

# DIN EN 12245:2022-08 (E)

## Transportable gas cylinders - Fully wrapped composite cylinders

---

<b>Contents</b>	<b>Page</b>
European foreword .....	5
Introduction .....	6
1 Scope.....	7
2 Normative references.....	7
3 Terms, definitions and symbols .....	9
3.1 Terms and definitions.....	9
3.2 Symbols .....	11
4 Design and manufacture .....	12
4.1 General.....	12
4.2 Liner.....	12
4.2.1 Metallic liners.....	12
4.2.2 Non-metallic liners.....	12
4.2.3 Design drawing.....	13
4.2.4 Design of ends .....	14
4.2.5 Neck ring .....	14
4.3 Composite overwrap.....	14
4.3.1 Materials .....	14
4.3.2 Winding .....	14
4.4 Finished cylinder .....	15
4.4.1 Design drawings.....	15
4.4.2 Cylinders without liner.....	15
4.4.3 Autofrettage.....	15
4.4.4 Manufacturing requirements for the finished cylinder .....	16
5 Cylinder and material tests .....	16
5.1 General.....	16
5.2 Requirements and test methods .....	16
5.2.1 Test 1 - Composite material tests, including adhesives (where applicable) .....	16
5.2.2 Test 2 - Liner material tests.....	17
5.2.3 Test 3 - Liner test (for metallic liners only).....	18
5.2.4 Test 4 - Pressure test of finished cylinders at ambient temperature.....	20
5.2.5 Test 5 - Cylinder burst test.....	20
5.2.6 Test 6 - Resistance to pressure cycles at test pressure ( $p_h$ ) and ambient temperature.....	21
5.2.7 Test 7 - Immersion in salt water .....	23
5.2.8 Test 8 - Exposure to elevated temperature at test pressure.....	24
5.2.9 Test 9 - Drop/Impact test .....	24
5.2.10 Test 10 - Flawed cylinder test.....	27
5.2.11 Test 11 - Extreme temperature cycle test .....	29
5.2.12 Test 12 - Fire resistance test .....	30
5.2.13 Test 13 - Permeability test of cylinders with non-metallic or without liners .....	32
5.2.14 Test 14 - Liner collapse and blistering test (only for cylinders with non-metallic liners for compressed gases).....	33
5.2.15 Test 15 - Test of compatibility of thermoplastic liners and matrix for type 5 cylinders with air or oxidising gases.....	33

5.2.16	Test 16 – Torque test (for taper threads only)	34
5.2.17	Test 17 – Neck strength	34
5.2.18	Test 18 – Cylinder stability	35
5.2.19	Test 19 – Neck ring	35
5.2.20	Test 20 – Shear stress calculation for parallel threads for steel liners and steel bosses	35
5.3	Failure to meet test requirements	35
5.3.1	Metallic liners	35
5.3.2	Finished cylinder	35
6	Conformity evaluation	36
7	Marking	36
8	Operating instructions for cylinders with non-metallic liners	37
Annex A	(normative) Prototype, design variant and production testing	38
A.1	General	38
A.2	Prototype testing	38
A.2.1	General	38
A.2.2	Definition of new design	38
A.2.3	Prototype testing requirements	39
A.2.4	Prototype testing certificate	39
A.3	Design variant testing	43
A.3.1	General	43
A.3.2	Definition of a design variant	43
A.3.2.1	Conditions to be satisfied	43
A.3.2.2	Equivalent fibre	44
A.3.2.3	Equivalent matrix	44
A.3.2.4	Equivalent liner	44
A.3.2.5	Cylinder variant	45
A.3.3	Design variant test requirements	46
A.3.4	Design variant testing certificate	46
A.4	Production testing	49
A.4.1	General	49
A.4.2	Production test requirements	49
A.4.3	Liner batch tests and inspections	49
A.4.3.1	Metallic liner	49
A.4.3.2	Non-metallic liner	50
A.4.4	Composite materials batch tests and inspections	50
A.4.5	Tests and inspections of the finished cylinder	50
A.4.5.1	Tests	50
A.4.5.2	Inspections	51
A.4.6	Batch acceptance certificate	51
Annex B	(informative) Examples of prototype approval and production testing certificates	52

<b>B.1</b>	<b>Type approval certificate – composite cylinders with metallic liners .....</b>	<b>52</b>
<b>B.2</b>	<b>Type approval certificate – composite cylinders with non-metallic liners .....</b>	<b>53</b>
<b>B.3</b>	<b>Type approval certificate – composite cylinders without liners.....</b>	<b>54</b>
<b>B.4</b>	<b>Design variant approval certificate – composite cylinders with metallic liners .....</b>	<b>55</b>
<b>B.5</b>	<b>Production test certificate .....</b>	<b>56</b>
<b>Annex C (informative)</b>	<b>Example of high velocity impact (bullet) test.....</b>	<b>58</b>
<b>C.1</b>	<b>Procedure .....</b>	<b>58</b>
<b>C.2</b>	<b>Criteria.....</b>	<b>58</b>
<b>C.3</b>	<b>Parameters to monitor and record .....</b>	<b>58</b>
<b>Annex D (informative)</b>	<b>Standardized test requirements for thermally activated pressure relief devices.....</b>	<b>59</b>
<b>D.1</b>	<b>General.....</b>	<b>59</b>
<b>D.2</b>	<b>Cylinder test.....</b>	<b>59</b>
<b>D.2.1</b>	<b>Cylinder set up .....</b>	<b>59</b>
<b>D.2.2</b>	<b>Fire source.....</b>	<b>59</b>
<b>D.2.3</b>	<b>Temperature and pressure measurements .....</b>	<b>59</b>
<b>D.2.4</b>	<b>General test requirements .....</b>	<b>60</b>
<b>D.2.5</b>	<b>Tests options .....</b>	<b>60</b>
<b>D.2.5.1</b>	<b>Option A – Controlled release of pressure .....</b>	<b>60</b>
<b>D.2.5.2</b>	<b>Option B – Fire until rupture .....</b>	<b>60</b>
<b>D.3</b>	<b>PRD test .....</b>	<b>60</b>
<b>D.4</b>	<b>Vent test.....</b>	<b>60</b>
<b>D.5</b>	<b>System assessment.....</b>	<b>61</b>
<b>D.5.1</b>	<b>Qualification limit envelope.....</b>	<b>61</b>
<b>D.5.2</b>	<b>Service limit envelope.....</b>	<b>61</b>
<b>D.5.3</b>	<b>Acceptable results .....</b>	<b>61</b>
<b>Bibliography</b>	<b>.....</b>	<b>64</b>