IS 15477 (2004): Adhesives for Use with Ceramic Tiles and Mosaics [PCD 12: Plastics]

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भारतीय मानक

सिरैमिक टाइल्स और पच्चीकारी में प्रयुक्त आसंजक

Indian Standard

ADHESIVES FOR USE WITH CERAMIC TILES AND MOSAICS

ICS 83.180; 91.100.25

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

July 2004

Price Group 6

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Plastics Sectional Committee had been approved by the Petroleum, Coal and Related Products Division Council.

Standard methods of testing tile adhesives are an essential adjunct to a tile adhesive specification. This standard specifies the procedure for the tests to evaluate the physical properties of different types of tile adhesives suitable for fixing tiles of different porosity.

Tile adhesives, thus, are classified as follows:

a) Type 1 Adhesive: based on fixing tiles of apparent porosity greater than 3 percent, and

b) Type 2 Adhesive: based on fixing tiles of apparent porosity less than or equal to 3 percent.

It should be understood that the suitability of the tile adhesive — and thus its performance and specification — largely depends on two factors: (a) the porosity/density etc of the tile[1)] to be fixed, (b) the nature, surface and location of the background where the tile/slab is to be fixed. In general it means that more porous tiles and less demanding backgrounds are suitable for Type 1 adhesive and less porous/denser tiles in demanding backgrounds require Type 2 adhesive. In practice, the vast majority of tiles and situations are covered by Type 1 adhesive but where either fully vitrified tiles/large dense tiles and/or demanding backgrounds occur then Type 2 adhesive may be more appropriate.

It shall be noted that in this standard, adhesion strengths are specified in terms of force (expressed in Newton) rather than as force per unit area (expressed in Pascal); this change has been made because the force required is not proportional to the contact area.

In the preparation of this standard considerable assistance has been derived from the following:

ISO 5893[(1)] : 1993 'Specification for testing machines for rubbers and plastics — Part 1 : Tensile, flexural and compression types (constant rate of traverse)' issued by the International Organization for Standardization.

BS 5980 : 1980 'Specification for adhesives for use with ceramic tiles and mosaics' issued by the British Standards Institution, UK.

EN 12004 'Adhesives for tiles — Definitions and specifications'.

For tropical countries like India, the standard temperature and the relative humidity shall be taken as 27 ± 2°C and 65 ± 5 percent respectively.

The composition of the Committee responsible for formulation of this standard is given in Annex E.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'.

[1)] Slabs, stones, etc, can also be fixed by tile adhesives, but this standard is based on specifying tiles and considers tile adhesive in relation to tiles.

Indian Standard

ADHESIVES FOR USE WITH CERAMIC TILES AND MOSAICS

1 SCOPE

This standard prescribes the requirements for tile adhesives used for fixing tiles of different porosity. In so doing, it specifies tile adhesive as either Type 1 or Type 2 to ensure that they are suitable for their proposed application.

2 DEFINITIONS

For the purpose of this standard the following definitions apply.

2.1 Type 1 Adhesive — Mainly for tiles of standard body composition with apparent porosity greater than 3 percent. Type 1 adhesive will be suitable for most ceramic (that is non-vitrified) tiles and the majority of porous stones and backgrounds.

2.2 Type 2 Adhesive — Mainly for tiles of standard body composition with an apparent porosity less than or equal to 3 percent. Type 2 adhesive will be suitable for vitrified/fully vitrified tiles, dense and large dimension tiles (slabs), and where background and location is especially demanding.

2.3 Thin-Bed Fixing — A process of tile fixing into a bed of an adhesive not exceeding 3 mm in final bed thickness.

2.4 Thick-Bed Fixing — A process of tile fixing into a bed of an adhesive not less than 3 mm and not exceeding 12 mm in thickness.

3 CLASSIFICATION

3.1 Polymer Modified Adhesive

Standard adhesive will contain varying amounts of chemical polymers, hence the name 'polymer modified adhesive' is suitable for general, internal, ceramic tiling. The vital minor amounts of chemical polymers enable powder adhesives, which are based on bulk cement and filler, to be modified to have appropriate properties. These are usually Type 1 adhesive.

3.2 Highly Polymer Modified Adhesive

The comments that apply to polymer modified adhesives, apply more so, to highly polymer modified adhesives. The latter contain additional chemical polymer and consequently bond strength and flexible characteristics are further enhanced. These are the more technical products, which are demanded in situations where the background or the tile surface is particularly difficult. These are usually Type 2 adhesive.

3.3 Polymer Modified Adhesive Enhanced by Liquid Admixture

Similar results to highly polymer modified adhesive can be achieved by the addition of a liquid admixture to the standard polymer modified adhesive. This can be thought of as a more specialist, technical solution that provides enhanced adhesion/bonding and increased flexibility. Thus, by liquid admixture addition, normally to a Type 1 adhesive, can enhance the properties of the latter such that the resultant adhesive may meet the performance criteria of Type 2 adhesive.

3.4 Reaction Resin Adhesive

Mixtures of synthetic resin, mineral fillers and organic additives in which hardening occurs by chemical reaction. They are available in one or more component forms and, in essence, these cover epoxy adhesives and the like. Epoxy adhesives are not cementitious adhesives and may or may not meet the criteria of a Type 1 or Type 2 adhesive.

