British Standard

BRITISH STANDARD

BS 7874 : 1998

Method of test for

Microbiological deterioration of elastomeric seals for joints in pipework and pipelines

ICS 23.040.80

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee PRI/70, Elastomeric seals for joints in pipework and pipelines, upon which the following bodies were represented:

British Gas plc
British Plastics Federation
British Precast Concrete Federation Ltd.
British Rubber Manufacturers' Association Ltd.
Chartered Institution of Water and Environmental Management
Clay Pipe Development Association Limited
Concrete Pipe Association
Ductile Iron Producers' Association
Fibre Cement Manufacturers' Association Limited
Malaysian Rubber Producers' Research Association
RAPRA Technology Ltd.
Society of British Water Industries
Water Companies Association
Water Services Association of England and Wales

This British Standard, having been prepared under the direction of the Sector Board for Materials and Chemicals, was published under the authority of the Standards Board and comes into effect on 15 March 1998

Amendments issued since publication

Amd. No.	Date	Text affected

The following BSI references relate to the work on this standard:
Committee reference PRI/70
Draft announced in *Update Standards*, February 1998

ISBN 0 580 26299 5

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Foreword

This British Standard has been prepared by Technical Committee PRI/70. This method was previously contained in annex B of BS 2494 : 1990, from which it has been deleted as a consequence of the publication of BS EN 681-1 : 1996.

NOTE. Seals of type D, H, S and W, as specified previously in BS 2494 : 1990, conformed to the following requirements:

a) the average loss in mass (Z) of the test set of test pieces does not exceed 3.5 %;

b) there is no greater release of carbon black or other fillers from the test set than from the control set when the surface of the specimens is lightly rubbed.

In the case of composite seals the requirements applied only to those components exposed to the contents of the pipeline or pipework.

Within BS EN 681-1 there is no microbiological requirement for elastomeric seals. However, the UK has found the above requirements and method to be acceptable.

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 4, an inside back cover and a back cover.

Method

1 Scope

This British Standard details the test method for microbiological deterioration for elastomeric joint seals. The method is applicable to elastomeric components of composite or non-composite rings, seals, jointing gaskets and similar components used to seal aqueous fluids in pipes and fittings. It is applicable to all categories of aqueous fluid, including raw and treated potable water, sewerage and drainage water.

2 Informative references

This British Standard refers to other publications that provide information or guidance. Editions of these publications current at the time of issue of this standard are listed on the inside back cover, but reference should be made to the latest editions.

3 Principle

Test pieces under tensile strain are exposed to raw river water, inoculated with suitable organisms and maintained at a high dissolved oxygen concentration. Losses in mass are measured at the end of the exposure period and any release of carbon black or other fillers noted.

4 Materials

4.1 A source of raw river water having all the following characteristics:

a) an oxygen saturation greater than 60 %;

b) a biological oxygen demand (BOD) of ≤ 8.5 mg/l;

c) an ammonia content, as ammonium ions, ≤ 0.9 mg/l.

4.2 An inoculum of rubber degrading organisms is provided by introducing into the header tank (**5.2**) a suspended rubber seal showing active signs of biological deterioration.

5 Apparatus

5.1 *Stainless steel frame*, containing two stainless steel rods of 4.7 mm to 4.8 mm diameter, maintained in parallel (110 ± 1) mm apart (see figure 1).

NOTE. Spacer plates may be located at intervals as necessary to brace the rods at the specified spacing if the tension exerted by the test pieces would otherwise cause excessive flexure of the rods.

5.2 *Header tank*, constructed of non-metallic material and including a cover which permits ventilation. The tank is constructed or enclosed such that light is excluded from the contents of the tank. The tank shall contain water of the type described in **4.1**, in which a source of inoculum in accordance with **4.2** is maintained following an initial residence period of not less than 7 days. The tank shall discharge continuously into the test tank (**5.3**) via a flow control device which maintains the rate of overflow discharge from the test tank equivalent to (0.4 ± 0.1) volume change/day of the water content of the test tank. The header tank shall be replenished with water in accordance with **4.1** so that the source of inoculum in the header tank remains submerged.

NOTE. The system for replenishment of the header tank will depend upon the rate of discharge used when filling the test tank and when maintaining the required rate of overflow discharge from the test tank.

5.3 *Test tank*, constructed of glass or other inert material, into which the frame can be inserted (see figure 1).

The tank shall initially be filled with raw river water conforming to **4.1**, or with inoculated water from the header tank, and shall be provided with an overflow outlet to maintain the level in the test tank by discharging the excess supply of inoculated water from the header tank (**5.2**), which has been on stream from the header tank for not less than 7 days.

Except when access to the samples is required, the tank shall be surrounded by an enclosure that excludes light.

5.4 *Air pump*, fitted with a multiple outlet manifold to maintain a visible diffuse air stream throughout the length of the water in the test tank (see figure 1).

5.5 *Temperature controls*, for maintaining the temperature within the test tank at (23 ± 2) °C.

