International Standard


Petroleum, petrochemical and natural gas industries — Metallic materials resistant to sulfide stress cracking in corrosive petroleum refining environments

Élément introductif — Élément central — Élément complémentaire

An American National Standard
Approved November 23, 2015

Reference number


© ANSI/NACE/ISO 2015
13.1.5 Requirements for other alloy steels

13.1.6 Requirements for cold-formed carbon and alloy steels

13.1.7 Welding requirements for carbon steels listed as P-No. 1 in Section IX of the ASME BPVC

13.1.8 Welding requirements for alloy steels listed as P-No. 3, 4, or 5A in Section IX of the ASME BPVC

13.1.9 Corrosion resistant weld overlays, hard facing weld overlays, cladding, and thermal spray coatings on carbon steels and alloy steels

13.2 Cast iron and ductile iron

13.3 Ferritic stainless steels

13.4 Martensitic stainless steels

13.4.1 Conventional martensitic stainless steels

13.4.2 Low-carbon martensitic stainless steels

13.4.3 Welding and overlays on martensitic stainless steels

13.5 Austenitic stainless steels

13.6 Specific austenitic stainless steel grades

13.7 Highly alloyed austenitic stainless steels

13.8 Duplex stainless steels

13.8.1 General requirements for duplex stainless steels

13.8.2 Welding requirements for duplex stainless steels

13.9 Precipitation-hardenable stainless steels

13.9.1 Austenitic precipitation-hardenable stainless steel

13.9.2 Martensitic precipitation-hardenable stainless steels

13.9.3 Welding requirements for precipitation-hardenable stainless steels

13.9.4 Martensitic precipitation-hardenable stainless steels

14 Nonferrous materials

14.1 Nickel alloys

14.1.1 Solid-solution nickel alloys

14.1.2 Precipitation-hardenable nickel alloys

14.2 Cobalt-Nickel-chromium-molybdenum alloys

14.3 Cobalt-nickel-chromium-tungsten alloys

14.4 Titanium alloys

14.5 Aluminium alloys

14.6 Copper alloys

15 Fabrication requirements

15.1 General fabrication requirements

15.2 Corrosion resistant overlays, hard facing overlays, and cladding

15.3 Welding

15.4 Cladding on carbon steels, alloy steels, and martensitic stainless steels

15.5 Identification stamping

15.6 Threading

15.6.1 Machine-cut threads

15.6.2 Cold-formed (rolled) threads

15.7 Cold-deformation processes

16 Bolting

16.1 General bolting requirements

16.2 Exposed bolting

16.3 Nonexposed bolting

17 Plating, coatings, and diffusion processes

18 Special components

18.1 General requirements for special components

18.2 Bearings

18.3 Springs

18.4 Instrumentation and control devices
ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO’s adherence to the WTO principles in the Technical Barriers to Trade (TBT), see the following URL: Foreword — Supplementary information.

The committee responsible for this document is ISO/TC 67, Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries.
that can occur because of the effects of hydrogen charging in wet H₂S refinery or gas plant process environments. One of the types of material damage that can occur as a result of hydrogen charging is sulfide stress cracking (SSC) of hard weldments and microstructures, which is addressed by this International Standard. Other types of material damage include hydrogen blistering, hydrogen-induced cracking (HIC), and stress-oriented hydrogen-induced cracking (SOHIC), which are not addressed by this International Standard.

Historically, many end users, industry organizations (e.g. API), and manufacturers that have specified and supplied equipment and products such as rotating equipment and valves to the refining industry have used NACE MR0175/ISO 15156 to establish materials requirements to prevent SSC. However, it has always been recognized that refining environments are outside the scope of NACE MR0175/ISO 15156, which was developed specifically for the oil and gas production industry. In 2003, the first edition of NACE MR0103 was published as a refinery-specific sour service metallic materials standard. This International Standard is based on the good experience gained with NACE MR0175/ISO 15156, but tailored to refinery environments and applications. Other references for this International Standard are NACE SP0296, NACE Publication 8X194, NACE Publication 8X294, and the refining experience of the task group members who developed NACE MR0103.

The materials, heat treatments, and material property requirements set forth in NACE MR0103 are based on extensive experience in the oil and gas production industry, as documented in NACE MR0175/ISO 15156, and were deemed relevant to the refining industry by the task group.

This International Standard was developed on the basis of NACE MR0103.
1 Scope

This International Standard establishes material requirements for resistance to SSC in sour petroleum refining and related processing environments containing H₂S either as a gas or dissolved in an aqueous (liquid water) phase with or without the presence of hydrocarbon. This International Standard does not include and is not intended to include design specifications. Other forms of wet H₂S cracking, environmental cracking, corrosion, and other modes of failure are outside the scope of this International Standard. It is intended to be used by refiners, equipment manufacturers, engineering contractors, and construction contractors.

Specifically, this International Standard is directed at the prevention of SSC of equipment (including pressure vessels, heat exchangers, piping, valve bodies, and pump and compressor cases) and components used in the refining industry. Prevention of SSC in carbon steel categorized under P-No. 1 in Section IX of the ASME Boiler and Pressure Vessel Code (BPVC) is addressed by requiring compliance with NACE SP0472.

This International Standard applies to all components of equipment exposed to sour refinery environments (see Clause 6) where failure by SSC would (1) compromise the integrity of the pressure-containment system, (2) prevent the basic function of the equipment, and/or (3) prevent the equipment from being restored to an operating condition while continuing to contain pressure.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NACE Standard TM0177, Laboratory Testing of Metals for Resistance to Sulfide Stress Cracking and Stress Corrosion Cracking in H₂S Environments


ASTM A833, Standard Practice for Indentation Hardness of Metallic Materials by Comparison Hardness Testers


SAE AMS2430, Shot Peening, Automatic

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 lower transformation temperature

\( A_{c1} \)