

ICS 75.180.01
CCS E 10



**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 20972.2-2025

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

石油天然气工业 油气开采中用于含硫化氢环境的材料 第2部分：抗开裂碳钢、低合金钢和铸铁

(English Translation)

Issued on: January 24, 2025

Implemented on: August 1, 2025

**Issued by: State Administration for Market Regulation, China National
Standardization Administration**

Table of Contents

Preface
Introduction
1 Scope
2 Normative references
3 Terms and Definitions
4 Abbreviations
5 General
6 Factors affecting crack resistance
7 Evaluation and selection of carbon steel and low alloy steel resistant to SSC, SOHIC and SZC
8 Evaluation of HIC and SWC resistance of carbon steel and low alloy steel
9 Purchasing Information
10 Mark
Annex A (informative) Structural adjustments of this document compared with ISO 15156-2:2020
Appendix B (Informative) Technical differences between this document and ISO 15156-2:2020 and their reasons
Appendix C (Normative) Requirements and recommendations for the use of SSC-resistant carbon steel, low alloy steel and cast iron
Appendix D (Normative) Laboratory test evaluation of carbon steel and low alloy steel for use in hydrogen sulfide environments
Appendix E (Informative) Determination of Hydrogen Sulfide Partial Pressure
Appendix F (Informative) Recommended Method for Determining In Situ pH
Appendix G (Informative) Information provided on material procurement recommendations
Reference

Foreword

This document is in accordance with the provisions of GB/T 1.1-2020 "Guidelines for standardization work Part 1: Structure and drafting rules for standardization documents" Drafting.

This document is Part 2 of GB/T 20972 "Materials for use in hydrogen sulfide environments in oil and gas production in the petroleum and natural gas industry".

GB/T 20972 has published the following parts.

- Part 1: General principles for selecting crack-resistant materials;
- Part 2: Cracking resistant carbon steel, low alloy steel and cast iron;
- Part 3: Cracking and corrosion resistant alloys and other alloys.

This document replaces GB/T 20972.2-2008 "Materials for use in hydrogen sulfide environments in oil and gas production in the petroleum and natural gas industry Part 2 Compared with GB/T 20972.2-2008, in addition to structural adjustments and editorial changes, the main changes are as follows.

The technical changes are as follows.

- a) The scope has been changed (see Chapter 1, Chapter 1 of the 2008 edition);
- b) The clause for using Method 1 when the hydrogen sulfide partial pressure is greater than 1 MPa has been modified (see 7.2.1, 7.1 of the 2008 edition);
- c) Modified the provisions for the sour environment service assessment of materials not listed in Appendix C (see 7.2.2.1, 2008 edition) 7.2.1.1);
- d) The exemption conditions for post-weld heat treatment of carbon steel and low alloy steel have been changed (see C.2.1.4, A.2.1.4 of the 2008 edition);
- e) Added clauses for evaluating the impact of heat treatment on the covering layer (see C.2.1.5);
- f) The applicable national standard products have been changed (see Table C.2, Table A.2 and Appendix F of the 2008 edition);
- g) The casing and tubing materials C110 were changed, and C95 was renamed R95 (see Table C.3, Table A.3 of the 2008 edition);
- h) The pH value requirements for controlling the drilling environment have been changed (see C.2.3.2.3, A.2.3.2.3 of the 2008 edition)
- i) The four-point bending test standard and evaluation standard have been changed (see D.3, B.3 of the 2008 edition);
- j) The acceptance criteria for HIC test have been changed (see D.5, B.5 of the 2008 edition);

This document is modified to adopt ISO 15156-2:2020 "Materials for use in hydrogen sulfide environments in oil and gas production in the petroleum and natural gas industry" Part 2: Cracking resistant carbon steels, low alloy steels and cast irons.

Compared with ISO 15156-2:2020, this document has many structural adjustments. See the table of structural changes between the two documents for details.

Appendix A.

This document has many technical differences compared to ISO 15156-2:2020.

A list of these technical differences and their reasons is given in Appendix B.

The following editorial changes were made to this document.

- Deleted the note in 7.3.2 of ISO 15156-2:2020;
- Deleted the note of 7.3.3.2 in ISO 15156-2:2020;
- Deleted Note 1 to Chapter 8 of ISO 15156-2:2020;
- Added Appendix A and Appendix B;
- Deleted the note of B.1 in ISO 15156-2:2020;
- Changed Note 1 of B.2.1.1 in ISO 15156-2:2020;
- Deleted footnotes a and c in Table B.3 of ISO 15156-2:2020;
- Deleted footnote c of Figure C.1 in ISO 15156-2:2020.

Introduction

Sulfide stress cracking and stress corrosion cracking are dangerous failure forms in the production of hydrogen sulfide oil and gas.

Equipment materials may crack rapidly and unpredictably, causing great loss of life and property.

The purpose of the "Materials for use in hydrogen sulfide environments in oil and gas production in the gas industry" is to standardize the crack-resistant materials used in hydrogen sulfide environments in oil and gas production.

The requirements for material evaluation, selection and application were formulated with reference to ISO 15156 and other relevant domestic and foreign standards, and the recent acidic oil and gas the research results of field engineering application practice experience and technical standards are planned to be composed of three parts.

--- Part 1: General principles for selecting crack-resistant materials. The purpose is to establish general principles for service environment definition, material evaluation and selection.

in principle.

--- Part 2: Cracking resistant carbon steel, low alloy steel and cast iron. The purpose is to establish the selection, assessment and Requirements for use, and requirements for use of cast iron.

--- Part 3: Cracking resistant corrosion resistant alloys and other alloys. The purpose is to establish the selection, evaluation and Usage requirements include austenitic stainless steel, martensitic stainless steel, ferritic stainless steel, duplex stainless steel, nickel-based alloys, titanium alloys, etc.

Used in sulfur-containing oil and gas production in the petroleum and natural gas industry
Materials for use in hydrogen atmospheres Part 2: Carbon steels resistant to cracking, Low alloy steel and cast iron

1 Scope

This document specifies the selection, evaluation and use of carbon steel and low alloy steel materials for use in hydrogen sulfide (H₂S) environments in oil and gas production and natural gas processing plants.

Specification and usage requirements, as well as the usage requirements of cast iron.

This document applies to the selection, evaluation and use of crack-resistant materials for equipment designed and manufactured using load-controlled design methods.

Note: Cracking includes sulfide stress cracking (SSC), stress-induced hydrogen cracking (SOHIC), soft zone cracking (SZC), hydrogen induced cracking (HIC) and step cracking.

(SWC), excluding material loss due to uniform corrosion, localized corrosion or fatigue corrosion.

2 Normative references

The contents of the following documents constitute the essential clauses of this document through normative references in this text.

For referenced documents without a date, only the version corresponding to that date applies to this document; for referenced documents without a date, the latest version (including all amendments) applies to this document.

GB/T 230.1 Rockwell hardness test for metallic materials Part 1: Test method (GB/T 230.1-2018, ISO 6508-1.

2016,MOD)

GB/T 231.1 Metallic materials Brinell hardness test Part 1: Test method (GB/T 231.1-2018, ISO 6506-1.

2014,MOD)

GB/T 4157 Laboratory test method for resistance of metals to sulfide stress cracking and stress corrosion cracking in hydrogen sulfide environments GB/T 4340.1 Metallic materials Vickers hardness test Part 1: Test method (GB/T 4340.1-2024, ISO 6507-1:2023,MOD)