BRITISH STANDARD

BS 3445 :
Part 1 : 1992

# Agricultural water troughs and water fittings

## Part 1. Specification for water trough bodies, service boxes and water supply system

Chenaux et robinetterie à l'eau pour l'agriculture
Partie 1. Corps de chenaux boîtes de service et système d'adduction d'eau — Spécifications

Wassertränken und zugehörige Armaturen für die Landwirtschaft
Teil 1. Wassertröge, Anschlußkästen und Zuführungssysteme



BSI
STANDARDS

# Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Farm and Horticultural Buildings Standards Policy Committee (FHB/-) to Technical Committee FHB/6, upon which the following bodies were represented:

British Agricultural and Garden Machinery Association Ltd.
British Precast Concrete Federation Ltd.
Glassfibre Reinforced Cement Association
Ministry of Agriculture, Fisheries and Food
National Farmers' Union
Plastic Tanks and Cisterns Manufacturers' Association
S T C Water Regulations and Fittings Scheme
Scottish Office (Agriculture and Fisheries Department)
Water Services Association of England and Wales

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# Contents

# Foreword

This Part of BS 3445, together with Part 2, is a revision of BS 3445 : 1981 and has been prepared under the direction of the Farm and Horticultural Building Standards Policy Committee. It supersedes BS 3445 : 1981 which is withdrawn.

The specification for the trough bodies has been revised so as to retain features such as strength and robustness whilst maintaining optional other features which may be requested as extras. In addition agricultural water trough bodies manufactured from polyethylene have been added.

It remains one of the chief functions of this British Standard to protect the water supply against contamination.

It is recognized that manufacturers of troughs are rarely involved in the manufacture or supply of water fittings, or in the installation of the troughs. The new standard is therefore written in two Parts in order that the Parts can be specified separately or together as required.

BS 3445 : Part 2 gives recommendations for the installer and operator on meeting water byelaw requirements.

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

# Section 1. General

## 1.1 Scope

This Part of BS 3445 specifies requirements for the bodies of agricultural water troughs for holding drinking water for livestock and for the associated water pipes and fittings, the water level being maintained by a float operated valve controlling a supply of water through a pipe.

Troughs of any suitable shape and of capacity between 60 L and 3000 L inclusive are covered by this Part of BS 3445.

Section 2 deals with trough bodies and section 3 deals with the water fittings and service box.

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

## 1.2 Definitions

For the purposes of this Part of BS 3445 the definitions given in BS 6100 apply together with the following.

**1.2.1 trough body**

Principal water container of a water trough.

**1.2.2 service box**

Housing, either integral with the water trough or attached to it, incorporating a means of attachment for a water supply and for a float operated valve and float.

**1.2.3 surface box**

Box covering the chamber in which an underground stop valve/cock is located.

**1.2.4 backflow**

Flow of a liquid in a direction contrary to the intended normal direction of flow.

**1.2.5 backsiphonage**

Backflow caused by the siphonage of liquid, from a cistern or appliance, into the pipe feeding the cistern or appliance.

**1.2.6 Type A air gap**

A visibly unobstructed and complete gap measured vertically between the lowest point of discharge of the inlet pipe and the spill-over level provided on the associated receiving vessel into which the flow is discharged.

# Section 2. Trough bodies

## 2.1 Design: general requirements

**2.1.1** The water-holding capacity of the container shall be within the range 60 L to 3000 L inclusive and the size of the trough shall be defined by this capacity.

**2.1.2** Surfaces and edges accessible to livestock shall be free from sharp edges and projections.

**2.1.3** The minimum depth of water that the container is able to hold before overflow shall be 150 mm and the maximum shall be 800 mm.

**2.1.4** The trough body shall either incorporate, or provide for the attachment of, a service box.

**2.1.5** The trough body shall withstand the watertightness and rigidity test specified in **2.6**.

**2.1.6** Materials and substances used in the manufacture of troughs shall not impart toxicity to the trough body, nor shall they render the water in the trough unfit for consumption by livestock.

## 2.2 Concrete troughs

### 2.2.1 General

Concrete troughs shall comply with the general requirements specified in **2.1**.

### 2.2.2 Materials

#### 2.2.2.1 *General*

Materials used in the manufacture of precast concrete elements for troughs shall comply with the appropriate British Standards specified in **2.2.2.2** to **2.2.2.6**.

The constituents of the concrete shall be proportioned and mixed to a minimum characteristic compressive strength of 45 N/mm$^2$ at 28 days when tested in accordance with BS 1881, and a maximum free water/cement ratio of 0.5 by mass.

