DEAS 1305: 2025

ICS 83.083.01

DRAFT EAST AFRICAN STANDARD

Moulded polyethylene chemical storage tank — Specification

EAST AFRICAN COMMUNITY

First Edition 2025

Copyright notice

Contents

Page

Foreword

Development of the East African Standards has been necessitated by the need for harmonizing requirements governing quality of products and services in the East African Community. It is envisaged that through harmonized standardization, trade barriers that are encountered when goods and services are exchanged within the Community will be removed.

The Community has established an East African Standards Committee (EASC) mandated to develop and issue East African Standards (EAS). The Committee is composed of representatives of the National Standards Bodies in Partner States, together with the representatives from the public and private sector organizations in the community.

East African Standards are developed through Technical Committees that are representative of key stakeholders including government, academia, consumer groups, private sector and other interested parties. Draft East African Standards are circulated to stakeholders through the National Standards Bodies in the Partner States. The comments received are discussed and incorporated before finalization of standards, in accordance with the Principles and procedures for development of East African Standards.

East African Standards are subject to review, to keep pace with technological advances. Users of the East African Standards are therefore expected to ensure that they always have the latest versions of the standards they are implementing.

The committee responsible for this document is Technical Committee EASC/TC 072, *Plastics and related products*

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

Moulded polyethylene chemical storage tank — Specification

1 Scope

This Working Draft East African Standard specifies requirements, sampling and test methods for rotational and blow moulded flat bottom, upright cylindrical polyethylene chemical storage tanks for storage of chemical liquids having a maximum specific gravity of 1400 kg/m^3, designed for a service temperature of not more than 60ºC.

This Working Draft East African Standard covers the design of stationery vessels for use at atmospheric pressure intended for storage/use with liquid chemicals heated below their flash points.

This standard is not applicable to underground tanks, mobile water tanks and horizontal cylindrical water tanks.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

ISO 1133-1, *Plastics — Determination of the melt mass-flow rate (MFR) and melt volume-flow rate (MVR) of thermoplastics — Part 1: Standard method*

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

ISO 18872, *Plastics — Determination of tensile properties at high strain rates*

ISO 23900-3, *Pigments and extenders — Methods of dispersion and assessment of dispersibility in plastics — Part 3: Determination of colouristic properties and ease of dispersion of black and colour pigments in polyethylene by two-roll milling*

ISO 1209-1, *Rigid cellular plastics — Determination of flexural properties — Part 1: Basic bending test*

ISO 1209-2, *Rigid cellular plastics — Determination of flexural properties — Part 2: Determination of flexural strength and apparent flexural modulus of elasticity*

ASTM D2837, *Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
net capacity
value of 95 % of the brimful capacity

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

3.3
mould parting line
circumferential line visible only on the external surface of the tank corresponding to a parting joint of the mould required for rotational moulding (see Figure 1 and Figure 2)

3.4
overall height
height of the finished empty tank at its highest point, including the top rim of the manhole and lid of the tank (see Figure 1 and Figure 2)

3.5
effective height
height of the finished empty tank from its base to the point where overflow connection is provided for the purpose of limiting water storage capacity (see Figure 1 and Figure 2)

3.6
overall diameter
maximum outer diameter of the finished empty tank measured at its base (see Figure 1 and Figure 2)

3.7
manhole/handhold hole
hole of suitable internal diameter provided at the top of the tank for the purpose of inspection of internal surface and entry into the tank (see Figure 1)

3.8
internal diameter of manhole/hand-hole
internal diameter of the rim of the manhole measured as the mean of two perpendicular diameters (see Figure 1 and Figure 2)

3.9
closed tank
tank moulded as a single piece with the top as an integral part (see Figure 1)

3.10
open top tank
tank where the body and top are moulded separately and assembled after moulding (see Figure 2)

3.12
elongation
increase in distance between references likes on the narrow parallel portion of the test specimen, due to a tensile load, and expressed as a percentage of the initial distance between the reference lines

