



# SVENSK STANDARD SS-EN 14015:2005

Fastställd 2005-02-25

Utgåva 1

**Anvisningar för konstruktion och tillverkning av stationära, vertikala, cylindriska, svetsade stålcisterner, ovan jord med plan botten, för lagring av vätskor vid omgivningstemperatur eller högre temperatur**

**Specification for the design and manufacture of site built, vertical, cylindrical, flat-bottomed, above ground, welded, steel tanks for the storage of liquids at ambient temperature and above**

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English version

Specification for the design and manufacture of site built,  
vertical, cylindrical, flat-bottomed, above ground, welded, steel  
tanks for the storage of liquids at ambient temperature and  
above

Spécification pour la conception et la fabrication de  
réservoirs en acier, soudés, aériens, à fond plat,  
cylindriques, verticaux, construit sur site destinés au  
stockage des liquides à la température ambiante ou  
supérieure

Auslegung und Herstellung standortgefertigter,  
oberirdischer, stehender, zylindrischer, geschweißter  
Flachboden-Stahltanks für die Lagerung von Flüssigkeiten  
bei Umgebungstemperatur und höheren Temperaturen

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COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

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## Contents

	page
Foreword.....	11
1 Scope.....	12
2 Normative references .....	13
3 Terms, definitions, symbols and abbreviations .....	15
3.1 Terms and definitions.....	15
3.2 Symbols .....	19
3.3 Abbreviations .....	21
4 Information and requirements to be documented.....	22
4.1 Information to be specified by the purchaser.....	22
4.2 Information to be agreed between the purchaser and the tank manufacturer.....	22
4.3 Information to be supplied by the tank manufacturer.....	22
4.4 Information to be supplied by the steel manufacturer.....	22
4.5 Information to be agreed between the steel manufacturer and the tank manufacturer .....	22
4.6 Information to be agreed between the purchaser and the cover supplier.....	22
4.7 Information to be agreed between the tank manufacturer and the cover supplier..	22
4.8 Information to be supplied by the cover supplier .....	22
5 Requirements .....	22
5.1 Design pressure.....	22
5.2 Design metal temperature.....	23
5.2.1 Maximum design metal temperature.....	23
5.2.2 Minimum design metal temperature .....	23
5.3 Design density.....	24
5.4 Yield strength .....	24
6 Materials.....	24
6.1 Carbon and carbon manganese steels .....	24
6.1.1 Plate materials.....	24
6.1.2 Structural steel sections .....	30
6.1.3 Forgings.....	30
6.1.4 Pipes.....	31
6.1.5 Welding consumables .....	31
6.1.6 Charpy V-notch impact energy requirements of carbon and carbon manganese steels .....	31
6.1.7 Mountings .....	33
6.1.8 Thickness tolerances.....	33
6.2 Stainless steels .....	34
6.2.1 General .....	34
6.2.2 Plate materials.....	36
6.2.3 Structural steel sections .....	36
6.2.4 Forgings.....	36
6.2.5 Pipes.....	36
6.2.6 Welding consumables .....	37
7 Design loads.....	37
7.1 Loads.....	37
7.2 Load values .....	38
7.2.1 Liquid induced loads .....	38
7.2.2 Internal pressure loads.....	38

7.2.3	Thermally induced loads .....	38
7.2.4	Dead loads .....	38
7.2.5	Insulation loads .....	38
7.2.6	Live load .....	38
7.2.7	Concentrated live load .....	38
7.2.8	Snow loads .....	38
7.2.9	Rainfall .....	39
7.2.10	Wind .....	39
7.2.11	Seismic loads .....	39
7.2.12	Loads resulting from connected piping and attachments .....	39
7.2.13	Foundation settlement loads .....	39
7.2.14	Emergency loads .....	39
7.3	Load combinations .....	39
8	Tank bottoms .....	40
8.1	General .....	40
8.2	Materials .....	40
8.3	Design .....	43
8.4	Fabrication .....	43
9	Shell design .....	45
9.1	Design and test stress .....	45
9.2	Internal loads .....	48
9.3	Wind and vacuum loads .....	49
9.3.1	Stiffening rings .....	49
9.3.2	Primary stiffening ring (wind girder) design .....	51
9.3.3	Secondary stiffening ring (wind girder) design .....	51
9.4	Shell plate arrangement .....	54
9.5	Shell joints .....	54
10	Fixed roof design .....	54
10.1	Loads .....	54
10.2	Type of roof .....	54
10.3	Roof plating with supporting structure .....	54
10.4	Roof plating without supporting structure (membrane roofs) .....	56
10.5	Compression area at the junction of the shell and roof .....	56
10.6	Venting requirements .....	59
10.6.1	General .....	59
10.6.2	Scope of venting provided .....	59
10.6.3	Venting capacity .....	59
10.6.4	Accumulation of pressure and vacuum .....	59
10.7	Floating covers .....	59
11	Floating roof design .....	59
12	Tank anchorage .....	60
12.1	General .....	60
12.2	Anchorage attachment .....	60
12.3	Holding down bolt or strap .....	60
12.3.1	Allowable tensile stress .....	60
12.3.2	Cross-sectional area .....	60
12.4	Resistance to uplift during test .....	61
13	Mountings .....	61
13.1	Shell nozzles O/D 80 mm and above .....	61
13.2	Shell nozzles less than O/D 80 mm .....	71
13.3	Roof nozzles .....	71
13.4	Studded pad connections .....	73
13.5	Nozzle loads .....	73
13.6	Flush type clean-out doors and water draw-off sumps .....	73
13.6.1	General .....	73
13.6.2	Flush type clean-out doors .....	74

