

# DIN EN 17533:2024-11 (E)

## Gaseous hydrogen - Cylinders and tubes for stationary storage

---

<b>Contents</b>		<b>Page</b>
European foreword .....		5
Introduction .....		6
1	Scope .....	7
2	Normative references .....	7
3	Terms, definitions and symbols .....	9
3.1	Terms and definitions .....	9
3.2	Symbols .....	13
4	Specified service conditions .....	14
4.1	Maximum allowable working pressure .....	14
4.2	Maximum allowable energy content .....	14
4.3	Maximum and minimum allowable temperature .....	14
4.4	Pressure cycle life .....	14
4.5	Shallow pressure cycle life .....	14
4.6	Effective pressure cycle count and maximum number of pressure cycles allowed in service .....	14
4.7	Service life .....	15
5	Additional service conditions .....	15
5.1	Environmental conditions .....	15
5.2	Fire conditions .....	15
6	Information to be recorded .....	16
6.1	General .....	16
6.2	Statement of service .....	16
6.3	Design drawings and information .....	17
6.4	Stress analysis report .....	17
6.5	Material property data .....	17
6.6	Manufacturing data .....	18
6.7	Retention of records .....	18
7	Material properties .....	18
7.1	Compatibility .....	18
7.2	Steel .....	18
7.3	Stainless steels .....	18
7.4	Aluminium alloys .....	18
7.5	Fibre material .....	18
7.6	Resins .....	19
7.7	Plastic liner material .....	19
8	Requirements for new designs .....	19
8.1	General considerations .....	19
8.2	Construction and workmanship .....	22
8.3	Qualification of new designs .....	24
8.4	Production and batch tests .....	34
8.5	Markings .....	38
8.6	Preparation for dispatch .....	39

9	Requirements for existing design standards .....	40
Annex A (normative) Test methods and acceptance criteria .....		41
A.1	Hydrogen compatibility tests .....	41
A.2	Hydrogen sensitivity tests .....	41
A.3	Tensile properties of plastics .....	44
A.4	Softening temperature of plastics .....	44
A.5	Resin properties tests .....	44
A.6	Hydrostatic burst pressure test .....	44
A.7	Ambient temperature pressure cycling for cycle life definition .....	45
A.8	Leak-before-break (LBB) test .....	46
A.9	Bonfire test .....	46
A.10	High strain impact test .....	47
A.11	Accelerated stress rupture test .....	47
A.12	Extreme temperature pressure cycling .....	47
A.13	Permeation test .....	48
A.14	Boss torque test .....	48
A.15	Hydrogen gas cycling test .....	48
A.16	Hardness test .....	49
A.17	Hydraulic test .....	49
A.18	Leak test .....	49
A.19	Coating tests .....	49
A.20	Coating batch tests .....	50
A.21	Impact damage test .....	50
Annex B (normative) Use of existing and approved design standards for stationary storage .....		52
B.1	General .....	52
B.2	Requirements .....	52
B.3	Marking .....	55
B.4	Certificate .....	55
B.5	Examples of calculation for MAWP .....	55
B.6	Cycle life calculation .....	56
Annex C (informative) Verification of stress ratios using strain gauges .....		57
Annex D (informative) Non-destructive examination (NDE) defect size by flawed pressure vessel cycling .....		58
Annex E (informative) Manufacturer's instructions for handling, use and inspection of pressure vessels .....		59
E.1	General .....	59
E.2	Distribution .....	59
E.3	Reference to existing codes, standards and regulations .....	59
E.4	Pressure vessel handling .....	59
E.5	Installation .....	59
E.6	Use of pressure vessels .....	60
E.7	In-service inspection .....	60
Annex F (informative) Fatigue life evaluation using Goodman diagrams .....		61
F.1	Purpose .....	61
F.2	Developing an S-N diagram .....	61
F.3	Equivalent pressure cycling .....	62
F.4	Developing a Goodman diagram .....	62
Annex G (informative) Optional bonfire test .....		66
G.1	General .....	66
G.2	Cylinder test .....	66

<b>G.3</b>	<b>PRD test .....</b>	<b>67</b>
<b>G.4</b>	<b>Vent test .....</b>	<b>68</b>
<b>G.5</b>	<b>System assessment .....</b>	<b>68</b>
<b>G.6</b>	<b>Generation of a safety envelope and actual cylinder/PRD performance .....</b>	<b>68</b>
<b>Annex H (informative) Information on factor of safety .....</b>		<b>70</b>
<b>H.1</b>	<b>Purpose .....</b>	<b>70</b>
<b>H.2</b>	<b>Background .....</b>	<b>70</b>
<b>H.3</b>	<b>Recommended safety factor .....</b>	<b>70</b>
<b>H.4</b>	<b>Discussion .....</b>	<b>70</b>
<b>H.5</b>	<b>Conclusions .....</b>	<b>72</b>
<b>H.6</b>	<b>Recommendations .....</b>	<b>72</b>
<b>H.7</b>	<b>Further reading .....</b>	<b>72</b>
<b>Annex I (informative) Guidance for evaluation of pressure vessels designed according to other standards .....</b>		<b>73</b>
<b>Bibliography .....</b>		<b>76</b>