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# **BS 6920 TESTING OF NON-METALLIC COMPONENTS WITH REGARD TO THEIR EFFECT OF THE QUALITY OF WATER**

## **GUIDANCE NOTES**

These Guidance Notes gives details of the BS 6920 tests and test sample requirements for Water Regulations Advisory Scheme (WRAS) approval. If any further information or assistance is needed concerning sample requirements and preparation please contact the Account Management Team:

Tel: +44 (0) 1495 236 260  
Email: [materials@nsf.org](mailto:materials@nsf.org)

## **1. TEST REQUIREMENTS**

To be acceptable to the Water Regulations Advisory Scheme (WRAS) products and materials must comply with BS 6920 “Suitability of non-metallic products for use in contact with water intended for human consumption with regards to their effect on the quality of the water”. BS 6920 consists of five separate tests:

- Odour and Flavour of water
- Appearance of water
- Growth of Aquatic Microorganisms
- The Extraction of Substances that may be of Concern to Public Health
- Extraction of Metals

## **2. THE INDIVIDUAL TESTS**

The requirements for the suitability of non-metallic products are given in BS 6920 Part 1: Specification. The methods used for the individual tests are described in full in BS 6920: Part 2: Methods of Test. Further guidance for materials testing can be found in the documents *WRAS Material Guidance* (for stand-alone material approvals) and *WRAS Approvals Guidance - Appendix A* (if the material is intended to be used as part of a fittings approval) available from the WRAS website ([www.wras.co.uk](http://www.wras.co.uk)).

### **ODOUR AND FLAVOUR OF WATER**

This test assesses the ability of a product to impart a discernible odour or flavour to water. The test is carried out using chlorinated and non-chlorinated water.

The final non-chlorinated and chlorinated (1 mg L<sup>-1</sup> free chlorine) extracts obtained from the product must be free from odour and the first 1:1 dilutions must be free from flavour. If more than one of the three panellists detects an odour or flavour, then the product does not comply with the requirements of the standard unless two further test samples are assessed and no odour and flavour is reported in the final extracts from both additional samples.

### **APPEARANCE OF WATER**

This test assesses the ability of a product to impart any noticeable colour or turbidity (suspended solids) to water.

Any increase in the colour and turbidity of the final extract from the product must be less than 5 Hazen units and 0.5 FNU respectively. If any colour or turbidity is detected in the final extract, then the product does not comply with the specification unless two further samples are tested and the mean of the colour and turbidity measurements of the final extracts of all three samples comply with the specification.

**GROWTH OF AQUATIC MICROORGANISMS**

This test assesses the ability of a product to promote a significant degree of growth of aerobic microorganisms when in contact with water and takes 7 to 9 weeks to complete.

The mean dissolved oxygen difference (MDOD) value obtained for a product is a measure of the ability of the product to support the growth of aquatic microorganisms – as the growth of the microorganisms increases oxygen is removed from the test system and this loss is compared with the control system. Thus the greater the loss of dissolved oxygen from the water in contact with the product, so the greater the final value. MDOD is the mean value from measurements taken at weeks 5, 6 and 7.

The MDOD between the water in contact with the product and the negative control system must be less than 1.7 mg L<sup>-1</sup>.

If after seven weeks the MDOD value is between 1.7 and 2.0 mg L<sup>-1</sup>, then the test can be continued for a further two weeks. If the final MDOD value, over weeks five to nine, is less than 1.7 mg L<sup>-1</sup>, then the product complies.

If the product gives an MDOD value in the range 1.7 to 2.9 mg L<sup>-1</sup>, then two further samples of the product can be tested. The arithmetic mean of the MDOD values from the three samples must be less than 2.4 mg L<sup>-1</sup> for the product to comply with the specification.

If the product gives an MDOD value greater than 2.9 mg L<sup>-1</sup> then the product does not comply with the specification and no further testing is acceptable.

