

DIN EN 14140:2017-01 (E)

LPG equipment and accessories - Transportable refillable welded steel cylinders for LPG - Alternative design and construction (includes Corrigendum :2015)

Contents		Page
European foreword		4
Introduction		5
1	Scope	6
2	Normative references	6
3	Terms, definitions and symbols	7
3.1	Terms and definitions	7
3.2	Symbols	9
4	Materials	9
5	Design	10
5.1	General requirements	10
5.2	Calculation of cylindrical shell wall thickness	11
5.3	Design of torispherical and semi-ellipsoidal ends concave to pressure	11
5.4	Ends of other shapes	15
5.5	Minimum wall thickness	15
5.6	Design of openings	15
5.7	Valve protection	16
5.8	Non-pressure containing attachments welded to the cylinder	16
5.9	Resistance against external corrosion	16
5.10	Over-moulded cylinders	16
5.11	Hot air balloon cylinders	17
6	Construction and workmanship	17
6.1	General	17
6.2	Environment	17
6.3	Welding qualification	17
6.4	Plates and pressed parts	18
6.5	Welded joints	18
6.6	Tolerances	19
6.6.1	Out-of-roundness	19
6.6.2	Straightness	19
6.6.3	Verticality	19
6.7	Closure of openings	20
6.8	Heat treatment	20
7	Tests and examinations	20
7.1	General	20
7.2	Types of test and evaluation of test results	21
7.3	Test specimens and related tests and examinations	22
7.3.1	All cylinders	22
7.3.2	Two-piece cylinders	22
7.3.3	Three-piece cylinders	23
7.3.4	Bung welds	24
7.3.5	Tensile test	24
7.3.6	Bend test	25
7.3.7	Resistance to external corrosion	28

7.4	NDT	31
7.4.1	Radiographic examination	31
7.4.2	Macro examination	33
7.4.3	Visual examination of the surface of the weld	33
7.5	Prototype and production batch testing	33
7.5.1	Burst test under pressure	33
7.5.2	Fatigue test	34
7.5.3	Cylinder body integrity impact tests (not required for hot air balloon cylinders)	35
7.5.4	Drop tests (all cylinders except hot air balloon cylinders)	39
7.5.5	Drop tests (hot air balloon cylinders only)	40
8	Technical requirements for type approval	41
8.1	General	41
8.2	Extent of testing	41
8.3	Design type variations	42
8.3.1	General	42
8.3.2	Two piece cylinders	42
8.3.3	Three piece cylinders	42
9	Initial inspection and tests	43
9.1	Tests and examinations applicable to all cylinders	43
9.2	Radiographic examination	43
9.3	Macro examination	44
9.4	Examination of bung welding	44
9.5	Examination of welding of non-pressure containing attachments	44
9.5.1	Macro examinations	44
9.5.2	Weld penetration requirement	44
9.6	Unacceptable imperfections in radiographic or macro examination	44
9.7	Production pressure test	44
9.7.1	Procedure	44
9.7.2	Requirements	45
9.8	Production batch testing (Mechanical / Burst tests)	45
9.8.1	Production batch	45
9.8.2	Inspection lots	45
9.8.3	Rate of sampling	45
9.8.4	Verification of conformance with type approval	47
9.9	Failure to meet mechanical and burst test requirements	48
9.9.1	General	48
9.9.2	Mechanical	48
9.9.3	Burst	48
9.9.4	Production batch retest	48
9.9.5	Resubmission of production batch	48
9.9.6	Additional checks	49
9.10	Production adhesion test for over-moulded cylinders	49
9.11	Production water absorption test for over-moulded cylinders	49
10	Marking	50
11	Documentation	51
12	Certification	51
Annex A (normative) Additional manufacturers markings		52
Annex B (informative) Over-moulded cylinder		53
Annex C (informative) Hot Air Balloon Cylinders		55
C.1	Description	55
Annex D (informative) Environmental checklist		57
Bibliography		59