5.6 *Balance*, capable of weighing to within 0.0005 g.

5.7 *Drying oven*, maintained at (105 ± 2) °C.

5.8 *Ultrasonic cleaning bath*, capable of operation at 45 kHz.

NOTE. A power input of 55 W has been found satisfactory for use with an ultrasonic cleaning bath having a capacity of between 1.7 l and 2 l.

6 Preparation of test pieces

Prepare eight test pieces, each measuring approximately 140 mm × 20 mm, from test sheets (2 ± 0.2) mm thick (see figure 2).

Punch two holes approximately 3 mm in diameter on the centre line of each strip and (100 ± 1) mm between centres.

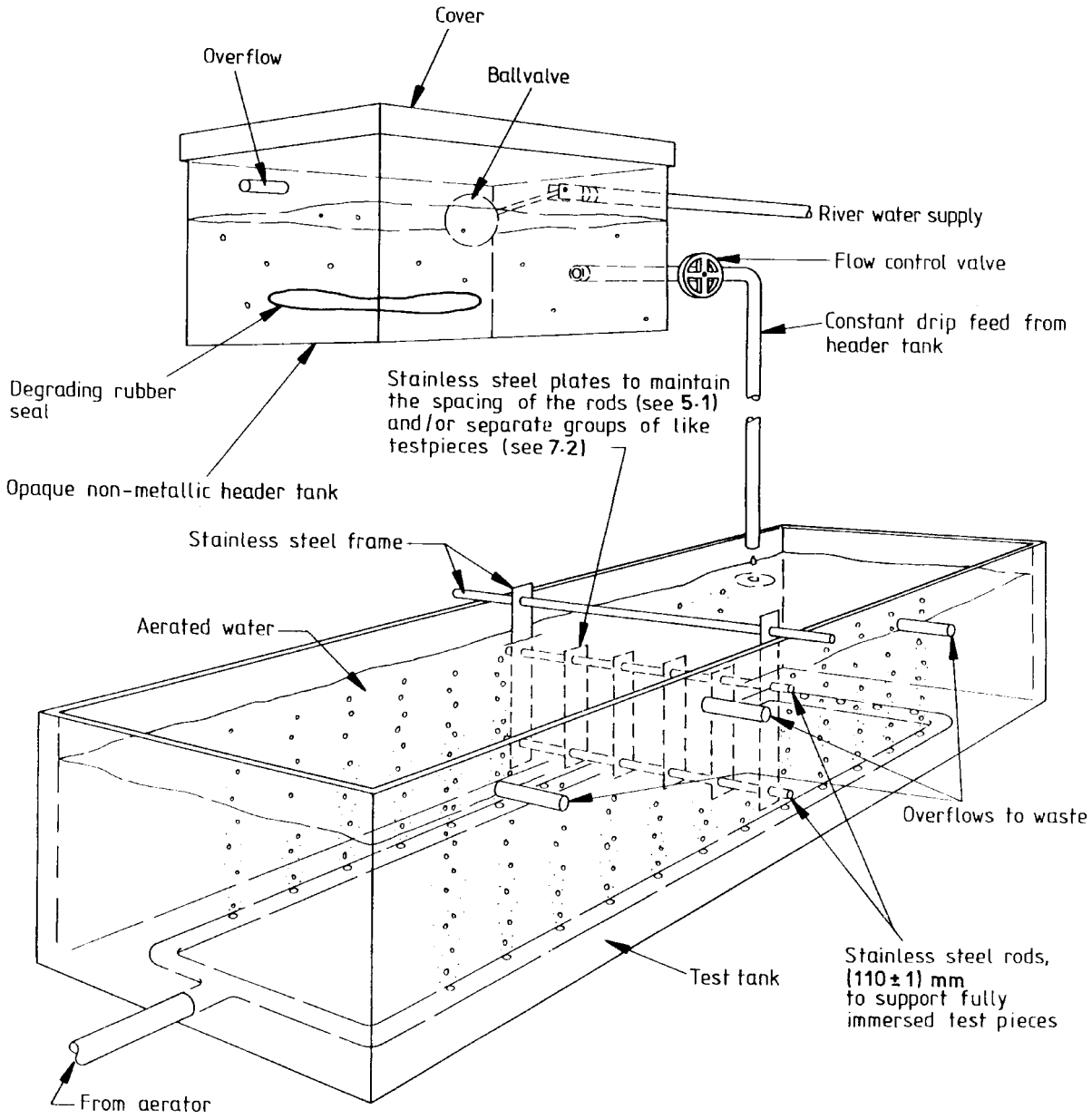


Figure 1. Typical arrangement of tanks for biodeterioration test

7 Procedure

7.1 Divide the test pieces into a control set of four and a test set of four. Identify each test piece by means of a suitable procedure. Weigh all test pieces to an accuracy of 0.0005 g. Record the individual masses, M_1, of the control set test pieces and the individual masses, M_2, of the test set test pieces. Store the control set at (23 ± 2) °C in a sealed opaque envelope or packet.

