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**STANDARD FOR INSPECTION, REPAIR AND  
MODIFICATION OF SHOP-FABRICATED  
UNDERGROUND TANKS  
FOR STORAGE OF  
FLAMMABLE AND COMBUSTIBLE LIQUIDS  
SP131**

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## TABLE OF CONTENTS

PREFACE.....	1
1. SCOPE.....	2
2. DEFINITIONS.....	2
3. SAFETY CONSIDERATIONS .....	4
4. PERSONNEL QUALIFICATIONS.....	5
5. MATERIAL REQUIREMENTS.....	5
6. WELDING REQUIREMENTS.....	6
7. COATINGS and LININGS.....	7
8. INSPECTION .....	7
9. TANK REPAIR .....	8
10. MODIFICATIONS.....	9
11. REPAIRS BY WELDING .....	12
12. DOUBLE WALL and JACKETED TANKS.....	16
13. JACKETED TANKS.....	19
14. TESTING OF MODIFICATIONS AND REPAIRS.....	21
REFERENCES .....	23
APPENDIX A .....	24

## **PREFACE**

The Steel Tank Institute (STI), formed in 1916, is a not-for-profit organization whose purpose is to secure co-operative 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 Standard was developed by the Steel Tank Institute UST Repair Standard Committee, comprised of the following members and alternates:

## 1. SCOPE

- 1.1 This standard covers the inspection, repair, and modification of an atmospheric-type, shop-fabricated carbon and stainless steel underground storage tank. It applies to tanks storing stable liquids at atmospheric pressure.

This standard covers tank built to a nationally recognized standard for underground storage tanks. It may be used for the repair of other tanks at the discretion of the tank owner, noting owner's responsibilities in paragraph 1.4. The edition of the construction standard to which the tank was built, must be consulted for minimum construction requirements not otherwise covered in this standard.

- 1.2 The scope is limited to the tank and the tank's openings. This standard applies to tanks that are installed and also to tanks that have been temporarily removed to achieve a repair. Consult with the authority having jurisdiction (AHJ) to determine requirements for reinstalling the tank.
- 1.3 This standard does not address repairs or modifications to cathodic protection systems associated with USTs. See STI R972 for testing and repair of sti-P3 cathodic protection systems and NACE SP0285 for impressed current systems.
- 1.4 The owner is responsible for complying with the provisions of this standard, in addition to compliance with fire codes, local ordinances, and other applicable rules and regulations. The owner may want to retain assistance from specialists to aid in regulatory compliance, safe operations and installations in accordance with recognized industry standards. The owner shall verify that persons working on tanks understand and address the hazards associated with the contents of and procedures associated with those tanks.
- 1.5 The repair of a tank may affect the Listing status of the tank. This Standard does not address the Listing status of a tank. Contact the original Listing organization for more information.
- 1.6 The repair of a tank may affect the warranty status of the tank and associated equipment. Contact the original manufacturer for more information.
- 1.7 This Standard is intended for use by organizations and/or individuals who are knowledgeable and experienced in underground tank, repair, modification and inspection.

All repairs and modifications shall be in accordance with good engineering practice.

## 2. DEFINITIONS

**AHJ – Authority Having Jurisdiction** - The governmental agency assigned responsibility for the enforcement of municipal, state and/or federal regulations pertaining to atmospheric-type underground storage tanks (UST).

**ATMOSPHERIC UNDERGROUND STORAGE TANK** – A tank or container designed to operate at pressures ranging from up to a gauge pressure of one psig measured at the top of the tank.

**COATING** – A nonmetallic material used to cover steel.

**COATING FAILURE** – Any peeling, cracking, spalling, blistering, pitting and chipping etc. of the lining or coating on a tank including exposure of the metal surface.

**COMPOSITE TYPE TANKS** – Steel tanks that rely solely on an external coating for external corrosion protection. This includes tanks Listed under UL 1746 Part 2 and Part 4. This also includes tanks built under STI's ACT-100 and ACT-100-U.

**CONFINED SPACE** - a space or working environment that has the following three characteristics:

1. It is large enough and so configured that a person can physically enter and perform assigned work.
2. It has limited or restricted means for entry or exit.
3. It is not designated for continuous human occupancy.

**DOUBLE-WALL TANK** – A tank with a primary tank contained within a secondary tank, forming an interstitial (annular) space. The interstitial (annular) space between the two tanks is capable of being tested and monitored for leakage into the interstice.

**OVERLAP** - The protrusion of unfused weld metal beyond the weld toe or weld root.

**OWNER** – The legal entity having control and responsibility for the operation of the existing tank and storage facilities.

**PERFORATION** – A complete penetration of either the primary tank shell (for single-wall tanks) or secondary tank shell (for double-wall tanks).

**PERMIT-REQUIRED CONFINED SPACE** – an enclosed area that has one or more of the following characteristics:

1. Contains or has a potential to contain a hazardous atmosphere.
2. Contains a material that has the potential for engulfing an entrant, has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section.
3. Contains any other recognized serious safety or health hazard.

**PIT** – A thinned area of the tank concentrated in a small section.

**PRIMARY TANK** – the tank in direct contact with the liquid stored.

**PUDDLE WELDING** - The act of striking a weld arc, maintaining the arc over the crater (puddle), holding the arc steady or in a small circular motion to fill a pit in the base metal.

**REINFORCING PLATE** - A plate installed around a connection to replace the material removed from the opening in the shell.

**SECONDARY TANK** – the outer tank of a double-wall tank.

**SHOP-FABRICATED TANK** – a welded carbon or stainless steel tank fabricated in a manufacturing facility typically with a volume less than or equal to 75,000 U.S. gallons (283,906 liters).

**SINGLE-WALL TANK** – a tank with only one shell. The tank has either no coating, or an unknown coating system. The tank may be either with or without cathodic protection. The tank may be either with or without an internal lining.

**STABLE** - Not likely to change in chemical or physical properties.

**THIRD PARTY CERTIFIED PRECISION TIGHTNESS TEST** - A method that has been approved by an outside organization as suitable for verifying that a tank is tight.

**UNDERGROUND STORAGE TANK** - a tank that is used to contain an accumulation of substances and that has 10% or more of its volume below the surface of the ground in which it is installed.

**WELD OVERLAP** – The protrusion of unfused weld metal beyond the weld toe or weld root.

### 3. SAFETY CONSIDERATIONS

- 3.1 The hazards associated with the cleaning, entry, inspection, testing, maintenance or other aspects of tanks are significant. Safety considerations and controls shall be established prior to undertaking physical activities associated with the installation, inspection, maintenance, modification, repair or removal of tanks.
- 3.2 This Standard does not address all applicable health and safety risks and precautions with respect to particular materials, confined space, conditions or procedures. Information concerning safety and health risks and precautions shall be obtained from the applicable standards, regulations, suppliers of materials and material safety data sheets.
- 3.3 Plans to enter a tank require development and use of appropriate safety procedures, precautions and requirements. The owner, contractors and all persons associated with the tank inspection, repair or modification, cleaning or entry, shall review these prior to the start of work.
- 3.4 The following activities may be regulated. Local as well as federal requirements shall be consulted. The inspection, repair and modification of a tank shall include consideration of relevant requirements and best management practices:
- Breaking Lines, Isolating, and Release of Equipment
  - General Work Permit
  - Hot Work
  - Lockout/Tagout
  - Gas Testing
  - Contractor Safety
  - Respiratory Protection
  - Tank Cleaning, Repair, and Dismantling
  - Confined Space Permit
- 3.5 **BEFORE STARTING WORK**
- 3.5.1 Before the repair or modification begins, check for the accumulation of harmful vapors around and in the tank. Refer to the latest edition of the following documents for additional information:
- NFPA 326, *Standard for the Safeguarding of Tanks and Containers for Entry, Cleaning or Repair*
  - API RP 2015, *Requirements for Safe Entry and Cleaning of Petroleum Storage Tanks*
  - API RP 2016, *Guidelines and Procedures for Entering and Cleaning Petroleum Storage Tanks*
- 3.5.2 Each tank entry requires an Emergency Action Plan. Refer to 29 CFR 1910.38 for further information about EAP requirements. The owner and contractor must develop the Plan together. This Plan describes the actions required for personal safety from fire and other emergencies. This plan includes the following requirements as well as other:
- SCBA (Self Contained Breathing Apparatus) and lifelines on site, as well as rescuers trained in their use.
  - Establishment of and review of emergency escape routes and procedures with authorized entrants.
  - Establishment of an assembly area and procedures to account for all authorized entrants after emergency evacuation is complete.
  - Establishment of rescue and first-aid duties for those authorized entrants assigned to perform them.
- 3.5.3 After plans, procedures and administrative controls are in place and before entering the tank, isolate the tank by locking out and tagging all energy sources associated with the tank. Line isolation shall be at the closest flange practical to the equipment or space. Lockout/Tagout establishes a procedure for affixing lockout or tagout devices to energy-isolating equipment and for otherwise disabling machines or equipment to prevent unexpected energization, startup, or release of stored energy. Its intent is to prevent injury to employees, and to comply with the following OSHA regulations or their equivalent:
- 29 CFR part 1910.147, The Control of Hazardous Energy (Lockout/Tagout)
  - 29 CFR part 1910.331 to 1910.333, Electrical Lockout/Tagout
  - 29 CFR part 1910.146, Permit-required Confined Spaces

