6.4.1. The location of a tank can be affected by the location of nearby structures. When selecting a tank site, care must be taken to avoid undermining the foundations of existing structures or new buildings to be constructed. (*See FIGURE 6-6.*)

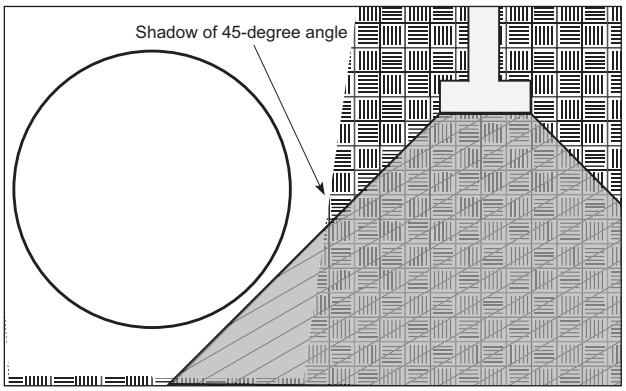

FIGURE 6-6

6.4.1.1. 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.

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

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

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

6.4.2.3. 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.

6.4.2.4. The tank must not fall within the "shadow" of the 45-degree-angle line drawn from the foundation's footing. (See FIGURE 6-6.)

6.4.2.5. If the tank would fall within this "shadow," do one of the following to ensure that the tank does not fall within the "shadow": a.) move the tank away from the existing building, b.) move the foundation of the building to be constructed away from the tank, or c.) deepen the footing of the planned building's foundation.

6.5. GEOTEXTILE

6.5.1. The tank owner or the owner's technical representative is responsible for determining whether a geotextile or an alternate filtering technique is appropriate for a specific installation. Geotextile allows the passage of water, but prevents the migration and mixing of in situ soil and the select backfill material. Geotextile helps preserve the integrity of the select backfill envelope, which surrounds and supports the tank.

6.5.2. Xerxes recommends that geotextile be used when the tank is installed in:

- areas with frequently changing groundwater conditions or areas subject to tidal fluctuations,
- unstable soils such *as cited in SECTION 6.3.3.,*
- water conditions with silty in situ soil.

6.5.3. For further information concerning geotextile specifications and installation procedures, consult the geotextile supplier's installation guidelines or instructions.

6.5.4. Polyethylene film is not considered an effective geotextile material. It may tear or degrade while in service.

7. ANCHORING TANKS

CAUTION

Xerxes recommends that every site be thoroughly evaluated for the potential of a rise in the local water table or of trapped water. Failure to anchor a tank when required may cause tank failure, or damage the tank or surrounding property.

7.1. DEADMEN

7.1.1. Deadmen are typically a reinforced concrete beam.

7.1.2. The length of deadmen is typically equal to the length of the tank.

7.1.3. Deadmen may be fabricated in multiple sections as long as the total length of each deadman is not decreased and as long as each section contains at least two balanced anchor points.

7.1.4. The width and thickness of deadmen depend on the tank diameter, water-table height, number of access openings that extend to the surface and burial depth.

7.1.5. Deadmen should be designed according to the American Concrete Institute (ACI) code.

7.1.6. *Refer to TABLE 7-1* for typical deadmen dimensions given the situation of an empty tank with a burial depth of 3 feet, with groundwater to grade and with two 24-inch access openings that extend to the surface.

Tank Diameter	Typical Deadman Dimensions (Width x Depth)
4'	6" x 6"
6'	12" x 12"
8'	12" x 12"
10'	18" x 9"
12'	36" x 8"

TABLE 7-1

7.1.7. Tanks of 10-foot diameter with a capacity of 30,000 gallons or larger may require larger deadmen than those *in TABLE 7-1,* depending on burial depth, to offset buoyancy. Contact technical support at Xerxes Minneapolis for further information.

7.1.8. Lay the deadmen in the excavation parallel to the tank and outside of the tank "shadow." *(See FIGURE 6-3.)*

7.1.9. In multiple tank installations with deadmen:

- each tank will have its own set of deadmen (one deadman may be used between two tanks if the deadman is double in width);
- a separate anchor point must be provided for each hold-down strap;
- the minimum spacing between tanks must be no less than twice the width of a single deadman.

