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BSI Standards Publication

Static thermoplastic tanks for the above ground storage of chemicals — Blow moulded or rotationally moulded polyethylene tanks — Requirements and test methods

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National foreword

This British Standard is the UK implementation of EN 13575:2012. It supersedes BS EN 13575:2004 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PRI/62, Static thermoplastics tanks.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Static thermoplastic tanks for the above ground storage of chemicals - Blow moulded or rotationally moulded polyethylene tanks - Requirements and test methods

Réservoirs statiques thermoplastiques destinés au stockage non enterré de produits chimiques - Réservoirs en polyéthylène moulés par soufflage ou par rotation - Exigences et méthodes d'essai

Ortsfeste Tanks aus Thermoplasten für die oberirdische Lagerung von Chemikalien - Tanks aus blas- oder rotationsgeformtem Polyethylen - Anforderungen und Prüfverfahren

This European Standard was approved by CEN on 25 February 2012.

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This document (EN 13575:2012) has been prepared by Technical Committee CEN/TC 266 “Thermoplastic static tanks”, the secretariat of which is held by DIN.

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of an identical text or by endorsement, at the latest by October 2012, and conflicting national standards shall be withdrawn at the latest by October 2012.

This document supersedes EN 13575:2004.

The main changes compared to the previous edition are:

a) Clause 1, Scope: the field of application has been extended to tanks with a volume of 400 l to 10 000 l;

b) Clause 2, Normative references has been updated;

c) Clause 6, Evaluation of conformity has been revised and moved to Annex D in its entirety;

d) B.3. Tensile properties has been revised;

e) B.4, Chemical resistance has been revised with reference to EN ISO 23667;

f) C.8: For the pressure resistance test a support framework for tanks > 3 500 l is permitted;

g) Annex D has been deleted;

h) Annex E has been deleted;

i) The new Annex D "Evaluation of conformity" has been added;

j) The new Annex E "A-deviations" has been added due to the national regulations of the Netherlands.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

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

1 Scope

This European Standard specifies requirements for materials, physical properties and performance for blow moulded and rotationally moulded polyethylene single tanks, with or without reinforcement, for the above ground storage of chemical liquids having a maximum specific gravity of 1 400 kg/m^3 except water and those liquids dealt with by EN 13341.

It is only applicable to static blow moulded or rotationally moulded polyethylene tanks, which are subjected to atmospheric pressures but not subject to any external loading and having a volume of 400 l to 10 000 l. Except for periodic temperature fluctuation their normal operating temperature does not exceed 25 °C.

Tanks according to this European Standard are expected to have a period of intended use of 10 years.

This European Standard specifies test methods and factory production control tests as well.

NOTE National and/or international regulations above and beyond the requirements of this standard may apply to the storage of liquids and the installation of tanks.

2 Normative references

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

EN 13616, *Overfill protection devices for static tanks for liquid petroleum fuels*

EN ISO 179-1, *Plastics — Determination of Charpy impact properties — Part 1: Non-instrumented impact test (ISO 179-1:2000)*

EN ISO 293:2005, *Plastics — Compression moulding of test specimens of thermoplastic materials (ISO 293:2004)*

EN ISO 527-2:1996, *Plastics — Determination of tensile properties — Part 2: Test conditions for moulding and extrusion plastics (ISO 527-2:1993 including Corr 1:1994)*

EN ISO 1133, *Plastics — Determination of the melt mass-flow rate (MFR) and the melt volume-flow rate (MVR) of thermoplastics (ISO 1133:2005)*

EN ISO 1183-1, *Plastics — Methods for determining the density of non-cellular plastics — Part 1: Immersion method, liquid pyknometer method and titration method (ISO 1183-1:2004)*

EN ISO 1183-2, *Plastics — Methods for determining the density of non-cellular plastics — Part 2 Density gradient column method (ISO 1183-2:2004)*

EN ISO 1872-2:2007, *Plastics — Polyethylene (PE) moulding and extrusion materials — Part 2: Preparation of test specimens and determination of properties (ISO 1872-2:2007)*

EN ISO 4892-1, *Plastics — Methods of exposure to laboratory light sources — Part 1: General guidance (ISO 4892-1:1999)*

EN ISO 4892-2, *Plastics — Methods of exposure to laboratory light sources — Part 2: Xenon-arc lamps (ISO 4892-2:2006)*

EN ISO 23667:2007, *Packaging —Transport packaging for dangerous goods — Rigid plastics and plastics composite IBCs — Compatibility testing (ISO 23667:2007)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
tank
container for the storage of liquids at atmospheric pressure which retains its designed shape without any support when empty

3.2
brimful capacity (of a tank)
volume of water held by the tank filled through the filling orifice to the point of overflowing

3.3
maximum filling capacity (of a tank)
value of 95 % of the brimful capacity

3.4
reinforcement
constitutive element of a tank, which contributes to its mechanical stability

3.5
regrind
material prepared from clean, rejected, unused tanks, including trimmings from the production of tanks that will be reprocessed in a manufacturer's plant after having been previously processed by the same manufacturer in the production of tanks

4 Requirements for materials

4.1 Tank

Flammable liquids with a flash point > 55 °C may be stored in these tanks without further requirements.

Flammable liquids with a flash point ≤ 55 °C may be only stored in these tanks if the requirements concerning electrostatic behaviour according to CLC/TR 50404 are considered.

4.2 Material

The raw materials and samples taken from the tanks shall be tested and fulfil the requirements according to Table1.

The proportion of the regrind from the same material shall not exceed 50 % for blow-moulded tanks. Regrind shall not be used for rotationally moulded tanks.

If required by national authorities, creep curves similar to those given in Annex A shall be used to determine the long-term behaviour of the material.

If required by national authorities, the impact strength at low temperature shall be determined. When tested in accordance with C.6, the impact strength of a sample, cut from the tank, measured at - 18 °C shall be at least 75 % of the impact strength measured at (23 ± 2) °C.

