

# **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**

ICS 13.060.20

## Committees responsible for this British Standard

The preparation of this British Standard was entrusted by Technical Committee EH/3, Water quality, to Subcommittee EH/3/7, Effects of materials on water quality, upon which the following bodies were represented:

Association of Manufacturers of Domestic Electrical Appliances  
 Automatic Vending Association of Britain  
 British Bathroom Council  
 British Cement Association  
 British Coatings Federation Ltd.  
 British Malleable Tube Fittings Association  
 British Non-Ferrous Metals Federation  
 British Plastics Federation  
 British Plumbing Fittings Manufacturers' Association  
 British Precast Concrete Federation Ltd.  
 British Rubber Manufacturers' Association  
 British Valve and Actuator Manufacturers' Association  
 British Water  
 Department of the Environment for Northern Ireland  
 The Drinking Water Inspectorate  
 Galvanizers Association  
 Laboratory of the Government Chemist  
 Lead Development Association  
 Pipeline Industries Guild  
 UK Steel Association  
 UK Water Byelaws Scheme  
 Water Research Centre  
 Water UK  
 Zinc Development Association

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### Amendments issued since publication

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# Contents

	Page
Committees responsible	Inside front cover
Foreword	ii
Introduction	1
1 Scope	1
2 Normative references	2
3 Terms and definitions	2
4 Odour and flavour of water	2
5 Appearance of water	3
6 Growth of aquatic microorganisms	3
7 The extraction of substances that may be of concern to public health	3
8 The extraction of metals	3
9 High temperature tests	4
10 Odour and flavour of water from hoses intended for food and drink application	4
Annex A (informative) Scheme of testing showing the relationship between the standards of the BS 6920 series	5
Bibliography	7
Table 1 — Maximum allowable concentrations of certain metals	4

## Foreword

This part of BS 6920 has been prepared by Subcommittee EH/3/7 under the direction of the Health and Environment Sector Committee. This part of BS 6920 supersedes BS 6920-1:1996, which is withdrawn.

It is intended that appropriate British Standards and other specifications should cross-refer to this part of BS 6920 if they specify requirements for the effects of the specified product on the quality of water intended for human consumption.

BS 6920 is published in several parts, namely *Part 1 Specification*, *Part 2 Methods of test*, *Part 3 High temperature tests* and *Part 4 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;*

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

*Section 2.6: The extraction of metals.*

Annex A is informative.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

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### Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 7 and a back cover.

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## Introduction

The most common consumer complaint concerning the wholesomeness of water intended for human consumption is the presence of unacceptable taste. The role of construction and plumbing materials in giving rise to certain types of taste in water is well documented. Although the assessment of odours and flavours is subjective, semi-quantitative methods of assessing odours and flavours in water have been used by the water industry for operational control and quality monitoring purposes for many years. The EC Directive relating to the quality of water intended for human consumption (80/778/EEC) [1] specified for the first time a maximum admissible threshold level for taste in water intended for human consumption, and this value is derived from the assessment by individuals of a series of successive dilutions of the water sample under examination. The latest version of this Directive (98/83/EC) [4] states that odour and taste of water shall be "acceptable to consumers and no abnormal change" (sic).

The criteria used to assess the ability of a product to support an appreciable growth of aquatic microorganisms have been determined from a review of data obtained from the use of the method described in BS 6920-2.4:2000 during investigations into incidents of microbial contamination of water intended for human consumption over a period of 20 years.

When samples drawn from more than one commercial batch of a product are compared for the purpose of quality assurance or formulation development, some variation in the results should be anticipated. Any variation in results should be critically examined in light of the precision of the method and also the homogeneity of the material or the conditions employed during manufacture or storage, as these can substantially alter the characteristics of some products with respect to the availability of chemical substances that act as nutrients for microbial growth.

The criteria given in clause 6 have been set in the light of the precision of the method, which was calculated on the basis of a homogeneous reference material.

Careful consideration has been given to the desirability of some form of toxicological evaluation of extracts from products in contact with water intended for human consumption. It has been concluded that some form of toxicological evaluation is essential, particularly in view of the scarcity of toxicological data on many chemicals and the lack of knowledge of the chemical species which may be extracted from products in contact with water intended for human consumption.

Since there is no single test that can discriminate between harmless and harmful extracts, the cytotoxicity requirements given in clause 7 are meant only as a preliminary screening test for extracts from products in contact with water intended for human consumption. Passing the tests indicates that extracts probably do not contain significant amounts of acutely toxic substances, but the tests cannot be used to indicate the presence or absence of substances that may be harmful on prolonged exposure. A failure in the tests indicates that the product requires further investigation before it can be accepted for use in contact with water intended for human consumption.

