

# Specification for Shop Welded Tanks for Storage of Production Liquids

API SPECIFICATION 12F  
ELEVENTH EDITION, NOVEMBER 1, 1994

**American Petroleum Institute**  
1220 L Street, Northwest  
Washington, D.C. 20005



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**Exploration and Production Department**

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## FOREWORD

This specification is under the jurisdiction of the API Committee on Standardization of Production Equipment.

This specification is based on the accumulated knowledge and experience of purchasers and manufacturers of shop welded steel storage tanks of various sizes and capacities for internal pressures approaching atmospheric. The object of this publication is to provide a purchase specification to facilitate the manufacture and procurement of storage tanks for production service, such as storage of crude oil, condensate, hydrocarbon products and non-potable water. If tanks are purchased in accordance with these specifications, the purchaser is expected to specify certain basic requirements.

*This standard shall become effective on the date printed on the cover but may be used voluntarily from the date of distribution.*

# Specification for Shop Welded Tanks for Storage of Production Liquids

## 1 Scope

### 1.1 GENERAL

a. This specification covers material, design, fabrication, and testing requirements for shop-fabricated vertical, cylindrical, aboveground, closed top, welded steel storage tanks in various standard sizes and capacities for internal pressures approximately atmospheric, not to exceed those listed in Column 2, Table 1.

b. This specification is designed to provide the oil production industry with tanks of adequate safety and reasonable economy for use in the storage of crude petroleum and other liquids commonly handled and stored by the production segment of the industry. This specification is for the convenience of purchasers and manufacturers in ordering and fabricating tanks.

### 1.2 COMPLIANCE

The manufacturer is responsible for complying with all of the provisions of this specification. The purchaser may make any investigation necessary to satisfy himself of compliance by the manufacturer and may reject any material that does not comply with this specification. It is urged that the purchaser avail himself of this right and furnish his own inspection independently of any supervisory inspection furnished by the manufacturer, and that the purchaser's inspector follow closely all the details of shop fabrication and/or field construction and testing herein specified which affect the integrity and safety of the completed structure.

## 2 Material

### 2.1 GENERAL

Materials listed in this section have been selected to provide adequate strength and reasonable service life. Other materials having mechanical properties equal to or greater than these listed may be used by agreement between the purchaser and the manufacturer. Where higher strength materials are used, the minimum thicknesses called for in this specification shall not be reduced.

### 2.2 PLATES

a. Plates shall conform to the latest edition of the following ASTM Standards\*:

A 36 *Structural Steel*

A 285 *Low and Intermediate Tensile Strength Carbon Steel Plates of Structural Quality—grade C or D.*

A 285 *Low and Intermediate Tensile Strength Carbon Steel Plates for Pressure Vessels—Grade C.*

b. Shell plates for which minimum thicknesses have been fixed for practical reasons (greater than required by computation) and which will not underrun the required computed thickness by more than 0.01 in., as well as all roof and bottom plates, may be purchased on a weight basis. The plate thicknesses or weights, as stipulated herein, are minimums; thicker or heavier material may be required on the order at the option of the purchaser.

### 2.3 SHEETS

Sheets shall conform to the latest edition of ASTM A 570, grade C or D, open-hearth process and basic oxygen process. Sheets may be ordered on a weight or thickness basis, at the option of the tank manufacturer.

### 2.4 WELDING ELECTRODES

Manual arc-welding electrodes shall conform to the E 60 and E 70 Series of Classification (suitable for the electric current characteristics, the position of welding, and other conditions of intended use) in the latest edition of AWS\*\* A 5.1 *Specification for Mild Steel Arc-Welding Electrodes.*

### 2.5 STRUCTURAL SHAPES

Structural shapes shall be of open-hearth, electric-furnace, or basic oxygen process and shall conform to the latest edition of ASTM A 36.

### 2.6 PIPING

Pipe shall conform to Grade A or B of the latest edition of API Specification 5L; ASTM A 53; or ASTM A-106.

### 2.7 FLANGES

Hub slip-on welding and welding-neck flanges shall conform to the material requirements for forged carbon steel flanges as specified in ANSI B16.5.†

### 2.8 COUPLINGS

Couplings for threaded connections may be supplied with or without recess, complying with the dimensional, physical and chemical requirements of the latest edition of API Specification 5L, Grade B. Alternatively, couplings may comply with the latest edition of ANSI B16.11† for Steel Pipe Couplings.

