

GP 18-10-01	Additional Requirements for Materials	August 2003
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Additional Requirements for Materials

GP 18-10-01

Scope

- 1) [I] This Global Practice (GP) covers special materials requirements relating to the fabrication of equipment in the areas of hardness testing, carbon steel chemistry requirements, hydrostatic and wash water quality, impact testing, and protection of equipment.
 - 2) [I] An asterisk (*) indicates that a decision by Purchaser is required or that additional information is specified by Purchaser.
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1. Required References

[I] This Section lists Practices and Standards that are generically referenced and assumed to be a part of this document. Unless otherwise specified herein, use the latest edition.

1.1. Global Practices–ExxonMobil Engineering Practices

GP 03-15-01	Pressure Relief Valves
GP 09-04-01	Atmospheric Storage Tanks
GP 09-06-01	Refrigerated Storage Tanks
GP 20-01-01	Inspection of Equipment and Materials
GP 20-01-03	Quality Programs

1.2. API–American Petroleum Institute

API RP 579	Fitness-for-Service
API RP 941	Steels for Hydrogen Service at Elevated Temperatures and Pressures in Petroleum Refineries and Petrochemical Plants
API STD 661	Air-Cooled Heat Exchangers for General Refinery Services

1.3. ASME–American Society of Mechanical Engineers

Unless specific references to the ASME Code are listed, an IHS link to the Introduction is provided to facilitate accessing the relevant parts of the Code.

ASME SEC IX	BPVC Section IX
ASME SEC VIII D1	BPVC Section VIII - Rules for Construction of Pressure Vessels - Division 1
ASME SEC VIII D2	BPVC Section VIII - Rules for Construction of Pressure Vessels - Division 2 Alternative Rules
ASME B31.3	Process Piping

1.4. ASTM–American Society for Testing and Materials

ASTM A 833	Standard Practice for Indentation Hardness of Metallic Materials by Comparison Hardness Testers
ASTM A 956	Standard Test Method for Leeb Hardness Testing of Steel Products

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1.5. BSI–British Standards Institution

BSI PD 5500	Unfired Fusion Welded Pressure Vessels
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1.6. SNCT and AFIAP

COD AP	French Code for the Manufacture of Unfired Pressure Vessels
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1.7. STOOMWEZEN (Netherlands)

STOOMWEZEN	Rules for Equipment Under Pressure
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1.8. NACE–National Association of Corrosion Engineers

NACE MR0175	Sulfide Stress Cracking Resistant Metallic Materials for Oilfield Equipment Item No. 21304
NACE TM0284	Evaluation of Pipeline and Pressure Vessel Steels for Resistance to Hydrogen-Induced Cracking

1.9. EN–European Standards

EN 13445	Unfired Pressure Vessels
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2. Definitions

Term	[I] Description
Critical Exposure Temperature (CET)	* Defined as the lowest metal temperature derived from either the operating or atmospheric conditions. The CET may be a single temperature at an operating pressure or an envelope of temperatures and pressures. The CET is determined for different types of equipment including pressure vessels, piping and machinery as defined herein.
CET for Machinery	The CET for machinery pressure containing components to be supplied by the Owner's Engineer.
CET for Piping	The CET for systems constructed to the ASME B31.3 Piping Code is defined as the lowest metal temperature at which a component will be subject to either 30 percent of the MAWP at ambient temperature or a combined total longitudinal stress due to pressure, weight effects and displacement strains which does not exceed 55.2 MPa (8 ksi). The CET for piping is determined from the anticipated process and atmospheric conditions.

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Term	[I] Description
CET for Pressure Vessels (including heat exchangers and pressure storage spheres)	The CET for pressure vessels is determined from the anticipated process and atmospheric conditions. The CET is defined as the lowest metal temperature at which a component will be subjected to a general primary membrane tensile stress greater than 55.2 MPa (8 ksi). The CET may also be defined according to the following options: 1. The minimum metal temperature at which a component could be subjected to a pressure greater than 40 percent of the design pressure for vessels constructed to ASME SEC VIII D1. 2. The minimum metal temperature at which a component could be subjected to a pressure greater than 35 percent of the design pressure for vessels constructed to ASME SEC VIII D1, with a 3.5 safety factor as recognized in the 1999 addenda. 3. The minimum metal temperature at which a component could be subjected to a pressure greater than 30 percent of the design pressure for vessels constructed to ASME SEC VIII D2. 4. For pressure vessels designed to a higher allowable stress than that permitted in these codes, the CET may be taken as the lowest metal temperature at which the vessel will be subjected to a pressure no greater than 25 percent of the design pressure, or a membrane stress of no greater than 55.2 MPa (8 ksi).
Hardness Test	A single hardness reading in either the weld metal, base metal, or HAZ.
Heat Affected Zone (HAZ)	The zone of the base metal affected by the heat input of welding.
Hydrogen Service	Equipment is in hydrogen service when the design temperature is greater than the CS curve in API RP 941 for the given hydrogen partial pressure.
Inspector	As used in this GP, refers to the Owner's Representative.
Stainless Steel	A steel that meets one of the following descriptions: 1. Martensitic or ferritic chromium stainless steels containing more than 10 percent chromium (typically AISI 400 series). 2. Austenitic chromium-nickel stainless steels containing more than 16 percent chromium and more than 6 percent nickel (typically AISI 300 series). This also includes the super austenitic stainless steels (with 6 percent Mo) and the alloys with nominally 20 percent Cr and 35 percent Ni such as Incoloy 825 or Alloy 20. 3. Duplex ferritic-austenitic stainless steels containing approximately 15–30 percent chromium and 2–8 percent nickel (typically the 2205 and 2507 alloys).

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Term	[I] Description
Wet H₂S Service	Equipment is in Wet H ₂ S service when the H ₂ S level in a water phase is 50 ppm by weight or greater.

3. Hardness Testing

3.1. Personnel and Procedure Qualification

[R] Personnel performing hardness testing shall demonstrate their capabilities to the satisfaction of the Inspector. Qualification of the hardness testing personnel, including training and experience, shall be made available to the Inspector.

3.2. Testing Equipment

[R] A list of acceptable hardness testers is shown in Table 1. The Owner's Engineer shall approve any hardness tester not listed in Table 1.

3.3. Testing Procedure

- 1) [R] Testing procedures using the Brinell Type Hardness Tester shall be as follows:
 - a) Brinell hardness test methods shall be in accordance with ASTM A 833 and Manufacturer recommendations.
 - b) Hardness tests shall be conducted in the center of the weld and in the HAZ and adjacent base metal, when required.
 - c) The diameter of the indentation ball shall not be smaller than 7 mm and not larger than 10 mm.
 - d) If a hardness reference bar is used, the bar hardness shall be within 12.5 percent of the maximum hardness required for the specific material.
 - e) The surface to be hardness tested shall be ground, to ensure that the edge of the impression will be clearly defined to permit measurement of the diameter to within ± 0.02 mm.
 - f) Grinding shall be conducted in such a manner that overheating of the material is prevented.
 - g) Adjacent readings shall be at least 0.25 in. (6.4 mm) apart, edge to edge.
 - h) When hardness testing of the HAZ is required, the weld cap shall be ground so that the indentation ball can be placed in the center of the HAZ. This hardness test shall represent a composite of weld metal, HAZ and base metal.

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