4 REQUIREMENTS

4.1 Mixing of Adhesive

Where the adhesive requires a mixing process before use, for example, the mixing of two components as supplied, or the mixing of a powder with water, the process shall be carried out in accordance with the adhesives manufacturer's instructions. Unless otherwise stated by the manufacturer the mixed material in its ready-for-use condition shall then be used within 20 min.

4.2 Storage Stability

When stored in a dry place in the temperature range 5°C to 30°C, or such other wider temperature range as the manufacturer claims, the adhesive shall comply with the requirements of this standard for a period of not less than 12 months.

4.3 Rheology

Ideally a mixed adhesive shall have a rheology that does not deform or round-off when pulled from the

cup with a palette knife, does not slump from the knife and can be cut with a clean palette knife without any stickiness or deformation evident.

4.4 Tensile Adhesion Strength for Type 1 Adhesive

The mean tensile adhesion strength of the adhesive for Type 1 tiles, when tested by the method prescribed in Annex A, shall satisfy each of the following requirements (*see also* Table 1).

a) *Dry condition* — Not less than 750 N after conditioning for 14 days in normal laboratory conditions.

b) *Wet condition* — Not less than 450 N after conditioning for 7 days in normal laboratory conditions followed by 7 days immersion in water at laboratory temperature.

NOTE — This test is not applicable for Type 2 adhesive.

4.5 Shear Adhesion Strength for Type 1 Adhesive

The mean shear adhesion strength of the adhesive for Type 1 tiles when tested by the method prescribed in Annex B, shall satisfy each of the following requirements (*see also* Table 1).

a) *Dry condition:*

1) Not less than 8.0 kN after conditioning for 14 days under normal laboratory conditions.

2) Not less than 2.5 kN after conditioning for 24 h under normal laboratory conditions.

b) *Heat ageing condition* — Not less than 4.0 kN, after conditioning for 7 days under normal laboratory conditions, followed by 7 days storage in an oven at a temperature of 100 ± 2°C.

c) *Wet condition* — Not less than 4.0 kN, after conditioning for 7 days under normal laboratory conditions followed by 7 days immersion in water at laboratory temperature.

4.6 Shear Adhesion Strength for Type 2 Adhesive

The mean shear adhesion strength of the adhesive, for Type 2 tiles, when tested by the method prescribed in Annex B, shall satisfy each of the following requirements:

a) *Dry condition*:

1) Not less than 10.0 kN, after conditioning for 14 days under normal laboratory conditions; and

2) Not less than 4.0 kN, after conditioning for 24 h under normal laboratory conditions.

b) *Heat ageing condition* — Not less than 5.0 kN after conditioning for 7 days under normal laboratory conditions, followed by 7 days storage in an oven at a temperature of 100 ± 2°C.

c) *Wet condition* — Not less than 5.0 kN, after conditioning for 7 days under normal laboratory conditions followed by 7 days immersion in water at laboratory temperature.

4.7 Open Time

When tested by the method prescribed in Annex C, the open time, shall not be less than that stated by the manufacturer.

4.8 Adjustability

When tested by the method prescribed in Annex D, the adjustability, shall not be less than that stated by the manufacturer.

5 CONDITIONING

Unless otherwise stated, all the test shall be carried out at standard atmospheric conditions 27 ± 2°C temperature and 65 ± 5 percent humidity.

6 INSTRUCTIONS

Adhesive supplied in accordance with this standard, when mixed and spread in accordance with the manufacturer's instructions, shall be suitable for the practical process of tile fixing on those types of background for which they are recommended by the manufacturer. The manufacturer's instruction shall be carefully followed when any pre-mixing of the adhesive is required.

7 PACKING AND MARKING

7.1 Packing

a) Adhesive shall be suitably packed in bags, and

b) Liquid admixture shall be bottled in suitable containers.

7.2 Marking

The bags shall be marked with the following information:

a) Name of the manufacturer and the trade-mark, if any;

b) Batch or Lot number;

c) Month and year of manufacturer;

d) Type of adhesive that is Type 1 or Type 2;

e) Open time of the adhesive;

f) Storage life and storage condition for the adhesive; and

g) Mixing instructions (if appropriate).

7.2.1 *BIS Certification Marking*

The bags may also be marked with the Standard Mark.

7.2.1.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 1986 and the rules and regulations made there under. The details of conditions under which the license for the use of the Standard Mark may be granted to manufacturer or producers may be obtained from the Bureau of Indian Standards.

Table 1 Shear and Tensile Adhesion Type 1/Type 2 Adhesive

(*Clauses* 4.4 *and* 4.5)

Sl No.	Requirements	Type 1	Type 2
i)	Tensile adhesion, *Min*		
	a) Dry conditions	750 N	—
	b) Wet conditions	450 N	—
ii)	Shear adhesion, *Min*		
	a) Dry condition 24 h	2.50 kN	4.00 kN
	b) Dry condition 14 days	8.00 kN	10.00 kN
	c) Heat aging conditions	4.00 kN	5.00 kN
	d) Wet conditions	4.00 kN	5.00 kN