- 3.5.4 Residual fuel in the tank should be removed to the extent possible. Precautions should be taken to prevent dead spots. A small amount of water can be pumped into the tank, allowing the residual fuel to float to the top for removal and subsequent proper disposal of the now-contaminated water. There are liquid additives that can be poured into the tank which will mix with the gas to render it safe for removal. Lastly, it is possible to inert the tank by the use of various gases, typically carbon dioxide (dry ice is commonly used) or nitrogen. If possible, monitor at opposite ends of the tank to confirm the entire tank is safe. See Section 12 for special conditions for double wall and jacketed tanks. Comply with local codes for LEL and other safe entry requirements.
- 3.5.5 The atmosphere inside the space shall be tested and confirmed safe (see 3.5.4) before authorized entrants may enter. The atmosphere shall be tested at the start of each work shift every day and whenever work conditions may have changed. Continuous atmospheric monitoring is recommended. At a minimum, test the space for the following:
- Oxygen content
  - Carbon Monoxide (CO)
  - Hydrogen Sulfide (H<sub>2</sub>S)
  - Lower Explosive Limit (LEL)
- 3.5.6 A safety analysis shall be conducted prior to a leak test. Leak testing methods may be hazardous. For example, the leak test methods referenced in Section 14 require that either an inert gas be used for that the tank be thoroughly cleaned and gas free prior to testing and pressurizing a tank. Combining hydrocarbons with air provides a potentially hazardous atmosphere. Each test method may have unique hazards and these shall be considered and addressed in a pre-test safety plan. A qualified person shall review and approve the safety plan.

#### **4. PERSONNEL QUALIFICATIONS**

- 4.1 Personnel making repairs and modifications in accordance with this Standard shall be one or more of the following:
- Company qualified welding personnel of a facility that manufactures tanks built to STI, API, UL, ULC, or SwRI tank standards.
  - ASME Section IX qualified welders
  - AWS D1.1, AWS D1.6, or AWS B2.1 qualified welders
  - Coating applicator experienced in the application of chemical resistant coating systems or company certified as a tank coating applicator.
  - Additionally certified as may be required by individual states or other governing bodies.
- 4.2 Personnel qualified to perform testing described in accordance with Section 14 of this Standard shall have one of the following:
- Experience with the test procedure to be utilized.
  - Necessary training and/or certification by the manufacturer of the equipment used in the procedure.
  - Certification to standards imposed by regulatory bodies or other overseeing authorities. (i.e. American Society for Nondestructive Testing (ASNT), SNT-TC-1A, etc.).

#### **5. MATERIAL REQUIREMENTS**

##### **5.1 STEEL**

Repair material shall be of the same material specification (or equivalent in corrosion-resistance, strength and weldability) as the material to which it is welded. For carbon steel tanks for which the original material specification is unknown or obsolete, the repair material shall be equivalent to ASTM A36 material as a minimum.

##### **5.2 COATING SYSTEMS**

The coating system shall be suitable for the product stored. All coating manufacturer's surface preparation, mixing, and application instructions must be followed.



A Certificate of Compatibility, signed by the lining/coating manufacturer, shall be provided for all coating and lining systems stating that the materials is suitable for the intended use.

The following information shall be provided in the Certificate of Compatibility:

- 1- Type of repair, or upgrade, being made (corrosion pit, seam repair, or perforation).
- 2- The complete coating system to be applied, including surface preparation and dry film thickness (DFT).
- 3- Product to be stored.
- 4- The temperatures at which the product(s) may be stored.

The coating must be tested and meet the criteria for permeation, flexural strength, softening, blisters, cracking, bond strength and any other properties that the coating manufacturer deems necessary to issue a Certificate of Compliance for the life time requested by the tank owner. If a repair is made to an existing internal coating, the coating material system that is used for making the repair must be compatible with the original internal coating.

## **6. WELDING REQUIREMENTS**

**6.1** Welding procedure specifications shall be qualified in accordance with the original construction standard, if known, original manufacturer's specification or pre-qualified AWS D1.1 or 1.6, as applicable. Welding procedures shall take into account conditions at the site.

Welding shall be performed by any welding process that will produce a joint meeting the minimum strength requirements of the base metals and the welding procedure qualification.

### **6.2 PREPARATION OF WELDING SURFACES**

Surfaces to be welded shall be free from water, scale, slag, heavy rust, grease, coatings, paint, cement, or any other foreign material. Joint surfaces shall be smooth, uniform, and free from defects that adversely affect proper welding. After wire brushing, any residual light film of rust remaining on the cut or sheared edges to be welded need not be removed. Surfaces that were previously torch-cut or air-arc gouged shall be ground to remove slag and oxidation.

### **6.3 WEATHER CONDITIONS**

Welding shall not be performed when the ambient temperature is less than 0°F (-18°C), or when the weld surface is wet from rain, condensation, snow or ice, or during periods of high wind, unless the operator and the work are properly protected. Pre-heat may be required per approved AWS procedure.

### **6.4 WELD QUALITY**

The following are unacceptable:

- Undercutting of the base metal in tank and adjoining the weld;
- Cracks in weld and base metal;
- Incomplete fusion, weld slag;
- Incomplete joint penetration (including fillet welds that do not penetrate past the point of intersection of the members being joined);
- Weld overlap; and
- Porosity.

Undercutting of the base metal in the tank and adjoining the weld is a defect and shall be repaired. The finished fillet weld shall be free of grooves, deep valleys, or ridges and shall contain no abrupt changes in section at the toe. Defects shall be removed prior to rewelding.

### **6.5 LAP-OR FILLET-WELD LEGS AND FACES**

Lap or fillet welds shall have legs of equal size, except when specified otherwise. The minimum fillet weld size must be no smaller than the thickness of the thinner member to be welded.

### **6.6 STEEL THICKNESS**

When welding new steel for repair of a tank, the steel shall nominally be the same thickness as the original steel tank thickness. The steel being welded onto shall also be nominally 80% of the original steel tank thickness, and, a minimum of 0.123 inches thick.

## **7. COATINGS and LININGS**

All safety precautions stated within Section 3, including requirements for confined space entry, shall be followed. Follow safety requirements for the particular lining used. Tank shall be inspected prior to any repair work, including coating.

### **7.1 INTERNAL COATINGS AND LININGS**

The coating system shall be suitable for the product stored. All coating manufacturer surface preparation, mixing, and application instructions must be followed. The application of internal coatings and linings in the enclosed tank environment may result in a dangerous working condition, such as, but not limited to the introduction of flammable or explosive vapors. Appropriate safety measures shall be taken.