Table 1 — Material requirements

Material type	Property	Requirement	Test method
Blow-moulded polyethylene	Density[a]	shall not be less than 938 kg/m^3	B.1
	Melt flow rate[b]	shall be less than 12 g/10 min at 190 ºC, 21,6 kg maximum increase of the melt flow rate of the moulded tank shall not be greater than 15 % of the value determined on the raw material	B.2
	Tensile strength [c]	tensile strength at yield shall not be less than 21 MPa elongation at yield shall not be more than 15 % elongation at break shall not be less than 200 %	B.3
Rotationally moulded polyethylene	Density[a]	shall not be less than 930 kg/m^3	B.1
	Melt flow rate[b]	shall be 4,0 g/10 min ± 3,0 g/10 min at 190 ºC, 2,16 kg maximum variation of the melt flow rate of the moulded tank shall not be greater than 20 % of the value determined on the raw material	B.2
	Tensile strength [c]	tensile strength at yield shall not be less than 15 MPa elongation at yield shall not be more than 25 % elongation at break shall not be less than 200 %	B.3
Blow-moulded polyethylene and rotationally moulded polyethylene	Resistance against chemical liquids[c]		
	Absorption behaviour	mass alteration shall be less than 10 %.	B.4.3
	Stress cracking resistance	either: After 28 days immersion the tensile strength shall not be less than 85 % of the reference sample without pin impression	B.4.4.2
		or: ---------- the time to 50 % failure shall not be less than 500 h	B.4.4.3
		or: ---------- the time to failure at reference stress 9 MPa shall not be less than 20 h	B.4.4.4
	Degradation test	the increase in melt flow rate shall not be more than 30 % reduction in elongation at break shall not exceed 50 % of that measured in B.3.	B.4.5
	Weather resistance[c]	For external installations after exposure to global irradiance of 34 GJ/m^2 (corresponding to an irradiance of 2,3 GJ/m² for the band from 300 nm to 400 nm) the elongation at break shall be greater than 50 % of the initial value. For internal installations the elongation at break after exposure to global irradiance of 3,4 GJ/m^2 (corresponding to an irradiance of 0,23 GJ/m² for the band from 300 nm to 400 nm) shall be greater than 50 % of the initial elongation at break. NOTE The manufacturer should ensure that changing the additive package does not decrease weather resistance.	B.5

[a] Test to be carried out on raw material.

[b] Test to be carried out on raw material and on tank.

[c] Test to be carried out on tank.

5 Design requirements

5.1 General

The requirements according to 5.2 to 5.6 are minimum requirements. Additionally openings, e.g. manholes or inspection hatches, are recommended.

5.2 Filling systems

In the case of direct fill, the opening for filling shall be a minimum of 38 mm in diameter and shall be covered with a cap or lid.

5.3 Venting systems

All tanks shall be equipped with venting facilities. The cross sectional area of the venting shall not be less than the cross sectional area of the filling system. The cross sectional area shall be sufficient to avoid either over- or under-pressure.

5.4 Suction/outlet system

Tanks shall be equipped with an opening permitting the safe and reliable connection of withdrawal systems. All fittings shall be corrosion resistant. The tank outlet may be installed above or below the liquid level.

5.5 Overfill alarm / overfill prevention system

All tanks, which are filled by fixed pipework, shall have on the top of the tank a provision to fit an appropriate overfill alarm/overfill prevention system, which in the case of liquid petroleum fuels shall be in accordance with the requirements of EN 13616.

5.6 Contents gauge connection facility

If the level of liquid can be seen through the walls of the tank a contents gauge is not required. In all other cases provision shall be made for a contents gauge to be fitted.

6 Requirements for tanks

Blow-moulded and rotationally-moulded tanks shall be tested according to Table 2 and Table 3.

Table 2 — Requirements for blow-moulded polyethylene thermoplastic tanks

<table>
<tr><th>Property</th><th>Requirement</th><th>Test method</th></tr>
<tr><td>Capacity</td><td>The brimful capacity shall be measured The maximum filling capacity, declared by the manufacturer, shall be checked.</td><td>C.1</td></tr>
<tr><td>Visual inspection</td><td>There shall be no bubbles, blisters or other defects in the tank wall which could cause a hole or fracture.</td><td>C.2</td></tr>
<tr><td>Mass</td><td>Minimum mass shall be the mass of the lightest tank.</td><td>C.3</td></tr>
<tr><td rowspan="10">Wall thickness</td><td>For tanks tested in accordance with C.7.1 the minimum wall thickness shall not be less than 2,5 mm.</td><td rowspan="10">C.4</td></tr>
<tr><td>For tanks tested in accordance with C.7.2, the minimum wall thickness shall be as follows, except for each area in which the surface does not exceed 300 mm^2, where a margin of 10 % shall be allowed regarding the minimum wall thickness. These areas shall be located a minimum of 50 mm from the bottom of the tank. The manufacturer shall declare in a document that the margin has no effects on the physical properties of the tank.</td></tr>
<tr><td>For maximum filling capacity | Minimum wall thickness</td></tr>
<tr><td>≥ 400 l, < 1 000 l | 3,0 mm</td></tr>
<tr><td>≥ 1 000 l, < 1 500 l | 3,2 mm</td></tr>
<tr><td>≥ 1 500 l, < 2 000 l | 3,5 mm</td></tr>
<tr><td>≥ 2 000 l, < 2 500 l | 3,7 mm</td></tr>
<tr><td>≥ 2 500 l, < 3 000 l | 3,9 mm</td></tr>
<tr><td>≥ 3 000 l, < 3 500 l | 4,0 mm</td></tr>
<tr><td>The minimum wall thickness of tanks with a maximum filling capacity ≥ 3 500 l shall be determined according to C.7.1.</td></tr>
<tr><td>Impact resistance</td><td>The tank shall remain leak tight.</td><td>C.5</td></tr>
<tr><td>Elongation</td><td>Elongation at the surface shall not exceed 1,5 % after 1 000 h.</td><td>C.7.1</td></tr>
<tr><td>Deformation</td><td>After refilling, the deformation shall conform to the following formulae:
$w_d \leq w_i + 100$ mm
$l_d \leq l_i + 200$ mm
where
l_d is the length of the tank after deformation in mm,
l_i is the initial length of the tank in mm,
w_d is the width of the tank after deformation in mm ,
w_i is the initial width of the tank in mm.</td><td>C.7.2</td></tr>
<tr><td>Pressure resistance</td><td>The tank shall be pressure resistant.
In the case of reinforced tanks, the reinforcement shall retain its reinforcing function up to a hydrostatic pressure corresponding to twice the tank height.</td><td>C.8</td></tr>
<tr><td>Leak tightness</td><td>The tank shall be leak tight.</td><td>C.9</td></tr>
</table>