**EN 14015:2004 (E)**

13.6.3	Water draw-off sumps .....	74
13.6.4	Combined water draw-off and clean-out sump .....	74
13.7	Nozzle welding details .....	74
13.8	Flange drilling .....	75
13.9	Post-weld heat treatment of nozzles .....	75
13.10	Heating and/or cooling systems .....	75
13.11	Stairways and walkways .....	78
13.12	Handrailing .....	78
13.13	Ladders .....	79
13.14	Earthing connections .....	79
13.15	Permanent attachments .....	79
13.16	Temporary attachments .....	79
14	Insulation .....	79
15	Shop fabrication of tank components .....	79
15.1	General .....	79
15.2	Reception and identification of materials .....	79
15.3	Handling and storage of materials .....	80
15.4	Material markings .....	80
15.5	Plate preparation and tolerances .....	81
15.6	Preparation of nozzle components .....	81
15.7	Plate forming and tolerances .....	81
15.8	Openings .....	81
15.8.1	Nozzles .....	81
15.8.2	Inspection windows .....	82
15.8.3	Nozzles for mixers .....	82
15.8.4	Clean-out doors .....	82
15.8.5	Reinforcement plates .....	82
15.8.6	Insert plates .....	82
15.9	Welding .....	82
15.10	Surface condition .....	83
15.11	Marking for erection purposes .....	83
15.12	Packing, handling and transport to site .....	83
16	Site erection and tolerances .....	84
16.1	General .....	84
16.2	Foundations .....	84
16.2.1	General .....	84
16.2.2	Peripheral tolerance .....	85
16.2.3	Foundation surface tolerance .....	85
16.3	Anchor points .....	85
16.4	Handling and storage .....	86
16.5	Rectification of parts damaged during transportation and handling .....	86
16.6	Bottom plates .....	86
16.7	Shell to bottom, and shell .....	86
16.7.1	Assembly tolerances of first shell course on flat bottom .....	86
16.7.2	Tolerance on shell geometry .....	87
16.7.3	Vertical tolerance .....	88
16.7.4	Tolerances on alignment of plates .....	88
16.7.5	Tolerances on shape of welded joints .....	88
16.7.6	Primary and secondary stiffening rings (wind girders) .....	89
16.8	Fixed roofs .....	89
16.8.1	General .....	89
16.8.2	Support framework .....	89
16.8.3	Roof plates .....	89
16.8.4	Roof plating and roof structure .....	90
16.8.5	Frangible roofs .....	90
16.9	Nozzles .....	90
16.10	External attachments .....	90
16.11	Internal attachments .....	90

