between the riser or sump and the slab. *See SECTION 16.*

7.5. TANK SPACING

7.5.1. GENERAL

7.5.1.1. The following are minimum spacings and must be increased as needed to accommodate deadmen or anchor slabs. *See SECTION 8.*

7.5.1.2. Always provide sufficient clearance to allow the deadmen to be set outside of the tank "shadow." *See FIGURE 7-2.*

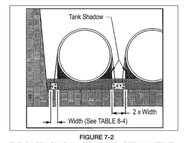

FIGURE 7-2

7.5.2. SPACING IN STABLE IN SITU (NATIVE) SOIL CONDITIONS

7.5.2.1. The minimum spacing between the sidewall or endcap of the tank and the side of the excavation must be 18 inches. *See FIGURE 7-3.*

NOTE: All measurements from the tank sidewalls are to be taken from the outside diameter of the tank ribs.

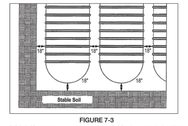

FIGURE 7-3

7.5.2.2. If two or more tanks are installed in the same hole, allow for at least 18 inches between the tanks. *See FIGURE 7-3.*

7.5.2.3. If two or more tanks are installed in the same hole and deadmen are used, the space between the tanks must be equal to or greater than two times the width of the deadman or deadmen required between the tanks. *See FIGURE 7-2 and TABLE 8-4.*

7.5.2.3.1. For instance, the space between tanks using deadmen is typically 24 inches for tanks up to and including 8-foot-diameter tanks, 36 inches for 10-foot-diameter tanks, and 72 inches for 12-foot-diameter tanks.

REVISIONS

1 4-15-2016	
COUNTY COMMENTS	SRH

ENVIRONMENTAL HEALTH SPECIALIST III
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ALTERNATIVE SYSTEM
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AND NOTES

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November 30, 2015

SCALE AS NOTED

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