\*\*Available from American Welding Society (AWS) P.O. Box 351040, Miami, Florida 33135.

†American National Standards Institute (ANSI), 1430 Broadway, New York, N.Y. 10018.

\*Available from American Society for Testing and Materials (ASTM), 1916 Race Street, Philadelphia, Pa. 19103.

## 2.9 BOLTING

Tank bolting  $\frac{1}{2}$  inch in diameter to and including  $\frac{1}{2}$  inch in length shall conform to the requirements given in Appendix A. All other bolting shall conform to the latest revision of ASTM A-307, Grade A or B. Unless otherwise specified on the purchase order, black-finish bolts and nuts shall be furnished. When specified to be galvanized, bolts and nuts shall be zinc-coated in accordance with Appendix A or the applicable ASTM Specification. Alternative materials and/or finish conforming to recognized standards for bolting may be furnished by agreement between the purchaser and the manufacturer.

## 3 Design

### 3.1 GENERAL

Tanks covered by this specification have been designed using established engineering calculations to determine minimum metal thickness and bolting specifications for each size tank filled with water (62.37 lb/cu.ft @ 60F) and at the internal pressure specified in column 2, Table 1. In order to assure structural stability and integrity, additional metal thickness has been added to that determined by calculation. The minimum metal thickness specified in this standard shall in no case be decreased.

### JOINT DESIGN

#### 3.2 DEFINITIONS

The following definitions shall apply to tank-joint designs.

**3.2.1 double-welded butt joint:** A joint between two abutting parts lying in approximately the same plane and welded from both sides. A joint with filler metal added from one side only is considered equivalent to a double-welded butt joint when means are provided for accomplishing complete penetration and reinforcement on both sides of joint.

**3.2.2 double-welded lap joint:** A joint between two overlapping members, in which the overlapping edges of both members are welded with fillet welds.

**3.2.3 butt weld:** A weld placed in a groove between abutting members. Grooves may be square V (single or double) or U (single or double).

**3.2.4 fillet weld:** A weld of approximately triangular cross-section joining two surfaces approximately at right angles to each other as in a lap joint, tee joint, or corner joint.

**3.2.5 full fillet weld:** A fillet weld whose size is equal to the thickness of the thinner member joined.

**3.2.6 tack weld:** A weld made to hold parts of a weldment in proper alignment until the final welds are made.

#### 3.3 SIZE OF WELD

The size of a weld shall be based on the following dimensions:

- Groove-Weld. The joint penetration (depth of chamfering plus the root penetration when specified).
- Fillet Weld. For equal leg fillet welds, the leg length of the largest isosceles right-triangle which can be inscribed within the fillet-weld cross-section. For unequal leg fillet welds, the leg lengths of the largest right-triangle which can be inscribed within the fillet-weld cross-section.

### 3.4 JOINT RESTRICTIONS

The following restrictions on type and size of joints or welds shall apply.

- Tack welds shall not be considered as having any strength value in the finished structure.
- The minimum size of fillet welds shall be as follows: Plate  $\frac{3}{16}$  in. in thickness, full-fillet weld; plates over  $\frac{3}{16}$  in. thick, not less than one-third the thickness of the thinner plate at the joint, with a minimum of  $\frac{3}{16}$  in.
- Single-welded joints shall not be permissible on tank bottoms, shells, or decks.

### 3.5 SIZE

Tanks under this specification shall be furnished in the sizes and dimensions as stipulated in Table 1, columns 1 through 4, and Fig. 1, as specified on the purchase order.

### BOTTOM DESIGN

#### 3.6 TYPE

The tank bottom shall be flat, or of the type A (unskirted) or type B (skirted) cone design, as specified on the purchase order. Type A and type B cone bottoms shall conform to Fig. 2 and 3 respectively.

#### 3.7 THICKNESS

The thickness of bottom plates shall be  $\frac{1}{4}$  in. (10.20 lb. per sq. ft.) nominal, except the sump of the type A cone bottom which shall be  $\frac{3}{8}$  in. (15.30 lb. per sq. ft.) nominal.

#### 3.8 JOINTS IN BOTTOM PLATES

Bottom joints shall be double-welded butt joints with complete penetration.

#### 3.9 SHELL ATTACHMENTS

The tank bottom shall be attached to the tank shell, if the bottom is flanged, by a double-welded butt joint with complete penetration, or by a double-welded, full-fillet lap joint; or, if the bottom is not flanged, by full-fillet welds, both inside and outside.