BS 6920-1:2014
Incorporating Corrigendum No.1

BSI Standards Publication

Suitability of non-metallic materials and 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

Publishing and copyright information

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Contents

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 12, an inside back cover and a back cover.

Foreword

Publishing information

This part of BS 6920 is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 30 June 2014. It was prepared by Technical Committee EH/6, *Effects of materials on water quality*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This part of BS 6920 supersedes BS 6920-1:2000, which is withdrawn.

Relationship with other publications

The following parts and sections of BS 6920 have been published.

- Part 1: *Specification;*
- Part 2: *Methods of test*:
- 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 multi-layered 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*;
- Part 3: *High temperature tests*;
- Part 4: *Method for the GCMS identification of water leachable organic substances*.

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

Information about this document

This is a full revision of the standard, and introduces the following principal changes.

- A statement has been added to the scope that this part of BS 6920 is not applicable to metallic materials and products;
- The definition of the term "product" has been revised (see **3.3**);
- The pass/fail requirements of the odour and flavour of water test have been clarified (see Clause **4**), and supporting flow diagrams given in a new Annex B;
- Interpretation of the results of the growth of aquatic microorganisms test have been clarified (see Clause **6**);
- The fact that some cold water testing is required before high temperature tests are carried out has been clarified (see Clause **9**).

Text and figures introduced or altered by Corrigendum No. 1 are indicated in the text by tags [C1] ⟨C1⟩. Minor editorial changes are not tagged.

Hazard warnings

WARNING. This British Standard calls for the use of substances and/or procedures that can be injurious to health if adequate precautions are not taken.
This British Standard refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

Use of this document

It has been assumed in the preparation of this part of BS 6920 that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is "shall".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Requirements in this standard are drafted in accordance with *Rules for the structure and drafting of UK standards*, subclause **J.1.1**, which states, "Requirements should be expressed using wording such as: 'When tested as described in Annex A, the product shall ...'". This means that only those products that are capable of passing the specified test will be deemed to conform to this standard.

Contractual and legal considerations

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 cannot confer immunity from legal obligations.

However, BS 6920-1 is an appropriate British Standard for conformity to Regulation 4 of the Water Supply (Water Fittings) Regulations 1999 (as amended) [5], and for conformity to part of Regulation 31 of the Water Supply (Water Quality) Regulations 2000 (as amended) [1].

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1 Scope

This part of BS 6920 specifies requirements for the suitability of non-metallic (including cementitious) materials and products, and also 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.

This standard is not applicable to metallic materials and products.

NOTE Under the requirements of

a) *Regulation 31 of the Water Supply (Water Quality) Regulations 2000. Statutory Instrument 2000, No. 3184 (England) [1];*

b) *Regulation 31 of the Water Supply (Water Quality) Regulations 2010. Welsh Statutory Instrument 2010, No. 994 (W.99) [2];*

c) *Regulation 27 of the Water Supply (Water Quality)(Scotland) Regulations 2001. Scottish Statutory Instrument 2001, No. 207 [3];*

d) *Regulation 30 of the Water Supply (Water Quality)(Amendment) Regulations (Northern Ireland) 2009. Statutory Rules of Northern Ireland 2009, No. 246 [4] ;*

e) *Clause 2, Schedule 2 of the Water Supply (Water Fittings) Regulations 1999. Statutory Instrument 1999, No. 1148 (England and Wales) [5] ;*

f) *Clause 2, Schedule 2 of the Scottish Water Byelaws 2004 [6];*

g) *Clause 2, Schedule 2 of the Water Supply (Water Fittings) Regulations (Northern Ireland) 2009. Statutory Rules of Northern Ireland 2009, No. 255 [7];*

in some cases national authorities or regulators might 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 documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) 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 odours and flavours imparted to water by multi-layered hoses, 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*

3 Terms and definitions

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

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

3.2 material
prepared form of a substance, or of a combination of substances, organic and/or mineral, suitable for use in a manufacturing process

3.3 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

*COMMENTARY ON **CLAUSE 4***

The most common consumer complaints 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 (98/83/EC) [8] states that odour and taste of water shall be "acceptable to consumers and no abnormal change" (sic).