ANNEX A

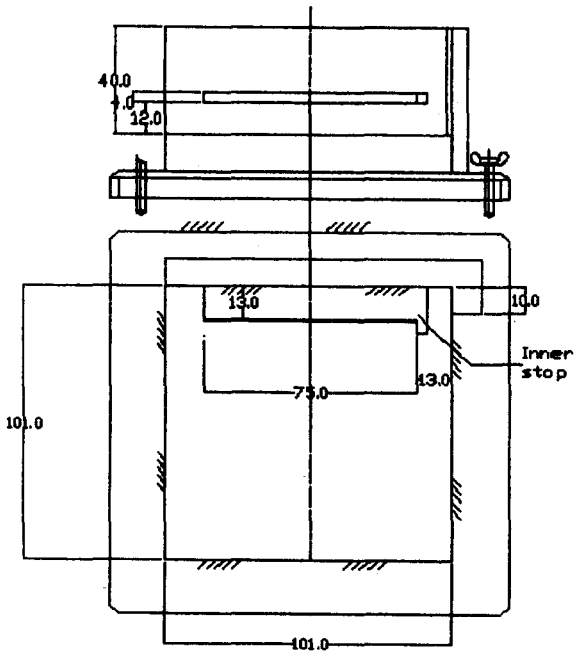
(*Clause* 4.4)

DETERMINATION OF TENSILE ADHESION STRENGTH

A-1 APPARATUS

A-1.1 Jig and Levelling Tile, as given in Fig. 1, for preparation of preliminary assemblies and of test units.

A-1.2 Test Unit Holder, as given in Fig. 2.



All dimensions in millimetres.

FIG. 1 JIG FOR PREPARATION OF TEST UNITS FOR THE TENSILE ADHESION STRENGTH TEST

A-1.3 Tensile Testing Machine, complying with tne following requirements:

A-1.3.1 *Definitions*

A-1.3.1.1 *Tensile-testing system* — A machine composed of a nominally fixed member and a movable member, to which may be attached suitable grips or jigs for holding the test piece. The movable member is power driven and may be equipped with adjustable control. The machine has a force measuring system complete with indicator and/or recorder.

A-1.3.1.2 *Applied force* — The force which produces the distortion in the test piece, measured along the strain axis of the machine. Depending on the arrangement of the grips or jigs, the test piece will be in tension, shear, compression or flexure.

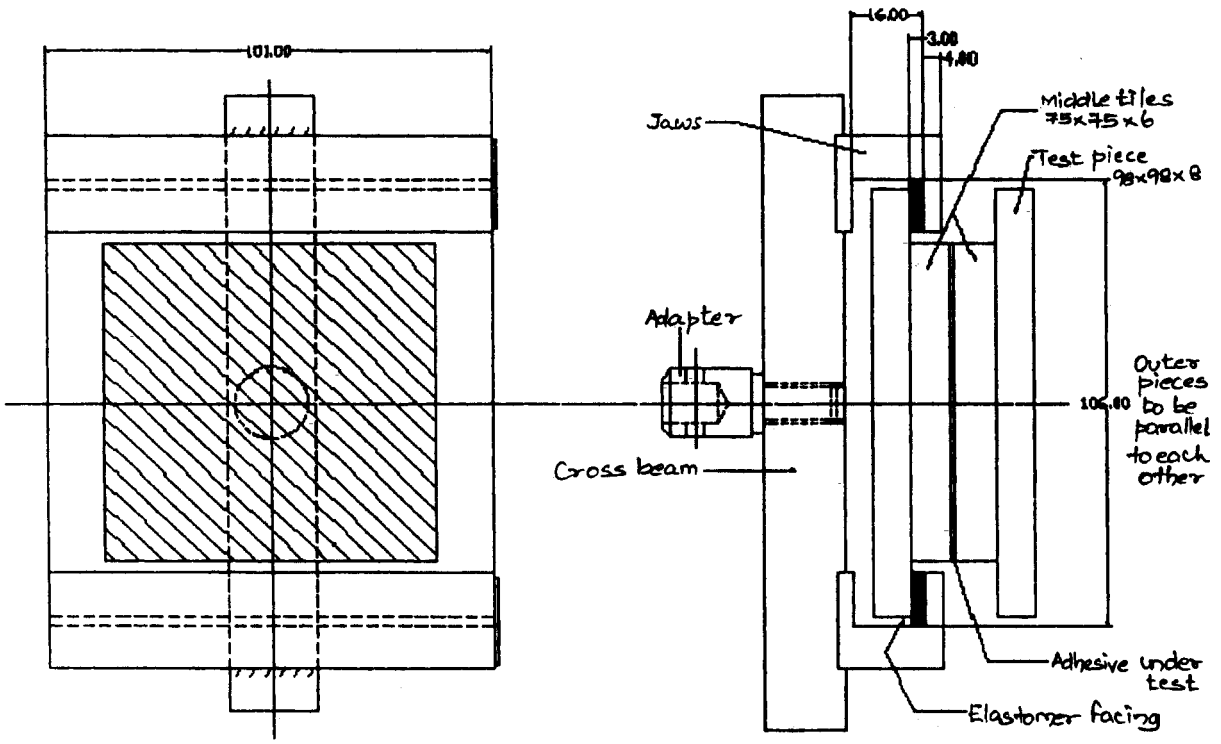
NOTE — For the purpose of this definition, grip is taken to mean platen or other member for application of force to the test piece when the machine is used for tests other than tensile tests.

