



## EAST AFRICAN STANDARD

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**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 2: Methods of test — Section 2.1: Samples for testing**

*Draft for comments only — Not to be cited as East African Standard*

**EAST AFRICAN COMMUNITY**

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## Foreword

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

In order to meet the above objectives, the EAC Partner States have enacted an East African Standardization, Quality Assurance, Metrology and Test Act, 2006 (EAC SQMT Act, 2006) to make provisions for ensuring standardization, quality assurance, metrology and testing of products produced or originating in a third country and traded in the Community in order to facilitate industrial development and trade as well as helping to protect the health and safety of society and the environment in the Community.

East African Standards are formulated in accordance with the procedures established by the East African Standards Committee. The East African Standards Committee is established under the provisions of Article 4 of the EAC SQMT Act, 2006. The Committee is composed of representatives of the National Standards Bodies in Partner States, together with the representatives from the private sectors and consumer organizations. 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 procedures of the Community.

Article 15(1) of the EAC SQMT Act, 2006 provides that "Within six months of the declaration of an East African Standard, the Partner States shall adopt, without deviation from the approved text of the standard, the East African Standard as a national standard and withdraw any existing national standard with similar scope and purpose".

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.

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## Introduction

In the preparation of this East African Standard, the following source was consulted extensively:

BS 6920-2-1:2000, *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 2: Methods of test — Section 2.1: Samples for testing*

Assistance derived from this source and others inadvertently not mentioned is hereby acknowledged.

Draft for comments only — Not to be cited as East African Standard

**BRITISH STANDARD**

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**BS 6920-2.1:  
2000**

*Incorporating  
Amendments  
Nos. 1 and 2*

# **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 2: Methods of test —**

**Section 2.1: Samples for testing**

ICS 13.060.20

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**BSi**  
British Standards

## Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee EH/6, Effects of materials on water quality, upon which the following bodies were represented:

- Automatic Vending Association of Britain
- British Cement Association
- BCF — British Coatings Federation Ltd
- British Malleable Tube Fittings Association
- British Plastics Federation
- British Plumbing Fittings Manufacturers' Association
- British Precast Concrete Federation Ltd
- British Rubber Manufacturers' Association Ltd
- British Water
- DEFRA — Water and Land Directorate
- Galvanizers Association
- Laboratory of the Government Chemist
- Pipeline Industries Guild
- UK Steel Association
- Water Regulations Advisory Scheme
- Water Research Centre plc

This British Standard, having been prepared under the direction of the Health and Environment Sector Committee, was published under the authority of the Standards Committee and comes into effect on 15 May 2000

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## Foreword

This section of BS 6920 has been prepared by Technical Committee EH/6. It supersedes BS 6920-2.1:1996, which is withdrawn.

This edition introduces technical changes but it does not reflect a full review or revision of the standard.

BS 6920 is published in several parts, namely *Part 1: Specification*, *Part 2: Methods of test*, *Part 3: High temperature tests* and *Part 4: Method for the GCMS identification of water leachable organic substances*.

Part 2 is further subdivided into a number of sections and subsections as follows:

*Section 2.1: Samples for testing;*

*Section 2.2: Odour and flavour of water;*

*Subsection 2.2.1: General method of test;*

*Subsection 2.2.2: Method of testing odours and flavours imparted to water by hoses and composite pipes and tubes;*

*Subsection 2.2.3: Method of testing odours and flavours imparted to water by hoses for conveying water for food and drink preparation;*

*Section 2.3: Appearance of water;*

*Section 2.4: Growth of aquatic microorganisms test;*

*Section 2.5: The extraction of substances that may be of concern to public health;*

*Section 2.6: The extraction of metals.*

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 13 and a back cover.

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Sidelining in this document indicates the most recent changes by amendment.

## 1 Scope

This section of BS 6920 describes the preparation of samples of all types of non-metallic products for testing their suitability for use in contact with water intended for human consumption.

NOTE Under the requirements of the Water Supply (Water Quality) Regulations (Regulation 25) and the Water Supply (Water Fittings) Regulations (Clause 2 of Schedule 2), the National Regulator may specify additional provisions in some cases and assess the significance of the results obtained.

## 2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this section of BS 6920. For dated references, subsequent amendments to or revisions of, any of these publications do not apply. For undated references, the latest edition of the publication referred to applies.

BS 12, *Specification for Portland cement.*

BS 864-2, *Capillary and compression tube fittings of copper and copper alloy — Part 2: Specification for capillary and compression fittings for copper tubes.*

BS 887:1982, *Specification for precision vernier callipers.*

BS 2871-1, *Specification for copper and copper alloys — Tubes — Part 1: Copper tubes for water, gas and sanitation.*

BS 2874, *Specification for copper and copper alloy rods and sections (other than forging stock).*

BS 3574, *Specification for the controlled storage and packaging of vulcanized rubber and rubber products.*

BS 3900-C5, *Methods of test for paints — Determination of film thickness.*

BS 4372:1968, *Specification for engineers' steel measuring rules.*

BS 6068-2.50, *Water quality — Physical, chemical and biochemical methods — Determination of pH.*

BS 6920-1:2000, *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 6920-2.2.1, *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 2: Methods of test — Section 2.2: Odour and flavour of water — Subsection 2.2.1: General method of test.*

