# DIN EN 14140:2017-01 (E)

## LPG equipment and accessories - Transportable refillable welded steel c ylinders 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