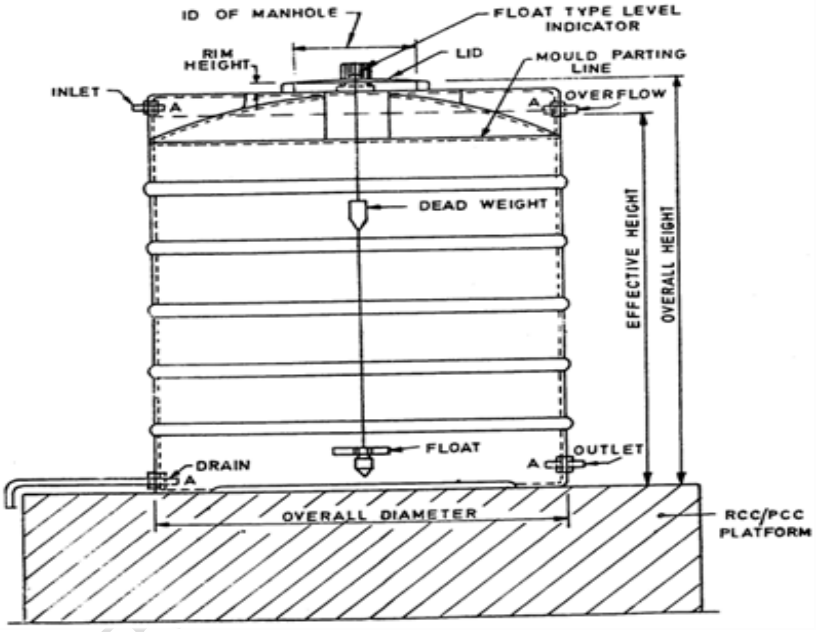
3.13
flash point
lowest liquid temperature at which, under certain standardized conditions, a liquid gives off vapours in a quantity such as to be capable of forming an ignitable vapour/air mixture

3.14
bottom knuckle radius
radius of curvature at the junction where the tank wall meets the bottom plate

3.15
Impact failure
any crack in the test specimen resulting from the impact and visible in normal room lighting to a person with normal eyesight

3.16
rotational molding
three-stage commercial process consisting of loading the mold with powdered resin,fusing the resin by heating while rotating the mold about more than one axis, and cooling and removing the molded article

3.16
service factor
number less than 1.0 (that takes into consideration all the variables and degrees of safety involved in a polyethylene storage tank installation) that is multiplied by the hydrostatic design basis to give the design hoop stress