Compliance with the above requirements shall be judged in accordance with **3.16.2** of BS 5328 : Part 4 : 1990.

#### 2.2.2.2 *Cement*

The cement shall comply with one of the following:

(a) be factory-produced by the cement manufacturer and comply with one of the British Standards given in table 1; or

**Table 1. British Standards for cement in concrete troughs**

| Type of cement | British Standard |
|---|---|
| Ordinary and rapid-hardening Portland | BS 12 |
| Portland-blastfurnace | BS 146 : Part 2 |
| Sulfate-resisting Portland | BS 4027 |
| Portland pulverized-fuel ash | BS 6588 |

(b) consist of one of the following combinations of BS 12 cement and ground granulated blastfurnace slag (g.g.b.s.) or pulverized-fuel ash (p.f.a.), in accordance with table 2, to be included as part of the concrete mix by combining them with the other concrete materials in the concrete mixer.

**Table 2. Cementitious components**

| Cementitious component other than cement | British Standard | % by mass of total cementitious content |
|---|---|---|
| g.g.b.s | BS 6699 | 0 % to 65 % |
| p.f.a. | BS 3892 : Part 1 | 15 % to 35 % |

#### 2.2.2.3 *Aggregates*

Aggregates shall consist of materials that comply with BS 882 except for the grading requirements of clause **5** of BS 882 : 1983.

NOTE. The manufacturer may modify the gradings to suit his manufacturing process. (See clause **0** of BS 882 : 1983.)

The nominal maximum size of aggregate shall not exceed the least of the following:

(a) 20 mm;

(b) the concrete cover (see **2.2.3.1**);

(c) one-quarter of the minimum thickness of the units.

#### 2.2.2.4 *Water*

Water shall be clean and free from harmful matter in such quantities as would affect the properties of the concrete in the plastic or hardened state (see appendix A of BS 3148 : 1980).

#### 2.2.2.5 *Steel reinforcement*

The steel reinforcement shall comply with BS 4449, BS 4482 or BS 4483 as appropriate.

#### 2.2.2.6 *Admixtures*

Admixtures shall comply with BS 5075.

NOTE. Admixtures, when used, should not impair the durability of the concrete, nor combine with the ingredients to form harmful compounds nor increase the risk of corrosion of reinforcement.

The chloride ion content of admixtures shall not exceed 2 % by mass of the admixture or 0.03 % by mass of the cement, when used in the following:

(a) any concrete containing reinforcement or other embedded metal; and

(b) any concrete made with cement complying with BS 4027.

**2.2.3 Design**

**2.2.3.1** The walls and the floor of the water-containing compartment shall be not less than 48 mm thick.

The minimum nominal cover to the reinforcement shall be 20 mm.

The unit shall be designed in accordance with BS 8110 or otherwise reinforced to ensure that cracking does not occur as a result of stress imposed during handling and normal use.

**2.2.3.2** As a protection against frost damage, the water container shall have a vertical taper of not less than 12 mm per 300 mm depth on all sides in contact with water.

**2.2.4 Compaction**

All units shall be compacted so that, when hardened, they shall be free from honeycombing and from any individual large void (i.e. greater than 6 mm) as defined in **4.4.1** of BS 1881 : Part 120 : 1983.

**2.2.5 Work in cold weather**

Concrete, when placed, shall have a temperature of not less than 5 °C, which shall be maintained until the concrete is hardened.

It is permissible to heat aggregates and water, before mixing, to a temperature not exceeding 60 °C.

No materials or moulds shall be used at a temperature below 0 °C.

## 2.3 Galvanized steel troughs

**2.3.1 General**

Galvanized steel troughs shall comply with **2.1.**

**2.3.2 Materials**

**2.3.2.1** Troughs shall be constructed from low carbon steel sheet with continuous welded joints.

**2.3.2.2** Troughs with either a height or a width that does not exceed 600 mm shall be constructed in low carbon steel of thickness not less than 1.59 mm before galvanizing.

**2.3.2.3** Troughs with either a height or a width that does exceed 600 mm shall be constructed in low carbon steel of thickness not less than 2.00 mm before galvanizing.