BS 6920-2.2.2, *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 2: Methods of test — Section 2.2: Odour and flavour of water — Subsection 2.2.2: Method of testing odours and flavours imparted to water by hoses and composite pipes and tubes.*

BS 6920-2.2.3, *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 2: Methods of test — Section 2.2: Odour and flavour of water — Subsection 2.2.3: Method of testing odours and flavours imparted to water by hoses for conveying water for food and drink preparation.*

BS 6920-2.3, *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 2: Methods of test — Section 2.3: Appearance of water.*

BS 6920-2.4, *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 2: Methods of test — Section 2.4: Growth of aquatic microorganisms test.*

BS 6920-2.5, *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 2: Methods of test — Section 2.5: The extraction of substances that may be of concern to public health.*

BS 6920-2.6, *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 2: Methods of test — Section 2.6: The extraction of metals.*

BS 6920-3, *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 3: High temperature tests.*

BS 7766, *Specification for assessment of the potential for metallic materials to affect adversely the quality of water intended for human consumption.*

BS 8007, *Code of practice for design of concrete structures for retaining aqueous liquids.*

BS EN 30012-1, *Quality assurance requirements for measuring equipment — Part 1: Metrological confirmation system for measuring equipment.*

BS EN ISO 3696, *Water for analytical laboratory use — Specification and test methods.*

### 3 Terms and definitions

For the purposes of this section of BS 6920, the following definitions apply.

#### 3.1

##### **product**

all or a component part of a manufactured item, in its finished form, that comes into contact with water

#### 3.2

##### **composite product**

product whose water-contact surface is made from a material that differs from those comprising the remainder of the product

#### 3.3

##### **test sample**

product, or part of a product, submitted to the test procedure

NOTE In some cases the sample may consist of more than one example of the product.

#### 3.4

##### **anaerobic adhesive**

adhesive that cures spontaneously in the absence of oxygen, curing being inhibited by the presence of oxygen and catalysed by metal ions

### 4 Apparatus

#### 4.1 *Polyethylene bags, of a type suitable for food contact.*

Prior to use, the bags shall be stored in a closed container. The bags shall not be used for thermosetting rubber compounds (6.3).

#### 4.2 *Test plates*

4.2.1 *Glass plates*, constructed of sand-blasted glass, that have a total surface area of  $(15\,000 \pm 500)$  mm<sup>2</sup>. The width of the plates shall not exceed 60 mm.

Soak the plates for 24 hours in 10 % nitric acid and thoroughly rinse in tap water. Clean them in an aqueous solution of a biodegradable laboratory detergent. Rinse thoroughly in tap water and then once in distilled water conforming to grade 3 of BS EN ISO 3696. Drain and dry in a hot air cabinet and store in polyethylene bags (4.1).

4.2.2 *Stainless steel plates*, of the same surface area and dimensions as the glass plates of 4.2.1.

The plates shall be cleaned before use in accordance with 4.2.1 omitting the soaking in 10 % nitric acid.

4.2.3 *Special glass plates*, as specified in 4.2 except that only one side shall be sand-blasted.

4.3 *Brass couplings, female/female*, 15 mm diameter compression brass couplings conforming to BS 864-2 that have a composition meeting the designations CZ 122 or CZ 132 of BS 2874 or BS 7766, respectively.

Take the coupling apart and discard the compression “olives”; retain the body of the coupling and the two screw collars. Immerse the couplings in a cleaning agent (see 4.2) for 5 min. Rinse the couplings with distilled water conforming to grade 3 of BS EN ISO 3696, and then immerse in a 1 % by volume solution of nitric acid for 1 min. Rinse in tap water and then in distilled water again. Drain and dry in a hot air cabinet and store in polyethylene bags (4.1).

**4.4 Special glass plates**, as specified in 4.2 except that only one side shall be sand-blasted.

**4.5 Test container**, made of glass, as specified in the appropriate section of BS 6920, and of size as given in 5.1.2.

## 5 Procedure

### 5.1 General requirements

#### 5.1.1 Nature of samples

The samples used for testing shall be manufactured products or components of water fittings drawn from production batches that have received no other treatment, except for the exclusions given below.

In a very few special applications, e.g. within water undertakings' distribution systems involving products used for joints in service reservoirs, or large tanks constructed in accordance with BS 8007, the surface area to volume ratio used for the tests described in BS 6920-2.2, BS 6920-2.3, BS 6920-2.4, BS 6920-2.5 and BS 6920-2.6 shall be  $1\,000\text{ mm}^2/\text{l}$ .

#### 5.1.2 Sample and test container size

Use, wherever possible, a sample with a total surface area of  $(15\,000 \pm 500)\text{ mm}^2$  and a test container (4.5) bearing a calibration mark for a capacity of 1 000 ml. If in exceptional circumstances this size of sample cannot be obtained, use a test container calibrated for a capacity in accordance with Table 1. The sample shall be made up from one or more articles drawn from the same production batch or cut from a single larger product. The maximum length and width of any single sample shall be 150 mm and 70 mm respectively.

