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**Petroleum and natural gas  
industries — Materials selection for  
high content CO<sub>2</sub> for casing, tubing  
and downhole equipment**

*Industries du pétrole et du gaz naturel — Choix des matériaux une  
teneur élevée en CO<sub>2</sub> pour tubes de cuvelage et de production et  
équipements de fond*



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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

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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](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*.

## Introduction

This International Standard gives recommendations and guidelines for materials selection in oil and gas production wells, specifically for high CO<sub>2</sub> content gas injection and production systems, as well as for water alternating gas (WAG) injection systems. It is intended to enable responsible parties to carry out materials selection in a consistent manner as a part of the engineering work, based upon a design basis for a particular installation. The main users of this International Standard are oil and gas production companies and engineering contractors. Material manufacturers and equipment suppliers can benefit from using this International Standard for their product development.

Carbon capture and storage (CCS) has been identified as an important technology for achieving a significant reduction in CO<sub>2</sub> emissions to the atmosphere.

Many of the technologies and practices that have been developed for CO<sub>2</sub> enhanced oil recovery (EOR) can have applicability in CCS projects, assuming that each project design meets its site-specific conditions. The CO<sub>2</sub> EOR experiences of the oil and gas industry represent the largest collective base of technical information available on CO<sub>2</sub> injection and, as such, provide valuable information for development and implementation of CCS field projects as they move forward.

This International Standard does not provide detailed material requirements and recommendations for manufacturing and testing of equipment. Such information can be found in particular product standards and in manufacturing and testing standards. Other International Standards related to material usage limitations are referred to, e.g. ISO 15156 (all parts) for H<sub>2</sub>S containing service.

In case of conflict between this International Standard and other international product standards, the requirements of the latter take precedence.



# Petroleum and natural gas industries — Materials selection for high content CO<sub>2</sub> for casing, tubing and downhole equipment

## 1 Scope

This International Standard provides guidelines and requirements for material selection of both seamless casing and tubing, and downhole equipment for CO<sub>2</sub> gas injection and gas production wells with high pressure and high CO<sub>2</sub> content environments [higher than 10 % (molar) of CO<sub>2</sub> and 1 MPa CO<sub>2</sub> partial pressure]. Oil production wells are not covered in this International Standard. This International Standard only considers materials compatibility with the environment.

Guidance is given for the following:

- corrosion evaluation;
- materials selection;
- corrosion control.

This International Standard is aimed at high CO<sub>2</sub> content wells, where the threat of low pH and CO<sub>2</sub> corrosion is greatest. However, many aspects are equally applicable to environments containing lower CO<sub>2</sub> concentrations.

Materials selection is influenced by many factors and synergies and should be performed by either materials or corrosion engineer.

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

ISO 13680, *Petroleum and natural gas industries — Corrosion-resistant alloy seamless tubes for use as casing, tubing and coupling stock — Technical delivery conditions*

ISO 15156 (all parts), *Petroleum and natural gas industries — Materials for use in H<sub>2</sub>S-containing environments in oil and gas production*

ISO 21457, *Petroleum, petrochemical and natural gas industries — Materials selection and corrosion control for oil and gas production systems*

ISO 23936-1, *Petroleum, petrochemical and natural gas industries — Non-metallic materials in contact with media related to oil and gas production — Part 1: Thermoplastics*

ISO 23936-2, *Petroleum, petrochemical and natural gas industries — Non-metallic materials in contact with media related to oil and gas production — Part 2: Elastomers*