7.2 Stretch the four test pieces of the test set between the rods, using the punched holes, to give an extension of approximately 10 %. Space the test pieces on the frame so that they do not touch one another and record the position of each test piece for identification purposes.

If simultaneously testing materials which may give rise to mutual interference, for example by cross-contamination or by the effects on the micro-organisms of a leachable biocide, separate test tanks shall be used which are connected in parallel so that each is flushed at the specified rate (see **4.2**). Otherwise, if test pieces of different formulations are to be tested on a common frame, stainless steel separator plates shall be interposed.

7.3 Insert the loaded frame into a test tank containing inoculated water in accordance with **4.3** so that the test pieces are completely immersed. Maintain the level of the water by topping up with inoculated water from the header tank and pass air continuously through the water in the test tank. Maintain the temperature within the test tank enclosure at (23 ± 2) °C.

7.4 After 6 months withdraw the frame from the test tank and remove the test pieces of the test set from the frame and the test pieces of the control set from their envelopes maintaining their order and identities. Clean each test piece for 1 min in the ultrasonic cleaning bath containing clean tap water only, without solvent or detergent. Remove each test piece, rinse for 30 s under running tap water and place in an oven at (105 ± 2) °C for 2 h.

7.5 Remove the test pieces from the oven, allow them to cool to (23 ± 2) °C in a desiccator for 1 h and weigh them to an accuracy of 0.0005 g. Record the individual masses, M_3, of the control set test pieces and the individual masses, M_4, of the test set test pieces.

7.6 After the mass loss measurements have been taken, lightly rub each test piece on one place with a tissue and compare the carbon black or other filler release of the control test pieces and the exposed test pieces.

8 Calculation of results

Calculate the percentage mass loss, M_5, for each control set test piece as follows:

$$M_5 = \frac{M_1 - M_3}{M_1} \times 100$$

where:

M_1 is the initial mass of the test piece (in g);

M_3 is the mass of the test piece after drying (in g).

Determine the average mass loss, X, of the control set test pieces.

Calculate the percentage mass loss, M_6, for each test set test piece as follows:

$$M_6 = \frac{M_2 - M_4}{M_2} \times 100$$

where:

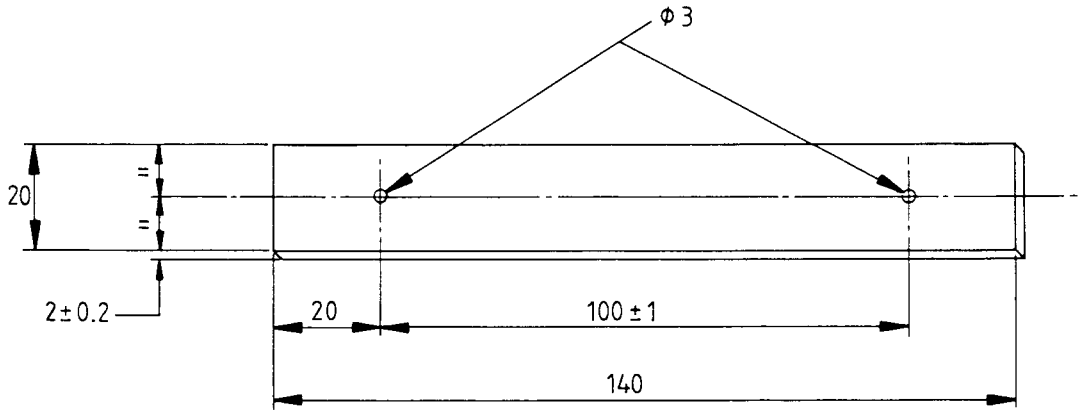
M_2 is the initial mass of the test piece (in g);

M_4 is the mass of the test piece after testing and drying (in g).

Determine the average mass loss, Y, of the test set test pieces.

Calculate the difference in average percentage change in mass loss, Z, between the test set pieces and the control set test pieces as follows:

$$Z = Y - X$$



All dimensions are in millimetres

Figure 2. Test piece dimensions for biodeterioration test

9 Test report

The test report shall include the following information:

a) identification of samples tested;

b) test start date;

c) test finish date;

d) identification of testing laboratory;

e) type of water used;

f) inoculum used;

g) initial values of sample mass;

h) final values of sample mass;

i) average percentage change in sample mass;

j) difference in average percentage mass loss between the test samples and dry control samples, after oven drying;

k) removal of carbon black or other filler by the tissue rub test;

l) general observations on the visual appearance of samples after test;

m) details of any interruptions or other deviations in the test programme.

List of references

Informative references

BSI standards publications

BRITISH STANDARDS INSTITUTION, London

BS 2494 : 1990	*Specification for elastomeric seals for joints in pipework and pipelines*
BS EN 681 :	*Elastomeric seals — Materials requirements for pipe joint seals used in water and drainage applications*
BS EN 681 : Part 1 : 1996	*Vulcanized rubber*

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