BRITISH STANDARD

BS 2782-3: Methods 340A and 340B: 1978

Incorporating Amendment No. 1

Methods of testing

Plastics —

Part 3: Mechanical properties —

Method 340A: Determination of shear strength of moulding material —

Method 340B: Determination of shear strength of sheet material

IMPORTANT NOTE. Before reading this method it is essential to read the foreword, general introduction and instructions to BS 2782, issued separately.

UDC 678.5/.8:678.01:620.176.2:539.415.2

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 4 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.

This British Standard, having been prepared under the direction of the Plastics Standards Committee, was published under the authority of the Executive Board on 30 June 1978

The following BSI references relate to the work on this standard:
Committee reference PLC/17
Draft for comment 77/52147 DC

ISBN 0 580 10245 9

Amendments issued since publication

Amd. No.	Date of issue	Comments
5168	July 1987	Indicated by a sideline in the margin

Contents

0 Introduction

These two methods describe tests for determining the short term shear strength of the materials described in clause **1**. Method 340A is a revision of, and replaces, method 305A of BS 2782:1970. Method 340B is a revision of, and replaces, method 305B of BS 2782:1970. Methods 305A and 305B of BS 2782:1970 are therefore being withdrawn.

The materials have been divided into two categories, according to type of test piece.

WARNING NOTE. These methods do not necessarily detail all the precautions necessary to meet the requirements of the Health and Safety at Work etc. Act 1974.

Attention should be paid to any appropriate safety precautions, and the methods should be operated only by trained personnel.

1 Scope and field of application

Method 340A describes a procedure which is applicable to the determination of the shear strength of test pieces produced by the compression moulding or the injection moulding of rigid thermoplastic and thermosetting moulding materials, including filled and reinforced compounds.

Method 340B describes a procedure which is applicable to the determination of the shear strength of test pieces cut from rigid thermoplastic or thermosetting sheet, including fibre reinforced sheet (composites) and laminates.

2 References

The following standards publications are referred to in these methods.

BS 2782, *Methods of testing plastics — Foreword, general introduction and instructions:1975 — Method 901A:1977 Compression moulding test specimens of thermoplastic materials — Method 902A:1977 Compression moulding test specimens of thermosetting materials — Method 910A:1977 Injection moulding test specimens of thermoplastic materials — Method 930A:1977 Preparation of test specimens by machining.*

BS 5214, *Testing machines for rubbers and plastics — Part 1: Tensile, flexural and compression machines.*

3 Principle

3.1 Method 340A. The shear strength of a moulded test piece in the form of a disc is determined by shearing a 12.7 mm diameter hole through it using a specified punching tool assembly.

3.2 Method 340B. A test piece in the form of a 6.4 mm wide rectangular bar is tested so that both ends of the bar are simultaneously sheared using the same tool as for Method 340A. A factor K is used in the calculation to allow for the cylindrical curvature of the sheared surfaces.

4 Apparatus

The following apparatus is required.

4.1 *Compression testing machine*, which shall be power-driven and capable of maintaining a constant rate of movement such that the test piece fractures within 15 s to 45 s. A continuous indication of the force applied to the test piece, preferably recorded autographically, with a permanent indication of the maximum force, shall be provided. The force scale shall be calibrated by a suitable method to ensure that the error does not exceed the requirements for grade A of BS 5214-1.

4.2 *Punching tool* (see Figure 1), which shall consist of a bolster, into one end of which is screwed a die, and a cylindrical punch which is a close-sliding fit in the other end of the bolster. The cutting edges of the punch and die shall be re-ground as necessary to maintain maximum sharpness. The bolster shall be provided with rectangular slots to accept the rectangular bar test piece used in Method 340B.

5 Test pieces

501 Method 340A. Test three test pieces.

Each test piece shall be a moulded disc 25.3 ± 0.1 mm in diameter and 1.6 ± 0.1 mm thick. Alternatively, the test piece may be machined from a moulded disc of larger diameter but of the same thickness.

