

# STEEL TANK INSTITUTE

## Technology Summary

### sti-P3®, System for External Corrosion Protection of Underground Steel Storage Tanks

(NOTE: This document is only a summary and as such does not contain specific details of the tank construction.)

#### **PREFACE**

Steel has proven to be the most flexible and durable material to withstand the powerful forces exerted upon USTs. The sti-P3® specification covers a pre-engineered external corrosion control system (termed sti-P3®) for underground steel storage tanks that was developed in 1969 for the Steel Tank Institute (STI) by leaders in the field of corrosion engineering.

The system is a practical and economical means of extending the life of underground tanks from a minimum of thirty (30) years in corrosive soil conditions to an indefinite term in less severe environments. The design includes a safety factor that will allow for somewhat more than ordinary damage to the coating from shipping and handling and other accidental holidays.

The sti-P3® system combines three basic methods of underground corrosion control, all installed on the tanks during manufacture: (1) Cathodic Protection, (2) Protective Coating, (3) Electrical Isolation of the tank from other underground metallic structures.

More than 1/4 million sti-P3® steel underground storage tanks have been placed in service during the past quarter century using the technology's unparalleled three-way combination of pre-engineered corrosion-prevention features. Since 1969, the sti-P3® system has established a verified record of dependable performance. An audit by

Tillinghast, a leading risk management consultancy, reviewed the sti-P3® performance record and documented that sti-P3® tanks have the best UST performance record, an incidence rate of less than 0.04%.

#### **1. PRODUCT NAME**

sti-P3®, System for External Corrosion Protection of Underground Steel Storage Tanks

#### **2. MANUFACTURER**

Manufacturers of sti-P3® double-wall and single-wall cathodically protected steel underground storage tanks are members of Steel Tank Institute (STI), 570 Oakwood Road, Lake Zurich, IL 60047.  
Phone: (847) 438-8265

#### **3. PRODUCT DESCRIPTION**

Basically, the methods employed by the sti-P3® system to prevent exterior corrosion and have been successfully used on pipelines and other underground structures for more than fifty years. Although the basic methods are quite different in their way of protecting steel underground, they are related and must be used in combination with each other to achieve complete protection.

For example, a typical protective coating should not be used alone, because in practice no thin film coating will be completely free of holidays. Some corrosion engineers contend that a thin film applied coating alone is about 75% effective against corrosion, whereas

coating supplemented with cathodic protection results in an effectiveness of these combined methods approaching 100% corrosion control.

During recent years, society's wishes for the protection of the environment and underground water reserves have resulted in an increasing number of states, counties, and municipalities requiring secondary containment of USTs. A double wall UST is basically a tank-within-a-tank that meets this mandate.

Many tank specifiers prefer double wall construction regardless of regulatory requirements. As a result, secondary containment use continues to increase and single wall tanks now comprise less than 50% of the underground storage tanks specified in America.

Regardless of whether single or double wall designs are specified, sti-P3® tanks supply economic benefits for UST specifiers. Each sti-P3® tank provides:

- Alternative fuels compatibility without additional cost of internal linings
- Easy customization for multi-product storage compartments in capacities up to 50,000 gallons aggregate per tank
- Steel striker plates below each tank opening to protect the tank bottom
- Potential cost savings during installation through a variety of acceptable backfill options.
- A variety of dimensions are available from manufacturers.
- Steel shell fabrication, surface preparation, coating application and installation of galvanic anodes take place at the manufacturer's plant.

#### **4. TECHNICAL DATA**

The sti-P3® technology meets the

requirements of:

- U.S. Environmental Protection Agency underground storage tank regulations (40 CFR 280)
- Steel Tank Institute STI-P3-90, the Specification and Manual for External Corrosion Protection Underground Steel Storage Tanks
- Underwriters Laboratories UL 58 Standard for Steel Underground Tanks for Flammable and Combustible Liquids
- Underwriters Laboratories UL 1746 Standard for External Corrosion Protection Systems for Steel Underground Storage Tanks
- Underwriters Laboratory of Canada S603.1
- Relevant fire codes

#### **A. General Characteristics**

An sti-P3® tank has characteristics unique to the pre-engineered design for protection against corrosion:

Dielectric Coating: Every sti-P3® underground storage tank is protected with one of the three generic types of coating that have been tested to STI requirements and then approved for adoption into the sti-P3® specification: coal tar epoxy, urethane, or isophthalic polyester resin. This first line of defense against corrosion completely covers the external surface of the tank. A coating is applied to a blast-cleaned, prepared surface. If this coating is flawless, external corrosion cannot occur. Also, the protective coating serves to reduce the amount of protective current needed for cathodic protection.

Cathodic Protection: The only practical approach to a pre-engineered cathodic protection system for this application is using sacrificial anodes attached to the tank in a manner similar to that employed for ship hull

protection. Galvanic anodes develop their own protective current because of the natural potential difference between the anode metal and the metal being protected. This means that the anode system is self-activated after the tank is buried and will continue to provide corrosion control until the anode is consumed by corrosion.