Table 3 — Requirements for rotationally moulded polyethylene thermoplastic tanks

Property	Requirement		Test method
Capacity	The brimful capacity shall be measured. The maximum filling capacity, declared by the manufacturer, shall be checked.		C.1
Visual inspection	There shall be no bubbles, blisters or other defects in the tank wall which could cause a hole or fracture.		C.2
Mass	Minimum mass shall be the mass of the lightest tank.		C.3
Wall thickness	For tanks tested in accordance with C.7.1 the minimum wall thickness shall not be less than 2,5 mm.		C.4
	For tanks tested in accordance with C.7.2, the minimum wall thickness shall be as follows, except for each area in which the surface does not exceed 300 mm^2, where a margin of 10 % shall be allowed regarding the minimum wall thickness. These areas shall be located a minimum of 50 mm from the bottom of the tank. The manufacturer shall declare in a document that the margin has no effects on the physical properties of the tank.		
	For maximum filling capacity	Minimum wall thickness	
	≥ 400 l, < 1 000 l	3,3 mm	
	≥ 1 000 l, < 1 500 l	3,5 mm	
	≥ 1 500 l, < 2 000 l	3,9 mm	
	≥ 2 000 l, < 2 500 l	4,1 mm	
	≥ 2 500 l, < 3 000 l	4,3 mm	
	≥ 3 000 l, < 3 500 l	4,4 mm	
	≥ 3 500 l, < 5 000 l	4,8 mm	
	≥ 5 000 l, < 7 500 l	5,1 mm	
	≥ 7 500 l, < 10 000 l	5,4 mm	
Impact resistance	The tank shall remain leak tight.		C.5
Elongation	Elongation at the surface shall not exceed 1,5 % after 1 000 h.		C.7.1
Deformation	After refilling the deformation shall conform to the following inequalities: $w_d \leq w_i + 100$ mm $l_d \leq l_i + 200$ mm where l_d is the length of the tank after deformation in mm, l_i is the initial length of the tank in mm, w_d is the width of the tank after deformation in mm, w_i is the initial width of the tank in mm.		C.7.2
Pressure resistance	The tank shall be pressure resistant. In the case of reinforced tanks, the reinforcement shall retain its reinforcing function up to a hydrostatic pressure corresponding to twice the tank height.		C.8
Leak tightness	The tank shall be leak tight.		C.9

7 Marking, transport, handling and installation of tanks

7.1 Marking

The following information shall be marked legibly, visibly and durably on the tank:

a) permitted location (internal and/or external);

b) month and year of manufacture;

c) brimful capacity;

d) maximum filling level for translucent tanks;

e) EN 13575;

f) statement "For storage of chemicals as certified by the manufacturer";

g) serial number;

h) identification of manufacturer;

i) material type.

7.2 Transport and handling

The manufacturer's instructions and national requirements regarding transportation, storage, installation and maintenance shall be complied with.

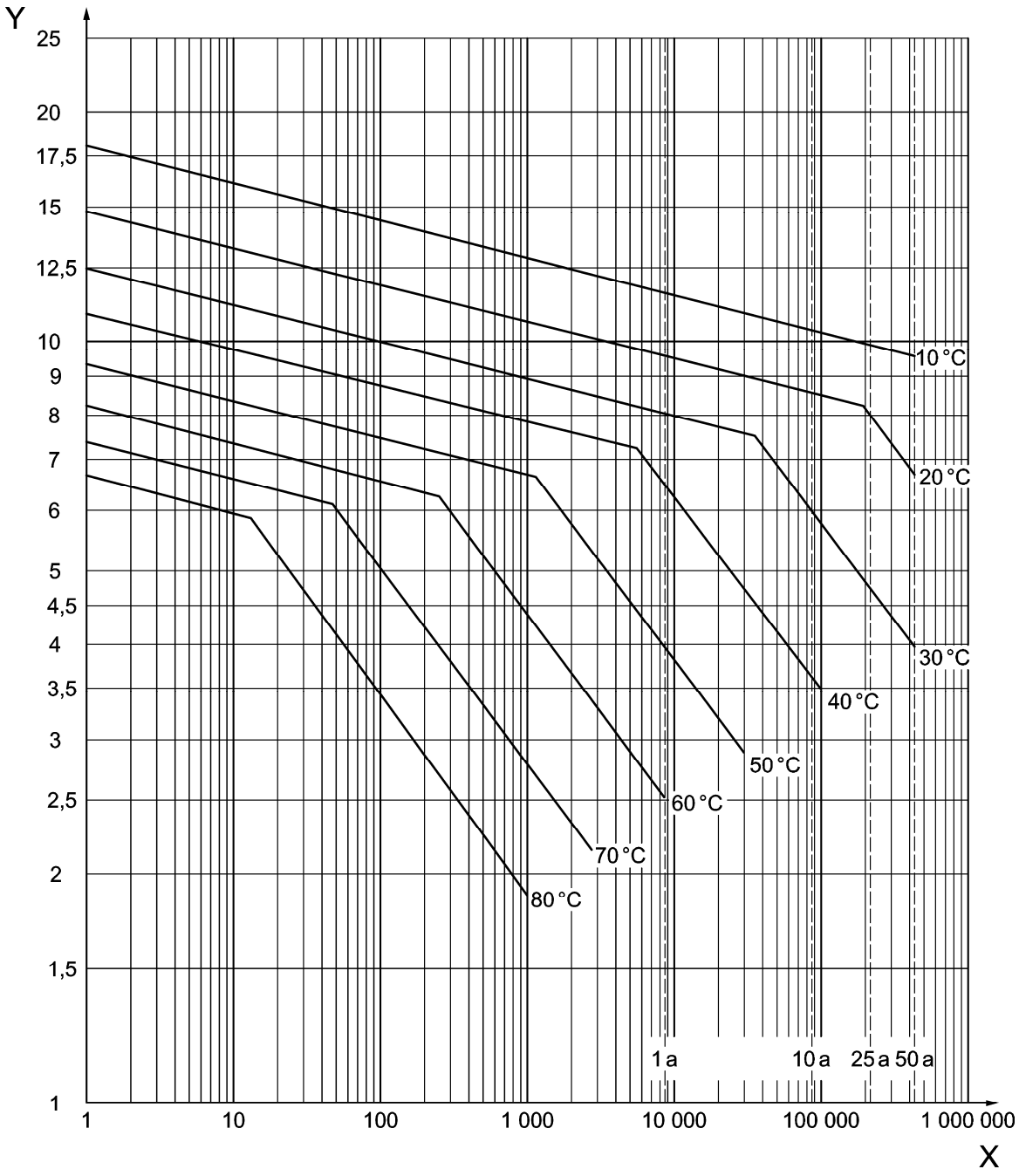
NOTE Special properties of the stored product should be taken into account.

