

# DIN EN ISO 9809-4:2023-03 (E)

## Gas cylinders - Design, construction and testing of refillable seamless steel gas cylinders and tubes - Part 4: Stainless steel cylinders with an $R_m$ value of less than 1100 MPa (ISO 9809-4:2021)

---

<b>Contents</b>		<b>Page</b>
	<b>European foreword</b> .....	<b>4</b>
	<b>Foreword</b> .....	<b>5</b>
	<b>Introduction</b> .....	<b>6</b>
<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 .....	11
	6.3 Heat treatment .....	11
	6.4 Cold working or cryoforming .....	11
	6.5 Failure to meet test requirements .....	12
<b>7</b>	<b>Design</b> .....	<b>12</b>
	7.1 General requirements .....	12
	7.2 Design of cylindrical shell thickness .....	12
	7.3 Design of convex ends (heads and bases) .....	13
	7.4 Design of the concave base ends .....	14
	7.5 Neck design .....	15
	7.6 Foot rings .....	15
	7.7 Neck rings .....	15
	7.8 Design drawing .....	16
<b>8</b>	<b>Construction and workmanship</b> .....	<b>16</b>
	8.1 General .....	16
	8.2 Wall thickness .....	16
	8.3 Surface imperfections .....	16
	8.4 Ultrasonic examination .....	16
	8.5 Out-of-roundness .....	17
	8.6 Mean diameter .....	17
	8.7 Straightness .....	17
	8.8 Verticality and stability .....	17
	8.9 Neck threads .....	18
<b>9</b>	<b>Type approval procedure</b> .....	<b>18</b>
	9.1 General requirements .....	18
	9.2 Prototype test .....	19
	9.2.1 General requirements .....	19
	9.2.2 Pressure cycling test .....	20
	9.2.3 Base check .....	20
	9.2.4 Torque test for taper thread only .....	21
	9.2.5 Shear stress calculation for parallel threads .....	21
	9.3 Type approval certificate .....	21
	9.4 Specific type approval/production tests for cylinders ordered in small quantities .....	22
<b>10</b>	<b>Batch tests</b> .....	<b>22</b>
	10.1 General requirements .....	22

10.2	Tensile test .....	24
10.3	Bend test and flattening test.....	25
	10.3.1 Bend test.....	25
	10.3.2 Flattening test.....	26
	10.3.3 Ring flattening test.....	26
10.4	Impact test.....	26
10.5	Hydraulic burst test.....	28
	10.5.1 Test installation.....	28
	10.5.2 Test conditions.....	29
	10.5.3 Interpretation of test results.....	30
10.6	Intergranular corrosion test.....	31
<b>11</b>	<b>Tests/examinations on every cylinder.....</b>	<b>31</b>
11.1	General.....	31
11.2	Hydraulic test.....	32
	11.2.1 Proof pressure test.....	32
	11.2.2 Volumetric expansion test.....	32
11.3	Hardness test.....	32
11.4	Leak test.....	32
11.5	Capacity check.....	33
<b>12</b>	<b>Certification.....</b>	<b>33</b>
<b>13</b>	<b>Marking.....</b>	<b>33</b>
<b>Annex A</b>	<b>(normative) Description and evaluation of manufacturing imperfections and conditions for rejection of seamless steel gas cylinders at the time of final inspection by the manufacturer.....</b>	<b>34</b>
<b>Annex B</b>	<b>(normative) Ultrasonic examination.....</b>	<b>49</b>
<b>Annex C</b>	<b>(informative) Example of type approval certificate.....</b>	<b>55</b>
<b>Annex D</b>	<b>(informative) Example of acceptance certificate.....</b>	<b>56</b>
<b>Annex E</b>	<b>(informative) Example of shear strength calculation for parallel threads.....</b>	<b>58</b>
<b>Bibliography</b>	<b>.....</b>	<b>60</b>