**Table 1 — Test container calibration mark**

| Sample surface area<br>mm <sup>2</sup> | Volume indicated by calibration mark<br>ml |
|--|--|
| $5\,500 \leq \text{to} < 9\,500$       | 500  |
| $9\,500 \leq \text{to} < 13\,000$      | 750  |
| $13\,000 \leq \text{to} < 19\,000$     | 1 000                                      |
| $19\,000 \leq \text{to} \leq 26\,000$  | 1 500                                      |

During testing, the samples shall always be completely submerged in the test water. If the density of the sample is less than that of water, the sample shall be kept totally submerged for the duration of the test by using glass-encapsulated weights.

Determine the dimensions of all samples using measuring equipment calibrated in accordance with BS EN 30012-1. The instruments used shall include rules and callipers conforming to the accuracy requirements of BS 4372:1968, 2.5.4 and BS 887:1982, Clause 6 respectively.

If the sample has a textured finish to the surface, or the shape of the sample is such that accurate calculation of the surface area is impracticable, then a sample of estimated surface area shall be used. In this case the length and width shall be recorded together with a sufficiently detailed description of the product(s) to enable further samples to be prepared that will be within  $\pm 10\%$  of the surface area of the original sample.

**NOTE** The supplier of the samples should be instructed to ensure that the products or test samples represent the product as it is used in contact with water intended for human consumption. If the product has to be cut to obtain the required sample area, this should be done before the samples receive any post-cure or special surface treatment and in a manner that ensures the area of the cut edges is as small as possible.

### 5.2 Sample storage

The samples shall be protected from contamination by dirt, oil, grease, excessive heat, sunlight and volatile chemicals. Store samples in the laboratory in polyethylene bags (4.1) and in the absence of light at  $(21 \pm 4)\text{ }^\circ\text{C}$  except where the individual supplying the samples provides alternative written storage instructions, which are those that the products are subject to in practice. Use a fresh bag for each product or set of products made from an identical material.

Do not test samples bearing adhesive tape or labels, ink or pencil marks. Polyethylene bags (4.1) are not suitable for the storage of thermosetting rubber compounds (6.3).

## 6 Special requirements for factory made products

### 6.1 General

Products made from certain material types shall be subject to the additional requirements given in 6.2 to 6.14.

### 6.2 Thermoplastics products

Thermoplastic products shall be tested in any typical/suitable manufactured form using the production method for which they are designed, e.g. moulding grades for moulded test samples, extrusion grades for extruded samples.

Granules shall not be tested. Test samples shall be manufactured products, e.g. test sheets, extruded or moulded products etc.

NOTE By their very nature the materials used to manufacture these products are designed to melt when heated and solidify when cooled; when reheated they will again melt (unlike thermosetting products).

### 6.3 Thermosetting products

Thermosetting materials shall be tested in their final manufactured form.

NOTE Unlike thermoplastics materials, the performance of thermosetting materials, e.g. most rubber compounds, glass reinforced plastics (GRP) and epoxy resin based products can vary in the BS 6920 tests according to the conditions of final cure (together with any post cure treatments) and method of manufacture, e.g. compression moulding and extrusion.

Elastomeric products shall be stored in accordance with BS 3574 except that storage envelopes or pockets shall not be sealed, dusting powder shall not be used and cleaning shall not be carried out unless any of these procedures form part of the usual production procedures.

Suppliers of products shall be instructed to arrange for storage of the products for at least four weeks before dispatch to the laboratory.

NOTE If samples of elastomeric products are tested within four weeks of manufacture, the results obtained with these methods may not be representative of the material as it is used in practice.

### 6.4 Composite products

Samples of composite products shall be made of all the component parts or coatings, but with only the water contact material in contact with the test water (see also 6.4.1).

NOTE 1 Cistern or spiral-wound glass-reinforced plastics pipes, reinforced hoses or laminate pipes and tubes are typical examples of composite products.

Reinforced hoses, composite and laminate pipes and tubes shall be tested in accordance with BS 6920-2.2.2 for potential effects on the odour and flavour of water.

NOTE 2 Provided that the product is not one that falls within the definition of site-applied products (see Clause 7), composite products may be tested in the form of specially prepared samples, provided that they contain all the component materials present in the finished article.

#### 6.4.1 Hoses

To ensure that test samples are as representative as possible of potential use, obtain a minimum length of 20 m of hose as one continuous piece and cut off lengths from the centre of the hose to give the appropriate surface area for testing. Do not test the remainder of the hose.

In the case of hoses prepared for testing in accordance with BS 6920-2.2.2 and BS 6920-2.2.3, the test samples shall consist of 1 m lengths of the complete hose, including all reinforcements and outer coverings.

### 6.5 Ion-exchange resins

(2 ± 0.2) g of the resin beads shall be placed in a test container (4.5) calibrated for a capacity of 1 000 ml.

NOTE The BS 6920 methods are unsuitable for testing of other water treatment materials, e.g. polyphosphate, coagulants etc.

### 6.6 Greases, oils and lubricants

#### 6.6.1 Greases

(5 ± 0.5) g of the sample shall be evenly spread over the sand-blasted surface of a special glass plate (4.4). The plate shall be placed in a test container (4.5) calibrated for a capacity of 1 000 ml. Testing shall start immediately, or in strict accordance with the instructions for use.

### 6.6.2 Oils

A special glass plate (4.4) shall be dipped into the product and allow the plate to drain for 30 minutes. Testing shall start immediately, or in strict accordance with the instructions for use.