7.3 Installation

The manufacturer shall provide installation instructions which, where relevant, shall also take into account wind and snow loading and ambient temperature.

Annex A
(informative)

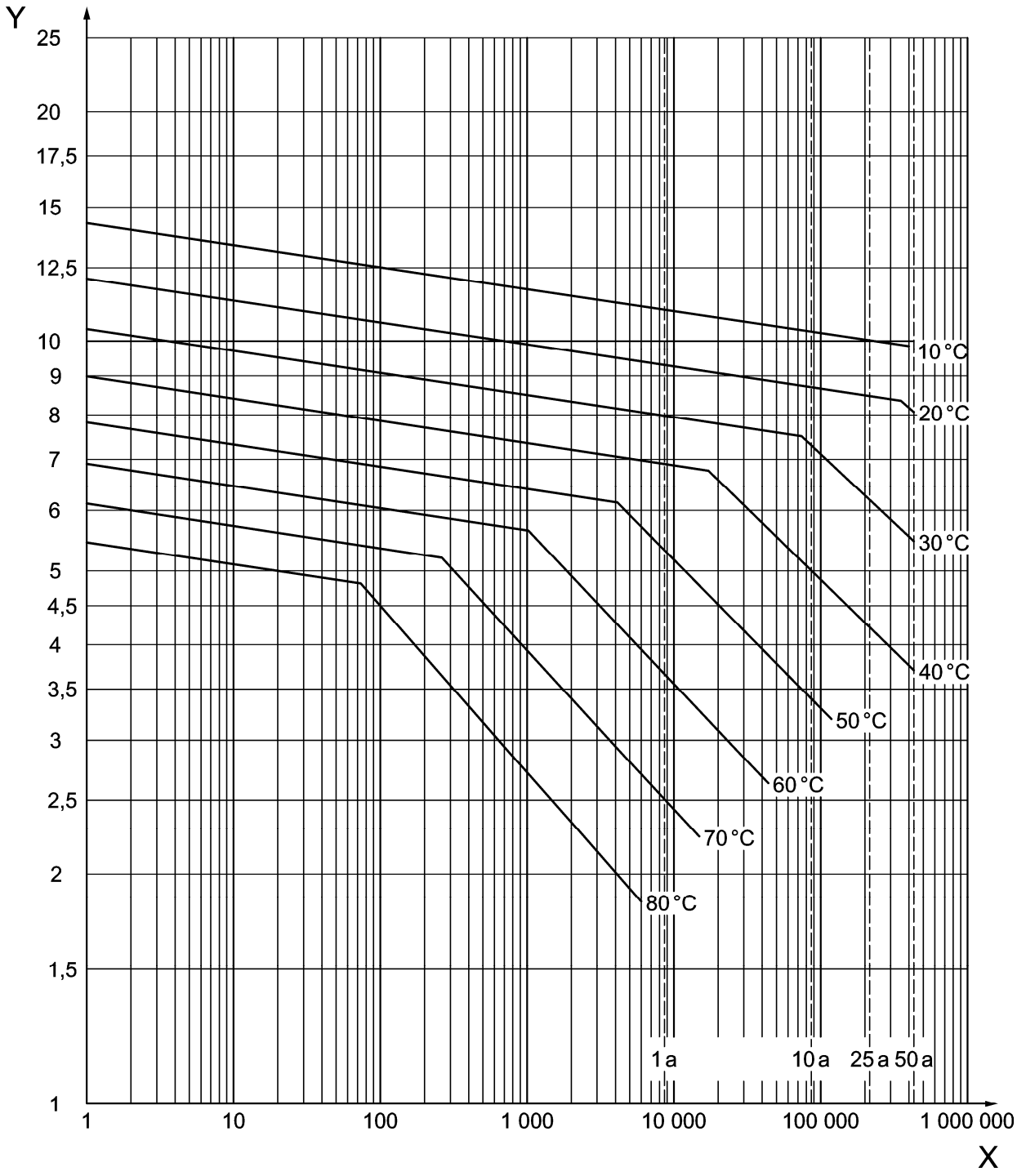
Creep curves



Key

X Hoop stress in MPa
Y Rupture time in hours

Figure A.1 — Creep rupture time of PE-HD-pipes (rotational moulding grades)



Key

X Hoop stress in MPa
Y Rupture time in hours

Figure A.2 — Creep rupture time of PE-HD-pipes (blow moulding resin)

Annex B
(normative)

Test methods for determination of material characteristics

B.1 Density

The density of the raw material shall be measured in accordance with EN ISO 1183-1 or EN ISO 1183-2. The method in accordance with EN ISO 1872-2 shall be used to anneal the specimen.

B.2 Melt flow rate

The melt flow rate of the raw material and of a section taken from any location on the moulded tank shall be measured in accordance with EN ISO 1133, using condition G for blow-moulded polyethylene and condition D for rotationally moulded polyethylene.

B.3 Tensile properties

B.3.1 Blow moulded polyethylene

The test shall be carried out in accordance with EN ISO 527-2:1996 at a testing speed of 100 mm/min, using Type 1B test pieces from plates cut out of the original wall of the blow-moulded tank in the direction of extrusion.

For the determination of elongation at break after artificial weathering (see B.4), the type 1BA test pieces shall be prepared by machining weathered plates cut out of the original wall after the exposure of the plates to artificial weathering.

NOTE The thickness of the test piece can vary from the requirements of EN ISO 527-2:1996 since it is obtained from the original wall of the tank.