**2.3.3 Stiffening**

To ensure rigidity during galvanizing and in use, troughs shall be provided with lateral and top edge stiffening as follows:

(a) lateral stiffeners consisting of 25 mm x 6 mm bar steel, welded at both ends across the width of the trough, as specified in table 3;

**Table 3. Minimum number of stiffeners required for galvanized steel troughs**

| Length of trough body | Minimum number of stiffeners | |
|---|---|---|
| | Troughs of 1.59 mm steel (see 2.3.2.1) | Troughs of 2.00 mm steel (see 2.3.2.2) |
| Up to and including 1500 mm | Nil | Nil |
| Over 1500 mm and up to 2000 mm | Nil | One |
| Over 2000 mm and up to 2500 mm | Two | Two |
| Over 2500 mm and up to 3000 mm | Three | Three |

(b) top edge stiffening (which also provides protection to animals from sharp edges) shall be provided either:

(1) using split tube tops as specified in table 4 and illustrated in figure 1(a); or

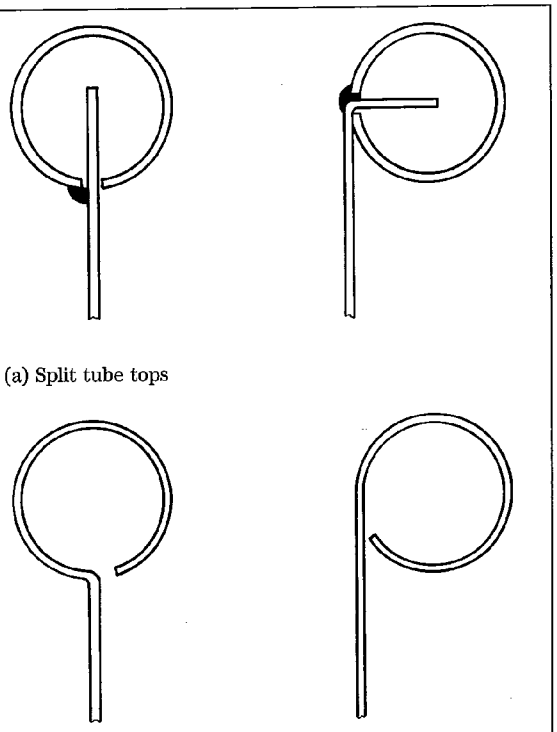
(2) using rolled tops which shall have an external diameter of not less than 25 mm.

**2.3.4 Corners**

The corners of the top edge shall be free from sharp projections to avoid injury to animals. Split tube tops or roll tops shall be either mitred and welded or the gap between the top edge stiffening on the side and end of the trough shall be covered by a shaped fitting welded into place to cover the gap.

**Table 4. Minimum dimensions for split tube used for top edge stiffening**

| Characteristic | Troughs of 1.59 mm steel (see 2.3.2.1) | Troughs of 2.00 mm steel (see 2.3.2.2) |
|---|---|---|
| External diameter of tube | 25 mm | 31 mm |
| Wall thickness of tube | 1.21 mm | 1.59 mm |



(a) Split tube tops

(b) Roll tops

**Figure 1. Top edge protection of galvanized steel troughs**

### 2.3.5 Galvanizing

After assembly, the troughs shall be galvanized in accordance with BS 729.

## 2.4 Spray moulded glass reinforced cement (GRC) troughs

### 2.4.1 General

GRC troughs shall comply with **2.1.**

### 2.4.2 Materials

#### 2.4.2.1 *Cement*

The cement used shall comply with the appropriate British Standard as given in table 5.

**Table 5. British Standards for cement in GRC troughs**

| Type of cement | British Standard |
|---|---|
| Ordinary and rapid-hardening Portland | BS 12 |
| Portland-blastfurnace | BS 146 : Part 2 |
| Sulfate-resisting Portland | BS 4027 |
| Portland pulverized-fuel ash | BS 6588 |
| Pozzolanic cement with pulverized-fuel ash as a pozzolana | BS 6610 |

#### 2.4.2.2 *Aggregates*

Aggregates shall be suitably graded silica sand, limestone, granite or other stable fine material which is hard, durable and clean. It shall not contain deleterious materials in such a form or in sufficient quantity to affect adversely the strength at any age or the durability of the GRC. Account shall be taken of the fact that aggregates vary in properties such as shrinkage and modulus of elasticity.

#### 2.4.2.3 *Water*

Water shall be clean and free from harmful matter in such quantities as would affect the properties of the GRC (see appendix A of BS 3148 : 1980).

#### 2.4.2.4 *Alkali-resistant glassfibre*

The glassfibre shall be of alkali-resistance quality containing not less than 16 % zirconia. The strength of the glassfibre in a cement environment shall be assessed by means of the strand strength test and a certificate giving the results of the test shall be provided.