CONTINUE NEXT PAGE

7.2. XERXES PREFABRICATED DEADMEN

7.2.1. Xerxes-supplied prefabricated deadmen are pre-engineered and sized to the tank ordered. As with any deadmen, water-table height, number of access openings that extend to the surface and burial depth must be considered.

7.2.2. Placement of Xerxes prefabricated deadmen is the same as standard deadmen. *(See FIGURE 7-1.)*

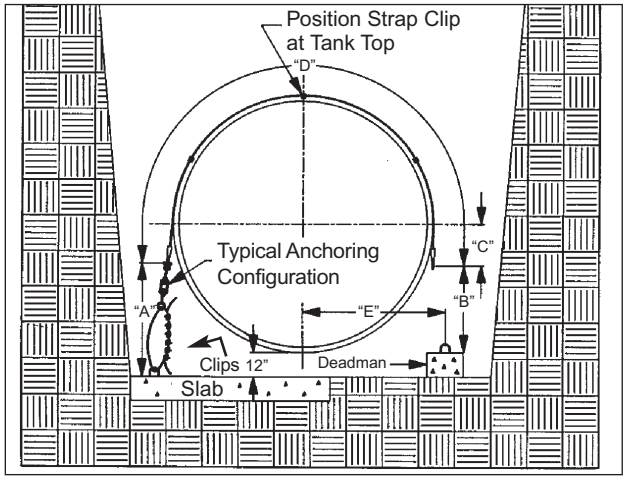

FIGURE 7-1

7.2.3. Xerxes prefabricated deadmen are supplied with 3/4-inch-diameter, galvanized, adjustable anchor points (subsequently referred to as anchor points). These anchor points protrude up through the slots in the deadmen and are held in place with cotter pins.

⚠ WARNING

Only use the anchor points when lifting and positioning the deadmen. A spreader bar may be required to lift longer sections of deadmen. Use guy ropes to guide the deadmen when lifting. Failure to do so could result in death or serious injury.

7.2.4. The anchor points can be moved and positioned to match hold-down strap locations on the tank (marked by arrowhead symbols ▶◀).

7.2.5. When using these deadmen in man-out-of-hole strapping applications, align the anchor points with the proper ribs before setting them in the hole. *(See SECTION 7.6.)*

7.2.6. Care should be taken to keep backfill from entering the anchor point slot until final adjustment is made.

7.2.7. The deadmen are to be butted together when multiple sections are used.

7.2.8. Use one anchor point per strap end and only one strap per anchor point.

7.3. ANCHOR SLAB

7.3.1. An anchor slab is typically a reinforced concrete base.

7.3.2. The total length of the slab must be at least the same as the length of the tank.

7.3.3. The minimum slab thickness is 8 inches.

7.3.4. The width of the slab depends on the tank diameter. The slab must extend a minimum of 18 inches [12 inches for 4-foot-diameter tanks] beyond the width of the tank.

7.3.5. *Refer to TABLE 7-2 and FIGURE 7-1* for anchor-point dimensions.

Tank Diameter	Anchoring Dimensions					
	"A"	"B"	"C"	"D"	"E" Min.	"E" Max.
4'	24"	18"	12"	8' - 4 1/4"	27"	30"
6'	35"	23"	13"	12' - 1"	42"	48"
8'	43"	31"	15"	15' - 1"	52"	58"
10'	57"	45"	15"	18' - 8 3/4"	69"	75"
12'	58"	50"	23"	22' - 6 3/4"	87"	93"

TABLE 7-2

7.3.6. Provide a separate anchor point for each hold-down strap.

7.3.7. All anchor points must be engineered to withstand the tank's buoyancy forces.

7.3.8. When using a concrete base slab, allow sufficient depth in the excavation for 12 inches of bedding material below the tank. *(See FIGURE 7-1.)*

7.4. HOLD-DOWN STRAPS

7.4.1. Only Xerxes straps may be used when anchoring a Xerxes tank.

7.4.2. The locations for hold-down straps on each tank are marked on the tank by the arrowhead symbols ▶◀ .

7.4.3. Straps must be used on all marked hold-down locations.

CAUTION

Do not place straps between ribs (except on 4-foot-diameter tanks). Failure to properly place straps may result in tank damage.