B.3.2 Rotationally moulded polyethylene

B.3.2.1 Preparation of compression moulded specimen

Use a moulding press and mould in accordance with 4.1 and 4.2 of EN ISO 293:2005 respectively. The mould thickness shall be appropriate to obtain a final thickness of the compression-moulded specimen of (3±0,2) mm.

Cut a square specimen in the wall thickness of the moulded tank of a mass calculated to fill 105 % of the volume of the cavity of the mould

The compression-moulded specimen shall be prepared using the conditions specified in Table 2 of EN ISO 1872-2:2007, except for the moulded temperature to be applied which shall be 200°C, to obtain the final thickness of (3 ± 0,2) mm.

B.3.2.2 Tensile testing

The test shall be carried out in accordance with EN ISO 527-2:1996 at a testing speed of 100 mm/min, using type 1BA test pieces cut in a specimen prepared according to B.3.2.1.

For the determination of elongation at break after artificial weathering (see B.4), the type 1BA test pieces shall be prepared by machining the weathered specimens.

B.4 Chemical resistance

B.4.1 Introduction

Three types of degradation mechanisms might be observed on polyethylene in contact with chemicals:

— Softening through swelling (refer to absorption behaviour according to B.4.3);

— Cracking under stress (refer to stress cracking resistance according to B.4.4);

— Molecular degradation (refer to degradation test according to B.4.5).

B.4.2 General

For chemicals assimilated to (a) standard liquid(s) according to the procedure given in Annex C of EN ISO 23667:2007, the chemical resistance shall be proven with the appropriate standard liquid(s) defined in Annex A of EN ISO 23667:2007 (see Table B.1).

Table B.1 — Test to do for chemicals assimilated according to Annex C of EN ISO 23667:2007

Standard liquids	No test needed	Absorption behaviour (B.4.3)	Stress cracking resistance (B.4.4)	Degradation test (B.4.5)
Water	X			
Wetting solution			X	
Acetic acid			X	
Normal butyl acetate		X	X	
Mixture of hydrocarbons (white spirit)		X		
Nitric acid				X

For all other chemicals not assimilated in accordance with Annex C of EN ISO 23667:2007 or not listed in Table C.1 of EN ISO 23667:2007, the chemical resistance shall be tested by the chemical itself, taking into account the relevant type(s) of degradation mechanism(s) as defined in B.4.

B.4.3 Absorption behaviour

The test shall be carried out using the Method A test procedure described in B.4.1.2 to B.4.1.8 of EN ISO 23667:2007.

The test liquid shall be the appropriate standard liquid in accordance with Table B.1 or the chemical intended to be stored.

B.4.4 Stress cracking resistance

B.4.4.1 General

The stress crack resistance shall be measured using either the pin impression test according to B.4.4.2 or the bent strip test according to B.4.4.3 or the full-notch creep test (FNCT) according to B.4.4.4.

B.4.4.2 Pin impression test

The test shall be carried out using the Method B1 test procedure described in B.4.2.2 of EN ISO 23667:2007.

The test liquid shall be the appropriate standard liquid in accordance with Table B.1 or the chemical intended to be stored.

The evaluation compares the maximum stress of the unstressed specimen as initial value and the maximum stress of the tested specimens after the storage periods of 7, 14, 21 and 28 days. By conversion of these maximum stress values to %, in reference to the initial value, the residual tensile strength is determined.

$$\frac{\sigma_{yield}\ \text{stored}}{\sigma_{yield}\ \text{initial}} \geq 0{,}85\ \text{after 28 days}$$

B.4.4.3 Bent strip test

According to Method B2 of EN ISO 23667:2007.

The test shall be carried out under the following conditions:

— Preconditioning: none,

— Test temperature: 50 °C,

— Test solution: an aqueous solution of 1% of alkyl benzene sulphonate, or an aqueous solution of 5% nonylphenol ethoxylate, which has been preliminarily stored for at least 14 days at a temperature of 40 °C before being used for the first time for the tests or the chemical intended to be stored.

B.4.4.4 Full-notch creep test (FNCT)

The full-notch creep test shall be carried out using Method B3 of EN ISO 23667:2007.

The test conditions shall be:

— Stress level: 9 MPa,

— Dimension of the sample: 90 mm × 6,0 mm × 6,0 mm,

— Notch depth: 1,0 mm,

— Notch radius: < 20 μm,

— Test solution: an aqueous solution of 1% of alkyl benzene sulphonate, or an aqueous solution of 5% nonylphenol ethoxylate, which has been preliminarily stored for at least 14 days at a temperature of 40 °C before being used for the first time for the tests or the chemical intended to be stored.

B.4.5 Degradation test

This test shall be carried out either according to Method C1 of EN ISO 23667:2007 or according to Method C3 of EN ISO 23667:2007.

The test liquid shall be nitric acid or the chemical intended to be stored.

B.5 Weather resistance

Samples shall be taken from the moulded tank and shall be exposed to UV radiation in accordance with EN ISO 4892-1 and EN ISO 4892-2.

The test shall be carried out under the following conditions:

a) xenon arc lamp;

b) black standard temperature 65 °C;

c) relative humidity 65 %;

d) spray cycle:

   1) duration of spray: 18 min,

   2) dry interval between spraying: 102 min.

Annex C
(normative)

Test methods for determination of tank characteristics

C.1 Capacity

The tank shall be conditioned at (20 ± 5) °C for 48 h and then be filled to the point of overflow at a rate of (150 ± 40) l/min with water at (15 ± 5) °C. After 10 min the tank shall be filled again to overflow and the capacity shall be measured to an accuracy of ± 1 %.

C.2 Visual inspection

The visual inspection shall be carried out with suitable illumination in order to detect faults according to Table 2 or 3 as applicable

The marking in accordance with Clause 7 shall be checked.

C.3 Mass

The mass of the tank shall be measured with all moulded-in inserts, without reinforcements and accessories to an accuracy of ± 0,5 %.

Record the mass of the tank.

C.4 Wall thickness

The wall thickness shall be determined round to the nearest 0,1 mm using ultrasonic wall thickness measurement equipment calibrated in accordance with the manufacturer's instructions. A reference test piece of similar thickness, manufactured by the same process and from the same raw material as the tank, shall be used for calibration.