16.12	Temporary attachments .....	90
17	Approval of welding procedures and welders .....	91
17.1	General .....	91
17.2	Welding procedure approval .....	91
17.2.1	General .....	91
17.2.2	Welding of test pieces .....	91
17.2.3	Examination and testing of test pieces .....	91
17.3	Welding Procedure Approval Record (WPAR) .....	92
17.3.1	Preparation .....	92
17.3.2	Range of approval .....	92
17.4	Welders and welding operators approval .....	92
17.5	Production control test plates .....	92
17.5.1	Horizontal welds .....	92
17.5.2	Vertical welds .....	93
18	Welding .....	93
18.1	General .....	93
18.2	Welding sequences .....	93
18.3	Welding of bottoms .....	93
18.3.1	Removal of coatings .....	93
18.3.2	Annular ring plates .....	93
18.3.3	Bottom plates .....	94
18.4	Welding of shell to bottom .....	94
18.5	Welding of shell .....	94
18.6	Welding of roof .....	94
18.7	Temporary welds .....	94
18.8	Atmospheric conditions .....	94
18.9	Preheating .....	95
18.10	Post-weld heat treatment .....	95
18.11	Repair welding .....	96
19	Testing and inspection .....	96
19.1	General .....	96
19.2	Qualification of NDT personnel .....	96
19.3	Test procedures .....	97
19.4	Type of inspections and examinations .....	97
19.4.1	Inspection of materials .....	97
19.4.2	Examinations of edges to be welded and joint preparations .....	97
19.4.3	Visual examination .....	97
19.4.4	Type and extent of examination and test of welds .....	98
19.4.5	Additional examinations if imperfections are found .....	102
19.5	Vacuum box test .....	103
19.6	Penetrant test .....	104
19.7	Magnetic particle examination .....	104
19.8	Soap bubble examination .....	104
19.8.1	Reinforcement plates .....	104
19.8.2	Fixed roof and roof to shell .....	104
19.8.3	Shell to bottom with double fillet weld .....	105
19.9	Radiographic examination .....	105
19.9.1	General procedure .....	105
19.9.2	Storage of films .....	105
19.10	Ultrasonic examination .....	105
19.11	Acceptance criteria .....	106
19.11.1	Imperfection acceptance criteria .....	106
19.11.2	Acceptable thinning after grinding .....	109
19.12	Dimensional check .....	110
19.13	Hydrostatic and pneumatic tests .....	110
19.13.1	General .....	110
19.13.2	Hydrostatic test liquid level .....	110
19.13.3	Pneumatic test pressure .....	110

**EN 14015:2004 (E)**

19.13.4	Conditions of implementation .....	110
19.13.5	Examination during filling .....	111
19.13.6	Filling.....	112
19.13.7	Checking and testing of roof (over pressure) .....	112
19.13.8	Test for tank stability under negative pressure .....	113
19.14	Empty checks .....	113
19.15	Accessories .....	113
19.15.1	External accessories .....	113
19.15.2	Internal accessories.....	113
20	Documentation and name-plate .....	114
20.1	Documentation .....	114
20.2	Name-plate.....	116
Annex A	(normative) Information and requirements to be documented .....	117
A.1	Information to be supplied by the purchaser.....	117
A.2	Information agreed between the purchaser and the manufacturer .....	119
A.3	Information to be supplied by the manufacturer .....	120
A.4	Information to be supplied by the steel manufacturer.....	121
A.5	Information to be agreed between the steel manufacturer and the tank manufacturer .....	121
A.6	Information to be agreed between the purchaser and the cover supplier.....	121
A.7	Information to be agreed between the tank manufacturer and the cover supplier	121
A.8	Information to be supplied by the cover supplier .....	121
Annex B	(informative) Operational and safety considerations for storage tanks and storage installations .....	122
B.1	General .....	122
B.2	Tank type .....	122
B.2.1	Stored product .....	122
B.2.2	Local climatic and geological conditions.....	122
B.3	Health, safety and environmental considerations .....	123
B.3.1	Containment .....	123
B.3.2	Fire protection .....	123
B.4	Attachments to tanks for safety or firefighting facilities .....	123
Annex C	(normative) Requirements for floating covers .....	124
C.1	General .....	124
C.2	Types of floating covers.....	125
C.3	Design and construction requirements .....	128
C.3.1	Design .....	128
C.3.2	Materials of construction .....	130
C.3.3	Cover fittings .....	133
C.3.4	Tank fittings.....	137
C.4	Installation .....	139
C.4.1	Tank examination.....	139
C.4.2	Examination and installation of the cover.....	139
C.4.3	Tests .....	140
C.5	Documentation .....	140
Annex D	(normative) Requirements for floating roofs.....	141
D.1	General .....	141
D.2	Roof types.....	141
D.3	Design .....	141
D.3.1	General .....	141
D.3.2	Buoyancy .....	142
D.3.3	Structural design.....	144
D.3.4	Roof stability under wind load.....	144
D.3.5	Pontoon manholes.....	144
D.3.6	Roof manhole .....	144
D.3.7	Centering and anti-rotation devices.....	144
D.3.8	Main roof drains .....	145



