DIN EN 12542:2020-12 (E)

LPG equipment and accessories - Static welded steel cylindrical pressure vessels, serially produced for the storage of Liquefied Petroleum Gas (LPG) having a volume not greater than 13 m<(hoch)3> - Design and manufacture

Contents

Page

European foreword 6

Introduction 7

1 Scope 8

2 Normative references 8

3 Terms and definitions 10
3.1 General terms 10
3.2 Terms for coatings 12

4 Materials 12
4.1 Environmental 12
4.2 Shells and ends 12
4.3 Pressure parts other than shell or ends 14
4.4 Parts welded to the pressure vessel 14
4.5 Welding consumables 14
4.6 Inspection documents for materials 14
4.7 Non-metallic materials (gaskets) 14

5 Design 14
5.1 General 14
5.2 Temperature 15
5.3 Pressure 15
5.4 Vacuum conditions 15
5.5 Support loadings 16
5.6 Lifting lugs loadings 16

6 Openings 16
6.1 General 16
6.2 Reinforcement 16
6.3 Position of welds and openings 16

7 Workmanship and manufacture 16
7.1 General 16
7.2 Environment 17
7.3 Control and traceability of materials 17
7.4 Manufacturing tolerances 17
7.5 Acceptable weld details 17
7.6 Formed pressure parts 18
7.7 Welding 20
7.8 Post weld heat treatment 21
7.9 Repairs 22

8 Non-pressure attachments 22
8.1 Attachments 22
8.2 Position 22
8.3 Vent hole 22

9 Inspection and testing 23
9.1 Visual examination of welds 23
9.2 Non-destructive testing (NDT) 23
9.3 Non-destructive testing techniques 24
9.4 Marking for non-destructive testing 25
9.5 Qualification of personnel 25
9.6 Acceptance criteria 25
9.7 Production test plates (coupon plates) 26
9.8 Final assessment 27

10 Surface treatment and finishing 28
10.1 Environmental considerations 28
10.2 Above ground pressure vessels 28
10.3 Underground pressure vessels 29
10.4 Finishing operations 29

11 Marking and certification 29

12 Records and documentation 30
12.1 Records to be obtained by the manufacturer 30
12.2 Documents to be prepared by the manufacturer 30

Annex A(informative) Design pressure and filling conditions 31

A.1 Above ground pressure vessels 31
A.1.1 Design pressure (p) 31
A.1.2 Filling conditions 31
A.1.3 Calculation of maximum fill 32
A.2 Underground pressure vessels -- Design pressure 32

Annex B(normative) Tolerances on pressure vessels 33

B.1 Mean external diameter 33
B.2 Out of roundness 33
B.3 Deviation from the straight line 33
B.4 Irregularities in circular profile 33
B.5 Thickness tolerance 34
B.6 Profile 34
B.7 Surface alignment 35
B.8 Attachments, nozzles and fittings 35

Annex C(normative) Hydraulic pressure test 36

C.1 Temporary fittings 36
C.2 Pressure gauges 36
C.3 Pressurizing agent 36
C.4 Avoidance of shocks 36
C.5 Test procedure 36

Annex D(normative) Imperfections 37

Annex E(normative) Design formulae for pressure vessels 39

E.1 Allowable stresses 39
E.2 Design formulae 39
E.2.1 General 39
E.2.2 Cylindrical shell calculation 39
E.2.3 Torispherical end calculation 39
E.2.4 Ellipsoidal end calculation 40
E.2.5 Hemispherical ends 42
E.2.6 Equations for calculating 42

E.3 Nozzle reinforcement 43
E.3.1 General 43
E.3.2 Size of openings 43
E.3.3 Distance between openings or branches 43
E.3.4 Openings and branches 44
E.3.5 Cylindrical shells and ends with openings 44
E.3.6 Shell reinforcement 44
E.3.7 Extent of reinforcement 44
E.3.8 Elliptical openings 44
E.3.9 Welded branches 45
E.3.10 Compensating plates 45
E.3.11 Reinforcement - General 45
E.3.12 Reinforcement by pads 45
E.3.13 Reinforcement by branches 46
E.3.14 Branch connections normal to the pressure vessel wall 46

Annex F(informative) Measurement of shell peaking 50

F.1 Profile gauge 50
F.2 Peaking survey 50

Annex G(informative) Examples of joints 53

Annex H(informative) Method of determining reflectivity indices (above ground pressure vessels) 57

Annex I(normative) External protection of underground pressure vessels 58

I.1 General 58
I.2 Unmonitored protection systems 58
I.3 Monitored protection systems 58
I.3.1 Systems incorporating cathodic protection 58
I.3.2 Systems incorporating a protective envelope 59
I.3.3 Other systems 59

Annex J(informative) Exterior corrosion protective coating with special performance against chemical and mechanical attacks 60

J.1 General 60
J.2 Requirements 60
J.2.1 General requirements 60
J.2.2 Requirements for the coating material 60
J.2.3 Requirements for the coating 61
J.2.4 Requirements for the coating process 62
J.3 Testing 62
J.3.1 Testing for the coating material 62
J.3.2 Testing for the coating 63
J.3.3 Documentation of the coating procedure 64
J.3.4 Test reports and certificates 65
J.4 Supervision during production 65

Annex ZA(informative) Relationship between this European Standard and the essential requirements of EU Directive 2014/68/EU 66

Bibliography 68