The glassfibre shall have an S.I.C. value greater than 330 $N/mm^2$ after 96 h in water at 80 °C when tested in accordance with the Glassfibre Reinforced Cement Association document GRCA 5 0104/0184 : January 1984.

#### 2.4.2.5 *Admixtures*

Where admixtures are used they shall comply with BS 5075 and the supplier's recommendations and instructions shall be followed. Any admixtures used shall not reduce the strength of the product or cause any corrosion of fittings, nor shall they impart any obnoxious or unpallatable substance into the drinking water.

#### 2.4.2.6 *Polymers*

Only polymers of a type formulated, or recommended by a supplier, for use in cementitious slurries shall be used. Anti-foaming agent shall be added or included in the constitution of the polymer.

#### 2.4.2.7 *Requirements for GRC*

Test board samples for testing in accordance with BS 6432 shall be produced each working day and the arithmetic mean of the test results for the specimens taken from each board shall satisfy the requirements given in table 6.

**Table 6. GRC for trough bodies**

| Property | Minimum mean value |
|---|---|
| Modulus of rupture | 19 $N/mm^2$ |
| Limit of proportionality | 6.4 $N/mm^2$ |
| Wet bulk density | 2000 $N/mm^2$ |
| Glass content | 4.5 % by mass |

**2.4.3 Design**

**2.4.3.1** The sides of the trough shall be not less than 10 mm thick. The base of the trough shall be not less than 12 mm thick for troughs up to 500 L capacity, and not less than 15 mm thick for those exceeding 500 L capacity.

**2.4.3.2** The upper edges of the trough shall be stiffened by flanges having a minimum depth of 20 mm and a minimum width of 50 mm.

**2.4.3.3** As a protection against frost damage the water container shall have a vertical taper of not less than 15 mm per 300 mm depth on all sides in contact with water.

## 2.5 Polyethylene troughs

**2.5.1 General**

Polyethylene troughs shall comply with **2.1.**

**2.5.2 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/cm$^3$ but not exceeding 0.967 g/cm$^3$ at 23 °C when determined in accordance with appendix B of BS 3412 : 1976.

(b) Carbon black in such amount that, when the compound is tested by the method described in BS 2782 : Method 452B, the carbon black content shall be 2.0 % to 3.0 %. The carbon black shall comply with the following requirements:

(1) density of 1.5 g/cm$^3$ to 2.0 g/cm$^3$;

(2) maximum volatile matter of 9 % (*m/m*);

(3) average particle size of 0.01 mm to 0.025 mm;

(4) toluene extract of not more than 0.10 % (*m/m*) when determined by the method described in appendix A.

When tested by the method described in BS 2782 : Method 823A, the carbon black dispersion in the trough shall be as illustrated in figure 1, 'photomicrographs 1 to 5' of the standard. The uniformity of appearance in respect of smears and streaks shall be equal to or better than that illustrated in figure 1, 'photomicrograph A' of that standard.

(c) Antioxidant in such amount that, when the compound is tested as described in BS 2782 : Method 434D, 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 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 plus up to 0.5 % (*m/m*) of calcium or sodium stearate.

NOTE. The addition of up to 100 % of rework material of the same type, complying with this specification, is permissible.

**2.5.3 Finish of troughs**

The trough surface finish shall be smooth and of even texture and free from surface imperfections which detract from the performance of the trough in use. Where reinforcing plates are supplied they shall be treated to prevent corrosion and shall be free from sharp edges, sharp corners or surface projection.

**2.5.4 Design of polyethylene troughs**

**2.5.4.1** ***General***

Troughs manufactured from the materials specified in **2.5.2** shall comply with the relevant performance requirements specified in **2.5.4.2** and **2.5.4.3** for samples selected in accordance with **2.5.5.**

**2.5.4.2** ***Resistance to impact***

Troughs shall be tested in accordance with the method given in appendix B and the impact shall neither split nor puncture the trough.

**2.5.4.3** ***Tensile strength and elongation at break***

When tested in accordance with the method given in appendix C the ultimate tensile strength of the polyethylene component of the wall of the trough shall be not less than 7.6 N/mm$^2$. Also the percentage elongation at break of the specimens from both the horizontal axes and the vertical axes shall be not less than 100 %.

**2.5.5 Selection of trough samples for testing**

**2.5.5.1** In order to maintain quality during production, troughs shall be selected for routine testing in accordance with **2.5.5.2** and tested as relevant for:

(a) impact resistance (see **2.5.4.2**);

(b) tensile strength (see **2.5.4.3**).