A-1.3.1.3 *Elongation* — The increase in test length of a tensile test piece.

A-1.3.1.4 *Precision of force* — The greatest difference at a given true value, between the indicated values obtained by repeated measurement of the true value.

NOTE — This definition of precision assumes verification by observing the variation in the indicated values obtained by repeated application of known values.

A-1.3.1.5 *Accuracy for a given true force* — The difference between the true force and the arithmetic mean of readings obtained by repeated application



All dimensions in millimetres.

FIG. 2 ASSEMBLY FOR THE TENSILE ADHESION STRENGTH TEST WITH THE TEST UNIT HOLDER

of the force. It is expressed as a percentage of the true force.

NOTE — This definition of accuracy assumes verification by observing the variation in the indicated values obtained by repeated application of known values.

A-1.3.2 *Design Features*

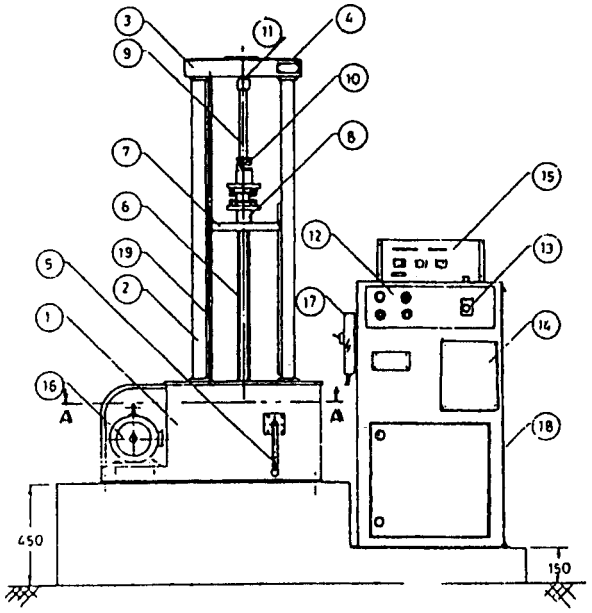
A-1.3.2.1 *Size and construction* — The size and construction shall be such that the machine is capable of testing all materials for which it is intended to be used and has no features that may adversely affect the test results. The moving grip shall be capable of traversing a distance sufficient to accommodate the maximum, elongation of the test piece. In the case of the more highly extensible materials, a traverse distance in excess of 1 m may be necessary. A schematic diagram of tensile testing machine is given in Fig. 3.

A-1.3.2.2 *Axial alignment of the machine* — The coupling between the force measuring system and the test piece grips or jigs shall be accurately aligned with the strain axis. When fitted in place, the test piece shall also be accurately aligned with the strain axis, and the test axis of the test piece shall coincide with the direction of the applied force.

NOTE — Non-axial alignment of a test piece in the grips and lack of test piece symmetry are particularly important causes of variation in test results.

A-1.3.2.3 *Test piece grips* — For testing dumb-bell, parallel-strip and similar tensile-test pieces of flexible materials, the machine shall be provided with a type of grip which closes automatically as the tension increases (for example, wedge or pneumatic) and which exerts a uniform pressure across the whole width of the test piece. For rigid materials, screw-action grips are also suitable. The test piece shall be held in such a manner that slippage relative to the grips is prevented as far as possible. For testing ring test pieces, the machine shall be provided with two pulleys, both of which are free to rotate; one at least is automatically rotated by the machine at between 3 rev/min and 50 rev/min to equalize the strain in the ring during the test. The pulleys shall be 25 mm in diameter for large rings (52.5 mm, OD) and 4.5 mm in diameter for small rings (10 mm OD). For testing adhesion in the peel mode, the machine shall be provided either with the grips described in the relevant test method or with grips which exert a uniform pressure across the whole width of the test piece. The test piece shall be held in such a manner that relative to the grips is prevented. When an adhesion test piece is made from different adherands, then grips of a different design may be required for each adherand.

A-1.3.2.4 *Drive characteristics* — The moving crosshead of the machine shall be driven smoothly at all test speeds, and the drive shall be without any



1. Base
2. Column
3. Top Plate
4. Top Cover
5. Hand Operation Handle
6. Main Screw
7. Cross Head
8. Lower Grip Head
9. Upper Grip Head
10. Load Cell
11. Central Member
12. Push Button Station
13. Speed Set Knob
14. Variable Speed Drive
15. Data Acquistion System
16. Electric Motor
17. MCB
18. Control Panel
19. Limit Switch Assembly

FIG. 3 SCHEMATIC DIAGRAM OF TENSILE TESTING MACHINE

significant backlash. A schematic diagram for drive arrangements of the tensile testing machine is given in Fig. 4.

A-1.3.2.5 *Jigs for use in compression, shear and flexure testing* — Such jigs or fixtures shall conform with requirements of the relevant method of test or material specification. They shall not significantly affect the accuracy of the machine by the introduction of friction, backlash or misalignment.

A-1.3.3 *Types of Force Measuring System*

In all cases, a continuous indication of the force applied to the test piece, preferably recorded automatically with a permanent indication of the maximum force, shall be provided. Machines with low-inertia force measuring systems are preferred.

