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Indian Standard

SPECIFICATION FOR ONE-PART GUN-GRADE POLYSULPHIDE-BASED JOINT SEALANTS

PART 2 METHODS OF TESTS

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SPECIFICATION FOR ONE-PART GUN-GRADE POLYSULPHIDE-BASED JOINT SEALANTS

PART 2 METHODS OF TESTS

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Indian Standard

SPECIFICATION FOR ONE-PART GUN-GRADE POLYSULPHIDE-BASED JOINT SEALANTS

PART 2 METHODS OF TESTS

0. FOREWORD

0.1 This Indian Standard (Part 2) was adopted by the Indian Standards Institution on 23 January 1986, after the draft finalized by the Building Construction Practices Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 One-part gun-grade polysulphide-based joint sealant contains a polysulphide polymer and a curing system which is activated by exposure to moisture and cures to a rubber like solid.

0.3 This standard is based on BS 5215 : 1975 Specification for one part gun grade polysulphide based sealants, issued by the Britist Standards Institution.

0.4 This standard is being formulated in two parts. Part 1 of this standard covers the general requirements while Part 2 covers the methods of tests.

0.5 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*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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1. SCOPE

1.1 This standard (Part 2) covers methods of tests for one-part gun-grade polysulphide-based sealants used in sealing or glazing applications in buildings and structures. The tests on following properties have been covered in this standard:

a) Rheological properties,

b) Recovery,

*Rules for rounding off numerical values (*revised*).

c) Mass loss after heat ageing,

d) Staining,

e) Cyclic adhesion,

f) Adhesion in peel,

g) Adhesion in peel after sunlamp irradiation through glass, and

h) Adhesion after heat ageing.

2. TEST FOR RHEOLOGICAL PROPERTIES

2.1 Apparatus — The following apparatus is required.

2.1.1 Four aluminium open-ended channels of rectangular cross section. Internal dimensions: length 200 mm, width 25 mm and depth 12 mm. The channels shall have a transverse V-notch, 0·5 mm wide × 1·0 mm deep at the mid-point of the exposed face of each side wall.

2.1.2 Enclosure maintained at a temperature of 35 ± 2°C at 50 ± 5 percent relative humidity with a rail for suspending the channel.

2.1.3 Enclosure maintained at 5 ± 2°C with a rail for suspending the channel.

2.1.4 Enclosure maintained at 25 ± 2°C.

2.2 Preparation of Sample — Suitable amounts of the sealant shall be conditioned in closed containers for at least 4 hours at 25 ± 2°C; the metal channels shall be conditioned at the same temperature for not less than 1 hour.

2.3 Test Procedure — Remove the compound from the conditioning enclosure. Unless otherwise agreed, immediately fill the sealant into the channel and strike off the surplus with the fewest possible number of strokes of a pallet knife.

2.3.1 *For Testing with the Channel Held Vertically* — Draw a knife blade along the two V-notches in the aluminium channel, producing a transverse mark across the face of the sealant and immediately suspend the channel in the test enclosure with its longitudinal axis vertical for 24 h. Measure the slump to the nearest millimetre by measuring the vertical distance between the V-notches on the sides of the aluminium channel and the lowest point to which the transverse mark on the surface of specimen has slumped. The test shall be carried out both at 5°C and 35°C.

2.3.2 *For Testing with Channel Held Horizontally* — Place the channel with its longitudinal axis horizontal and its open side vertical in the test enclosure for 24 h. Measure the amount in mm by which the sealant protrudes in front of its original profile. The test shall be carried out both at 5°C and 35°C.

2.4 Reporting

2.4.1 Report as the slump value, in units of 1 mm, the vertical distance by which the reference mark on the sealant has slumped. Record whether any sealant has become detached or has slipped from the channel.

2.4.2 Report the distance in units of 1 mm by which the sealant has protruded in front of its original profile.

3. TEST FOR RECOVERY

3.1 Apparatus — The following apparatus is required.

3.1.1 Tensile testing machine equipped with jaws capable of holding the specimen aligned whilst maintaining the rate of separation at 5 mm to 6 mm per min and capable of recording the force required to extend the specimen.

3.1.2 Humidity cabinet maintained at 40 ± 2°C and 95 ± 5 percent reletive humidity.

3.1.3 Six 50 mm × 50 mm plates of aluminium alloy 64430 WP mill finish, as specified in IS : 736-1974*, sufficiently rigid to withstand deformation under testing.

