# STANDARD FOR FIREGUARD® THERMALLY INSULATED ABOVEGROUND STORAGE TANKS

# F941

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## FIREGUARD® SPECIFICATION
## LOG OF SECTION CHANGES

| SECTION NUMBER | TECHNICAL BULLETIN | DATE OF CHANGE |
|---|---|---|
| ALL | REVISED | JANUARY 2006 |
| 4.9, 6.1, 6.1.3 | E06-1 | NOVEMBER 2006 |
| APPENDIX D - SEC 6.7-6.7.3 | E07-1 | FEBRUARY 2007 |
| NO CHANGES | E07-2 | JULY 19, 2007 |
| NO CHANGES | E08-1 | JANUARY 31, 2008 |
| NO CHANGES | E08-2 | MAY 27, 2008 |
| NO CHANGES | E08-3 | JULY 1, 2008 |
| APPENDIX B - SEC 1.0-r)1, 1.1-1.1.2 AND FIGURE B1.2 APPENDIX D - 3.2.1C | E08-4 | DECEMBER 2008 |
| SECTION 5.2.1, APPENDIX D - SECTIONS 3.2.2.2-3.2.2.8, FIGURE D-3.2.2.2 | E09-1 | JUNE 2009 |
| APPENDIX B 1.2 (A-D) | E09-2 | AUGUST 2009 |
| NO CHANGES | E10-1 | JULY 2010 |

## PREFACE

The Steel Tank Institute (STI), formed in 1916, is a not-for-profit organization whose purpose is to secure cooperative action in advancing, by all lawful means, the common purposes of its members and to promote activities designed to enable the industry to conduct itself with the greatest economy and efficiency.

It is further the purpose of STI to cooperate with other industries, organizations and government bodies in the development of reliable standards which advance industry manufacturing techniques to solve market-related problems.

This Fireguard® Thermally Insulated Aboveground Storage Standard is based on the application of sound engineering principles and the combined experience of STI membership, which includes state-of-the-art manufacturing considerations. It represents a composite of input from users, manufacturers, regulatory authorities and consultants.



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## 1.0 SCOPE

1.1 This specification covers a method of thermally insulating an aboveground storage tank for the purpose of providing a two hour fire rating. This design utilizes a double-wall steel tank with a monolithic insulation placed into the interstice of the tank. Both the primary and the secondary tank are equipped with emergency vents. It also addresses the inspection, testing, and installation of these tanks.

1.2 This tank assembly has been fully tested by Underwriters Laboratories in accordance with UL2085 and UL2080 and has two listings: Protected Secondary Containment Aboveground Tanks for Flammable Liquids and Fire Resistant Secondary Containment Tanks for Flammable Liquids.

1.3 The interstitial space has been tested to ensure that
a) fluid will flow and be detectable and
b) the emergency venting will work properly in the event of a pool fire.

1.4 This tank was tested in accordance with NFPA 30A, and UFC Appendix A-IIF-1.

## 2.0 DEFINITIONS

**CONTINUOUS WELDED JOINT:** A continuous weld bead without any discontinuities.

**HOSE STREAM RESISTANT:** A method of tank construction in which the tank system has a tested ability to prevent leakage of the primary tank or damage to the insulation material when the completed tank assembly is impacted with a stream of water for 2 ½ minutes, as per the UFC test criteria, with the purpose of simulating a fire hose. This test shall be conducted immediately after the furnace test.

**IMPACT PROTECTION:** A method of tank construction in which the tank system has a tested ability to prevent leakage of the primary tank if impacted by a vehicle. Testing shall consist of hitting the completed tank assembly with a 12,000 pound (5455 kg) weight moving at 10 m.p.h.(16 kph), 18 inches (457 mm) off the ground in a one square foot area.

**LICENSEE:** A fabricator who agrees to be subjected to quality assurance inspection by STI upon tanks built and in compliance with this specification.

**MANWAY:** A penetration of a tank whose purpose is to provide access for entrance into the tank. It may be used for inspection, etc., or to provide piping access for one or more pipe connections.

**MATERIAL TEST REPORT**: A report, normally obtained from the mill, that specifies the chemical composition of the steel.

**MONITORING DEVICE:** Equipment designed to monitor an operation or an area and signal if a problem exists.

**MONOLITHIC INSULATION:** A cement type material poured between the walls of a tank to minimize heat transfer from the secondary tank to the primary tank.

**NON-COMPLIANCE:** Any tank which fails to meet this specification.

**PROJECTILE (OR BALLISTICS) PROTECTION:** A method of tank construction in which the tank system has a tested ability to prevent penetration of a bullet into the primary tank. The ballistics test shall require that the tank be shot five times with a 150 grain (9.72 g) M-2 ball ammunition, having a muzzle velocity of 2700 feet per second (823 meters per second), fired from a .30 caliber rifle at a distance of 100 feet (30.5 m).

**PROTECTED TANK:** An aboveground atmospheric tank with secondary containment and an insulation system intended to reduce the heat transferred to the primary tank when the tank is exposed to a hydrocarbon pool fire, and provided with protection from physical damage.

**SEAL WELD:** A properly applied continuous weld which fills the weld groove and is leak tight.

**SECONDARY CONTAINMENT ABOVEGROUND TANK:** A primary containment tank is encompassed by a steel secondary tank forming an interstitial (annular) space. This space is capable of being tested or monitored for leakage.

**TWO HOUR FIRE RATING (for storage tanks):** A certified rating that indicates a storage tank system which has the ability to maintain the temperature of the primary tank surface below a specified limit when exposed to a 2-hour fire test.

**VARIANCE:** A deviation from the manufacturing specification which is not critical to the performance of the tank.

## 3.0 COMPLIANCE

3.1 All tanks manufactured by a Fireguard® Licensee must be built in strict conformance with these Fireguard® Specifications and are to be covered by a limited manufacturer's warranty. This technology is licensed by Steel Tank Institute and incorporates a third-party quality control program and a UL Listing.

3.2 To control quality, STI employs a staff of independent third party quality control inspectors making unannounced visits to plants. This inspection service is mandatory for all Licensees. These inspection services assure that tanks are fabricated in strict accordance with the latest edition of the Fireguard® Specification. Any tank determined not to conform to this specification must be corrected and reinspected by the tank manufacturer. STI may inform the Licensee that reinspection by third party quality control inspectors will be required prior to shipment. The STI Board of Directors has the authority to levy penalties for non-compliance with this specification.