NOTE — Pendulum-type machines may have levels of friction and inertia, which will significantly affect their dynamic response and decrease their accuracy.

A-1.3.4 *Dynamic Machine Accuracy*

A-1.3.4.1 Tensile-testing machines fitted with electronic force-measuring device may be regarded as sufficiently free of inertia at the test speeds given in **A-1.3.5**. This does not necessarily apply to the electronic recorders normally used with them and in many cases the dynamic inaccuracy of these recorders considerably exceeds their steady-state inaccuracy.

A-1.3.4.2 All electromechanical recorders suffer from dynamic errors that are usually made up of acceleration errors, stemming from the inertia of the device and pen lag errors due to mechanical and electrostatic friction effects. Measurement of dynamic recorder accuracy is best achieved by recording the error-signal level during the test. This can be done without affecting instrument performance, but it is usually technically difficult. It is, therefore, not considered practicable at present to specify limits and a calibration procedure for dynamic accuracy in this standard. Consequently, the user is advised to obtain from the test-machine manufacturer dynamic accuracy figures for the recorder with which he/she can calculate the probable measurement error, and assess whether or not it is significant. In cases where it is, either the test speed can be reduced, or the full-scale reading of the output device can be increased, in order to reduce the acceleration and velocity levels.

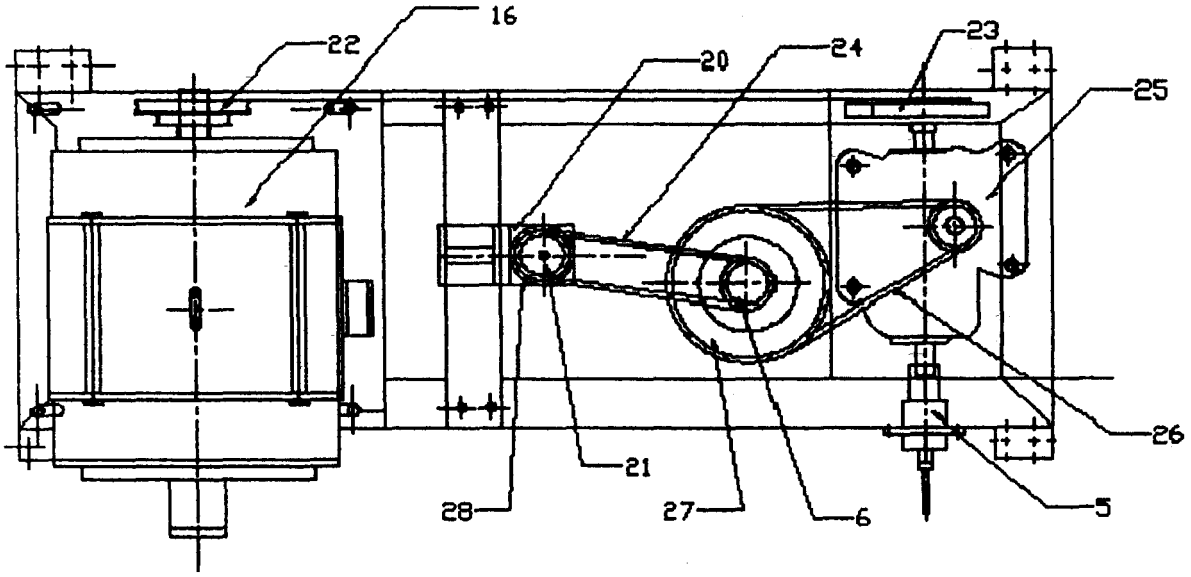
A-1.3.5 *Rate of Displacement of Driven Grip*

A-1.3.5.1 The testing machine will be power-driven and shall be capable of being set at one or more of the following rates of displacement of the driven grip:

a) 1 ± 0.2 mm/min
b) 2 ± 0.4 mm/min
c) 5 ± 1 mm/min
d) 10 ± 2 mm/min
e) 20 ± 2.5 mm/min
f) 25 ± 2.5 mm/min
g) 50 ± 5 mm/min
h) 100 ± 10 mm/min
j) 200 ± 20 mm/min
k) 250 ± 25 mm/min
m) 500 ± 50 mm/min

A-1.3.5.2 After setting, the rate shall not vary during the course of any test or series of tests by more than ± 5 percent of the mean rate and shall remain within the limits imposed in the above list.

A-1.3.5.3 Verification of the accuracy of the rate of displacement of the driven grip shall be done whilst increasing the load uniformly from zero to some specified maximum within the machine force range. Unless otherwise stated, this maximum shall be the normal maximum force capacity of the machine. Verification can be achieved by obtaining a



Section A-A

20.	Encoder Bkt	25.	Gear Box
21.	Encoder	26.	Chain
22.	Motor Pulley	27.	Nut Sprocket
23.	G. B. Pulley	28.	Timing Pulley
24.	Timing Belt		

FIG. 4 SCHEMATIC DIAGRAM FOR DRIVE ARRANGEMENTS OF THE TENSILE TESTING MACHINE

displacement/time recording. To make a realistic assessment of the rate of displacement of the driven grip, the displacement of the driven grip during the verification test shall be at least 10 mm and the duration of the verification test shall be at least 1.0 min.