4.1 Products and materials other than multi-layered hoses, pipes and tubes

When the material or product is tested in accordance with BS 6920-2.2.1, the odour and flavour of the water shall meet the following requirements:

a) at least two of the three test panellists shall 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; and

b) none of the panellists shall report any flavour in the second dilutions of these extracts.

If the results from the first extracts conform to these requirements, the first extracts shall be taken as the final extracts.

If two or more panellists report a flavour in the first dilution of these extracts, but not in the second dilution, repeat tests shall be carried out on two further samples of the material or product using both test water types. If the results from both samples using both water types meet the requirements given in a) and b) the material or product shall be deemed to conform to the standard.

If any results for the two additional samples do not meet the requirements given in a) and b) the material or product shall be deemed not to conform to the standard.

NOTE 1 These requirements are set out diagrammatically in Annex B.

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

4.2 Multi-layered hoses, pipes and tubes

When multi-layered hoses, pipes or tubes are tested in accordance with BS 6920-2.2.2, the odour and flavour of the water shall meet the requirements specified in **4.1** a) and b). Hoses intended for conveying water for food and drink preparation shall meet the additional requirements specified in Clause **10**.

Repeat testing, if required, shall be carried out in accordance with **4.1**.

5 Appearance of water

When the material or product is tested in accordance with BS 6920-2.3, [C1] any increase in [C1] the colour and turbidity of the water shall meet the following requirements:

a) the colour of the water in the final extract shall be not more than 5 mg/L Pt and;

b) the turbidity of the water in the final extract shall be [C1] not [C1] more than 0.5 formazine nephelometric units (FNU).

If a single sample does not meet the requirements given in a) and b) repeat tests shall be carried out on two further samples. If the mean [C1] increase in [C1] colour of the final extracts of all the samples is not more than 5mg/L Pt and the [C1] mean increase in [C1] turbidity is not more than 0.5 formazine nephelometric units (FNU), after contact for 9 days (seven extractions), the material or product shall be deemed to conform to this standard. If either of these requirements is not met, the material or product shall be deemed not to conform to this standard.

6 Growth of aquatic microorganisms

*COMMENTARY ON **CLAUSE 6***

Criteria used to assess the ability of a product to enhance 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 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 this Clause have been set in the light of the precision of the method, which was calculated on the basis of a homogeneous reference material, and the use of a residual disinfectant in most United Kingdom drinking water supplies.

When the material or product is tested in accordance with BS 6920-2.4, the mean dissolved oxygen difference (MDOD) shall be 2.39 mg/L or less. The product or material shall be deemed to conform to this requirement if either of the following requirements is met:

a) the MDOD derived from testing a single sample of a material or product is 1.69 mg/L or less; or

b) in the case of a single sample of a material or product giving an MDOD in the range that is greater than or equal to 1.7 mg/L but not more than 2.9 mg/L, the arithmetic mean of the 5 to 7 week MDOD value of the original test sample, together with the 5 to 7 week MDOD values obtained from testing two further test samples, is 2.39 mg/L or less.

Any product giving an MDOD value of 2.4 mg/L or greater, when tested and the results evaluated as given in a) and b), shall be deemed to have the potential to support appreciable microbial growth and shall be deemed not to conform to this standard.

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

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

*COMMENTARY ON **CLAUSE 7***

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 might 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 this Clause 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 may 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.

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

NOTE 1 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 material or product extract affects the morphology of the cell line in any way, two further samples shall be tested using fresh reagents. If these exhibit a "non-cytotoxic" response, the materials or products can be regarded as being suitable for contact with water intended for human consumption.

NOTE 2 Materials and products in contact with water supplied by the local water company within buildings are governed by the Water Supply (Water Fittings) Regulations 1999 [5] in England and Wales, The Scottish Water Byelaws 2004 [6] and the Water Supply (Water Fittings) Regulations (Northern Ireland) 2009 [7]. In relation to this standard these regulations cover the potential adverse effects materials might have on drinking water quality within buildings. Satisfactory materials and products are considered for approval by the Water Regulations Advisory Scheme.

NOTE 3 Substances and products used by water suppliers in England are governed by Regulation 31 of the Water Supply (Water Quality) Regulations 2000 [1]. Regulation 31 refers to the use of substances or products in the treatment and provision of water supplies. The regulation requires that a water undertaker does not apply to, or introduce into, water intended for human consumption any substance or product unless it is permitted by this regulation. Comparable regulations apply in Wales, Scotland and Northern Ireland [2], [3], [4].