NOTE: An additional reference system is included for cementitious products or those containing bacteriostatic or bactericidal compounds. If the reference system shows a reduction in MDOD greater than 0.6 mg L<sup>-1</sup> of the MDOD obtained for the positive reference system (paraffin wax), the product is reported as showing a bacteriostatic or bactericidal effect.

**Summary of Growth of Aquatic Microorganisms (MDOD) test pass requirements**

**MDOD on first sample, weeks 5 to 7**

Result mg L <sup>-1</sup>	0 to <1.7	≥1.7 to <2.0	>2.0 to ≤2.9	>2.9
Action	Pass	Extend test by a further two weeks	Re-test with two further samples	Fail

**Extended MDOD on first sample, weeks 5 to 9**

Result mg L <sup>-1</sup>	<1.7	≥1.7
Action	Pass	Re-test

**Re-test with two further samples**

Measure MDOD of weeks 5 to 7, determine mean MDOD of all three samples

Result mg L <sup>-1</sup>	<2.4	≥2.4
Action	Pass	Fail

### **THE EXTRACTION OF SUBSTANCES THAT MAY BE OF CONCERN TO PUBLIC HEALTH (Cytotoxicity test)**

This is a simple cytotoxicity based screening test and extraction procedure designed to assist in the toxicological assessment of products.

The aqueous extract from the product must show no toxicity to a mammalian cell line to comply with this test.

If a cytotoxic response is detected in the extract, then the product does not comply with the specification unless two further samples are tested and both samples show no cytotoxic response.

### **THE EXTRACTION OF METALS**

This test assesses the leaching of metals from the product into water.

Any metal detected in the aqueous extracts from the product must be at a concentration less than the Maximum Admissible Concentration (MAC) as given in BS 6920: Part 1. Depending on the nature of the product, WRAS may also specify analysis of other metals and assess the results obtained. The test is carried out on duplicate test samples and both test samples must comply with the specification.

If the MAC of any metal is exceeded in either of the duplicate final extracts from the test product then the product does not comply to meet this specification, unless three further duplicate test samples are tested and the concentrations of the specified metals in the extracts from all of three additional samples do not exceed the MAC.

The list of metals and MAC values for the Extraction of Metals Test are given below:

Metal	MAC ( $\mu\text{g L}^{-1}$ )	Metal	MAC ( $\mu\text{g L}^{-1}$ )
Aluminium	200	Iron	200
Antimony	5	Lead	10
Arsenic	10	Manganese	50
Boron	1000	Mercury	1
Cadmium	5	Nickel	20
Chromium	50	Selenium	10

### **3. HIGH TEMPERATURE TESTS**

For products likely to be used in domestic hot water services or other systems where the water temperature regularly exceeds 23 °C and the water is made available for drinking, bathing or culinary purposes, high temperature tests are specified. These tests can be carried out to show compliance with the standard at any temperature up to 85 °C.

The Odour & Flavour of Water; Appearance of Water; Extraction of Substances that may be of Concern to Public Health and Extraction of Metals tests are carried out at the specified high temperature, in addition the Odour & Flavour and Extraction of Substances that may be of Concern to Public Health tests are also carried out at 23 °C. The Growth of Aquatic Microorganisms test is always carried out at a temperature of 30 °C.

### **4. SAMPLE SPECIFICATIONS**

#### **4.1 GENERAL REQUIREMENTS**

**Important:** - Samples submitted for testing must comply with BS 6920: Section 2.1 Samples for Testing.

- **TEN** samples of each product/material are required.
- The surface area of the article or articles that constitute a sample that come into contact with the test water must total 15,000 ±500 mm<sup>2</sup>.
- A sample may consist of more than one article of the product / material. In these cases a sufficient number of components to provide TEN separate composite samples will be calculated. Each composite sample must have a total surface area of 15,000 ±500 mm<sup>2</sup>.
- WRAS require that a test sample should be no more than 12 months old at the date of receipt by the laboratory and testing of that sample should commence within not more than 12 weeks of its receipt.
- Normally sample(s) should be placed in a polyethylene bag (sandwich / food grade bags are ideal) and clearly identified by labelling the bag, not the sample(s).
- **Rubber samples** should be placed in paper bags or wrapped in paper.
- Samples bearing adhesive tape or labels, ink or pencil marks CANNOT be accepted for testing.
- Information on the chemical composition of the product is required for Health and Safety risk assessment. All information provided will be treated in the strictest confidence
- If in exceptional circumstances these conditions cannot be met, please contact the test laboratory who will discuss the issue with WRAS prior to commencing testing.

