

Additional Requirements for Heavy Wall Pressure Vessels, Thickness Over 2 Inches

(This practice is appropriate for attachment to Inquiry or Purchase Document)

IP 5-1-2

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Rev. 1

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Changes shown by ↕

SCOPE

- I 1.1 This practice covers additional requirements governing the design, fabrication, examination, and testing of unfired pressure vessels having a thickness in excess of 2 in. (50 mm) and up to 6 in. (150 mm).
- I 1.2 The examination and testing requirements of [IP 5-1-1](#) are replaced in their entirety by those specified in this practice. All other requirements are in addition to those in [IP 5-1-1](#).
- I 1.3 An asterisk (*) indicates that a decision by the Purchaser is required, or that additional information is furnished by the Purchaser.
- I * 1.4 Additional requirements for pressure vessels having a thickness in excess of 6 in. (150 mm) will be specified.

SUMMARY OF ADDITIONAL REQUIREMENTS

- I 2.1 **Table 1** lists the practices and standards which shall be used with this practice to supplement [IP 5-1-1](#), **Table 1**.

TABLE 1

PRACTICE	
IP 5-1-1	Pressure Vessels
IP 18-10-1	Additional Requirements for Materials
STANDARDS	
ASTM Standards	
A 388	Ultrasonic Examination of Heavy Steel Forgings
A 578 / A 578M	Straight-Beam Ultrasonic Examination of Plain and Clad Steel Plates for Special Applications
E 94	Radiographic Testing

DESIGN

ANALYSIS

- R * 3.1 **Thermal Stress.** When thermal gradients exceed 150°F (80°C) in a distance equal to $\sqrt{Rt}$, where R and t are the mean radius and thickness of the vessel component in question, a thermal stress analysis shall be performed in accordance with the **applicable design code**. If the design code used does not contain procedures for thermal analysis, the procedures of the **ASME Code Section VIII, Division 2** may be used.
- R * 3.2 **The Owner's Engineer shall specify if a fatigue analysis is required.** An acceptable method for determining the need for a fatigue analysis is contained in the **ASME Code Section VIII, Division 2, Par. AD-160**. When a fatigue analysis is required, the procedures of the **ASME Code Section VIII, Division 2** may be used for the analysis.

HEADS AND TRANSITION SECTIONS

- R 3.3 **Formed heads** shall be 2:1 elliptical or hemispherical.
- R 3.4 **Knuckles** for conical transition sections shall have an inside radius no less than 14% of the outside diameter of the adjoining cylindrical section.

NOZZLES AND CONNECTIONS

- R 3.5 **Slip-on flanges** shall not be used.

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R 3.6 Nozzle configurations shall be as follows:

Nozzle NPS, in. (mm) ⁽¹⁾	Figure Reference From Indicated Division of the ASME Code Section VIII	
	Division 1	Division 2
≤ 4 (100)	Fig. UW 16.1 (a), (b), (c), (d) or (e) (2)	Fig. AD 610.1 (a), (b), (c), (d), (e), (e-1) or (f)
> 4 (100)	Fig. UW 16.1 (f1), (f2), (f3) or (f4) (3) (4)	Fig. AD 613.1 (a), (b), (c), (c-1) or (d) (3) (5)

Notes:

- (1) In all cases, nozzle configurations that are acceptable for diameters over NPS 4 (100 mm) may be used for smaller diameters as well.
- (2) Backing strips, if used, shall be removed after welding.
- * (3) Proposals to use alternative design details, which will permit either 100% radiographic or ultrasonic examination of the nozzle to shell weld, shall be submitted to the Purchaser for approval by the Owner's Engineer.
- (4) Alternatively Figure UW 16.1 (g) may be used at design temperatures below 850°F (450°C).
- (5) Alternatively Figure AD 610.1 (g) may be used at design temperatures below 850°F (450°C).

R 3.7 **The minimum inside corner radius** for all openings shall be the lesser of the following:

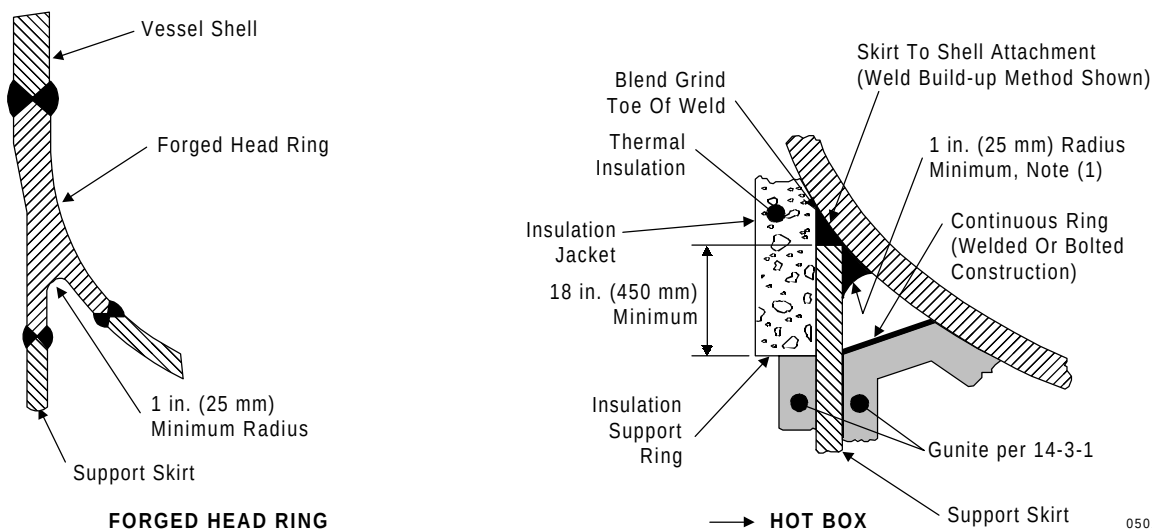
- a. 1/4 of the thickness of the vessel component penetrated.
- b. 1/4 of the finished inside diameter of the opening.
- c. 3/4 in. (19 mm).

R 3.8 **No exterior radius for attachments** shall be less than 1/4 in. (6 mm).

VESSEL SUPPORT

R * 3.9 **For skirt supported vessels with design temperatures above 500°F (260°C)**, excluding internally lined vessels, the skirt to shell attachment shall be made by means of a forged head ring with stub, as shown below, or weld build-up on the shell. If the weld build-up method is used, its design details shall be approved by the Owner's Engineer.

R 3.10 For vessels with design temperatures above 500°F (260°C), excluding internally lined vessels, a support skirt "hot box," as shown below, shall be provided at the vessel to skirt junction.



Note:

- * (1) If approved by the Owner's Engineer, the radius may be reduced based on a detailed stress analysis.

R 3.11 For lug supported vessels with design temperatures above 500°F (260°C), excluding internally lined vessels, a thermal stress analysis shall be performed of the lug to vessel attachment.