3.3 All steel tanks or subassemblies to be used for STI licensed technologies must be fabricated and/or completed by a manufacturer subject to and under the auspices of STI's Quality Control program.

3.4 The Steel Tank Institute conducts regular quality assurance seminars. Licensee attendance at these seminars is mandatory.

3.5 The responsibility for supplying a tank in strict compliance with this specification, including all current appendices, tables, technical bulletins, supplements, addenda, etc. is the Licensee's. Also, careful inspection to assure compliance with current Fireguard® requirements is the Licensee's responsibility. Under no circumstances may any part of these responsibilities be delegated or assigned to a coating applicator, insulator, buyer, installer, hauler or any other second party. Final responsibility remains that of the Fabricator.

3.5.1 STI must be notified of all off site contractor work. The cost of STI inspectors visiting such contractors, if any, must be absorbed by the Licensee using the contractor. Quality control shall be done by the licensee on site, or the sub-contractor shall attend STI Quality Control meetings.

3.6 Licensees should consult STI for interpretations to this specification. Assistance will be given on the specific problem, but is not to be interpreted as setting precedents until, and if, revisions to the specification are issued.

3.7 Any tank which fails to meet the requirements of this specification shall be in a noncompliance.

## 4.0 GENERAL REQUIREMENTS

4.1 The Fireguard® tank and supports must meet the fabrication requirements of STI's UL 2085 Listing for an insulated secondary containment aboveground storage tank for storage of flammable and combustible liquids. Any waivers require written approval from the Steel Tank Institute.

4.1.1 As an option, tanks may be labeled per ULC-S655, “Aboveground Protected Tank Assemblies for Flammable and Combustible Liquids”. In accordance with this option, the steel tank and support construction shall be in accordance with either ULC-S601, ULC-S630 or ULC/ORD 142.18.

4.1.2 The minimum thickness of the primary tank shall be 0.123 inches (3.12 mm).

4.2 All cylindrical tanks may be built in sizes ranging from186 to 50,000 gallons (704 to 189,270 liters) capacity. Rectangular tanks may be built in sizes ranging from 186 to 24,700 gallons (704 to 93,500 liter) capacity.

4.3 A long-bolt manway shall not be used for emergency venting in lieu of an emergency vent.

4.4 All weld joints shall be made with continuous seal welds, in accordance with Appendix A, "Weld Profiles" unless otherwise stated within this specification.

4.5 Cylindrical tanks with flanged flat heads or flanged and dished heads. Flanged flat heads shall have an inside knuckle radius equal to at least two times the head thickness.

4.6 Materials allowed are carbon steel, stainless steel 304 and stainless steel 316.

4.7 Steel used in the manufacture of the tank must meet the requirements of Underwriters Laboratories standards or the ASME standard as applicable. In addition, all carbon steels shall comply with either (a) or (b).

(a) Carbon steels shall comply with ASTM A36, specification for structural steel; or ASTM A569, hot-rolled sheet and strip, commercial quality, hot-rolled carbon; or ASTM A635, specification for hot-rolled carbon steel sheet and strip, commercial quality, heavy thickness coils or ASTM A1011/A1011M, standard specification for steel, sheet and strip, hot-rolled, carbon, structural, high-strength low-alloy and high-strength low-alloy with improved form ability.

(b) Carbon steel shall have a carbon content of 0.3% or less and a carbon equivalency of 0.53% or less. Carbon equivalency (CE) shall be determined by the following formula:

$$CE = C + (Mn + Si)/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15$$

(C=Carbon, Mn=Manganese, Si=Silicone, Cr=Chromium, Mo=Molybdenum, V=Vanadium, Ni=Nickel and Cu=Copper)

4.7.1 Material test reports shall, as a minimum, specify the material composition and be retained on file by the manufacturer for a period of 1 year from the time of shipment of the tank. If a report is not obtainable from the steel mill, a metallurgical test may be obtained from other sources, such as a steel service center supplier, to identify the steel's composition.

4.8 Integral tank supports, such as saddles or skids, shall be approved by STI. Refer to Addendum A for additional support requirements.

4.8.1 All tank supports must be built in accordance with STI's UL Listing for protected secondary containment aboveground tank for flammable liquids.

4.8.2 No support may be in excess of 12 inches (305 mm) in height from the ground at the center of the tank.

4.8.3 All supports must be seal welded to the tank.

4.9 This standard does not address pipe connections to the tank. Fire and building codes, such as NFPA 30, NFPA 30A, IFC and UFC, should be followed for proper pipe and valve design and placement. In addition, all primary tank openings shall be located along the top of the tank above the maximum normal liquid level.

4.10 The primary and secondary tanks shall have provisions for normal and emergency venting in accordance with UL 142. Vent devices shall be assembled to or provided with each tank.

4.10.1 The secondary tank emergency vent fitting shall be placed within 2 feet (6.08 mm) of the center of the top of the tank.

4.11 A means shall be provided for the attachment of at least two grounding connections sized in accordance with NFPA780, Installation of Lightning Protection Systems.

4.11.1 A means for grounding may be provided by placing holes in the saddles or attaching a lug.

## 5.0 TIGHTNESS TESTING

5.1 Weld seams shall be inspected in accordance with Appendix A of this specification.

5.2 Before painting, each tank shall be tested to determine that the tank does not leak.

5.2.1 A safety relief valve set at the appropriate level is required. The flow rate through the pressure relief device used in air testing tanks must be more than the flow rate of the air supply.

5.2.2 All gauges must be kept in gook working order. If a test gauge is not believed to be accurate, then it shall either be replaced or calibrated.

5.2.3 All tanks must be tested in a well lighted area. On the surface of the tank where the inspector is testing the weld, the minimum visible light reading shall be 20 foot candles (215 lux).

5.2.4 Apply positive air pressure of
a) 3-5 psig (20.7-34.5 kPa) for horizontal tanks
b) 3 psig (20.7 kPa) maximum for rectangular tanks
c) 1½ to 2½ psig (10-17 kPa) for vertical tanks.

5.2.5 Apply seam test solution to all welds and inspect visually for bubbles indicative of a leak.

5.2.6 If leaks are noted during the test, they shall be repaired and retested.
**NOTE: Exercise caution when applying pressure to the tank to avoid over pressurization by not exceeding the pressure that first causes visible deformation of the tank.**

5.3 Perform an air test on the primary tank of all double wall tanks prior to the installation of the secondary tank.

5.3.1 There shall be no evidence of leakage or sign of permanent deformation following the leakage test. A tank wall, head, or roof may deflect when subjected to the leakage test pressure, but shall return to its original position and shape when the test pressure is released.