### 6.6.3 Water miscible lubricants

#### 6.6.3.1 General

NOTE These products are designed to facilitate assembly of joints etc. and are designed to be readily flushed away once the joint is complete.

#### 6.6.3.2 Low viscosity lubricants (oils)

A special glass plate (4.4) shall be dipped into the product and the plate shall be allowed to drain for 30 minutes. The plate shall then be placed into a 1 litre beaker, through which tap water is allowed to gently flow at a low rate (0.5 to 0.75 litre per minute) for 60 minutes.

NOTE Ensure that the water entering the beaker does not directly disturb the test plate surfaces.

The plate shall then be removed from the beaker and allowed to drain for 2 to 4 minutes and then placed on test immediately.

#### 6.6.3.3 High viscosity lubricants (greases)

(5 ± 0.5) g of the sample shall be spread over the sand blasted surface of a special glass plate (4.4). The plate shall then be placed into a test container (4.5) calibrated for a capacity of 1 000 ml.

Testing shall start immediately, or in strict accordance with the instructions for use.

NOTE 1 Since the grease may be easily washed off the plate, it is essential to ensure that the test water is added so as to cause the least possible disturbance of the grease film on the test plate in the test containers, both at the commencement of each test, and also at each change of test water. Similarly, it is important to ensure that pre-test rinsing with the test waters does not disturb the grease film.

NOTE 2 In all cases it is likely that some or all of the product will wash off the plate during the test period - this is normal but it should be noted in the final report.

### 6.7 Braided gland packings

NOTE A sample of a gland packing with a nominal surface area of 15 000 mm<sup>2</sup> will have an actual surface area of up to ten times this value once it is in contact with water intended for human consumption and the water has entered the structure of the packing. In addition, when this type of product is used in practice the actual area of the product in contact with water intended for human consumption is very small; on the basis of static volumes and contact areas in valves and pumps a realistic "worst-case" surface area to volume contact ratio appears to be about 1 000 mm<sup>2</sup> in contact with 1 litre of water.

These products shall be tested using the reduced nominal surface area to volume ratio of 1 000 mm<sup>2</sup> to 1 litre of water. Determine the size of the test sample piece shall be determined by assuming that the surface of the product is, in fact, a smooth surface, this will give the correct sample size with the nominal surface area required. Testing shall be undertaken in accordance with the appropriate section of BS 6920.

#### 6.7.1 Reporting

In addition to the normal requirements given in the pertinent standard the report shall include the following statement.

"This product has been tested at the reduced surface area (nominal) of 1 000 mm<sup>2</sup> in 1 l of test water, and under the conditions of test it was found to conform with the requirements BS 6920-1, for use as a gland packing only.

N.B. It has not been assessed for conformity with the requirements of BS 6920 at the standard surface area of 15 000 mm<sup>2</sup> in 1 l of test water."

### 6.8 Heat shrink products

These products shall be tested after they have been fully shrunk using the manufacturer's recommended heat treatment method, including the temperature and time of heating.

NOTE 1 Heat shrink products are designed to shrink to a tight fit (over components) when heated.

When a heat shrink product is to be fitted over probes etc. before the heat treatment is given, test samples shall be prepared by shrinking the material onto a metal rod made from a non-corroding material (e.g. aluminium or stainless steel) of a similar diameter to the proposed use.

Full details of the method used shall be recorded. After heat treatment, calculate the surface area of the sample and then test in the normal way using a surface area/volume ratio of 15 000 mm<sup>2</sup>/l. Full details of the heat shrink treatment used to prepare the test specimens shall be included in the final report.

NOTE 2 The normal heat treatment used for these products is hot air, although exceptionally other heating methods e.g. steam, hot water, may be recommended by the manufacturer.

### 6.9 UV cured products

NOTE These products rely upon sufficient exposure (penetration into the product) of both an adequate strength and wavelength of UV light, to bring about a complete cure. The presence of pigments in the product will, of course, affect penetration of the product. Most of these products, in their uncured form, contain styrene; the presence of free-styrene in the cured product is a sensitive indicator of the efficacy of the curing conditions.

Test samples shall be prepared under supervision of the test laboratory staff. The test report shall contain the following information relating to sample preparation:

- a) main wavelength(s) of the UV light emissions (if known);
- b) distance of the light from the test samples;
- c) duration of exposure to the UV light source.

### 6.10 Ceramic and graphite based products

#### 6.10.1 Ceramic products

These products shall be tested in accordance with BS 6920-1, Clause 8 (no other tests are required).

NOTE These products may leach metals into water.

#### 6.10.2 Graphite based products

##### 6.10.2.1 Carbon products

Graphite products based entirely upon carbon without any other ingredients shall be tested in accordance with BS 6920-1, Clause 8 (no other tests are required).

##### 6.10.2.2 Carbon products with metallic binders and lubricants

Graphite products containing metal additives, including binders and lubricants shall be tested in accordance with BS 6920-1, Clause 8 (no other tests are required).

NOTE Additional parameters may be required to cover the specific metal(s) included as additives, e.g. molybdenum.

##### 6.10.2.3 Carbon products with organic binders

Graphite products containing organic based binders/resins shall be tested to the full requirements of BS 6920-2, excepting subsections 2.2.2 and 2.2.3.

