

Interior Lining and Periodic Inspection of Underground Storage Tanks

API STANDARD 1631
FIFTH EDITION, JUNE 2001

REAFFIRMED, MAY 2020



AMERICAN PETROLEUM INSTITUTE

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Downstream Segment

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FOREWORD

API Standard 1631 provides recommendations for lining the interior of existing steel and fiberglass reinforced plastic underground petroleum storage tanks and periodic inspections of lined steel tanks. This standard was prepared under the auspices of the API Manufacturing, Distribution and Marketing Department and is based upon the experience of knowledgeable members of the petroleum industry and lining manufacturers. This standard is intended for use by API member companies and others to develop safe practices and procedures for lining and inspecting underground tanks storing petroleum products. A number of additional API standards and recommended practices as well as government and industry regulations and publications, noted in the reference section, provide supplemental information applicable to the requirements and components of this standard.

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Interior Lining and Periodic Inspection of Underground Storage Tanks

1 General

1.1 SCOPE

This standard provides minimum recommendations for the interior lining of existing steel and fiberglass reinforced plastic underground tanks and periodic inspection of steel underground tanks used for the storage of petroleum-based motor fuels and middle distillates. These recommendations include procedures to be followed and operating conditions to be maintained by contractors, workers and engineers preparing, inspecting, testing and lining the interiors of existing underground storage tanks. Requirements for vapor-freeing tanks, removing sediment and cleaning interior surfaces of steel and fiberglass tanks as well as guidelines to identify tanks that are suitable for lining, are also included. All work associated with the interior lining and periodic inspection of underground storage tanks shall be accomplished in accordance with applicable federal, state, and local regulations, including applicable environmental and safety requirements.

1.2 APPLICABILITY

The methods described in this standard are applicable to steel and fiberglass-reinforced plastic tanks used for the storage of petroleum-based motor fuels and middle distillates. The procedures are applicable to tanks installed in typical retail service station outlets but may also be used for tanks installed at other types of facilities.

1.3 EPA TECHNICAL STANDARDS

The U.S. Environmental Protection Agency (EPA) issued its Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks (UST) (herein referred to as "Technical Standards") in 1988. These regulations can be found in the *Code of Federal Regulations* at 40 CFR Part 280. In addition, legislation and regulations on all aspects of underground storage tank management have been developed by state and local jurisdictions that may have requirements other than those specified in the EPA Technical Standards. Therefore, employers should consult the appropriate government agencies responsible for implementing an approved underground storage tank program within a geographic area of interest, and determine the applicable requirements before any action recommended or suggested by this standard is taken.

The EPA Technical Standards allow this standard to be used as a guide for compliance with EPA's requirements for interior lining and periodic inspection of underground storage tanks. In some respects, the requirements of this standard may be more stringent than the EPA Technical Standards. In addition, this standard is not intended to cover all of the sub-

jects included in the EPA Technical Standards. While substantial effort has been made to ensure that none of this standard's requirements contradict those of the EPA Technical Standards, the API is not undertaking to interpret the EPA Technical Standards and cannot guarantee that the recommendations in this standard are completely in accord with them. Also, the API makes no representation that the requirements of this standard conform with any requirements imposed by state and local agencies.

2 References

2.1 GENERAL

The following government regulations and standards and industry and consensus standards, codes, and publications referenced herein* provide information related to safe entry, vapor freeing, ventilation, cleaning, lining and inspection of underground petroleum storage tanks. While this standard is intended to be consistent with applicable codes and standards in effect at the time of publication, the most recent edition of each regulation, code, standard or publication that is applicable, should be consulted, as appropriate, to assure compliance.

