

Changes shown by ↕

SCOPE

- I ↕ 1.1 This practice covers the design, fabrication, erection, inspection and testing of welded aboveground storage tanks and spheres furnished to **API Standard 620, Appendix Q or R**, and operated at metal temperatures between -270°F and +40°F (-168°C and +5°C) and at pressures not exceeding 15 psig (103 kPa), except as modified and supplemented by this practice.
- I 1.2 This practice also covers accessories and auxiliary structures furnished with refrigerated storage tank installations.
- I 1.3 This practice does **not** cover double containment and full containment tanks per **British Standard BS7777, Flat-bottomed, Vertical, Cylindrical Storage Tanks for Low Temperature Service, Part 2**.
- I 1.4 **An asterisk (*)** indicates that a decision by the Purchaser is required or that additional information is furnished by the Purchaser.

SUMMARY OF ADDITIONAL REQUIREMENTS

- I ↕ 2.1 **Table 1** lists the practices, codes, and standards which shall be used with this practice.

TABLE 1

PRACTICES			
IP 3-2-3	Firewater Systems	IP 18-12-1	Positive Materials Identification
IP 18-7-1	Welding Procedures	IP 20-1-1	Inspection of Equipment and Materials
IP 18-10-1	Additional Requirements for Materials	IP 20-1-3	Quality Programs
CODES AND STANDARDS			
ANSI Standard		ASME Codes	
A12.1	Safety Requirements for Floor and Wall Openings, Railings, and Toeboards	Section VIII	Pressure Vessels, Division 1
		Section VIII	Pressure Vessels, Alternative Rules, Division 2
API Standard		B31.3	Process Piping
620	Recommended Rules for Design and Construction of Large, Welded, Low-Pressure Storage Tanks	ASME Standards	
ASTM Standards		B16.47	Large Diameter Steel Flanges NPS 26 Through NPS 60
A 20 / A 20M	General Requirements for Steel Plates for Pressure Vessels	B16.5	Pipe Flanges and Flanged Fittings
A 370	Mechanical Testing of Steel Products	B16.11	Forged Steel Fittings, Socket-Welding and Threaded

- I ↕ *2.2 **Table 2** lists the practices, standards, and specifications which shall be used with this practice as **specified** by the Purchaser.

TABLE 2

PRACTICES			
IP 3-8-1	Expansion Joints	IP 4-8-1	Tank Foundations
IP 3-15-1	Pressure Relief Valves	IP 14-1-1	External Thermal Insulation
IP 3-16-1	Flanged Joints, Gaskets and Bolting	IP 19-1-1	Paint and Protective Coatings
IP 4-1-3	Design Loads for Structures		
STANDARDS AND SPECIFICATIONS			
ASTM Standards		ASTM Standards (Cont)	
A 131	Structural Steel for Ships	A 573 A / 573M	Structural Carbon Steel Plates of Improved Toughness
A 353 / A 353M	Pressure Vessel Plates, Alloy Steel, 9 Percent Nickel, Double-Normalized and Tempered	ANSI / AWS Specifications	
A 516 / A 516M	Pressure Vessel Plates, Carbon Steel, for Moderate and Lower Temperature Service	A5.1	Carbon Steel Electrodes for Shielded Metal Arc Welding
A 537 / A 537M	Pressure Vessel Plates, Heat-Treated, Carbon-Manganese-Silicon Steel	A5.17	Carbon Steel Electrodes and Fluxes for Submerged Arc Welding
A 553 / A 553M	Pressure Vessel Plates, Alloy Steel, Quenched and Tempered 8 and 9 Percent Nickel	A5.18	Carbon Steel Electrodes and Rods for Gas Shielded Arc Welding

IP 9-6-1		Refrigerated Storage Tanks	
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(This practice is appropriate for attachment to Inquiry or Purchase Document)

DOCUMENTATION

- R 3.1 A **complete material specification** shall be submitted with the proposal.
- R 3.2 **Fabrication drawings** shall identify welding materials and procedures for each type of weld.
- R 3.3 **Welding and weld repair procedures** shall be submitted to the Purchaser for review prior to fabrication.
- R 3.4 A **record of tank shell and bottom settlement measurements** shall be furnished. Procedures for settlement measurements shall be submitted to the Purchaser for review.
- O * 3.5 Six copies of a **gauge table** showing calculated capacity shall be furnished. Unless otherwise specified, capacity shall be shown in 42 (U.S.) gallon barrels for 1/8 in. increments of liquid level [m³ for 10 mm increments plus auxiliary table showing m³ for 1 mm increments].

DEFINITIONS

- I 4.1 The term **Critical Exposure Temperature** shall be used in place of the term "design metal temperature" which is defined in **API-620**, Appendix Q and Appendix R.

