BRITISH STANDARD

BS 6319-8: 1984

Testing of resin compositions for use in construction —

Part 8: Method for the assessment of resistance to liquids

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Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Civil Engineering and Building Structures Standards Committee (CSB/-) to Technical Committee CSB/20 upon which the following bodies were represented:

British Adhesive Manufacturers' Association
British Plastics Federation
Cement and Concrete Association
Concrete Society
Construction Industry Research and Information Association
County Surveyors' Society
Department of the Environment (Building Research Establishment)
Department of the Environment (Property Services Agency)
Department of the Environment (Transport and Road Research Laboratory)
Federation of Epoxy Resin Formulators and Applicators Ltd.
Institution of Civil Engineers
Institution of Highways and Transportation
Institution of Structural Engineers
Plastics and Rubber Institute
Society of Chemical Industry
Coopted member

This British Standard, having been prepared under the direction of the Civil Engineering and Building Structures Standards Committee, was published under the authority of the Board of BSI and comes into effect on 29 June 1984

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Amendments issued since publication

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Contents

Foreword

This Part of this British Standard has been prepared under the direction of the Civil Engineering and Building Structures Standards Committee. This Part describes a method for assessment of resistance to liquids and is one of a series of Parts describing methods for measuring basic physical properties of resin based materials.

The method described in this standard is fairly simple and provides a means of initial assessment of the chemical resistance of a resin composition, including the effects of water. A further aspect of chemical resistance is whether it is affected by other factors such as mechanical stress, for instance when resin compositions are used as floor coatings.The assessment of this aspect is likely to be complex and is not included in this Part of BS 6319.

Since the conditions of exposure to aggressive chemicals will vary considerably according to the intended application, this method does not specify a particular duration of exposure to the test reagents. However, in order that comparisons may be made between materials under identical conditions, a range of time spans is specified for the test and the duration required may be selected from these. It may be advisable to repeat this method of test for two or more time spans to indicate whether the effect of aggressive chemicals has reached a maximum after a given period or if it is continuing. The specimens are tested in the saturated but surface dried condition. This is the worst case and in some situations there will be a significant or even complete recovery of properties upon drying.

This Part of this British Standard should be read in conjunction with BS 6319-1 which provides general information and describes a method for preparing test specimens.

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

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.

Compliance with a British Standard does not of itself confer immunity from legal obligations. In particular, attention is drawn to the Health and Safety at Work etc. Act 1974.

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.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This Part of BS 6319 describes a method for assessing the resistance to liquids of resin based mortars and concrete using the test for flexural strength described in BS 6319-3.

The method described is not applicable to unfilled systems.

NOTE 1 For unfilled systems the procedures described in BS 4618-4.1 should be used.
NOTE 2 The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

For the purposes of this Part of BS 6319 the definitions given in BS 6319-1 apply.

3 Principle

The principle of the test is the comparison of the flexural strength of test specimens which have been exposed to chemical reagents under defined conditions with that of control specimens which have not been exposed to the reagents but which were prepared from the same batch of resin composition. Any changes in the mass and appearance of the specimen or test reagent during the test are observed and recorded.

4 Apparatus and reagents

4.1 *Flexural testing machine,* as described in BS 6319-3.

4.2 *Moulds,* as described in BS 6319-3.

4.3 *Containers,* for immersion of the test specimens, made from a material resistant to the test reagents. The size of the container shall allow a minimum separation of 10 mm between any two specimens or between a specimen and the side of the container. The depth of the container shall allow the upper surface of the specimen to be at least 10 mm below the surface of the test reagent. Any spacers used shall be resistant to the test reagent and shall be cylindrical in form. The container shall be provided with a loose-fitting lid that is also resistant to the test reagents.

4.4 *Tared weighing bottle,* of sufficient size to take the test specimen (see **5.2**).

4.5 *Balance,* capable of determining the mass of the weighing bottle and the test specimen to the nearest 10 mg.

4.6 *Heater,* capable of safely maintaining the temperature of the test reagent and test specimen at the required level throughout the duration of the test, subject to a variation of ± 1 °C.

4.7 *Absorbent cloth*

4.8 *Solvent*

4.9 *Test reagents* as required.

5 Test specimens

5.1 Preparation of test specimens. The preparation of test specimens, including the conditioning, proportioning, and mixing of the materials and the conditioning and filling of the mould shall be in accordance with BS 6319-1.

Swab each test specimen, including control specimens, with a solvent to remove any mould release agent, taking care that the solvent chosen does not adversely affect the resin composition.

Allow the specimen to become air dry.

NOTE Methyl chloroform has been found to be a generally effective solvent on epoxide resin based compositions.

5.2 Dimensions of test specimens. Test specimens shall be prisms of the size specified in BS 6319-3.

6 Procedure

6.1 Sample. Test a minimum of eight specimens at a time from the same mix for each set of test conditions. Use alternate specimens as-cast as the four control specimens and the remaining four as the specimens to be exposed to the test reagent.

6.2 Testing

6.2.1 *Temperature.* Carry out the test at 20 ± 1 °C unless, for a specific purpose, an alternative temperature is deemed more appropriate. Maintain the test specimens at the test temperature conditions for not less than 16 h before testing commences. Heat the test reagent to the test temperature prior to its use.

