

Cisterns for domestic use — Cold water storage and combined feed and expansion (thermoplastic) cisterns up to 500 l — Specification

ICS 91.140.60

Confirmed December 2009

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee PRI/62, Static thermoplastics tanks, upon which the following bodies were represented:

- Association of Tank and Cistern Manufacturers
- British Chemical Distributors and Traders
- British Plastics Federation
- Chemical Industries Association (CIA)
- Federation of Petroleum Suppliers
- Institute of Materials, Minerals and Mining
- Oil Firing Technical Association (OFTEC)
- Water UK
- Welding Institute
- Co-opted members

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 10 March 2004.

© BSI 10 March 2004

First published October 1967
Second edition September 1975
Third edition August 1986
Fourth edition May 1991
Fifth edition March 2004

The following BSI references relate to the work on this British Standard:
Committee reference PRI/62
Draft for comment: 02/122802 DC

Amendments issued since publication

Amd No.	Date	Comments

ISBN 0 580 43333 1

Contents

	Page
Committees responsible	Inside front cover
Foreword	ii
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 General	2
5 Materials	3
6 Configuration	3
7 Performance requirements	3
8 Covers	6
9 Marking	7
10 Additional fittings	8
Annex A (informative) Notes on installation of cisterns	10
Annex B (normative) Method of test for determination of toluene extract of carbon black	10
Annex C (normative) Sampling and testing	11
Annex D (normative) Methods of test for resistance to deformation	12
Annex E (normative) Method of test for resistance to deflection	13
Annex F (normative) Method of test for fatigue resistance	15
Annex G (normative) Method of test for impact resistance	15
Annex H (normative) Method of test for tensile strength and elongation at break	15
Annex I (normative) Method of test for resistance to reversion	16
Annex J (normative) Method of test for resistance to sprue strain	16
Annex K (normative) Method of test for resistance to delamination	17
Annex L (normative) Method of test for weathering	17
Annex M (normative) Method of test for hot water resistance	17
Annex N (normative) Method of test for closeness of cover fitting	19
Annex O (normative) Method of test for the assessment of ingress of particles	21
Annex P (normative) Method of test for determining the impact resistance of covers	22
Annex Q (normative) Method of test for thermal insulation	22
Bibliography	25
Figure 1 — Installation instructions	7
Figure D.1 — Centreline measurement	13
Figure E.1 — Arrangement for the deflection test and fatigue test	14
Figure M.1 — Typical installation for hot water test: elevation	18
Figure M.2 — Typical installation for hot water test: plan view	19
Figure N.1 — Typical installation for cover fitting test	20
Figure O.1 — Typical installation of cistern in test box for the particle ingress test	21
Figure Q.1 — Apparatus for the insulation test	23
Table 1 — Position of water line	2
Table 2 — Types of delamination	5
Table C.1 — Type tests	11
Table C.2 — Routine tests	12
Table I.1 — Testing conditions for reversion and sprue strain	16
Table K.1 — Immersion media	17

Foreword

This British Standard has been prepared by Technical Committee PRI/62. It supersedes BS 4213:1991, which will be withdrawn three months after the publication date of this revision.

The specification covers cisterns up to 500 l capacity from which water is drawn for domestic purposes. It provides methods of test for the evaluation of the properties of cisterns and covers made by any of the processes currently available.

This new edition represents a full revision of the standard. It takes into account the Water Supply (Water Quality) Regulations 2001 [1], the Water Supply (Water Quality) (Scotland) Regulations 2001 and subsequent amendments [2] and the Water Supply (Water Quality) Regulations (Northern Ireland) 2002 and subsequent amendments [3], which include detailed provisions to safeguard the integrity of stored water for domestic (i.e. drinking, washing, cooking and sanitary) purposes. It also takes into account EC Directive 98/83/EC [4], which implies that water quality from any domestic draw-off point should be of drinking water quality. It includes requirements for both cisterns and their associated fittings to assist in safeguarding against waste and contamination, and insulation requirements to reduce the likelihood of the stored water freezing or warming. It also gives a method of test for the assessment of the ingress of particles and insects.

As in the previous editions, the specification is confined to cisterns produced from thermoplastics, although an outer reinforcing layer of an unspecified composition is permitted.

As a result of problems encountered when analysing processed material, this British Standard requires all materials to conform to BS 6920-1. The details of the analytical methods for determining the permitted antioxidants are not given in this British Standard, but reference is made to the relevant methods in BS 2782.

Because slight changes are necessary in plumbing practice when using thermoplastics cisterns as opposed to more rigid materials, additional recommendations for installation are given in Annex A.

Upon publication of this revision, BSI Sales Department will respond to purchase orders for BS 4213 by supplying copies of the 2004 edition. Copies of the 1991 edition may be obtained until it is withdrawn by quoting BS 4213:1991.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 25 and a back cover.