5.2 Method 340B. Test three test pieces for each of the required directions in the plane of the sheet. (See **6.2**.)

Each test piece shall be a rectangular bar, 6.4 ± 0.2 mm wide and not less than 32 mm long. The thickness of the test piece shall be the thickness of the sheet under test, except that where this exceeds 6.35 mm the thickness of the test piece shall be reduced to 6.10 ± 0.25 mm, one original surface of the sheet being left intact.

6 Preparation of test pieces

PRECAUTIONARY NOTE. In all machining operations, precautions shall be taken against inhalation of dust and the occurrence of skin irritation.

6.1 Method 340A. The moulded discs shall be prepared under the conditions specified in the relevant British Standard for the moulding material under test. Where there is no relevant British Standard, the recommendations of the material manufacturer shall be followed. Unless otherwise specified, the preparation of the moulded discs shall be in accordance with the requirements of BS 2782:Methods 901A, 902A or 910A, as applicable. The moulding pressure shall be applied in a direction normal to the faces of the disc.

6.2 Method 340B. As stated in BS 2782: Foreword, general, introduction and instructions, the properties of some types of sheet material may vary in accordance with the direction in the plane of the sheet. In practice it is usual to cut two groups of test pieces with their major axes respectively parallel with and perpendicular to the direction of some feature of the sheet that is either visible or inferred from a knowledge of the method of its manufacture.

Test pieces shall be machined in accordance with the requirements of the relevant British Standard for the sheet material or, in the absence of any British Standard requirements, in accordance with the recommendations of the material manufacturer. Unless otherwise specified, the test pieces shall be machined in accordance with the requirements of BS 2782:Method 930A.

7 Conditioning

The test pieces shall be conditioned after any specified annealing or normalizing treatment. Unless otherwise specified in the relevant material standard, conditioning procedure A specified in BS 2782: Foreword, general introduction and instructions: 1975 shall be adopted. However, when it is known that the shear strength of the material under test is not sensitive to changes in humidity, procedure B may be used.

8 Procedure

Unless otherwise specified in the material specification, carry out the test procedure under the same atmospheric conditions as for conditioning.

Measure the thickness of the test piece, (and, for method 340B, its width also) at several points along the expected lines of shear and determine the mean value of these measurements to the nearest 0.01 mm.

Immediately following conditioning and measurement, position the test piece symmetrically in the punching tool and screw the die home against the test piece in the bolster. Use only sufficient force to ensure that there is no clearance between the test piece and the adjacent die and bolster surfaces.

Mount the punching tool assembly between the anvils of the testing machine and apply a steadily increasing force to the test piece by means of the punch so that the test piece fractures within 15 s to 45 s. Record the maximum force (F) sustained by the test piece.

Repeat the test with the remaining test pieces.

9 Calculation and expression of results

9.1 Calculation

9.1.1 *Method 340A.* Calculate the shear strength of each test piece using the following equation:

$$S = \frac{F}{\pi DT}$$

where

S is the shear strength (in MPa) of the test piece
F is the force (in N) at fracture
D is the diameter (in mm) of the punch
T is the mean thickness (in mm) of the test piece

9.1.2 *Method 340B.* Calculate the shear strength of each test piece using the following equation:

$$S = \frac{F}{2BTK} = \frac{F}{2.096BT}$$

where

S is the shear strength (in MPa) of the test piece
F is the force (in N) at fracture
B is the mean width (in mm) of the test piece
T is the mean thickness (in mm) of the test piece
K is the factor of constant value 1.048, introduced to allow for the cylindrical curvature of the sheared surfaces

9.2 Expression of results. In all cases, express the arithmetic mean of the shear strengths of the three test pieces as the shear strength of the material under test.

In cases where tests have been carried out by Method 340B in different directions in the plane of the sheet (see **6.2**), calculate and report a result for each direction.

NOTE The relevant British Standard for the sheet material under test should be consulted for any additional instructions, e.g. the reporting of the lower of the two mean values as the overall test result.

10 Test report

The test report shall include the following particulars.

a) A complete identification of the material tested, including type, source, manufacturer's code number, previous history, etc.

b) A reference to the appropriate British Standard method, (e.g. BS 2782: Method 340A:1978).

c) The conditioning atmosphere and the testing atmosphere used.

d) The dimensions of the test pieces and the method of preparation.

e) If applicable, the relation of the direction(s) of testing to some feature of the sheet.

f) The shear strength of the material (for each direction of testing, if applicable).

g) The individual test results.