C.5 Impact

The tank shall be filled to overflow with water at a temperature of (15 ± 5) °C.

An impact hammer or pendulum (in the form of an equilateral triangle with rounded tips and edges having radii of 3 mm) shall be used. The five most vulnerable surfaces of the tank (normally in corners or stiff sections) shall be subjected to an impact of 30 J, see Figure C.1.

C.6 Impact strength at low temperature

The impact strength shall be measured according to EN ISO 179-1. The specimens shall be cut from a sample from the tank wall. The specimens shall be Type 1 according to EN ISO 179-1 and the test method shall be ISO 179-1/1eA. 4 mm sample thickness is preferred but 4 mm to 8 mm is acceptable. 10 specimens shall be cooled to –18 °C in a chest freezer for more than 4 h. The specimen shall be tested edgewise as rapidly as possible, making sure the temperature does not rise significantly (one specimen at a time is taken from the freezer taking care not to warm up the middle part of the specimen). The 10 specimens shall be tested accordingly in a test room at (23 ± 2) °C.

Dimensions in millimeters

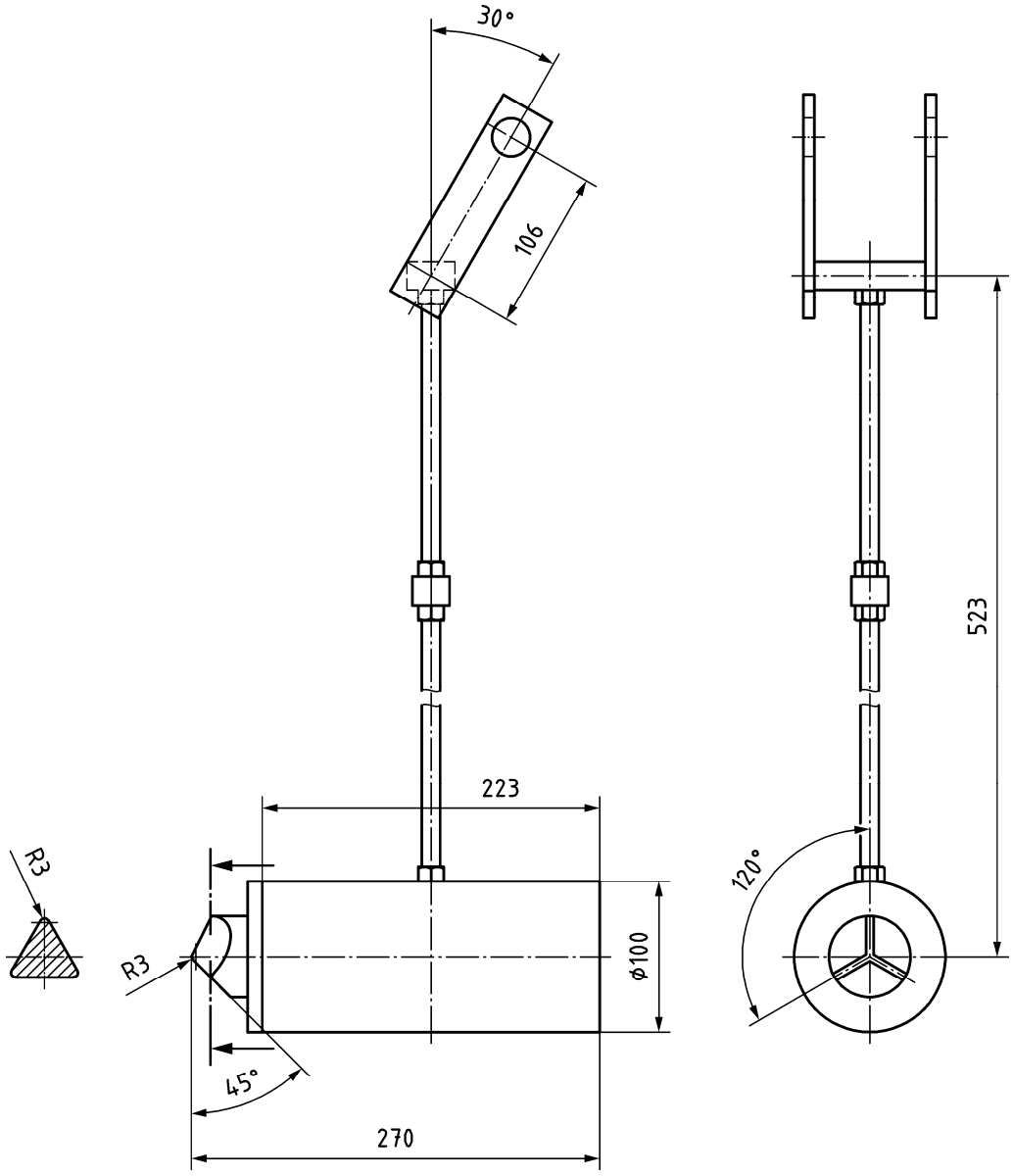


Figure C.1 — Impact test equipment

C.7 Elongation or deformation

C.7.1 Elongation

The elongation test shall be carried out on the lightest tank at (23 ± 2) °C.

At points where the greatest deformation is expected, a minimum of five expansion measurement strips shall be fitted (use the results from the pressure resistance test in accordance with C.8 to determine the measuring points).

The tank shall be filled with water at a temperature not exceeding 23° C. The test pressure shall correspond to 1,3 times the hydrostatic pressure at the deepest part of the tank calculated with the density of the stored chemical and shall be kept constant for 1 000 h. The expansion shall be measured per decade at least three times in logarithmically equal intervals (at least nine measurements in 1 000 h).

C.7.2 Deformation

A tank shall be subjected to a test pressure corresponding to 1,3 times the hydrostatic pressure at the deepest part of the tank calculated with the density of the stored chemical for a minimum of 30 days and a maximum of 42 days.

Reinforced tanks shall be tested with their reinforcements.

The temperature of the test room shall be (23 ± 2) °C and the pressure variation during the test shall not exceed 2 %.

The tank shall be placed on flat ground with reference to a measurement grid so as to be able to determine its length and width.

The tank shall be stabilized by filling it with 30 cm of water.

The initial length (l_i) and height (h_i) shall be determined, and the initial width (w_i) shall be measured in at least three cross-sections where the deformation, due to the hydrostatic pressure, is most critical.