A-1.3.6 *Stability*

The long-term stability of electronic test machines is influenced by a number of factors, the most important of which are temperature, mechanical hysteresis in the force-sensing element, sensitivity to mains supply voltage and change in electronic component value. The manufacturer shall therefore state in his specification, and in any instruction manual, such of the following requirements as may be necessary to maintain the stated accuracy of the machine:

a) Temperature range over which the machine accuracy is guaranteed,

b) Variation of supply voltage over which the machine accuracy is guaranteed, and

c) Frequency at which it is necessary to adjust any manual control, for example, for zero or span.

A-1.3.7 *Certificate of Verification*

A-1.3.7.1 When a test machine has been verified in accordance with this standard, the verifying authority shall issue a certificate stating the following:

a) Identity of the machine and date of verification;

b) Method of verification used and the identity of any calibration devices employed;

c) Ambient temperature at the time of verification; and

d) Accuracy of the rate setting (*see* **A-1.3.4**).

A-1.3.7.2 The test machine shall be re-verified periodically to ensure that it continues to meet this standard. The frequency of re-verification depends on the type of machine, the standard of maintenance, and the amount of usage. Normally, it is recommended that re-verification should be carried out at intervals not exceeding 12 months. However, a machine shall be re-verified if, it is moving to a new location, it is dismantled, or if it is subject to major repairs or adjustments.

A-2 TEST SPECIMENS

A-2.1 Two test piece tiles of 98 mm × 98 mm × 8 mm size.

A-2.2 Two test piece tiles with greater than 3 percent porosity of 75 mm × 75 mm × 6.5 mm size.

A-3 PRELIMINARY ASSEMBLY

Place the 98 mm × 98 mm × 8 mm tile on a plane surface and using a suitable high-strength adhesive, for

example, an epoxide, bond to it one side of a 75 mm × 75 mm × 6.5 mm and keep this epoxide applied tile on 98 mm × 98 mm × 8 mm tile exactly at the centre and press it, clean the excess material. Prepare 20 of these preliminary assemblies for each conditioning sequence.

A-4 PREPARATION OF TEST UNITS

For the preparation of each test unit, apply adhesive to the 75 mm × 75 mm × 6.5 mm face of a prepared preliminary assembly in sufficient quantity to result in a bed thickness of 1.5 mm. Immediately press another preliminary assembly with the 75 mm × 75 mm × 6.5 mm tile facing downwards on to the spread adhesive obtaining the required bed thickness by the use of spacer rods of the appropriate diameter. Align the outer tiles accurately in the jig (*see* Fig. 1). Carefully remove the last unit from the jig, remove the spacer rods and scrape off excess adhesive. Make a final check of alignment before conditioning the test units.

A-5 CONDITIONING

One set of 10 test units for each of the regimes as appropriate,

a) *Dry condition* — 14 days under normal laboratory conditions,

b) *Wet condition* — 7 days under normal laboratory conditions, followed by 7 days immersion in water at laboratory temperature.

A-6 PROCEDURE

On completion of the conditioning, remove a test unit from the conditioning environment, insert it in the test unit holder mounted in the tensile testing machine, and subject the unit to tensile stress at a cross-head speed of 5 to 6 mm/min. Note the tensile adhesion strength of the test unit. Then test each of the other test units similarly. If one or both of the tiles in any test unit are broken in the test, record the value at which the breakage occurred, and include it in the mean calculation (*see* **A-7**) if the value is within ± 15 percent of the mean value. Discard any individual result in which the breaking force differs by more than 15 percent from the mean value. If more than 5 out of the 10 units fail at forces outside these limits, repeat the whole test.

A-7 EXPRESSION OF TEST RESULTS

Calculate for each conditioning sequence the tensile adhesion strength (in N) as the mean tensile adhesion breaking force of at least 5 test units.

ANNEX B

(*Clauses* 4.5 *and* 4.6)

DETERMINATION OF SHEAR ADHESION STRENGTH

B-1 APPARATUS

B-1.1 Jig, constructed from 6 mm × 6 mm section metal, as given in Fig. 5, for assembly of test units.

B-1.2 Test Unit Holder, as given in Fig. 6, for shear testing.

B-1.3 Tensile Testing Machine, complying with the requirements given in **A-1.3**.

B-1.4 Laboratory Oven, controlled at 100 ± 2°C.

B-2 TEST SPECIMENS

108 mm × 108 mm × 6.5 mm test piece tiles of Type 1/Type 2, two of which are required for each test unit. Sixty tiles are required for adhesives for different conditions.

B-3 PREPARATION OF TEST UNITS

B-3.1 Place 108 mm × 108 mm × 6.5 mm test piece tile, on a plane horizontal surface and locate the jig over the tile and against one corner of it. The jig serves the dual purpose of keeping the unit square and of allowing for the 13 mm, overhang of a second similar test piece tile, which is to be bonded to the first with the adhesive under test.

B-3.2 Place two 1.5 mm diameter spacer rods on the first tile in the frame of the jig as shown in Fig. 5. Smear the smooth biscuit face of the second tile with an excess of the adhesive and immediately press it into place on top of the first, allowing 13 mm overhang by means of the metal stop on the jig. Remove the unit from the jig, remove the spacer rods and clean any excess of adhesive from the edges.

Prepare 10 of these test units for each conditioning sequence.