Key

RCC Reinforcement

PCC Pre-cast cement concrete

Figure 1 — Typical view of closed top tank

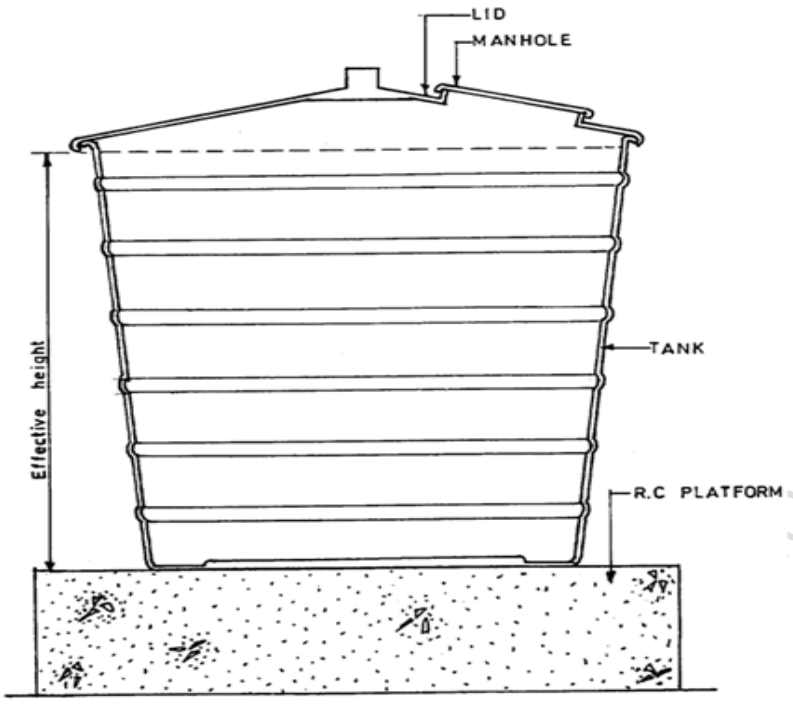


Figure 2— Typical view of open top tank

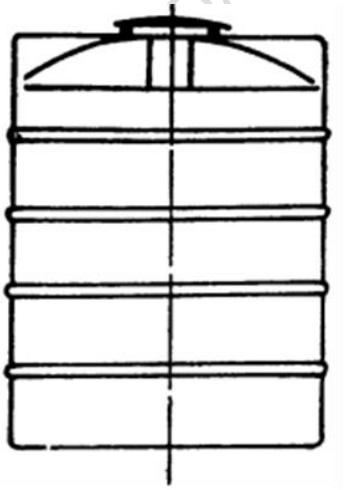


Figure 3a) — Cylindrical vertical with closed top

5 Requirements

5.1 General requirements

5.1.1 For safety from chemicals, and prevention of contamination all polyethylene chemical storage tanks shall be of closed top.

5.1.2 The nominal service temperature shall be upto 60 °C.

5.1.3 The lid of the tank shall fit securely over the top rim of the tank, and it shall rest evenly on it in order to prevent the ingress of contaminants through the top of the tank. The lid shall be provided with a suitable closing system.

5.1.4 For tank installation that falls under the scope of National Fire Protection Association, NFPA 30 (Flammable and Combustible Liquids Code) or NFPA 31 (Standard for Installation of Oil-Burning Equipment), the requirements of those standards shall be complied with in addition to this standard.

5.1.5 This tank shall be designed to withstand the pressure exerted by the height of the chemical it contains known as its hydrostatic head

5.1.6 Design calculations (e.g., wall thickness, bottom knuckle radius, laminate strength, tank capacity e.tc) shall be based on the maximum fill height and density of chemicals to be stored.

5.1.7 All tank installations shall be such that the tank rests on a flat, level surface that provides even support across the entire bottom.

5.1.8 The chemical storage tank shall be made from material that does not react with the chemicals to be stored.

5.1.9 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.

5.2 Materials

5.2.1 The tank shall meet the material requirements given in Table 1.

Table 1 — Requirements for materials

Material type	Property		Requirement	Test method
Rotationally moulded polyethylene	Density[a], kg/m3, min.		930	ISO 1183-1
	Melt flow rate[b] at 190 ºC and 2.16 kg		4.0 g/10 min ± 3.0 g/10 min[d]	ISO 1133-1
	Tensile strength[c]	At yield, MPa, min.	12	ISO 18872
	Elongation	Elongation at yield, %, max.	25	
		Elongation at break, %, min.	200	
Blow-moulded polyethylene	Melt flow rate[b] at 190 ºC and 2.16 kg	4.0 g/10 min ± 3.0 g/10 min[d]	ISO 1133-1	Melt flow rate[b] at 190 ºC and 2.16 kg
	Tensile strength[c]	At yield, MPa, min.	12	Tensile strength[c]
	Density[a], kg/m3, min.	930	ISO 1183-1	Density[a], kg/m3, min.

[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.

[d] 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

Note The parameters related to raw materials serve as guidance for the manufacturer and shall be tested exclusively by the manufacturer.

5.2.2 All polyethylene resin materials shall contain UV stabilizer as compounded by the resin manufacturer or compounded by the tank manufacturer, which is applicable to the layer that is exposed to the sun.

5.2.3 If carbon black pigment is added to the moulding material for the outer layer or the exposed layer and it shall be 2.5 % ± 0.5 % when tested in accordance with Annex A.

5.2.4 The carbon black or any other UV stabilizer added shall be uniformly dispersed in the material, when tested in accordance with Method A of ISO 23900-3.

5.3 Total amount of inorganic material

The total amount of inorganic material present in polyethylene shall not exceed 0.2 % (m/m) when tested by the Atomic Absorption Method and in accordance with Annex B. An alternative method of testing for the metals shall be by X-ray fluorescence, where the Atomic Absorption Method may not be applicable or just non-operational.