**2.5.5.2** At the start of a production run of any type of trough, tests shall be carried out on successive troughs until a satisfactory trough has been produced. Thereafter the rate of test shall be either:

(a) 0.2 % of the production run; or

(b) one trough at the end of the production run if the run is less than 500 troughs.

Should a trough so tested fail any of the relevant routine tests, a selection of previously produced troughs in that production run shall be tested until the first satisfactory trough is identified. This trough and all troughs produced subsequent to this shall be rejected.

### 2.5.6 Wall and base sections

To ensure rigidity and prevent deformation during use, polyethylene troughs shall have a minimum wall and base thickness, as specified in table 7.

**Table 7. Wall and base thickness for polyethylene troughs**

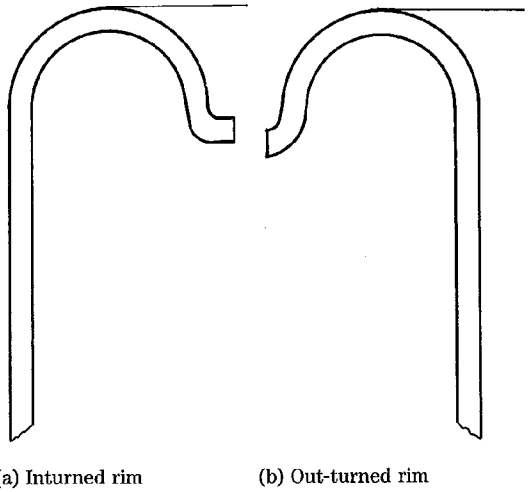
| Capacity of trough | Minimum wall and base thickness |
|---|---|
| | mm |
| Up to and including 500 L | 4.0 |
| Over 500 L and up to 1000 L | 5.0 |
| Over 1000 L and up to 1500 L | 6.0 |
| Over 1500 L and up to 2000 L | 7.0 |
| Over 2000 L and up to 2500 L | 8.0 |
| Over 2500 L and up to and including 3000 L | 9.0 |

### 2.5.7 Rim design

Additional strength and protection shall be given to the rim of the trough by either of the following:

(a) by being of a design shown in figure 2;

(b) alternative arrangements that offer at least an equivalent degree of protection and strength.



(a) Inturned rim (b) Out-turned rim

**Figure 2. Rim sections**

### 2.5.8 Radii in the trough body

Any change in section of the trough body shall have a minimum radius of 3 mm. In order to prevent crack propagation, trough moulding shall be trimmed in a manner such as not to leave any corner or notch without the minimum radius.

## 2.6 Test for watertightness and rigidity of completed trough

### 2.6.1 Procedure

**2.6.1.1** Mount the trough as recommended by the manufacturer and in such a way that the top edges of the drinking compartment are horizontal.

**2.6.1.2** Fill the trough with water to the maximum depth for usage.

**2.6.1.3** Examine the trough for signs of leakage or overspillage owing to distortion.

### 2.6.2 Results

Troughs that show visible signs of leaking, or of overspilling owing to distortion, shall be deemed not to have satisfied the test.

## 2.7 Marking and information

**2.7.1** Trough bodies complying with this British Standard shall be clearly and durably marked with the following:

(a) the manufacturer's name and identification mark;

(b) the number of this British Standard, (i.e. BS 3445)[1];

(c) the nominal capacity in litres.

**2.7.2** Recommendations on the handling, siting and installation of the trough body shall be made available (see BS 3445 : Part 2).

[1] Marking BS 3445 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is therefore solely the responsibility of the person making the claim. Such a declaration is not to be confused with third party certification of conformity, which may also be desirable.

# Section 3. Water fittings and service box

## 3.1 General

**3.1.1** The design of water fittings shall be such that the trough, when installed, can be supplied with water in such a way that the supply is protected from contamination, backsiphonage, or backflow, by the provision of a clear type 'A' air gap between the lowest point of discharge of the float valve and the unobstructed spillover level of the trough.

The water supply upstream of the air gap shall be protected from contamination by the use of materials or substances defined as unsuitable in BS 6920 : Part 1. It shall also be protected from waste caused by damage to water fittings or the use of unsuitable, or improperly installed, water fittings.

NOTE. Attention is drawn to local byelaws or regulations where appropriate.

**3.1.2** A covered service box shall be provided to contain the inlet and float operated valve.

## 3.2 Materials

### 3.2.1 Water fittings

Water fittings shall comply with the British Standards given in table 8, as appropriate.