## 4.2 PRODUCT SPECIFICS & SPECIAL REQUIREMENTS

### Product ranges

Plastics with different amounts of fillers, colours, etc. and rubbers with different hardnesses, size and shape, etc. can be tested. It may be that full BS 6920 testing is required on one grade and limited BS 6920 testing on the other grade(s).

See the *WRAS Material Guidance* or *WRAS Approvals Guidance* documents for further information.

### Elastomeric (Rubber) Products

Differences can occur between sheet, moulded and extruded elastomeric products, depending on the final processing and curing conditions. Samples of these products must be submitted in the form of the final component. Elastomeric products can be tested in sheet form, however, the WRAS Directory will list the product as sheet material only; if a manufacturer moulds a component from the approved material there will possibly be further testing required.

NOTE Elastomeric products are generally stored for some time before use. To simulate this practice, freshly cured samples should be placed in unsealed bags and stored in a clean atmosphere for one month before being submitted for testing.

Please ensure that:

- Samples are wrapped in paper envelopes;
- Samples that are greater than 4 weeks old (but less than 11 months old) when submitted for testing;
- The specific section of the application form for *Elastomeric Materials* has been fully completed;
- If a mould release agent or similar agent is used in the preparation of test samples it should be identical to that used in the manufacture of products (note that some mould release agents may affect the performance of elastomeric products in the tests).

### Small Components

A sufficient number of components is required to provide TEN separate samples each with a surface area of 15,000  $\pm$ 500 mm<sup>2</sup>, these samples can be made up of multiple small components.

In the case of O-rings the total number of items required to give ONE test sample can be calculated as follows:

Number required to give an area of 15,000 mm<sup>2</sup> =  $15,000/\pi^2(R^2-r^2)$

Where, R = outer radius in mm and r = inner radius in mm

### Multi-layered (Composite) Products

Samples of multi-layered products shall be made of all the component parts of coatings, but with only the water contact material in contact with the test water. Examples of multi-layered products include: glass-reinforced plastic pipes, laminate pipes, and reinforced hoses.

For multi-layered pipes and hoses, the odour and flavour test is carried out on the complete pipe/hose and the other four tests are carried out on samples of the inner (water-contact) layer only.

Please contact NSF for information on sample requirements for these products.

### **Flexible Hoses and Tubing**

Flexible hoses and tubing should be submitted as a single 20 metre length.

### **Plastic Products (Including Plastic Pipes)**

Plastic materials can be tested in either sheet or component form.

Pellets or granules cannot be tested and should be moulded into a suitable component.

Plastic materials produced for the production of plastic pipes must be submitted in the form of extruded pipes. Please ensure to supply cut pipe sections sufficient to provide 10 samples, each sample must have a total surface area of 15,000  $\pm$ 500 mm<sup>2</sup>.

Products such as glass reinforced polyesters; thermosetting plastic materials and glass-filled plastics must be tested in the form of the final component.

Please inform NSF if the plastic material contains any recycled or regrind materials prior to submitting samples for testing, as WRAS will require further information before deciding whether approval can be granted.

### **Factory Applied/Processed Coatings and Paints**

Definition: a product which is applied and cured (if appropriate) under carefully controlled conditions as part of a manufacturing process in a factory or workshop

Factory applied coatings and paints must be applied to plates of a material of similar adherent properties to that which the product is to be used.