8 The extraction of metals and boron

*COMMENTARY ON **CLAUSE 8***

This Clause deals with the extraction of certain elements, undesirable in excessive amounts, from non-metallic materials and products. The limits for these elements are given in Table 1 and are derived from those in the Drinking Water Directive (98/83/EC)[8]. The range of elements included in this specification reflects the current knowledge and experience of elements likely to arise in waters intended for human consumption, as a result of contact with the materials for construction of water storage and distribution systems. Materials and products submitted for testing in accordance with BS 6920 in the future might contain other elements which might 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.

When tested in accordance with BS 6920-2.6, the material or product shall be deemed suitable for contact with water intended for human consumption if the concentrations of the specified elements in the final extracts do not exceed the specified maximum allowable concentrations given in Table 1.

If the maximum allowable concentration for any element is exceeded in either of the final extracts, then the material or product shall be deemed unsuitable for contact with water intended for human consumption unless a further three individual untested samples are tested and the amounts of the specified elements reported in each of the three additional final extracts do not exceed the maximum allowable concentrations specified in Table 1.

Table 1 **Maximum allowable concentrations of certain elements**

Element	**Maximum allowable concentrations** μg/L	**Reporting limits** [A)] μg/L	**Expression of results**
Aluminium	200	20	Al μg/L
Antimony	5	0.5	Sb μg/L
Arsenic	10	1	As μg/L
Boron	1 000	100	B μg/L

Table 1 **Maximum allowable concentrations of certain elements**

Cadmium	5	0.5	Cd μg/L
Chromium	50	5	Cr μg/L
Iron	200	20	Fe μg/L
Lead	10	1	Pb μg/L
Manganese	50	5	Mn μg/L
Mercury	1	0.1	Hg μg/L
Nickel	20	2	Ni μg/L
Selenium	10	1	Se μg/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 might be assessed by the National Regulator.

NOTE 2 Under the requirements of the Water Supply (Water Fittings) Regulations [5] (Clause 2 of Schedule 2) and the Water Supply (Water Quality) Regulations [1] (Regulation 31), the National Regulator might specify additional provisions in some cases and will assess the significance of the results obtained.

A) In many cases the analytical detection limits for a particular method in a particular laboratory might well be better than the National Regulator's requirement for the reporting limits.

When a metal or boron fitting has been used in the testing of a material or product, the assessment shall be made on the differences in concentrations of the specified elements between the final extracts and the element 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 3 Experience from testing products using the method described in BS 6920-2.6 over a number of years has shown that materials or products that satisfy these criteria on the first 24 h extracts also conform to the final 24 h extracts.

9 High temperature tests

*COMMENTARY ON **CLAUSE 9***

The tests in this standard 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 might subsequently be drunk. There is proven evidence that satisfactory test results for odour and flavour in hot water might not indicate the suitability of the material for use in cold water.

This Clause deals with the specific requirement of products intended for use in contact with hot water intended for human consumption or culinary use.

When materials and products that have already given satisfactory results, using cold water extraction conditions in both the odour and flavour of water test (appropriate sub-section of BS 6920-2.2) and the substances of concern test (BS 6920-2.5), are subsequently tested in accordance with BS 6920-3, these materials and products shall be deemed suitable for contact with hot water intended for human consumption or culinary use up to and including the selected test temperature if the results using hot water conform to Clause **4**, Clause **5**, Clause **7** and Clause **8**.

NOTE There is evidence that materials and products that conform with the odour and flavour and substances of concern test requirements for use with hot water, might not, in some cases, meet these requirements when tested for use in contact with water at lower temperatures.

