DIN EN ISO 9809-1:2020-02 (E)

Gas cylinders - Design, construction and testing of refillable seamless steel gas cylinders and tubes - Part 1: Quenched and tempered steel cylinders and tube s with tensile strength less than 1100 MPa (ISO 9809-1:2019)

Contents

Page

European foreword ... **4**

Foreword ... **5**

Introduction ... **6**

1 Scope ... **7**

2 Normative references ... **7**

3 Terms and definitions ... **7**

4 Symbols ... **9**

5 Inspection and testing ... **10**

6 Materials ... **10**
6.1 General requirements ... 10
6.2 Controls on chemical composition ... 10
6.3 Typical steels ... 12
6.4 Heat treatment ... 12
6.5 Failure to meet test requirements ... 12

7 Design ... **13**
7.1 General requirements ... 13
7.2 Limitation on tensile strength ... 13
7.3 Design of cylindrical shell thickness ... 13
7.4 Design of convex ends (heads and bases) ... 14
7.5 Design of concave base ends ... 16
7.6 Neck design ... 16
7.7 Foot rings ... 17
7.8 Neck rings ... 17
7.9 Design drawing ... 17

8 Construction and workmanship ... **17**
8.1 General ... 17
8.2 Wall thickness ... 17
8.3 Surface imperfections ... 17
8.4 Ultrasonic examination ... 17
8.5 Out-of-roundness ... 18
8.6 Mean diameter ... 18
8.7 Straightness ... 18
8.8 Verticality and stability ... 18
8.9 Neck threads ... 18

9 Type approval procedure ... **19**
9.1 General requirements ... 19
9.2 Prototype tests ... 20
9.2.1 General requirements ... 20
9.2.2 Pressure cycling test ... 21
9.2.3 Base check ... 21
9.2.4 Bend test and flattening test ... 21
9.2.5 Torque test for taper thread only ... 23
9.2.6 Shear stress calculation for parallel threads ... 23
9.3 Type approval certificate ... 23

Batch tests **23**
10.1 General requirements 23
10.2 Tensile test 25
10.3 Impact test 26
10.4 Hydraulic burst test 28
10.4.1 Test installation 28
10.4.2 Test conditions 29
10.4.3 Interpretation of test results 30
10.4.4 Acceptance criteria 30
11 Tests/examinations on every cylinder **31**
11.1 General 31
11.2 Hydraulic test 31
11.2.1 Proof pressure test 31
11.2.2 Volumetric expansion test 31
11.3 Hardness test 31
11.4 Leak test 32
11.5 Capacity check 32
12 Certification **32**
13 Marking **32**
Annex A (normative) **Description and evaluation of manufacturing imperfections in seamless gas cylinders** **33**
Annex B (normative) **Ultrasonic examination** **48**
Annex C (informative) **Example of type approval certificate** **54**
Annex D (informative) **Example of acceptance certificate** **55**
Annex E (informative) **Bend stress calculation** **58**
Annex F (informative) **Chemical compositions of internationally-recognized steel** **59**
Annex G (informative) **An example of shear strength calculation for parallel threads** **60**
Bibliography **62**