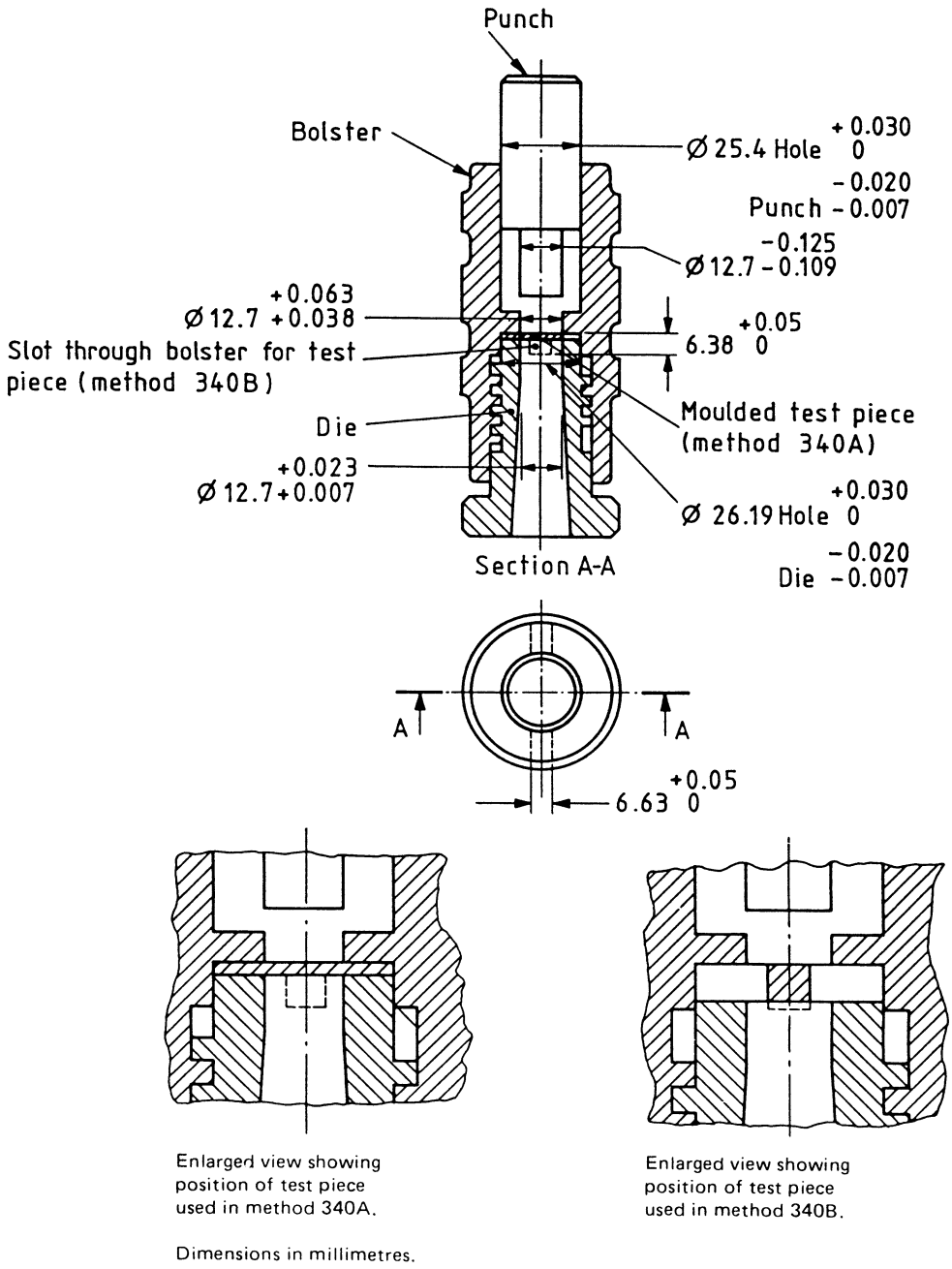

Figure 1 — Punching tool assembly

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