5.3.2 Each compartment of a tank having two or more compartments is to be tested separately for leakage.

5.4 Perform an air test on all double wall tanks after the installation of the secondary tank.

5.4.1 While maintaining the pressure in the primary tank, use air from the primary tank to apply a positive air pressure to the annular space. Do not attach the air supply directly to the annular space.

5.4.2 Apply seam test solution to all welds and inspect visually for bubbles indicative of a leak.

5.4.3 If leaks are noted during the test, they shall be repaired and retested.

## 6.0 MONOLITHIC INSULATION MATERIAL REQUIREMENTS

6.1 The insulation thickness required varies between 3-6 inches (76-152 mm) minimum depending on tank volume and the wetted surface area (see 6.1.1 to 6.1.3 for requirements). The approved insulation thickness is required around the perimeter of the primary tank except as noted in 6.2. The monolithic insulation material may be mixed in a mortar mixer, a transit mixer, or with a special mixer/pump type equipment. The various methods of mixing and installing the insulation material are outlined in Addendum A of this Specification. The specification for the perlite is also given in Addendum A.

6.1.1 Tanks with total primary tank volume greater than or equal to 785 gallons (2971 liters) require 3 inches (76 mm) minimum insulation thickness.

6.1.2 Tanks with total primary tank volume less than 785 gallons (2971 liters) with wetted secondary tank surface area ($ft^2$) to primary tank volume (gallons):

$\leq$0.175 $ft^2$/gallon (0.004 $m^2$/L) require 3 inch (7.62 cm) minimum insulation thickness.

>0.175 $ft^2$/gallon (0.004 $m^2$/L) require 6 inch (15.2 cm) minimum insulation thickness.

6.1.3 Procedure for calculating the ratio of primary tank volume to secondary tank the wetted surface area is as follows:

a. CYLINDRICAL TANKS

*Primary tank volume* = 3.14 x $r^2$ x $L_P$ where 'r' is the primary tank radius and $L_P$ is the length of the primary tank

*Secondary wetted surface area* = 0.75 { [(3.14*$D_S$ $^2$) / 2 ] + (3.14*$D_S$*$L_S$) }, where $D_S$ is the diameter of the secondary tank and $L_S$ is the length of the secondary tank

b. VERTICAL TANKS

*Primary tank volume* = 3.14 x $r^2$ x $H_P$ where 'r' is the primary tank radius and $H_P$ is the height of the primary tank

*Secondary wetted surface area* = (3.14*$D_S$*$H_S$) where $D_S$ is the diameter of the secondary tank and $H_S$ is the height of the secondary tank. If the tank is set on supports or channels, then the area of the bottom must also be included. Also, if the tank is over 25 feet high, then $H_S$ is to be 25 feet. Wetted surface area calculations do not include the top.

c. RECTANGULAR TANKS

*Primary tank volume* = $L_P$ x $W_P$ x $H_P$ where $L_P$, $W_P$, and $H_P$ are the length, width and height of the primary tank, respectively

*Secondary wetted surface area* = (2 x $L_S$ x $H_S$) + (2 x $W_S$ x $H_S$) + ($L_S$ x $W_S$) where $L_S$, $W_S$, and $H_S$ are the length, width and height of the secondary tank, respectively. Because rectangular tanks are regularly supplied with channels on the bottom, the area of the bottom is included in this calculation. Wetted surface area calculations do not include the top.

6.2 Tanks shall have a 3/4 inch (19 mm) to one inch (25 mm) uninsulated space at the top of the tank. See Addendum A, Section 7 for more information.

## 7.0 COATING

7.1 Prior to abrasive blasting, the tank shall be inspected (and the appropriate section of the inspection form signed) to confirm that the following conditions exist:

1. Tank, or structure, is complete and conforms to governing code or to drawing submitted to and approved by STI.
2. Grind all sharp edges, corners, weld beads and remove all weld slag. Weld quality shall meet Appendix A.
3. Tightness tests are complete.
4. Label holders (if necessary) are welded on the tank.
5. Threaded openings shall be covered with pipe plugs or plastic thread protectors. Mask any exposed threads.

6. All steel surfaces to be coated have been thoroughly cleaned, removing all dirt, grease, oil and dust.
7. Temperature, humidity and dew point are within coating manufacturer's recommendations.

7.2 Prior to coating, the entire exterior surface including bottom surface shall be subjected to the abrasive blast. A minimum brush blast (SSPC-SP 7) cleaned surface when viewed without magnification shall be free of all visible oil, grease, dirt, dust and loose rust.

7.2.1 Tightly adherent mill scale (including staining from mill scale or rust) can remain as long as it is evenly dispersed over the tank's surface area. Tightly adherent mill scale is defined as being non-removable through lifting action with a new blunt edge putty knife. The surface shall be uniformly roughened to a degree suitable for the applicable coating and shall be in compliance with the coating manufacturer's surface preparation requirements.

7.2.2 Surface imperfections such as sharp edges, projections, crevices, laminations, weld slag residue, etc., can cause premature failure and pose as features which are difficult to cover. The severity of these features can directly impact the quality of blast cleaning operations. No more than 2 weld spatters may remain on any 6 inches x 6 inches (36 sq. inch) area (152 mm x 152 mm or 23,104 sq. mm) of the tank.

7.3 Surface profile is the roughness of the surface which results from abrasive blast cleaning. The profile depth is dependent upon the size, type and hardness of the abrasive, particle velocity, angle of impact, surface hardness and maintenance of working mixtures. The minimum surface profile shall be 1.5 mils (0.038 mm).

7.4 The selection of abrasive size and type shall be based on the type, grade and surface condition of the steel to be cleaned; type of blast cleaning system to be employed; the finished surface to be produced and whether the abrasive will be recycled. Recycled abrasives may be used when size and cleanliness is maintained. All abrasives shall be dry and free of oil, grease and other contaminants.

7.5 Complete abrasive blast without interruption and apply the coating immediately after, especially in conditions of high relative humidity. In normal conditions a period of up to 24 hours may elapse between start of blasting and completion of coating. Tank must be reblasted if rust-back occurs or more than 24 hours elapses.