D.3.9	Emergency drains .....	145
D.3.10	Drain plugs .....	145
D.3.11	Vents.....	146
D.3.12	Seals .....	146
D.3.13	Support legs .....	146
D.3.14	Gauging device .....	147
D.3.15	Rolling ladder .....	147
D.3.16	Earthing cables .....	147
D.3.17	Foam dam .....	147
D.4	Prefabrication in the workshop .....	147
D.5	Marking, packing, handling, transport.....	148
D.5.1	General.....	148
D.5.2	Repair after damage during handling operations.....	148
D.6	Assembly .....	148
D.7	Welding .....	148
D.7.1	General.....	148
D.7.2	Support legs .....	148
D.7.3	Bulkheads .....	148
D.8	Inspection and testing.....	149
D.8.1	Welds.....	149
D.8.2	Pontoons.....	149
D.8.3	Checks.....	149
D.8.4	Drains .....	149
D.9	Documentation .....	149
Annex E	(normative) Requirements for rim seals for floating roofs .....	150
E.1	General.....	150
E.2	Design .....	150
E.3	Seal types .....	151
E.4	Weather shields.....	151
E.5	Application and technical details of rim seals.....	151
E.5.1	Mechanical shoe seals .....	151
E.5.2	Spring-forced lip primary seals .....	152
E.5.3	Liquid-filled primary seals.....	152
E.5.4	Foam-filled primary seals.....	152
E.5.5	Spring-forced pad or lip secondary seals .....	152
E.5.6	Compression plate secondary seals.....	153
E.5.7	Wiper seals .....	153
E.5.8	Integrated primary/secondary seals .....	153
E.6	Installation .....	153
Annex F	(normative) Selection of carbon and carbon manganese steel plate to alternative specifications to those in 6.1.....	156
F.1	Alternative national standards .....	156
F.2	General.....	156
F.3	Chemical composition.....	156
F.4	Mechanical properties .....	158
F.5	Impact testing.....	158
F.5.1	General.....	158
F.5.2	Impact properties .....	159
Annex G	(informative) Recommendations for seismic provisions for storage tanks .....	161
G.1	General.....	161
G.2	Design loads.....	161
G.2.1	Overturning moment.....	161
G.2.2	Effective mass of tank contents .....	162
G.2.3	Lateral force coefficients.....	163
G.3	Resistance to overturning.....	165
G.3.1	The tank contents .....	165
G.3.2	The thickness of the bottom plate.....	165
G.4	Shell compression .....	166

**EN 14015:2004 (E)**

G.4.1	Unanchored tanks .....	166
G.4.2	Anchored tanks .....	166
G.4.3	Maximum allowable shell compression.....	167
G.4.4	Upper shell courses .....	168
G.5	Anchorage of tanks.....	168
G.5.1	Minimum anchorage required.....	168
G.5.2	Design of anchorage.....	168
G.6	Piping .....	169
G.7	Sloshing height .....	169
<b>Annex H (informative) Recommendations for other types of tank bottoms (double bottoms, elevated bottoms etc.).....</b>		
H.1	Non-fully supported bottoms.....	170
H.2	Double bottoms .....	171
H.2.1	General .....	171
H.2.2	Design .....	171
H.2.3	Leak detection .....	174
H.3	Elevated or beam supported tanks .....	174
H.4	Leak test.....	175
<b>Annex I (informative) Recommendations for tank foundations .....</b>		
I.1	General .....	176
I.2	Soil Investigation .....	176
I.2.1	General .....	176
I.2.2	Water tables .....	176
I.2.3	Seismic investigations .....	177
I.2.4	Sites to be avoided .....	177
I.3	Foundation design .....	177
I.3.1	General .....	177
I.3.2	Loading conditions .....	177
I.3.3	Allowable soil loading .....	177
I.3.4	Settlement.....	177
I.3.5	Soil improvement and piling .....	178
I.3.6	Drainage.....	178
I.3.7	Resistance to uplift.....	179
I.3.8	Membrane vapour barrier.....	179
I.4	Types of foundations.....	179
I.4.1	General .....	179
I.4.2	Pad foundations .....	179
I.4.3	Ring beam foundations .....	180
I.4.4	Surface raft foundations.....	180
I.4.5	Pile supported raft .....	180
<b>Annex J (informative) Example calculations of stiffening rings (wind girders).....</b>		
J.1	General .....	184
J.2	Section moduli .....	184
J.3	Worked examples of design of secondary stiffening rings (wind girders).....	184
J.4	Example 1 .....	186
J.5	Example 2 .....	187
<b>Annex K (normative) Design rules for tanks with frangible roof to shell joints .....</b>		
K.1	General .....	188
K.2	Construction .....	189
K.3	Materials.....	189
K.4	Design rules.....	190
<b>Annex L (normative) Requirements for venting systems .....</b>		
L.1	General .....	194
L.2	Types of vents and valves .....	195
L.2.1	General.....	195
L.2.2	Free vents for outbreathing and inbreathing .....	195
L.2.3	Pressure and vacuum relief valves .....	195

