SLOVENSKI STANDARD
SIST EN ISO 15156-3:2015

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Nadomešča:
SIST EN ISO 15156-3:2010

Industrija za predelavo nafte in zemeljskega plina - Materiali za uporabo v okoljih s H2S v proizvodnji olja in plina - 3. del: Visokolegirana jekla (CRAs) in druge zlitine (ISO 15156-3:2015)

Petroleum and natural gas industries - Materials for use in H2S-containing environments in oil and gas production - Part 3: Cracking-resistant CRAs (corrosion-resistant alloys) and other alloys (ISO 15156-3:2015)

Erdöl- und Erdgasindustrie - Werkstoffe für den Einsatz in H2S-haltiger Umgebung bei der Öl- und Gasgewinnung - Teil 3: Hochlegierte Stähle (CRAs) und andere Legierungen (ISO 15156-3:2015)

Industries du pétrole et du gaz naturel - Matériaux pour utilisation dans des environnements contenant de l'hydrogène sulfuré (H2S) dans la production de pétrole et de gaz - Partie 3 : ARC (alliages résistants a la corrosion) et autres alliages résistants à la fissuration (ISO 15156-3:2015)

Ta slovenski standard je istoveten z: **EN ISO 15156-3:2015**

ICS:

75.180.10	Oprema za raziskovanje in odkopavanje	Exploratory and extraction equipment
77.060	Korozija kovin	Corrosion of metals

SIST EN ISO 15156-3:2015 **en**

EUROPEAN STANDARD
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English Version

Petroleum and natural gas industries - Materials for use in H2S-containing environments in oil and gas production - Part 3: Cracking-resistant CRAs (corrosion-resistant alloys) and other alloys (ISO 15156-3:2015)

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

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European foreword

This document (EN ISO 15156-3:2015) has been prepared by Technical Committee ISO/TC 118 "Compressors and pneumatic tools, machines and equipment" in collaboration with Technical Committee CEN/TC 12 “Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries” the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 2016, and conflicting national standards shall be withdrawn at the latest by March 2016.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN ISO 15156-3:2009.

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Endorsement notice

The text of ISO 15156-3:2015 has been approved by CEN as EN ISO 15156-3:2015 without any modification.

INTERNATIONAL STANDARD

ISO 15156-3

Third edition
2015-09-01

Petroleum and natural gas industries — Materials for use in H2S-containing environments in oil and gas production —

Part 3: Cracking-resistant CRAs (corrosion-resistant alloys) and other alloys

Industries du pétrole et du gaz naturel — Matériaux pour utilisation dans des environnements contenant de l'hydrogène sulfuré (H2S) dans la production de pétrole et de gaz —

Partie 3: ARC (alliages résistants à la corrosion) et autres alliages résistants à la fissuration

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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*.

This third edition cancels and replaces the second edition (ISO 15156-3:2009), which has been technically revised with the following changes:

— replacement in the Scope of the term “conventional elastic design criteria” by the term “load controlled design methods”;

— refinements to 6.3 to require the use of absolute values when F_{PREN} is calculated for use in this part of ISO 15156;

— acceptance of the environmental limits for low carbon 300 series stainless steels also for their dual certified grades;

— changes to some of the tables of Annex A to more conservatively reflect the current knowledge of the limits of use of some materials;

— changes to the definition of acceptable limits to *in situ* production environment pH in some tables of Annex A;

— additions to a number of tables of Annex A of new sets of acceptable environmental limits for (new) materials and their associated metallurgical requirements.

ISO 15156 consists of the following parts, under the general title *Petroleum and natural gas industries — Materials for use in H2S-containing environments in oil and gas production*:

— *Part 1: General principles for selection of cracking-resistant materials*

— *Part 2: Cracking-resistant carbon and low-alloy steels, and the use of cast irons*

— *Part 3: Cracking-resistant CRAs (corrosion-resistant alloys) and other alloys*

Introduction

The consequences of sudden failures of metallic oil and gas field components associated with their exposure to H_2S-containing production fluids led to the preparation of the first edition of NACE MR0175 which was published in 1975 by the National Association of Corrosion Engineers, now known as NACE International.

The original and subsequent editions of NACE MR0175 established limits of H_2S partial pressure above which precautions against sulfide stress-cracking (SSC) were always considered necessary. They also provided guidance for the selection and specification of SSC-resistant materials when the H_2S thresholds were exceeded. In more recent editions, NACE MR0175 has also provided application limits for some corrosion-resistant alloys in terms of environmental composition and pH, temperature, and H_2S partial pressures.

