

DIN EN 13831:2007-12 (E)

Closed expansion vessels with built in diaphragm for installation in water

Contents		Page
Foreword		4
Introduction		5
1	Scope	6
2	Normative references	6
3	Terms and conditions	7
4	Symbols and units	9
5	Materials	10
5.1	General	10
5.2	Materials proven by experience and current use	10
5.3	Fasteners	11
5.4	Non-pressurised parts	11
6	Design and calculation	11
6.1	Design	11
6.1.1	Requirements pertaining to the diaphragm	11
6.1.2	Requirements pertaining to fresh water application	11
6.1.3	Outside finish	11
6.1.4	Inspection openings	11
6.1.5	Connections	12
6.1.6	Clenched joints	12
6.1.7	Volume tolerance of vessels	12
6.1.8	Fatigue	12
6.1.9	Loadings	13
6.2	Experimental design method	13
6.2.1	General	13
6.2.2	Preparations	13
6.2.3	Vessels with $PS \times V \geq 1\,000 \text{ bar} \times \text{L}$	13
6.2.4	Vessels with $1\,000 \text{ bar} \times \text{L} < PS \times V < 6\,000 \text{ bar} \times \text{L}$	13
6.2.5	Vessel parts and components	13
6.3	Calculation method	14
6.3.1	General	14
6.3.2	Symbols	14
6.3.3	Cylindrical and spherical shells under internal pressure	15
6.3.4	Dished ends under internal pressure	15
6.3.5	Openings in cylindrical shells, spherical shells and dished ends	18
6.3.6	Bolted circular flat ends under internal pressure	25
6.3.7	Flanges and boltings	31
7	Manufacturing and welding	39
7.1	Introduction	39
7.2	General	39
7.3	Manufacturing tolerances	39
7.3.1	General	39
7.3.2	Middle line and surface alignment	39
7.3.3	Tolerances for vessels	40
7.4	Weld details	41

7.4.1	Recommended weld details	41
7.4.2	Vessels made in more courses	42
7.4.3	Joggle joints	42
7.5	Welding	42
7.5.1	General	42
7.5.2	Welding procedure specification (WPS)	42
7.5.3	Qualification of WPS	42
7.5.4	Qualification of welders and welding operators	42
7.5.5	Preparation of edges to be welded	43
7.5.6	Execution of welded joints	43
7.5.7	Attachments, supports and stiffeners	43
7.6	NDE personnel	43
7.7	Manufacture and testing of permanent joints	43
7.7.1	Welded joints	43
7.7.2	Clenched joints	46
7.8	Forming of parts subject to pressure	46
7.8.1	Ratio of deformation	46
7.8.2	Forming conditions	48
7.8.3	Heat treatment	48
7.8.4	Visual examination and control of dimensions	49
7.8.5	Test certificate	49
7.9	Repairs	49
7.9.1	Surface defects	49
7.9.2	Repairs, elimination of defects	49
7.10	Finishing operations	49
8	Diaphragm	50
8.1	General	50
8.2	Materials	50
8.3	Hygienic demands	50
8.4	Test concept	50
8.5	Testing	50
8.5.1	General	50
8.5.2	Tests on diaphragms	50
8.5.3	Cyclic stressing on vessels	51
8.5.4	Diaphragm permeability test	53
8.5.5	Repetition of tests	53
8.5.6	Test report	53
8.6	Tests by the diaphragm manufacturer	54
8.7	Marking of diaphragms	54
9	Testing and inspection	54
9.1	General	54
9.2	Technical documentation	54
9.3	Inspections during manufacturing	55
9.4	Pressure test	55
9.5	Marking	55
9.6	Documentation	56
Annex A (informative) Standards for testing diaphragms		57
Annex B (informative) Proven diaphragm materials		58
Annex ZA (informative) Relationship between this European Standard and the Essential requirements of EU Directive 97/23/EC		59
Bibliography		60