##### 6.10.2.4 Activated carbon products

Activated carbon products based upon a plastics matrix (porous moulded blocks) shall be tested to the full requirements of BS 6920-2, excepting subsections 2.2.2 and 2.2.3.

NOTE The National Regulator may specify other test requirements for the effect any activated carbon product (including granular and powdered) may have on water quality.

### 6.11 Metallic magnets with no organic component

These products shall be tested in accordance with BS 6920-2.6.

### 6.12 Jointing and gasket products

These products shall be tested in accordance with BS 6920-2.2, BS 6920-2.3, BS 6920-2.5 and BS 6920-2.6, using a surface area of 1 000 mm<sup>2</sup> consisting only of the cut edge of the material.

NOTE 1 This can be achieved by clamping one or more layers of the material between stainless steel plates (4.2.2).

These products shall be tested for the growth of aquatic organisms in accordance with BS 6920-2.4 using the standard sample size (15 000 mm<sup>2</sup>) consisting of a cut sheet of the material.

NOTE 2 These materials usually consist of sheets with a suitable surface finish on both of the main faces. In use, however, it is the cut edge of the material and not the main faces that will usually be exposed to water intended for human consumption, and water may well enter the matrix structure of these products through this cut edge. On the basis of these applications a realistic "worst-case" surface area to volume contact ratio appears to be about 1 000 mm<sup>2</sup> in contact with 1 litre of water. Whilst this sample size is adequate for the leaching tests, due to some very bad in-service failures caused by some of these materials (including biodegradation of the material and significant biofilm development downstream) no relaxation in the sample size for the Growth of Aquatic Microorganisms Test (BS 6920-2.4) is acceptable.

### 6.13 Factory-applied coatings

The manufacturer or supplier shall be instructed to apply samples of these products to panels of a material with similar adherent properties to the material(s) for which the coating is designed. The panels shall be resistant to rusting or corrosion under the conditions of the tests (e.g. stainless steel).

The panels shall be given the same number of coats (including primers and undercoats) and identical maturing and curing conditions as would be applied to articles being coated in the factory.

All surfaces and edges of the panels shall be covered completely with the water contact coating.

The final overall dimensions of the test panels shall conform to 5.1.2. A test container (4.5) calibrated for a capacity of 1 000 ml shall be used.

NOTE These products should be prepared and cured by the manufacturer/supplier and tested as received without any further curing/treatment. To ensure that the samples provided are typical of normal production they should be drawn from the production line wherever possible and the following additional information provided: the date of preparation, the mode of preparation and the curing conditions.

### 6.14 Factory made cementitious products

#### 6.14.1 General

NOTE 1 Cementitious products for use in contact with water intended for human consumption are either made in the factory or made for application on site (see 7.8).

NOTE 2 The test methods in BS 6920 were originally established for use with materials and products made of non-metallic, typically, organic substances.

Where cementitious, factory made products contain organic substances as additives (e.g. polymers, admixtures etc.) or have had organic coatings (e.g. porous seal-coats etc.) applied to them, they shall be tested in accordance with BS 6920-2, excepting subsections 2.2.2 and 2.2.3 (see 6.14.2.1).

Where cementitious products are free from organic additives or coatings, they shall be tested in accordance with BS 6920-2.6 (see 6.14.2.1).

NOTE 3 Factory made cementitious products for use in contact with water intended for human consumption are generally cement-mortar linings to metallic pipes or boilers. On occasion, however, factory made concrete products e.g. concrete pipes, elements for water-retaining structures etc. may be used in the water intended for human consumption.

#### 6.14.1.1 Sampling from factory made cementitious products

A test sample shall consist of a representative section, segment, block etc., of suitable size, for the particular dimensional requirements of a test method (see 5.1.1 and 5.1.2).

A sufficient number of test samples (see 6.14.1.3) shall be preconditioned to supply sufficient test samples to fulfil the requirements of all the test methods specified for a particular product.

#### 6.14.1.2 Curing of factory made cementitious products

Factory made cementitious products shall have been cured in the factory, under the normal manufacturing conditions, before test samples are taken and preconditioned.

#### 6.14.1.3 Preconditioning of samples taken from factory made cementitious products

Test samples of factory made cementitious products shall be preconditioned in accordance with the following procedure.

- a) Before testing, place the sample in a clean and dust-free container of 1 l capacity. Fill the container with water obtained from a tap connected directly to a service pipe at mains pressure, and having an aggressivity index (*I*) of greater than 12.0. Calculate the aggressivity index using the following equation:

$$I = \text{pH} + \log_{10} (AH)$$

where

*A* is the total alkalinity (in mg/l of CaCO<sub>3</sub>);

*H* is the calcium hardness (in mg/l of CaCO<sub>3</sub>).

NOTE Information concerning the alkalinity and hardness of water may be obtained from the local water supplier.

b) Measure the pH of the water after 24 h in accordance with BS 6068-2.50. Discard the water and refill the container with fresh tap water. Continue this process of sequential soaking until the pH of the water is less than  $(9.0 \pm 0.1)$  on two successive occasions. Dry and then store the sample in a polythene bag (4.1), at the same temperature used during the curing of the test sample, for a maximum of six days before testing is started.

