Specification for Bolted Tanks for Storage of Production Liquids

API SPECIFICATION 12B
FIFTEENTH EDITION, OCTOBER 2008

EFFECTIVE DATE: APRIL 1, 2009

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Upstream Segment

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Specification for Bolted Tanks for Storage of Production Liquids

1 Scope

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

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.

2 References

API Specification 5L, *Specification for Line Pipe*

API Specification 6A, *Specification for Wellhead and Christmas Tree Equipment*

API Standard 2000, *Venting Atmospheric and Low-pressure Storage Tanks: Nonrefrigerated and Refrigerated*

ASME B1.1 [1], *Unified Inch Screw Threads, (UN and UNR Thread Form)*

ASME B16.11, *Forged Steel Fittings, Socket-Welding and Threaded*

ASME B18.2.1, *Square and Hex Bolts and Screws (Inch Series)*

ASME B18.2.2, *Square and Hex Nuts (Inch Series)*

ASTM A6 [2], *Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling*

ASTM A36, *Standard Specification for Carbon Structural Steel*

ASTM A53, *Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless*

ASTM A105, *Standard Specification for Carbon Steel Forgings for Piping Applications*

ASTM A106, *Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service*

ASTM A123, *Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products*

ASTM A153, *Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware*

ASTM A181, *Standard Specification for Carbon Steel Forgings, for General-Purpose Piping*

ASTM A216, *Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service*

ASTM A283, *Specification for Low and Intermediate Tensile Strength Carbon Steel Plates*

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1 ASME International, 3 Park Avenue, New York, New York 10016, www.asme.org.
2 ASTM International, 100 Barr Harbor Drive, West Conshohocken, Pennsylvania 19428, www.astm.org.

ASTM A307, *Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength*

ASTM A568, *Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements*

ASTM B454, *Specification for Mechanically Deposited Coatings of Cadmium and Zinc on Ferrous Metals* (Withdrawn 1981)

NFPA No. 30 [3], *Flammable and Combustible Liquids Code*

3 Material

3.1 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 thickness called for in this specification shall not be reduced.

3.2 Plates

Plates shall conform to the latest edition of ASTM A36 and ASTM A283 (Grade C only).

3.3 Sheets

Sheets shall be commercial quality having a minimum tensile strength of 52,000 psi. Sheets may be ordered on a weight or thickness basis, at the option of the tank manufacturer.

3.4 Structural Shapes

Structural shapes shall be open-hearth, electric-furnace or basic oxygen process and shall conform to the latest edition of ASTM A36.

3.5 Piping

Pipe shall conform to Grade A or B of the latest edition of API 5L; ASTM A53 or ASTM A106.

3.6 Flanges

Flanges shall be steel, conforming to one of the following ASTM Specifications: ASTM A216 for cast steel, or ASTM A181 or ASTM A105 for forged steel.

3.7 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 5L, Grade B. Alternatively, couplings may comply with the latest edition of ASME B16.11.

[3] National Fire Protection Association, 1 Batterymarch Park, Quincy, Massachusetts 02169-7471, www.nfpa.org.

3.8 Finish

Tanks shall be furnished with mill finish, painted, galvanized, or with factory applied coating for corrosion control, as specified on the purchase order. When galvanizing is specified on the purchase order, the galvanized coating on all tank plates, sheets, and structural shapes shall be applied after shop fabrication and shall conform to ASTM A123, except that, at the option of the manufacturer, written assurance may be furnished to the purchaser as to compliance, in lieu of actual test reports.

3.9 Bolting

Tank bolting 1/2 in. in diameter to and including 1 1/2 in. in length shall conform to the requirements as given in Annex A. All other bolting shall conform to the latest revision of ASTM A307 Grade A and shall have dimensions conforming to ANSI regular square or regular hex.

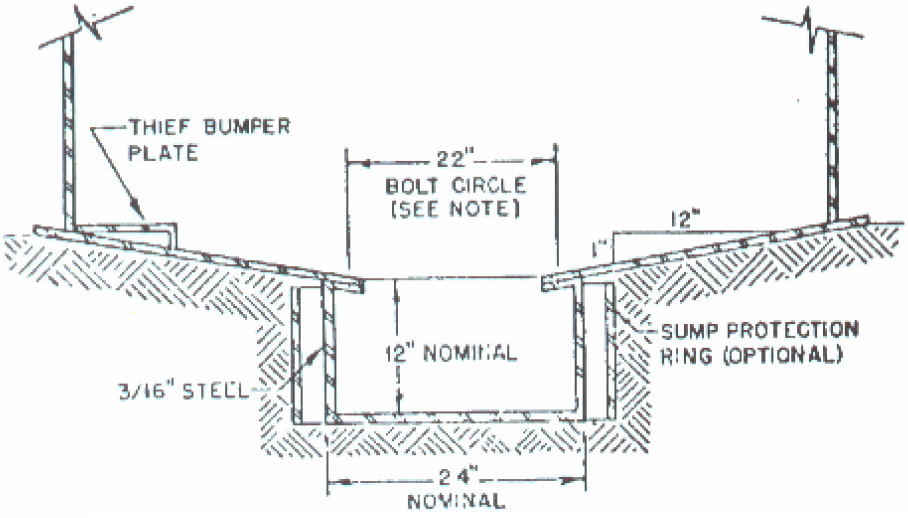
4 Design

4.1 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/ft^3 at 60°F) 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 specification shall in no case be decreased.

4.2 Size

Tanks shall conform to the sizes and dimensions shown in Table 1 as specified on the purchase order.



NOTE 30 holes 17/32 in. diameter required for all sizes, except 21 ft, 6 1/2 in. diameter tanks which require 28 17/32 in. diameter.

Figure 1—Cone Bottoms [See 4.3 b)]

4.3 Tank Bottoms

Tank bottoms shall conform to one of the following requirements as specified on the purchase order:

a) *Flat bottoms*. Flat bottoms shall conform to the requirements of Table 2 and Figure 2 and Figure 3 for the particular size tank ordered. Bottom segments shall be supplied with a 1/4 in. identification hole as shown in Figure 2 and Figure 3.

b) *Cone bottoms*. Cone bottoms for tank sizes 29 ft, 8 5/8 in. in diameter and smaller shall conform to the requirements of Figure 1. Cone bottom segments shall have the same dimensions as deck segments (see Figure 5) but without flange, for the particular size tank ordered, except the flanged deck dome shall not be furnished. When a cone bottom is furnished, the inside center support shall be either extended to the sump bottom or the sump opening shall be adequately bridged and the center support securely attached to such bridge.

c) By agreement between purchaser and manufacturer, a bottom design alternative to those specified in 4.3 a) and 4.3 b) may be furnished, providing such alternative design possesses equivalent strength, tightness, and utility.

4.4 Staves

Tank staves shall conform to the requirements of Table 2 and Figure 4 for the particular size of tank ordered.

NOTE When open-top tanks are supplied under this specification, a top reinforcing member shall be provided. The minimum section modulus of this member shall conform to the following equation:

$$S = 0.0001\ HD^2 \tag{1}$$

where

S is the section modulus, in in.^{3};

H is the height of tank, in ft;

D is the diameter of tank, in ft.

4.5 Tank Deck

Tank decks shall conform to the requirements of Table 2 and Figure 5 for the particular size of tank ordered, except that if so agreed between the purchaser and the manufacturer, an alternative design of deck (including supporting members) of equivalent strength, tightness, and utility shall be furnished.

4.6 Deck Supports

All elements of deck supports not specifically dimensioned herein, shall be designed to support a live load of not less than 20 psf in addition to the dead load. Allowable design stresses shall be as follows:

Rolled Structural Shapes:

Tension, psi, max	20,000
Bending, psi, max	20,000
Compression, psi, max	$\dfrac{20{,}000}{1 + L^2/20{,}000r^2}$
L/r ratio, max	200

Formed Sections:

Basic design stress, psi, max 18,000

Column footings:

Soil-bearing load, psf, max 4,000 (Based on maximum water load plus super-imposed roof load)

4.7 Low Capacity Tanks—Supports

Tanks of 100-, 200-, 300-, 250-, high 500-, 750-, low 500-, high 1,000-, and 1,500-bbl capacity shall be furnished with structural-type center support, with the upper end fastened inside the dome with three bolts in each leg and the lower end fastened to a bottom attachment base designed to permit height adjustment.

Table 1—Sizes and General Dimensions

(1)	(2)	(3)	(4)	(5)	(6)
Nominal Capacity 42-gal bbl	**Design Pressure** oz/in.^{2} **Pressure, Vacuum**	**Number of Rings**	**Inside Diameter** [a] ft, in.	**Height of Shell** [b] ft, in.	**Calculated Capacity** [c] 42-gal bbl
100	3, 1/2	1	9, 2 3/4	8, 1/2	96
200	3, 1/2	2	9, 2 3/4	16, 1	192
300	3, 1/2	3	9, 2 3/4	24, 1 1/2	287
250	3, 1/2	1	15, 4 5/8	8, 1/2	266
High 500	3, 1/2	2	15, 4 5/8	16, 1	533
750	3, 1/2	3	15, 4 5/8	24, 1 1/2	799
Low 500	2, 1/2	1	21, 6 1/2	8, 1/2	522
High 1,000	2, 1/2	2	21, 6 1/2	16, 1	1,044
1,500	2, 1/2	3	21, 6 1/2	24, 1 1/2	1,566
Low 1,000	2, 1/2	1	29, 8 5/8	8, 1/2	994
2,000	2, 1/2	2	29, 8 5/8	16, 1	1,987
3,000	2, 1/2	3	29, 8 5/8	24, 1 1/2	2,981
5,000	1, 1/2	3	38, 7 5/8	24, 1 1/2	5,037
10,000	1, 1/2	3	54, 11 3/4	24, 2	10,218

[a] The inside diameter is an approximate dimension. The values shown are 2 in. less than the bottom bolt-circle diameters.