L.2.4	Vent pipes .....	195
L.2.5	Emergency venting valves .....	195
L.2.6	Venting systems with flame arresting capability.....	195
L.3	Calculation of maximum flow rates for normal outbreathing and inbreathing .....	196
L.3.1	General .....	196
L.3.2	Pump capacities .....	196
L.3.3	Thermal outbreathing and inbreathing .....	196
L.4	Calculation of maximum flow rates for emergency pressure venting .....	199
L.4.1	General .....	199
L.4.2	Fire .....	199
L.4.3	Malfunction of blanketing system .....	201
L.4.4	Other possible causes .....	201
L.5	Emergency vacuum venting .....	201
L.6	Testing venting devices .....	201
L.6.1	General .....	201
L.6.2	Test apparatus.....	202
L.6.3	Method.....	204
L.7	Manufacturers documentation and marking of venting devices .....	205
L.7.1	Documentation .....	205
L.7.2	Marking .....	205
Annex M	(informative) Tank anchorages.....	207
M.1	General.....	207
M.2	Holding down strap.....	207
M.3	Holding down bolt with individual chair .....	207
M.4	Holding down bolt with continuous support ring.....	207
Annex N	(informative) Weld details for the connection of mounting .....	211
N.1	Set-through mountings .....	211
N.2	Set-on mountings.....	215
N.3	Studded pad connections .....	216
Annex O	(informative) Flush-type clean-out doors and water draw-off sumps .....	217
O.1	Flush-type clean-out doors .....	217
O.1.1	General.....	217
O.1.2	Flush-type clean-out doors with insert plate reinforcement. ....	217
O.1.3	Flush-type clean-out doors with plate reinforcement.....	218
O.2	Water-draw-off sumps .....	218
O.3	Combined water draw-off and clean-out sump.....	218
Annex P	(informative) Heating and/or cooling systems .....	225
P.1	General .....	225
P.2	Heat transfer fluid .....	225
P.3	Type of heating or cooling devices.....	225
P.4	Installation .....	226
Annex Q	(informative) Recommendations for the design and application of insulation ..	228
Q.1	General .....	228
Q.2	Design considerations.....	229
Q.2.1	General .....	229
Q.2.2	Dead load .....	229
Q.2.3	Wind loads .....	229
Q.2.4	Thermal expansion .....	230
Q.2.5	Movements due to hydrostatic pressure.....	230
Q.3	Mechanical support arrangement .....	230
Q.3.1	General .....	230
Q.3.2	Supports attached by welding.....	231
Q.3.3	Supports attached by adhesive.....	231
Q.3.4	External structural frame.....	233
Q.3.5	Secondary support members .....	233
Q.3.6	Roof insulation .....	233
Q.4	Design details.....	234

**EN 14015:2004 (E)**

<b>Q.4.1</b>	<b>Nozzles and manholes.....</b>	<b>234</b>
<b>Q.4.2</b>	<b>Stairway connections .....</b>	<b>234</b>
<b>Q.4.3</b>	<b>Supports near stiffening rings (wind girders).....</b>	<b>235</b>
<b>Q.4.4</b>	<b>Roof projection.....</b>	<b>235</b>
<b>Q.4.5</b>	<b>Stiffening rings (wind girders).....</b>	<b>235</b>
<b>Q.4.6</b>	<b>External shell stiffening rings (wind girders) and bottom-to-shell insulation.....</b>	<b>235</b>
<b>Q.5</b>	<b>Corrosion protection .....</b>	<b>235</b>
<b>Q.6</b>	<b>Insulation .....</b>	<b>235</b>
<b>Q.6.1</b>	<b>General .....</b>	<b>235</b>
<b>Q.6.2</b>	<b>Nozzle connections and manholes .....</b>	<b>237</b>
<b>Q.6.3</b>	<b>Stiffening rings (wind girders).....</b>	<b>239</b>
<b>Q.7</b>	<b>Cladding.....</b>	<b>240</b>
<b>Q.7.1</b>	<b>General .....</b>	<b>240</b>
<b>Q.7.2</b>	<b>Side-wall cladding.....</b>	<b>240</b>
<b>Q.7.3</b>	<b>Roofing cladding.....</b>	<b>240</b>
<b>Q.8</b>	<b>Securing insulation materials .....</b>	<b>241</b>
<b>Q.8.1</b>	<b>Slab or block insulation with metal cladding.....</b>	<b>241</b>
<b>Q.8.2</b>	<b>In situ foam behind metal cladding.....</b>	<b>241</b>
<b>Q.8.3</b>	<b>Spray foam.....</b>	<b>242</b>
<b>Q.8.4</b>	<b>Roofs .....</b>	<b>242</b>
<b>Q.9</b>	<b>Fire hazard .....</b>	<b>242</b>
<b>Annex R (normative)</b>	<b>Surface finish .....</b>	<b>243</b>
<b>R.1</b>	<b>Internal surfaces in contact with the product .....</b>	<b>243</b>
<b>R.1.1</b>	<b>General .....</b>	<b>243</b>
<b>R.1.2</b>	<b>Carbon and carbon manganese steel tanks.....</b>	<b>243</b>
<b>R.1.3</b>	<b>Stainless steel tanks.....</b>	<b>243</b>
<b>R.2</b>	<b>External surfaces .....</b>	<b>246</b>
<b>R.2.1</b>	<b>General .....</b>	<b>246</b>
<b>R.2.2</b>	<b>Carbon and carbon manganese steel tanks.....</b>	<b>246</b>
<b>R.2.3</b>	<b>Stainless steel tanks.....</b>	<b>246</b>
<b>Bibliography</b>	<b>.....</b>	<b>247</b>