The coating must extend at least 4 inches beyond all repaired areas.

### **7.2 INTERNAL LINING OF TANKS NOT PREVIOUSLY LINED**

Coating systems shall be compatible with the materials to be stored in the tank. Further consideration shall be paid to the fact that in some UST's, water may separate from the product and pool at the bottom of the tank, thus creating a different, and potentially far more corrosive environment at the bottom of the tank. The coating system must also be designed to be installed and cured at temperatures that are representative of the surface temperature of the tank as they are typically different than the air temperature and may be different at different locations within the tank.

### **7.3 REPAIRS TO EXISTING INTERNAL COATINGS**

The repair specification must include the same considerations as outlined in 7.2 plus ensure appropriate adhesive characteristics of the repair coating to the existing coating. It may, or may not, be necessary to use the same coating system for repair as was initially used for lining.

### **7.4 REPAIRS TO EXTERNAL COATINGS**

Any necessary repairs shall be made by first abrading at least 4 inches around the area. The coating shall be repaired with a material compatible with the original coating. Follow the tank or repair coating manufacturer's recommendations.

### **7.5 INSPECTION OF COATINGS & LININGS**

Coatings may be inspected after curing by holiday testing with approximately 100 volts per mil of nominal coating thickness, as in ASTM D 5162 "Standard Practice for Discontinuity (Holiday) Testing of Nonconductive Protective Coating on Metallic Substrates". Contact coating manufacturer to verify the appropriate voltage setting. Spark testing must be conducted on repairs of external coatings for all composite, coated and jacketed type tanks and complete internal linings.

A Barcol® Hardness test is required for all repairs to external fiberglass reinforced plastic (FRP) coatings and jackets, and all complete internal linings. The test shall be conducted per ASTM D2583, using (model 935 Barcol® Impresser). This test is used as a measure of adequate cure for FRP coatings. Hardness readings shall be within the coating manufacturer's specifications.

As a "rule of thumb", when a thermosetting coating reaches acceptable solvent resistance per D5402 *Standard Practice for Assessing the Solvent Resistance of Organic Coatings Using Solvent Rubs*, it is considered to be "cured for service".

All coatings and linings shall meet the acceptable range of the Dry Film Thickness (DFT) requirements of the manufacturer.

Any failures of tests above shall require correction in accordance with the lining or coating material manufacturer's specifications and retesting until the above testing specifications are met.

## **8. INSPECTION**

### **8.1 VISUAL OBSERVATION**

After the tank is cleaned of all residual fuel and sludge and manned entry has been made, visual observation may indicate the source of the breach. While the visual observation is being

conducted, it also gives time for any residual fuel or groundwater to possibly migrate back into the primary tank. Wet spots, signs of product wicking, or deformation in the tank may be indications of a problem area. Sandblasting of the floor may visually reveal areas of deterioration. Removing striker plates prior to sandblasting is recommended as the perforation may be underneath the striker plate. If the striker plate is seal welded completely, or fully sealed to the tank bottom with sound lining material, it should be treated as if the striker plate were the tank bottom.

## **8.2 STRUCTURAL DEFICIENCY LIMITS**

The following structural deficiency limits apply to the repair of underground storage tanks in accordance with this Standard, except as approved by a professional engineer, or the tank manufacturer. A tank does not qualify for repair under this Standard if;

1. The tank is greater than 5% out of round;
2. The tank has a flat spot which has a cross measurement greater than the radius of the tank head;
3. The tank has a dent which has a cross measurement greater than the radius of the tank head or which protrudes into the tank greater than one inch for every foot of tank radius;
4. The tank has a seam split greater than 1/4 inch wide or greater than 1/6 the circumference of the tank in length.

## **8.3 INSPECTION TECHNIQUES**

The following methods may be used to find a leak on the primary tank. Other methods are also possible.

1. Visual
2. Acoustical
3. Vacuum box
4. Dye penetrant, (PT)
5. Magnetic particle inspection (MT)
6. Acoustic

Acoustical equipment may be used to listen for air leaving or entering the primary tank. Trace each seam with the device to get as close as possible to the problem area.

Follow the directions that come with the vacuum box to conduct a vacuum box test.

If the tank is lined, holiday testing may be used in conjunction with these other methods.

## **9. TANK REPAIR**

### **9.1 SINGLE WALL BARE STEEL TANKS**

- a. Joint repair on shell, shell to head joint or joint at bulkhead shall be repaired by welding per Section 11. The area shall then be coated per Section 7.0.
- b. Corroded metal areas, with less than 50% of the original wall thickness remaining, shall be repaired by welding. The area shall then be coated near the area of the repair per Section 7.0.
- c. All perforations shall be repaired by welding per Section 11.
- d. Corrosion perforations may be repaired for:
  - Five or fewer perforations in any 1 square foot area, and
  - Twenty or fewer in any 500 square feet area, and
  - No single perforation larger than 1/2 inch in diameter.
- e. Leaks at a fitting or manway shall be repaired by welding per Section 11. The area shall then be coated per Section 7.0.

### **9.2 SINGLE WALL STI-P3, CATHODICALLY PROTECTED TANK**

- a. Joint repair on shell, shell to head joint or joint at bulkhead shall be repaired by coating per Section 7.0. As an alternative, the joint may be repaired by welding per Section 11, followed by an external coating repair per Section 7.
- b. Thinned metal areas on the exterior or interior surface shall be repaired by coating per Section 7.0. As an alternative, the area may be repaired by welding per Section 10, followed by an external coating repair.

- c. Perforations shall be repaired by welding per Section 11. Coat the repaired area as per Section 7.0.  
Corrosion perforations may be repaired for tanks with less than:
  - Five or fewer perforations
  - No single perforation larger than ½ inch in diameter.
- d. Leaks at a fitting or manway shall be repaired by welding per Section 11. Coat the repaired area per Section 7.0. Leaks below the maximum liquid level require welding. Leaks above the maximum liquid level may be repaired by either internal or external coating per Section 7.0.

Following repairs, verify tank is isolated from all other structures. Test the tank for adequate cathodic protection after repairs are complete. See STI R051. If repairs are needed to the cathodic protection, see STI R972.

**9.3 SINGLE WALL URETHANE (OR OTHER THERMOPLASTIC COATED) AND FIBERGLASS REINFORCED PLASTIC (FRP) (OR OTHER THERMOSETTING COATING) COATED OR COMPOSITE TANK**

- a. Joint repair on shell, shell to head joint or joint at bulkhead shall be repaired by welding per Section 11. Coat the repaired area as per Section 7.0.
- b. Thinned metal areas on the exterior or interior surface shall be repaired by coating per Section 11. As an alternative, the area may be repaired by welding per Section 11 followed by an external coating repair.
- c. Perforations shall be repaired by welding per Section 11. Coat the repaired area as per Section 7.0.  
Corrosion perforations may be repaired for tanks with less than:
  - Five or fewer perforations
  - No single perforation larger than ½ inch in diameter.
- d. Leaks at a fitting or manway shall be repaired by welding per Section 11. Coat the repaired area per Section 7.0. Leaks below the maximum liquid level require welding. Leaks above the maximum liquid level may be repaired by either internal or external coating per Section 7.0.

**9.4** Visually verify that there is no damage to exterior coating in weld area(s). Make repairs if necessary and perform ultrasonic or magnetic thickness and holiday testing and Barcol® hardness tests of repaired clad coating. Clad coating must meet minimum thickness and hardness requirements per manufacturer's specification.

**9.5 DOUBLE WALL AND JACKETED TANKS**

See Section 12.

**10. MODIFICATIONS**

**10.1 GENERAL**

Modifications must meet or exceed the original standard. Certain modifications to existing tanks require specialized engineering assistance, including, change of product to specific gravity greater than 1.

If the tank has bracing in the area to be modified, then the modified section must also be braced to match the original design.

