



**International  
Standard**

**ISO 27913**

**Carbon dioxide capture,  
transportation and  
geological storage — Pipeline  
transportation systems**

*Captage, transport et stockage géologique du dioxyde de  
carbone — Systèmes de transport par conduites*

**Second edition  
2024-10**

**Corrected version  
2025-09**

iteh Standards  
(standards.iteh.ai)  
Document Preview

[ISO 27913:2024](https://standards.iteh.ai/catalog/standards/iso/c0c0877c-7b61-498f-9015-84ca4f19cf37/iso-27913-2024)

<https://standards.iteh.ai/catalog/standards/iso/c0c0877c-7b61-498f-9015-84ca4f19cf37/iso-27913-2024>

iTeh Standards  
(<https://standards.iteh.ai>)  
Document Preview

ISO 27913:2024

<https://standards.iteh.ai/catalog/standards/iso/c0c0877c-7b61-498f-9015-84ca4f19cf37/iso-27913-2024>



**COPYRIGHT PROTECTED DOCUMENT**

© ISO 2024

All rights reserved. Unless otherwise specified, or required in the context of its implementation, 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  
CP 401 • Ch. de Blandonnet 8  
CH-1214 Vernier, Geneva  
Phone: +41 22 749 01 11  
Email: [copyright@iso.org](mailto:copyright@iso.org)  
Website: [www.iso.org](http://www.iso.org)

Published in Switzerland

# Contents

	Page
<b>Foreword</b> .....	<b>vi</b>
<b>Introduction</b> .....	<b>vii</b>
<b>1 Scope</b> .....	<b>1</b>
<b>2 Normative references</b> .....	<b>1</b>
<b>3 Terms and definitions</b> .....	<b>1</b>
<b>4 Symbols and abbreviated terms</b> .....	<b>5</b>
4.1 Symbols.....	5
4.2 Abbreviated terms.....	5
<b>5 Properties of CO<sub>2</sub>, CO<sub>2</sub> streams and the mixing of CO<sub>2</sub> streams that influence pipeline transportation</b> .....	<b>6</b>
5.1 General.....	6
5.2 Pure CO <sub>2</sub> .....	6
5.2.1 Thermodynamics.....	6
5.2.2 Chemical reactions and corrosion.....	6
5.3 CO <sub>2</sub> streams.....	7
5.3.1 Thermodynamics.....	7
5.3.2 Chemical reactions.....	7
<b>6 Concept development and design criteria</b> .....	<b>7</b>
6.1 General.....	7
6.2 Safety philosophy.....	7
6.3 Reliability and availability of CO <sub>2</sub> stream pipeline systems.....	8
6.4 Short-term storage reserve.....	8
6.5 Access to the pipeline system.....	8
6.6 System design principles.....	9
6.6.1 General.....	9
6.6.2 CO <sub>2</sub> stream specification.....	9
6.6.3 Pressure control and protection system.....	10
6.7 General principles to avoid internal pipeline corrosion.....	10
6.7.1 Particular aspects related to CO <sub>2</sub> streams.....	10
6.7.2 Maximum water content.....	10
6.7.3 Avoidance of hydrate formation.....	10
6.7.4 Measurement of water content in the CO <sub>2</sub> stream.....	11
6.8 Flow assurance.....	11
6.8.1 General.....	11
6.8.2 Operation under single-phase flow conditions during normal operation.....	11
6.8.3 Pipeline operation under multi-phase flow conditions during transient operations.....	12
6.8.4 Planned and unscheduled pipeline pressure release.....	12
6.8.5 Reduced flow capacity.....	13
6.8.6 Available transport capacity.....	13
6.8.7 Flow coating.....	13
6.8.8 External thermal insulation.....	14
6.8.9 Leak detection.....	14
6.8.10 Fugitive emissions.....	14
6.8.11 Impurities.....	14
6.9 Pipeline layout.....	14
6.9.1 Vent stations.....	14
6.9.2 Block valve stations.....	15
6.9.3 Pumping and compressor stations.....	15
6.9.4 In-line inspection.....	15
6.9.5 Onshore vent facility design.....	15
6.9.6 Offshore vent facilities.....	16

<b>7</b>	<b>Materials and pipeline design</b>	<b>16</b>
7.1	General	16
7.2	Internal corrosion	16
7.3	Pipeline system materials	17
7.3.1	Steel selection	17
7.3.2	External coating	17
7.3.3	Non-metallic materials	17
7.3.4	Lubricants	17
<b>8</b>	<b>Wall thickness calculations</b>	<b>18</b>
8.1	Calculation principles	18
8.1.1	Design loads	18
8.1.2	Minimum wall thickness	18
8.1.3	Minimum wall thickness against internal pressure	18
8.1.4	Minimum wall thickness against dynamic pressure alterations	18
8.1.5	Minimum wall thickness, $t_{\min DF}$ , against running ductile fracture for gas phase pipelines	19
8.1.6	Minimum wall thickness, $t_{\min DF}$ , against running ductile fracture for dense phase pipelines	19
8.1.7	Fracture toughness	19
8.1.8	Overview of the different aspects of wall thickness determination	19
8.2	Additional measures	22
8.2.1	Dynamic loads due to operation (alternating operation pressure)	22
8.2.2	Topographical profile	22
8.2.3	Fracture arrestors	22
8.2.4	Offshore pipelines	22
<b>9</b>	<b>Construction</b>	<b>22</b>
9.1	General	22
9.2	Pipeline pre-commissioning	23
9.2.1	Overview	23
9.2.2	Pipeline dewatering and drying	23
9.2.3	Preservation before pipeline commissioning	23
<b>10</b>	<b>Operation</b>	<b>23</b>
10.1	General	23
10.2	Pipeline commissioning	23
10.2.1	Initial filling and pressurization with product	23
10.2.2	Initial or baseline inspection	24
10.3	Pipeline shutdown	24
10.4	Pipeline system depressurization	24
10.4.1	General	24
10.4.2	Pipeline depressurization	24
10.4.3	Vent facilities	25
10.5	Inspection, monitoring and testing	25
10.5.1	General	25
10.5.2	In-line inspection procedure	25
10.5.3	Monitoring of water content and dew point	26
10.5.4	Network code or equivalent set of operational terms and conditions	26
10.5.5	Measurement of CO <sub>2</sub> stream at each custody transfer point	26
10.5.6	Measurement of impurities	26
10.5.7	Action to be taken in the event of an exceedance of impurities	27
10.5.8	Measurement of CO <sub>2</sub> mass flow rate	27
<b>11</b>	<b>Re-qualification of existing pipelines for CO<sub>2</sub> service</b>	<b>27</b>
<b>Annex A (informative) Examples of CO<sub>2</sub> stream compositions</b>		<b>29</b>
<b>Annex B (informative) CO<sub>2</sub> characteristics</b>		<b>33</b>
<b>Annex C (informative) Internal corrosion and erosion</b>		<b>35</b>