3.1.4 Six softwood spacer bars, 12 mm × 19 mm × 50 mm.

3.2 Cleaning of Test Surface — Major contamination shall be removed by cleaning with water, detergents or solvents but not abrasives. The surface shall then be cleaned with ethyl methyl ketone or similar solvent, washed with dilute detergent solution, rinsed with distilled or deionized water and finally rinsed in alcohol (industrial methylated spirits) and air-dried.

3.3 Preparation of Test Assemblies — Three test assemblies shall be prepared as follows:

Each test assembly shall be prepared using two spacer bars sandwiched between the test plates to form a cavity 12 mm × 12 mm × 50 mm down the middle of the test surfaces as shown in Fig. 1. One end of the cavity may be sealed with masking tape. Before assembly of the test sample, the softwood spacer bars shall be wrapped in siliconized release paper or coated with other non-migratory release agent such as talc. The cavity shall be carefully filled with sealant either by spatula or extrusion gun, taking care to prevent voids and occlusion of bubbles. Any material protruding at the end shall be tooled off flush with the assembly.

*Specification for wrought aluminium and aluminium alloys, plate (for general engineering purposes) (*second revision*).

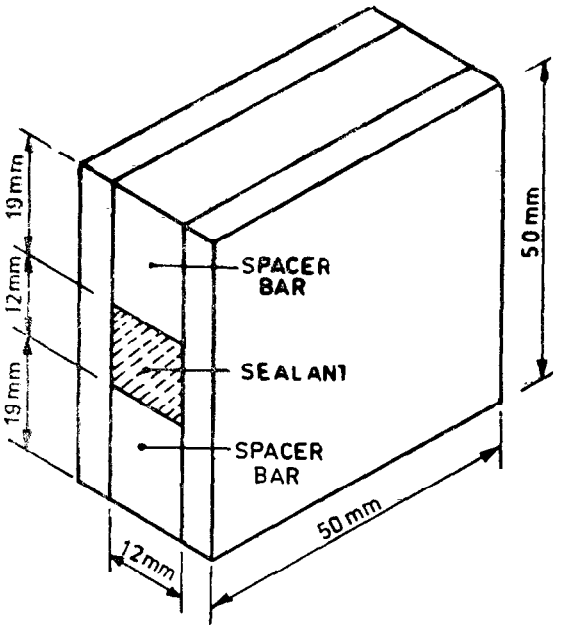


FIG. 1 ASSEMBLY FOR TESTING ADHESION AND COHESION IN TENSION

3.4 Curing of Test Assemblies — The cure conditions used in testing sealants covered by this standard shall be 40 ± 2°C and 95 ± 5 percent relative humidity for 21 days.

After 7 days, the spacers shall be moved away from the sides of the sealants to leave a space approximately 6 mm wide on either side of the sealant.

The assembly shall be clamped securely to prevent movement throughout the curing period.

3.5 Test Procedure — Test the three assemblies as follows:

a) At the end of the 21 days, remove the clamps and spacers from the assemblies.

b) Condition the assemblies on end with the long axis of the sealant vertical for 24 hours at 25 ± 2°C and 50 ± 5 percent relative humidity.

c) After conditioning, place each assembly in the grips of the tensile testing machine and extend the sealant by 100 percent that is, to 24 mm, at a rate of 5 mm to 6 mm per minute. Record the force required to obtain this extension. Hold the assembly at 100 percent extension for 5 minutes.

d) Immediately remove the assembly from the machine and allow it to recover for one hour at 25 ± 2°C without compression by placing edgewise on a glass surface with the long axis of the sealant perpendicular to this surface. Measure the recovered width of the sealant (W_r). Take measurements at both ends of the specimen to an accuracy of 0·1 mm and use the average in calculations. Calculate recovery as follows:

$$\frac{(W_e - W_r)}{(W_e - W_i)} \times 100 = \text{percent recovery}$$

where

W_e is the width extended;

W_r is the width after recovery; and

W_i is the initial width.

Report the individual results for each specimen.

e) After the test, the sealant shall be cut open with a clean sharp knife; there shall be no substantial transfer of the sealant into the knife blade.