All underground tanks shall have provisions for venting. Modifications to a tank shall not eliminate or reduce the sizes of the vents below that required by the applicable code or standard of construction.

## **10.2 PIPE CONNECTION**

All piping and fittings shall be a minimum of schedule 40. Piping flanges shall be ANSI Class 150, raised face.

Connections for venting shall be flush with the inside of the top of the tank.

At a minimum, continuous welding from the exterior of the tank is required. Additional welding may be required based on the type of piping connection used in accordance with the appropriate standard of construction.

## **10.3 REINFORCING PLATE REQUIREMENTS:**

Reinforcing plates are required for connections of piping from 2-1/2 inches to 12 inches diameter and if any portion of the penetration is below the maximum normal liquid level. Shell connections of 2 inches diameter or less do not require reinforcing plates. Reinforcing plates are not required for penetrations that are completely above the maximum normal liquid level.

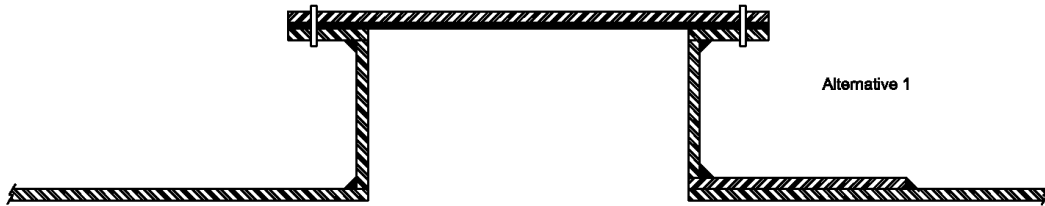
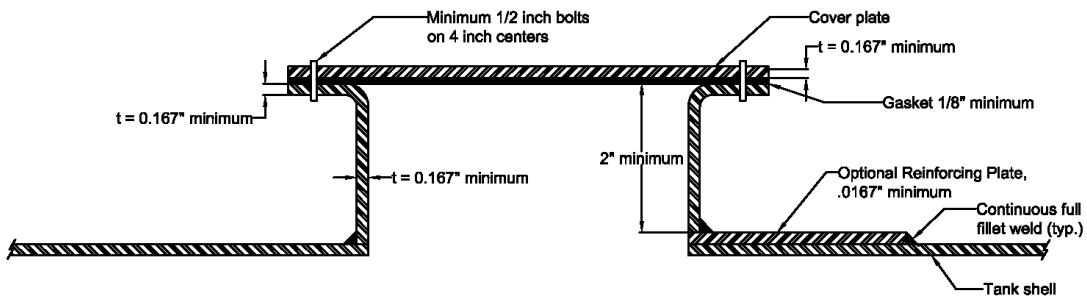
The reinforcing plate shall be at least 3 inches in width and at minimum the same thickness as the shell. The outside diameter of the reinforcing plate shall be twice the diameter of the opening. The size of the reinforcing plate may be proportionally reduced with an increase in thickness. The minimum cross sectional area of reinforcing plates shall be equal to the maximum diameter of the hole cut in the shell multiplied by the nominal shell thickness.

Reinforcing plates may be circular, oval, or rectangular with corners rounded to a minimum radius of 2 inches. Square-cornered reinforcing plates shall not be used. Reinforcing plates shall be formed to the contour of the tank and shall be seal welded around the perimeter of the plate.

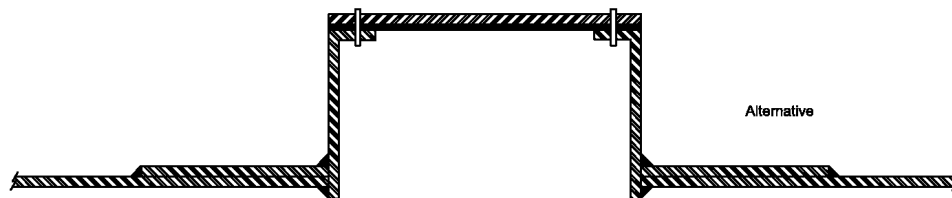
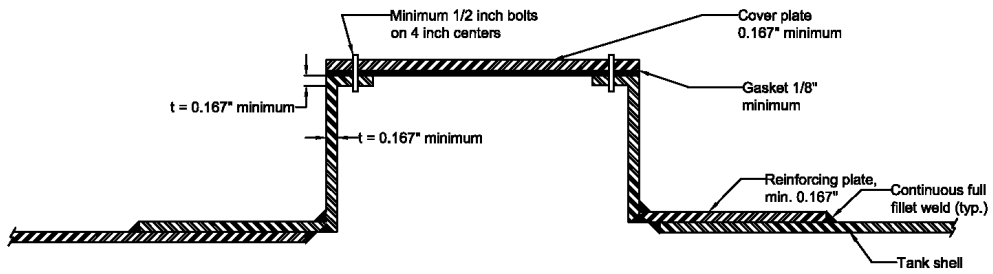
## **10.4 MANWAYS**

Manways must be constructed according to Figures 10.4a and 10.4b (manway details).

Manway-cover joints shall be provided with a ring or face gasket of material determined to be acceptable for use with the product contained in the tank and shall have a thickness of not less than 1/8 inch (3.2 mm).



**FIGURE 10.4a**  
**MANWAY CONSTRUCTION OPTIONS**  
**WITH OUTWARD-FACING FLANGE**



**FIGURE 10.4 B**  
**MANWAY CONSTRUCTION OPTIONS WITH INWARD-FACING FLANGE**

**10.5 TESTING AFTER MODIFICATION**

This test procedure does not include lining the interior of the tank. After visual inspection of weld(s) on installed patch plates conduct a vacuum box test of weld(s) and observe for bubbles indicating any leaks. Make additional repairs as needed and re-test to verify there are no leaks.

If the modification is the addition of manways, bungs, or other fittings, visual inspection of the welds is required. Following this, conduct a 5 PSIG pressure test of the tank and soap test weld area(s) for leaks. Where possible a vacuum box test may be used in place of the 5 PSIG pressure test.

**10.6 PENETRATION REMOVAL AND PATCHING**

To remove the existing penetration, the tank shell shall be cut at least 1 inch away from the penetration weld. The cut-out may be round or oval, and all corners must have a minimum of 2 inch radius.

10.6.1 The cut to remove a penetration shall be a minimum of one inch from an existing weld. The cut may cross over an existing weld seam, but must extend beyond the seam by a minimum of 3 inches. This dimension may be larger depending on the type of repair procedure required to cover the removal. The cut should not follow along an existing weld seam.

10.6.2 If the existing penetration had a reinforcing pad, the entire reinforcing plate shall also be removed. The reinforcing plate may be removed by grinding or cutting the external full fillet weld from the tank surface.

10.6.3 The cut to remove a penetration shall be at least 3 inches away from the edge of a knuckle, in the tank head. Under no circumstances shall the removed section include any part of the knuckle in a head of a tank.

10.6.4 Covering the opening created by removal of the previous shell shall be performed following the procedures for installation of patch plates in Sections 11.6 – 11.8 of this Standard.

10.6.5 Use proper gasket material and install gasket per installation requirements.

**11. REPAIRS BY WELDING**

**11.1 GENERAL REQUIREMENTS**

To minimize the risk of damage to external coatings, the following shall be followed:

- Intermittent welding is recommended to reduce the amount of heat in an area at one time.
- Limit concentrated heat input.
- Use lowest heat input possible for an adequate weld when welding
- Use small diameter electrode which requires less amperage to weld. If multiple passes required, wait for steel to cool before continuing.

**11.2 ALLOWABLE METHODS**

Repairs to the shell shall be made with weld deposition, with lap-welded patch plates, as described below. The appropriate method(s) of repair shall be determined from an evaluation of the nature and extent of damage requiring the repair. The placement of patches on top of a previous repair is not permitted. The repair provisions contained herein are limited to shell plates not exceeding 1/2-inch in thickness.