7.6 After blasting, the surface shall either be vacuumed or cleaned by blowing clean, dry, oil-free compressed air over the entire surface of the tank.

7.7 The entire exterior of the tank shall be coated with a primer coat followed by a coating of either an enamel, polyurethane, or coating of equal or higher quality. The primer and coating shall both be applied to a minimum of 1½ mils (0.025-0.038 mm) DFT each over the entire surface of the tank. A minimum total 3 mils (0.076 mm) DFT is required, or twice the surface profile, whichever is greater. The primer and coating shall be compatible with each other.

7.8 As an alternate to Section 7.7, a one coat paint system may be used with a minimum total 3 mils (0.076 mm) DFT, or twice the surface profile, whichever is greater. After coating has cured, inspection with DFT gauge shall be made. Measurements shall be taken at dispersed points over the entire surface including hard to reach places.

7.9 The entire coating procedure may be done either before or after the insulation material is installed.

7.9.1 If the insulation is installed after coating the tank, care must be taken not to damage the coating. This can be accomplished either by protecting the tank with a covering, or cleaning any damaged areas and touching up the paint.

## 8.0 COMPLETION

8.1 The following steps are to be completed after the above specifications have been complied with:

8.1.1 Apply labels per Appendix B.

8.1.2 Thread protectors or plugs shall be installed in each opening during storage and shipment.

8.2 Tanks in storage will be considered complete by the STI Quality Control Inspector unless they are stored in a separate location and tagged, “Do not ship until re-inspected.”

8.3 Inspect tank and bring inspection papers up to date. Carefully load or store tank. Tank must be shipped with installation instructions per Appendix D.

8.4 Complete required paper work. See Appendix C.

## 9.0 FINAL INSPECTION

9.1 Final inspection of Fireguard® tanks shall be completed as soon as the coating has hardened and prior to storage. Tanks in storage will be considered completed by the STI quality control inspector unless they are tagged "Do not ship until re-inspected."

9.2 Inspect tank and bring inspection papers up to date. Carefully load or store tank.

9.2.1 Installation instructions must be sent to every tank site and signed by the person accepting delivery.

9.3 Mail inspection papers to STI. See Appendix D for Installation Instructions that must be followed for warranty to be in effect.

**Disclaimer**

Although the information in this standard is believed accurate and reliable, STI makes no warranties, express or implied , including NO IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, as to any of the ideas, information or guidance in this Standard. STI warns that the types of work described herein should be left to trained professionals. Federal, state and municipal laws, regulations and ordinances should be consulted. STI shall not be liable in the event of any conflict between this Standard and such laws, regulations and ordinances. In no event, whether as a result of breach of warranty, breach of contract, negligence or otherwise, shall STI be liable for any loss or damage, including without limitation, any special, incidental, indirect or consequential damage resulting from the use of or reliance on this Standard.

This Standard may be revised or withdrawn at any time without prior notice. This practice does not necessarily address all of the applicable health and safety risks and precautions with respect to particular materials, conditions or procedures. Information concerning safety and health risks and precautions should be obtained from the applicable standards, regulations, suppliers of materials or material safety data sheets.

# APPENDIX A
# WELD PROFILES

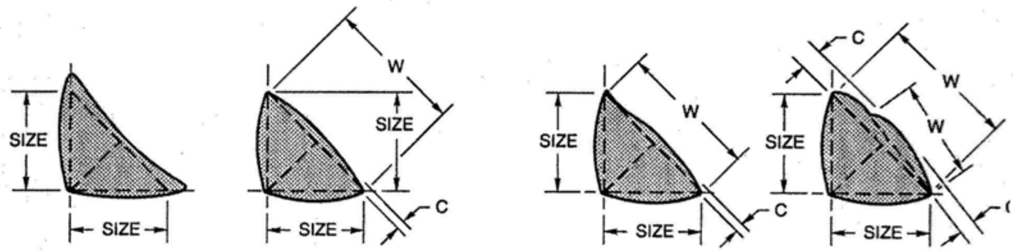
## 1.0 GENERAL

1.1 All welds on Fireguard® tanks are to be seal welds without undercuts, cracks, pinholes, or surface irregularities that will prevent adequate surface preparation and complete coating of the welds.

1.2 Section 1.1 should not be construed as superseding more stringent requirements of any standard, code, regulation, specification, etc.

1.3 It is assumed that a Licensee with good weld profiles has also gone to the trouble of assuring that good penetration with the proper welding materials and procedures will have also been accomplished. For assistance in accomplishing quality welds consult your material and equipment specialists.

1.4 The figures shown on the following page (Figure A1.4) identify both acceptable and unacceptable weld profiles.

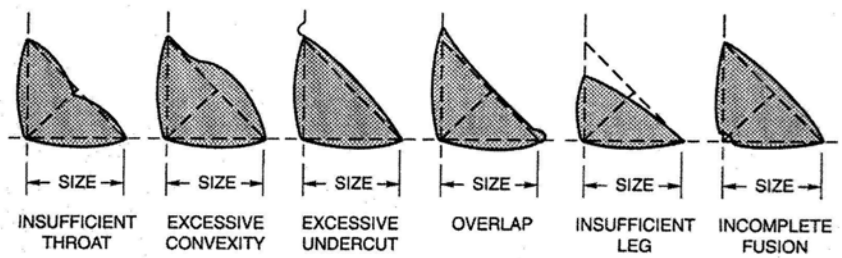



**(A) DESIRABLE FILLET WELD PROFILES**

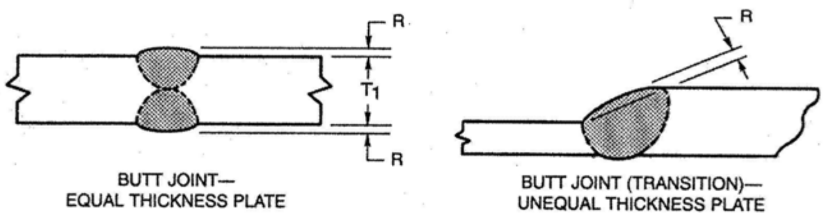
**(B) ACCEPTABLE FILLET WELD PROFILES**

NOTE: CONVEXITY, C, OF A WELD OR INDIVIDUAL SURFACE BEAD WITH DIMENSION W SHALL NOT EXCEED THE VALUE OF THE FOLLOWING TABLE:

| WIDTH OF WELD FACE OR INDIVIDUAL SURFACE BEAD, W | MAX CONVEXITY, C |
|---|---|
| W ≤ 5/16 in. (8 mm) | 1/16 in. (1.6 mm) |
| W > 5/16 in. TO W < 1 in. (25 mm) | 1/8 in. (3 mm) |
| W ≥ 1 in. | 3/16 in. (5 mm) |

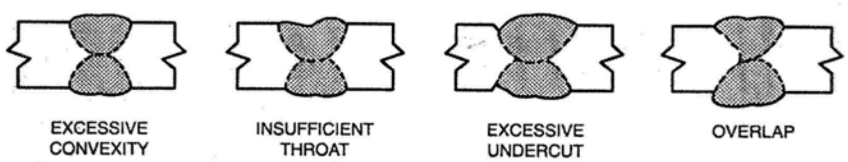



**(C) UNACCEPTABLE FILLET WELD PROFILES**




NOTE: REINFORCEMENT R SHALL NOT EXCEED 1/8 in. (3 mm). SEE 5.24.4.