In separate developments, the European Federation of Corrosion issued EFC Publication 16 in 1995 and EFC Publication 17 in 1996. These documents are generally complementary to those of NACE, though they differed in scope and detail.

In 2003, the publication of the ISO 15156-series and NACE MR0175/ISO 15156 was completed for the first time. These technically identical documents utilized the above sources to provide requirements and recommendations for materials qualification and selection for application in environments containing wet H_2S in oil and gas production systems. They are complemented by NACE TM0177 and NACE TM0284 test methods.

The revision of this part of ISO 15156 involves a consolidation of all changes agreed and published in the Technical Circular 1, ISO 15156-3:2009/Cir.1:2011(E), Technical Circular 2, ISO 15156-3:2009/Cir.2:2013(E), Technical Circular 3, ISO 15156-3:2009/Cir.3:2014(E), and Technical Circular 4, ISO 15156-3:2009/Cir.4:2014(E), published by the ISO 15156 Maintenance Agency secretariat at DIN, Berlin.

The changes were developed by and approved by the ballot of representative groups from within the oil and gas production industry. The great majority of these changes stem from issues raised by document users. A description of the process by which these changes were approved can be found at the ISO 15156 maintenance website: www.iso.org/iso15156maintenance.

Technical Circular ISO 15156-3:2009/Cir.2:2013 and Technical Circular ISO 15156-3:2009/Cir.3:2014 intend that an informative Annex F should be published for this part of ISO 15156 that was to give an alternative presentation of the information contained in the materials selection tables of Annex A.

During final editing of this part of ISO 15156, a number of technical errors were found in the transfer of information between the materials selection tables of Annex A and Table F.1. In order not to delay the publication of the new edition of this part of ISO 15156, the ISO 15156 Maintenance Agency agreed that the proposed Annex F should not be published at this time.

When found necessary by oil and gas production industry experts, future interim changes to this part of ISO 15156 will be processed in the same way and will lead to interim updates to this part of ISO 15156 in the form of Technical Corrigenda or Technical Circulars. Document users should be aware that such documents can exist and can impact the validity of the dated references in this part of ISO 15156.

The ISO 15156 Maintenance Agency at DIN was set up after approval by the ISO Technical Management Board given in document 34/2007. This document describes the make up of the agency which includes experts from NACE, EFC and ISO/TC 67, and the process for approval of amendments. It is available from the ISO 15156 maintenance website and from the ISO/TC 67 Secretariat. The website also provides access to related documents that provide more detail of ISO 15156 maintenance activities.

Petroleum and natural gas industries — Materials for use in H2S-containing environments in oil and gas production —

Part 3: Cracking-resistant CRAs (corrosion-resistant alloys) and other alloys

WARNING — CRAs (corrosion-resistant alloys) and other alloys selected using this part of ISO 15156 are resistant to cracking in defined H_2S-containing environments in oil and gas production, but not necessarily immune to cracking under all service conditions. It is the equipment user's responsibility to select the CRAs and other alloys suitable for the intended service.

1 Scope

This part of ISO 15156 gives requirements and recommendations for the selection and qualification of CRAs (corrosion-resistant alloys) and other alloys for service in equipment used in oil and natural gas production and natural gas treatment plants in H_2S-containing environments whose failure can pose a risk to the health and safety of the public and personnel or to the environment. It can be applied to help avoid costly corrosion damage to the equipment itself. It supplements, but does not replace, the materials requirements of the appropriate design codes, standards, or regulations.

This part of ISO 15156 addresses the resistance of these materials to damage that can be caused by sulfide stress-cracking (SSC), stress-corrosion cracking (SCC), and galvanically induced hydrogen stress cracking (GHSC).

This part of ISO 15156 is concerned only with cracking. Loss of material by general (mass loss) or localized corrosion is not addressed.

Table 1 provides a non-exhaustive list of equipment to which this part of ISO 15156 is applicable, including permitted exclusions.

This part of ISO 15156 applies to the qualification and selection of materials for equipment designed and constructed using load controlled design methods. For design utilizing strain-based design methods, see ISO 15156-1:2015, Clause 5.

This part of ISO 15156 is not necessarily suitable for application to equipment used in refining or downstream processes and equipment.

