Sti-P3® Tank Tips

Technical Bulletin	Title	Comments
	Venting Requirement of UL58 Tanks	Enclosed is a letter from UL deleting the requirement for venting of a double wall UL 58 tank if the tank is shipped with a vacuum on the interstice. If the tank is not shipped with a vacuum on the interstice, the interstice only needs to remain vented until the tank is vented.
93-10	Vacuum Testing	Double wall tanks with less than one-half inch separation shall have no maximum vacuum limitation. Double wall tanks (with space between the heads exceeding one-half inch) should use vacuum not to exceed 10" Hg, unless the heads are reinforced by spacers placed vertically and off center.
97-1	Welding Procedures	Welding procedures will be available from STI for the use of any member. These procedures will cover: SAW (sub-arc) SMAW (stick) GMAW (MIG) FCAW (fluxcore)
97-2	UL58 9th Edition UL1746 3rd Edition Roark Formula	Most of you are probably aware that UL issued a new edition of 1746 on September 13, 1996. A new edition of UL 58 was issued on December 13, 1996. Both of these standards now require tanks to be manufactured in accordance with the Roark formula. For most tank sizes, the current charts in 58 may be used because they exceed the minimum wall thickness calculated under Roark. However larger tanks, for instance exceeding 35,000 gallons will be required to be built from thicker steel. (A 12' x 42' single wall 35,000 gallon tank will be minimum 0.381, compared to 0.365 required under the old UL 58.) Other differences in the new standard include: • The maximum burial depth must be marked on the tank. The burial depth must be a minimum 5 feet. • Head thickness is a function of diameter now instead of capacity (length). • Please refer to the standard for other differences. STI has developed a spreadsheet to calculate the wall thickness for any size tank, both single wall and double wall. We also have available a spreadsheet that was developed by UL for their use. Both of these spreadsheets were written in Excel for windows. While either of these may be used as an aid to determine the minimum thickness of steel, neither should be relied on solely by your company without being verified by you. Copies of these spreadsheets are available either by downloading them through STI's website or you can contact us and we will email you the spreadsheet. Copies of these spreadsheets are available either by downloading them through STI's website or you can contact us and we will mail you a disk.

Technical Bulletin	Title	Comments
98-2	Roark Formula Changes	STI recently completed new testing with UL with regards to the Roark formula. The testing allows STI members greater flexibility in designing their underground storage tanks when using bulkheads or stiffeners. Now, when designing tanks with stiffeners or bulkheads, STI members may place the stiffener in various locations along the tank length, and still take credit for the stiffener when calculating the required tank thickness. To go along with this testing, STI has developed a modified version of the Roark formula excel spreadsheet. This program, or an approved alternate, must be used if you intend to take credit for a stiffener that is not directly at the center of the tank, or when two stiffeners are used, at the 1/3 and 2/3 positions. One copy of the new spreadsheet has been included with this technical bulletin to each manufacturing plant. As an example of what this new testing allows you to do, I have provided the following examples 15,000 gallon tank, split 10/5 8,000 gallon tank Diameter = 126" diameter = 96" length = 256" length = 286" one stiffener at tank center (flat plate rolled hard way = 3/8" x 2 ½") min shell thickness = 0.23" min shell thickness = .167
98-3	Roark Formula	Due to comments received at the STI summer meeting, STI has made revisions to the Roark formula spreadsheet. One of the differences on the new spreadsheet is that we made it clear that you can only utilize two stiffeners, or bulkheads, in calculating the reduced shell thickness. Also, on the STI inspection form for underground tanks, in the section for tank shell thickness, you need to fill the *measured/actual* shell thickness, not the calculated/required shell thickness. Using the Roark formula requires that the shell thickness actually be measured and recorded for every tank. The UL criteria for determining steel thickness is as follows: *"The thickness of steel is to be determined by five micrometer readings equally spaced along the edge of the full piece as rolled. Thickness is to be determined on the plate or sheet not less than 3/8 inch (9.5 mm) from a cut edge and not less than 3/4 inch (19.1 mm) from a mill edge."* Based on this, STI is requiring that the steel thickness be measured in at least five places on the tank, near the edge of the sheet. The average of the five readings is to be recorded on the inspection form.
03-3	Type II Double-wall UST Construction	UL 58 defines a Type II tank as follows: *3.3 TYPE II TANK – An outer tank physically separated from the inner primary containment tank by standoffs; where, the inner tank is completely contained within the outer tank.* UL has clarified that this definition allows for any double wall tank that physically separates the inner tank from the outer, whether by lap welds, stand-off material, channels or other UL approved means can be labeled as a Type II tank. This is stated in UL 58 as follows: *15.6 Standoffs shall provide a defined annular space between the primary and secondary tank. Examples of standoffs are 3 x 1.5 inches (76.2 x 38.1 mm) channels ..., mesh material, and lap welds.*