**(D) ACCEPTABLE GROOVE WELD PROFILE IN BUTT JOINT**




**(E) UNACCEPTABLE GROOVE WELD PROFILES IN BUTT JOINTS**

## FIGURE A1.4
**ACCEPTABLE AND UNACCEPTABLE - WELD PROFILES**

## APPENDIX B
## MARKING REQUIREMENTS

**1.0** Each tank shall be marked in accordance with UL label requirements, including legibility and permanency, as follows:

a) Manufacturer's name and address

b) The Fireguard® Licensee must obtain a label kit from STI for each Fireguard® tank. Two large pressure-sensitive vinyl Fireguard® labels are supplied in each label kit for horizontal tanks and four labels are supplied in each label kit for rectangular tanks. These are to be applied at the center of each side of the tank. The Steelmark label shall be applied above the left-hand corner of each Fireguard® label. (Note: Tanks less than or equal to 1,500 gallons (5678 liters) in volume require only two Fireguard® labels to be placed on opposite sides of the tank.)

c) The tank capacity of the primary containment tank. For compartment tank constructions, the capacity of each compartment shall be marked.

d) The month and year of manufacture. It is acceptable for the date of manufacture to be abbreviated, or in code affirmed by the manufacturer, if the code does not repeat in less than 20 years, and does not require reference to the production records of the manufacturer to determine when the product was manufactured.

e) The following statements:

1) For the primary containment tank, "This Tank Requires Emergency Relief Venting. Capacity Not Less Than ____ Cubic Feet Per Hour," with the appropriate value derived from the requirements for steel aboveground tanks for flammable and combustible liquids, UL 142.

2) For the secondary containment tank,"This Tank Requires Emergency Relief Venting. Capacity Not Less Than ____ Cubic Feet Per Hour (Primary Tank) and ___ Cubic Feet Per Hour (Annular Space)" with the appropriate values derived from the requirements for steel aboveground tanks for flammable and combustible liquids, UL 142.

f) For tanks provided with a spill container, the following statement shall be marked on the lid: "Keep Closed and Locked When Not In Use" or the equivalent. In addition, instructions for filling the tank and draining the containment box shall also be marked on the cover.

g) †† "This tank shall be investigated to determine acceptability of use after fire exposure damage, other physical damage, or misuse".

h) †† Tanks shall be either marked: "Vehicle Impact Resistant" or the equivalent, or shall be marked to require protective guard posts upon installation.

i) †† Protected tanks can be marked: "Projectile Resistant" or the equivalent if the steel thicknesses used meets the requirements in Section 1.2 of Addendum A of this specification.

j) †† The statement “If a leak is detected (water or fuel), this tank is to be removed from service. The local code authority and tank manufacturer should be contacted to determine if the insulation can be replaced or repaired.”

k) †† The statement “Pressurize primary tank when pressure testing annular space.”

l) The serial numbered label issued by STI shall be attached to the tank in a location on the top of the tank or the tank head so that it can be easily seen. Attach it adjacent to the UL or ULC label.

m) All tank connections shall be correctly identified, for example, venting, filling, and monitoring.

n) †† The statement “Follow Installation Instructions.”

o) †† The statement “This tank is intended for stationary installation only.”

p) †† The statement “This tank is intended for installation in accordance with either NFPA 30, NFPA 30A, NFPA 31 or the Uniform Fire Code.”

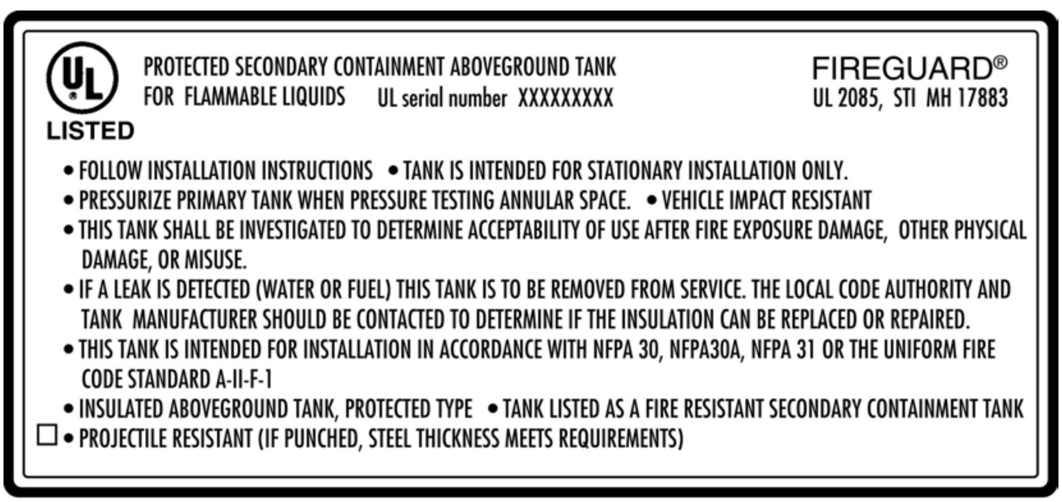
q) Rectangular tanks require the statement, “Maximum leakage test pressure of 3 psig.”

r) ††“UL 2085 Protected Secondary Containment Aboveground Tank for Flammable Liquids”

    1) As an alternative, “ULC-S655, Aboveground Protected Tank Assemblies for Flammable and Combustible Liquids”.