The tank shall be filled to brimful capacity at a filling rate of (700 ± 100) l/h and shall be pressured to 1,3 h_i.

The total amount of water added to the tank at filling and pressuring stage shall be determined, and the length and width shall be measured at the same locations after 5, 18 and 27 days.

From day 28, the volume change shall be measured until the volumetric deformation has been stabilized for 2 successive days to a maximum of 42 days.

The volumetric deformation is stable when the value is not greater than 0,015 % volume per day for tanks up to and including 3 800 l maximum filling capacity or 0,02 % volume for tanks over 3 800 l.

After stabilisation the length (l_d) and the width (w_d) shall be measured.

C.8 Pressure resistance

The second lightest tank shall be used for the test and shall be filled with water of (15 ± 5) °C. The opening shall be closed with reinforced or metal caps.

Reinforced tanks shall be tested with their reinforcements.

The tank shall be tested with five times the pressure resulting from hydrostatic pressure based on the height of the tank and measured at its base. The hydrostatic pressure shall be calculated with the maximum density of allowed chemicals.

After the tank is filled the pressure shall be increased using a filling rate of 10 l/min up to the test pressure and shall be held at this pressure for 5 min.

NOTE The pressure may be increased up to bursting of the tank for additional information.

During the pressure increase, the condition of the reinforcement shall be observed up to twice the hydrostatic pressure.

For tanks with a maximum filling capacity of over 3 500 l, a support framework which restrains the tank vertically between its base and its top is permitted during testing. The top part of the framework shall not support more than 20 % of the surface area of the top of the tank and the framework shall not restrain the deformation of the sides of the tank during testing.

C.9 Leak tightness

All tanks (whether reinforced or not) shall be subjected to a pneumatic pressure of 30 kPa for at least 15 s or 10 kPa for at least 60 s.

Annex D
(informative)

Evaluation of conformity

D.1 General

The compliance of thermoplastic tanks with the requirements of this standard and with the stated values should be demonstrated by:

- initial type test;
- factory production control (FPC) by the manufacturer, including product assessment.

For the purposes of testing, thermoplastic tanks may be grouped into families, where it is considered that the results for one or more characteristics are representative for those same characteristics for all others within that family.

NOTE Tanks can be in different families for different characteristics.

D.2 Type testing

Initial type testing (ITT) should be performed to demonstrate conformity with this standard for all tanks.

Tests previously performed in accordance with the provisions of this standard (same tank, same characteristic, test method, sampling procedure, etc) may be taken into account.

All characteristics in Clause 4 should be subjected to ITT.

Whenever one of the following circumstances occur, the type test as given in Table 2 should be repeated:

1) when the method of production is altered in such a way as to affect type test performance;

2) when the manufacturer changes the base polymer grade used;

3) when changes are made in the dimensions of wall thickness height, diameter, length, width or configuration for any one tank capacity;

4) when the maximum density of the liquid to be stored increases;

5) if the chemical liquid to be stored changes.

Table D.1 indicates tests given in Annexes B and C that should be used for the initial type tests of the tanks.

Table D.1 — Initial type tests of the tank

Property	Test Method	Circumstance requiring initial type test
Density	B.1	2)
Melt flow rate	B.2	
Tensile	B.3	
Resistance against chemicals	B.4	2); 5)
Weather resistance	B.5	2)
Capacity	C.1	1); 2); 3)
Visual inspection	C.2	
Mass	C.3	
Wall thickness	C.4	
Impact	C.5	
Elongation or deformation[a]	C.7	1); 2); 3); 4)
Pressure resistance	C.8	

[a] The choice of the test method depends on the minimum wall thickness, see Table 2 and Table 3.

D.3 Factory production control

The manufacturer should establish, document and maintain a FPC system to ensure that the products placed on the market conform to the stated performance characteristics. The FPC should consist of procedures, regular inspections and tests and/or assessments and the use of the results to control raw and other incoming materials or components, equipment, the production process and the product.

The tests listed in Table D.2 should be used to determine whether conformity is maintained during production; and records should also be maintained within a factory production control system. The documentation regarding the factory production control should be kept for at least 10 years.

Table D.2 — Factory production control

Property	Test method	Test to be carried out on tank and/or raw material	Frequency
Melt flow rate	B.2	Tank	Once every working week on a programme that covers all machines
		Raw material[a]	Every new batch
Visual inspection	C.2	Tank	Every tank
Mass	C.3	Blow-moulded tank	Every tank
		Rotationally-moulded tank	Every shot and a tank per shift
Wall thickness	C.4	Tank	Every tank at its critical points as identified by the manufacturer and an overall test per shift. The minimum wall thickness shall be the wall thickness as determined by the initial type test.
Leak tightness	C.9	Tank	Every tank

[a] This requirement may be waived if the raw material manufacturer supplies a Type 3.1 certificate in accordance with EN 10204 with each delivery certifying that the melt flow rate of the material supplied is in compliance with the requirements of this standard.

Annex E
(informative)

A-deviations

A-deviation: National deviation due to regulations, the alteration of which is for the time being outside the competence of the CEN-CENELEC member.

European Standard not under any EU Directive

This European Standard does not fall under any Directive of the EU. In the relevant CEN-CENELEC countries these A-deviations are valid instead of the provisions of the European Standard until they have been removed.

The Netherlands

- Directive dated October 19th, 2007, concerning general legislation for installations (Directive general legislation for environmental management) /
  Besluit van 19 oktober 2007, houdende algemene regels voor inrichtingen (Besluit algemene regels voor inrichtingen milieubeheer – BARIM)

- Regulations from the Minister of Housing, Spatial Planning and Environment dated November 9th, 2007, no. DJZ2007104180, concerning general regulations for installations (Regulations general legislation for environmental management) /
  Regeling van de Minister van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer van 9 november 2007, nr. DJZ2007104180, houdende algemene regels voor inrichtingen (Regeling algemene regels voor inrichtingen milieubeheer – RARIM)

- Publication series Dangerous Goods 30:2005 “Liquid petroleum products – Outside storage in small installations" /
  Publicatiereeks Gevaarlijke Stoffen 30:2005 “Vloeibare aardolieproducten – Buitenopslag in kleine installaties”

- BRL-K903 “Regulations for installers of tank installations (REIT)” /
  BRL-K903 “Regeling Erkenning Installateurs Tankinstallaties (REIT)”

Based on the above legislation the rotationally moulded polyethylene thermoplastic tanks complying with EN 13575 shall comply with the following requirements:

A) Clause 1: Scope

The tank design shall be based on the following:

- a life expectancy of 20 years;

- in the case of outside installation:
  - an ambient temperature between – 20 °C to + 40 °C;
  - a maximum wind speed of 45 m/sec;
  - snow loads of a maximum of 20 cm on the projected tank surface;
  - adequate measures when storing fluids that are susceptible to degradation when directly or indirectly exposed to sunlight, to prevent the degradation of the fluid stored.