7.4.4. Data for hold-down straps are given *in TABLE 7-2 and FIGURE 7-1.*

7.4.5. Evenly distribute loads by tightening all hold-down straps uniformly until they are snug over the ribs but cause no deflection of the tank.

7.4.6. Take a measurement of the internal diameter of the tank to determine whether vertical deflection is within the limits specified by Xerxes after the straps have been installed and tightened. *(See SECTION 14 of the Installation Manual* for instructions on taking diameter measurements.)

7.5. HARDWARE AND ANCHORING POINTS

7.5.1. Anchoring hardware must be sized *according to TABLE 7-3*, and manufactured to industry standards and dimensions.

Tank Diameter	Minimum Turnbuckle Diameter (by Type)			Minimum Wire-Rope Diameter
	Hook	Jaw	Eye	
4'	3/4"	1/2"	1/2"	3/8"
6'	3/4"	1/2"	1/2"	3/8"
8'	1 1/4"	3/4"	3/4"	1/2"
10'	1 1/4"	3/4"	3/4"	1/2"
12'	1 1/4"	3/4"	3/4"	1/2"

TABLE 7-3

7.5.2. The installing contractor is responsible for providing hardware and anchor points of sufficient size and strength.

7.5.3. The particular configuration of hardware will be determined by the contractor, the owner or the owner's representative.

7.5.4. Locate the anchor points *as shown in TABLE 7-2 and FIGURE 7-1.* Refer to dimension "E." Align all anchor points with the marked arrowhead symbols ▶◀ on the tanks, within a tolerance of ±1 inch.

7.5.5. For specific information on hardware and its use, consult the hardware manufacturer or supplier.

7.5.6. The installer is responsible for using appropriate and approved engineering practices when fastening wire rope. Refer to recommendations of wire-rope manufacturer and supplier, and follow accepted industry standards when selecting, using, attaching or connecting wire rope. *(See FIGURE 7-3, FIGURE 7-4 and FIGURE 7-5.)*

⚠ CAUTION

Use only appropriately sized hardware with the strap eye. Oversized hardware may damage the strap eye and result in minor or moderate injury. See FIGURE 7-2 for dimensions of strap eye.

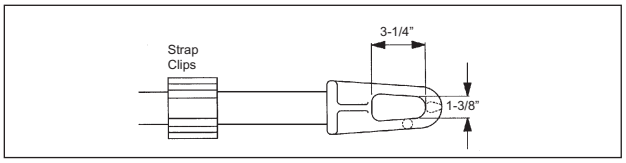

FIGURE 7-2

7.5.7. When connecting the end of a hold-down strap to the anchor, common methods *(shown in FIGURE 7-3)* are: A.) using a drop-forged turnbuckle, B.) using a looped wire rope, or C.) using a combination of both.

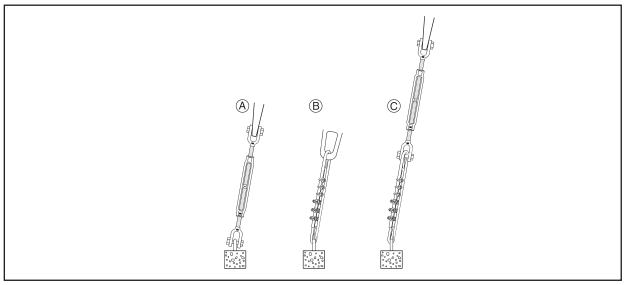

FIGURE 7-3

7.5.8. All exposed metal on the anchoring system must be coated or galvanized to protect against corrosion.

7.5.9. When fastening wire rope, use a minimum of two clips for a 3/8-inch wire rope and three clips for a 1/2-inch wire rope on each termination. *See TABLE 7-3* for minimum wire-rope diameter.