2.2 INDUSTRY AND CONSENSUS CODES, STANDARDS AND PUBLICATIONS

API

RP 651	<i>Cathodic Protection of Aboveground Storage Tanks</i>
RP 652	<i>Lining of Aboveground Petroleum Storage Tank Bottoms</i>
RP 1604	<i>Closure of Underground Petroleum Storage Tanks</i>
RP 1615	<i>Installation of Underground Petroleum Storage Systems*</i>
RP 1632	<i>Cathodic Protection of Underground Petroleum Storage Tanks and Piping Systems*</i>
RP 2003	<i>Protection Against Ignitions Arising out of Static, Lightning, and Stray Currents</i>
Std 2015	<i>Safe Entry and Cleaning of Petroleum Storage Tanks</i>
RP 2016	<i>Entering and Cleaning Petroleum Storage Tanks</i>
Publ 2027	<i>Ignition Hazards Involved in Abrasive Blasting of Atmospheric Storage Tanks in Hydrocarbon Service</i>
Publ 2217A	<i>Guidelines for Work in Inert Confined Spaces in the Petroleum Industry</i>
Publ 2219	<i>Safe Operating Guidelines for Vacuum Trucks in Petroleum Service</i>

RP 2220 *Improving Owner and Contractor Safety Performance**

ACGIH¹

Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices and Documentation (2000)

ANSI²

Z117.1 *Safety Requirements for Confined Spaces*

ASTM³

D543 *Test Method for Resistance of Plastics to Chemical Reagents*

D790 *Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials*

D2583 *Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor*

D2794 *Test Method for Resistance of Organic Coatings on the Effects of Rapid Deformation (Impact)*

D4541 *Test Methods for Pull-Off Strength of Coatings Using Portable Adhesive Testers*

FTPI⁴

T-95-02 *Remanufacturing of Fiberglass Reinforced Plastic (FRP) Underground Storage Tanks*

KWA⁵

Recommended Practice for Inspecting Buried Lined Steel Tanks Using a Video Camera

NACE⁶

RPO 386-97 *Application of a Coating System to Interior Surfaces of Covered Steel Hopper Rail Cars in Plastic, Food, and Chemical Service. Item No. 21033*

RPO 288-94 *Inspection of Linings on Steel and Concrete. Item No. 21039*

RPO 295-95 *Application of a Coating System To Interior Surfaces of new and Used Rail Tank Cars. Item No. 21070*

1/SSPC—SP5 *White Metal Blast Cleaning (RPO 494-2000). Item NO. 21065*

2/SSPC—SP10 *Near White Metal Blast Cleaning (RPO 594-2000). Item No. 21066*

3/SSPC—SP6 *Commercial Blast Cleaning (RPO 694-2000). Item NO. 21067*

NFPA⁷

NFPA 326 *Safeguarding Tanks and Containers*

NFPA 329 *Handling Releases of Flammable and Combustible Liquids and Gases*

NFPA 70 *National Electrical Code*

NFPA 77 *Static Electricity*

SSPC⁸

SP 7 *Brush Off Cleaning (NACE No. 4)*

SP 10 *Near White Metal Blast Cleaning (NACE No. 2)*

UL⁹

Std. 58 *Steel Underground Tanks for Flammable and Combustible Liquids*

Std. 1316 *Glass Fiber Reinforced Underground Storage Tanks for Petroleum Products, Alcohol and Alcohol-blended Mixtures, etc.**

*Note: Although these publications and standards are not referenced within this document, the information provided may be useful when lining underground storage tanks.

2.3 UNITED STATES GOVERNMENT REGULATIONS AND STANDARDS

EPA¹⁰

EPA Regulations 40 CFR Part 280

Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks

OSHA¹⁰

OSHA 29 CFR Part 1910

Subpart L *Hazardous materials*

Subpart I *Personal protective equipment*

Subpart J *General environmental controls*

Subpart Z *Toxic and hazardous substances*

¹American Conference of Governmental Industrial Hygienists, Building D-5, 6500 Glenway Avenue, Cincinnati, Ohio 45211.

²American National Standards Institute, 11 West 42nd Street, New York, New York 10036.

³American Society for Testing Materials, 100 Barr Harbor Dr., W. Conshohocken, Pennsylvania 19428.

⁴Fiberglass Tank and Pipe Institute, 11150 S. Wilcrest Dr., Suite 1, Houston, Texas 77099-4343.

⁵Ken Wilcox Associates, 1125 Valley Ridge Dr., Grain Valley, Missouri 64029.

⁶NACE International, (formerly the National Association of Corrosion Engineers), 1440 South Creek Drive, P.O. Box 218340, Houston, Texas 77218-8340

⁷National Fire Protection Association, 1 Batterymarch Park, Quincy, Massachusetts 02269.