NOTE 1 It is possible that a water which has an *I* value of about 12 but with a low alkalinity and hardness may be aggressive to the sample and a pH value of <9.0 may not be achieved. In this case it is necessary to precondition with an alternative water of a comparable aggressivity index.

NOTE 2 In general, samples taken from cementitious products (factory made or site applied) are preconditioned before testing. Preconditioning reflects the pre-service commissioning procedures e.g. flushing etc., experienced by the product but also minimizes the potential for a pH increase during testing, which could adversely affect results.

### 6.14.2 Test method requirements

#### 6.14.2.1 Factory made cementitious products free from organic additives or organic coatings

##### 6.14.2.1.1 General

Cementitious products free from organic additives/coatings shall be tested in accordance with BS 6920-2.6.

##### 6.14.2.1.2 Linings to calorifiers or boilers

These products shall be tested in accordance with BS 6920-2.6 at an elevated temperature of  $(85 \pm 2)$  °C.

##### 6.14.2.1.3 Factory made cementitious products containing organic additives and/or having organic coatings applied to them

These products, including those used in calorifiers or boilers, shall be tested in accordance with BS 6920-2, excepting subsections 2.2.2 and 2.2.3.

Products that are used in contact with hot water, e.g. cementitious linings for calorifiers and boilers, shall be tested in accordance with BS 6920-3.

## 7 Special requirements for site applied products

### 7.1 General

WARNING. Many site-applied material coatings contain hazardous solvents. Observe all the manufacturer's safety warnings during the preparation of these samples.

NOTE 1 Site applied products include all coatings, sealing compounds, soldering fluxes, anaerobic adhesives and most cementitious products intended for application on site.

Product application instructions shall be checked for consistency with the method of test sample preparation used and retained on file together with the relevant Material Safety Data Sheets (MSDS).

Test sample preparation conditions and curing shall always be achievable on site. The products, which include paints, coatings, adhesives, sealants, epoxy resins, and cementitious materials, shall be prepared by or the preparation witnessed by the test laboratory staff, who shall then take responsibility for the subsequent pre-test curing of the test samples.

The samples shall consist of all specified component parts and shall be supplied to the test laboratory together with all relevant instructions for site application, including information on the time for complete cure relative to temperature.

Test samples shall be prepared as follows, using all the specified component parts of the product in accordance with the manufacturer's recommendations.

Apply all relevant primers or undercoats to all surfaces of a glass plate (4.2) before application of the finish coat. Where the product consists of two or more parts, these shall be prepared in strict accordance with the manufacturer's instructions and the precise mixing ratio used as either mass or volume shall be recorded. If specified by the manufacturer/supplier, the wet film thickness of each coating shall be determined and recorded in accordance with BS 3900-C5.

NOTE 2 It is necessary to prepare a sufficient number of panels for the tests to be carried out.

During the application of the sample and throughout the curing period, the panels shall be kept suspended (e.g. by using stainless steel or copper wire or nylon monofilament) so as to avoid contact of the sample with apparatus. If specialized equipment is normally required for site application of a material, then the panels shall be prepared by a contractor under the personal supervision of, and to the satisfaction of, an officer from the testing laboratory.

## 7.2 Curing

Immediately following completion of the preparation of the panels or sheets, they shall be cured in accordance with the manufacturer's instructions, except in the following two cases.

- a) If the material is intended for use in water undertakings' installations then the cure period shall not exceed 21 days and the atmospheric temperature shall not exceed  $(7 \pm 2) ^\circ\text{C}$ .
- b) If the material is intended for use within dwellings or other buildings, then the cure period shall not exceed 7 days and the atmospheric temperature shall not exceed  $(12 \pm 2) ^\circ\text{C}$ .

Throughout the cure period, the test panels shall be suspended in a thermostatically controlled, cooled incubator with fan-assisted air circulation, and with ventilation to prevent accumulation of volatile substances.

NOTE Some products have very specific curing regimes where temperatures are controlled, e.g. where the air in the structure to be coated is heated to and thermostatically controlled at  $30 ^\circ\text{C}$  for 24 hours using industrial heaters. Manufacturers may therefore request non-standard curing conditions using higher cure temperatures, e.g.  $25$  or  $30 ^\circ\text{C}$ .

If non-standard curing conditions are requested by the manufacturer, the manufacturer/supplier user instruction sheets detailing the cure temperature requirements together with a statement describing how the elevated cure temperature will be achieved and maintained throughout the duration of the cure, shall be obtained from the manufacturer. The procedure used shall be credible and achievable on site. If non-standard curing conditions are used in the preparation of test samples it shall be ensured that this is included in the test report for the product.

## 7.3 Testing

The cured samples shall be tested in suitably sized test containers (4.5).

## 7.4 Sealing compounds

Sealing compounds shall be applied to glass plates (4.2) or cast samples for testing as sheets (2 mm to 5 mm thick) between food-grade polyethylene film. If polyethylene film is used, it shall be removed from the semi-cured sheets within 48 h and the sheets shall be suspended, as in 7.1, for the remainder of the cure period.