**Table 8. British Standards for water fittings for troughs**

| Water fitting | British Standard |
|---|---|
| Float operated valves | BS 1212 : Part 1[1], Part 2 or Part 3 |
| Floats | BS 1968 (copper) BS 2456 (plastics) |
| Underground stop valves/cocks | BS 5433 (stop valves) BS 2580 (plug cocks) |

[1] It is permissible to use valves specified in BS 1212 : Part 1 for all sizes of installation. However, when used for $\frac{1}{2}$ in installations the valves shall be fitted with an easily adjustable device for setting the water level. In a $\frac{1}{2}$ in installation it is not permissible to bend the float arm to set the water level.

### 3.2.2 Supply or distribution pipes

Supply or distribution pipes shall comply with the British Standards given in table 9, as appropriate. All insulation to pipes shall be as specified in BS 6700.

When laid underground, copper tube shall comply with table Y in BS 2871 : Part 1 : 1971.

When laid underground, steel pipes, joints and fittings shall be heavy gauge tubes only and protected by the methods described in BS 534. Pipework above ground shall be heavy or medium grade, either coated internally and externally in accordance with BS 534 or galvanized.

**Table 9. British Standards for supply or distribution pipes, and pipe fittings, to troughs**

| Pipe and pipe fitting material | British Standard |
|---|---|
| Copper or copper alloy pipes | BS 2871 : Part 1 |
| Joints and fittings for use with copper or copper alloy pipes | BS 4504 or BS 1724 or BS 864 as appropriate |
| Polyethylene pipes | BS 6572 |
| Joints and fittings for use with polyethylene pipes | BS 864 : Part 5 |
| Stainless steel pipes | BS 4127 : Part 2 |
| Joints and fittings for use with stainless steel pipes | BS 864 : Part 2 |
| Steel pipes | BS 1387 |
| Joints and fittings for use with steel pipes | BS 1740 : Part 1 |
| UPVC pipes | BS 3505 |
| Joints and fittings for use with UPVC pipes | BS 4346 |

NOTE 1. Galvanizing is not accepted as the only protection for underground pipework.

NOTE 2. Additional protection by the provision of external polyethylene coating to the pipes and fittings is sometimes advisable.

NOTE 3. Advice on the suitability of the distribution pipe material may be obtained from the appropriate official bodies including the local water company, or the Advisory Service of the Ministry of Agriculture, Fisheries and Food.

### 3.2.3 Float operated valves

The types of float operated valves shall be related to water pressure in accordance with table 10.

**Table 10. Types of float operated valves for various water pressures**

| Water pressure[1] | Type of valve required |
|---|---|
| Up to and including 3 bar[2] | Low pressure |
| Over 3 bar and up to 7 bar | Medium pressure |
| Over 7 bar and up to 14 bar | High pressure |

[1] Advice on water pressure and flow may be obtained from the appropriate official bodies including the regional water authority, or the Advisory Service of the Ministry of Agriculture, Fisheries and Food.

[2] 1 bar = $10^5$ N/m$^2$ = 100 kPa (≃ 1 atm).

NOTE. 3 bar = 30.5 m $H_2O$
7 bar = 71.0 m $H_2O$
14 bar = 142.0 m $H_2O$

### 3.2.4 Service box

**3.2.4.1** The service box shall be manufactured from one of the following:

(a) materials as specified in **2.2.2**; or

(b) low carbon steel of thickness not less than 1.59 mm or 1.22 mm when rigidly fixed to a concrete trough, galvanized after manufacture to BS 729; or

(c) materials as specified in **2.4.2**; or

(d) materials as specified in **2.5.2.**

**3.2.4.2** Materials and substances used in the manufacture of the service box shall not impart toxicity to the trough body, nor shall they render the water in the trough unfit for consumption by livestock.

## 3.3 Design and construction

### 3.3.1 Float operated valve and service box

**3.3.1.1** The level of water in the trough shall be controlled by a float operated valve.

**3.3.1.2** Valves of 15 mm or 22 mm nominal sizes shall be provided.

**3.3.1.3** The service box shall be designed such that the inside may be readily inspected and cleansed, and any float operated valve, or other device used for controlling the inflow of water, may be readily installed, repaired, renewed or adjusted.

**3.3.1.4** The service box shall provide a 12 mm clearance around the float operated valve with a 150 mm diameter float. The clearance is to allow for the satisfactory operation of the float operated valve.

NOTE. When loose (separate) service boxes are supplied, the size of the float operated valve should be established between the supplier and the purchaser.

**3.3.1.5** The float operated valve shall be accommodated in a service box, which shall be constructed so that it is either integral with the drinking compartment or is securely and rigidly attached to the drinking compartment.