The BSI copyright notice displayed in this document indicates when the document was last issued.

1 Scope

This British Standard specifies requirements for the materials, physical properties and performance of cold water storage cisterns and combined feed and expansion cisterns of up to 500 l capacity, from which water is drawn for domestic purposes. It also specifies requirements for the associated fittings of such cisterns, i.e. covers, screened breathers, screened warning pipes and vent pipe entry devices, and for cistern insulation. It gives methods of test for the evaluation of the properties of cisterns and covers made by any of the processes currently available.

This British Standard applies only to cisterns that are manufactured from thermoplastics, and that have covers manufactured either from thermoplastics or from other manufactured materials having a thermoplastics layer on the inside face. It covers both circular and non-circular cisterns, but does not apply to flushing cisterns.

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.

BS 1566-1:2002, *Copper indirect cylinders for domestic purposes — Part 1: Open vented copper cylinders — Requirements and test methods*.

BS 2071, *Specification for Soxhlet extractors*.

BS 2782-4:Method 452B, *Methods of testing plastics — Chemical properties — Determination of carbon black content of polyolefin compound*.

BS 2782-8:Methods 823A and 823B:1978, *Methods of testing plastics — Other properties — Methods for the assessment of carbon black dispersion in polyethylene using a microscope*.

BS 4781, *Specification for pressure-sensitive adhesive plastics labels for permanent use*.

BS 6920-1, *Suitability of non-metallic products for use in contact with water intended for human consumption with regard to their effect on the quality of the water — Part 1: Specification*.

BS EN 1057, *Copper and copper alloys — Seamless, round copper tubes for water and gas in sanitary and heating applications*.

BS EN 60335-2-73, *Specification for safety of household and similar electrical appliances — Part 2: Particular requirements — Section 2-73: Fixed immersion heaters*.

BS EN ISO 527-1 (BS 2782-3:Method 321), *Plastics — Determination of tensile properties — Part 1: General principles*.

BS EN ISO 4892-2, *Plastics — Methods of exposure to laboratory light sources — Part 2: Xenon-arc sources*.

3 Terms and definitions

For the purposes of this British Standard the following definitions apply.

3.1

additional fitting kit

assembly of additional fittings for a cistern

3.2

capacity

volume of a cistern measured up to the water line

3.3 cisterns

3.3.1

cistern

fixed container for holding water at atmospheric pressure

NOTE The water is usually supplied through a float-operated valve.

3.3.2

cold water storage cistern

cistern, including cover and additional fitting kit (3.1), used only for storing cold water for domestic (i.e. drinking, washing, cooking and sanitary) purposes

3.3.3

combined feed and expansion cistern

cistern used for supplying water to and receiving expansion water from a hot water system

3.4 pipes

3.4.1

breather

pipe or hole which allows the free exchange of air when the cistern is emptying and filling and which preserves the integrity of the stored water

3.4.2

warning pipe

pipe that indicates fault conditions, fixed so that its outlet, whether inside or outside the building, is in a conspicuous position where the discharge of water can be seen

3.4.3

vent pipe

pipe open to the atmosphere and used in connection with a hot water system for the escape of air and/or steam

3.5

top of a cistern

plane across the highest point of a cistern excluding any extension of the cistern provided for supporting or securing the removable cover

NOTE This definition applies to cisterns with part integral or integral covers only.

3.6

water line

line marked inside a cistern to indicate the highest water level at which the float-operated valve (or other water inlet-control device) should be adjusted to shut off

4 General

The wall thickness of a cistern shall be not less than 1.5 mm.

The water line position as specified in Table 1 shall be clearly and durably marked by moulded impression on the wall of the cistern.

Table 1 — Position of water line

Cistern type reference ^a	Minimum capacity to water line l (gallon) ^b	Minimum distance of water line from top of cistern mm
Up to and including XX8	38 (8)	≥110
Including and above XX15	68 (15)	≥115
^a See 9.1.		
^b 1 gallon = 4.546 09 l		

5 Materials

5.1 General

All materials used for cisterns, covers and additional fittings that are, or are likely to be, in contact with water (including condensation) shall conform to the requirements of BS 6920-1.

5.2 Carbon black

Where carbon black is used it shall conform to the following requirements.

- a) When tested in accordance with BS 2782-4:Method 452B, the carbon content shall be not less than 0.5 % and not greater than 3.0 %.
- b) The density shall be $\geq 1.5 \text{ g/cm}^3$ and $\leq 2.0 \text{ g/cm}^3$.
- c) The total amount of volatile matter shall not exceed a mass fraction of 9.0 %.
- d) The average particle size shall be not less than $0.010 \mu\text{m}$ and not greater than $0.025 \mu\text{m}$.
- e) When determined in accordance with Annex B, the total amount of toluene extract shall not exceed a mass fraction of 0.10 %.
- f) When tested in accordance with BS 2782-8:Method 823A, the carbon black dispersion in the cistern shall show a numerical rating of 3 or less and the uniformity of appearance in respect of smears and streaks shall be equal to or better than photomicrograph A of BS 2782-8:Method 823A:1978, Figure 1.

