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



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AS ISO 17945:2022

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- DNV-GL Oil and Gas
- Energy Safe Victoria
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Preface

This Standard was prepared by the Standards Australia Committee ME-092, Materials, equipment, structures and related services for petroleum, petrochemical and natural gas industries.

The objective of this document is to establish material requirements for resistance to sulfide stress cracking (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 document 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 document. It is intended to be used by refiners, equipment manufacturers, engineering contractors, and construction contractors.

This document 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 conformance with NACE SP 0472.

This document applies to all components of equipment exposed to sour refinery environments (see Clause 6) where failure by SSC would:

- (a) compromise the integrity of the pressure-containment system;
- (b) prevent the basic function of the equipment; and/or
- (c) prevent the equipment from being restored to an operating condition while continuing to contain pressure.

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The terms “normative” and “informative” are used in Standards to define the application of the appendices or annexes to which they apply. A “normative” appendix or annex is an integral part of a Standard, whereas an “informative” appendix or annex is only for information and guidance.

Contents

Preface	ii
Foreword	v
Introduction	vi
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Symbols and abbreviated terms	3
5 Responsibilities	3
5.1 Responsibilities of the end user	3
5.2 Responsibility of the manufacturer	4
6 Factors contributing to SSC	4
6.1 General parameters affecting SSC	4
6.2 Effect of material condition and stress level on susceptibility to SSC	4
6.3 Effect of hydrogen permeation flux on SSC	5
6.4 Effect of elevated temperature exposure on SSC	5
6.5 Factors affecting time to failure due to SSC	6
6.6 Bases for establishing whether equipment falls within the scope of this International Standard	6
7 Materials included in this International Standard	6
8 Hardness requirements	7
9 Procedure for the addition of new materials or processes	8
9.1 General balloting requirements	8
9.2 Field experience data requirements	8
9.3 Laboratory test data requirements	8
10 New restrictions and deleted materials	8
11 Qualification of unlisted alloys, conditions, and/or processes for specific applications	9
12 Standard road map	9
13 Ferrous materials	11
13.1 Carbon and alloy steels	11
13.1.1 Requirements for all carbon and alloy steels	11
13.1.2 Requirements for carbon steels listed as P-No. 1 Group 1 or 2 in Section IX of the ASME BPVC	11
13.1.3 Requirements for other carbon steels	11
13.1.4 Requirements for alloy steels listed with P-numbers in Section IX of the ASME BPVC	12
13.1.5 Requirements for other alloy steels	12
13.1.6 Requirements for cold-formed carbon and alloy steels	12
13.1.7 Welding requirements for carbon steels listed as P-No. 1 in Section IX of the ASME BPVC	12
13.1.8 Welding requirements for alloy steels listed as P-No. 3, 4, or 5A in Section IX of the ASME BPVC	13
13.1.9 Corrosion resistant weld overlays, hard facing weld overlays, cladding, and thermal spray coatings on carbon steels and alloy steels	13
13.2 Cast iron and ductile iron	13
13.3 Ferritic stainless steels	14
13.4 Martensitic stainless steels	14
13.4.1 Conventional martensitic stainless steels	14
13.4.2 Low-carbon martensitic stainless steels	14

13.4.3	Welding and overlays on martensitic stainless steels	15
13.5	Austenitic stainless steels	15
13.6	Specific austenitic stainless steel grades	16
13.7	Highly alloyed austenitic stainless steels	16
13.8	Duplex stainless steels	17
13.8.1	General requirements for duplex stainless steels	17
13.8.2	Welding requirements for duplex stainless steels	17
13.9	Precipitation-hardenable stainless steels	17
13.9.1	Austenitic precipitation-hardenable stainless steel	17
13.9.2	Martensitic precipitation-hardenable stainless steels	17
13.9.3	Welding requirements for precipitation-hardenable stainless steels	18
14	Nonferrous materials	19
14.1	Nickel alloys	19
14.1.1	Solid-solution nickel alloys	19
14.1.2	Precipitation-hardenable nickel alloys	20
14.2	Cobalt-Nickel-chromium-molybdenum alloys	20
14.3	Cobalt-nickel-chromium-tungsten alloys	21
14.4	Titanium alloys	21
14.5	Aluminium alloys	22
14.6	Copper alloys	22
15	Fabrication requirements	22
15.1	General fabrication requirements	22
15.2	Corrosion resistant overlays, hard facing overlays, and cladding	22
15.3	Welding	22
15.4	Cladding on carbon steels, alloy steels, and martensitic stainless steels	23
15.5	Identification stamping	23
15.6	Threading	24
15.6.1	Machine-cut threads	24
15.6.2	Cold-formed (rolled) threads	24
15.7	Cold-deformation processes	24
16	Bolting	24
16.1	General bolting requirements	24
16.2	Exposed bolting	24
16.3	Nonexposed bolting	25
17	Plating, coatings, and diffusion processes	25
18	Special components	25
18.1	General requirements for special components	25
18.2	Bearings	25
18.3	Springs	26
18.4	Instrumentation and control devices	26
18.4.1	General requirements for instrumentation and control devices	26
18.4.2	Diaphragms, pressure-measuring devices, and pressure seals	26
18.5	Seal rings and gaskets	26
18.6	Strip Rings	27
18.7	Special process parts	27
19	Valves	27
20	Compressors and pumps	27
Annex A	(informative) Sulfide species plot	29
Annex B	(informative) Background information on hardness testing and requirements	30
Annex C	(normative) Welding procedure qualification hardness survey layouts	34
Bibliography	43

Foreword

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).

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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*.

Introduction

The term “wet H₂S cracking”, as used in the refining industry, covers a range of damage mechanisms 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.

Australian Standard[®]

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

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*¹⁾

ANSI/NACE MR0175/ISO 15156, *Petroleum and natural gas industries — Materials for use in H₂S-containing environments in oil and gas production*¹⁾

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

ASTM E384, *Standard Test Method for Knoop and Vickers Hardness of Materials*

ASTM E562, *Standard Test Method for Determining Volume Fraction by Systematic Manual Point Count*

SAE AMS 2430, *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}

temperature at which austenite begins to form during heating

1) NACE International, 1440 South Creek Dr., Houston, TX 77084-4906, USA.