5.5 Fillers and pigments

The plastic shall not contain any filler. Pigments may be added as desired by the customer, or as designated by polymer processing companies, but shall not exceed 0.5 % dry blended, and 2 % compounded in, of the total weight.

5.6 Wall thickness

The wall thickness of the Blow-moulded polyethylene thermoplastic tank shall be in accordance with Table 2.

Maximum filling capacity	**Blow-moulded polyethylene thermoplastic tanks, mm (min.)**
Below 400 l	2.5
≥ 400 l < 1 000 l	3.0
≥ 1 000 l < 1 500 l	3.2
≥ 1 500 l < 2 000 l	3.5
≥ 2 000 l < 2 500 l	3.7
≥ 2 500 l < 3 000 l	3.9
≥ 3 000 l < 3 500 l	4.0

Maximum filling capacity	**Rotationally moulded polyethylene thermoplastic tanks, mm (min.)**
Below 400 l	2.5
≥ 400 l < 1 000 l	3.3
≥ 1 000 l < 1 500 l	3.5
≥ 1 500 l < 2 000 l	3.9
≥ 2 000 l < 2 500 l	4.1
≥ 2 500 l < 3 000 l	4.3
≥ 3 000 l < 3 500 l	4.4
≥ 3 500 l < 5 000 l	4.8
≥ 5 000 l < 7 500 l	5.1
≥ 7 500 l < 10 000 l	5.4

The wall thickness of the rotationally-moulded polyethylene thermoplastic tank shall be in accordance with Table 3.

5.10 Dimensions and tolerances

5.10.1 General

All dimensions shall be taken, with the tank in the vertical position, unfilled. Tank dimensions shall represent the exterior measurements.

5.10.2 Outside diameter

The tolerance for the outside diameter, including out of roundness, shall be ±3 %.

5.10.3 Shell wall and head thickness

The tolerance for average thickness at each elevation shall be −10 % of the design thickness on the low side and shall be unlimited on the high side. The tolerance for individual audit readings shall be limited to -20 % of the design thickness. The total amount of surface area on the low side of the tolerance shall not exceed 10 % of the total surface area.

5.10.4 Placement of fittings

The tolerance for fitting placements shall be 12.7 mm in elevation and 2° radial at ambient temperature.

5.11 Mechanical properties

5.11.1 Flexural modulus

The flexural modulus of the wall of the water tank shall not be less than 400 N/mm^2 when determined in accordance with ISO 1209-1 and ISO 1209-2.

5.11.2 Deformation

When the cylindrical vertical water storage tank is tested in accordance with Annex C, the difference between the circumferential measurements shall not be greater than 2 % of the original measurements.

5.11.3 Low temperature impact

The test specimen shall not show any crack in the test specimen resulting from the impact and visible in normal room lighting to a person with normal eyesight when tested in accordance with Annex D.

6 Fittings

6.1 Fabricated nozzles, gaskets, and other fitting accessories shall be chemically compatible with the materials to be handled in the tanks.

6.2 Openings that are cut in tanks to install fittings shall not have sharp corners. Holes shall have minimum clearance to insure best performance of fittings.

6.3 Bolts securing mechanical fittings shall be manufactured of materials compatible with tank contents.

7 Vents

7.1 The vents shall be at least as large as the filling or withdrawal connection, but in no case less than 25.4 mm (1 in.) nominal inside diameter.

8 Tank openings

8.1 Manhole or inspection opening

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.

8.2 Manhole or inspection 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.

8.3 Manhole or inspection 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.

9 Finish

9.1 The internal surface of the chemical storage tank shall be smooth to the extent that nothing sticks to it, and easily cleanable, clean and free from other hidden internal defects, such as air bubbles, pits and metallic or other material inclusions.

9.2 The mould parting line near the top rim of the tank shall be cut and finished to the required level. Defects like air bubbles and pits at the parting line and at the top of the manhole shall be repaired.

9.3 The finished tank wall shall be free, as commercially practicable, of visual defects such as foreign inclusions, air bubbles, pinholes, pimples, crazing, cracking and delamination that will impair the serviceability of the tank.

