

Specification for

**Cold water storage and
combined feed and expansion
cisterns (polyolefin or olefin
copolymer) up to 500 L
capacity used for domestic
purposes**

ICS 91.140.60

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Plastics and Rubber Standards Policy Committee (PRM/-) to Technical Committee PRM/62, upon which the following bodies were represented:

- British Plastics Federation
- Chartered Institution of Building Services Engineers
- Department of the Environment (Property Services Agency)
- Engineering Equipment and Materials Users' Association
- Institution of Water and Environmental Management
- Plastic Tanks and Cisterns Manufacturers' Association
- Royal Institute of British Architects
- Royal Institute of Public Health and Hygiene
- Water Byelaws Advisory Service

This British Standard, having been prepared under the direction of the Plastics and Rubber Standards Policy Committee, was published under the authority of the Standards Board and comes into effect on 31 May 1991

© BSI 1998

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

The following BSI references relate to the work on this standard:
Committee reference PRM/62
Draft for comment 89/37122 DC

ISBN 0 580 19477 9

Amendments issued since publication

Amd. No.	Date	Text affected
6797	November 1991	Incorporated in reprint
9526	September 1997	Indicated by a line in the margin
9780	January 1998	Indicated by a line in the margin

Summary of pages

The following table identifies the current issue of each page. Issue 1 indicates that a page has been introduced for the first time by amendment. Subsequent issue numbers indicate an updated page. Vertical sidelining on replacement pages indicates the most recent changes (amendment, addition, deletion).

Page	Issue	Page	Issue
Front cover	3	11	3
Inside front cover	3	12	original
a	2	13	original
b	blank	14	2
1	2	15	original
2	2	16	original
3	original	17	original
4	2	18	original
5	2	19	original
6	3	20	original
7	3	21	original
8	2	22	original
9	original	Inside back cover	original
10	original	Back cover	2

Contents

	Page
Committees responsible	Inside front cover
Foreword	3
Specification	
1 Scope	4
2 Definitions	4
3 Cistern capacities, dimensions and water line position	4
4 Designation of cisterns	4
5 Materials for cisterns	5
6 Configuration of cisterns	8
7 Sampling and testing	8
8 Performance requirements of cisterns	9
9 Covers	10
10 Marking of cisterns and covers	11
11 Additional component kit	11
Appendices	
A Method for determination of toluene extract of carbon black	13
B Method for deformation test	13
C Method for deflection test	14
D Method for fatigue test	14
E Method for impact resistance for cisterns	15
F Method for tensile strength and elongation at break tests	15
G Method for determining reversion	15
H Method for determining sprue strain	15
J Method for determining delamination	16
K Weathering test	16
L Hot water test	16
M Close fitting cover test	17
N Method of test for the assessment of ingress of particles	17
P Method for determining impact resistance of covers	17
Q Thermal insulation test	20
R Notes on installation of cisterns	20

	Page
Tables	
1 Cistern dimensions and preferred capacities	5
2 Antioxidants for use with polyethylene compositions	6
3 Antioxidants for use with polypropylene compositions	7
4 Type tests	8
5 Routine tests	9
6 Testing conditions for the reversion test	15
7 Testing conditions for the determination of sprue strain	16
8 Immersion media	16
Figures	
1 Types of delamination	10
2 Centreline measurements	13
3 Arrangement for the deflection test	14
4 Typical installation for hot water test: elevation	18
5 Typical installation for hot water test: plan view	19
6 Typical installation of cistern in test box for the particle ingress test	21
7 Apparatus for the insulation test	22

Foreword

This British Standard has been prepared under the direction of the Plastics and Rubber Standards Policy Committee. It supersedes BS 4213 : 1986, 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 available processes. As in the previous editions, the specification is confined to cisterns produced from polyolefins or olefin copolymers, an outer reinforcing layer of an unspecified composition being permitted.

New Water Byelaws implemented in January 1989 require detailed provisions to safeguard the integrity of stored water for domestic purposes. This standard deals with cistern and associated fitting requirements to assist in safeguarding against waste and contamination. The fittings dealt with are cistern covers, screened air inlets, screened warning pipes and vent pipe entry devices. Requirements for insulation to reduce the likelihood of the stored water freezing or warming are also given, together with a method of test for the assessment of the ingress of particles and insects.

This revision incorporates the general requirements for water tanks prepared under the direction of the Building Services Standards Policy Committee, following publication of the European Community Directive on Water for Human Consumption, which implied that water quality from any domestic draw-off point should be of drinking water quality. Accordingly cisterns marked as complying with this standard also indicate compliance with BS 7181.

As a result of problems encountered when analysing processed material, this specification only requires that the tests to ensure compliance with the antioxidant requirements are to be performed on the raw material before moulding rather than on the finished cistern. The details of the analytical methods for determining the permitted antioxidants are not given in this revision but reference is made to the appropriate methods in BS 2782.

Because slight changes are necessary in plumbing practice when using thermoplastics cisterns as opposed to more rigid materials additional information relating to installation has also been given in appendix R.

Upon publication of this revision, BSI Sales Department will respond to purchase orders for BS 4213 by supplying copies of the 1991 edition. Copies of the 1986 edition may be obtained by quoting BS 4213/86.

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

Specification

1 Scope

This British Standard specifies requirements for materials, physical properties and performance of cold water storage cisterns and combined feed and expansion cisterns of up to 500 L capacity, used for domestic purposes. The cisterns are manufactured from polyolefin, or olefin copolymer and their covers are manufactured either from polyolefin or olefin copolymer, or from other manufactured materials having a polyolefin or olefin copolymer layer on the inside face.

The specification covers both circular and non-circular cisterns, but does not apply to flushing cisterns. Float operated valve mechanisms are not included.