## 7.5 Jointing compounds

0.25 g of the sample shall be applied to both screw threads of a brass coupling (4.3), the olives shall be discarded and the coupling shall be reassembled so that the compression nuts are finger tight. The reassembled coupling shall be rinsed in tap water for 10 min before placing it in a test container (4.5) calibrated for a capacity of 1 000 ml.

NOTE Do not cure but test immediately.

## 7.6 Solder fluxes

A test piece shall be made up in accordance with the following instructions.

Clean two 60 mm lengths of 22 mm diameter copper pipe conforming to BS 2871-1 in accordance with 4.3. Clean one 22 mm diameter straight copper capillary coupling provided with internal (lead-free) solder rings conforming to BS 864-2 in accordance with 4.3, but omit the acid wash. Apply the solder flux to the pipes in accordance with the manufacturer's instructions, assemble the joint and heat until the solder melts. Cool the joint and, after rinsing in accordance with the appropriate test method given in BS 6920-2.2, BS 6920-2.3, BS 6920-2.4, BS 6920-2.5 or BS 6920-2.6, place the test piece in a test container (4.5) calibrated for a capacity of 1 000 ml and test immediately.

If the manufacturer of the flux recommends a specific solder mix, then use a 22 mm straight copper capillary end-feed coupling conforming to BS 864-2, and cleaned in accordance with 4.3. Use the recommended solder in sufficient quantity to fill the annulus around the joint, determined by visual inspection of an additional sample after assembly.

### 7.7 Anaerobic adhesives

Anaerobic adhesive shall be applied to both threads of a brass coupling (4.3) in accordance with the manufacturer's instructions, and the coupling reassembled. The assembly shall be cured in accordance with the adhesive manufacturer's instructions.

The assembly shall be placed in a test container (4.5) calibrated for a capacity of 1 000 ml.

### 7.8 Site applied cementitious products (see 7.1 and note 2 to 6.14.1)

#### 7.8.1 Introduction

For the purposes of testing, site applied cementitious products for use in contact with water intended for human consumption, they shall be classified into two main categories:

- a) products which do not contain an additive;
- b) products which contain an additive (generally non-metallic but not exclusively), in addition to the cementitious (inorganic) component.

In the case of site applied products in category b), a further sub-classification shall be made:

- 1) products which include the additive (typically an organic polymer) as formulated;
- 2) products to which the additive (usually an admixture) is added to the cementitious component on site.

NOTE The special requirements in 7.8 vary depending on the chemical nature of the site applied product (i.e. organic-free versus organic-containing) and on the point at which any additive (organic or inorganic) is included in the site applied product (i.e. either as formulated or added on site).

The general requirements for sampling, curing of test samples and preconditioning of test samples are given in 7.8.2. The particular requirements for testing, appropriate to the different types of site applied products, are given in 7.8.3, 7.8.4 and 7.8.5.

#### 7.8.2 General

##### 7.8.2.1 Sampling from site applied cementitious products

A test sample shall consist of a representative quantity of the product, either applied to a stainless steel test plate (see 4.2.2), or cast into a rigid mould of sufficient size appropriate to the dimensional requirements of a test method (see 5.1.1 and 5.1.2).

NOTE Stainless steel test plates are used, in preference to glass plates, in order to obviate any potential enhancements to migration which could result from chemical reactions between alkalis derived from cement and glass.

A sufficient number of test samples shall be taken and preconditioned (see 6.14.1.3) to meet the requirements of all of the test methods specified for a particular product.

##### 7.8.2.2 Curing of test samples taken from site applied cementitious products

Samples of site applied cementitious products shall be tested in accordance with 7.2.

NOTE Suppliers' written instructions for curing may include additional requirements for a minimum relative humidity or for the need to keep the sample covered for part of the curing period. If these additional requirements are to be observed they should be credible and achievable on site (see 7.2).

##### 7.8.2.3 Preconditioning of test samples taken from site applied cementitious products

Precondition test samples of site applied cementitious products in accordance with 6.14.1.3, except where the special requirements given in 7.8.5.2.2 apply. Dry, and then store the sample in a polyethylene bag (4.1) at the same temperature used during the cure of the test sample, for a maximum of six days before testing is started.

#### 7.8.3 Test method requirements for site applied cementitious products free from additives

NOTE Products which contain inorganic additives are treated in the same generic way as those which are additive-free.

Special requirements apply, however, for testing and assessing the results obtained from the extraction of metals test to BS 6920-2.6, where the inorganic additive has been added as an admixture on site (see 7.8.5.2).

##### 7.8.3.1 General

Site applied cementitious products which are free from additives shall be tested in accordance with 6.14.2.1.1.

**7.8.3.2 Linings to calorifiers or boilers**

Site applied cementitious linings to calorifiers/boilers which are free from additives shall be tested in accordance with 6.14.2.1.2.

**7.8.4 Test method requirements for site applied cementitious products which contain organic additives as formulated**

Site applied cementitious products which contain organic additives (typically a polymer) that are components of the product as formulated shall be tested in accordance with BS 6920-2, excepting subsections 2.2.2 and 2.2.3 .

**7.8.5 Test method requirements for site applied cementitious products which contain organic additives added on site**

Where site applied cementitious products contain an organic additive/admixture added on site, the cementitious (inorganic) component and the admixture (organic) component shall be tested separately.

The cementitious component shall be tested in accordance with 7.8.5.1.