9.4 All cut edges where openings are cut into the tanks shall be trimmed, smoothened.

10 Leakage

The tank shall be filled with water to its maximum capacity, it shall remain for a period of two weeks. it shall observe no signs of leakage. a leak test will be conducted if requested by the customer

11 Tank capacity

Tank capacity shall be based on the fluid level used to determine the minimum wall thickness

12 Percent Gel (O-Xylene Insoluble Fraction) level

When tested in accordance with Annex E, the percent gel level shall be a minimum of 60 %.

13 Marking and labelling

13.1 Plastic chemical storage tanks shall be marked legibly and indelibly in English and/or any other official language (French, Kiswahili, etc.) used in the importing East African Partner State with the following information with the:

a) manufacturer's name or trade mark;

b) net capacity in litres;

c) country of origin; and

d) code of resin identification and symbol for recycling in accordance with EAS 1086.

13.2 Plastic chemical storage tanks shall be labelled legibly and indelibly in English and/or any other official language (French, Kiswahili, etc.) used in the importing East African Partner State with the following information with the:

a) name of product as, “Plastic Chemical Storage Tank”;

b) name and physical address of manufacturer;

c) lot number and/or batch number; and

d) manufacture date.

14 Sampling

14.1 All the chemical storage tanks of same raw material, same type, size and produced under relatively uniform conditions of manufacture shall constitute a lot.

14.2 The sample size shall be determined in accordance with Table 4.

Table 4 — Scale of sampling and criteria for conformity of tanks

Lot size	Sample size	Maximum possible failure
Up to 50	1	0
200	2	0
300	3	0
500	5	0
501 and above	8	1

14.3 Tanks shall be selected at random from the lot. In order to ensure randomness of selection, tables of random numbers shall be used.

Annex A
(normative)

Determination of carbon black content

A.1 Apparatus

A.1.1 **Combustion boat**, made of porcelain or silica, having minimum dimensions of 15 mm length, 9 mm width and 8 mm height

A.1.2 **Combustion tube**, made of hard glass of approximately 30 mm diameter and 400 mm ± 50 mm length

A.1.3 **Gas flow meter**, for measuring and controlling the rate of flow of nitrogen within 1.7 L/s ± 0.3 L/s

A.1.4 **Thermometer**, in the range of 250 °C - 550 °C

A.1.5 **Furnace**, to accommodate the combustion tube to give temperatures up to at least 500 °C

A.2 Reagents

A.2.1 Nitrogen, as technical grade

A.2.2 Trichloroethylene

A.3 Procedure

A.3.1 Assemble the apparatus as shown in Figure A.1. Both cold traps following the combustion tube shall contain trichloroethylene, but only the first needs be cooled with solid carbon dioxide. Alternatively, the entire apparatus may be placed in a fume hood and the two traps following the combustion tube omitted. Fill the dry tube with anhydrous $CaCl_2$ or other suitable desiccant. Hold between loose plugs of glass wool.

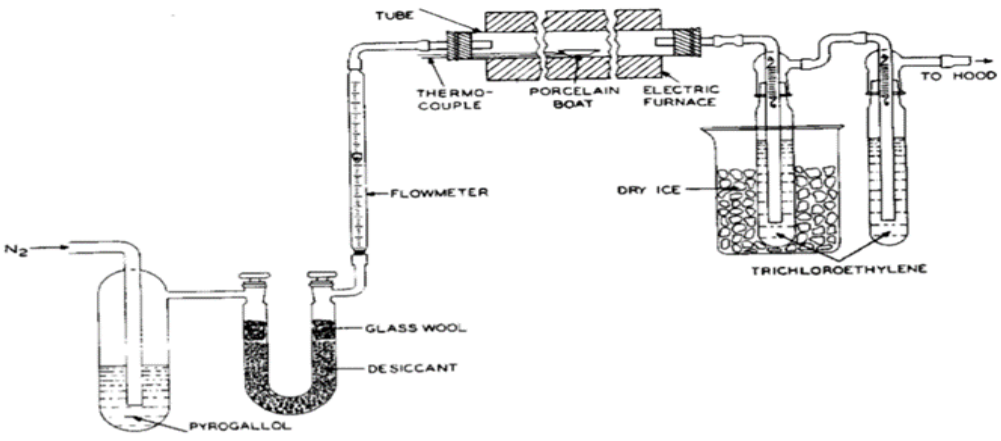


Figure A.1 – Assembly of apparatus for carbon black determination

A.3.2 Heat a clean combustion boat to red hot in a Bunsen flame; transfer the boat to the desiccant and allow it to cool over fresh desiccant. Hold between loose plugs of glass wool.

