

ISO/TS 17519:2019 (E)

Gas cylinders — Refillable permanently mounted composite tubes for transportation

Contents

	Foreword
	Introduction
1	Scope
2	Normative references
3	Terms and definitions
4	Basis for the design requirements
4.1	General
4.2	Design life
4.3	Design number of filling cycles
4.4	Temperature range
4.4.1	Gas temperature
4.4.2	Tube material temperature
4.5	Gas compatibility
4.6	Prohibited gases
4.7	External environment
5	Conformity
5.1	General
5.2	Design documentation
5.2.1	General
5.2.2	Tube design verification
5.2.3	Statement of design intent
5.2.3.1	Statement of service
5.2.3.2	Tube drawings
5.2.3.3	Frame drawings
5.2.3.4	Stress analysis report
5.2.3.5	Material property data
5.2.4	Fire protection
5.2.5	Tube specification sheet
5.3	Type approval
5.4	Assembly documentation
6	Tube requirements
6.1	Failure modes
6.2	Materials
6.2.1	Liner materials
6.2.1.1	Metal liners
6.2.1.2	Polymer liners
6.2.2	Composite materials
6.2.2.1	Resins
6.2.2.2	Fibres
6.2.3	Metal end bosses
6.3	Design requirements
6.3.1	Test pressure
6.3.2	Burst pressure and fibre stress ratios
6.3.3	Stress analysis
6.3.4	Openings
6.3.5	Fire protection

- 6.3.6 Flammable gas permeation
 - 6.4 Construction and workmanship
 - 6.4.1 General
 - 6.4.2 Liner and boss requirements
 - 6.4.3 Fibre winding
 - 6.4.4 Curing of resins
 - 6.4.5 Neck threads
 - 6.4.6 Autofrettage
 - 6.4.7 Exterior environmental protection
 - 6.5 Type approval procedure
 - 6.5.1 General
 - 6.5.2 Prototype tests
 - 6.5.2.1 General
 - 6.5.2.1.1 Tests required
 - 6.5.2.1.2 Full diameter sub-scale tubes
 - 6.5.2.1.3 General sub-scale tubes
 - 6.5.2.2 Material test for liners
 - 6.5.2.2.1 Polymer liners
 - 6.5.2.2.2 Metal liners and bosses
 - 6.5.2.2.3 Resin material
 - 6.5.2.3 Burst test
 - 6.5.2.4 Ambient temperature cycle test
 - 6.5.2.5 Leak-before-break (LBB) test
 - 6.5.2.6 Bonfire test
 - 6.5.2.7 Environmental test
 - 6.5.2.8 Flaw tolerance test
 - 6.5.2.9 High temperature creep test
 - 6.5.2.10 Accelerated stress rupture test
 - 6.5.2.11 Extreme temperature pressure cycling test
 - 6.5.2.12 External loads test
 - 6.5.2.13 Impact test
 - 6.5.2.14 Boss torque test
 - 6.5.2.15 Permeation test
 - 6.5.2.16 Gas cycling and blow down test
 - 6.5.2.17 High velocity impact (gunfire) test
 - 6.5.3 Change of design
 - 6.6 Batch tests
 - 6.6.1 General requirements
 - 6.6.2 Required inspection and tests
 - 6.6.2.1 Burst test
 - 6.6.2.2 Ambient pressure cycle test
 - 6.6.2.3 General tests
 - 6.7 Production tests and examinations
 - 6.8 Batch acceptance certificate
 - 6.9 Failure to meet test requirements
- 7 Marking
- 7.1 General
 - 7.2 Additional marking
 - 7.2.1 General
 - 7.2.2 Positioning of additional markings
 - 7.2.3 Letter size
- 8 Preparation for dispatch
- 9 Requirements for frames, mounting and fitting
- 9.1 General
 - 9.2 Frame materials
 - 9.3 Interchangeable frames for intermodal service
 - 9.4 Mounting frames for compressed gas service (non-intermodal)
 - 9.5 Mounting frame testing
 - 9.6 Mounting frames static loads
 - 9.7 Piping, valves, fittings and manifold components
 - 9.8 Change of design

Annex A (normative) Test methods and criteria

- A.1 Leak-before-break (LBB) test
- A.2 Extreme temperature pressure cycling test
- A.3 Coating tests
- A.4 Leak test
- A.5 Hydraulic pressure test
 - A.5.1 General
 - A.5.2 Test A — Volumetric expansion test
 - A.5.3 Test B — Proof pressure test
- A.6 Burst test
- A.7 Ambient temperature cycle test
- A.8 Environmental test
 - A.8.1 General
 - A.8.2 Pendulum impact preconditioning
 - A.8.3 Environmental fluids exposure
 - A.8.4 Pressure cycle and pressure hold test
 - A.8.5 Acceptable results
- A.9 Bonfire test
 - A.9.1 General
 - A.9.2 Frame set-up
 - A.9.3 Fire source
 - A.9.4 Temperature and pressure measurement
 - A.9.5 General test requirements
 - A.9.6 Acceptable results
- A.10 Composite flaw tolerance tests
- A.11 High temperature creep test
- A.12 Accelerated stress rupture test — Glass or aramid fibre tubes only
- A.13 Permeation test
- A.14 Tensile properties of polymers
- A.15 Softening temperature of polymers
- A.16 Coating batch tests
 - A.16.1 Coating thickness
 - A.16.2 Coating adhesion
- A.17 Boss torque test
- A.18 Resin shear strength
- A.19 Gas cycling and blow down test — Type 4 tubes only
- A.20 Sulfide stress cracking test for steel
- A.21 Hydrogen embrittlement test
- A.22 Blunt impact test
- A.23 High velocity impact (gunfire) test

Annex B (informative) Report forms

- B.1 General
- B.2 Documentation file
 - B.2.1 General
 - B.2.2 Example format for approval certificate
 - B.2.3 Report of manufacture and certification of conformance

Annex C (informative) Verification of stress ratios using strain gauges

Annex D (informative) Manufacturer's instructions for handling, use and inspection of tubes

- D.1 General
- D.2 Distribution
- D.3 Reference to existing codes, standards and regulations
- D.4 Tube handling
- D.5 Installation
- D.6 Use of tubes
- D.7 In-service inspection

Annex E (informative) Factor of safety (FS) for carbon fibre reinforced pressure tubes

- E.1 Background
- E.2 Recommended safety factor
- E.3 Discussion

- E.4 Conclusions
- E.5 Recommendations

Annex F (informative) Background regarding safety when transporting gas at high pressure in large tubes made of composite material

- F.1 Volume, pressure, and energy
- F.2 HAZID/Risk assessment
- F.3 Filling and discharge
- F.4 Inspection
- F.5 Operator's manual

Page count: 51