7.5.10. Turn back from thimble the exact amount of wire rope specified by the manufacturer of the clips used.

7.5.11. Apply the first clip at a distance from the dead end of the wire rope that is equal to the largest width of the clip used. *(See FIGURE 7-4.)*

7.5.12. For each clip, apply a U-bolt over the dead end of wire rope. *(See FIGURE 7-4.)* **(Note: Live end rests in saddle.)**

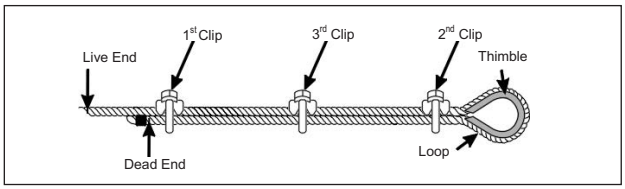

FIGURE 7-4

7.5.13. When two clips are required, apply the second clip as near the loop or thimble as possible. *(See FIGURE 7-4.)*

7.5.14. When more than two clips are required, apply the second clip as near the loop or thimble as possible; turn nuts on second clip firmly, but do not tighten initially. *(See FIGURE 7-4.)*

7.5.15. When more than two clips are required, space additional clips equally between the first two; take up rope slack; and tighten nuts on each U-bolt evenly.

7.5.16. Tighten all hardware uniformly and follow the manufacturer's torque specifications. Double-check the tightness once the anchoring system is complete.

7.5.17. If forming a loop in the wire rope, a splice is required for connecting the two ends together. Standard rigging practice for splicing wire rope calls for using twice the number of clips recommended for a single-end termination. Use a minimum of four clips for a 3/8-inch wire rope and a minimum of six clips for a 1/2-inch wire rope. Place the rope ends parallel to each other and install the clips *as shown in FIGURE 7-5.*

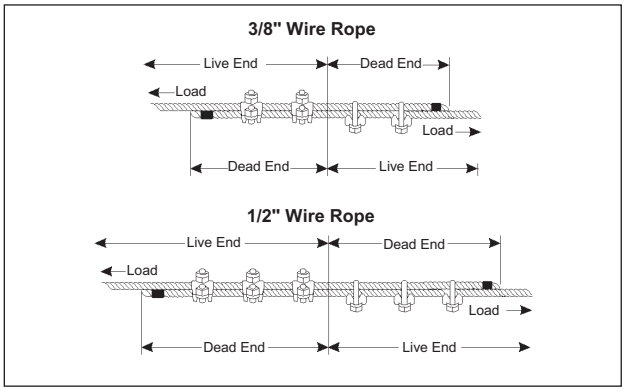

FIGURE 7-5

7.6. MAN-OUT-OF-HOLE ANCHORING

7.6.1. The Xerxes man-out-of-hole (MOH) strapping system is designed for use in installations where water is in the excavation and/or where personnel may not enter the hole because of site restraints. An MOH strapping system can be, but need not be, used in conjunction with Xerxes deadmen.

7.6.2. When using the MOH strapping system, the placement of components is critical. *(See FIGURE 7-6.)* See separate Xerxes document, Man-Out-of-Hole (MOH) Straps Instructions.

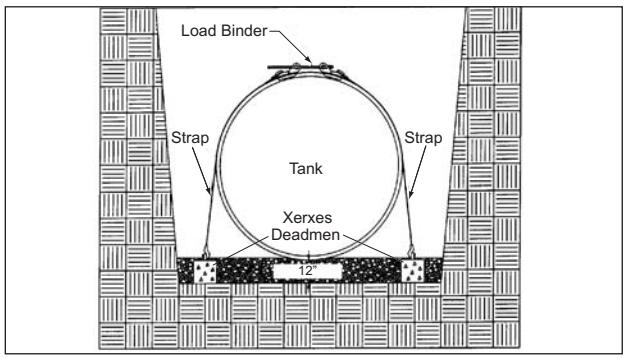

FIGURE 7-6

7.7. ALTERNATE ANCHORING METHODS IN WET-HOLE INSTALLATIONS

7.7.1. In wet-hole installations, when Xerxes' preferred method of man-out-of-hole anchoring is not available, the following methods may be used.