- The panels must be compatible with water, i.e. non-rusting or corroding. Plates made from stainless steel 316 or frosted glass are ideal, and can be supplied at a cost;
- The dimensions of the plates must not exceed 150 mm in length and 70 mm in width the preferred plate size is 120 x 60 x 1 mm thick;
- If the coating or paint is applied to a substrate other than stainless steel or glass all surfaces and edges will need to be completely coated;
- The coated plates must be given the same pre-treatment, including all primers and undercoats, maturing and curing conditions as used in normal practice.

It is imperative that the following information is confirmed within the application form:

- 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;
- Where products are made from more than one part, description of the parts and how these were mixed.

### **Biocides**

Please inform NSF if the product contains a biocide prior to submitting samples for testing, as WRAS will require further information before deciding whether approval can be granted.

### **Site-Applied Products**

These products are applied on site, (by the supplier or end-user) they may undergo some form of change or cure before they are suitable for use in contact with water.

The samples for testing must be prepared (or witnessed) by NSF. A charge for sample preparation will be made.

Preparation instructions must be supplied and include details such as;

- curing time(s) and temperature(s);
- Mix ratios (weight:weight);
- Wet film thickness (microns);
- Details on all necessary primers and undercoats.

We will require full safety information and instructions for use. Test samples will not be prepared at NSF unless full Health and Safety information is supplied. This information is required for our safety procedures e.g. Control of Substances Hazardous to Health Regulations. Normally a Manufacturers Safety Data Sheet will provide adequate information.

The procedures used for the sample preparation and curing will be given in the final report. The material will only be approved for the curing conditions at which the sample was prepared. If the cure conditions are varied from those specified then the material will not be covered by the scope of the approval.

To approve a range of cure conditions, WRAS will request a curing curve which includes times and temperatures for use of the product. Usually, where there is a curing curve, two sets of samples are required:

- Highest temperature and shortest recommended time at that temperature;
- Lowest temperature and shortest recommended time at that temperature.

Samples for testing will be prepared according to BS 6920: Section 2.1, unless instructed to the contrary.

Site Applied Products for testing must:

- Be supplied in their normal containers;
- The maximum pack size is 5 kilos for dry products and 1 litre for liquid products;
- Quantities of unused product in excess of these amounts will be returned or disposed, a charge may be made for this service.

For products that can only be prepared and/or applied using specialised equipment NSF are required to witness the preparation of the test samples and to transport the samples to NSF for testing. For these products, a site visit can be arranged; a charge will be made for this service.

### **Lubricants**

A minimum of 250 grams of each lubricant, supplied in a suitable container, is required for testing. If a lubricant is used in conjunction with a product, the product and the lubricant must be submitted for testing separately, i.e. the product must be submitted without lubricant.



#### **Bitumen & Coal Tar Containing Products**

The Water Regulations states that no pipe; pipe fitting or storage cistern shall be internally lined or coated with coal tar, or any substance that includes coal tar.

WRAS will not list any products containing coal tar, including products having coal tar coated components not in direct contact with potable water.

WRAS will consider granting approval of petroleum or asphaltic bitumen, please contact NSF for more information.

#### **Solders and Fluxes**

Sufficient quantity of solder or flux, with instructions, must be supplied for application to ten joints. If a specific flux is recommended for use with the solder for test a sufficient quantity of solder and flux must be supplied for ten joints (or vice versa).

#### **Cementitious Products and Additives**

These are normally "site-applied" products and the test samples will require preparation at NSF, a charge is made for this service. All necessary materials, together with full-user instructions, material safety data sheets, with health and safety information must be provided.

Please inform NSF if the product contains any blast furnace slag prior to submitting samples for testing, as WRAS will require further information before deciding whether approval can be granted.

***If you require any further information or clarification of sample requirements for testing please contact the Account Management Team:***

***Tel. +44 (0) 1495 236 260***

***Email: [materials@nsf.org](mailto:materials@nsf.org)***

***[www.nsf.org](http://www.nsf.org)***