1.1 Tanks shall bear either a UL Listing label or a SwRI label.

1.1.1 UL Listing label - The marking requirements described in Section 1.0 above and denoted with this symbol †† are included in the label shown in Figure B1.1. This label can be obtained from Topflight Corporation.




P/N – Fireguard
Black printing on white stock

**FIGURE B1.1**

1.1.2 SwRI Listing label - The marking requirements described in Section 1.0 above and denoted with this symbol †† are included in the label shown in Figure B1.2. This label can be obtained from STI.

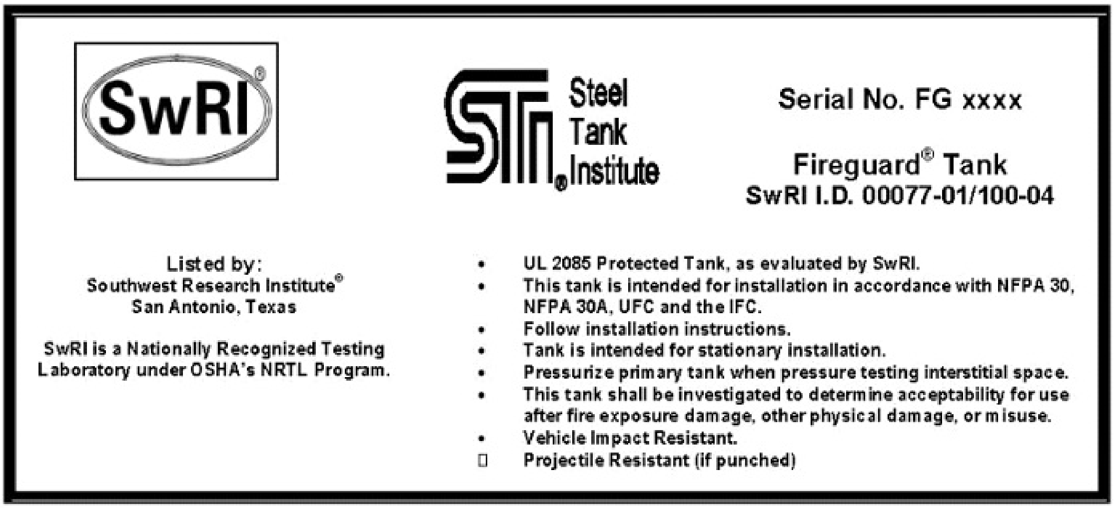



**FIGURE B1.2**
**SwRI Label Mark for Fireguard® Tanks**

1.2 The following list of labels must be applied to a Fireguard® tank before the tank leaves the manufacturer's site.

a) The weight of the tank in pounds shall be marked at a location near the lift lugs, and/or on the bill of lading. The weight of the tank in pounds (or kg) shall be marked at a location near the lift lugs, and/or on the bill of lading.

b) STI Maintenance tag with the following language:
"The primary tank should be inspected monthly for the presence of water. Inspection should take place at the lowest possible points inside the primary tank. **Remove any water found.** Water and sediment in fuel can cause plugging of filters. Also, bacterial growth originating from the fuel, can cause filters to plug and corrosion of tanks and lines. A report by the US Department of Energy, BNL 48406, provides information on methods to test for and remove water, test for bacterial presence in fuel, tank cleaning and fuel additives. Additional Installation, Testing, & Maintenance Instructions are provided with each tank. Failure to adhere to these instructions may void any applicable warranties."

c) Other required and appropriate warning labels shall be applied, as required by the authority having jurisdiction including, but not limited to, the following statement:

1) "This tank requires overfill prevention and an anti-siphon device."

## APPENDIX C
## INSPECTION, REPORT FORMS AND PROCEDURES

1.1 Procedures of inspection and reporting must be followed for the purpose of assuring uniform high quality of product from all STI Licensees/Fabricators.

1.2 The Licensee/Fabricator must obtain a Label Kit from STI for each tank. The label kit includes several decals and forms. The Licensee/Fabricator shall assign a serial number to each tank and use care to assure that that label is attached to the tank to which it is assigned. This serial number can be in the form of a UL number, or an internal work order number.

1.3 An Inspection Form must be filled out on each tank as it is built. Make sure the Inspection Form is signed by a qualified QA designated employee to indicate that the requirements of this specification have been met.

1.3.1 Return the white copy to STI for STI files. Keep the yellow copy for the Licensee's files.

# APPENDIX D
# INSTALLATION AND TESTING INSTRUCTIONS

## 1.0 TANK SITE EVALUATION AND PREPARATION PRIOR TO INSTALLATION

1.1 The foundation must be designed to support the tank plus 100% of its contents when full. The foundation design shall also take into account the type of support that is being used and the point load associated with that support. The foundation may be constructed using concrete, asphalt, gravel or other stable material and must include provisions in its design to prevent tank movement. The foundation should include any provisions necessary for seismic design. The foundation design must also include provision for draining surface water away from the tank.

1.2 For tank installations without cathodic corrosion protection, the tank should be grounded in accordance with applicable electrical and fire code standards.

1.3 Where the steel tank body is in contact with the earth, use a zinc grounding rod. Do not use a copper grounding rod.

1.4 Where the steel tank body is in contact with the earth or foundation, it should be protected from external corrosion. For external corrosion protection using cathodic corrosion protection, consult applicable standards (i.e., National Association of Corrosion Engineers) to provide the tank with appropriate protection from lightning without interference with the corrosion protection. Steel tanks in contact with the earth should not use copper grounding. Refer to STI R893-89, "Recommended Practice for External Corrosion Protection of Shop Fabricated Aboveground Storage Tank Floors."

1.5 Tanks located in areas subject to flooding must be protected against floatation.

1.6 Aboveground tanks should not be located above underground utilities or directly beneath overhead power lines.

1.7 The tank shall be protected from vandalism and accidental damage in accordance with all applicable codes, i.e., NFPA 30, NFPA 30A, UFC, etc. as well as local environmental regulations and safety codes. Consult local authorities before installing this tank.

## 2.0 TANK HANDLING

2.1 Do not handle or install the tank without having knowledge and experience in procedures involved with proper and safe installation of an aboveground tank used for storage of stable, flammable and combustible liquids.

2.2 Equipment for handling the tank shall be of adequate size to lift and position the tank. **DO NOT DROP OR DRAG THE TANK.**

2.3 Tanks shall be carefully handled using cables or chains of adequate length (with spreader bars, if necessary) and size. Attach to the tank using the lifting lugs provided. Care should be taken that the angle between the two cables, at the lift point, shall be no greater than 60 degrees.