Table 1 — List of equipment

ISO 15156 is applicable to materials used for the following equipment	Permitted exclusions
Drilling, well construction, and well-servicing equipment	Equipment exposed only to drilling fluids of controlled composition[a] Drill bits Blowout-preventer (BOP) shear blades[b] Drilling riser systems Work strings Wireline and wireline equipment[c] Surface and intermediate casing
Wells including subsurface equipment, gas lift equipment, wellheads, and christmas trees	Sucker rod pumps and sucker rods[d] Electric submersible pumps Other artificial lift equipment Slips
Flow-lines, gathering lines, field facilities, and field processing plants	Crude oil storage and handling facilities operating at a total absolute pressure below 0,45 MPa (65 psi)
Water-handling equipment	Water-handling facilities operating at a total absolute pressure below 0,45 MPa (65 psi) Water injection and water disposal equipment
Natural gas treatment plants	—
Transportation pipelines for liquids, gases, and multi-phase fluids	Lines handling gas prepared for general commercial and domestic use
For all equipment above	Components loaded only in compression

[a] See ISO 15156-2:2015, A.2.3.2.3 for more information.

[b] See ISO 15156-2:2015, A.2.3.2.1 for more information.

[c] Wireline lubricators and lubricator connecting devices are not permitted exclusions.

[d] For sucker rod pumps and sucker rods, reference can be made to NACE MR0176.

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.

ISO 6507-1, *Metallic materials — Vickers hardness test — Part 1: Test method*

ISO 6508-1, *Metallic materials — Rockwell hardness test — Part 1: Test method*

ISO 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature*

ISO 7539-7, *Corrosion of metals and alloys — Stress corrosion testing — Part 7: Method for slow strain rate testing*

ISO 10423, *Petroleum and natural gas industries — Drilling and production equipment — Wellhead and christmas tree equipment*

ISO 11960, *Petroleum and natural gas industries — Steel pipes for use as casing or tubing for wells*

ISO 15156-1:2015, *Petroleum and natural gas industries — Materials for use in H2S-containing environments in oil and gas production — Part 1: General principles for selection of cracking-resistant materials*

ISO 15156-2:2015, *Petroleum and natural gas industries — Materials for use in H2S-containing environments in oil and gas production — Part 2: Cracking-resistant carbon and low alloy steels, and the use of cast irons*

ASTM A747/A747M[1)], *Standard Specification for Steel Castings, Stainless, Precipitation Hardening*

ASTM E29, *Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications*

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

EFC Publications Number 17[2)], *Corrosion resistant alloys for oil and gas production: guidelines on general requirements and test methods for H2S service*

NACE CORROSION/95[3)], Paper 47, *Test methodology for elemental sulfur-resistant advanced materials for oil and gas field equipment*

NACE CORROSION/97 Paper 58, *Rippled strain rate test for CRA sour service materials selection*

NACE TM0177, *Laboratory testing of metals for resistance to sulfide stress cracking and stress corrosion cracking in H2S environments*

NACE TM0198, *Slow strain rate test method for screening corrosion resistant alloys (CRAs) for stress corrosion cracking in sour oilfield service*

SAE AMS-2430, *Shot Peening, Automatic*

SAE[4)] — ASTM, *Metals and alloys in the Unified Numbering System*, ISBN 0-7680-04074

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 15156-1, ISO 15156-2, and the following apply.

3.1
ageing
change in metallurgical properties that generally occurs slowly at room temperature (natural ageing) and more rapidly at higher temperature (artificial ageing)

3.2
anneal
heat to and hold at a temperature appropriate for the specific material and then cool at a suitable rate for such purposes as reducing hardness, improving machineability, or obtaining desired properties

3.3
austenite
face-centred cubic crystalline phase of iron-based alloys

3.4
duplex stainless steel
austenitic/ferritic stainless steel
stainless steel (3.13) whose microstructure at room temperature consists primarily of a mixture of *austenite* (3.3) and *ferrite* (3.5)

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1) ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, USA.

2) European Federation for Corrosion, available from The Institute of Materials, 1 Carlton House Terrace, London SW1Y 5DB, UK [ISBN 0-901716-95-2].

3) NACE International, P.O. Box 2183140, Houston, TX 77218-8340, USA.

4) Society of Automotive Engineers (SAE), 400 Commonwealth Drive, Warrendale, PA 15096-0001, USA.