



**International  
Standard**

**ISO 21055**

**Corrosion of metals and alloys —  
Test method for microbiologically  
influenced corrosion of oil and gas  
transmission pipelines**

*Corrosion des métaux et alliages — Méthode d'essai pour la  
corrosion microbienne des canalisations de transport de  
pétrole et de gaz*

**First edition  
2026-04**

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Published in Switzerland

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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 document 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)).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at [www.iso.org/patents](http://www.iso.org/patents). ISO shall not be held responsible for identifying any or all such patent rights.

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC156, *Corrosion of metals and alloys*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

## Introduction

Microbiologically influenced corrosion (MIC) refers to corrosion caused by the presence and activities of microorganisms (e.g. bacteria, archaea and fungi). Although microorganisms do not produce unique types of corrosion, they can accelerate corrosion reactions and increase the susceptibility of materials to corrosion processes such as pitting, embrittlement and under deposit corrosion (UDC). MIC has been identified as a contributor to rapid corrosion of metals and alloys exposed to seawater, crude oil, hydrocarbon fuels, soils and sewage. In recent years, the oil and gas industry, especially pipelines, are suffering from severe MIC threats. It is estimated that approximately 20 % of pipeline incidents are related to MIC.

This document establishes a microbiological corrosion test method applicable to oil and gas transmission pipelines to facilitate microbiological corrosion test evaluation by oil and gas industry users and product suppliers. In this document, the total immersion corrosion test is used to determine the corrosion rate (including uniform corrosion rate and pitting corrosion) of metals and alloys. In particular, the test conditions (e.g. strain source, test solution and corrosive gas), procedures and results are regulated in detail. This document focuses on the internal microbial corrosion environment of oil and gas transmission pipelines, but it also applies to environments involving microbial corrosion risks such as water injection and downhole in the oil and gas industry.

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# Corrosion of metals and alloys — Test method for microbiologically influenced corrosion of oil and gas transmission pipelines

## 1 Scope

This document specifies a laboratory test method for microbiologically influenced corrosion (MIC) of oil and gas transmission pipelines, including the principle, apparatus, sources of strains, solutions, specimens, sterilization, procedure, results and report.

This document applies to the MIC test of metals and alloys for internal surfaces of oil and gas transmission pipelines.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 8199, *Water quality — General requirements and guidance for microbiological examinations by culture*

ISO 8407, *Corrosion of metals and alloys — Removal of corrosion products from corrosion test specimens*

ISO 11463, *Corrosion of metals and alloys — Guidelines for the evaluation of pitting corrosion*

ISO 20391-1, *Biotechnology — Cell counting — Part 1: General guidance on cell counting methods*

## 3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

### 3.1 abiotic

test solution without living organisms, their biological components or the metabolic activities of living organisms

### 3.2 archaea

prokaryotic single celled organisms which lack cell nuclei and are morphologically similar to *bacteria* (3.3) but radically different in molecular organization, with eukaryote-like metabolic pathways and enzyme production

**EXAMPLE 1** Methanogens are a group of archaea which are involved in microbiologically influenced corrosion (MIC) by consuming hydrogen at the metal surface and, hereby, creating a depolarization process. Methanogens are common in oil production systems, but they are normally not measured with current culturing techniques.

**EXAMPLE 2** Sulfate-reducing archaea is a group of anaerobic archaea that reduce sulfate and result in sulphide formation. They are most likely to grow at reservoir conditions (60 °C to 95 °C).