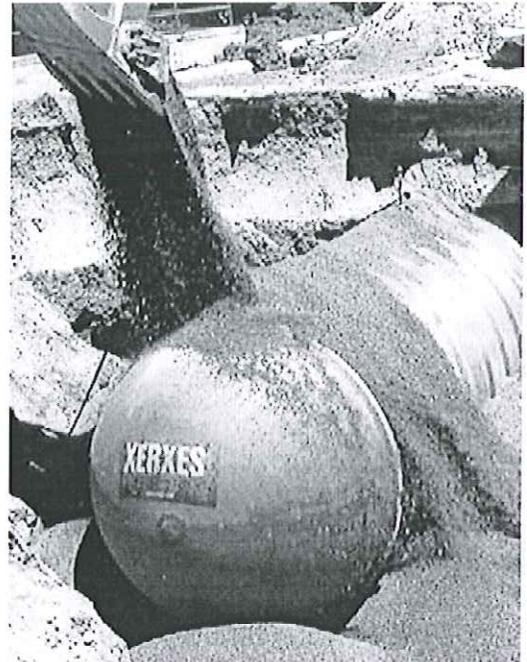


Backfill Guidelines

The backfill material surrounding an underground storage tank (UST) is a critical part of a proper tank installation. This document gives guidelines for choosing the best material to use when installing Xerxes fiberglass tanks. The Xerxes Installation Manual and Operating Guidelines (Installation Manual) specifies that rounded gravel or crushed stone be used as backfill material.

Materials that meet Xerxes' specifications for backfill material

Coarse aggregate is a technical term for the material (rounded gravel and crushed stone) that meets Xerxes' backfill size requirements. The American Society for Testing and Materials (ASTM) and The American Association of State Highway Transportation Officials (AASHTO) have specifications for standard sizes of coarse aggregate. The tables in this document give the standard sizes of coarse aggregate that meet Xerxes' backfill material specifications. The following descriptions of rounded gravel and crushed stone are taken from the Xerxes Installation Manual.



Rounded Gravel

When using rounded gravel, the material is to be a mix of rounded particles, sizes between 1/8 inch and 3/4 inch. The rounded gravel must conform to the specifications of ASTM C-33, paragraph 9.1, sizes 6, 67 or 7. No more than 5% (by weight) of the backfill may pass through a #8 sieve. The material is to be washed, free-flowing, and free of ice, snow and debris. See Table 1 on other side of this document for more information.

Crushed Stone

When using crushed stone, the material is to be a mix of angular particles, sizes between 1/8 inch and 1/2 inch. The crushed stone must conform to the specifications of ASTM C-33, paragraph 9.1, sizes 7 or 8. No more than 5% (by weight) of the backfill may pass through a #8 sieve. The material is to be washed, free-flowing, and free of ice, snow and debris. See Table 2 on other side of this document for more information.

Some material suppliers may produce materials that meet Xerxes' requirements but are not identified by a standard coarse aggregate size number. The supplier should be able to provide a specification that identifies the size or gradation of the material. If a specification for the material is not available, an independent testing laboratory can provide a sieve analysis performed on a sample of the backfill material according to ASTM C-136 specifications. The sieve analysis or material specification can then be compared against Xerxes' size requirements for the rounded gravel or crushed stone.

Another important characteristic of good backfill material is hardness or stability when exposed to water or loads. Most materials have no problems meeting the hardness requirement. Materials like soft limestone, sandstone or shale should not be used as backfill because they break down over time.

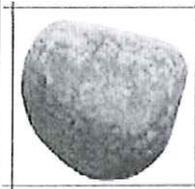
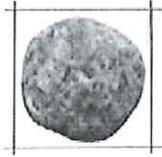
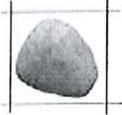
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These tables identify standard sizes of coarse aggregate that meet Xerxes' specifications for rounded gravel (Table 1) and crushed stone (Table 2). Each table identifies standard sieve sizes used to grade aggregate material. For each aggregate size, the amount of material finer than each laboratory sieve (square openings) is given as a percentage of the total weight of the sample.

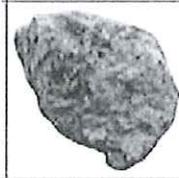
These percentages give an indication of the particle size distribution or gradation within a given aggregate size. With aggregate size number 6 of rounded gravel, for example, 20-55% of the sample (measured by weight) should pass through a 1/2-inch sieve. And, with aggregate size number 7 of crushed stone, 0-15% of the sample (measured by weight) should pass through a No. 4 sieve.