**3.3.1.6** The float operated valve shall be securely and rigidly fixed to the service box.

NOTE. The position of the float operated valve should make provision for its installation.

**3.3.1.7** When a float operated valve is fitted which conforms with BS 1212 : Part 1 the lowest part of its outlet shall be above the top edge of the drinking compartment of the trough by the dimension $S$, specified in table 11.

**Table 11. Position of float operated valves**

| Nominal size of diameter ($d$) of supply pipe | Minimum value of $S$ |
|---|---|
| | mm |
| Up to and including 14 mm | 20 |
| 15 mm and up to 21 mm | 25 |
| 22 mm and up to 41 mm | 70 |
| 42 mm and over | $2d$ |

NOTE. The value of $S$ is related not to the size of the float operated valve but to the size of the supply pipe, which in many cases will be larger than the nominal size of the float operated valve.

**3.3.1.8** The wall(s) separating the service box from the drinking compartment(s) shall be provided with an aperture large enough to permit the free flow of water to the drinking compartment(s) and shall be designed in such a way as to prevent an animal from getting its head trapped when drinking from a trough that is almost empty.

**3.3.1.9** The service box shall be fitted with a close fitting removable cover securely fixed in position or otherwise designed so that it will protect the float operated valve from interference by livestock, will deter interference by unauthorized persons, and yet will allow access for maintenance.

**3.3.1.10** Surfaces and edges accessible to livestock shall be free from sharp edges and projections.

# Appendices

## Appendix A. Method for determination of toluene extract of carbon black

### A.1 Apparatus

**A.1.1** *Paper extraction thimbles,* double thickness, fat extracted.

**A.1.2** *Soxhlet extractor,* complying with BS 2071.

**A.1.3** *Shallow borosilicate glass weighing dish,* 50 mL capacity.

### A.2 Reagent

**A.2.1** *Toluene,* sulfur free, of a recognized reagent quality.

### A.3 Procedure

Place 5 g to 8 g of pelletized carbon black or 2 g to 5 g of compressed fluffy black in an extraction thimble. Insert the thimble into a Soxhlet extractor. Measure 50 mL to 60 mL of toluene into the Soxhlet flask.

Assemble the Soxhlet extraction apparatus and extract for 22 h.

Transfer the extract solution into the previously cleaned, dried and tared weighing dish. Filter, if necessary, and rinse the extraction flask with toluene and add to the weighing dish. Evaporate the total solution on a hotplate to a volume of approximately 5 mL to 10 mL and then place in a drying oven at 115 °C until dry.

Cool in a desiccator to room temperature and weigh.

### A.4 Calculation

The toluene extract shall be calculated as follows:

$$T_E = \frac{M_E}{M_S} \times 100$$

where

$T_E$ is the percentage of toluene extract (in % (*m/m*));

$M_E$ is the mass of extract (in g);

$M_S$ is the mass of sample (in g).

## Appendix B. Method of test for impact resistance

### B.1 Testing machine

**B.1.1** The testing machine shall be such as to allow the striker to fall freely from a height of 3 m.

**B.1.2** The striker shall be 25 mm in diameter, hemispherically ended and have a mass of 2.5 kg. Its shape shall be such that only the surface of the specified hemisphere comes into contact with the trough under the initial blow.

### B.2 Conditions prior to test

The trough shall be maintained in an inverted position at a temperature of 23 ± 2 °C for a period of not less than 1 h prior to the commencement of the test.

### B.3 Procedure

**B.3.1** Arrange the striker so as to hit the base of the trough at its midpoint.

**B.3.2** Allow the striker to fall freely from a minimum height of 3 m and strike the base of the trough.

**B.3.3** Repeat the operation given in **B.3.2** but with the impacts occurring as close as is practicable to the edge or corners of the base of the trough.

## Appendix C. Method of test for tensile strength and elongation at break tests

**C.1** Carry out the test in accordance with Method 320A of BS 2782 : Methods 320A to 320F : 1976 using the test piece illustrated in figure 1 of that standard, except for the following.

(a) The thickness of the specimens shall be that of the trough wall. An equal number of specimens shall be taken from the horizontal and vertical axes of the trough wall, but where design only permits specimens to be taken in the vertical axis, an equal number of specimens shall be taken from the trough base.

(b) The specimens shall be either punched from the trough wall at a temperature not in excess of 50 °C, or machined or routed from the trough wall. When routed or machined, the edges of the specimens shall be polished to ensure the absence of notches.