Clause 8 deals with the extraction of certain metals, undesirable in excessive amounts, from non-metallic products. The limits for these metals are given in Table 1. The range of metals included in this specification reflects the current knowledge and experience of metals likely to arise in waters intended for human consumption, as a result of contact with the materials of construction of water storage and distribution systems. Products submitted for testing in accordance with BS 6920 in the future may contain other metals which may be undesirable in excessive amounts but which are not listed in Table 1. In this case, it will be necessary to obtain an expert opinion from a competent national authority on the desirability of including their determinations in this test.

These tests were originally designed for materials used in contact with cold water intended for human consumption at temperatures up to 25 °C. BS 6920-3 was introduced to allow these tests to be applied to materials likely to be used in contact with hot water which may subsequently be drunk.

Clauses 9 and 10 deal with the specific requirements of products intended for use in contact with hot water intended for human consumption or culinary use, and of hoses intended for conveying water for food and drink preparation respectively.

NOTE A diagram showing the relationship of the various parts and sections of this standard is given in annex A.

## 1 Scope

This part of BS 6920 specifies requirements for the suitability of non-metallic products, including water fittings and components, pipes and materials used in coating, protection, lining, jointing, sealing and lubrication, for use in contact with either hot or cold water intended for human consumption, with regard to their effect on the quality of the water.

NOTE In some cases the appropriate national authorities or regulators may require specific additional testing to be carried out on extracts from certain types of these materials; interpretation of the results from additional testing is the responsibility of the requesting body.

## 2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part 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 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 tastes imparted to water by hoses.*

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 tastes 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.*

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.*

## 3 Terms and definitions

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

### 3.1

#### water fitting

component associated with supply, distribution, and use of water, apart from its disposal

NOTE This definition is taken from BS 6100-3.3.

### 3.2

#### product

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

## 4 Odour and flavour of water

NOTE 1 See also paragraph one of the Introduction.

When assessed by the method given in BS 6920-2.2.1, the product shall be deemed suitable for contact with water intended for human consumption if:

- a) at least two of the three test panellists report that there is no discernible odour in the test extracts and no discernible flavour in the first dilutions of both the final unchlorinated and final chlorinated extracts;
- b) none of the panellists report flavour in the second dilutions.

These odour and flavour requirements shall also apply to hoses and laminate/composite pipes assessed in accordance with BS 6920-2.2.2. Hoses intended for conveying water for food and drink preparation shall also meet the additional requirements of clause 10. If the results from the first extract conform to these requirements, the first extract shall be defined as the final extract.

NOTE 2 The method yields results for the first and the final extracts in a sequential series of seven extractions.

If two or more panellists report a flavour in the first dilution of the final (i.e. seventh) chlorinated or unchlorinated extracts, but not in the second dilution, then the product shall be deemed unsuitable for contact with water intended for human consumption unless two further samples are assessed and the results from both of these further samples are found to conform with the requirements of this clause.

## 5 Appearance of water

When assessed in accordance with BS 6920-2.3, the product shall be deemed suitable for contact with water intended for human consumption if the increase in colour and turbidity of the water in the final extract is not more than 5 standard units (of colour) mg/l Pt<sup>1)</sup> or 0.5 FNU, respectively. If a single sample does not conform to this requirement, then the product shall be deemed unsuitable for contact with water intended for human consumption unless two further samples are examined and the mean colour and turbidity of the final extracts of all the samples are not increased by more than 5 standard units (of colour) mg/l Pt<sup>1)</sup> or 0.5 FNU, respectively, after contact for 9 days (seven extractions).

## 6 Growth of aquatic microorganisms

NOTE See also paragraphs two, three and four of the Introduction.

When a product is examined by the method given in BS 6920-2.4, it shall be deemed not to support appreciable microbial growth if the mean dissolved oxygen difference (MDOD) is 2.39 mg/l or less.

If a single sample of a product gives an MDOD value that is greater than 1.69 mg/l but not more than 2.9 mg/l, then two further samples of the product shall be examined. If the arithmetic mean of the three MDOD values obtained is 2.39 mg/l or less, then the product shall again be regarded as not being capable of supporting an appreciable microbial growth when in contact with water intended for human consumption.

NOTE The significance of any bacteriostatic/bacteriocidal effects observed, and/or any changes in the appearance of the tested samples, may be assessed by the National Regulator.

## 7 The extraction of substances that may be of concern to public health

NOTE 1 See also paragraphs five and six of the Introduction.

In general, when a product is assessed by the method given in BS 6920-2.5, a product shall be regarded as being suitable for contact with water intended for human consumption if it exhibits a "non-cytotoxic".

NOTE 2 There are no absolute criteria that can be applied to the results obtained with the methods given in BS 6920-2.5.

If the test product extract affects the morphology of the cell line in any way, test two further samples using fresh reagents. If these exhibit a "non-cytotoxic" response the products can be regarded as being suitable for contact with water intended for human consumption.