Repairs by welding may be used to repair damage or defects that adversely affect the structural or tightness integrity of the tanks.

### 11.3 DEFECTS

The following defects that need repair shall be removed completely by air arc-gouging and/or grinding and the resulting cavity properly prepared and welded. Visual examination and either MT or PT of the area shall be performed to verify that the defect has been completely removed and repaired.

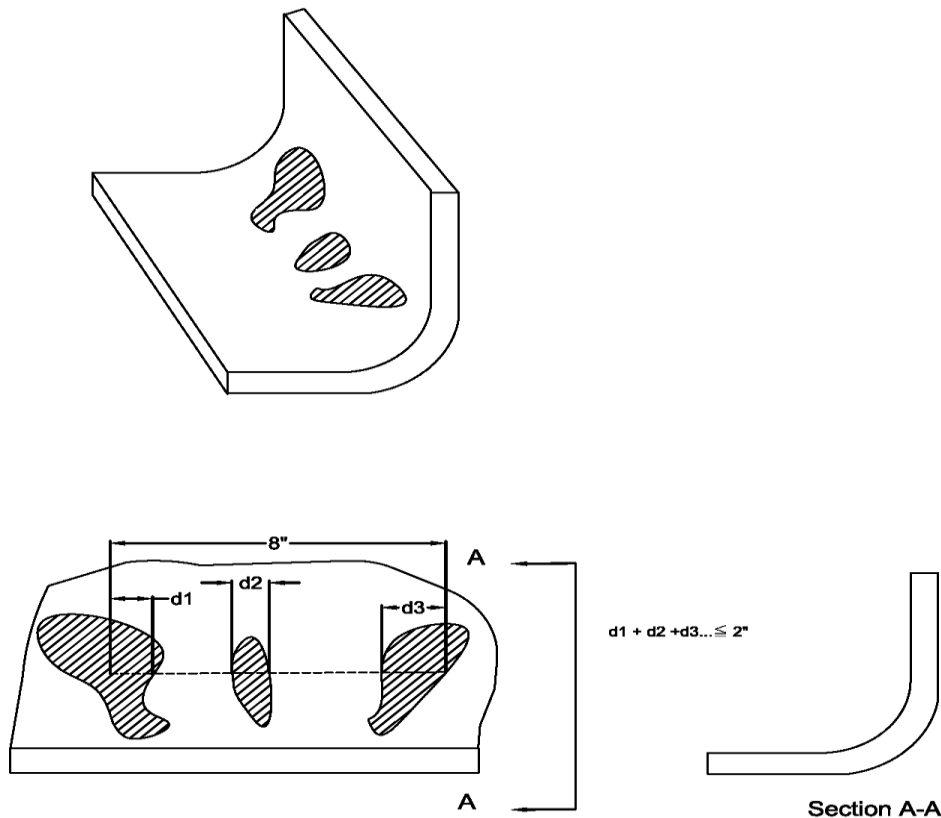
- Cracks
- Incomplete fusion
- Slag inclusion
- Porosity
- Excessive weld undercut
- Corroded weld joints
- Broken welds on attachments

### 11.4 PITS

Pits shall be repaired, if deemed necessary, by weld deposition (puddle welding), or by the use of patch plates. Perforations shall be repaired by patch plates seal welded on all sides.

### 11.5 KNUCKLE RADIUS

Repair in the knuckle curvature or within 3 inches of the knuckle is limited to pit welding or deposition welding, provided that the sum of the pit dimensions in any direction is less than 2 inches in any 8-inch length. Perforations in the knuckle area shall not be repaired. See Figure 10.2.3.



**FIGURE 11.5**  
**PITTING CRITERIA ALLOWED FOR REPAIR IN KNUCKLE**

11.5.1 Weld-on patch plates are not permitted in the knuckle.

11.5.2 Continuous welding on the accessible side of the repair is required.

### 11.6 LAP PATCHES



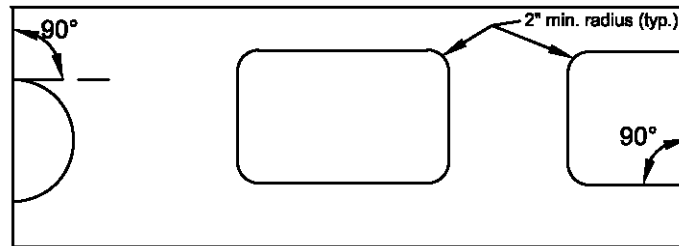
Lapped patch shell repairs are an acceptable form of repair for butt-welded and lap-welded tank shells (see Figure 10.3) providing the following conditions are satisfied:

- The patch plate shall match the as-built thickness of the existing shell plate to be repaired. Steel plates shall match the contour of the existing tank wall. Original tank metal thickness shall be measured in an area of the tank that has not deteriorated.
- The minimum dimension of a patch plate shall be 6 inches.
- Patch plates shall be continuously welded to the shell around the patch plate.
- All welding shall be continuous full fillet welds.
- The existing minimum shell thickness to which the patch plate is welded must be 0.10 inches.

### 11.7 PATCH PLATE SHAPE

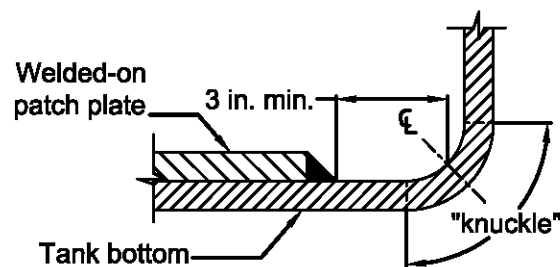
Patch plates may be circular, oval, or rectangular with corners rounded to a minimum radius of 2 inches. Patch plates shall extend one inch minimum beyond the tank defect. Square-cornered patch plates shall not be used.

Patch plates may extend to and intersect with the shell-to-head joint if the horizontal sides intersect the head at a 90-degree angle. Such plates, when used, shall not have rounded corners at the intersecting weld but shall have them at all other corners. Refer to Figure 10.4a. .



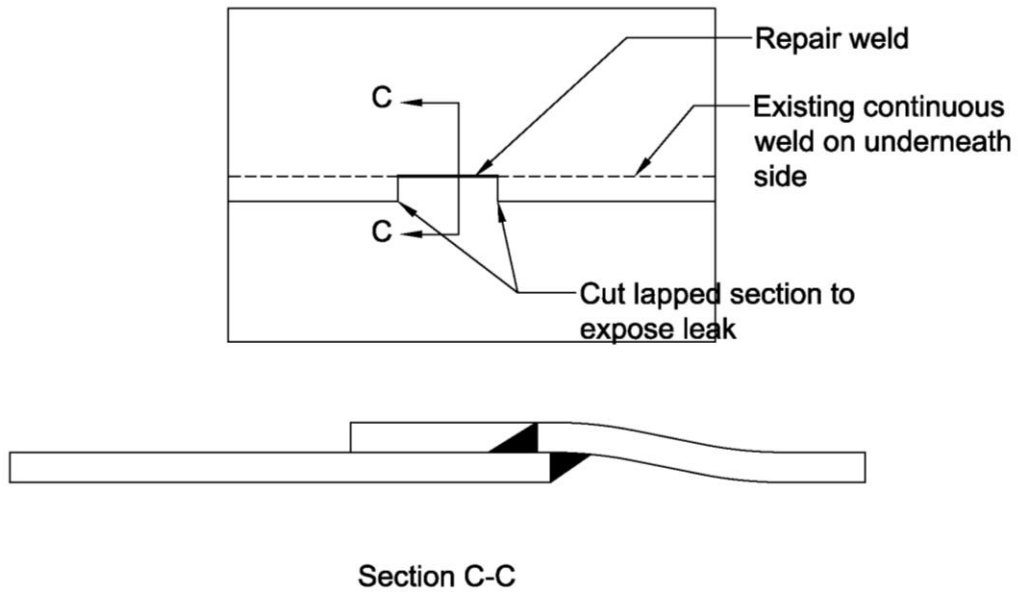
**FIGURE 11.7 A  
PATCH PLATE SHAPES**

When a patch plate is needed near the heads of tanks, which are fabricated with a knuckle, it shall be no closer than 3 inches from the knuckle. Refer to Figure 11.7a. .