⁸Steel Structure Paint Council, 40 24th St., Pittsburgh, Pennsylvania 15222.

⁹Underwriters Laboratories, Inc. 333 Pfingsten Rd, Northbrook, Illinois 60062.

¹⁰OSHA and EPA Codes of Federal Regulations are available from the U.S. Government Printing Office, Washington, D.C. 20402.

3 Definitions

3.1 GENERAL

The following definitions are applicable to underground tank lining and inspection as described in this standard.

3.2 DEFINITIONS

3.2.1 air supplied respirators: A respirator that provides a supply of safe breathing air from a tank (either a self contained breathing apparatus portable tank or an air line supply tank) or from a source of fresh air (approved breathing air compressor) not subject to potential contamination.

3.2.2 attendant: A qualified employee stationed outside one or more permit required confined spaces who monitors the entrants and who performs all attendant's duties in accordance with the employer's (owner/operator and contractor) permit required confined space program. Attendants may also perform the duties of standby personnel when entrants use respiratory protective equipment.

3.2.3 bonding: The joining of metal parts to form an electrically conductive path that ensures electrical continuity and has the capacity to safely conduct any current likely to be generated. (See alternate definition, "bond").

3.2.3.1 bond: The adhesion of the lining to the metal surface of the tank.

3.2.4 clean (cleaning): The removal of all product, vapor, sludge and residue from a tank and washing, rinsing and drying a tank so that no product or residue remains on any tank surfaces (shell, bottom, piping, appurtenances, etc.).

3.2.5 combustible gas indicator: An instrument used to sample the atmosphere to indicate if any flammable (combustible) vapors/gases are present, determine the composition of hydrocarbon gas and air mixtures and indicate the concentration of vapor/gas present in the atmosphere as a percentage of the lower explosive (flammable) limit (LEL).

3.2.6 combustible liquid: A liquid having a closed cup flash point equal to or greater than 100°F (37.8°C).

3.2.7 confined space: Any underground tank that meets *all three* of the following requirements:

- Is large enough and so configured that an employee can bodily enter and perform assigned work, and
- Has limited or restricted means for entry or exit (for example, tanks and vessels, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry or exit) and
- Is not designed for or meant to be continuously occupied by employees.

3.2.7.1 permit-required confined space: A confined space that meets *all three* of the confined space requirements and also has *one or more* of the following four characteristics:

- Contains or has the potential to contain a hazardous atmosphere.
- Contains a material with the potential to engulf an entrant.
- Has an internal configuration such that an entrant could become trapped or asphyxiated by inwardly converging walls or by floors that slope downward, tapering to smaller cross-sections.
- Contains any other recognized serious safety or health hazard.

3.2.7.2 non-permit required confined space: A confined space (a space that meets all three of the confined space characteristics) but has been checked and inspected and its atmosphere has been monitored and it *does not have* (or does not have the potential to have) any of the characteristics required to be classified as a *permit required* confined space.

3.2.8 degassing: The process of collecting, oxidizing or treating vapors and gases expelled from an underground tank so as to prevent or reduce the amount of organic volatile compounds released into the atmosphere during vapor freeing operations.

3.2.9 electrical division classification of hazardous (classified) locations: The division classification system is used to designate locations where fire or explosion hazards may exist due to the potential for the presence of flammable gases, vapors or liquids.

Note: These classifications are identical to those defined by NFPA 70, The National Electric Code.

3.2.9.1 Class I, Division 1: A location wherein any one of the following conditions applies:

- Ignitable concentrations of flammable gases or vapors exist under normal operating conditions.
- Ignitable concentrations of flammable gases or vapors may exist frequently because of repair or maintenance operations or because of leakage.
- Ignitable concentrations of flammable gases or vapors might be released by breakdown or faulty operation of equipment or processes that might cause electrical equipment to simultaneously fail in such a manner as to become a source of ignition.

3.2.9.2 Group D Location: A division classified location wherein a specific level of protection is required for flammable and combustible liquid vapor or gas that may burn or explode when mixed with air and exposed to a specific ignition source.