NOTE 3 Assistance can be gained by reference to the parameters in annex 1 of the EC Directive relating to the quality of water intended for human consumption (80/778/EEC) [1], now incorporated into the Water Supply (Water Quality) Regulations 1989 [2], and in Part B of the revised EC Directive (98/83/EC) [4].

NOTE 4 Fittings in premises are considered by the Water Regulations Advisory Scheme. Materials used by water undertakers are covered by the following legislation.

NOTE 5 All water undertakers in England and Wales are subject to the requirements of the Water Supply (Water Quality) Regulations 1989 [2], which came into force on 1 September 1989. Regulation 25 refers to the use of substances or products in the treatment and provision of water supplies. Essentially the regulation requires that a water undertaker does not, other than for the purpose of testing and research, apply to or introduce into water which is to be supplied for drinking, washing or cooking, any substance or product unless it:

- a) has been approved by the Secretary of State;
- b) is considered by the water undertaker to be unlikely to affect adversely the quality of the water;
- c) has been used by a water undertaker during the 12 months prior to 6 July 1989;
- d) is listed in the Water intended for human consumption Inspectorate supplement in The Water Fittings and Materials Directory [3].

## 8 The extraction of metals

NOTE 1 See also paragraph seven of the Introduction.

When tested in accordance with BS 6920-2.6, the product shall be deemed suitable for contact with water intended for human consumption if the amounts of the specified metals in the final extracts do not exceed the specified limits given in Table 1.

If the limit for any metal is exceeded in either of the final extracts, then the product shall be deemed unsuitable for contact with water intended for human consumption unless a further three untested samples are tested and the amounts of the specified metals in all of the further final extracts do not exceed the limits specified in Table 1.

<sup>1)</sup> Hazen units.

**Table 1 — Maximum allowable concentrations of certain metals**

Metal	Maximum allowable concentrations $\mu\text{g/l}$	Reporting Limits <sup>a</sup> $\mu\text{g/l}$	Expression of results
Aluminium	200	20	Al $\mu\text{g/l}$
Antimony	10	0.5	Sb $\mu\text{g/l}$
Arsenic	50	1	As $\mu\text{g/l}$
Barium	1 000	100	Ba $\mu\text{g/l}$
Cadmium	5	0.5	Cd $\mu\text{g/l}$
Chromium	50	5	Cr $\mu\text{g/l}$
Iron	200	20	Fe $\mu\text{g/l}$
Lead	50	1	Pb $\mu\text{g/l}$
Manganese	50	5	Mn $\mu\text{g/l}$
Mercury	1	0.1	Hg $\mu\text{g/l}$
Nickel	50	2	Ni $\mu\text{g/l}$
Selenium	10	1	Se $\mu\text{g/l}$
Silver	10	1	Ag $\mu\text{g/l}$

NOTE 1 The significance of results that conform to the specified limits in Table 1 in the seventh test extracts, but exceed the limits in the first extracts may be assessed by the National Regulator.

NOTE 2 The National Regulator may also specify analysis for other metals and assess the results obtained.

<sup>a</sup> The Reporting limits required by the National Regulator for some of the metals are based upon the new lower requirements specified in EC Directive on the quality of water intended for human consumption (98/83/EC).

When a metal fitting has been used in the testing of a product, the assessment shall be made on the differences in concentrations of the specified metals between the final extracts and the metal fitting blank test.

If the results from the first 24 h extracts conform to the limits in Table 1, then the first extracts shall be defined as the final extracts.

NOTE 2 Experience from testing products using the method described in BS 6920-2.6 over a number of years has shown that products that satisfy these criteria on the first 24 h extracts also conform to the final 24 h extracts.

### 9 High temperature tests

NOTE See also paragraph eight of the Introduction.

When tested in accordance with BS 6920-3, products shall be deemed suitable for contact with hot water intended for human consumption or culinary use up to and including the chosen test temperature if the results obtained conform to clauses 4, 5, 7 and 8.

Products that conform to these high temperature test requirements shall be deemed suitable for use in contact with cold water without any further testing.

### 10 Odour and Flavour of water from hoses intended for food and drink application

NOTE 1 See also paragraph eight of the Introduction.