**NOTE: Welded patches are not permitted in the formed knuckle region**

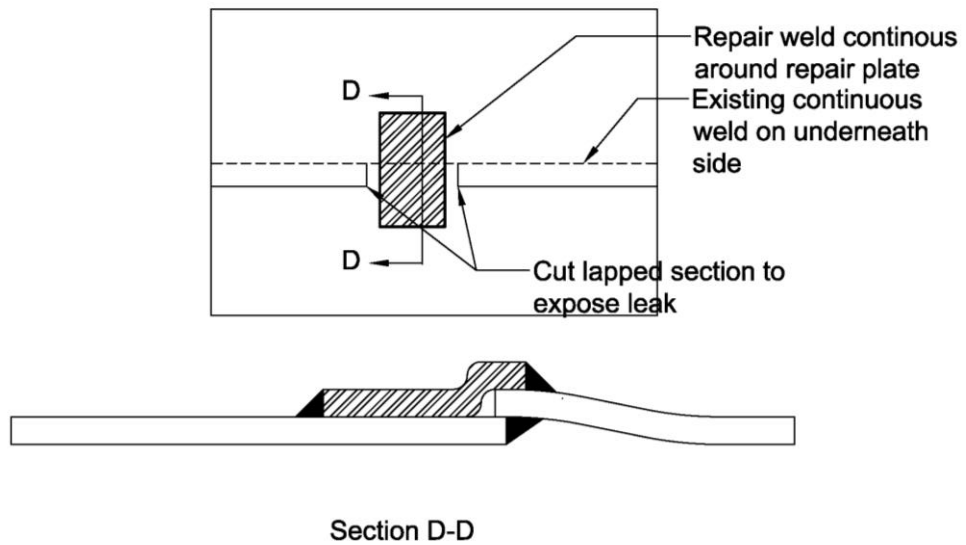
**FIGURE 11.7B  
PATCH PLATES INSTALLED NEAR KNUCKLE**



**11.8 PATCH PLATES OVER EXISTING WELD JOINTS**

New patch plate weld joints shall not be closer than 3 inches to an existing weld joint.

**FIGURE 11.8B  
LAP WELD REPAIR 2**



## **12. DOUBLE WALL and JACKETED TANKS**

### **12.1 LEAK INVESTIGATION**

Repairs to the primary steel tank shell must be conducted according to Section 9 of this Standard.

Before accessing the primary tank, try to verify the location of a breach by using needed steps described in Sections 12.1, 12.2 and 12.3.

This Section describes a process for investigating a possible breach in the tank. The breach could be in either the primary or the secondary tank. If at any point in the process it's determined that the tank is tight, this process can be stopped. These steps are organized in what is typically the most logical process, but each tank needs to be evaluated individually.

Check the interstitial space by placing a gauge stick into the interstitial monitoring tube. If there is liquid, identify if it is product (and type of product if tank is compartmented) or water, and the level of the liquid in the interstice.

If you have water in the interstice, the leak is likely either in the outer tank/jacket or entering from the interstitial monitoring tube. If the water level in the interstice is determined to be the same as the exterior groundwater, the leak is more likely in the outer tank or jacket.

If there is fuel in the interstitial space, the leak is more likely from the primary tank, although fuel may enter the interstice from accidents or other human error. Compare the product level in the interstice to the product level in the primary tank. If the two levels are nearly identical, it is more likely that there is a breach in the primary tank.

Remove all liquid from the interstice to the extent possible. This may require several attempts as the liquid will migrate down from the interstice walls to the bottom of the tank and the interstitial tube. Record the time and amount remaining in the interstice as well as the level in the primary tank.

Let the tank sit, several hours up to a day. Determine if the liquid returns and to what level. As above, if the water or fuel returns to the same level in the interstice as the primary tank level or external water level, it is an indication of a primary shell breach or an external shell / jacket breach. Record the time and the results.

### **12.2 INVESTIGATING WATER ENTRY FROM INTERSTITIAL MONITORING TUBE**

There are several options to verify water is not entering the interstitial space through the interstitial monitoring fitting.

1. Introduce no greater than 0.5 psi pressure of helium into the interstitial space. Using a helium monitor, sample for traces of helium. Reference the helium monitor's instructions for exact procedure. If the highest levels of helium are found at grade level, the leak is more likely to be caused from a tank top fitting.
2. Excavate to the tank top over interstitial monitor. Visually check connection to tank. If there are no obvious problems, apply soap solution to the joint and conduct an air pressure test at a very low level. The formation of soap bubbles indicates a leak.
3. Also acoustic listening devices to pick up escaping air when pressure is placed on the interstice may be successful if done from inside the tank.

### **12.3 VACUUM TEST INTERSTICE**

Just prior to conducting a vacuum test, to the extent possible, remove any liquid from the interstice to 1/8 inch or less, and all product from the primary tank to less than 1 inch. Removal of product to the extent possible in both the interstice and primary tanks is important as pulling a vacuum against a pool of product inhibits the flow of air and likewise masks any breach.

Pull at least 10 inch HG vacuum, or as allowed by the tank manufacturer. Record the time and vacuum level in the interstice, as well as the liquid level in both the interstice and primary tank at start and completion of the vacuum test. After the vacuum stabilizes, leave vacuum on for at least one hour with no loss in vacuum. At the start of the one hour time, the vacuum must be at least 10 in Hg. If there is a question, repeat the test or move on to another diagnostic test.

It is important to utilize a vacuum gauge device that extends past the top of the tank and allows testing of the interstice. This eliminates the often encountered issue of leakage where the field-installed transition pipe extends from grade level to the top of the tank.

Other third party approved vacuum leak detection methods may be used. Note: If the tank has a measurable distance between the two steel tank walls or the tank has extended heads, refer to, Steel Tank Institute's (STI) *Recommended Practice R012, Recommended Practice for Interstitial Tightness Testing of Existing Underground Double Wall Steel Tanks*.

#### **12.4 TIGHTNESS TEST PRIMARY TANK**

Conduct a tank tightness test using either a third party approved method that evaluates the entire volume of the tank, such as a nonvolumetric vacuum/acoustic method, or the tank manufacturer's recommended procedure. The test length should be extended as necessary to allow for air ingress from the interstice into the primary tank.

#### **12.5 ACCESSING THE TOP OF THE TANK**

If a manway is not available, several factors influence the decision on where to enter the tank: adequate space for excavation and working between utilized openings on the tank (STP sump, fill, monitor sump, etc.) to minimize disassembly /re-assembly of components; location of the orifice accessing the interstice; location of the fill, etc. It is advantageous to have the flow of purging air or inerting gas moving across the length of the tank to avoid dead spots.

#### **12.6 MAKING TANK SAFE, CUTTING ACCESS AND RESEALING JACKET**

If fuel in the interstice has identified which compartment has breached, the non-affected compartment(s) must be emptied prior to entering the breached compartment. Degassing of the non-affected compartment(s), space between bulkheads and possible entry and cleaning of same is also required. Follow the requirements in Section 3.5. Safety is the driving consideration in this evaluation.

Making the primary tank safe for entry is the same procedure as for single wall tanks (lowering the LEL to a safe level. See Section 3.5.

If fuel is present in the interstice, it should be removed to the extent possible. Create a safe condition within the interstice by using an inert gas. Precautions should be taken to prevent dead spots. The tilt of the tank must be verified. To reduce the possibility of dead spots, introduce the inert gas to the high end of the tank. If possible, monitor at opposite ends of the tank to confirm the inerting process is total and complete.