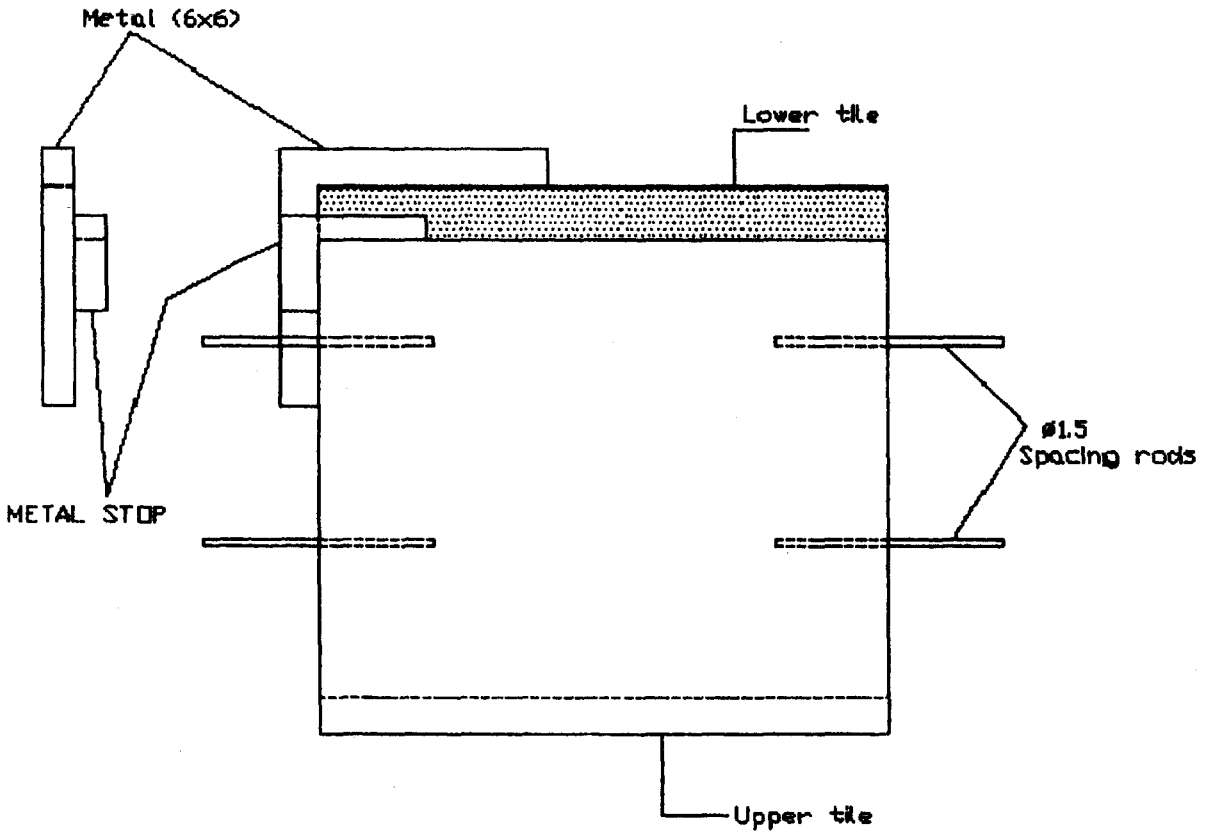
B-4 CONDITIONING

Condition one set of 10 test units for each of the regimes as appropriate:

a) *Dry condition*

1) 24 h under normal laboratory conditions,

2) 14 days under normal laboratory



All dimensions in millimetres.

FIG. 5 JIG FOR PREPARATION OF TEST UNITS FOR THE SHEAR ADHESION STRENGTH

conditions,

b) *Heat ageing condition* — 7 days under normal laboratory conditions followed by 7 days at 100 ± 2°C, and

c) *Wet condition* — 7 days under normal laboratory conditions followed by 7 days in water at laboratory temperature.