A.3.3 Remove the boat from the desiccant and weigh it to the nearest 0.000 1 g. Immediately place 1.0 g ± 0.1 g of the ethylene plastic under test in the boat and quickly weigh to the nearest 0.000 1 g.

A.3.4 Heat the furnace to a constant temperature of 600 °C. Adjust the rate of nitrogen flow to 1.7 L/min ± 0.3 L/min. Open the inlet end of the 2.9-cm diameter tube, quickly place the combustion boat with the sample into the tube at the centre of the furnace, and adjust the thermocouple so that the weld is touching the boat. Insert a copper plug, if this is used. Quickly close the furnace and allow heating to proceed for at least 15 min.

A.3.5 Move the tube or furnace so that the boat is no longer in the heated zone of the furnace and allow 5 min for cooling, while maintaining the flow of nitrogen. Remove the copper plug, if present and the boat through the inlet end of the tube and allow it to cool for at least 30 min. Take care that the boat does not become contaminated from any deposits on the walls of the tube. Then quickly reweigh the boat and its contents to the nearest 0.000 1 g.

A.3.6 Make all determinations in duplicate.

A.4 Calculation

The carbon black content, expressed as a percentage, shall be calculated using the formula below:

$$W = \frac{W_r}{w_s} \times 100$$

where

W is carbon black content, by percent weight;

W_r is the mass, in grams, of the boat before heating in air;

W_s is the mass, in grams, of the boat after heating in air.

Annex B
(normative)

Determination of total amount of inorganic material

B.1 Test specimen

Three test specimens of approximately 500 mm^2 in surface area shall be taken from the tank.

B.2 Method of extraction

B.2.1 Each test specimen shall be pre-washed for a period of 6 h using tap water with pH of 7 to 8. The water shall be passed through the specimen at a velocity of 50 mm/s while the specimen is kept fully immersed in water. After washing, the specimen shall be filled with fresh solution of the distilled water acidified to pH of 4.5 ± 0.1 by bubbling a current of carbondioxide through it, and both ends sealed with a material that does not contain any toxic substances or interfere with the determinations of such constituents in the aqueous samples.

B.2.2 After maintaining the specimens at room temperature for 48 h, the solution shall be decanted into a suitable container for analysis as the first extraction.

B.2.3 The procedure shall be repeated a second and a third time. Retain these samples for the determination of the amount of metals and other toxic substances as second and third extractions.

B.2.4 The first extraction and the third extraction shall be analysed for lead. The third extraction shall also be analysed for dialkyl tin as tin.

B.2.5 When calcium and mercury are present, all three extracts shall be analysed.

B.3 Method of analysis

Analysis for lead, tin, cadmium and mercury shall be carried out using atomic absorption.

Annex C
(normative)

Determination of resistance to deformation

C.1 Procedure

C.1.1 The tank shall be placed on a flat level base. A circumferential measurement shall be made parallel to the base at a distance of one third, the effective height from the bottom. The tank shall be filled up to the effective height at a minimum rate of 23 L/min with water at a temperature of not less than 15 °C.

C.1.2 A continuous film of polyethylene shall be floated over the whole of the surface of water in tank to prevent evaporation.

C.1.3 The temperature of the tank and water shall be maintained at a temperature not less than 15 °C and after seven days, a circumferential measurement shall be made at a level referred to in C.1.1. The difference between the two circumferential measurements shall be expressed as a percentage of the original circumferential measurement.