Sacrificial galvanic anodes made of either high-purity zinc or magnesium prevent corrosion of any exposed metallic surfaces, such as nicks or scratches in the coating that may occur during transportation or installation of the tank. Welded to the tank, these anodes control the direction of electrical current flow and will deteriorate in place of the steel. Based on the estimate of the average current produced by the anodes in a given soil, useful life of the anode system can be readily calculated. If the coating remains undamaged, the anodes will serve merely as back-up protection.

Electrical Isolation: All sti-P3® tanks must be electrically isolated from all metallic underground structures that will be exposed to backfill. This includes hold down straps installed to prevent the tank from floating out of the excavation during a high water table. Tank openings are electrically isolated by use of dielectric nylon bushings or flange isolators that will be compatible with stored product.

By preventing contact between the tank and other nearby metal structures through the piping system, the chance of stray current corrosion is minimized, and the current demand such contact would add is eliminated. This isolation, which defines the area to be protected by anodes, is intact when shipped from the factory.

## **B. Secondary Containment Tank Characteristics**

The vast majority of double-wall sti-P3® tanks are built to conform with the Steel Tank Institute Standard for Dual Wall Underground Steel Storage Tanks (F841). This STI standard details double wall tank construction requirements, which include built-in interstitial leak detection monitoring capability.

Primary Inner Tank: The UL 58 standard steel thickness requirements are determined by several factors such as tank diameter, tank length, and tank burial depth. However, UL 58 notwithstanding, the primary inner tank is built with a minimum steel thickness of 10 gauge.

Steel striker plates at least 1/4" thick are installed on the interior bottom below each tank opening greater than 1/2". This does not apply to manways which do not have openings in the lid. These striker plates prevent wear from inventory sticking and product flow.

Secondary Outer Tank: Construction of the steel outer wrap is separate from the inner wall, but intimate contact or face-to-face lay-up will occur. This intimate contact allows the flow of liquid through the interstice to designated monitoring points, if an internal leak were to occur.

Interstitial Leak Detection Monitoring: sti-P3® double-wall tanks come with built-in interstitial leak detection monitoring capability. Four different monitoring options are used:

- An external monitoring pipe
  - A monitoring pipe with sump
  - An interstice monitoring opening by an extended outer tank head beyond the inner tank head
  - An internal monitoring pipe
- Interstitial monitoring options should be

discussed with the tank manufacturer.

## **5. INSTALLATION**

Illustrated installation instructions for sti-P3® underground storage tanks (Document No. R821) are available upon request from STI and qualified manufacturers, and a copy is shipped with each tank. Tank installation is a specialized craft. It is important to assure that installers have the necessary knowledge, skills and equipment to enable proper and safe underground storage tank installation.

## **6. AVAILABILITY**

sti-P3® steel single and double-wall underground storage tanks are available from qualified manufacturing plants throughout North America. Contact STI for a complete list of qualified manufacturers.

Information on tank costs can be obtained directly from qualified sti-P3® manufacturers. Installation costs should be requested from qualified and experienced tank installation contractors.

## **7. WARRANTY**

For installations in the United States of America, Canada or Puerto Rico, sti-P3® underground storage tanks are backed by a 30-year limited warranty against tank failure caused by cracking, breakup or collapse; corrosion caused by reaction of the tank with its soil environment; and internal corrosion for tanks equipped with required wear plates and used to store heating or motor fuels, including alcohols, and other compatible chemicals. In addition, the steel tank manufacturer warrants the tank against failure due to defective materials and workmanship for one year following the delivery of the tank. Each sti-P3® tank is registered with STI by its serial number. A copy of the complete sti-P3® warranty is available from qualified STI manufacturers.

Except as specifically provided in the sti-P3® limited warranty, there are no warranties, express or implied, including, but not limited to, any implied warranties of merchantability or fitness for a particular purpose. In no event shall STI, STI members, STA, Stico or any subsidiaries thereof, be liable for loss of profits, indirect, incidental, special, consequential, or other similar damages. .

## **8. MAINTENANCE**

The sti-P3® design uniquely enables the testing of the tank's corrosion protection system. Varying federal and state regulations may require that periodic cathodic protection tests be performed on single-wall sti-P3® tanks. New sti-P3® tanks can be specified with PP4 cathodic protection testing equipment, which allows any tank owner to perform cathodic protection tests easily at any time.

## **9. TECHNICAL SERVICES**

Engineering and installation assistance can be provided by qualified sti-P3® manufacturers.

Steel Tank Institute's "sti-P3® Specification and Manual for External Corrosion Protection of Underground Steel Storage Tanks," Publication #STI-P3-90, is available for a nominal fee at the STI website, [www.steeltank.com](http://www.steeltank.com), or from the Steel Tank Association, Inc (STA) by calling (847) 438-0989.