6.2.2 *Duration of test.* Select the period or periods of immersion from the following:

a) 1, 7, 14, 28, 56 or 84 days;

b) 6 or 12 months.

If the test is of 1 day's duration, stagger the immersion of the specimens in order to take account of the time taken for individual flexural tests to be completed.

6.2.3 *Initial observations.* Weigh each test specimen and record its mass, m_o, in grams, to the nearest 10 mg. Record the colour and surface appearance of each test specimen.

Record the appearance and type, and concentration if appropriate, of the test reagent.

6.2.4 *Immersion of test specimens.* Place the test specimens in the container and immerse them completely in the test reagent ensuring that there is at least 10 mm between the specimens and at least 10 mm depth of test reagent above the upper surfaces of the test specimens.

If test specimens are to be arranged in layers, two spacers shall be used under each and shall be so positioned that line contact outside the middle third of the test specimen is ensured.

Place the lid on the container and maintain the temperature for the duration of the test.

If necessary check the level and concentration of the test reagent at suitable intervals and adjust them to the values at the commencement of the test.

Visually check the condition of the test specimens and test reagent at suitable intervals and note any changes in the appearance, size and shape of the test specimens and in the appearance of the test reagent.

6.2.5 *Control specimens.* Maintain the control specimens at the same temperature as the test specimens immersed in the test reagent and in a position where they will not be affected by the test reagent for the full duration of the test.

6.2.6 *Removal, drying and weighing.* When the specified period of immersion has elapsed, carefully remove the immersed test specimens from the container full of test reagent and remove excess test reagent by dabbing with a suitable absorbent cloth. Immediately transfer each test specimen in turn to a tared weighing bottle and determine the mass of the bottle and the test specimen, in grams, to the nearest 10 mg. Deduct the mass of the bottle to determine the final mass of the test specimen, m_t in grams.

Remove the test specimen from the weighing bottle. Note the condition of the test specimen and then rinse it in a non-aggressive solvent to avoid any damage to the flexural test equipment as a result of test reagent remaining on the test specimen. Dry the surface of the immersed specimen with a suitable absorbent cloth. Proceed immediately to the determination of the flexural strength.

6.2.7 *Determination of flexural strength.* Measure the flexural strength of all eight specimens as described in BS 6319-3. Test the immersed specimens with the minimum of delay, and within 10 min of removal from the test reagent. Test the control specimen after all measurements of the immersed specimens are completed.

7 Calculations

7.1 Change in mass. Calculate the % change in mass of each immersed specimen using the following formula:

$$\frac{m_t - m_o}{m_o} \times 100$$

where

m_o is the mass of the specimen prior to immersion (in g);

m_t is the mass of the specimen after immersion (in g).

Calculate the mean % change in mass.

7.2 Flexural strength. Calculate the flexural strength, M (in N/mm^2), of each test specimen using the following equation:

$$M = \frac{1.5WL}{BD^2}$$

where

W is the maximum load recorded prior to fracture (in N);

L is the span of the specimen (in mm);

B is the breadth of the specimen (in mm);

D is the depth of the specimen (in mm).

Calculate the mean flexural strength separately for the control specimens and for the immersed specimens. Express all values for flexural strength to the nearest 0.2 N/mm^2. The dimensions used in the above calculation shall be those measured at its point of fracture and not those quoted as the nominal dimensions before the test.

Calculate the % change in flexural strength using the following formula:

$$\frac{m_t - m_o}{m_o} \times 100$$

where

M_o is the mean flexural strength of the control specimens (in N/mm^2);

M_t is the mean flexural strength of the immersed specimens (in N/mm^2).

8 Test report

8.1 General. The following information, together with that given in **8.2** and **8.3**, shall be included in the test report:

a) date and site of sample preparation;

b) date of test;

c) ambient conditions during the preparation and testing of the specimens, and the curing regime adopted including the temperature of the test reagent and the duration of the period of immersion;

d) complete identification of the material tested including type, source, manufacturer's code numbers and history.

8.2 Test specimens

a) nominal sizes of each test specimen prior to testing, and dimensions at the site of any fracture as a result of testing;

b) mass of each test specimen prior to any immersion;

c) mass of immersed specimen after immersion;

d) % change in mass of the immersed specimens, and the mean % change in mass, expressed as a loss or gain;

e) flexural strength of each test specimen;

f) arithmetic mean flexural strength of control specimens;

g) arithmetic mean flexural strength of immersed specimens;

h) % change in flexural strength, expressed as a loss or gain;

i) breaking loads, including those results excluded from the calculations because of the location of the fracture;

j) any difference in the mode of failure;

k) any changes in appearance caused by exposure to the test reagent, e.g. colour, texture, formation of cracks, pitting;

l) any change in volume, shape or surface condition of the immersed specimens;

8.3 Test reagent

a) a complete description of the test reagent, including its chemical composition, concentration and source;

b) any visual evidence of change, for instance in clarity, colour, formation of sediment;

c) details of any measured changes of concentration of the test reagent during the test.

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Publications referred to

BS 4618, *Recommendations for the presentation of plastics design data.*
BS 4618-4, *Environmental and chemical effects.*
BS 4618-4.1, *Chemical resistance to liquids.*
BS 6319, *Testing of resin compositions for use in construction.*
BS 6319-1, *Method for preparation of test specimens.*
BS 6319-3, *Method for measurement of flexural strength.*

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