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

*COMMENTARY ON **CLAUSE 10***

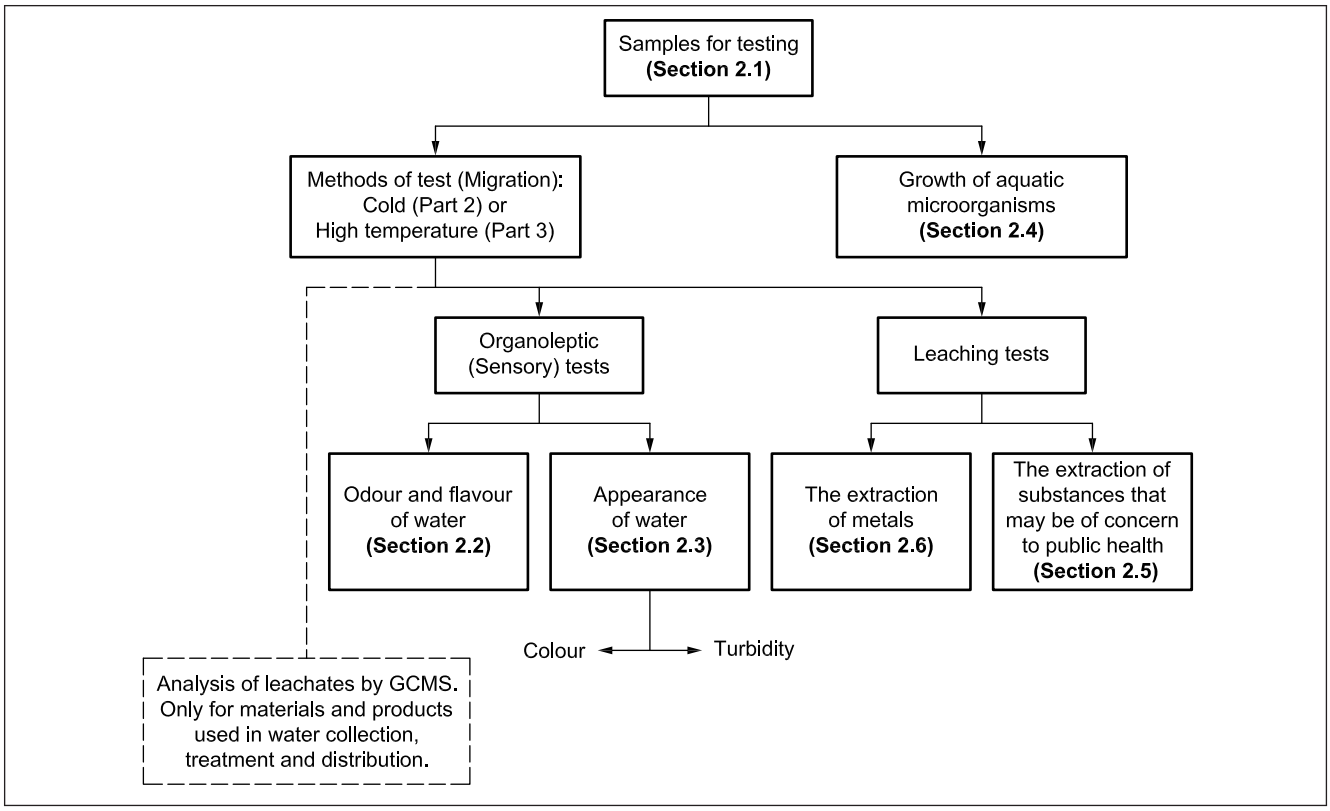
*This Clause deals with the specific requirement of hoses intended for conveying water for food and drink preparation. The requirement for this test is considerably more stringent than that of Clause **4** (odour and flavour of water).*

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.

Annex A (informative) Scheme of testing showing the relationship between the standards of the BS 6920 series

The following flow chart shows the relationship between the standards of the BS 6920 series.

Figure A.1 **Scheme of testing showing the relationship between the standards of the BS 6920 series**



Annex B (informative)

Odour and flavour of water test – Assessment of results

The following flow charts show how the results from the testing carried out in BS 6920-2.2.1 and BS 6920-2.2.2 can be assessed in relation to Clause **4** of this standard, using the two test water types.