MATERIALS

- R ♦ 5.1 **Materials** shall conform to the following **ASTM Standards**: **A 131** Grade CS, **A 353 / A 353M**, **ASTM A 516 / A 516M**, **A 537 / A 537M** Class 1, **A 553 / A 553M** Grade A, **A 573** Grades 65 or 70.
- S * 5.2 **Materials for all primary components and materials welded directly to primary components** shall meet the **impact requirements of Table 3** for the specified **Critical Exposure Temperature** and the following:
 - a. The requirements of **API-620** including Appendix Q or Appendix R, as applicable.
 - b. **Impact test requirements for ASTM A 353 / A 353M and A 553 / A 553M materials** shall be as specified in **API-620** Appendix Q. All **piping** falling within this scope shall be **classified as nozzles** for the purposes of establishing material impact test requirements.
 - c. **All impact testing** shall be conducted per **ASTM A 370** using the Charpy Vee (Type A) specimen.
 - d. Impact determinations shall be made for **each plate as rolled**. Specimens shall be selected as follows:
 - 1. **Impact specimens** shall be taken per **ASTM A 20 / A 20M**, with the base of the notch perpendicular to the plate surface.
 - 2. **Impact specimens** shall have their **long dimension** parallel to the final direction of rolling (longitudinal specimens) for all applications **except: spheres, or hemispherical heads fabricated from segments**.
 - 3. **For spheres, or hemispherical heads fabricated from segments, impact specimens** shall have their long dimension perpendicular to the final direction of rolling (transverse specimens). For spun or pressed (one piece) hemispherical heads or components, longitudinal impact specimens shall be used.
- R 5.3 **Annular plates** shall be of the same **material specification and grade** as the lowest shell course.
- R 5.4 **Materials for permanent structural attachments**, welded to the shell, shall be of the same nominal composition as the tank shell materials.



TABLE 3
CHARPY-VEE IMPACT REQUIREMENTS FOR FULL SIZE SPECIMENS (1)(2)(3)

CLASS	TYPE OF STEEL	THICKNESS, in.	CRITICAL EXPOSURE TEMPERATURE, °F		
			Below -20	From -20 Through 31	From 32 Through 40
II	Fully Killed and Medium Carbon & Low Alloy Material with a specified minimum yield strength < 35,000 psi and a specified maximum tensile strength ≤ 75,000 psi.	$t \leq 5/8$	25 / 20	25 / 20	None
		$5/8 < t \leq 1-1/2$	25 / 20	25 / 20	25 / 20
		$1-1/2 < t \leq 2$	30 / 25	30 / 25	30 / 25
		$t > 2$	35 / 28	35 / 28	35 / 28
	b. Material with a specified minimum yield strength ≤ 55,000 psi and a specified maximum tensile strength ≤ 90,000 psi.	$t \leq 5/8$	30 / 25	30 / 25	None
		$5/8 < t \leq 1-1/2$ $t > 1-1/2$	35 / 28 40 / 32	35 / 28 40 / 32	35 / 28 40 / 32
	c. Material with a specified minimum yield strength ≤ 65,000 psi and a specified maximum tensile strength ≤ 100,000 psi.	$t \leq 1/2$	35 / 28	35 / 28	None
		$1/2 < t \leq 1$ $t > 1$	40 / 32 45 / 36	40 / 32 45 / 36	40 / 32 45 / 36
IV	3-1/2% Nickel	All	20 / 16	None	None
V	9% Nickel, 5% Nickel	All	25 / 20	None	None

Notes:

- (1) When **subsize specimens** are necessary, the required impact values shall be those given in **Table 3** multiplied by the reduction factor given below for the corresponding specimen size. Interpolation is permitted to utilize maximum possible specimen width.

SPECIMEN SIZE	IMPACT REQUIREMENT REDUCTION FACTOR
10 x 7.5 mm	0.83
10 x 5 mm	0.67
10 2.5 mm	0.33

- (2) In the notation such as 25 / 20, the first number is the average energy in ft-lb of three specimens while the second number is the minimum for one specimen when full-size specimens are used, i.e., a 10 mm x 10 mm cross-section.
- (3) Longitudinal Type A specimens.

General Note:

Acceptable metric equivalents for the values of **Table 3**.

TENSILE AND YIELD STRENGTHS		THICKNESS		TEMPERATURE		ENERGY VALUES	
psi	MPa	in.	mm	°F	°C	ft-lb	J
35 000	241	1/4	6	< -20	< -29	20 / 16	27 / 22
45 000	310	1/2	13	-20 to < 32	-29 to < 0	25 / 20	34 / 27
55 000	379	5/8	16	32 to < 40	0 to < 5	30 / 25	40 / 34
65 000	448	1	25			35 / 28	47 / 38
75 000	517	1-1/2	38			40 / 32	54 / 43
80 000	551	2	50			45 / 36	61 / 48
90 000	620						
100 000	689						