5.3 Rework

No rework material, other than the addition of a mass fraction no greater than 15 % of the manufacturer's own rework material of the same type, resulting from the manufacture of cisterns conforming to the requirements of this British Standard, shall be used.

6 Configuration

Where a change in direction of the cistern wall is necessary, this shall be accomplished by the use of a radius not less than 3 mm. Where the walls of a cistern within 115 mm of the top or bottom of the cistern are tapered, the taper shall not exceed 5° from the vertical, except where ribs are positioned. Where a connection passes through the cistern, a means of excluding external condensate shall be provided.

NOTE 1 The cistern surface should have an even texture and should be free from surface imperfections, which detract from the performance of the cistern in use.

NOTE 2 Any backing plate for a float-operated valve to be fixed externally to the cistern is normally supplied treated to prevent corrosion, free from sharp edges or sharp corners and drilled to provide a 22 mm diameter hole.

NOTE 3 Ribs should not interfere with pipe installation.

7 Performance requirements

7.1 General

The tests cited in 7.2 to 7.11 shall be carried out as either type tests or routine tests in accordance with Annex C.

7.2 Resistance to deformation

7.2.1 Circular cisterns

When tested in accordance with Annex D, method 1, the difference between the circumferential measurements of a circular cistern shall be not greater than 2 % of the original circumferential measurement.

7.2.2 Non-circular cisterns

When tested in accordance with Annex D, method 2, the deformation in either direction of a non-circular cistern shall be not greater than 2 %.

7.3 Resistance to deflection

When measured in accordance with Annex E, the deflection shall not exceed 32 mm.

7.4 Fatigue resistance

When tested in accordance with Annex F, there shall be no cracking of the cistern in the region of the inlet hole.

7.5 Impact resistance

When tested in accordance with Annex G, any impact shall neither split nor puncture the cistern.

7.6 Tensile strength and elongation at break

When tested in accordance with Annex H, the ultimate tensile strength of the polyolefin fitting of the wall of the cistern shall be not less than 7.6 MPa.

The percentage elongation at break of the specimens from both horizontal and vertical axes shall be not less than:

- a) 100 % for polyethylene;
- b) 50 % for polypropylene.

7.7 Resistance to reversion

NOTE This requirement is applicable to injection moulded cisterns only.

When tested in accordance with Annex I, each specimen taken from a single cistern shall have a percentage reversion not greater than:

- a) 5.0 % for polyethylene with a density less than 0.94 g/cm³;
- b) 3.0 % for polyethylene with a density of 0.94 g/cm³ and above;
- c) 2.0 % for polypropylene.

7.8 Resistance to sprue strain

NOTE This requirement is applicable to injection moulded cisterns only.

When tested in accordance with Annex J, any slit opening on each specimen taken from a single cistern shall be not greater than 0.76 mm.

7.9 Resistance to delamination

NOTE This requirement is applicable to injection moulded cisterns only.

When tested in accordance with Annex K, the delamination at 50 °C on each specimen taken from a single cistern shall not be inferior to type 2 of Table 2.

7.10 Weathering

NOTE This requirement is not applicable to cisterns with a carbon black content greater than a mass fraction of 0.5 %.

For cisterns with a carbon black content less than a mass fraction of 0.5 %, when tested in accordance with Annex L, the elongation at break on each specimen taken from a single cistern shall be not less than 50 % of the value obtained from the unweathered material from the same cistern.

7.11 Hot water resistance

When tested in accordance with Annex M:

- a) there shall be no overflow from the top edge of the cistern or any other visible signs of leakage;
- b) there shall be no distortion of the cistern that might impair the function and operation of the float-operated valve;
- c) after the conclusion of the heating cycle and when the water has been left to cool for (120^{+15}_0) min, it shall be possible to replace the cover recommended by the manufacturer.

NOTE Deflecting the sides of the cistern in order to replace the cover, and contact between the turned-down edges of the cover and the cistern sides, is permissible provided that the cover remains in position with its edges overlapping the cistern at all points.

Table 2 — Types of delamination

Example	Type	Description
	Type 0	No signs of delamination
	Type 1	Small fissure along exposed face, no surface peeling
	Type 2	Peeling from specimen ends only
	Type 3	Extensive surface peeling, deep fissure long exposed face, lifted skin sections greater than 6.4 mm
	Type 4	Small coiled peeling superimposed on lifted skin sections, deep fissures along exposed surface