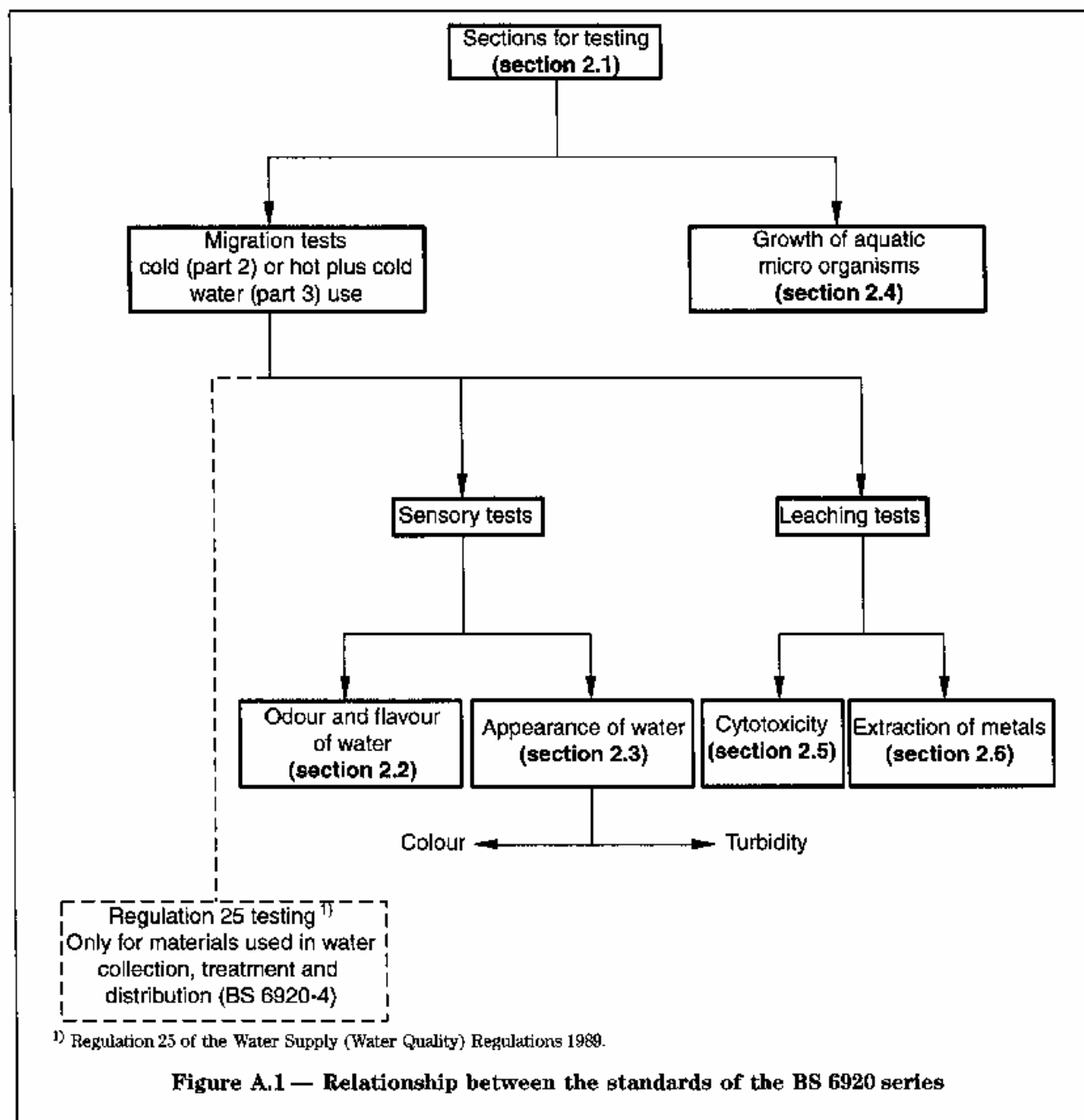
When assessed in accordance with BS 6920-2.2.3, both samples of hose shall give no reportable odour to the undiluted test water, or flavour to the dilution of the test water, from the second (final) extraction.

NOTE 2 The requirement for this test is considerably more stringent than that of clause 4 (odour and flavour of water).



**Annex A (informative)**

**Scheme of testing showing the relationship between the standards of the BS 6920 series**



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## Bibliography

### Standards publications

BS 6100:1992, *Glossary of building and civil engineering terms — Section 3: Sanitation — Subsection 3.3: Sanitation.*

BS 6920-4:1997, *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 4 Method of Test — The GCMS identification of water leachable organic substances.*

### Other documents

- [1] EC Directive relating to the quality of water intended for human consumption (80/778/EEC). Official Journal of the European Communities, No. L 229/11 to 15, 1988.
- [2] GREAT BRITAIN. The Water Supply (Water Quality) Regulations 1989. Statutory Instruments 1989, No. 1147 (and amendments). London: The Stationery Office.
- [3] GREAT BRITAIN. The Water Fittings and Materials Directory. Oakdale: Water Regulations Advisory Scheme.
- [4] EC Directive on the quality of water intended for human consumption (98/83/EC). Official Journal of the European Communities, No. L330/32 to 54, 1998.
- [5] GREAT BRITAIN. The Water Supply (Water Fittings) Regulations 1999. Statutory Instruments 1999, No. 1148 (and amendments). London: The Stationery Office.

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