[b] Shell heights shown do not include thickness of gaskets.

[c] The calculated capacity is based on the inside diameter (Column 4) and height of shell (Column 5).

4.8 Medium Capacity Tanks—Supports

Tanks of low 1,000-, 2,000-, and 3,000-bbl capacity shall be furnished with a structural- or pole-type center support, including a rafter support ring. The distance from the tank center to the point of attachment of the rafter to the rafter support ring clip shall be 38 1/32 in.

4.9 High Capacity Tanks—Supports

Tanks of 5,000-bbl and 10,000-bbl capacity shall be furnished with pole-type center support. The distance from the tank center to the point of attachment of the rafter to the rafter support ring clip shall be 28 in. for the 5,000 bbl tank and 60 in. for the 10,000-bbl tank.

4.10 Rafters

Tanks of low 1,000-, 2,000-, 3,000-, 5,000-, and 10,000-bbl capacity shall be furnished with rafters attached to each radial deck joint. Rafters shall conform to the allowable design stresses as given in 4.6. Each rafter shall be attached to the center support ring and by suitable brackets to the top chime area. The depth of rafters, measured from the underside of the deck at each end shall be 5 1/2 in. for low 1,000-, 2,000-, 3,000-, and 5,000-bbl tanks, and 6 3/4 in. for 10,000-bbl tanks. Rafters shall be punched or drilled to accommodate supporting clips for bolt retainers.

Except as provided above, rafters shall be furnished in conformance to design details as agreed upon between the purchaser and manufacturer.

Table 2—Details of Bottoms, Shells, and Decks

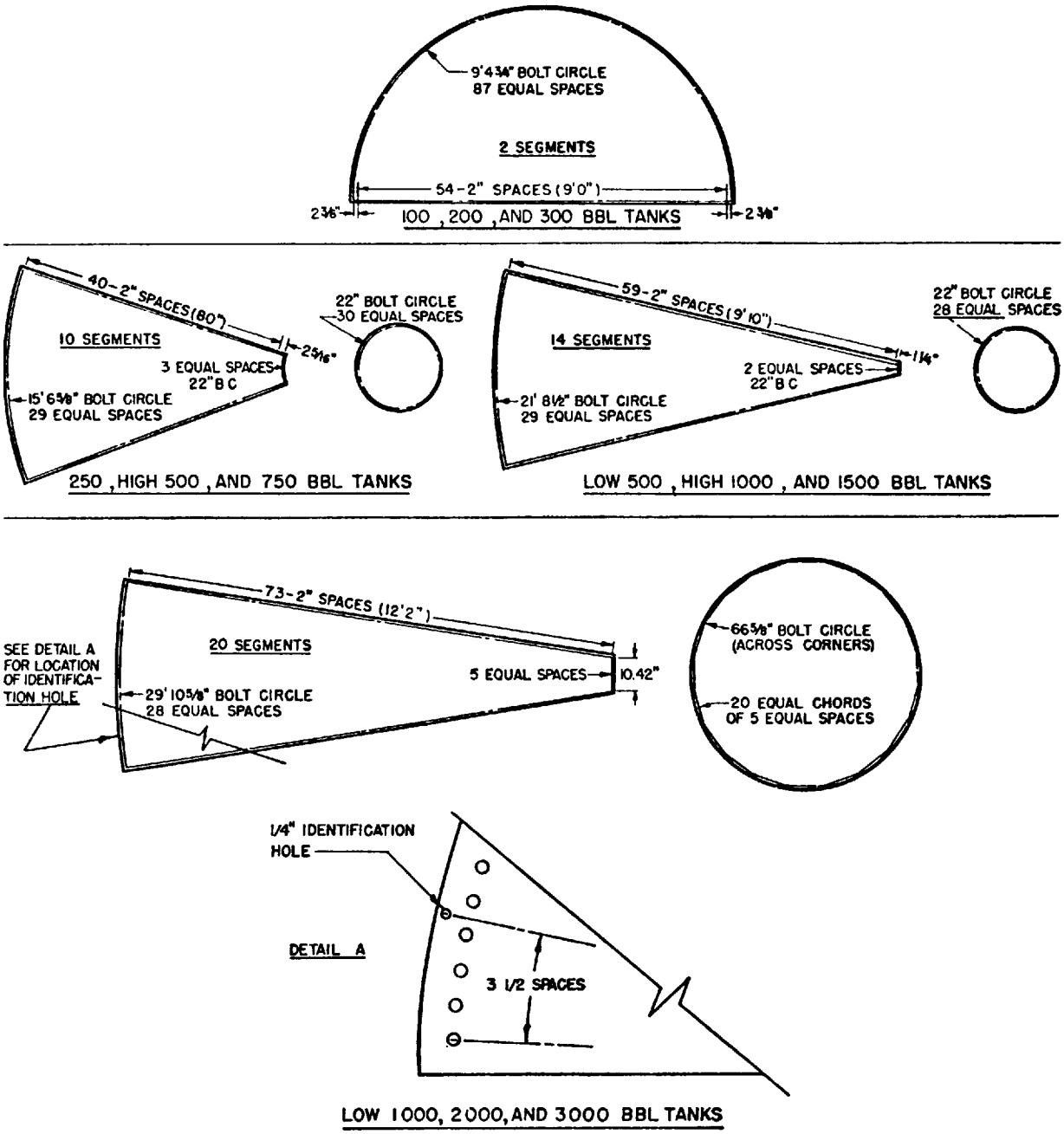
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Bottom		Shell							Deck	
Nominal Capacity 42-gal bbl	No. of Bottom Segments (See Figure 2 and Figure 3)	Thickness of Bottom Elements [a] in.	No. of Staves per Ring	Thickness of Staves [a] in.			No. of Rows of Bolts in Vertical Seams			No. of Deck Segments (See Figure 5)	Thickness of Deck Elements [a] in.
				1st Ring [b]	2nd Ring	3rd Ring	1st Ring [b]	2nd Ring	3rd Ring		
100	2	0.105	6	0.105	—	—	1	—	—	6	0.105
200	2	0.105	6	0.105	0.105	—	1	1	—	6	0.105
300	2	0.105	6	0.105	0.105	0.105	1	1	1	6	0.105
250	10	0.105	10	0.105	—	—	1	—	—	10	0.105
High 500	10	0.105	10	0.105	0.105	—	1	1	—	10	0.105
750	10	0.105	10	0.135	0.105	0.105	1	1	1	10	0.105
Low 500	14	0.105	14	0.105	—	—	1	—	—	14	0.105
High 1,000	14	0.105	14	0.105	0.105	—	1	1	—	14	0.105
1,500	14	0.105	14 [c]	0.105	0.105	0.105	2	1	—	14	0.105
Low 1,000	20	0.105	20	0.105	—	—	2	—	—	20	0.105
2,000	20	0.105	20	0.105	0.105	—	2	2	—	20	0.105
3,000	20	0.105	20	0.135	0.105	0.105	2	2	2	20	0.105
5,000	26 [d]	0.135	26	0.135	0.135	0.105	2	2	2	26 [d]	0.105
10,000	37 [d]	0.135	37	3/16	0.135	0.135	3	2	2	37 [d]	0.105

[a] Thickness of bottoms, staves and decks are minimum, and may be increased to 0.135 in., 3/16 in., or 1/4 in. by agreement between the purchaser and the manufacturer. Sheet (less than 3/16 in.) shall be ordered to decimal thickness. Tolerance shall be per ASTM A6. Corresponding AISC gage numbers and thickness are:
12-gage: [0.1045 (0.105) in.]; and
10-gage: [0.1345 (0.1345) in.]. Plate (3/16 in. and over) shall be ordered to nominal thickness. Tolerance shall be per ASTM A6.
[b] The first ring is the bottom ring.
[c] The first ring of the 1500-bbl tank shall consist of 14 regular staves, and a fill-in stave having 15 bolt-hole spaces on the chimes.
[d] Two piece segments.