2.4 **DO NOT HANDLE OR MOVE THE TANK UNLESS IT IS EMPTY.**
2.5 This is a stationary tank. Do not use this tank for transport of any product.

## 3.0 TESTING

3.1 **GENERAL REQUIREMENTS**

3.1.1 An on-site air test of the tank may be required by local authorities to ensure no damage has occurred in shipping and handling. All testing shall be done as described below.

3.1.2 Vacuum monitored double wall tanks are shipped from the manufacturer with a vacuum drawn on the space between the walls. Read and record the vacuum pressure. If the vacuum gauge reading is less than 12 inches Hg (40.5 kPa), contact the original tank manufacturer.

3.1.3 In lieu of the air pressure test described below, a vacuum may be applied to the interstice of a double-wall tank or to the interstice of a double-bottom tank. DO NOT APPLY A VACUUM TO THE PRIMARY TANK OF A DOUBLE-WALL TANK OR TO A SINGLE-WALL TANK. A vacuum of 7" to 10" Hg is to be applied to the
interstice and held for at least 24 hours with no more than a 2" Hg vacuum loss allowed. If this vacuum cannot be held for 24 hours, then perform the air test procedure described below.

3.1.3.1 Caution must be taken in applying a vacuum to the interstice of a tank and the testing must be stopped if any deformation appears on the tank.

3.2 **AIR PRESSURE TEST PROCEDURE FOR TANKS**

3.2.1 Remove emergency vents and cap openings to hold tank pressure as required. NOTE: Use only calibrated air pressure gauges with a 0-15 psig (0-103 kPa) dial span. The relief valve must have a flow rate at the set pressure that is greater than the flow rate of the air supply line. The regulated air supply test pressure used for this test should be as follows:

a. **HORIZONTAL CYLINDRICAL TANKS** - Not less than 3 psig (20.7 kPa) nor more than 5 psig (34.5 kPa) . Set pressure relief valve in test air supply line at 5.5 psi (38 kPa).

b. **VERTICAL TANKS** - Not less than 1½ psig (10.4 kPa) nor more than 3 psig (20.7 kPa). Set pressure relief valve in test air supply line at 3 psig (20.7 kPa).

c. **RECTANGULAR TANKS** -Not more than 1-1/2 psig (10.4 kPa). Set pressure relief valve in test air supply line at 1-1/2 psig (10.4 kPa).
CAUTION: Do not leave pressurized tank unattended while the pressure line/air line is connected. Do not stand in front of tank heads or fittings when pressurizing tank.
Pressurizing of large tanks may result in the slight deformation of the top and bottom of vertical tanks, of the sides of rectangular tanks, and of the heads and ends of cylindrical tanks. Should deformation appear severe, immediately relieve the pressure.

3.2.2 **TANK PRESSURIZING PROCEDURE**

3.2.2.1 The following air pressure testing does not apply to double-wall tanks equipped with interstitial vacuum monitoring systems. (In lieu of the air pressure test, the tank may be shipped from the factory with a vacuum in the tank interstice. Read and record the vacuum pressure. If the vacuum pressure gauge reading is less than 12 inches Hg (40.5 kPa), contact the tank manufacturer).

3.2.2.2 Install test piping as shown in Figure D-3.2.2.2. Temporarily plug, cap or seal off remaining tank openings to hold pressure.

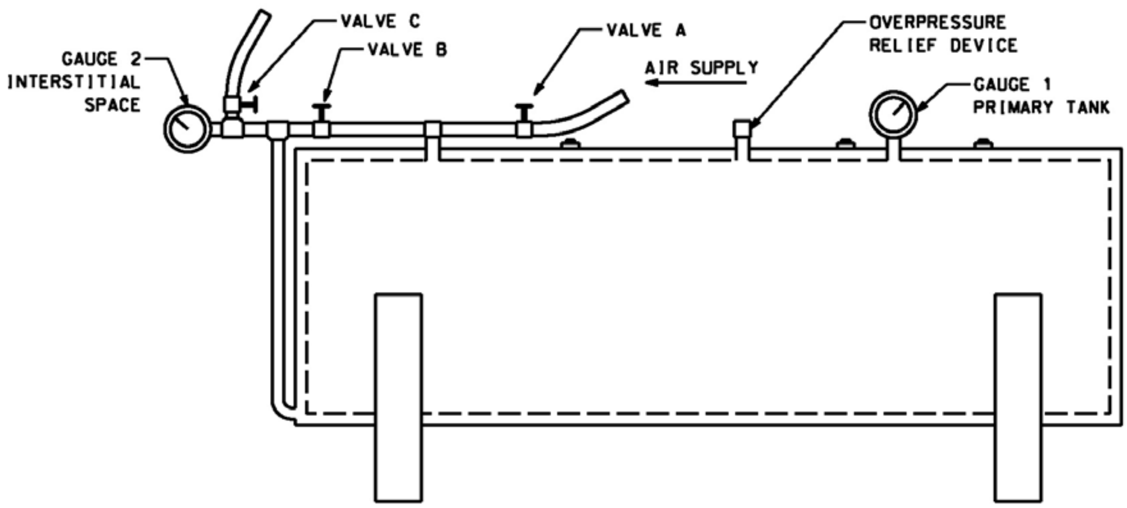



**FIGURE D-3.2.2.2**
DOUBLE WALL TANK

3.2.2.3 Close valves A and B. Open valve C.

3.2.2.4 Connect the regulated test air supply line to test piping as shown in Figure D-3.2.2.2.

3.2.2.5 Slowly open valve A to pressurize the primary tank. Pressure gauge 1 should indicate test air pressure given in Section 3.2.1 above.

3.2.2.6 Close valve A. Disconnect the regulated test air supply line from the test piping.

3.2.2.7 Monitor test pressure in the primary tank for 1 hour minimum. A steady drop in pressure reading for gauge 1 indicates there may be a leak in the primary tank. Check the fittings, the gauge, and then retest. If the problem persists, contact the tank manufacturer.

3.2.2.7 If no leaks are found, close valve C and slowly open valve B to pressurize the interstitial space between the double walls of the tank.

WARNING: Do not apply air pressure to the interstitial space between the walls of a double wall tank without air pressure in the primary tank. Do not apply air pressure to the interstitial space that is higher than the air pressure in the primary tank. Damage to the tank may result.