## Foreword

This document (EN 14015:2004) has been prepared by Technical Committee CEN/TC 265 "Site built metallic tanks for the storage of liquids", the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2005, and conflicting national standards shall be withdrawn at the latest by May 2005.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

This European Standard reflects the current practice within the oil, petrochemical, chemical, food and general bulk liquid storage industry, both European and world-wide. The practice is based on the theory of design stresses or allowable stresses.

There is a parallel pre-standard, ENV 1993-4-2 Tanks. It is based on the Limit State Theory (LST), which is being used more and more by the structure steel and reinforced concrete industry.

Experience in designing steel storage tanks to LST is limited, and there is little information on which to base the values for load factors, load combinations and serviceability. When sufficient experience has been gained in designing tanks to, and credible values become available for load factors, etc., it is envisaged that there may be a gradual move towards the use of LST for the design of tanks covered by this European Standard.

## EN 14015:2004 (E)

### 1 Scope

**1.1** This document specifies the requirements for the materials, design, fabrication, erection, testing and inspection of site built, vertical, cylindrical, flat bottomed, above ground, welded, steel tanks for the storage of liquids at ambient temperatures and above, and the technical agreements that need to be reached (see Annex A).

This document does not apply to tanks where the product is refrigerated to maintain it as a liquid at atmospheric pressure (see prEN 14620).

This document is concerned with the structural integrity of the basic tank structure and does not provide requirements for considering process design, operational issues, safety and firefighting facilities, in-service inspection, maintenance or repair. These aspects are covered in detail in other Codes of Practice (see Annex B).

**1.2** This document applies to closed-top tanks, with and without internal floating covers (see Annex C) and open-top tanks, with and without floating roofs (see Annexes D and E). It does not apply to 'lift-type' gas holders.

**1.3** This document applies to storage tanks with the following characteristics:

- a) design pressure less than 500 mbar<sup>1)</sup> and design internal negative pressure not lower than 20 mbar (see 5.1 for pressure limitations);
- b) design metal temperature not lower than -40 °C and not higher than +300 °C (see 5.2.2);
- c) maximum design liquid level not higher than the top of the cylindrical shell.

**1.4** The limits of application of this document terminate at the following locations.

- face of the first flange in a bolted flange connection;
- first threaded joint on the pipe or coupling outside of the tank shell, roof or bottom;
- first circumferential joint in a pipe not having a flange connection.

**1.5** This document is applicable to steel tanks with a maximum design strength  $\leq 260 \text{ N/mm}^2$ .

**1.6** In addition to the definitive requirements, this document also requires the items detailed in Annex A to be documented. For compliance with this document, both the definitive requirements and those required in Clause 4 have to be satisfied.

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<sup>1)</sup> All pressures are in mbar gauge unless otherwise stated.

## 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 287-1: 2004, *Qualification test of welders - Fusion welding - Part 1: Steels*

EN 288-2, *Specification and approval of welding procedures for metallic materials — Part 2: Welding procedure specification for arc welding*

EN 444, *Non-destructive testing- General principles for radiographic examination of metallic material by X- and gamma- rays*

EN 462-1, *Non-destructive testing – Image quality of radiographs – Part 1: Image quality indicators (wire type). Determination of image quality value*

EN 462-2, *Non-destructive testing – Image quality of radiographs – Part 2: Image quality indicators (step/hole type). Determination of image quality value*

EN 473, *Non destructive testing - Qualification and certification of NDT personnel - General principles*

EN 485 (all parts), *Aluminium and aluminium alloys — Sheet, strip and plate*

EN 499, *Welding consumables — Covered electrodes for manual metal arc welding of non alloy and fine grain steels — Classification*

EN 571-1, *Non destructive testing - Penetrant testing — Part 1: General principles*

EN 754 (all parts), *Aluminium and aluminium alloys — Cold drawn rod/bar and tube*

EN 755 (all parts), *Aluminium and aluminium alloys — Extruded rod/bar, tube and profiles*

EN 970, *Non-destructive examination of fusion welds - Visual examination*

EN 1092-1, *Flanges and their joints - Circular flanges for pipes, valves, fittings and accessories, PN designated — Part 1: Steel flanges*