If the tank does not have a manway, remove the tank's external protective coating 2 to 3 inches beyond each direction of the anticipated work area. The interstice shall be made safe via the use of an inert gas and then continuously monitored while the access opening is cut.

After the access opening is cut, entry into the tank and tank cleaning is accomplished per Section 3.5. It is very important that all residual product is removed and the tank interior is verified to be safe before entering the tank. Striker plates may need to be removed as part of the investigation and cleaning process.

Striker plates shall be reinstalled under openings that will be used for stick readings. The recommended practice is to install the striker plate on top of the new tank lining.

## **12.7 LOCATING BREACH**

This Standard covers six possible methods to find a leak on the primary tank. Other methods may be used.

1. Visual
2. Pressure on interstice - apply soap solution, look for bubbles
3. Pressure on interstice - liquid coming into tank
4. Pressure on interstice - acoustically listen for leak on any seam
5. Introduce helium into interstice and sample for helium inside the tank
6. Vacuum box

After the tank is cleaned of all residual fuel and sludge and manned entry has been made, visual observation may indicate the source of the breach. While this is being conducted, it also gives time for any residual fuel in the interstice to possibly migrate back into the primary tank. Wet spots, signs of product wicking, or deformation in the tank may be indications of a problem area. Sandblasting of the floor may visually reveal areas of deterioration. Removing striker plates prior to sandblasting is recommended as the perforation may be underneath the striker plate. If the tank is internally lined, it may be necessary to remove the striker plates anyway.

If the location of the leak is not apparent by visual inspection, re-seal the jacket to the primary shell at the access opening. This will then allow you to either pull a vacuum or apply a small amount of pressure to the interstice.

If the outer jacket is an FRP material, re-seal it to the primary tank shell (steel). This will require cleaning, sandblasting and/or grinding to create a profile in the metal and sealing with a compatible resin. See Section 13.3 on external repair of fiberglass jackets.

If the outer jacket is a heavy polyethylene type coating, see Section 13.2 on external repair of polyethylene jackets.

If the outer tank is steel, seal to the primary tank by cutting the outer shell back from the primary shell by ½ inch if installing a manway and 3 inches if installing a rolled plate lid. Next seal weld the outer shell to the primary plate.

Unless the tank manufacturer indicates otherwise, no more than 1.0 psi of pressure should be applied to the interstice. After applying pressure, again visually look for product entering the primary tank. Another option is to use acoustical equipment to listen for air leaving the primary tank. Trace each seam with the device to get as close as possible to the problem area.

Follow the directions that come with the vacuum box to conduct this test.

## **12.8 REPAIR OF PRIMARY TANK**

Repair of leaks in primary tanks are covered in Section 9. The repair method will depend upon the specifics of the breach. The following addresses some of the more frequent issues encountered.

In addition to other requirements in this specification, there are specific concerns for jacketed tanks. Care must be taken not to damage the jacket material if welding is used as the method of repair.

- Intermittent welding is recommended to reduce the amount of heat in an area at one time.
- Limit concentrated heat input.
- Use lowest heat input possible when welding

- Use small diameter electrode which requires less amperage to weld. If multiple passes required, wait for steel to cool before continuing.

Vacuum test interstice to verify jacket has not been damaged. Pull vacuum so that moisture is being pulled away from weld area and prevent water or product from coming back in and causing weld discontinuities.

Perforations in plates or welds accessible from the tank interior (i.e. internal corrosion), can be repaired via one of the following:

- Internal lining (i.e. epoxy or reinforced)
- Welding only of small perforations
- Combination of welding and internal lining or resin
- Weld patch plates
- Weld patch plates and internal lining or resin

There are two main concerns when repairing the primary tank. The first is a safety concern from residual product in the interstice, and the second is possible damage to the external protective coating on the tank. A welded repair is superior in terms of long term integrity. However, safety and outer coating damage concerns shall have priority.

There is no one best repair approach that encompasses all types of breaches. However there is a best repair approach for each individual breach encountered when taking into account the specific tank issues.

## 12.9 CLOSING THE TANK

Once the interstice has been sealed at the access opening, the tank can be closed. One approach is the installation of a manway (see Section 10.4).

An alternative approach is the installation of a plate rolled to the radius of the tank. The plate and the area surrounding the access opening should be ground or sandblasted to create a profile in the metal. The plate is attached with self-tapping bolts, with an epoxy or FRP resin utilized to seal the plate to the tank and to coat all exposed surfaces. A typical combination is as follows:

- Drill 3/8 inch holes in the lid.
- Use the lid as a template and drill 21/64 holes in the tank.
- Utilize a 3/8-16x1 1/2 hex washer head slot type F thread cutting screw zinc plated. Other combinations are acceptable.
- Verify that the size of the hole drilled in the tank is compatible with the self-tapping bolt.

Consulting with the tank manufacturer or a coating supplier is necessary when applying a different coating than is on the original tank, to assure a satisfactory bond and seal.

Once a repair is completed, a test of the interstice integrity shall be made. Refer to Section 12.3 for how to conduct the test.

## 13. JACKETED TANKS

This type of breach is typically discovered thru ingress of groundwater into the interstice or a failure of a vacuum test on the interstice where the access tube to the interstice is confirmed tight. Locating the general area of a breach may be approached by introducing helium into the interstice and detecting it at ground level or by entering the tank to determine if there is any deformation that may have stressed a seam. Also, acoustic listening devices to pick up escaping air when pressure is placed on the interstice may be successful if done from inside the tank.

### **13.1 REPAIRING A BREACH**

For breaches below the midpoint of a tank (below the 3 and 9 o'clock positions) removal of the tank from the ground is recommended. At the midpoint of the tank, excavation to the breach is possible.

Inerting the interstitial area should be done for any repair process that utilizes heat, grinding or sandblasting. Potential fuel in the interstice presents significant safety hazards.

Repairs may be done with a coating compatible with the existing external coating. If possible, consult the tank manufacturer to verify the coating material is compatible.

The tank manufacturer should also be consulted regarding the repair process for jacketed tanks.

### **13.2 EXTERNAL REPAIR OF A POLYETHYLENE JACKET**

1. After finding the point of leak, remove all dirt, water, and moisture from the area. Judge by sight if the problem is a pinhole, rip, cut or tear.
2. If some of the material has been deformed so that the jacket will not be able to seal by itself, try to find how big the affected area is. You will need a patch of jacketing material (same as the tank) in order to weld a full patch and cover all the affected area.
3. If the leaking point is able to close by realigning the jacket material, it is preferred that the cut is closed first by welding. Also weld an external patch covering the welding in order to have maximum tightness.
4. The tools needed to make these repairs include an extrusion welding gun, an electrical or pneumatic coarse grit sanding disk, and compatible weld rod to supply the welding gun with deposition material.
5. In case of a patch repair, use tack welds or any kind of adhesive to prevent the patch from moving while sanding or applying the bead of weld.
6. Before applying the weld onto any of the scenarios explained above, the existing jacket material and/or the new jacket material must be cleaned and prepared for the welding.
7. Any of the paths the welding gun will be travelling through must be thoroughly sanded with the sand disk in order to remove any impurity and to make the thermoplastic material able to receive the bead of weld.
8. Sand both sides of where the weld bead is to be deposited in order for the welding to be fully effective.
9. The extrusion welding machine should be equipped with an air heater which will preheat the area where the weld is after being deposited.
10. The tank Interstice can then be pressurized to 1.0 psi and a soap test of the required area should be made.
11. Vacuum can then be reinstated in the Interstice. Contact the original tank manufacturer to determine the level of vacuum that should be applied.

### **13.3 EXTERNAL REPAIR OF A FIBERGLASS JACKET**

Grind out damaged laminate area. Thoroughly clean all steel surfaces to be coated, removing all traces of contamination, e.g. oil, grease, dirt, etc. If not previously sandblasted, create a minimum surface profile of 1.5 mils. For small repair areas, this surface may be achieved by abrading with a coarse grinder.

