

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 15156-1:2015)

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN ISO 15156-1:2015 sisaldab Euroopa standardi EN ISO 15156-1:2015 ingliskeelset teksti.	This Estonian standard EVS-EN ISO 15156-1:2015 consists of the English text of the European standard EN ISO 15156-1:2015.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 16.09.2015.	Date of Availability of the European standard is 16.09.2015.
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ICS 75.180.01

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English Version

**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 15156-1:2015)**

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 1 : Principes généraux pour le
choix des matériaux résistant au craquage (ISO 15156-
1:2015)

Erdöl- und Erdgasindustrie - Werkstoffe für den
Einsatz in H₂S-haltiger Umgebung bei der Öl- und
Gasgewinnung - Teil 1: Allgemeine Grundlagen für die
Auswahl von gegen Rissbildung beständigen
Werkstoffen (ISO 15156-1:2015)

This European Standard was approved by CEN on 24 July 2015.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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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

European foreword

This document (EN ISO 15156-1:2015) has been prepared by Technical Committee ISO/TC 67 "Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries" 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 15156-1:2009.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Endorsement notice

The text of ISO 15156-1:2015 has been approved by CEN as EN ISO 15156-1:2015 without any modification.

Contents

	Page
Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	2
3 Terms and definitions	2
4 Abbreviated terms	6
5 General principles	6
6 Evaluation and definition of service conditions to enable material selection	7
7 Selection of materials resistant to SSC/SCC in the presence of sulfides from existing lists and tables	7
8 Qualification of materials for H₂S service	7
8.1 Material description and documentation.....	7
8.2 Qualification based upon field experience.....	8
8.3 Qualification based upon laboratory testing.....	8
8.3.1 General.....	8
8.3.2 Sampling of materials for laboratory testing.....	8
8.3.3 Selection of laboratory test methods.....	8
8.3.4 Conditions to be applied during testing.....	9
8.3.5 Acceptance criteria.....	9
9 Report of the method of selection or qualification	9
Bibliography	10

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).

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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 15156-1:2009), which has been technically revised to contain the following changes in the Scope and [Clause 5](#):

- replacement of the term “conventional elastic design criteria” by the term “load controlled design methods”;
- inclusion of improved guidance on the approach to the qualification of materials for use with strain-based design methods.

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 H₂S-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 H₂S 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 H₂S 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 H₂S 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 three parts of ISO 15156 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 H₂S 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 15156-1:2009/Cir.1:2014(E), published by the ISO 15156 Maintenance Agency secretariat at DIN.

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.

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 makeup 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 1: General principles for selection of cracking-resistant materials

WARNING — Metallic materials selected using ISO 15156 are resistant to cracking in defined H₂S-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 materials suitable for the intended service.

1 Scope

This part of ISO 15156 describes general principles and gives requirements and recommendations for the selection and qualification of metallic materials for service in equipment used in oil and gas production and in natural-gas sweetening plants in H₂S-containing environments, where the failure of such equipment can pose a risk to the health and safety of the public and personnel or to the environment. It can be applied to help to avoid costly corrosion damage to the equipment itself. It supplements, but does not replace, the materials requirements given in the appropriate design codes, standards, or regulations.

This part of ISO 15156 addresses all mechanisms of cracking that can be caused by H₂S, including sulfide stress cracking, stress corrosion cracking, hydrogen-induced cracking and stepwise cracking, stress-oriented hydrogen-induced cracking, soft zone cracking, and galvanically induced hydrogen stress cracking.

[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 [Clause 5](#).

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

Table 1 — List of equipment

ISO 15156-1 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
Flowlines, 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 multiphase 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 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*

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*

3 Terms and definitions

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