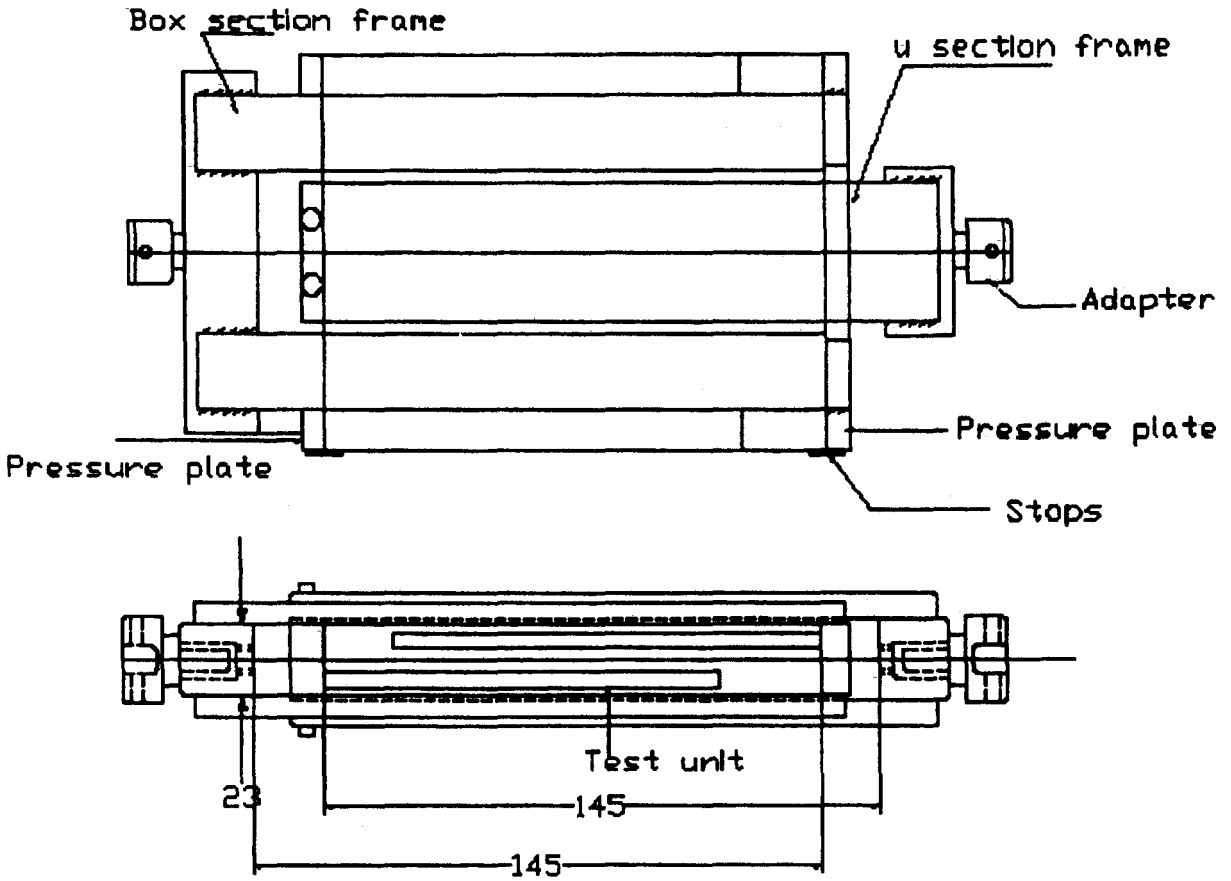
B-5 PROCEDURE

B-5.1 On completion of conditioning, remove a test unit from the conditioning environment. Insert it into the test unit holder mounted in the tensile-testing machine, and apply a shear stress to the test unit at a cross-head speed of 20 to 25 mm/min.

B-5.2 Failure of the unit shall be deemed to have occurred when the applied force reaches a maximum value. Then test each of the other test units similarly. If one or both of the test tiles are broken in the test, record the value at which the breakage occurs, and include it in the mean shear adhesion strength calculation if, the value is within ± 15 percent of the mean value. Discard any individual result in which the breaking force differs by more than 15 percent from the mean value. If more than 5 out of the 10 units fail at forces outside these limits, repeat the whole test.

B-6 EXPRESSION OF RESULTS

Calculate for each conditioning sequence the shear adhesion strength (in kN) as the mean shear adhesion breakage of at least 5 test units.



All dimensions in millimetres.

FIG. 6 ASSEMBLY FOR THE SHEAR ADHESION STRENGTH TEST WITH THE TEST UNIT HOLDER

ANNEX C

(*Clause* 4.7)

DETERMINATION OF OPEN TIME

C-1 APPARATUS

Trowel with 6 mm × 6 mm at 25 mm centre-square notched.

C-2 TEST SPECIMENS

Tiles of size 50 mm × 50 mm × 6.5 mm.

C-3 PROCEDURE

C-3.1 The adhesive is applied onto a chipboard using a trowel with 6 mm × 6 mm at 25 mm centre-square notched. Tiles of size 50 mm × 50 mm × 6.5 mm are fixed to the adhesive with a 2 kg of mass placed on the tiles for 10 s to improve the contact.

C-3.2 At definite intervals of time, say 5 min, 10 min, 15 min, etc, the tile is removed from the chipboard.

C-4 RESULT

The open time is defined as the last measurement before the adhesive fails to wet the tile. If the open time has been exceeded, it will prove relatively difficult to remove the tile to check the amount of adhesive remaining on the tile.

ANNEX D

(*Clause* 4.8)

DETERMINATION OF ADJUSTABILITY

D-1 APPARATUS

Adhesive spreader 6 mm × 6 mm at 25 mm centre-square notched.

D-2 TEST SPECIMENS

Tile pieces of approx 50 mm × 50 mm × 6.5 mm size.

D-3 PROCEDURE

D-3.1 The adhesive is applied onto chipboard using a trowel with 6 mm × 6 mm at 25 mm centre-square notched. Tiles of 50 mm × 50 mm × 6.5 mm size are fixed to the adhesive ribs with 2 kg weight placed on the tiles for 10 s to improve contact.

D-3.2 At definite time intervals, say 5 min, 10 min, 15 min, etc, the test tile should be rotated through 90° and then turned back to its original position. In the latter part of this process the tile should be removed from the chipboard and re-attached.

D-4 RESULT

The adjustability is defined as the last measurement before the tile fails to rotate.

ANNEX E

(*Foreword*)

COMMITTEE COMPOSITION

Plastics Sectional Committee, PCD 12

Organization	*Representative(s)*
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