Figure B.1 **Chlorine-free water test results**

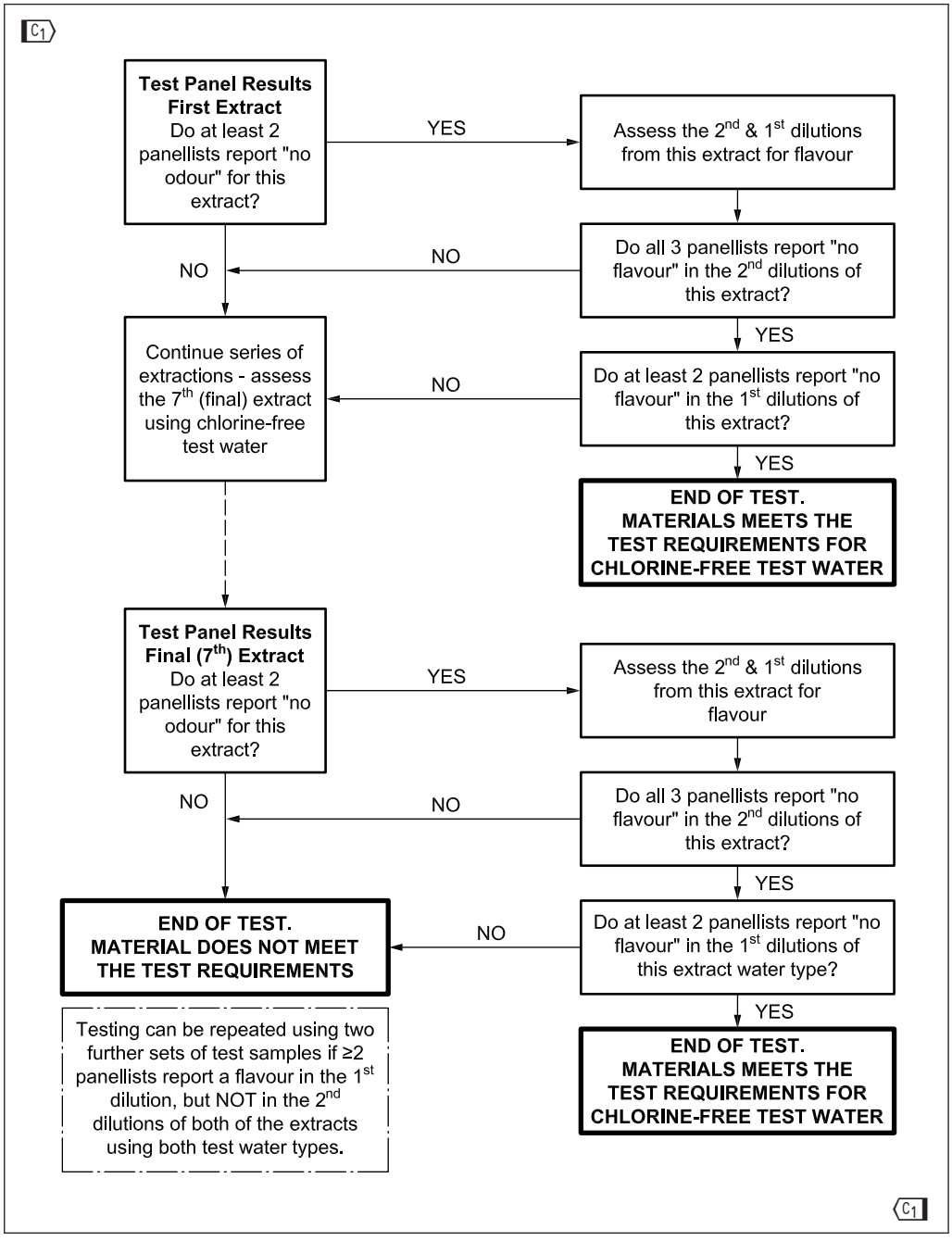
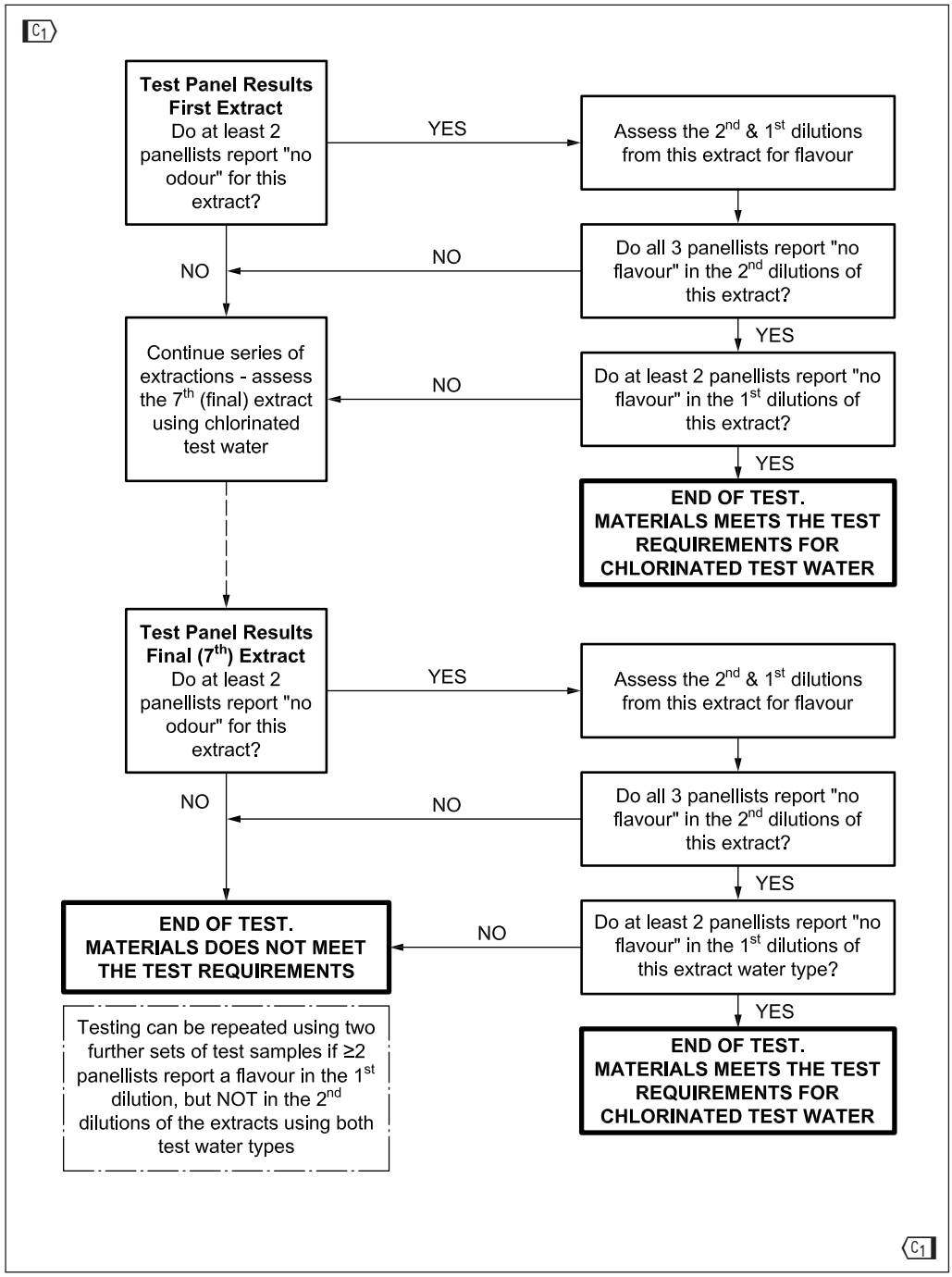