3.2.9.3 Group A, B and C Locations: Some petrochemical products require higher levels of protection than

Group D, including, but not limited to, acetylene (Group A), hydrogen (Group B) or ethylene (Group C) (see NFPA 70, Article 500, Hazardous Classified Locations, and NFPA 30, Flammable and Combustible Liquids, for additional information).

3.2.10 electrical zone classification of hazardous (classified) locations: the zone classification system is an alternate system (to division classification) for locations where fire or explosion hazards may exist due to flammable gases, vapors or liquids.

3.2.10.1 Class I, Zone 0 Location: is a location wherein either of the following conditions apply:

- Ignitable concentrations of flammable gases or vapors are present continuously
- Ignitable concentrations of flammable gases or vapors are present for long periods of time.

3.2.10.2 Class I, Zone 1 Location: is a location wherein any of the following conditions apply:

- A location where ignitable concentrations of flammable gases or vapors are likely to exist under normal operating conditions.
- A location where ignitable concentrations of flammable gases or vapors may exist frequently because of repair or maintenance operations or because of leakage.
- A location where equipment is operated or processes conducted in such a manner that breakdown or faulty operations could result in a release of ignitable concentrations of flammable gases or vapors and simultaneously cause failure of equipment so as to create a source of ignition.
- A location that is adjacent to a Class I, Zone 0 location from which ignitable concentrations of flammable gases or vapors could be communicated unless such communication is prevented by adequate positive pressure ventilation from a source of clean air and effective safeguards against ventilation failure are provided.

3.2.11 emergency: Any occurrence or event (including, but not limited to, failure of hazard control or monitoring equipment) internal or external to a confined space, that could endanger entrants or negatively impact on the tank lining operation.

3.2.12 employer: An owner, operator, contractor or sub-contractor whose respective employees are performing a task or activity described in this standard.

3.2.12.1 owner/operator: The company or person responsible for the facility in which the tank to be lined is located.

3.2.12.2 contractor: A company or person selected and hired by the owner/operator to conduct tank lining operations and activities in accordance with the contract and tank lining

agreements. There may be more than one contractor on a job at the same time.

3.2.12.3 sub-contractor: A company or person selected and hired by a contractor to conduct specific tank lining related operations and activities in accordance with sub-contract agreements. There may be more than one sub-contractor on a job at the same time.

3.2.13 empty: A tank that has no (standing) product remaining in the tank and is ready for vapor freeing and cleaning.

3.2.14 entrant: A qualified person who is authorized by the entry supervisor to enter a confined space.

3.2.15 entry: The action by which an entrant passes through an opening into a confined space. Entry includes ensuing work activities in both permit required confined spaces and non-permit confined spaces, and is considered to have occurred as soon as a part of the entrant's body breaks the plane of an opening into the confined space.

3.2.16 entry permit (confined space): The written or printed document provided by the employer (owner/operator or contractor) and issued by an entry supervisor that provides the site, potential hazard and work specific information necessary to control and authorize entry into a permit-required confined space including conditions canceling the permit and requirements for safeguarding or returning the space to service following termination of entry.

3.2.17 entry supervisor: The qualified person (employee, foreman, supervisor, crew chief, etc.) designated by the employer (owner/operator and contractor) to be responsible for determining the requirements and whether or not acceptable entry conditions exist at permit required confined spaces and non-permit required confined spaces, where entry is contemplated. Entry supervisors shall authorize entry, oversee entry operations and terminate entry as required by the permit or conditions. An entry supervisor, who is properly qualified, trained and equipped, may serve as an attendant or as an entrant. The duties of entry supervisor may be passed from one entry supervisor to another entry supervisor, during the course of an entry operation.

3.2.18 explosive (flammable) range: The range of concentrations of flammable vapor-in-air, between the lower explosive (flammable) limit (LEL) and the upper explosive (flammable) limit (UEL) that will propagate flame if ignited.

3.2.18.1 Lower Explosive (flammable) Limit (LEL): The minimum concentration expressed as a volume (percentage) of a vapor-in-air below which propagation of flame does not occur on contact with an ignition source; generally considered to be "too lean to burn".

