

This is a preview of "ISO 15156-2:2015". [Click here to purchase the full version from the ANSI store.](#)

Third edition  
2015-09-01

---

---

## **Petroleum and natural gas industries — Materials for use in H<sub>2</sub>S-containing environments in oil and gas production —**

Part 2:

### **Cracking-resistant carbon and low-alloy steels, and the use of cast irons**

*Industries du pétrole et du gaz naturel — Matériaux pour utilisation dans des environnements contenant de l'hydrogène sulfuré (H<sub>2</sub>S) dans la production de pétrole et de gaz —*

*Partie 2: Aciers au carbone et aciers faiblement alliés résistants à la fissuration, et utilisation de fontes*



Reference number  
ISO 15156-2:2015(E)

© ISO 2015



**COPYRIGHT PROTECTED DOCUMENT**

© ISO 2015, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office  
Ch. de Blandonnet 8 • CP 401  
CH-1214 Vernier, Geneva, Switzerland  
Tel. +41 22 749 01 11  
Fax +41 22 749 09 47  
copyright@iso.org  
www.iso.org

This is a preview of "ISO 15156-2:2015". Click here to purchase the full version from the ANSI store.

## Contents

	Page
<b>Foreword</b> .....	<b>iv</b>
<b>Introduction</b> .....	<b>v</b>
<b>1 Scope</b> .....	<b>1</b>
<b>2 Normative references</b> .....	<b>2</b>
<b>3 Terms and definitions</b> .....	<b>3</b>
<b>4 Symbols and abbreviated terms</b> .....	<b>6</b>
<b>5 Purchasing information</b> .....	<b>6</b>
<b>6 Factors affecting the behaviour of carbon and low alloy steels in H<sub>2</sub>S-containing environments</b> .....	<b>7</b>
<b>7 Qualification and selection of carbon and low-alloy steels with resistance to SSC, SOHIC and SZC</b> .....	<b>8</b>
7.1 Option 1 — Selection of SSC-resistant steels (and cast irons) using A.2.....	8
7.1.1 For $p_{\text{H}_2\text{S}} < 0,3$ kPa (0,05 psi).....	8
7.1.2 For $p_{\text{H}_2\text{S}} \geq 0,3$ kPa (0,05 psi).....	8
7.2 Option 2 — Selection of steels for specific sour-service applications or for ranges of sour service.....	8
7.2.1 Sulfide stress-cracking.....	8
7.2.2 SOHIC and SZC.....	10
7.3 Hardness requirements.....	10
7.3.1 General.....	10
7.3.2 Parent metals.....	10
7.3.3 Welds.....	10
7.4 Other fabrication methods.....	16
<b>8 Evaluation of carbon and low alloy steels for their resistance to HIC/SWC</b> .....	<b>16</b>
<b>9 Marking, labelling, and documentation</b> .....	<b>17</b>
<b>Annex A (normative) SSC-resistant carbon and low alloy steels (and requirements and recommendations for the use of cast irons)</b> .....	<b>18</b>
<b>Annex B (normative) Qualification of carbon and low-alloy steels for H<sub>2</sub>S service by laboratory testing</b> .....	<b>27</b>
<b>Annex C (informative) Determination of H<sub>2</sub>S partial pressure</b> .....	<b>35</b>
<b>Annex D (informative) Recommendations for determining pH</b> .....	<b>37</b>
<b>Annex E (informative) Information that should be supplied for material purchasing</b> .....	<b>42</b>
<b>Bibliography</b> .....	<b>44</b>

## 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](http://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](http://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*.

This third edition cancels and replaces the second edition (ISO 15156-2:2009), of which it constitutes a minor revision, specifically by the following:

- replacement in the Scope of the term “conventional elastic design criteria” by the term “load controlled design methods”;
- inclusion in both [7.2.1.1](#) and [A.2.1.1](#) of information that emphasizes the possibilities for the qualification for a specific sour service or range of sour service of carbon and low alloy steels not listed in [Annex A](#);
- replacement of paragraph 6 of [A.2.1.4](#) to improve the guidance on the welding of carbon and low alloy steels not covered elsewhere in this subclause.

ISO 15156 consists of the following parts, under the general title *Petroleum and natural gas industries — Materials for use in H<sub>2</sub>S-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*

This is a preview of "ISO 15156-2:2015". [Click here to purchase the full version from the ANSI store.](#)

## Introduction

The consequences of sudden failures of metallic oil and gas field components, associated with their exposure to H<sub>2</sub>S-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<sub>2</sub>S 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<sub>2</sub>S 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<sub>2</sub>S 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<sub>2</sub>S 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 15156-2:2009/Cir.1:2011(E) and the Technical Circular 2, ISO 15156-2:2009/Cir.2:2014(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](http://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 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.