Table 1 Standard Sizes of Coarse Aggregate¹ Meeting Xerxes' Rounded Gravel

Amount of material passing through each laboratory sieve given as percentage of total weight.							
Grade Number	6	100%	90-100%	20-55%	0-15%	0-5%	—
	67	100%	90-100%	—	20-55%	0-10%	0-5%
	7	—	100%	90-100%	40-70%	0-15%	0-5%
Sieve Size							
	1 inch 25.0 mm	3/4 inch 19.0 mm	1/2 inch 12.5 mm	3/8 inch 9.5 mm	0.187 inch 4.75 mm No. 4	0.094 inch 2.36 mm No. 8	

Note: 1. Standard sizes of coarse aggregate per ASTM D-448, ASTM C-33 and AASHTO M 43.

Table 2 Standard Sizes of Coarse Aggregate² Meeting Xerxes' Crushed Stone Specifications

Amount of material passing through each laboratory sieve given as percentage of total weight.							
Grade Number	7	—	100%	90-100%	40-70%	0-15%	0-5%
	8	—	—	100%	85-100%	10-30%	0-10%
Sieve Size							
	1 inch 25.0 mm	3/4 inch 19.0 mm	1/2 inch 12.5 mm	3/8 inch 9.5 mm	0.187 inch 4.75 mm No. 4	0.094 inch 2.36 mm No. 8	

Note: 2. Standard sizes of coarse aggregate per ASTM D-448, ASTM C-33 and AASHTO M 43.

Deep Burial Installation Guidelines

For Tanks Installed at Depths Greater than 7 Feet and Less Than 24 Feet

Note: Approval for underground storage tank (UST) burial greater than 7 feet is site specific. Prior written approval must be obtained from Xerxes in order to maintain the warranty.

1. GENERAL

1.1. This supplement and the Xerxes Installation Manual and Operating Guidelines (subsequently referred to as "Installation Manual") must be read in their entirety before tank installation. All instructions in the Installation Manual are relevant and must be followed carefully.

1.2. Tanks installed at depths greater than 7 feet are viewed as "made-to-order" tanks and require prior written approval by Xerxes before the applicable warranty is activated.

1.3. Accessories such as risers and riser joints must be properly sized for deep burial.

1.4. The following areas of the installation are especially critical and must be verified:

1.4.1. Safety — Working in excavations can be extremely dangerous. 29 CFR, Part 1926, Subpart P states OSHA's requirements for working in all open excavations made in the earth's surface. You must obtain a copy of the regulations and follow them in their entirety. OSHA regulations are available free of charge by logging onto the internet at www.OSHA.gov.

1.4.2. Compaction — The backfill must be placed and compacted completely under the tank haunches and dome area. Voids must be eliminated by pushing backfill into the spaces. The natural angle of repose, (ϕ), is not acceptable. This is the most critical area of tank support and must receive special attention. (See FIGURE 1-1.)

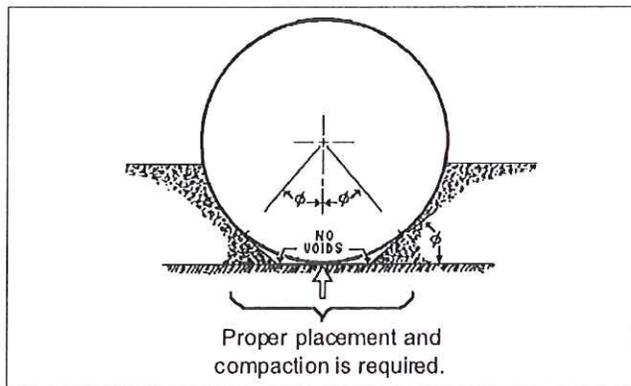


FIGURE 1-1

1.4.3. Backfill — Use only approved backfill material. It must conform to the specifications of ASTM C33, Par. 9.1, Sizes 6 through 8, with no more than 5% (by weight) passing a No. 8 sieve. For burials over 7 feet, carefully place and compact the backfill material around and up to diameter/2 over the tank.

1.5. In addition, the spacing from the tank to the in situ soil, other tanks or other structures must be increased as the depth of burial increases. The spacing is also a function of tank diameter. (See TABLE 1-1.)

Burial depth in feet	Normal tank spacing and side/end spacing
0 to 7 feet from surface grade	18-inch minimum
7 to 10 feet from surface grade	24-inch minimum or diameter/4 minimum, whichever is greater
10 to 24 feet from surface grade	linearly increase spacing diameter/4 to diameter/2

TABLE 1-1

1.6. A complete assessment of the in situ soil becomes more critical in deep burial situations. Xerxes recommends that a foundation engineer, familiar with the area, be consulted as to the suitability of the site for buried tank structures, for example, the in situ soil under the tank must be strong enough to support the backfill, etc. If unstable soil is present, a full foundation engineering design will be required.

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