EN 1290, *Non-destructive examination of welds - Magnetic partical examination of welds*

EN 1418, *Welding personnel - Approval testing of welding operators for fusion welding and resistance weld setters for fully mechanized and automatic welding of metallic materials*

EN 1435, *Non-destructive examination of welds — Radiographic examination of welded joints*

EN 1593, *Non-destructive testing — Leak testing — Bubble emission techniques*

EN 1600, *Welding consumables — Covered electrodes for manual metal arc welding of stainless and heat resisting steels — Classification*

EN 1714, *Non-destructive examination of welded joints - Ultrasonic examination of welded joints*

prEN 1759-1: 2000, *Flanges and their joints - Circular flanges for pipes, valves, fittings and accessories, Class designated - Part 1: Steel flanges, NPS ½ to 24*

EN 1991-1-3:2003, *Eurocode 1 - Actions on structures - Part 1-3: General actions - Snow loads*

## EN 14015:2004 (E)

- EN 10025:1992, *Hot rolled products of non-alloy structural steels — Technical delivery conditions*
- EN 10028-2: 1993, *Flat products made of steels for pressure purposes — Part 2: Non-alloy and alloy steels with specified elevated temperature properties*
- EN 10028-3: 1993, *Flat products made of steels for pressure purposes — Part 3: Weldable fine grain steels, normalized*
- EN 10029: 1991, *Hot rolled steel plates 3 mm thick or above — Tolerances on dimensions, shape and mass*
- EN 10045-1, *Metallic materials — Charpy impact test — Part 1: Test method*
- EN 10088-1, *Stainless steels — Part 1: List of stainless steels*
- EN 10088-2: 1995, *Stainless steels — Part 2: Technical delivery conditions for sheet/plate and strip for general purposes*
- EN 10088-3: 1995, *Stainless steels — Part 3: Technical delivery conditions for semi-finished products, bars, rods and sections for general purposes*
- EN 10113-2: 1993, *Hot-rolled products in weldable fine grain structural steels — Part 2: Delivery conditions for normalized/normalized rolled steels*
- EN 10113-3: 1993, *Hot-rolled products in weldable fine grain structural steels — Part 3: Delivery conditions for thermomechanical rolled steels*
- EN 10204: 2004, *Metallic products — Types of inspection documents*
- EN 10210-1: 1994, *Hot finished structural hollow sections of non-alloy and fine grain structural steels — Part 1: Technical delivery requirements*
- EN 10216-1, *Seamless steel tubes for pressure purposes — Technical delivery conditions - Part 1: Non-alloy steel tubes with specified room temperature properties*
- EN 10216-2, *Seamless steel tubes for pressure purposes - Technical delivery conditions - Part 2: Non-alloy and alloy steel tubes with specified elevated temperature properties*
- EN 10216-3, *Seamless steel tubes for pressure purposes - Technical delivery conditions - Part 3: Alloy fine grain steel tubes*
- EN 10216-5, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 5: Stainless steel tubes*
- EN 10217-1, *Welded steel tubes for pressure purposes — Technical delivery conditions - Part 1: Non-alloy steel tubes with specified room temperature properties*
- EN 10217-2, *Welded steel tubes for pressure purposes - Technical delivery conditions - Part 2: Electric welded non-alloy and alloy steel tubes with specified elevated temperature properties*
- EN 10217-3, *Welded steel tubes for pressure purposes - Technical delivery conditions - Part 3: Alloy fine grain steel tubes*
- EN 10217-5, *Welded steel tubes for pressure purposes - Technical delivery conditions - Part 5: Submerged arc welded non-alloy and alloy steel tubes with specified elevated temperature properties*
- prEN 10217-7, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 7: Stainless steel tubes*



EN 10222 (all parts), *Steel forgings for pressure purposes*

EN 10250 (all parts), *Open steel die forgings for general engineering purposes*

EN 12874, *Flame arresters - Performance requirements, test methods and limits for use*

ENV 1991-2-1, *Eurocode 1: Basis of design and actions on structures — Part 2-1: Actions on structures — Densities, self-weight and imposed loads*

ENV 1993-1-1, *Eurocode 3: Design of steel structures — Part 1-1: General rules and rules for buildings*

ENV 1993-4-2, *Eurocode 3: Design of steel structures — Part 4-2: Silos, tanks and pipelines — Tanks*

EN ISO 4063, *Welding and allied processes — Nomenclature of processes and reference numbers (ISO 4063:1998)*

EN ISO 6520-1, *Welding and allied processes — Classification of geometric imperfections in metallic materials — Part 1: Fusion welding (ISO 6520-1: 1998)*