The admixture (organic) component shall be subject to, both, indirect testing within a standard cementitious matrix (see note to 7.8.5.2.1) and a limited amount of comparative testing, for the extraction of metals, versus a control sample of the standard cementitious matrix, in accordance with 7.8.5.2.

**7.8.5.1 Test method requirements for the cementitious component of products to which organic additives are added on site**

The cementitious component of a product, to which organic additives are added on site, shall be tested in accordance with BS 6920-2.6.

**7.8.5.2 Test method requirements for admixtures added on site****7.8.5.2.1 General**

Admixtures shall be tested, at the manufacturer's maximum recommended dosage, in an indirect way, within a cement-mortar comprising any Portland cement 42.5 N, conforming to BS 12, and any sand, in the proportions 1:3 by mass.

In addition, comparative testing for the extraction of metals (see 7.8.5.2.2) shall be carried out against the same cement-mortar without the admixture.

Test samples and control samples shall be cast into suitable rigid moulds, in order to present a surface area of 15 000 mm<sup>2</sup> in contact with a 1 l total volume in distilled water, at the test temperature, during testing.

NOTE For curing and preconditioning see 7.8.2.2 and 7.8.2.3 respectively.

Organic admixtures shall be tested within a cement-mortar matrix in accordance with all of the test methods in BS 6920-2, excepting subsections 2.2.2 and 2.2.3.

**7.8.5.2.2 Extraction of metals**

Organic admixtures, within a cement-mortar matrix (see note to 7.8.5.2.1), together with samples of the cement-mortar without the admixture, shall be cured in a nominally identical manner; preconditioned using the same number of sequential soakings (determined as the minimum number required, whether for a test or control sample, for conformity to the pH criterion in 6.14.1.3); before being subjected to the test method for the extraction of metals in BS 6920-2.6.

The results of the testing shall be assessed on the final extracts by comparing the differences obtained between the test and control samples, with the specification criteria in Table 1 of BS 6920-1.

**8 Sample description**

An accurate record of the test product samples shall be kept in accordance with Clause 9.

## 9 Reporting

### 9.1 General

In addition to the requirements set out in BS 6920-2, each report shall contain certain information relating to the test sample(s).

### 9.2 Test product (all samples)

The report for each test product shall contain information on the following:

- a) general composition of the product;
- b) trade name and designation of both the material and the test product;
- c) nature of the material, e.g. nitrile rubber, polyethylene;
- d) date(s) of manufacture (if known);
- e) name and address of the manufacturer(s) of both the material and the test product;
- f) organization submitting the product for testing;
- g) organization responsible for preparing the samples (if different);
- h) description of the sampling procedure (if known);
- i) condition on receipt by the test laboratory, including packaging in contact with the test product;
- j) conditions of storage between sample receipt and the start of testing;
- k) comprehensive description of the test sample including material type, colour, shape/form, dimensions (mm), appearance, opacity and component type (if appropriate);
- l) surface area of one example of the product exposed to the test water calculated from the actual dimensions;
- m) number of examples of the product required to give the total surface area required for one test (15 000 mm<sup>2</sup>);
- n) volume of test water (in litres) used for a single test.

### 9.3 Cementitious products

The report for each cementitious product shall include details of any preconditioning given, including the Aggressivity Index of the preconditioning water, together with the pH values of each of the sequential preconditioning leachates.

Additionally, for admixtures, the final report shall include the volume of admixture added to a specified mass of cement.

### 9.4 Factory applied products

#### 9.4.1 Coatings and test samples prepared by the manufacturer or supplier

The report for these products shall include the method of preparation of the test sample, if known, e.g. number and thickness of coats applied (including primers), method of application of the product, ambient temperature at the time of preparation, date of preparation of the sample, cure conditions, substrate onto which the product has been applied and whether the product was prepared in accordance with the application instructions.

#### 9.4.2 Products used in assembly, e.g. greases, lubricants, solvent cements etc. and test samples prepared by the test laboratory in accordance with BS 6920-2.1

The report for these products shall include the method of preparation of the test sample, if known, e.g. whether the sample was prepared in accordance with the application instructions, and the cure conditions, if any, used before testing started.

### 9.5 Site applied products

The report for site applied products shall include the following:

- a) typical uses of the product;
- b) batch number(s) of site applied products (and other products, when known); if this information is not available this shall be stated in the final report;
- c) realistic cure conditions achievable on site; in the case of cure temperatures above either 7 °C or 12 °C (as appropriate) how these will be achieved reliably on site;
- d) method of preparation of test sample including whether the sample was prepared in accordance with the user instructions and the number and nature of coats applied, cure conditions etc.;
- e) full details of sample preparation, including component mix ratios (if appropriate), time and temperature of cure and sample description;

**NOTE** If non-standard cure conditions (other than those set out in 7.2) have been used for the product then include a statement highlighting these conditions.

f) for samples prepared at a different location to the test laboratory the following additional information applies:

- i) location;
- ii) description of equipment used and the area where the samples were prepared;
- iii) full description of sample preparation, mixing ratios and batches numbers;
- iv) chain of custody of the test samples, method of transfer to the test laboratory and temperature profiles of the test samples during transport to the laboratory for final curing;
- v) time and temperature of final curing.

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