

# DIN EN 1442:2017-08 (E)

## LPG equipment and accessories - Transportable refillable welded steel cylinders for LPG - Design and construction

---

<b>Contents</b>		<b>Page</b>
European foreword .....		5
Introduction .....		6
1	Scope .....	7
2	Normative references .....	7
3	Terms, definitions and symbols .....	8
3.1	Terms and definitions .....	8
3.2	Symbols .....	9
4	Materials .....	10
5	Design .....	11
5.1	General requirements .....	11
5.2	Calculation of cylindrical shell thickness .....	12
5.3	Design of torispherical and semi-ellipsoidal ends concave to pressure .....	12
5.4	Design of ends of shapes other than torispherical and semi-ellipsoidal .....	16
5.5	Minimum wall thickness .....	16
5.6	Design of openings .....	17
5.7	Valve protection .....	17
5.8	Non-pressure containing attachments .....	17
5.9	Over-moulded cylinders .....	17
6	Construction and workmanship .....	17
6.1	General .....	17
6.2	Welding qualification .....	18
6.3	Plates and formed parts .....	18
6.4	Welded joints .....	18
6.5	Tolerances .....	20
6.5.1	Out-of-roundness .....	20
6.5.2	Straightness .....	20
6.5.3	Verticality .....	20
6.6	Closure of openings .....	20
6.7	Heat treatment .....	20
7	Tests and examinations .....	21
7.1	General .....	21
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	Valve boss welds .....	25
7.4	Tensile test .....	25
7.4.1	Parent metal .....	25
7.4.2	Welds .....	25
7.5	Bend test .....	25
7.5.1	Procedure .....	25
7.5.2	Requirements .....	26

7.6	Burst test under hydraulic pressure .....	28
7.6.1	Procedure .....	28
7.6.2	Requirements .....	28
7.7	Pressure test .....	29
7.7.1	Procedure .....	29
7.7.2	Requirements .....	29
7.8	Radiographic examination .....	30
7.8.1	Procedure .....	30
7.8.2	Assessment .....	31
7.8.3	Requirements .....	31
7.9	Macro examination .....	31
7.9.1	Procedure .....	31
7.9.2	Requirement .....	31
7.10	Visual examination of the surface of the weld .....	32
7.10.1	Procedure .....	32
7.10.2	Requirements .....	32
7.11	Fatigue test .....	32
7.11.1	Procedure .....	32
7.11.2	Requirements .....	32
8	Technical requirements for type approval .....	32
8.1	General .....	32
8.2	Extent of testing .....	33
8.3	Cylinder types .....	33
8.4	Type approval certificate .....	34
9	Initial inspection and tests .....	34
9.1	Tests and examinations applicable to all cylinders .....	34
9.2	Radiographic examination .....	34
9.3	Macro examination .....	35
9.4	Examination of valve boss weld .....	35
9.5	Examination of non-pressure containing attachment welds .....	35
9.6	Unacceptable imperfections found by the radiographic or macro examinations .....	35
9.7	Production batch testing (mechanical / burst tests) .....	35
9.7.1	Production batch .....	35
9.7.2	Inspection lots .....	36
9.7.3	Rate of sampling .....	36
9.7.4	Verification of conformance with type approval .....	37
9.8	Failure to meet mechanical and burst test requirements .....	37
9.8.1	Mechanical .....	37
9.8.2	Burst .....	38
9.8.3	Production batch retest .....	38
9.8.4	Resubmission of a production batch .....	38
9.8.5	Weld repairs .....	38
10	Marking .....	39
11	Documentation .....	39
12	Certificate .....	39
Annex A (normative) Standard specific marking .....		40
Annex B (normative) Over-moulded cylinders .....		41
B.1	Over-moulded cylinder case design .....	41
B.2	Tests and examinations .....	41
B.2.1	General .....	41
B.2.2	Types of additional test and evaluation of results .....	42
B.2.3	Coated cylinder - resistance to external corrosion .....	42
B.2.3.1	Procedure .....	42
B.2.3.2	Requirements .....	42

<b>B.2.4</b>	<b>Over-moulding adhesion test procedure .....</b>	<b>44</b>
<b>B.2.4.1</b>	<b>General .....</b>	<b>44</b>
<b>B.2.4.2</b>	<b>Preparation .....</b>	<b>44</b>
<b>B.2.4.3</b>	<b>Breaking strength .....</b>	<b>44</b>
<b>B.2.4.4</b>	<b>Results .....</b>	<b>44</b>
<b>B.2.4.5</b>	<b>Test report .....</b>	<b>44</b>
<b>B.2.4.6</b>	<b>Requirements .....</b>	<b>45</b>
<b>B.2.5</b>	<b>Over-moulding material requirements .....</b>	<b>45</b>
<b>B.2.6</b>	<b>Additional technical requirements for type approval .....</b>	<b>46</b>
<b>B.2.7</b>	<b>Additional initial inspection and tests .....</b>	<b>46</b>
<b>B.2.7.1</b>	<b>Production adhesion test for over-moulded cylinders .....</b>	<b>46</b>
<b>B.2.7.2</b>	<b>Production water absorption test .....</b>	<b>47</b>
<b>B.3</b>	<b>Over-moulded cylinder identification system .....</b>	<b>47</b>
<b>B.3.1</b>	<b>Requirements .....</b>	<b>47</b>
<b>B.4</b>	<b>Certification .....</b>	<b>48</b>
<b>Annex C (informative) Example of over-moulded cylinder .....</b>		<b>49</b>
<b>Bibliography .....</b>		<b>50</b>