NOTE. The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

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

2.1 cistern

A fixed container for holding water at atmospheric pressure.

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

2.2 cold water storage cistern

A cistern used only for storing cold water for domestic purposes, which is complete with cover and the additional component kit (see 2.4).

2.3 water for domestic purposes

Water supplied for drinking, washing, cooking and sanitary purposes.

2.4 additional component kit

An assembly of additional components for the cistern, e.g. insulation (if not applied to the cistern), screened warning pipe termination assembly, screened breather and vent pipe connector (see clause 11).

2.5 combined feed and expansion cistern

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

2.6 water line

A 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.

2.7 capacity

The volume of the cistern measured up to the water line.

2.8 production run (termination of)

The time at which the machine is reset to manufacture other products.

NOTE. Accordingly a production run may extend over several shifts.

2.9 top of the cistern

(1) The plane across the cistern where the cover makes contact with the flange.

(2) In the case of a cistern with integral or part integral cover, the plane across the highest point of the cistern excluding any extension of the cistern provided for supporting or securing the removable cover.

2.10 vent pipe

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

2.11 warning pipe

A pipe to indicate 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 Cistern capacities, dimensions, and water line position

NOTE 1. Cisterns may be of any capacity not exceeding 500 L but should preferably be of one of the capacities listed in table 1.

Cisterns shall have minimum dimensions in accordance with table 1. Tank thickness shall not be less than 1.5 mm. Cisterns of capacities not listed in table 1 shall comply with the dimensional requirements specified for the next highest capacity cistern listed in table 1.

The water line position (see columns 2 and 3 in table 1) shall be as given in table 1 and permanently marked on the inside wall.

NOTE 2. The PC4 cistern (table 1) may be supplied with a loose fitting cover for use as a combined feed and expansion cistern only. An additional component kit (see clause 11) is not then required and the cistern marking may be omitted accordingly (see clause 10).

4 Designation of cisterns

Each cistern shall be designated by a code comprising components in the following order

(a) The number and date of this standard, i.e. BS 4213 : 1991.

(b) The capital letters PC, followed by a number representing the capacity in gallons derived from the capacity measured in litres. This part of the code comprises the type reference (see table 1).

(c) Either the capital letters C, R or X to denote the cistern shape, i.e. C shall denote a circular cistern, R a rectangular cistern and X any other shape of cistern.

For example a rectangular shaped 114 L cistern is designated BS 4213 : 1991 : PC25R.



Table 1. Cistern dimensions and preferred capacities

Type reference	Min. capacity to water line	Min. distance of water line from the top of the cistern
	L (gals)	mm
PC4	18 (4)	110
PC8	38 (8)	110
PC15	68 (15)	115
PC20	91 (20)	115
PC25	114 (25)	115
PC40	182 (40)	115
PC50	227 (50)	115
PC60	273 (60)	115
PC70	318 (70)	115
PC100	445 (100)	115
PC110	500 (110)	115

¹⁾ 'General' applies in all cases except where cisterns are constructed of polyethylene of density 0.940 g/cm³ to 0.967 g/cm³.

5 Materials for cisterns

5.1 General

All materials in contact with, or likely to be in contact with water (including condensation) shall comply with the appropriate requirements to safeguard water quality as specified by the Water Research Centre when used under the conditions for which they are designed. All materials in contact with, or likely to be in contact with potable water shall not constitute a toxic hazard, shall not support microbial growth and shall not give rise to unpleasant taste, odour, cloudiness or discoloration of the water.

All polyolefin or olefin copolymers used in the construction of cisterns shall comply with the requirements of BS 6920 when tested by the methods detailed therein. Products for installation and use in the United Kingdom which are verified and listed under the UK Water Fittings Byelaws Scheme¹⁾ are deemed to satisfy the requirements of this clause.

5.2 Polyethylene materials

The compound shall be manufactured from a mixture of the following.

(a) Homopolymer or copolymer of ethylene of density greater than 0.915 g/cm³ but not exceeding 0.967 g/cm³, at 23 °C, when determined in accordance with appendix B of BS 3412 : 1976.

(b) Carbon black in such an amount that, when the compound is tested in accordance with Method 452B of BS 2782, the carbon black content shall be 1.5 % to 3.0 %. The carbon black shall comply with the following requirements:

- (1) density, 1.5 g/cm³ to 2.0 g/cm³;
- (2) maximum volatile matter, 9.0 % (*m/m*);
- (3) average particle size, 0.010 µm to 0.025 µm;
- (4) toluene extract, not more than 0.10 % (*m/m*) when determined in accordance with appendix A.

When tested in accordance with Method 823A of BS 2782, the carbon black dispersion in the cistern shall show a numerical rating of 5 or less and the uniformity of appearance in respect of smears and streaks shall be equal to or better than photomicrograph A of figure 1 of Method 823A of BS 2782 : 1978.

(c) Antioxidant in such amount that, when the compound is tested in accordance with Method 434D of BS 2782, the total antioxidant content shall be between 0.1 % (*m/m*) and 0.3 % (*m/m*).

The antioxidant shall be one or more selected from groups 1 and 2 of table 2 except that antioxidants from group 1 shall be used in conjunction with antioxidants from group 2. Group 1 antioxidants shall not be used alone.

(d) Up to 0.5 % (*m/m*) of the dodecyl or octadecyl esters of thiodipropionic acid and up to 0.5 % (*m/m*) of calcium or sodium stearate.

(e) No rework material, other than, the addition of not more than 15 % (*m/m*) of the manufacturer's own rework material of the same type, resulting from the manufacture of cisterns complying with the requirements of this specification, shall be used.

¹⁾ WRc Byelaws Advisory Service, 660 Ajax Avenue, Slough SL1 4BG.