

Methods of test for
Adhesives —

Part B8: Determination of viscosity

Committees responsible for this British Standard

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- British Adhesives and Sealants Association
- British Plastics Federation
- British Railways Board
- Chemical Industries Association
- EEA (the Electronics and Business Equipment Association)
- Ministry of Defence
- PIRA
- SATRA Footwear Technology Centre
- Society of Motor Manufacturers and Traders Limited

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Foreword

This Part of BS 5350 is a revision and has been prepared under the direction of the Adhesives Standards Policy Committee. BS 5350-B8 was first published in 1977 and described three methods of determining the viscosity of adhesives. This revision differs from the previous edition in that it contains a section on the preparation of samples, and describes an additional method of determining viscosity, using a torsion wire viscometer. A method using a constant pressure horizontal capillary flow viscometer has been deleted as the manufacturer no longer makes the equipment or spares.

Detailed descriptions of how to use various instruments have been omitted since different makes and models have different operational requirements and are dealt with in the manufacturer's literature.

The methods in this Part of BS 5350 describe the determination of dynamic viscosity; methods of determining kinematic viscosity (the dynamic viscosity of a fluid divided by its density) may be found in BS 188.

Appendix A, for information only, describes how the viscosity of adhesives may be affected by the application of different rates of shear, and may be of help when selecting a method for measuring the viscosity.

This revision of BS 5350-B8 supersedes BS 5350-B8:1977 which is withdrawn.

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 10, an inside back cover and a backover.

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 5350 describes the following three methods of determining the dynamic viscosity of adhesives and of preparing samples for those determinations.

- a) Method 1, using the torsion wire viscometer;
- b) Method 2, using the rotational cylinder viscometer, cup and bob type;
- c) Method 3, using the cone-and-plate rotational viscometer.

Methods 1 and 2 are those most commonly used with adhesives that are non-Newtonian liquids.

Method 3 is particularly useful to define the complete rheology of a liquid adhesive as a function of stress and time.

This Part of BS 5350 describes a typical apparatus for each of the methods but other apparatus of equivalent function may be used.

Wherever the term viscosity is used in this Part of BS 5350, it is understood that it refers to dynamic viscosity.

NOTE 1 It should be noted that the effect of temperature on the coefficient of viscosity can be large for many materials, thus necessitating accurate control of temperature when carrying out the methods described in this Part of BS 5350.

NOTE 2 Kinematic viscosity is equal to the dynamic viscosity of a fluid divided by its density.

NOTE 3 The titles of the publications referred to in this standard are listed on the inside back cover.

2 Preparation

2.1 Apparatus

2.1.1 Container, capable of being sealed, made of glass or other material that does not react with the adhesive, of a size suitable for the amount of sample required.

2.1.2 Thermometer, complying with BS 593 of appropriate range and sensitivity.

2.1.3 Equipment for controlling the temperature of the sample, capable of maintaining the sample and container to within 0.1 °C for temperatures up to and including 50 °C, to within 0.5 °C at temperatures from 50 °C to 100 °C, and to within 1 °C for temperatures from 100 °C to 250 °C.

2.1.4 Equipment for applying a vacuum to the sample, for use only for adhesives not containing volatile components.

2.2 Procedure

2.2.1 Removal of occluded air

If the sample contains occluded air, remove the air as follows.

- a) For samples containing volatile components, allow them to stand in a closed container for 24 h.

NOTE 1 In general, this procedure is effective only for samples with a viscosity lower than 0.2 Pa s.

b) For samples not containing volatile components, apply a partial vacuum, gradually reducing the pressure so that foaming is controlled, until foaming ceases.

NOTE 2 A satisfactory method for removing occluded air from samples with a viscosity of 1 000 Pa s or higher is to stir the adhesive gently whilst simultaneously degassing under vacuum.

If neither of the two procedures described in a) or b) is applicable, there is no satisfactory way of removing occluded air and its presence shall be reported.

2.2.2 Mixing

Ensure that the sample is homogeneous by stirring gently with a glass rod or similar non-reactive implement, taking care not to entrain air.

NOTE Vigorous mixing using a mechanical stirrer is not recommended since it may affect the rheological properties of the adhesive.

2.2.3 Temperature conditioning

Allow the sample to stand in the thermostatically controlled environment for sufficient time to ensure that it is at the appropriate temperature before testing.

3 Method 1: measurement of viscosity using the torsion wire viscometer

3.1 Field of application

This method describes a procedure for the operation of a torsion wire viscometer for determining comparative viscosities in the range 0.1 Pa s to 10 Pa s. The apparatus is robust, relatively inexpensive and simple to operate.

3.2 Principle

The cylinder which is connected to the flywheel is immersed in the sample.

The flywheel is rotated through 360° against the force exerted by the torsion wire and released. The amount of overswing of the flywheel is measured. The amount of overswing is an inverse function of the viscosity of the sample. A higher viscosity causes a greater drag and hence smaller overswing.

3.3 Apparatus

3.3.1 Viscometer, consisting of a vertically mounted torsion wire, a flywheel mounted above a graduated scale and a cylinder suspended below the scale (see Figure 1).

3.3.2 Various torsion wires and cylinder sizes, used for different viscosity ranges which cover approximately 0.1 Pa s to 10 Pa s.

3.3.3 Water jacketed cups, available for tests at temperatures other than ambient.