B) Clause 4 – Table 1: Requirements for materials

1. Density

The density of the raw material shall not be less than 934 kg/m³ when determined according to EN ISO 1183-1 method B and EN ISO 1183-2. Annealing of the specimen shall be in accordance with EN ISO 1872-2.

2. Oxidation induction time (OIT)

The isothermal oxidation induction time (OIT) of the polyethylene material, when determined according to ISO 11357-6 with a test temperature of 200 °C, shall not be less than 20 minutes. Preferably, the tangent method shall be used, and when this is not possible the offset method with a trigger value of 0,05 W/g shall be used. The test samples shall be taken from the inside surface of the tank and the test shall be carried out in duplicate.

3. Melt temperature

The polyethylene used for the manufacture of the tank shall have a minimum melt temperature of + 120 °C when measured by means of the Differential Scanning Calorimetric method in accordance with ISO 11357-5.

4. Resistance to chemicals

Testing of the resistance to chemicals will be in accordance with EN 13575 with the following additional requirements:

— Only for those liquids, where the reduction factor A_{2K} =1 for HDPE as listed in EN 1778, no additional testing will be required.

— For the storage of chemicals with a reduction factor A_{2K} for HDPE greater than 1 but lower than or equal to 1.4, as listed in the EN 1778, the manufacturer shall provide the Certification Body with suitable calculations proving the acceptability of the design.

— For the storage of chemicals not listed in EN 1778, or where EN 1778 gives no information regarding the value A_{2K} for HDPE, the suitability of the material of the tank and spill container shall be demonstrated using the standard liquid or the actual chemical to be stored in accordance with the requirements of EN 13575. Hereby the samples shall be exposed to the chemical which will be maintained at (40 ± 2) °C until equilibrium is reached i.e. the change in weight after 1 week is less than 0,5 %.

C) Clause 5: Design requirements

1. General

All connections shall be on top of the tank. Only flanged connections are allowed, and these are to be welded on top of the tank. Connections below the maximum fluid level are not allowed.

2. Manhole or inspection openings

All tanks shall be provided with either a manhole opening or an inspection opening. The manhole opening shall have a minimum internal diameter of 600 mm and shall be located on top of the tank. The inspection opening shall have a minimum diameter of 100 mm and shall be provided with a means of being secured in place so that it can only be used for the intended purpose.

3. Filling opening

All tanks shall be provided with an opening for filling with a minimum size of DN 50. Direct filling of the tank is not allowed.

4. Suction opening

All tanks shall be provided with an opening for the suction with a minimum size of DN 50. This opening shall be on top of the tank. An opening below the maximum liquid level is not allowed.

D) Clause 6 – Table 3: Requirements for rotationally moulded polyethylene thermoplastic tanks

1. Wall thickness

The wall thickness of the tank shall be as follows:

Table E.1 — Wall thickness

Maximum filling capacity	Nominal wall thickness	Minimum wall thickness
> 450 litre < 1 000 litre	6,5 mm	3,3 mm
≥ 1 000 litre < 1 500 litre	7,5 mm	3,5 mm
≥ 1 500 litre < 2 000 litre	9,0 mm	3,9 mm
≥ 2 000 litre < 2 500 litre	9,0 mm	4,1 mm
≥ 2 500 litre < 3 000 litre	10,0 mm	4,3 mm
≥ 3 000 litre < 3 500 litre	10,0 mm	4,4 mm
≥ 3 500 litre < 4 000 litre	10,0 mm	4,8 mm
≥ 4 000 litre < 5 000 litre	10,0 mm	4,8 mm
≥ 5 000 litre < 7 500 litre	11,0 mm	5,1 mm
≥ 7 500 litre ≤ 10 000 litre	13,0 mm	5,4 mm

The nominal wall thickness of the tank is the wall thickness at the critical areas of the tank, i.e. at the lower knuckle radius with a lower tolerance of - 1,5 mm. At the less critical areas, i.e. the upper part of the tank, the minimum wall thicknesses as specified in Table E.1 shall be met. Critical areas are areas where the design analyses show the stresses to be the highest.

The above specified wall thicknesses are suitable for the storage of chemicals with a maximum density of 1 400 kg/m^3. Should the manufacturer consider the storage of chemicals with a higher density, then the wall thicknesses shall need to be increased to meet this application. In such cases the manufacturer shall obtain prior approval.

2. Pressure resistance

The minimum pressure for conducting this test in accordance with EN 13575 shall be 50 kPa. All types and sizes shall be tested for the initial type test.

Bibliography

[1] EN 1778:1999, *Characteristic values for welded thermoplastics constructions — Determination of allowable stresses and moduli for design of thermoplastics equipment*

[2] EN 10204:2004, *Metallic products — Types of inspection documents*

[3] EN 13341, *Static thermoplastic tanks for above ground storage of domestic heating oils, kerosene and diesel fuels — Blow moulded and rotationally moulded polyethylene tanks and rotationally moulded tanks made of anionically polymerized polyamide 6 — Requirements and test methods*

[4] ISO 11357-5, *Plastics — Differential scanning calorimetry (DSC) — Part 5: Determination of characteristic reaction-curve temperatures and times, enthalpy of reaction and degree of conversion*

[5] ISO 11357-6, *Plastics — Differential scanning calorimetry (DSC) — Part 6: Determination of oxidation induction time (isothermal OIT) and oxidation induction temperature (dynamic OIT)*

[6] CLC/TR 50404, Electrostatics — Code of practice for the avoidance of hazards due to static electricity

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