4.11 Bolted Joints

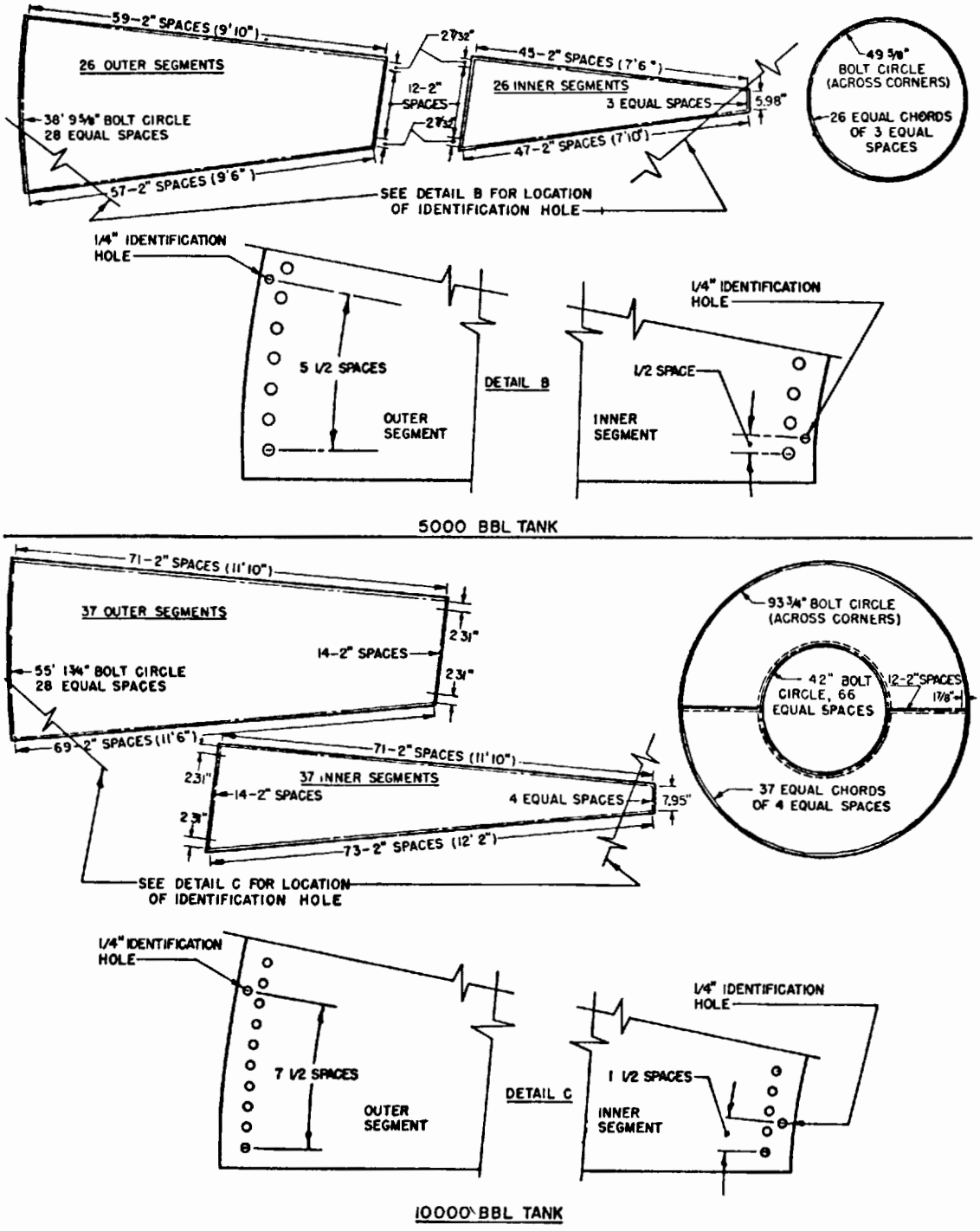
Bolt holes shall be 17/32 in. diameter. The tolerance on bolt-hole spacing shall be ± 1/32 in. between any two holes, measured in the flat before forming.

When using square head or hex head bolts, bolt retainers in the form of channels or other shapes shall be provided outside of all bottom joints, and inside of all staves, cleanouts, and decks to prevent inaccessible bolt heads from turning.



NOTE 1 Edge distance, all seams = 3/4 in. min.
NOTE 2 Bolt-hole diameter = 17/32 in.
NOTE 3 Bolt diameter = 1/2 in.
NOTE 4 All bolt-circle dimensions are diameter measurements.

Figure 2—Bottom Elements [See 4.3 a)]



NOTE 1 Edge distance, all seams = 3/4 in. min.
NOTE 2 Bolt-hole diameter = 17/32 in.
NOTE 3 Bolt diameter = 1/2 in.
NOTE 4 All bolt-circle dimensions are diameter measurements.

Figure 3—Bottom Elements

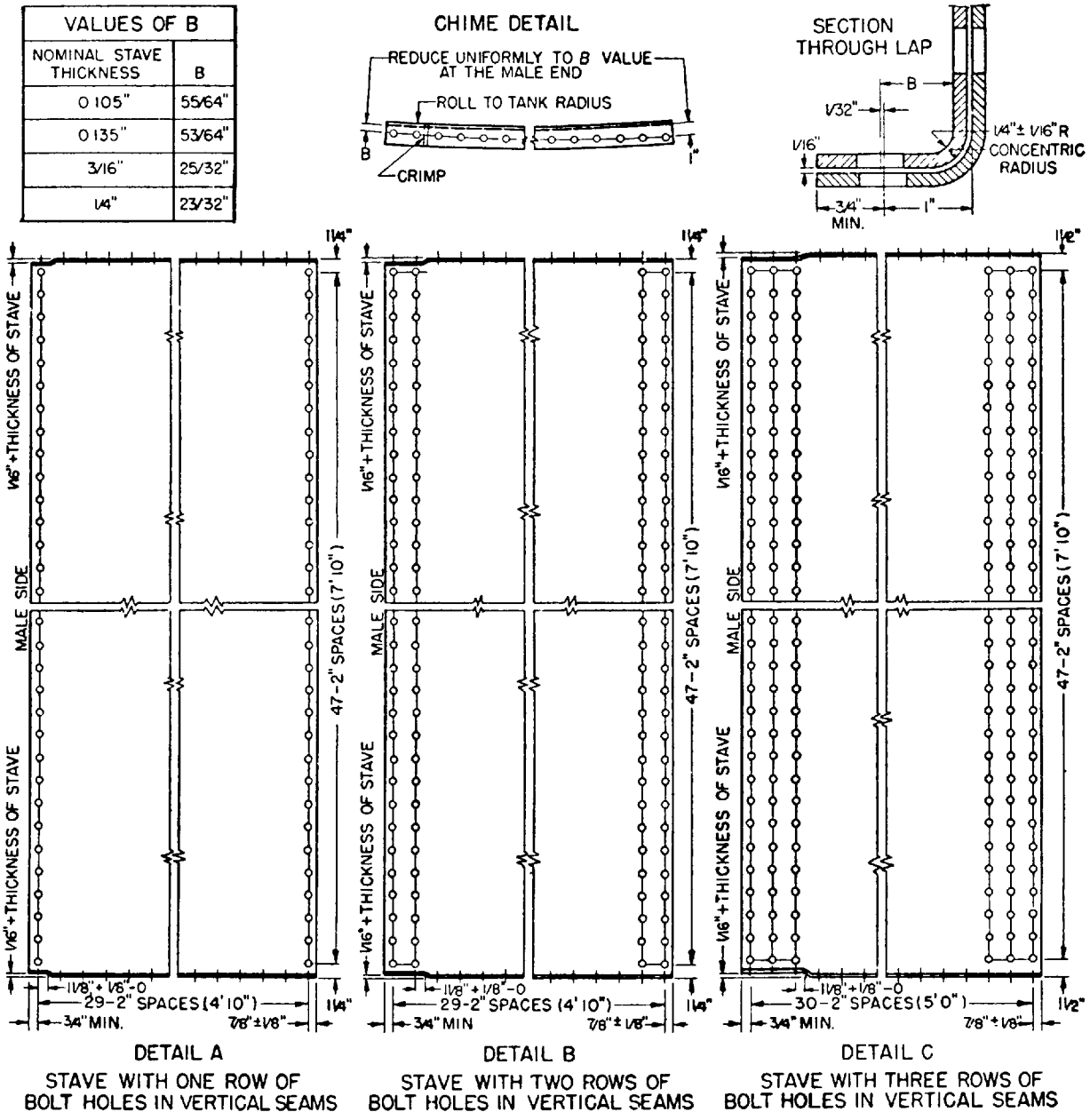
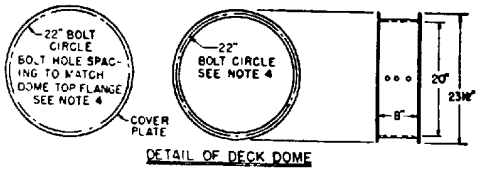
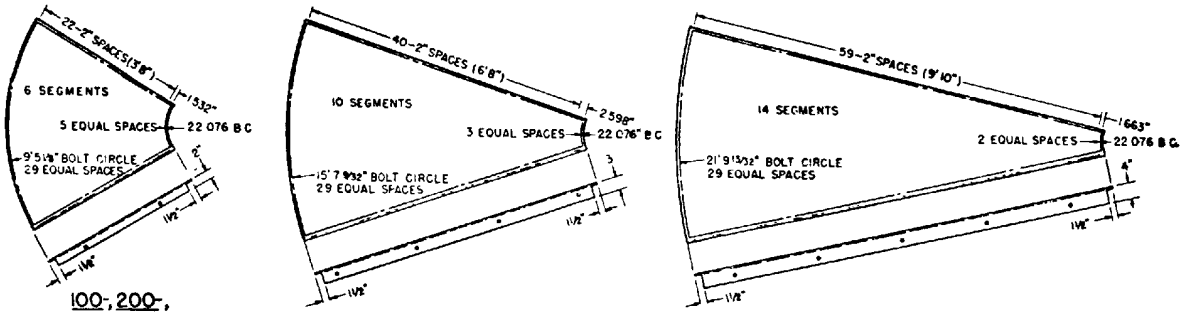


Figure 4—Stave Elements (See 4.4)

General Requirements
1. Edge distance, all seams = $^{3}/_{4}$ in. minimum.
2. Bolt-hole diameter = $^{17}/_{32}$ in., bolt diameter = $^{1}/_{2}$ in.
3. Dome shall have 30 equally spaced bolt holes in one flange 28 in the other flange and shall be installed so that the lower flange matches the bolt-hole spaces of the deck segments or deck center pieces.
4. Dimensions of deck segments are on nominal slope (1 in 12), dimensions of deck center pieces are in the flat.