# ISO 27913:2024(en)

<b>Annex D (informative) Avoidance of running ductile fracture: Approach for the evaluation of fracture arrest</b> .....	<b>37</b>
<b>Annex E (informative) Data requirements for an integrity management plan</b> .....	<b>39</b>
<b>Annex F (informative) Depressurization of a dense phase CO<sub>2</sub> stream avoiding low pipeline temperature issues</b> .....	<b>40</b>
<b>Bibliography</b> .....	<b>42</b>

## iTeh Standards (<https://standards.iteh.ai>) Document Preview

[ISO 27913:2024](https://standards.iteh.ai/catalog/standards/iso/c0c0877c-7b61-498f-9015-84ca4f19cf37/iso-27913-2024)

<https://standards.iteh.ai/catalog/standards/iso/c0c0877c-7b61-498f-9015-84ca4f19cf37/iso-27913-2024>

## 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.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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/TC 265, *Carbon dioxide capture, transportation, and geological storage*.

This second edition cancels and replaces the first edition (ISO 27913:2016), which has been technically revised.

The main changes are as follows:

- the entire text has been editorially revised;
- normative references have been updated;
- a subclause about CO<sub>2</sub> stream flowrate and impurity measurement has been added;
- the level of impurities has been limited to 5 % and a set of 17 requirements are defined to ensure CO<sub>2</sub> stream pipeline integrity;
- [Annex A](#) has been added to show example compositions of CO<sub>2</sub> streams for gaseous and dense phase CO<sub>2</sub> streams which fulfil the requirements of this document;
- the latest findings in fracture arrest design have been included in [Annex D](#);
- [Annex F](#) has been added to describe the decompression effects on pressure and temperature versus time.

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).

This corrected version of ISO 27913:2024 incorporates the following correction: " $t_{\min}$ " has been corrected to " $T_{\min}$ " in [8.1.7](#).

## Introduction

Carbon dioxide (CO<sub>2</sub>) capture, carbon dioxide use (CCU) and carbon dioxide storage (CCS) have been identified as key abatement technologies for achieving a significant reduction in CO<sub>2</sub> emissions to the atmosphere. Pipelines are likely to be the primary means of transporting CO<sub>2</sub> from the point-of-capture to storage sites (e.g. depleted hydrocarbon formations, deep saline aquifers), or to usage points (e.g. enhanced oil recovery or utilization) to avoid its release to the atmosphere. While there is a perception that transporting CO<sub>2</sub> via pipelines does not represent a significant barrier to implementing large-scale CCS, there is significantly less industry experience than there is for hydrocarbon service (e.g. natural gas). Furthermore, there are a number of issues that need to be adequately understood and associated risks that need to be effectively managed to ensure safe transport of CO<sub>2</sub>. In a CCS or CCU context, there is a need for larger CO<sub>2</sub> pipeline systems in more densely populated areas and with CO<sub>2</sub> coming from multiple sources. Also, offshore pipelines for the transportation of CO<sub>2</sub> to offshore storage sites are likely to become common.

The objective of this document is to provide specific requirements and recommendations on certain aspects of safe and reliable design, construction and operation of pipelines intended for the large-scale transportation of CO<sub>2</sub> that are not already covered in existing pipeline standards such as ISO 13623, ASME B31.4, ASME B31.8, EN 1594, AS 2885 or other standards listed in the Bibliography. Existing pipeline standards cover many of the issues related to the design and construction of CO<sub>2</sub> pipelines. However, there are some CO<sub>2</sub>-specific issues (e.g. fracture arrest, internal corrosion protection) that are not adequately covered in these standards but are addressed in this document. The purpose of this document is to cover these issues consistently. Hence, this document is not a standalone standard, but is written to be a supplement to other existing pipeline standards for natural gas or liquids for both onshore and offshore pipelines.

The system boundary (see [Figure 1](#)) between capture and transportation is the point at the inlet valve of the pipeline, where the composition, temperature and pressure of the CO<sub>2</sub> stream is within a certain specified range to meet the requirements for transportation as described in this document.

The boundary between transportation and storage or utilization is the point where the CO<sub>2</sub> stream leaves the transportation pipeline infrastructure and enters the downstream infrastructure, which can be permanent geological storage, utilization or buffer storage prior to shipping.

[ISO 27913:2024](#)

<https://standards.iteh.ai/catalog/standards/iso/c0c0877c-7b61-498f-9015-84ca4f19cf37/iso-27913-2024>