Technical Bulletin	Title	Comments
		15.7 The channel standoffs shall be placed longitudinally, Figure 15.1. Channel standoffs placed circumferentially requires an engineering evaluation. However, UL 58 further states: *5.2.4 The steel thickness for the inner and outer walls of a Type II tank is calculated independently using Roark's Equation.* All steel tanks built to UL 58 now utilize the Roark formula to determine the minimum steel wall thickness. STI has further developed a spreadsheet for STI members utilizing the Roark formula that has also been approved by UL for determining the steel wall thickness. Based on paragraph 5.2.4 of UL 58, both the primary and secondary walls of all Type II tanks must be calculated as single wall tanks so that each wall is calculated independently of the other. For example, using STI's Roark formula based spreadsheet, given the following: 50,000 gallon Type II tank 304 SS inner, carbon steel outer tank Burial depth 6 feet (from grade to the top of the tank) Outer diameter 144 inches (Note: per UL the inner diameter of a Type II DW tank shall be a maximum 144 inches, per Figure 15.1. However, if the outer diameter exceeds 144 inches, an engineering evaluation is required to determine the outer head thickness. <u>Case 1 - Tight Wrap</u> If the tank was actually tight wrapped, the outer steel thickness could not utilize stiffeners. Assuming a tank length of 722 inches and an outer diameter of 144 inches, the minimum calculated carbon steel thickness equals 0.4495 inches thick. The inner steel tank, because it is 304 stainless steel, must use a different modulus of elasticity than carbon steel. For SS, we use 27.6×10^6. Using a tank diameter of 143 inches, a tank length of 720 and 2 stiffeners (I picked 0.3125 x 5 inch stiffeners, but many sizes are available), the minimum calculated stainless steel inner tank thickness is 0.3426 inches. <u>Case 2 - Stand-off Construction</u> Assuming the tank uses stand-off construction, then the primary tank is assumed to be 6 inches smaller in diameter, but therefore must be longer. Based on this, the inner tank diameter is assumed to 138 inches, the length 773 inches, and again utilizing two stiffeners, the minimum calculated SS thickness is 0.3418 inches. The outer tank remains 144 inches diameter, but the length is now 777 inches. With only three inches of space between the primary and secondary tank, there is not enough room for the secondary tank to utilize stiffeners. Therefore, the secondary tank minimum calculated carbon steel thickness is 0.4629 inches. This memo is only regarding Type II DW tanks and does not address the requirements for Type I DW tanks. If anyone has any questions, please feel free to call Lorri at 847.438.8265 x244.

Technical Bulletin	Title	Comments
A03-6	Ballast Requirements	At their November 2003 meeting, the STI Board of Directors approved a change to the Sti-P3® Specification. It is felt that one advantage of steel tanks is their strength. Because of this strength, steel tanks are able to contain fluids, such as ballast water, without the exterior support of backfill materials. Therefore the requirement to ballast the tank only up to the level of backfill has been removed, but a caution about over tightening hold-down straps was added. This applies to all underground installation instructions.
A03-2	Sti-P3 Combination Zinc/Magnesium Anode Design	The STI Board of Directors, mandated the use of the combination magnesium, zinc anode design. This decision was made only to help assure that future tanks meet the NACE cathodic protection criteria of a minimum -850 mV. The other anode designs are still allowed for installations outside the United States, when the product will be heated and for other specially approved designs.
A04-1	Bulkhead Weld Joints	At their August 2004 meeting, the STI/SPFA approved a change to all underground tank technology specifications. Welding directly on the knuckle of a bulkhead is not permitted. Further, bulkhead weld joint drawings are added to the specification in order to make instructions for proper joints clear. The following reasons are given: 1. Welding should not be done directly on the knuckle of the bulkhead. One reason for this is because the welding increases the stiffness of the head. 2. The weld areas for the two shells being connected shall not touch.
A07-2	Approval to Use Vacuum as a Tightness Test Method	Ken Wilcox and Associates (KWA), a prominent company involved in certifying leak detection equipment, recently sent a letter of approval to use vacuum as a tightness test method on the interstice of any STI technology double wall steel tank. A copy of the letter is enclosed for your use. It will also be posted on the STI website.
A07-2	New Appendix for Storing Heated Product	A new appendix has been added for tanks storing heated product in response to numerous questions STI receives from end users and regulators. While the standard warranty for STI technology tanks excludes tanks storing heated products, this does not mean that the sti-P3® tank cannot be used for this application. In fact, the sti-P3® is the best technology of any underground technology available for this application. The new requirements include: • Using a newly approved ceramic based coating called Ceram-kote. This coating is available from Freecom, Inc. and is applied in a similar manner to other sti-P3® coatings and at the same thicknesses. However, this coating has not been approved for applications other than storing heated product. • Ceram-kote shall also be applied to the top 60 degrees of the inside of the tank. • All anodes must be magnesium in the quantity specified in Appendix O. • Other recommendations are stated in this appendix to help you advice the tank owner of the options available to provide the longest tank life possible.