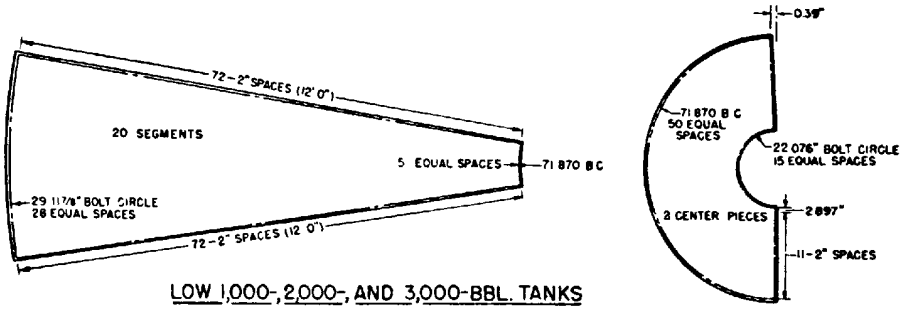
DETAIL OF DECK DOME



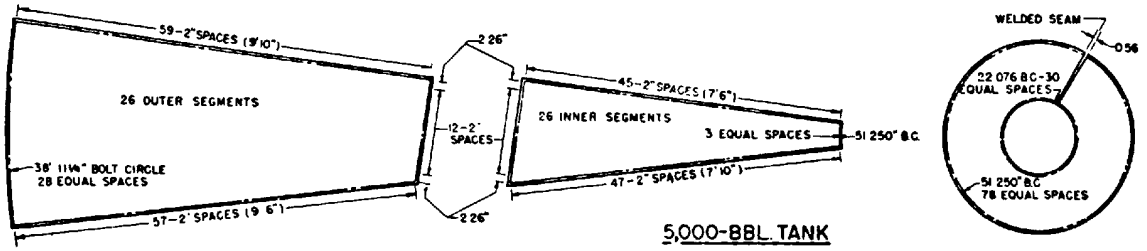
100-, 200-, AND 300-BBL TANKS

250-, HIGH 500-, AND 750-BBL TANKS

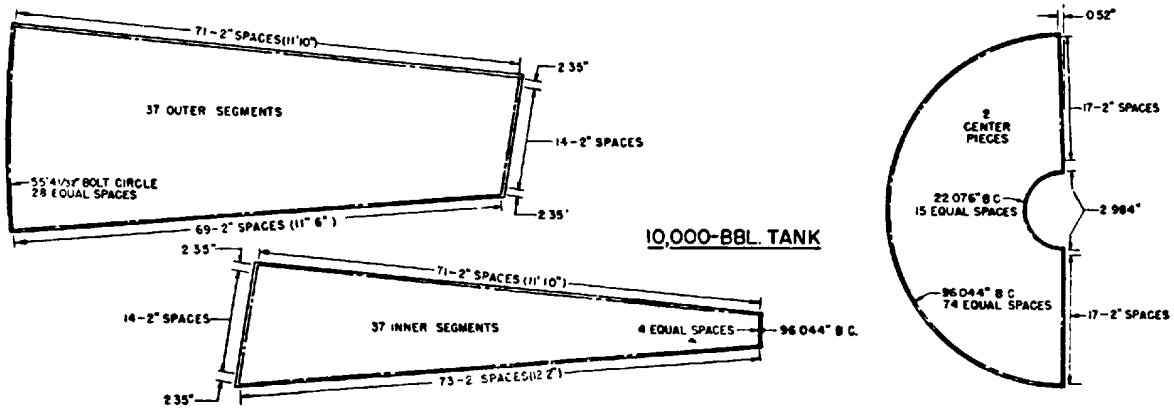
LOW 500-, HIGH 1000-, AND 1500-BBL TANKS



LOW 1,000-, 2,000-, AND 3,000-BBL. TANKS

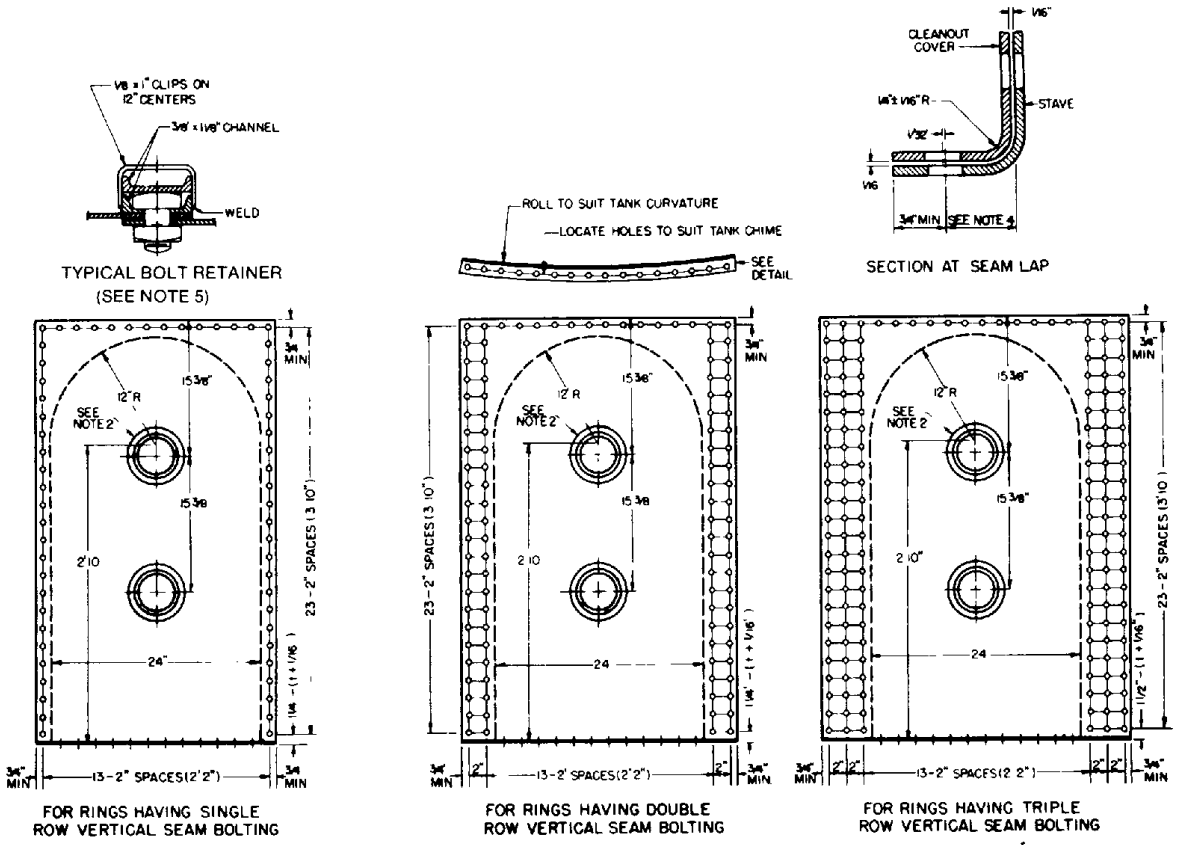


5,000-BBL. TANK



10,000-BBL. TANK

Figure 5—Deck Elements (See 4.5)



NOTE 1 The nominal thickness of the cleanout cover shall be not less than that of the stave to which attached.
NOTE 2 Cleanouts shall be funrished with bolt retainers, or handles, or both, if so specified on the purchase order. If not otherwise specified, retainers only shall be supplied. Alternative types of retainers may be substituted if demonstyrated adequate.
NOTE 3 See 4.16 for alternative designs.
NOTE 4 See Figure 4.
NOTE 5 Bolt retainers are not required when round-head bolts are used.

Figure 6—Flush-type Cleanout

4.12 Joint Gaskets

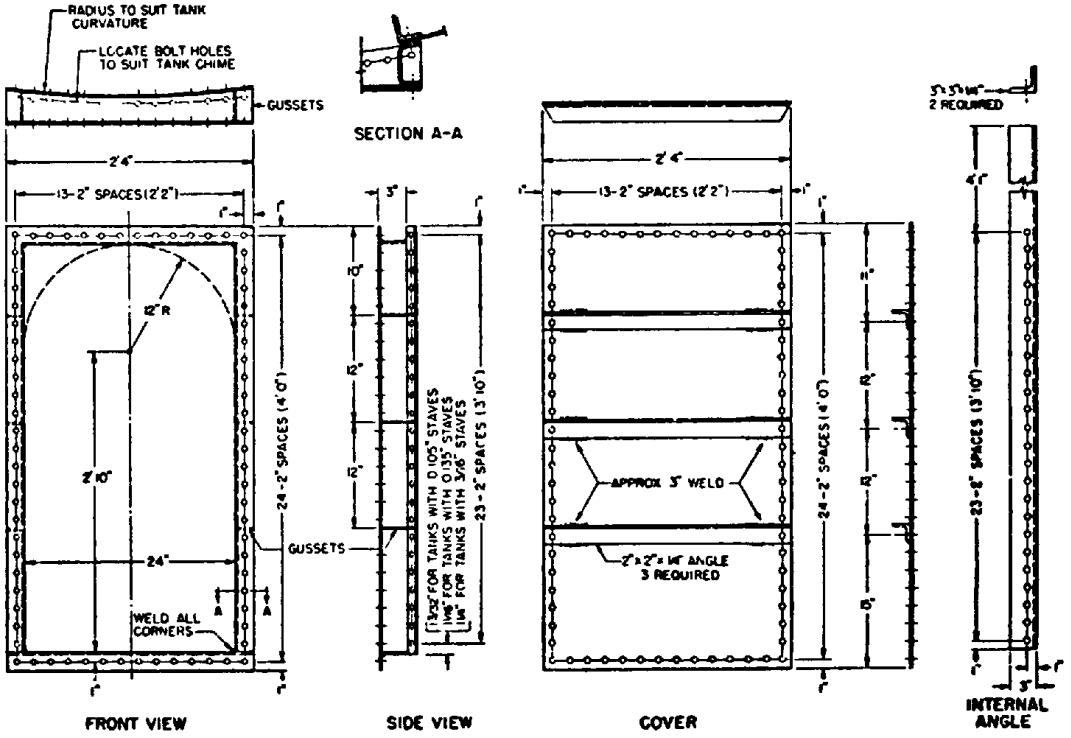
Joint gaskets shall be dimensioned on the assumption that the final net thickness in place will be $^1/_{16}$ in.

4.13 Bolting

All tank bolts and nuts, except flange bolting, shall be $^1/_2$ in. diameter and shall comply with Annex A.

4.14 Cleanout

Cleanouts shall be furnished unless otherwise specified on the purchase order. The location of the cleanout shall be as specified on the purchase order.