Figure B.2 **Chlorinated water test results**



Bibliography

Standards publications

BS 6920-4:2001, *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 for the GCMS identification of water leachable organic substances*

Other publications

[1] GREAT BRITAIN. The Water Supply (Water Quality) (England) Regulations 2000. Statutory Instrument 2000, No. 3184. London: The Stationery Office.

[2] GREAT BRITAIN. The Water Supply (Water Quality) Regulations 2010. Welsh Statutory Instrument 2010, No. 994 (W.99). London: The Stationery Office.

[3] GREAT BRITAIN. The Water Supply (Water Quality) (Scotland) Regulations 2001. Scottish Statutory Instrument 2001, No. 207. London: The Stationery Office.

[4] NORTHERN IRELAND. The Water Supply (Water Quality) (Amendment) Regulations (Northern Ireland) 2009. Statutory Rules of Northern Ireland 2009, No. 246. London: The Stationery Office.

[5] GREAT BRITAIN. The Water Supply (Water Fittings) Regulations 1999. Statutory Instrument 1999, No.1148 (England and Wales). London: The Stationery Office.

[6] GREAT BRITAIN. The Scottish Water Byelaws, 2004. London: The Stationery Office.

[7] NORTHERN IRELAND. The Water Supply (Water Fittings) Regulations (Northern Ireland) 2009. Statutory Rules of Northern Ireland 2009, No. 255. London: The Stationery Office.

[8] 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.

Further reading

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

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