Surface imperfections such as sharp edges, projections, crevices, laminations, weld slag residue, etc., can cause premature failure and are difficult to cover.

If applying new coating to an existing coating, area may be roughened with 60 grit sandpaper. The area roughened should be absent any chalk or gloss on the coated surface. Liberally wipe the area to be repaired with clean MEK (methyl ethyl ketone).

Bridge crevices and corners, such as at manways, lifting lugs, or bung openings, by applying a paste to contour the surface to remove sharp edges. The paste may be purchased or made from catalyzed resin with added milled or chopped glass. An alternate method is to use chopped strand mat cut to shape in strips to fit in these difficult locations.

The surface to be coated shall be dry, clean and uncontaminated. Apply fiberglass according to the coating manufacturer's instructions. Fiberglass mat shall be saturated with catalyzed resin. Roll out all air bubbles and air pockets. Achieve a proper bond between new FRP and existing laminate by overlapping cured area a minimum of 3 inches (152 mm) (previously ground out to remove glossiness).

Once the FRP laminate has set-up and cured, the entire surface must be tested with a holiday tester. A minimum holiday test with 100 volts per mil of nominal coating thickness shall be done per ASTM D 5162 "Standard Practice for Discontinuity (Holiday) Testing of Nonconductive Protective Coating on Metallic Substrates." Contact coating manufacturer to verify the appropriate voltage setting. Flanged connections which do not normally contain product do not require holiday testing. All holidays must be repaired and retested.

Perform Barcol® hardness test on repaired jacket. Jacket must meet minimum dry film thickness (DFT) and hardness requirements per original manufacturer's specification.

## **14. TESTING OF MODIFICATIONS AND REPAIRS**

### **14.1 VISUAL INSPECTION**

After visually inspecting for weld discontinuities (e.g. cracks, undercut, overlap, exposed porosity, slag inclusions, etc.) and coating discontinuities (e.g. signs of bubbling, cracking, or delamination) perform the testing indicated below.

### **14.2 SINGLE WALL TANK WELD REPAIRS**

After visual inspection of repaired weld(s), conduct a 3-5 PSIG pressure test of the primary and secondary tanks and soap test weld area(s) for leaks. The pressure gauge used shall read between 0 to 15 psi.

Where possible a vacuum box, liquid penetrant examination may be used in place of the 3-5 PSIG pressure test. Make additional repairs as needed and then re-test to verify that there are no leaks.

For a vacuum test, any observed bubbles indicate a leak. MT and PT are used primarily for inspecting welds for surface defect. However, PT can also locate pinholes when both sides of the weld are accessible.

### **14.3 DOUBLE WALL STEEL AND JACKETED TANKS**

Conduct standard vacuum test on interstice to verify repairs.

Regulatory agencies may require third party approved precision tightness test. Agencies also may require the tightness tester be certified to perform the test in the state in which the tank is located.

### **14.4 TESTING AFTER MODIFICATION**

This test procedure does not include lining the interior of the tank. After visual inspection of weld(s) on installed patch plates, conduct a vacuum box test of weld(s) and observe for bubbles indicating any leaks. Make additional repairs as needed and re-test to verify there are no leaks.

Addition of manways, bungs, or other fittings - After visual inspection of repairs to weld(s), conduct a 5 PSIG pressure test of the tank and soap test weld area(s) for leaks. Where possible, a vacuum box test may be used in place of the 5 PSIG pressure test.

### **14.5 ADDITION OF MANWAYS, BUNGS, OR OTHER FITTINGS**



After visual inspection of repairs to weld(s) conduct a 5 PSIG pressure test of the tank and soap test weld area(s) for leaks. Where possible a vacuum box test may be used in place of the 5 PSIG pressure test.

**14.6 CATHODICALLY PROTECTED TANKS**

Tanks shall be tested for adequate cathodic protection. For more information on how to conduct CP test, see STI R051 or NACE TM0101.

**14.7 ADDITIONAL TESTING APPLICABLE TO ALL REPAIRS**

Prior to placing the tank back into service: 1) If the tank was designed to use dielectric isolation a qualified individual will test to confirm that the tank is isolated from all other structures; 2) Perform an appropriate precision tank tightness test per a method recognized by the applicable authority having jurisdiction (AHJ).

Records of any repairs and testing shall be maintained by the owner/operator until the tank is permanently decommissioned.

## REFERENCES

### American Petroleum Institute:

- API Standard 653, *Tank Inspection, Repair, Alteration, and Reconstruction*.
- API RP 2015, *Requirements for Safe Entry and Cleaning of Petroleum Storage Tanks*
- API RP 2016, *Guidelines and Procedures for Entering and Cleaning Petroleum Storage Tanks*

### American Society of Mechanical Engineers

- *Section IX of the ASME Boiler and Pressure Vessel Code*

### American Welding Society

- *AWS D1.1, Structural Welding Code – Steel*
- *AWS D1.6 Structural Welding Code – Stainless Steel*
- *AWS B2.1 Specification for Welding Procedure and Performance Qualification*

### National Fire Protection Association:

- NFPA 30, *Flammable and Combustible Liquids*
- NFPA 326, *Standard for the Safeguarding of Tanks and Containers for Entry, Cleaning, or Repair*

### Steel Tank Institute

- STI R912, *Installation Instructions for Shop-Fabricated Stationary Aboveground Storage Tanks for Flammable, Combustible Liquids*
- STI SP031, *Standard for Repair of Shop-Fabricated Aboveground Tanks for Storage of Flammable and Combustible Liquids*

### Underwriters Laboratories

- UL 142, *Steel Aboveground Tanks for Flammable and Combustible Liquids*
- UL 58, *Steel Underground Tanks for Flammable and Combustible Liquids*
- UL 1746, *External Corrosion Protection Systems for Underground Storage Tanks*

### United States Department of Labor, Occupational Safety & Health Administration (OSHA)

- 29 CFR Part 1910.147, *The Control of Hazardous Energy (Lockout/Tagout)*
- 29 CFR Part 1910.337 to 1910.333, *Electrical Lockout/Tagout*

# APPENDIX A REPAIR FORM

Steel Tank Institute

Date \_\_\_\_\_

## Modification or Repair Report

### OWNER INFORMATION

### FACILITY INFORMATION

Name	Name
Number and Street	Number and Street
City, State, Zip code	City, State, Zip code
Phone/Fax	Phone/Fax

### TANK INFORMATION

Standard of Construction <input type="checkbox"/> UL Standard _____ <input type="checkbox"/> ASME Standard _____ <input type="checkbox"/> Other _____	Types of Construction <input type="checkbox"/> Single wall <input type="checkbox"/> Double wall <input type="checkbox"/> Jacketed <input type="checkbox"/> Other _____ <input type="checkbox"/> 110% containment   Tank mnfr _____			
<table style="width: 100%; border: none;"> <tr> <td style="width: 25%; border: none;">TANK No:</td> <td style="width: 25%; border: none;">Capacity</td> <td style="width: 50%; border: none;">Substance stored</td> </tr> </table>	TANK No:	Capacity	Substance stored	Special construction notes
TANK No:	Capacity	Substance stored		

### REPAIR PERSONNEL

### INSPECTION PERSONNEL

Name	Name
Number and Street	Number and Street
City, State, Zip code	City, State, Zip code
Phone/Fax	Phone/Fax
Qualification <input type="checkbox"/> Tank manufacturer <input type="checkbox"/> Other _____ <input type="checkbox"/> ASME welder <input type="checkbox"/> AWS welder	Qualification <input type="checkbox"/> Tank manufacture <input type="checkbox"/> Other _____

**TYPE OF MODIFICATION PERFORMED** (indicate all applicable items)

New manway, size \_\_\_\_\_  patch plate installed

Notes: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**TYPE OF REPAIR PREFORMED** (indicate all applicable items)

Crack or weld repair  patch plate  perforation repaired  Lining installed

Notes: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Attach sketches, photographs, and testing reports. This record shall be kept by the tank owner for the life of the tank.**