NOTE 1 All sheet and strip shall be 0.135 in. nominal thickness.
NOTE 2 See 4.17 for alternative height of cleanout.

Figure 7—Extended-neck Type Cleanout

4.15 Type of Cleanout

Cleanouts shall be of the flush-type, the extended-neck type of proven strength, or other type of proven strength, as specified on the purchase order.

4.16 Flush-type Cleanouts

Flush-type cleanouts shall conform to the requirements of Figure 6 except that alternative widths and heights of cleanout opening in the tank stave shall be supplied, if so agreed between the purchaser and the manufacturer.

4.17 Extended-neck or Other Type Cleanouts

Cleanouts of the extended neck or alternative type shall conform to the following requirements.

a) The height of cleanout opening in the stave shall be 3 ft, 10 in. except that, when so agreed upon between the purchaser and the manufacturer, the height of opening shall be 3 ft.

b) The bolting details for attachment of the cleanout neck to the stave shall conform to Figure 7 regardless of type of cleanout.

c) The design shall provide a minimum factor of safety of 2 1/2 as installed and as determined by proof test. The manufacturer shall submit evidence acceptable to the purchaser of compliance with this requirement.

NOTE The design of extended-neck cleanout shown in Figure 7 has been determined by proof test to be adequate for tanks of high 1,000-bbl and smaller capacity, in the sizes shown in Table 1. When used on such tanks the requirements of 4.17 c) shall be considered to have been satisfied.

4.18 Cleanout Cover Plate

Cover plates for all types of cleanouts shall be of one-piece or two-piece construction; if of the two-piece construction, the pieces shall be joined by a horizontal lap seam having one row of 1/2-in. bolts on 2-in. centers.

4.19 Inlet and Outlet Connections

Inlet and outlet connections shall conform to the sizes and locations specified on the purchase order.

4.20 Piping Flanges

Piping flanges shall conform to the requirements given herein, except that if so specified on the purchase order or if so agreed between the purchaser and the manufacturer, alternative types having equivalent strength, tightness, and utility shall be furnished.

4.21 Bolted Piping Flanges

Except as otherwise provided in 4.20, bolted piping flanges shall be attached by bolts or bolt-studs, and shall conform to the following requirements.

a) Flanges shall be furnished in the sizes given in Table 3 as specified on the purchase order, and shall conform to the provisions of Table 3 and Figure 8.

b) The inner flange shall be provided with bolt-head or bolt-stud nut retainers.

c) The length of thread shall conform to the requirements of Table 3. In all other respects the threads shall conform to the requirements of API 6A.

Table 3—Bolted Piping Flanges (See Figure 8)

(1)	(2)	(3)	(4)	(5)	(6)
Size, in.	2	3	4	6	8
Diameter of bolt circle, in.	4	5 3/8	6 3/8	9	11 1/4
Number of bolts	4	4	5	6	8
Diameter of bolts, in	1/2	5/8	5/8	5/8	5/8
Diameter of bolt holes, in.	5/8	3/4	3/4	3/4	3/4
Minimum thread length, Y, in.	7/8	1 3/16	1 5/16	1 9/16	1 3/4
Depth of counterbore	Optional with manufacturer	Optional with manufacturer	Optional with manufacturer	Optional with manufacturer	Optional with manufacturer
Outside diameter of flange, 0, in.	5 1/8	6 5/8	7 3/4	10 1/2	12 3/4

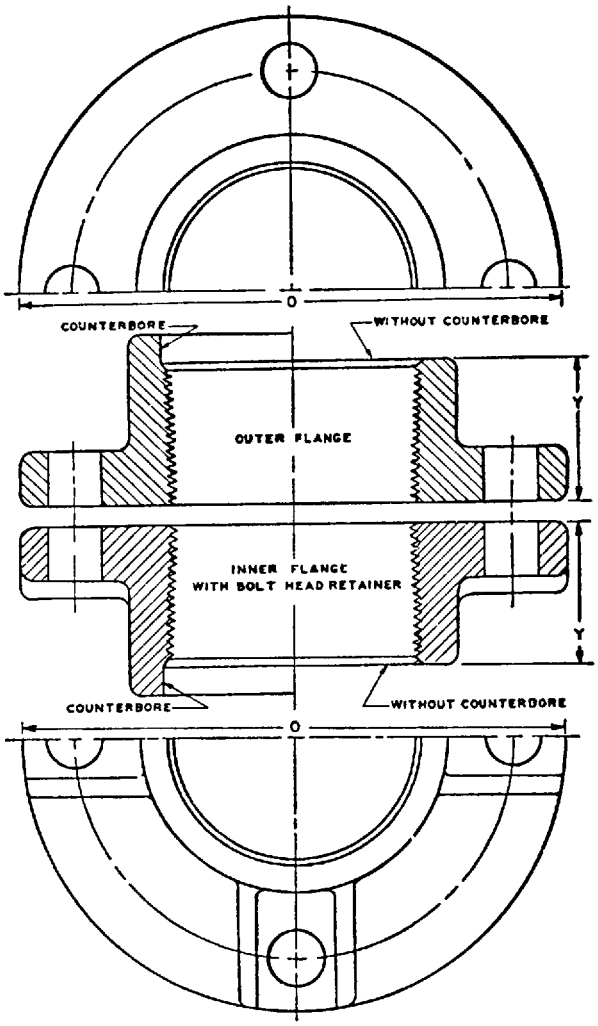


Figure 8—Bolted Piping Flanges (See Table 3 for Dimensions)

4.22 Flange Attachment

When bolted piping flanges conforming to Table 3 and Figure 8 are furnished, the tank members shall be drilled for flange attachment in accordance with the following stipulations:

a) the bolt-circle diameter and the number of bolt holes shall be as shown in Table 3 and Figure 8;

b) bolt-hole size shall be optional with the manufacturer, but shall be sufficient to accommodate the size of bolts given in Table 3;

c) flange bolt holes shall straddle the radial centerlines on decks and bottoms and vertical centerlines on staves, except that for the 4-in., 5-hole flange the odd hole shall be located on the centerline toward the center of the deck or the top of the stave.

4.23 Downcomer Pipe

A downcomer pipe shall be installed, if requested by the purchaser; design of downcomer to be by agreement between purchaser and manufacturer.

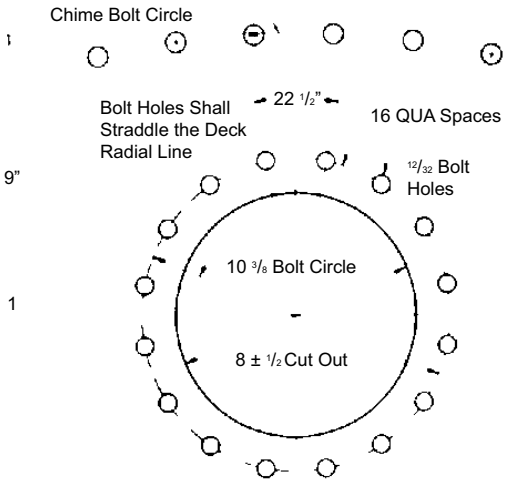


Figure 9—Bolting Pattern for 8-in. Circular Thief Hatches, Pressure-relief, and Vacuum-relief Valves

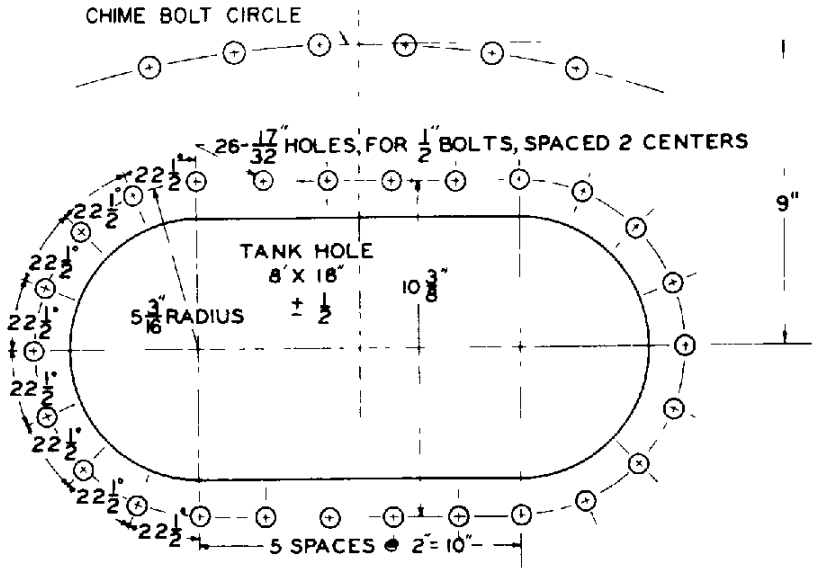


Figure 10—Bolting Pattern for 8-in. × 18-in. Oblong Thief Hatches, Pressure-relief, and Vacuum-relief Valves

4.24 Bolting Patterns for the Thief Hatches and Relief Valve

When tank decks are cut and drilled for the direct attachment of bolted thief hatches, pressure-relief valves, or vacuum-relief valves, bolting patterns shall be as shown in Figure 9, Figure 10, and Figure 11 as specified on the purchase order.

