

Welded Steel Tanks for Oil Storage

API STANDARD 650
TENTH EDITION, NOVEMBER 1998

ADDENDUM 1, JANUARY 2000
ADDENDUM 2, NOVEMBER 2001
ADDENDUM 3, SEPTEMBER 2003
ADDENDUM 4, DECEMBER 2005

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Downstream Segment

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FOREWORD

This standard is based on the accumulated knowledge and experience of purchasers and manufacturers of welded steel oil storage tanks of various sizes and capacities for internal pressures not more than 2½ pounds per square inch gauge. This standard is meant to be a purchase specification to facilitate the manufacture and procurement of storage tanks for the petroleum industry.

If the tanks are purchased in accordance with this standard, the purchaser is required to specify certain basic requirements. The purchaser may want to modify, delete, or amplify sections of this standard, but reference to this standard shall not be made on the nameplates of or on the manufacturer's certification for tanks that do not fulfill the minimum requirements of this standard or that exceed its limitations. It is strongly recommended that any modifications, deletions, or amplifications be made by supplementing this standard rather than by rewriting or incorporating sections of it into another complete standard.

The design rules given in this standard are minimum requirements. More stringent design rules specified by the purchaser or furnished by the manufacturer are acceptable when mutually agreed upon by the purchaser and the manufacturer. This standard is not to be interpreted as approving, recommending, or endorsing any specific design or detailing the method of design or construction.

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Certain serious adverse health effects are associated with asbestos, among them the serious and often fatal diseases of lung cancer, asbestosis, and mesothelioma (a cancer of the chest and abdominal linings). The degree of exposure to asbestos varies with the product and the work practices involved.

Consult the most recent edition of the Occupational Safety and Health Administration (OSHA), U.S. Department of Labor, Occupational Safety and Health Standard for Asbestos, Tremolite, Anthophyllite, and Actinolite, 29 *Code of Federal Regulations* Section 1910.1001; the U.S. Environmental Protection Agency, National Emission Standard for Asbestos, 40 *Code of Federal Regulations* Sections 61.140 through 61.156; and the U.S. Environmental Protection Agency (EPA) rule on labeling requirements and phased banning of asbestos products (Sections 763.160-179).

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Welded Steel Tanks for Oil Storage

1 Scope

1.1 GENERAL

1.1.1 This standard covers material, design, fabrication, erection, and testing requirements for vertical, cylindrical, aboveground, closed- and open-top, welded steel storage tanks in various sizes and capacities for internal pressures approximating atmospheric pressure (internal pressures not exceeding the weight of the roof plates), but a higher internal pressure is permitted when additional requirements are met (see 1.1.10). This standard applies only to tanks whose entire bottom is uniformly supported and to tanks in nonrefrigerated service that have a maximum design temperature of 93°C (200°F) (see 1.1.17) or less.

1.1.2 This standard is designed to provide the petroleum industry with tanks of adequate safety and reasonable economy for use in the storage of petroleum, petroleum products, and other liquid products commonly handled and stored by the various branches of the industry. This standard does not present or establish a fixed series of allowable tank sizes; instead, it is intended to permit the purchaser to select whatever size tank may best meet his needs. This standard is intended to help purchasers and manufacturers in ordering, fabricating, and erecting tanks; it is not intended to prohibit purchasers and manufacturers from purchasing or fabricating tanks that meet specifications other than those contained in this standard.

Note: A bullet (•) at the beginning of a paragraph indicates that there is an expressed decision or action required of the purchaser. The purchaser's responsibility is not limited to these decisions or actions alone. When such decisions and actions are taken, they are to be specified in documents such as requisitions, change orders, data sheets, and drawings.

• **1.1.3** This standard has requirements given in two alternate systems of units. The requirements are similar but not identical. These minor differences are due to issues such as numerical rounding and material supply. When applying the requirements of this standard to a given tank, the manufacturer shall either comply with all of the requirements given in SI units or shall comply with all of the requirements given in US Customary units. The selection of which set of requirements (SI or US Customary) shall apply to a given tank shall be by mutual agreement between the manufacturer and purchaser.

1.1.4 The appendices of this standard provide a number of design options requiring decisions by the purchaser, standard requirements, recommendations, and information that supplements the basic standard. An appendix becomes a requirement only when the purchaser specifies an option covered by that appendix. See Table 1-1 for the status of each appendix.

1.1.5 Appendix A provides alternative simplified design requirements for tanks where the stressed components, such as shell plates and reinforcing plates, are limited to a maximum nominal thickness of 12.5 mm ($\frac{1}{2}$ in.), including any corrosion allowance, and whose design metal temperature exceeds the minimums stated in the appendix.

1.1.6 Appendix B provides recommendations for the design and construction of foundations for flat-bottom oil storage tanks.

1.1.7 Appendix C provides minimum requirements for pan-type, pontoon-type, and double-deck-type external floating roofs.

1.1.8 Appendix D provides requirements for submission of technical inquiries on this standard.

- **1.1.9** Appendix E provides minimum requirements for tanks subject to seismic loading. An alternative or supplemental design may be mutually agreed upon by the manufacturer and purchaser.

1.1.10 Appendix F provides requirements for the design of tanks subject to a small internal pressure.

1.1.11 Appendix G provides requirements for an optional aluminum dome roof.

1.1.12 Appendix H provides minimum requirements that apply to an internal floating roof in a tank with a fixed roof at the top of the tank shell.

- **1.1.13** Appendix I provides acceptable construction details that may be specified by the purchaser for design and construction of tank and foundation systems that provide leak detection and subgrade protection in the event of tank bottom leakage, and provides for tanks supported by grillage.

1.1.14 Appendix J provides requirements covering the complete shop assembly of tanks that do not exceed 6 m (20 ft) in diameter.

1.1.15 Appendix K provides a sample application of the variable-design-point method to determine shell-plate thicknesses.

1.1.16 Appendix L provides data sheets listing required information to be used by the purchaser in ordering a storage tank and by the manufacturer upon completion of construction of the tank.

1.1.17 Appendix M provides requirements for tanks with a maximum design temperature exceeding 93°C (200°F) but not exceeding 260°C (500°F).