ISO 9809-2:2019 (E)

Gas cylinders — Design, construction and testing of refillable seamless steel gas cylinders and tubes — Part 2: Quenched and tempered steel cylinders and tubes with tensile strength greater than or equal to 1 100 MPa

Contents

Foreword

Introduction

- 1 Scope
- 2 Normative references
- 3 Terms and definitions
- 4 Symbols
- 5 Inspection and testing
- 6 Materials
 - 6.1 General requirements
 - 6.2 Controls on chemical composition
 - 6.3 Heat treatment
 - 6.4 Failure to meet test requirements
- 7 Design
 - 7.1 General requirements
 - 7.2 Limitation on tensile strength
 - 7.3 Design of cylindrical shell thickness
 - 7.4 Design of convex ends (heads and bases)
 - 7.5 Design of concave base ends
 - 7.6 Neck design
 - 7.7 Foot rings
 - 7.8 Neck rings
 - 7.9 Design drawing
- 8 Construction and workmanship
 - 8.1 General
 - 8.2 Wall thickness
 - 8.3 Surface imperfections
 - 8.4 Ultrasonic examination
 - 8.5 Out-of-roundness
 - 8.6 Mean diameter
 - 8.7 Straightness
 - 8.8 Verticality and stability
 - 8.9 Neck threads

9

Type approval procedure

- 9.1 General requirements
- 9.2 Prototype tests
- 9.2.1 General requirements
- 9.2.2 Verification of hardness/tensile correlation
- 9.2.3 Pressure cycling test
- 9.2.4 Flawed cylinder burst test
- 9.2.4.1 General
- 9.2.4.2 Details of flaw
- 9.2.4.3 Test procedure

- 9.2.4.4 Acceptance criteria for the flawed cylinder burst test
- Flawed cylinder cycle test 9.2.5
- Test conditions 9.2.5.1
- 9.2.5.2 Details of flaw
- 9.2.5.3 Acceptance criteria for the flawed cylinder cycle test
- 9.2.6 **Base check**
- 9.2.7 Bend test and flattening test
- Bend test 9.2.7.1
- Flattening test 9.2.7.2 9.2.7.3
- Ring flattening test
- 9.2.8 Torque test for taper thread only
- 9.2.8.1 Procedure
- 9.2.8.2 Acceptance criteria
- Shear stress calculation for parallel threads 9.2.9
- 9.2.9.1 Procedure
- 9.2.9.2 Acceptance criteria
- 9.3 Type approval certificate

10 **Batch tests**

- **General requirements** 10.1
- 10.2 **Tensile test**
- 10.3 Impact test
- 10.4 Hydraulic bursting test
- Test installation 10.4.1
- 10.4.2 Test conditions
- Interpretation of test results 10.4.3

11 Tests/examinations on every cylinder

- 11.1 General
- 11.2 Hydraulic test
- 11.2.1 Proof pressure test
- Volumetric expansion test 11.2.2
- 11.3 Hardness test
- 11.4 Leak test
- 11.5 **Capacity check**
- 12 Certification
- 13 Marking
- Annex A (normative) Description and evaluation of manufacturing imperfections in seamless gas cylinders
 - Overview A.1
 - A.2 General
 - A.3 Manufacturing imperfections and the procedure for their evaluation
 - A.4 Acceptance and rejection conditions
- (normative) Ultrasonic examination Annex B
 - **B.1** General
 - **General requirements B.2**
 - **B.3** Flaw detection of the cylindrical parts
 - B.3.1 Procedure
 - **Reference standard** B.3.2
 - B.3.3 Calibration of equipment
 - **B.4** Wall thickness measurement
 - Interpretation of results **B.5**
 - Certification **R** 6
- Annex C (informative) Example of type approval certificate
- Annex D (informative) Example of acceptance certificate
- Annex E (informative) Bend stress calculation
- Annex F (informative) An example of shear strength calculation for parallel threads