7.7.1.1. With both methods, place the hold-down strap between the wire rope and the tank so that the wire rope is never in direct contact with the tank.

7.7.1.2. The H-shaped positioning clips around the strap are designed to accommodate the wire rope on top of the strap *as shown in FIGURE 7-7 and FIGURE 7-8.*

7.7.1.3. The following method *is shown in FIGURE 7-7*:

- attach a wire rope to each end of each hold-down strap;
- secure the termination of the wire rope (*See SECTION 7.5. for suggested method.);*
- center each hold-down strap on each rib marked with the arrowhead symbols ▶◀ ;
- place the deadmen on top of the wire ropes on each side of the tank;
- lower the deadmen to the bottom of the excavation;
- take the slack out of each wire rope and splice the termination of the wire ropes on top of the tank *(See SECTION 7.5.)*.

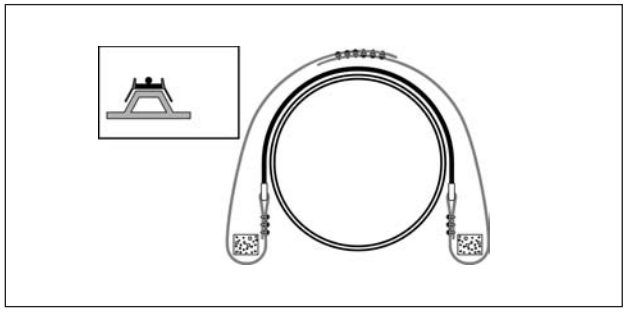

FIGURE 7-7

7.7.1.4. The following method *is shown in FIGURE 7-8*:

- loop a wire rope around the deadman at each location that corresponds to each rib marked with the arrowhead symbols ▶◀ ;
- secure the termination of the wire rope *(See SECTION 7.5. for suggested method.)*;
- lower each deadman to the bottom of the excavation using the wire rope;
- center each hold-down strap on each rib marked with the arrowhead symbols ▶◀ ;
- bring the live end of each wire rope up to the top of the tank at each marked rib;
- take the slack out of each wire rope and splice the termination of the wire ropes on top of the tank *(See SECTION 7.5.)*.

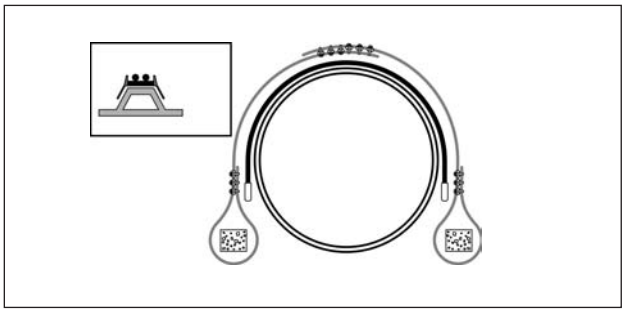

FIGURE 7-8

8. BOTTOM FITTINGS

8.1. GENERAL

8.1.1. When handling a tank with a bottom sump or fitting, always take extra care so that the bottom sump or fitting is not damaged.

CAUTION

All connections to the tank must be flexible. Provisions must be made to accommodate movement and misalignment between the piping and the tank. Failure to do this may damage the tank or surrounding property.

8.1.2. During installation, provide a clear area in the backfill bedding so that the tank rests on the backfill bedding and the bottom fitting is clear.

8.1.3. After setting the tank, fill and tamp the resulting void by using hand tools before continuing the backfilling.

9. INSTALLATION

⚠ WARNING

Do not use air pressure to test tanks that contain or have contained flammable or combustible liquids or vapors. The fuel and air mixture could explode and result in death or serious injury. Tanks should be air tested before ballasting.

CAUTION

Adequately ballast the tank (add liquid) in a wet hole or in a dry hole that may become wet (for example, from site runoff) until the installation has been completed. Failure to do this may damage the tank or surrounding property.