Pressure gauge 1 will indicate a slight drop in test pressure when valve B is opened, but should hold steady at the lower pressure. If the test pressure drops below the minimum requirements, close valve B, reconnect the air supply line and slowly open valve A to increase the pressure in the primary tank. When the required pressure is indicated on gauge 1 close valve A, disconnect the test air supply line. Open valve B to equalize the pressure in the primary tank and the interstitial space. Gauge 1 and gauge 2 should have the same pressure reading.

3.2.2.9 Close valve B. Hold the test pressure in the interstitial space for 1 hour minimum. A steady drop in pressure gauge 2 indicates there may be a leak in he interstitial space. Check the fittings, the gauges, and then retest. If the problem persists, contact the tank manufacturer.

3.2.2.10 Proceed to Section 3.2.3, "Detection of Leaks" below.

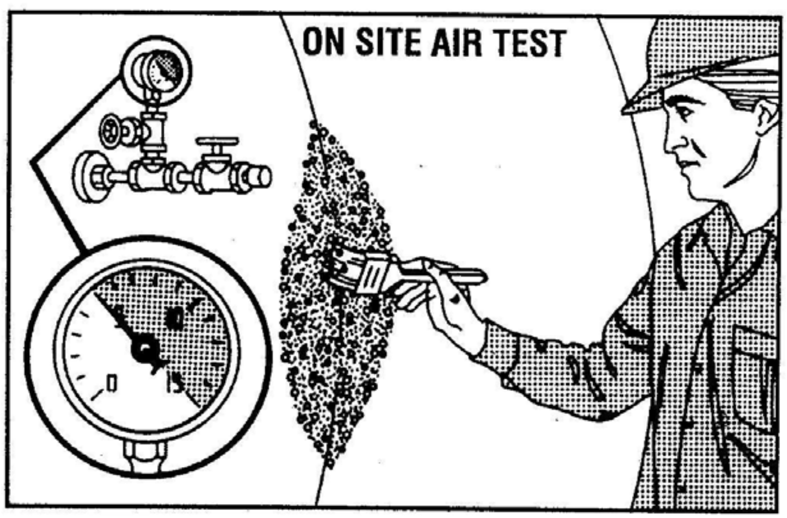
3.2.3 **DETECTION OF LEAKS**

3.2.3.1 Immediately apply the leak test solution to the tank exterior surfaces, welds, fittings, etc. Check for leaks. No leaks are allowed. If leaks are found, notify the tank manufacturer. If no leaks are found, testing of the tank is complete.

3.2.3.2 Open valve C, then slowly open valve B to release the test air pressure.

3.2.3.3 With the tank depressurized, remove the test piping, temporary plugs, caps and seals. Reinstall the emergency relief vents, etc. which were removed in Section 3.2.1 above. Emergency vents are required on both the primary tank and the secondary tank

WARNING: Emergency relief vents must be operable to prevent causing tank failure by over-pressurization.



## 4.0 TANK PIPING AND ACCESSORIES

4.1 Install all permanent piping and fittings using compatible, non-hardening thread sealant material.

4.2 All unused tank openings must be properly sealed and tested to be liquid and vapor tight prior to putting the tank into service.

4.3 DO NOT WELD ON THE TANK, MODIFY OR PENETRATE THE TANK STRUCTURE IN ANY WAY WITHOUT THE EXPRESS WRITTEN PERMISSION OF THE TANK MANUFACTURER.

4.4 All tank accessories shall be installed as required per local codes. Anti-siphon devices, overfill shut-offs and alarms, vents gauges, emergency vents, etc. are common requirements for tanks storing motor fuels for the purpose of being dispensed into motor vehicles.

## 5.0 LABELING

5.1 Tanks shall be labeled in accordance with all applicable codes.

## 6.0 MAINTENANCE

6.1 The tank operator should perform periodic walk-around inspections to identify and repair areas of damage to the vessel or the coating itself and check for proper drainage around the tank area.

6.2 It is imperative that the tank exterior be inspected periodically to ensure that the integrity of the coating is maintained. The frequency of periodic repainting will be based upon environmental factors in the geographic area where the tank is located. Special consideration should be given to the selection of the paint, surface preparation and coating application. The coating selected should be suitable for use with the current coating, or the existing coating should be removed. The coating selected should be of industrial quality.

6.3 Proper site preparation and maintenance are vital to ensure drainage of surface water. Should ground conditions change or settlement occur, take the appropriate steps to maintain proper drainage and prevent standing water near or under the tank area.

6.4 The primary tank shall be inspected monthly for the presence of water at the lowest possible points inside the primary tank. Remove any water found. Water and sediment in fuel can cause plugging of filters. Also, bacterial growth, originating from the fuel can cause corrosion of tanks and lines. For procedures on how to check for the presence of water and removal of water, refer to API Recommended Practice 1621, Appendix D and API Standard 2610. Another source of information is a report by the US Department of Energy Brookhaven National Laboratory, BNL 48406, which provides information on methods to test for and remove water, test for bacterial presence in fuel, tank cleaning and fuel additives.

6.5 This tank must be removed from service if damaged by fire exposure, other physical means or misuse.

6.6 Failure to adhere with these maintenance instructions may void your warranty.

6.7 Tank relocation requirements - often aboveground storage tanks are relocated. The following instructions are to be followed when this occurs: All steps are to be documented and the documentation is to be kept for the life of the tank.

6.7.1 The hazards associated with the cleaning, entry, inspection, testing, maintenance or other aspects of ASTs are significant. Safety considerations and controls should be established prior to undertaking physical activities associated with ASTs. Cleaning of tanks must be per state and local jurisdiction requirements.

6.7.2 Refer to the STI Standard SP001, "Standard for the Inspection of Aboveground Storage Tanks" for requirements concerning tank inspections. This SP001 Standard details requirements for inspections based on the tank installation and age. A tank must undergo the appropriate inspection prior to relocation.

6.7.3 In addition, the tank must be subjected to a pressure (or vacuum) test as detailed paragraph 3.2 above except an inert gas, such as nitrogen, should be used for tanks that have previously held fuel.

**Disclaimer**

These instructions are intended only as an aid to tank installers who are knowledgeable and experienced in aboveground tank installation. Compliance herewith does not necessarily meet the requirements of applicable federal, state and local laws, regulations and ordinances concerning tank installation. STI makes no warranties, express or implied, including but not limited to, any implied warranties of merchantability or fitness for a particular purpose, as a result of these installation instructions.

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