EN ISO 14122-1, *Safety of machinery — Permanent means of access to machinery - Part 1: Choice of fixed means of access between two levels (ISO 14122-1:2001)*

EN ISO 14122-2, *Safety of machinery -- Permanent means of access to machinery -- Part 2: Working platforms and walkways (ISO 14122-2:2001)*

EN ISO 14122-3, *Safety of machinery -- Permanent means of access to machinery -- Part 3: Stairs, stepladders and guard-rails (ISO 14122-3:2001)*

EN ISO 14122-4, *Safety of machinery -- Permanent means of access to machinery -- Part 4: Fixed ladders (ISO 14122-4:1996)*

EN ISO 15607:2003, *Specification and qualification of welding procedures for metallic materials - General rules (ISO 15607:2003)*

EN ISO 15614-1:2004, *Specification and qualification of welding procedures for metallic materials - Welding procedure test - Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys (ISO 15614-1:2004)*

### **3 Terms, definitions, symbols and abbreviations**

#### **3.1 Terms and definitions**

For the purpose of this document, the following terms and definitions apply:

##### **3.1.1**

##### **design pressure**

maximum permissible pressure in the space above the stored liquid

##### **3.1.2**

##### **design internal negative pressure**

maximum permissible negative pressure in the space above the stored liquid

##### **3.1.3**

##### **set pressure**

pressure at which the pressure relief device first opens

## EN 14015:2004 (E)

### 3.1.4

#### **set vacuum**

internal negative pressure at which a vacuum valve first opens

### 3.1.5

#### **test pressure**

pressure in the space above the test liquid during testing

### 3.1.6

#### **maximum design metal temperature**

temperature used for determining the maximum allowable stress for the material

### 3.1.7

#### **minimum design metal temperature**

temperature used for determining the material toughness requirements

### 3.1.8

#### **LODMAT (lowest one day mean ambient temperature)**

lowest recorded average temperature based over any 24 hour period

NOTE The average temperature is half (maximum temperature plus minimum temperature).

### 3.1.9

#### **purchaser**

company or its agent which prepares and agrees a proposal with a contractor for the design, construction and testing of a storage tank

### 3.1.10

#### **designer<sup>2)</sup>**

person or organization carrying out the engineering design of the tank

### 3.1.11

#### **contractor<sup>2)</sup>**

company with which the purchaser agrees a proposal for the design, construction and testing of a storage tank

### 3.1.12

#### **manufacturer<sup>2)</sup>**

organization carrying out the shop fabrication

### 3.1.13

#### **erector<sup>2)</sup>**

organization carrying out the construction on site

### 3.1.14

#### **inspector**

person or organization carrying out the inspection of the tank on behalf of the purchaser

### 3.1.15<sup>2)</sup>

#### **welding consumables manufacturer**

specific manufacturer of welding consumables

### 3.1.16

#### **supplier**

company manufacturing and supplying sub-assemblies

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<sup>2)</sup> A single organization may cover two or more of these activities.

**3.1.17**

**oxygenates**

oxygen compounds which may be added to fuels used for transport to enhance performance

NOTE Most commonly used ones are methanol, ethanol, methyl tertiary butyl ether (MTBE) and tertiary butyl alcohol (TBA).

**3.1.18**

**static electricity**

build-up of an electrical difference of potential or charge, through friction of dissimilar materials or substances e.g. product flow through a pipe

**3.1.19**

**operating basis earthquake (OBE)**

earthquake that the tank resists without any damage

**3.1.20**

**safe shutdown earthquake (SSE)**

earthquake that damages the tank without causing collapse or imposing serious consequential hazards

**3.1.21**

**floating roof**

metallic structure which floats on the surface of a liquid inside an open top tank shell, and in complete contact with this surface

**3.1.22**

**floating cover**

structure which floats on the surface of a liquid inside a fixed roof tank, primarily to reduce vapour loss

**3.1.23**

**contact type floating cover**

cover which floats in direct contact with the liquid with no space between the underside of the cover and the liquid surface

**3.1.24**

**non-contact type floating cover**

cover which is supported by buoyancy chambers or pontoons on the liquid surface causing the floating cover to be raised above the liquid surface, thus creating a void between the underside of the floating cover and the liquid surface

**3.1.25**

**cover**

main load bearing structure to which the peripheral (rim) seal is added

**3.1.26**

**peripheral (rim) seal**

seal mounted around the periphery of the floating roof or floating cover which contacts the tank shell and seals the annular gap

**3.1.27**

**cover skirt**

lightweight structure fitted to the periphery of a floating cover which protrudes above and is partially submerged in the stored liquid whose purpose is to prevent vapour escape from the underside of a non-contact type floating cover