5 Venting Requirements

5.1 Normal Venting

The purchaser shall specify the number, size and location of connections to be installed in the deck of each tank to provide for normal inbreathing and outbreathing due to temperature changes and to liquid movement into and out of the tank. These connections should be fitted with pressure-vacuum valves properly sized in accordance with

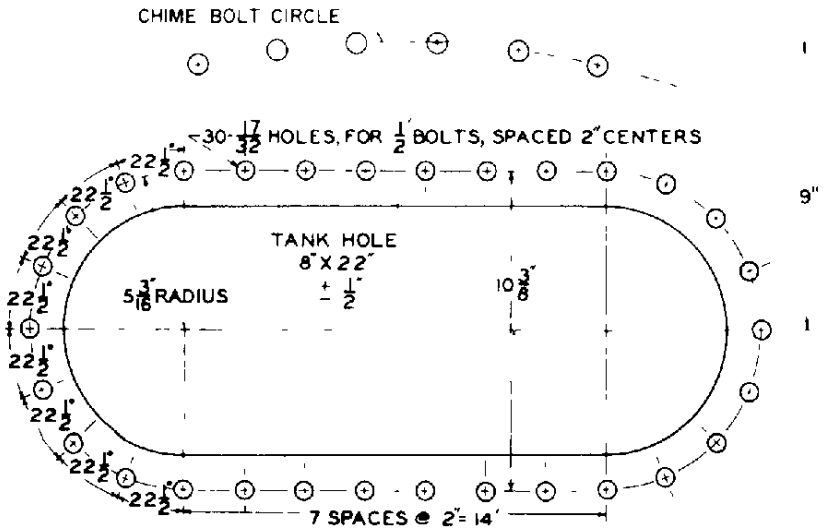


Figure 11—Bolting Pattern for 8-in. × 22-in. Oblong Thief Hatches, Pressure-relief, and Vacuum-relief Valves

API 2000. The pressure setting should be from 1/2 to 1 oz/in.^{2} less than the opening pressure of devices used for emergency venting. Annex B is provided as a guide to aid in the selection of venting devices, where required.

5.2 Emergency Venting

When storage tanks containing flammable liquids are exposed to fire, the venting rate may be in excess of that resulting from a combination of normal thermal effects and oil movement. Unless tanks are installed in remote locations, the purchaser shall provide, or cause to be provided, pressure relieving devices which will provide capacity in addition to normal venting to meet the requirements tabulated in Table C.1. The opening pressure of such devices shall not exceed the design pressure of the tank on which they are installed. The maximum internal pressure under relieving conditions should not exceed that tabulated in Column 6 of Table C.1. Pressure relieving devices may take the from of larger or additional vent valves, larger or additional thief hatches or deck dome covers (see Figure 5) installed with loose fitting long bolts and suitable gasket so that the dome cover will lift at the required pressure.

NOTE With drainage as used in Table C.1, Column 5. means that flammable or combustible liquids will not be retained near the tank by dykes or firewalls.

6 Erection and Clean Up

Tank staves shall be erected with the male side on the left when facing the outside surface of the stave (see Figure 4).

NOTE The dimensions as specified herein are based on the assumption that most of the slack, due to the difference in bolt and bolt-hole diameters, will be taken up in all stave joints by slippage when the tank is initially filled. The bottom and deck bolt-circle diameters provide for such slippage. At the time of erection, some pinning of the vertical stave joints will be required to bring the bolt holes into alignment.

Upon completion of erection, the erector shall remove or dispose of all rubbish and other unsightly material caused by erecting operations and shall leave the premises in as good condition, as found.

7 Marking

Tanks manufactured in conformance with this specification shall be identified by a nameplate bearing, as a minimum, the information shown in Figure 12.

Manufactured in Accordance with API Specification 12B

Manufacturer _____

Serial Number _____

Year Built _____

Nominal Diameter _____

Nominal Height _____

Design Pressure _____oz

Nominal Capacity _____bbl

Figure 12—Nameplate Format (May be Completed After Field Erection)

Nameplates shall be made of a corrosion-resistant material and installed on the cleanout stave approximately 8 in. above the top of the cleanout cover or frame. Installation of the nameplate may be on a boss seal welded to the stave (prior to galvanizing if applicable) or by any other suitable means to identify the product for the expected service life of the tank.

Nameplates may be attached at the point of manufacture or, at the option of the manufacturer, at the time of field erection.

8 Inspection and Rejection

8.1 Inspection Notice

Where the inspector representing the purchaser desires to inspect this material, reasonable notice shall be given of the time at which the run is to be made.

8.2 Inspection by Purchaser

The inspector representing the purchaser shall have free entry, at all times while work on the contract of the purchaser is being performed, to all parts of the manufacturer's works which will concern the manufacture of the material ordered. The manufacturer shall afford the inspector, without charge, all reasonable facilities to satisfy him/her that the material is being manufactured in accordance with this specification. All inspections should be made at the place of manufacture prior to shipment, unless otherwise specified on the purchase order; and shall be so conducted as not to interfere unnecessarily with the operation of the works.

8.3 Rejection

Material which shows injurious defects on mill inspection or subsequent to acceptance at manufacturer's works, or which proves defective when properly applied in service, may be rejected, and the manufacturer so notified. If tests that require the destruction of material are made at other than the place of manufacture, the purchaser shall pay for material complying with all of the provisions of this specification, but shall not pay for any material which fails to meet the specification.

8.4 Compliance

The manufacturer shall be responsible for complying with all provisions of this specification. The purchaser may make any investigation neccessary to be assured of compliance by the manufacturer and may reject any material that does not comply with this specification.

Annex A
(normative)

Specification for Tank Bolting

A.1 Scope

This annex covers tank bolting 1/2 in. in diameter to and including 1 1/2 in. in length. Bolts and nuts shall be either black-finish or galvanized, as specified on the purchase order.

A.2 Physical Properties

The breaking load of the bolts, tested in full size, shall not be less than 11,350 lb.

NOTE The breaking load of 11,350 lb is equivalent to a tensile strength of 80,000 lb/in.^{2} based on the stress area (mean thread area) or approximately 91,000 lb/in.^{2} based on the root thread area.

A.3 Tension Test

Tension tests of bolts shall be taken on the finished bolt with the load applied between the head and a nut or suitable fixture, either of which will have sufficient thread engagement to develop the full strength of the bolt. The nut or fixture shall be assembled on the bolt leaving at least three full bolt threads exposed within the grip. If failure occurs by threads stripping before reaching the minimum required tensile load, the individual test shall be discarded.

A.4 Stripping Test

The nuts for bolts shall be capable of developing the load specified in A.2 without stripping.

A.5 Head Test

During the tension test specified in A.3, failure shall occur in the threaded section and not at the junction of the head and shank.

A.6 Number of Tests

The requirements of these specifications are those met in continuous production for stock during which the manufacturer has made such sample inspections as to insure normally that the material is controlled within the specified limits. For this reason, additional tests by the manufacturer of the individual shipments of material are not contemplated. If specified on order, one tension test shall be made from each lot. A lot shall consist of 5,000 pieces or fraction thereof.

A.7 Retests

Should the sample from the lot fail to meet the requirements of a specified test, two additional samples shall be tested; in which case, both samples shall meet the test.

A.8 Thread Requirements

Threads of unplated product shall be coarse-thread series as specified for screw threads (ASME B1.1 of latest issue) having a Class 2A tolerance for bolts and Class 2B tolerance for nuts. Bolts to be galvanized shall have Class 2A threads before hot dip or mechanical galvanizing. After galvanizing, the maximum limit of pitch and major diameter may exceed the Class 2A limit by 0.021 in.

A.9 Bolt Requirements

Bolts shall be regular square, unless otherwise agreed upon between the purchaser and the manufacturer, in which case they may be regular hex. All bolts shall comply with the applicable section of the latest edition of ASME B18.2.1, *Square and Hex Bolts and Screws (Inch Series)*.

A.10 Nut Requirements

Nuts shall be regular square, unless otherwise agreed upon between the purchaser and the manufacturer, in which case they may be regular hex. All nuts shall comply with the applicable section of the latest edition of ASME B18.2.2, *Square and Hex Nuts (Inch Series)*.

A.11 Galvanizing

Unless otherwise specified, galvanized bolts and nuts shall be hot-dip galvanized in accordance with the requirements of ASTM A153. The weight of coating shall be that specified for Class C materials in ASTM A153 and the nuts shall be tapped after galvanizing. When specified by the purchaser to be mechanically galvanized, bolts and nuts shall be mechanically zinc-coated, and the coating shall conform to the requirements for Class 50 of ASTM B454 or to the coating thickness, adherence, and quality requirements for Class C of ASTM A153. Mechanically zinc-coated nuts for assembly with mechanically zinc-coated bolts shall be tapped oversize prior to coating and need not be retapped afterwards.

A.12 Marking

Bolt heads shall be marked (by raised or depressed mark at the option of the manufacturer) to identify the manufacturer. The manufacturer may use additional marking for internal use.

A.13 Alternate Specification for Tank Bolting Using Round-head Bolts

A.13.1 Scope

This annex covers tank bolting using $^1/_2$ in. diameter SAE Grade 5 round-head bolts. Bolts and nuts shall be mechanically galvanized, hot-dip galvanized, or electro-zinc plated.

A.13.2 Physical Properties

The breaking load of the bolts, tested in full size, shall not be less than 17,000 lb.

NOTE The breaking load of 17,000 lb is equivalent to a tensile strength of 120,000 lb/in.^{2} based on the stress area (mean thread area) or approximately 135,000 lb/in.^{2} based on the root thread area.

A.13.3 Tension Test

Tension tests of bolts shall be taken on the finished bolt with the load applied between the head and a nut or suitable fixture, either of which will have sufficient thread engagement to develop the full strength of the bolt. The nut or fixture shall be assembled on the bolt leaving at least three full bolt threads exposed within the grip. If failure occurs by threads stripping before reaching the minimum required tensile load, the individual test shall be discarded.

A.13.4 Stripping Test

The nuts for bolts shall be capable of developing the load specified on A.13.2 without stripping.

A.13.5 Head Test

During the tension test specified in A.13.3, failure shall occur in the threaded section and not at the junction of the head and shank.

A.13.6 Number of Tests

The requirements of these specifications are those met in continuous production for stock during which the manufacturer has made such sample inspections as to insure normally that the material is controlled within the specified limits. For this reason, additional tests by the manufacturer of the individual shipments of material are not contemplated. If specified on order, one tension test shall be made from each lot. A lot shall consist of 5,000 pieces or fraction thereof.