Annex D
(normative)

Determination of percent gel (O-Xylene Insoluble Fraction) level

D.1 Apparatus

D.1.1 Extraction Apparatus:

a) Resin Kettle 2-L;

b) Heating Mantle 2-L;

c) Clamp, Resin Kettle;

d) Condenser, with ground taper joint to fit hole in resin kettle lid;

e) Variable Transformer;

f) Stand with clamp to support the kettle and condenser; and

g) Metal pan, for setting the apparatus in to retain the o-xylene in the event the kettle breaks

D.1.2 Analytical Balance, that weighs to four decimal places.

D.1.3 Stainless Steel Screen, 100-mesh.

D.1.4 Muffle Furnace.

D.1.5 Forced-Draft Oven.

D.1.6 Reagents:

a) O-xylene, technical grade; and

b) Cyanox 2246, antioxidant9 or equivalent (2,2'-Methylenebis(4–methyl-6–tert-butylphenol))

D.1 Scope

This test method is used to measure the amount of crosslinked material in polyethylene by determining how much of it does not dissolve in ortho-xylene. This undissolved portion, known as the "gel content," indicates the degree of crosslinking. The method applies specifically to polyethylene used in Type I tanks.

D.2 Procedure

D.2.1 The test specimen shall be extracted from a non-critical section of the tank such as the manway, drain opening, or any other area that is routinely removed or discarded prior to the tank's operational use.

D.2.2 The test specimen shall be from the 3.2 mm thickness of the interior wall of the tank. It shall be cleanly cut so there are no frayed edges or corners.

D.2.2 Weigh a 0.3 g specimen cut from the molded part to ± 0.0002 g. Record the specimen weight as W1.

D.2.3 Cut a 35 mm by 76 mm piece of 100-mesh stainless steel screen for each specimen. Clean the screen with o-xylene, rinse with acetone, and dry in a stream of air.

Note An alternative specimen holder is a reusable cage made from 100-mesh stainless steel screen. A size of 15.2 mm by 35.6 mm has been found satisfactory for the cage. The cages must be cleaned after each test by burning off remaining polyethylene at 427°C (800°F) for approximately 30 minutes in a muffle furnace

D.2.4 Fold the screen to form a 38 by 38 mm square. Make a fold about 6.4 mm along each of the two open edges to form a pouch, and staple the folds.

D.2.5 Place the specimen into the screen pouch, fold the remaining edge, staple the fold and identify each screen with a metal tag. Do not squeeze the pouch sides together. Leave space for the specimen to swell. Weigh the sample plus screen to ± 0.0002 g and record this weight as W2.

D.2.6 Place 1500 mL of o-xylene and 10 g of Cyanox 2246 or equivalent antioxidant in the resin kettle and heat to reflux.

Note The antioxidant is added to prevent further crosslinking of the polymer during the extraction.

D.2.7 Suspend the sample screen in the refluxing solvent for 16 h. An overnight run is convenient.

Note Do not test more than eight specimens per run to avoid saturating the solvent with dissolved polyethylene.

D.2.8 Remove the sample screen while hot and dry to constant weight (W3) in a forced-draft oven at 170°C for about two hours.

Note The o-xylene insoluble portion (gel) of crosslinked polyethylene is an indication of the amount of crosslinking in the polyethylene. The gel is not a direct measure of the extent of the crosslinking network, but indirectly serves to provide a good measure of the crosslinking. It is, therefore, valuable as a test for the quality of the crosslinked polyethylene part.

Note Care shall be exercised in handling o-xylene. The Material Safety Data Sheet shall be consulted prior to its use.

D.2.9 Calculation:

Gel Weight, % = ([W1 – (W2 - W3)] x 100)/W1

where:

W1 = weight of sample, g,

W2 = weight of sample plus screen, g, and

W3 = weight of sample plus screen after extraction, g.

Bibliography

[1] RS 128: 2019, *Rotational moulded polyethylene water storage tanks — Specification*

[2] TZS 892-1: 2019, *Polyethylene tanks for storage of potable water — Part 1: Specifications*

[3] US 1560: 2022, *Moulded polyethylene water storage tank — Specification*

[4] IS 12701(1996), *Rotational moulded polyethylene water storage tanks.*

[5] ASTM D1998-21, *Standard Specification for Polyethylene Upright Storage Tanks*

[6] https://en.wikipedia.org/wiki/Flash_point