Technical Bulletin	Title	Comments
A10-1	Striker Plates	At the STI Board of Directors meeting on February 2, 2010, the Board approved a motion to eliminate all but one striker plate on all double wall underground storage tanks. One striker plate must be installed to meet the requirements of UL 58 under the fill opening. All striker plates are still required to be seal welded. This decision was made for several reasons: 1. Double wall tanks now constitute the majority of USTs manufactured and installed. 2. Double wall tanks provide superior environmental protection. 3. USTs today are more often monitored by electronic methods than by physically "sticking" the tank. 4. New data indicates that striker plates today are not preventing failures.

Underwriters Laboratories Inc.®

July 22, 1992

Steel Tank Institute
Ms. Lorri Grainawi
570 Oakwood Road
Lake Zurich, IL 60047

Our Reference: MH16166

Subject: Venting Requirements of Interstitial Space of UL 58 Tanks

Dear Lorri:

In response to your June 29, 1992 letter, secondary containment tanks that are shipped with a vacuum drawn on the interstice do not need to include the following marking:

> "Keep Space Between Outer Wrap and Inner Tank Vented to Atmosphere."

The above marking is required if the tank is not shipped with a vacuum to prevent pressure buildup in the interstice due to increased ambient temperature, especially for secondary containment tanks with substantial volume in the interstice.

As pressure buildup is a concern only when tanks are being shipped or stored aboveground prior to burial, the following marking statement or equivalent may be used for tanks not shipped with a vacuum:

> "Keep Space Between Outer Wrap and Inner Tank Vented to Atmosphere Until Tank is Buried."

We suggest that the above marking be included into the Follow-Up Service Procedure on an individual basis. That is, we will revise the Procedure based on the Applicant's request.

If you have any questions or comments, please do not hesitate to contact us.

Very truly,

T. A. Hillenbrand

T. A. HILLENBRAND (Ext. 2603)
Engineering Group Leader
Engineering Services

Reviewed by:

JON BRANNAN
Associate Managing Engineer
Engineering Services

Ken Wilcox Associates, Inc.

1125 Valley Ridge Drive
Grain Valley, Missouri 64029
Voice (816) 443-2494, Fax (816) 443-2495
E-mail:kwilcox@kwaleak.com
Web: http://www.kwaleak.com

May 4, 2007

Ms. Lorri Grainawi
Director of Technical Services
Steel Tank Institute
570 Oakwood Road
Lake Zurich, IL 60047

Dear Ms. Grainawi:

It is our understanding that some issues have been raised by the regulatory community relative to the acceptability of the third party evaluations for some types of double-wall steel tanks. This letter is to clarify the regulatory compliance status of the Permatank Interstitial Monitor system.

Two significant studies were conducted by KWA to determine the performance characteristics of the Permatank monitoring system.[1,2] Both studies involved substantial data collection to determine the performance of the system with air, volatile liquids and low volatility liquids. Our conclusion was that the system performed well beyond the requirements of the USEPA for both annual tightness testing and monthly monitoring. The Permatank systems are more sensitive to small leaks and react in shorter times than many other types leak detection systems.

These evaluations apply to the double-wall steel tanks manufactured according to the standards set by the Steel Tank Institute. Model numbers include the ACT-100, ACT-100-U and sti-P3 tanks. As far as we are aware the evaluations meet all of the requirements for leak detection set by the USEPA and the NWGLDE. Both evaluations are listed on the NWGLDE website, which can be accessed at www.nwglde.org.

Please feel free to contact me if you need further information or support.

Sincerely,

KEN WILCOX ASSOCIATES, INC.

H. Kendall Wilcox

H. Kendall Wilcox, President

[1] Evaluation of the Permatank Interstitial Vacuum Monitor for Installation Testing, March 25, 1993, KWA, Inc.
[2] Evaluation of the Permatank Interstitial Monitor for Detection of Liquid Leaks, February 24, 1994, KWA, Inc.