A.13.7 Retests

Should the sample from the lot fail to meet the requirements of a specified test, two additional samples shall be tested; in which case, both samples shall meet the test.

A.13.8 Thread Requirements

Threads of unplated product shall be coarse-thread series as specified for screw threads (ASME B1.1 of latest issue) having a Class 2A tolerance for bolts and Class 2B tolerance for nuts. Bolts to be galvanized shall have Class 2A threads before hot dip or mechanical galvanizing. After galvanizing, the maximum limit of pitch and major diameter may exceed the Class 2A limit by 0.021 in.

A.13.9 Bolt Requirements

Round-head bolts shall have a fin neck or ribbed neck to prevent turning when tightened. The height of the head shall be 0.25 in. to 0.27 in., with a diameter of 1 in. to 1.06 in.

On ribbed neck bolts, the longitudinal ribs shall have a length of 0.186 in. to 0.206 in. with an outside diameter of 0.540 in. to 0.550 in. There shall be at least 16 ribs.

On fin neck bolts, there shall be four radial fins equally spaced under the bottom side of the head. The longitudinal length of the fins shall be 0.156 in. to 0.187 in., with an outside diameter of 0.675 in. to 0.695 in.

For corrosion protection, the head of the bolt may be encapsulated with polyvinylidene fluoride (PVDF), ABS, or polyester. A sealing ring shall be molded under the head of the bolt.

A.13.10 Nut Requirements

Nuts shall be regular square or regular hex. All nuts shall comply with the applicable section of the latest edition of ASME B18.2.2.

For corrosion protection, nuts in contact with the stored liquid may be protected with threaded PVDF nut caps, or the nuts may be encapsulated with polyester.

A.13.11 Galvanizing

Galvanized bolts and nuts shall be hot-dip galvanized in accordance with the requirements of ASTM A153. The weight of coating shall be that specified for Class C materials in ASTM A153 and the nuts shall be tapped after galvanizing. Mechanically galvanized bolts and nuts shall be mechanically zinc-coated, and the coating shall conform to the requirements for Class 50 of ASTM B454 or to the coating thickness, adherence, and quality requirements for

Class C of ASTM A153. Mechanically zinc-coated nuts for assembly with mechanically zinc-coated bolts shall be tapped oversize prior to coating and need not be retapped afterwards.

Electro-zinc plated bolts and nuts shall have a minimum zinc coating of 0.0005 in. with a yellow dichromate dip. Electro-zinc plated nuts do not require oversize tapping prior to plating.

A.13.12 Marking

Bolt heads or shank ends shall be marked to identify the bolt manufacturer, including three radial marks indicating SAE Grade 5. Encapsulated bolts are to be marked prior to be encapsulated. Markings may be either raised or depressed.

Annex B
(informative)

Recommended Practice for Normal Venting

Table B.1—Venting Capacity Requirements (See 5.1)

(1)	(2)		(3)	(4)	(5)	(6)	(7)
Nominal Tank Capacity bbl	**Tank Size**		**Design Pressure** oz/in.^{2}	**Surface Area** ft^2	**Thermal Venting** SCFH		
					Vacuum (Inbreathing) All stocks	**Pressure (Outbreathing)**	
	Diameter ft, in.	**Height** ft	**Pressure, Vacuum**			**Flash Point 100°F or Above**	**Flash Point Below 100°F**
100	9, 2	8	3, 1/2	233	100	60	100
200	9, 2	16	3, 1/2	468	200	120	200
300	9, 2	24	3, 1/2	703	300	180	300
250	15, 6	8	3, 1/2	388	250	150	250
High-500	15, 6	16	3, 1/2	780	500	300	500
750	15,6	24	3, 1/2	1,170	750	450	750
Low-500	21, 6	8	2, 1/2	543	500	300	500
High-1,000	21, 6	16	2, 1/2	1,090	1,000	600	1,000
1,500	21, 6	24	2, 1/2	1,620	1,500	450	1,500
Low-1,000	29, 9	8	2, 1/2	750	1,000	600	1,000
2,000	29, 9	16	2, 1/2	1,500	2,000	1,200	2,000
3,000	29, 9	24	2, 1/2	2,250	3,000	1,800	3,000
5,000	38, 8	24	1, 1/2	2,840	5,000	3,000	5,000
10,000	55, 0	24	1, 1/2	4,170	10,000	6,000	10,000

NOTE 1 Filling and emptying venting.

— *Outbreathing at maximum filling rate*. For flash points less than 100°F, provide 1200 standard cubic feet per hour (SCFH) for each 100 bbl/hr. For flash points of 100°F or more, provide 600 SCFH for each 100 bbl/hr.

— *Inbreathing at maximum emptying rate*. For all liquids, provide 600 SCFH for each 100 bbl/hr.

NOTE 2 The values calculated for filling and emptying venting requirements shall be added to the appropriate thermal venting requirements.

Annex C
(informative)

Recommended Relieving Capacities

Table C.1—Emergency Venting Requirements (See 5.2)

(1)	(2)	(3)	(4)	(5)		(6)
Nominal Capacity bbl	**Diameter × Height** ft, in.	**Design Pressure** oz/in.^{2}	**Exposed Area** ft^2	**Emergency Venting Required** SCFH		**Max Press. During Emergency Venting** oz
		Pressure, Vacuum		**With Drainage** [a]	**Without Drainage**	
100	9, 2 3/4 × 8, 0 1/2	3, 1/2	233	114,750	229,500	4 1/2
200	9, 2 3/4 × 16, 1	3, 1/2	468	170,250	340,500	4 1/2
300	9, 2 3/4 × 24, 1 1/2	3, 1/2	703	214,000	428,000	4 1/2
250	15, 4 5/8 × 8, 0 1/2	3, 1/2	388	154,650	309,300	4 1/2
High-500	15, 4 5/8 × 16, 1	3, 1/2	780	227,600	455,200	4 1/2
750	15, 4 5/8 × 24, 1 1/2	3, 1/2	1,170	271,800	543,600	4 1/2
Low-500	21, 6 1/2 × 8, 0 1/2	2, 1/2	543	184,600	369,200	3
High-1,000	21, 6 1/2 × 16, 1	2, 1/2	1,090	267,200	534,000	3
1,500	21, 6 1/2 × 24, 1 1/2	2, 1/2	1,630	308,380	617,760	3
Low-1,000	29, 8 5/8 × 8, 0 1/2	2, 1/2	750	222,500	445,000	3
2,000	29, 8 5/8 × 16, 1	2, 1/2	1,500	300,250	600,500	3
3,000	29, 8 5/8 × 24, 1 1/2	2, 1/2	2,260	344,650	689,300	3
5,000	38, 7 5/8 × 24, 1 1/2	1, 1/2	2,840	371,000	742,000	1 1/2
10,000	54, 11 3/4 × 24, 1 1/2	1, 1/2	4,170	371,000	742,000	1 1/2

NOTE Normal vents (see 5.1 and Annex B) may satisfy all or part of these requirements.

[a] In applying recommended emergency venting required with drainage, careful attention should be given to the provisions of 2.3.2 and 2.5.7, NFPA No. 30.

Table C.2—Calculated Venting Capacity of Thief Hatches

(1)	(2)	(3)	(4)
	Venting Capacity SCFH Q		
Tank Pressure oz	**8 in. Round** A **= 44 in.^{2}**	**8 in. × 18 in. Obround** A **= 130 in.^{2}**	**8 in. × 22 in. Obround** A **= 154 in.^{2}**
1.5	59,783	174,650	206,892
3.0	84,547	246,992	292,590
4.5	103,548	302,503	358,348
6.0	119,567	349,299	413,785
12.0	169,094	Not Applicable	Not Applicable

NOTE Values in the above table are based on the following equation:

$$Q = 1667 C_f A \sqrt{P_t - P_a} \quad \text{(C.1)}$$

where

Q is the venting capacity in standard cubic feet of free air per hour (SCFH);

C_f is 0.5 (the flow coefficient);

A hatch area, in.^{2};

P_t absolute pressure inside the tank in inches of water;

P_a absolute pressure outside the tank in inches of water.

Annex D
(normative)

Walkways, Stairways, and Ladders

D.1 General

Walkways and stairways furnished to this specification shall be constructed from prefabricated components designed to be field erected alongside of tanks of similar structures. All material shall comply with the applicable parts of Section 3.

D.2 Access

It should be noted that walkways, platforms, and stairways or ladders are intended to provide access to devices on or near the deck within easy reach from the ladder or platform, and not for employee egress out the deck itself. Where individuals are required to have access to the deck, suitable guard railings should be installed to prevent their falling.

D.3 Walkways

Walkways shall consist of tread (decking) sections, railing assemblies, and toeboards designed and assembled so that the completed structure will support a uniform load of 50 lb/ft^2, or a concentrated load of 1,000 lb at any place on the span without deflecting more than $^1/_{360}$ of the unsupported span length. The maximum span between tank brackets or ground supports shall be 25 ft. Where intermediate supports are required, the vertical members shall terminate at the top rail. The base for ground supports shall be of concrete or other suitable permanent foundation.

D.4 Treadway

Treadway shall be a minimum of 26 in. wide. Tread shall be uniformly perforated from the bottom with shaped punches to form a non-skid surface. Optionally, at the request of the purchaser, the deck of treadway sections may be fabricated from structural expanded metal or grating to avoid the buildup of snow or ice.

D.5 Railings

Railings shall consist of posts, horizontal braces, sway (truss) braces, gusset plates, toeboards, midrail and top rail. Railings shall be assembled so that the top rail is 42 in. above the treadway. The completed structure, when assembled, shall be capable of withstanding a concentrated force of 200 lb applied in any direction at any point on the top rail.

D.6 Toeboards

Toeboards shall be installed on all open sides (except at the entrance of stairways or ladders) to provide an installed height of 4 in. above the treadway.

