ISO 27913:2024-10 (E)

Carbon dioxide capture, transportation and geological storage - Pipeline transportation systems

Contents

Page

Foreword ..... **vi**

Introduction ..... **vii**

1 Scope **1**

2 Normative references **1**

3 Terms and definitions **1**

4 Symbols and abbreviated terms **5**
4.1 Symbols 5
4.2 Abbreviated terms 5

5 Properties of CO_2, CO_2 streams and the mixing of CO_2 streams that influence pipeline transportation **6**
5.1 General 6
5.2 Pure CO_2 6
5.2.1 Thermodynamics 6
5.2.2 Chemical reactions and corrosion 6
5.3 CO_2 streams 7
5.3.1 Thermodynamics 7
5.3.2 Chemical reactions 7

6 Concept development and design criteria **7**
6.1 General 7
6.2 Safety philosophy 7
6.3 Reliability and availability of CO_2 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_2 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_2 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_2 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
7 Materials and pipeline design 16
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
8 Wall thickness calculations 18
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_{minDF}, against running ductile fracture for gas phase pipelines 19
8.1.6 Minimum wall thickness, t_{minDF}, 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
9 Construction 22
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
10 Operation 23
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_2 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_2 mass flow rate 27
11 Re-qualification of existing pipelines for CO_2 service 27
Annex A (informative) **Examples of CO_2 stream compositions 29**
Annex B (informative) **CO_2 characteristics 33**
Annex C (informative) **Internal corrosion and erosion 35**

Annex D (informative) **Avoidance of running ductile fracture: Approach for the evaluation of fracture arrest** **37**

Annex E (informative) **Data requirements for an integrity management plan** **39**

Annex F (informative) **Depressurization of a dense phase CO_2 stream avoiding low pipeline temperature issues** **40**

Bibliography **42**