

DIN EN 13445-6:2017-12 (E)

Unfired pressure vessels - Part 6: Requirements for the design and fabrication of pressure vessels and pressure parts constructed from spheroidal graphite cast iron

Contents	Page
Foreword	5
1 Scope	7
2 Normative references	7
3 Terms, definitions, units and symbols	8
3.1 Terms and definitions	8
3.2 Units	9
3.3 Symbols	9
3.4 Inter-relation of thicknesses definitions	11
4 Service conditions	11
4.1 Cyclic loading	11
4.2 Limitations on temperature and energy content	12
5 Requirements	12
5.1 Materials	12
5.2 Design	14
5.2.1 Technical documentation	14
5.2.2 Design methods	14
5.3 Founding	20
5.3.1 General	20
5.3.2 Welding	20
6 Material testing	20
6.1 General	20
6.2 Frequency and number of tests	20
6.3 Chemical analysis	20
6.4 Graphite structure	21
6.5 Inspection documents	21
7 Testing and final assessment	21
7.1 Testing	21
7.1.1 General	21
7.1.2 Testing requirements for CQ = 0,8	21
7.1.3 Testing requirements for CQ = 0,9	21
7.1.4 Surface imperfections	22
7.1.5 Cracks, laps, cold shut and non-fused chaplets	23
7.1.6 Ultrasonic testing and/or sectioning	23
7.1.7 Magnetic particle testing (only for ferritic grades)	23
7.1.8 Penetrant testing	23
7.1.9 Radiographic testing	23
7.1.10 Surface roughness	24
7.1.11 Minimum wall thickness	24
7.1.12 Wall thickness tolerances	24
7.1.13 Other dimensions	24
7.1.14 Qualification of testing personnel	24
7.2 Final assessment	24
7.2.1 General	24
7.2.2 Hydraulic test pressure	24

8	Pressure vessels constructed of a combination of parts in different materials	25
9	Marking and documentation	25
9.1	Marking of castings	25
9.2	Name plate for the complete pressure vessel	25
9.3	Documentation	25
Annex A	(normative) Technical data for the design calculations	26
A.1	Purpose	26
A.2	Technical data	26
A.2.1	Ferritic spheroidal graphite cast iron according to EN 1563:1997	26
A.2.2	Austenitic spheroidal graphite cast iron according to EN 13835:2002	27
Annex B	(informative) Ductility	28
Annex C	(informative) Determination of the minimum local wall thickness and minimum required burst test pressure	29
Annex D	(normative) Assessment of fatigue life	30
D.1	Purpose	30
D.2	Specific definitions	30
D.3	Specific symbols and abbreviations	30
D.4	Limitations	31
D.5	General	31
D.6	Simplified fatigue assessment	31
D.6.1	Pseudo-elastic stress range	31
D.6.2	Correction factors	32
D.6.3	Fatigue design curves	32
D.6.4	Allowable number of cycles	38
D.6.5	Allowable stress range	38
D.7	Detailed fatigue assessment	38
D.7.1	Pseudo-elastic stress ranges	38
D.7.2	Corrections to stress range	39
D.7.3	Fatigue design curves	40
D.7.4	Allowable number of cycles	41
D.7.5	Allowable stress range	42
D.8	Assessment rule for total fatigue damage	42
D.9	Repairs of surface imperfections	42
Annex E	(normative) Design by analysis for castings	43
E.1	Introduction	43
E.2	Special requirements to EN 13445-3:2014, Annex B	43
E.2.1	Addition to B.8.2.3: Design checks for normal operating load cases	43
E.2.2	Addition to B.8.2.4: Design checks for testing load cases	43
E.3	Additions to EN 13445-3:2014, Annex C	43
E.4	Requirements	44
Annex F	(informative) Recommendations for in-service validation and inspection	45
F.1	Purpose	45
F.2	Tests during operation	45
F.3	Measures to be taken when the calculated allowable fatigue lifetime has been reached ...	46
F.3.1	General	46
F.3.2	Testing of vessels and pressure parts at end of life without indicated damages	46
F.3.3	Hydraulic testing of vessels and vessel parts with indicated damages	46
Annex G	(normative) Specific design requirements	47

G.1	Scope	47
G.2	Design	47
G.2.1	General	47
G.2.2	Cover thickness, pressure to convex side	48
G.2.3	Pressure to concave side	48
G.2.4	Flange thickness	48
Annex H (normative) Experimental cyclic pressure testing procedure		49
H.1	Purpose	49
H.1.1	General	49
H.1.2	Experimental methods and other design methods	49
H.2	Validity	49
H.3	Tests requirements	49
H.3.1	General	49
H.3.2	Number of parts	49
H.3.3	Procedure	32
H.3.4	Material tests	51
H.4	Allowable number of cycles	51
Y.2	List of corrected pages of Issue 2 (2015-07)	53
Y.3	List of corrected pages of Issue 3 (2016-07)	53
Y.4	List of corrected pages of Issue 3 (2016-07)	53
Annex ZA (informative) Relationship between this European Standard and the essential requirements of Directive 2014/68/EU aimed to be covered		54
Bibliography		55