

# 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 tubes with tensile strength less than 1100 MPa (ISO 9809-1:2019)

---

<b>Contents</b>		<b>Page</b>
European foreword .....		4
Foreword .....		5
Introduction .....		6
<b>1</b>	<b>Scope</b> .....	<b>7</b>
<b>2</b>	<b>Normative references</b> .....	<b>7</b>
<b>3</b>	<b>Terms and definitions</b> .....	<b>7</b>
<b>4</b>	<b>Symbols</b> .....	<b>9</b>
<b>5</b>	<b>Inspection and testing</b> .....	<b>10</b>
<b>6</b>	<b>Materials</b> .....	<b>10</b>
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
<b>7</b>	<b>Design</b> .....	<b>13</b>
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
<b>8</b>	<b>Construction and workmanship</b> .....	<b>17</b>
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
<b>9</b>	<b>Type approval procedure</b> .....	<b>19</b>
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

<b>Batch tests</b> .....	<b>23</b>
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
<b>11 Tests/examinations on every cylinder</b> .....	<b>31</b>
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
<b>12 Certification</b> .....	<b>32</b>
<b>13 Marking</b> .....	<b>32</b>
<b>Annex A (normative) Description and evaluation of manufacturing imperfections in seamless gas cylinders</b> .....	<b>33</b>
<b>Annex B (normative) Ultrasonic examination</b> .....	<b>48</b>
<b>Annex C (informative) Example of type approval certificate</b> .....	<b>54</b>
<b>Annex D (informative) Example of acceptance certificate</b> .....	<b>55</b>
<b>Annex E (informative) Bend stress calculation</b> .....	<b>58</b>
<b>Annex F (informative) Chemical compositions of internationally-recognized steel</b> .....	<b>59</b>
<b>Annex G (informative) An example of shear strength calculation for parallel threads</b> .....	<b>60</b>
<b>Bibliography</b> .....	<b>62</b>