D.7 Midrail

Midrail shall be installed approximately halfway between treadway and top rail. Where the midrail projects into a walkway area, the ends shall be formed to a smooth contour.

D.8 Brackets

Each tank shall be equipped with two bracket assemblies, supported from the top and bottom chimes of the top ring. The brackets shall be installed to provide a 26-in. wide access to the tank at the point of attachment.

D.9 Stairways

When required for access to walkway sections, stairways shall be designed for field erection, and shall be capable of supporting a minimum of 100 lb per linear ft of tread width, or a concentrated load of 1,000 lb at any point on the stairway without deflecting more than 1/360 of the unsupported stairway length. Stairway width shall be a minimum of 26 in. Stairways shall be designed and installed to have an angle of 45 degrees with the horizontal, unless otherwise specified by the purchaser. When installed at 45 degrees, the stairway shall have a run and rise of 8 1/2 in. with a nominal tread width of not less than 8 in. Other uniform rise and tread combinations which will produce a stairway within angles to the horizontal between 30 and 50 degrees shall be acceptable, so long as all other requirements of this specification area met. The rise height and tread width shall be uniform throughout any stairway, including any foundation used as one or more steps.

D.10 Railings

Railings shall be installed on both sides of stairways, and shall be designed so that the completed assembly will withstand a minimum of 200 lb force in any direction applied at any point on the top rail. Top rails shall be installed so that the top rail is not less than 30 in. nor more than 34 in. measured vertically from the upper surface of the nose of a tread. Protection against falling shall be provided between the stairway runners and the top rail.

The juncture of the top rail of the stair railing shall make a smooth transition with the top rail of the walkway railing, preferably through the use of a structural gusset member.

D.11 Spiral Stairways

Spiral stairways, attached to brackets on the circumference of the tank, may be used in lieu of straight stairways, provided all of the above requirements are met, with the exception that railings are required only on the outside of the stairway. The run of the stair tread will depend on the radius of the exterior arc, and the minimum effective tread shall be 7 in., measured 13 in. from the exterior arc. Spiral stairways are not recommended for installation on tanks less than 15 ft, 6 in. in diameter.

D.12 Ladders

Fixed industrial ladders may be used in lieu of stairways. The use of a platform is optional with the purchaser, but when used, the platform shall have minimum dimensions of 26 in. × 30 in. with standard railings except at the entrance from the ladder.

Ladders, when used, shall be substantially anchored with the center of the rung at least 7 in. from the surface of the tank or other obstruction.

Rungs shall be a minimum of 3/4 in. diameter, spaced a maximum of 12 in., C-C (center to center), with a minimum clear length of 16 in., and designed to support a minimum load of 200 lb.

Open ladders may be used to climb a maximum of 20 ft, and caged ladders or acceptable safety slide devices should be used when the climbing height is between 20 ft and 30 ft.

Annex E
(informative)

Suggestions for Ordering Bolted Tanks

In placing orders for tanks to be manufactured in accordance with API 12B, purchasers should specify the following on their purchase order:

Specification	API 12B
Number of tanks	
Nominal capacity	Table 1, Column 1
Size:	
Inside diameter	Table 1, Column 4
Height of shell	Table 1, Column 5
Type of cleanout	4.15
Design of flush-type cleanout	4.16 and Figure 6, Note 2
Design of extended neck clearout	4.17
Cut-outs for thief hatch and relief valve	4.24
Delivery date and shipping instructions	
Inspection by purchaser	8.1

The purchaser should also state on the purchase order his/her requirements concerning the following stipulations which are optional with the purchaser:

Finish	3.8
Bolting	3.9
Bottom, stave, and deck thickness	Table 2, Footnote a
Open-top tanks	4.4, Note
Two-piece cleanout cover plates	4.18
Cleanout location	4.14
Inlet and outlet connections	4.19
Piping flanges	4.20 and 4.21
Walkways, stairways, and ladders	Annex D

Vending connections	5.1
Downcomer pipe and design	4.23

Attention is called to the following stipulations which are subject to agreement between the purchaser and the manufacturer:

Alternative designs of tank bottoms	4.3
Alternative design of decks	4.5
Rafter design	4.10
Alternative widths and heights of cleanout	4.16
Alternative designs of piping flanges	4.20

Annex F
(informative)

Use of the API Monogram by Licensees

F.1 Scope

The API Monogram Program allows an API Licensee to apply the API Monogram to products. The API Monogram Program delivers significant value to the international oil and gas industry by linking the verification of an organization's quality management system with the demonstrated ability to meet specific product specification requirements. The use of the Monogram on products constitutes a representation and warranty by the Licensee to purchasers of the products that, on the date indicated, the products were produced in accordance with a verified quality management system and in accordance with an API product specification.

When used in conjunction with the requirements of the API License Agreement, API Q1, in its entirety, defines the requirements for those organizations who wish to voluntarily obtain an API License to provide API monogrammed products in accordance with an API product specification.

API Monogram Program Licenses are issued only after an on-site audit has verified that the Licensee conforms to the requirements described in API Q1 in total, and the requirements of an API product specification. Customers/users are requested to report to API all problems with API monogrammed products. The effectiveness of the API Monogram Program can be strengthened by customers/users reporting problems encountered with API monogrammed products. A nonconformance may be reported using the API Nonconformance Reporting System available at https://ncr.api.org. API solicits information on new product that is found to be nonconforming with API specified requirements, as well as field failures (or malfunctions), which are judged to be caused by either specification deficiencies or nonconformities with API specified requirements.

This annex sets forth the API Monogram Program requirements necessary for a supplier to consistently produce products in accordance with API specified requirements. For information on becoming an API Monogram Licensee, please contact API, Certification Programs, 1220 L Street, N. W., Washington, D.C. 20005 or call 202-962-4791 or by email at certification@api.org.

F.2 References

In addition to the referenced standards listed in Section 2 of this document, this annex references the following standard:

API Specification Q1

For Licensees under the Monogram Program, the latest version of this document shall be used. The requirements identified therein are mandatory.

F.3 API Monogram Program: Licensee Responsibilities

F.3.1 For all organizations desiring to acquire and maintain a license to use the API Monogram, conformance with the following shall be required at all times:

a) the quality management system requirements of API Q1;

b) the API Monogram Program requirements of API Q1, Annex A;

c) the requirements contained in the API product specification(s) for which the organization desires to be licensed; and

d) the requirements contained in the API Monogram Program License Agreement.

F.3.2 When an API-Licensed organization is providing an API monogrammed product, conformance with API specified requirements, described in API Q1, including Annex A, is required.

F.3.3 Each Licensee shall control the application of the API Monogram in accordance with the following.

a) Each Licensee shall develop and maintain an API Monogram Marking Procedure that documents the marking/ monogramming requirements specified by the API product specification to be used for application of the API Monogram by the Licensee. The marking procedure shall define the location(s) where the Licensee shall apply the API Monogram and require that the Licensee's License number and date of manufacture be marked on monogrammed products in conjunction with the API Monogram. At a minimum, the date of manufacture shall be two digits representing the month and two digits representing the year (e.g. 05-07 for May 2007) unless otherwise stipulated in the applicable API product specification. Where there are no API product specification marking requirements, the Licensee shall define the location(s) where this information is applied.

b) The API Monogram may be applied at any time appropriate during the production process but shall be removed in accordance with the Licensee's API Monogram Marking Procedure if the product is subsequently found to be nonconforming with API specified requirements. Products that do not conform to API specified requirements shall not bear the API Monogram.

c) Only an API Licensee may apply the API Monogram and its License to API monogrammable products. For certain manufacturing processes or types of products, alternative Monogram marking procedures may be acceptable. The current API requirements for Monogram marking are detailed in the API Policy Document, *Monogram Marking Requirements*, available on the API Monogram Program website at http://www.api.org/certifications/monogram/.

d) The API Monogram shall be applied at the licensed facility.

e) The authority responsible for applying and removing the API Monogram shall be defined in the Licensee's API *Monogram Marking Procedure*.

F.3.4 Records required by API product specifications shall be retained for a minimum of five years or for the period of time specified within the product specification if greater than five years. Records specified to demonstrate achievement of the effective operation of the quality system shall be maintained for a minimum of five years.

F.3.5 Any proposed change to the Licensee's quality program to a degree requiring changes to the quality manual shall be submitted to API for acceptance prior to incorporation into the Licensee's quality program.

F.3.6 Licensee shall not use the API Monogram on letterheads or in any advertising (including company-sponsored web sites) without an express statement of fact describing the scope of Licensee's authorization (License number). The Licensee should contact API for guidance on the use of the API Monogram other than on products.

F.4 Marking Requirements for Products

These marking requirements apply only to those API Licensees wishing to mark their products with the API Monogram.

F.4.1 Manufacturers shall mark equipment on the nameplate with the information identified in Section 7 of this specification, as a minimum, including "API Spec 12B."

F.4.2 As a minimum, equipment should be marked with English (Imperial) units.

F.4.3 Nameplates shall be made of a corrosion-resistant material and shall be located as indication in the marking section of this specification. If the location is not identified, then F.3.3 a) of this annex shall apply.

F.4.4 Nameplates may be attached at the point of manufacture or, at the option of the manufacturer, at the time of field erection.

F.4.5 The API Monogram shall be marked on the nameplate, in addition to the marking requirements of this specification. The API Monogram License number shall not be used unless it is marked in conjunction with the API Monogram.

F.5 API Monogram Program: API Responsibilities

F.5.1 The API shall maintain records of reported problems encountered with API monogrammed products. documented cases of nonconformity with API specified requirements may be reason for an audit of the Licensee involved, (also known as audit for “cause”).

F.5.2 Documented cases of specification deficiencies shall be reported, without reference to Licensees, customers or users, to API Subcommittee 18 (Quality) and to the applicable API Standards Subcommittee for corrective actions.

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