(c) The rate of separation of the grips shall be 500 ± 50 mm/min for polyethylene with a derived density from 0.910 g/cm$^3$ to 0.925 g/cm$^3$; for polyethylene of higher derived density and for polypropylene, the rate of separation of the grips shall be 100 ± 10 mm/min.

**C.2** In the case of a trough having composite walls, carry out the test on specimens moulded from polyethylene compound identical to that used in the manufacture of the trough.

# Index

## Publication(s) referred to

| | |
|---|---|
| BS 12 | Specification for Portland cements |
| BS 146 | Specification for Portland-blastfurnace cement<br>Part 2 Metric units |
| BS 534 | Specification for steel pipes, joints and specials for water and sewage |
| BS 729 | Specification for hot dip galvanized coatings on iron and steel articles |
| BS 864 | Capillary and compression tube fittings of copper and copper alloy<br>Part 2 Specification for capillary and compression fittings for copper tubes<br>Part 5 Specification for compression fittings for polyethylene pipes with outside diameters to BS 5556 |
| BS 882 | Specification for aggregates from natural sources for concrete |
| BS 1212 | Float operated valves<br>Part 1 Specification for piston type float operated valves (copper alloy body) (excluding floats)<br>Part 2 Specification for diaphragm type float operated valves (copper alloy body) (excluding floats)<br>Part 3 Specification for diaphragm type float operated valves (plastics bodied) for cold water services only (excluding floats) |
| BS 1387 | Specification for screwed and socketed steel tubes and tubulars and for plain end steel tubes suitable for welding or for screwing to BS 21 pipe threads |
| BS 1724 | Specification for bronze welding by gas |
| BS 1740 | Specification for wrought steel pipe fittings (screwed BS 21 R-series thread)<br>Part 1 Metric units |
| BS 1881 | Testing concrete<br>Part 120 Method for determination of the compressive strength of concrete cores |
| BS 1968 | Specification for floats for ballvalves (copper) |
| BS 2071 | Specification for Soxhlet extractors |
| BS 2456 | Specification for floats (plastics) for float operated valves for cold water services |
| BS 2580 | Specification for underground plug cocks for cold water services |
| BS 2782 | Methods of testing plastics |
| BS 2871 | Specification for copper and copper alloys. Tubes<br>Part 1 Copper tubes for water, gas and sanitation |
| BS 3148 | Methods of test for water for making concrete (including notes on the suitability of the water) |
| BS 3412 | Specification. Polyethylene materials for moulding and extrusion |
| BS 3445 | Agricultural water troughs and water fittings<br>Part 2 Code of practice for installation and operation |
| BS 3505 | Specification for unplasticized polyvinyl chloride (PVC-U) pressure pipes for cold potable water |
| BS 3892 | Pulverized-fuel ash<br>Part 1 Specification for pulverized-fuel ash for use as a cementitious component in structural concrete |
| BS 4027 | Specification for sulphate-resisting Portland cement |
| BS 4127 | Specification for light gauge stainless steel tubes<br>Part 2 Metric units |
| BS 4346 | Joints and fittings for use with unplasticized PVC pressure pipes |
| BS 4449 | Specification for carbon steel bars for the reinforcement of concrete |
| BS 4482 | Specification for cold reduced steel wire for the reinforcement of concrete |
| BS 4483 | Specification for steel fabric for the reinforcement of concrete |

| | |
|---|---|
| BS 4504 | Circular flanges for pipes, valves and fittings (PN designated) |
| BS 5075 | Concrete admixtures |
| BS 5328 | Concrete<br>Part 4 Specification for the procedures to be used in sampling, testing and assessing compliance of concrete |
| BS 5433 | Specification for underground stopvalves for water services |
| BS 6100 | Glossary of building and civil engineering terms |
| BS 6432 | Methods for determining properties of glass fibre reinforced cement material |
| BS 6572 | Specification for blue polyethylene pipes up to nominal size 63 for below ground use for potable water |
| BS 6588 | Specification for Portland pulverized-fuel ash cement |
| BS 6610 | Specification for pozzolanic cement with pulverized-fuel ash as pozzolana |
| BS 6699 | Specification for ground granulated blastfurnace slag for use with Portland cement |
| BS 6700 | Specification for design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages |
| BS 6920 | 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<br>Part 1 Specification |
| BS 8110 | Structural use of concrete |

Glassfibre Reinforced Cement Association document GRCA 5 0104/0184 January 1984[1)]

[1)] Available from Glassfibre Reinforced Cement Association, 5 Upper Bar, Newport, Shropshire, TF10 7EH

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