4. TEST FOR MASS LOSS AFTER HEAT AGEING

4.1 Apparatus — The following apparatus is required.

4.1.1 Enclosure maintained at 40 ± 2°C and 95 ± 5 percent relative humidity.

4.1.2 Enclosure maintained at 25 ± 2°C and not exceeding 55 percent relative humidity.

4.1.3 Ventilated oven with fan, controlled at 70 ± 2°C.

4.1.4 Balance that weighs to an accuracy of 0·01 gram.

4.1.5 Two aluminium frames with internal dimensions of 125 mm × 38 mm × 6 mm, weighing not more than 50 g each.

4.1.6 Two aluminium plates, 150 mm × 75 mm and 0·5 mm to 1·6 mm thick.

4.1.7 Metal spatula.

4.2 Test Procedure — Prepare two specimens as follows:

a) Condition the sealant in a closed container at 25 ± 2°C for not less than 4 h. Clean an aluminium plate and frame with ethyl methyl ketone, dry and then weigh them.

b) Centre the aluminium frame upon the aluminium plate and fill the frame with the sealant which is then struck off flat with a spatula. Weigh the plate, frame and sealant and calculate the initial mass of the sealant (W_o).

c) Cure the two specimens for 21 days at the conditions specified in **3.4**. Place the specimen in oven at 70 ± 2°C for a further period of 14 days. At the end of this time, transfer the specimens to the enclosure maintained at 25 ± 2°C and not exceeding 55 per-cent relative humidity; condition then for 2 hours and then reweigh them. Deduct the mass of the aluminium plate and frame to give the final mass (W_f).

d) Calculate the weight loss as follows:

$$\frac{W_o - W_f}{W_o} \times 100 = \text{percent mass loss}$$

where

W_o is the original mass; and

W_f is the final mass.

Report the average mass loss of the two specimens.

e) Examine the specimens and report any formation of bubbles, cracking or chalking.

5. TEST FOR STAINING

5.1 Materials — The mortar mix shall consist of 1·0 part by mass of Portland cement complying with the requirements of IS : 269-1976*, 0·2 part by mass of high calcium hydrated lime complying with the requirements of IS : 712-1984† and 3·5 parts by mass of sand complying with the requirements of IS : 650-1966‡ with just sufficient water to form a still smooth mix.

5.2 Preparation — The cement, lime and sand shall be mixed dry with a trowel on a non-absorbent, non-metallic surface until the mixture is uniform. The water shall then be added and the whole mixed thoroughly.

*Specification for ordinary and low heat Portland cement (*third revision*).
†Specification for building limes (*third revision*).
‡Specification for standard sand for testing of cement (*first revision*).

The mortar mix shall be cast in a split ring mould 12 mm in depth and 76 mm in diameter that stands on a smooth glass plate. A central smooth bore cylindrical hole, about 20 mm in diameter, shall be formed by standing in the centre of the ring a 20 mm cylindrical mandrel of polyethylene or similar material to which the mortar will not adhere.

The mortar shall be allowed to set for $3\frac{1}{2} \pm \frac{1}{2}$ h at 25°C in moist air under a damp cloth. After the mortar has set, the central mandrel shall be removed.

5.3 Test Procedure — Test for staining as follows:

a) When a primer is recommended by the sealant manufacturer for use on concrete, coat half the area of the upper surface of the mortar block and the inner surface of the central hole with primer according to the manufacturer's directions. Then apply sufficient of the compound to the mortar block by first completely filling the hole, then spreading the remainder evenly over the whole of the top surface to a thickness between 6 mm and 10 mm.

b) Store the assembly for 24 h in a conditioning chamber maintained at 25 ± 2°C and 50 ± 5 percent relative humidity, then remove it from the conditioning chamber and inspect for staining.

c) Completely immerse the specimen in 400 ml of fresh distilled water at room temperature for one minute and return it to the conditioning chamber.

Repeat (b) and (c) 13 times within 21 days at intervals of not less than 24 h. The first appearance of discoloration, which is most likely to be visible on the uncoated smooth undersurface of the mortar around the interface with the compound in the central hole, shall be taken as evidence of staining.

Report whether or not staining occurs and, if so, whether on the primed surface or the unprimed surface.

6. TEST FOR CYCLIC ADHESION

6.1 Apparatus and Accessory Materials — The following apparatus and materials are required.

6.1.1 Cyclic adhesion test device as per Fig. 2.

6.1.2 Enclosure maintained at 40 ± 2°C and 95 ± 5 percent relative humidity.

6.1.3 Enclosure maintained at 25 ± 2°C.

6.1.4 Ventilated oven with fan, controlled at 70 ± 2°C and 110 ± 2°C.

6.1.5 Enclosure maintained at − 15 ± 2°C, sufficiently large to accommodate the cyclic adhesion test advice.

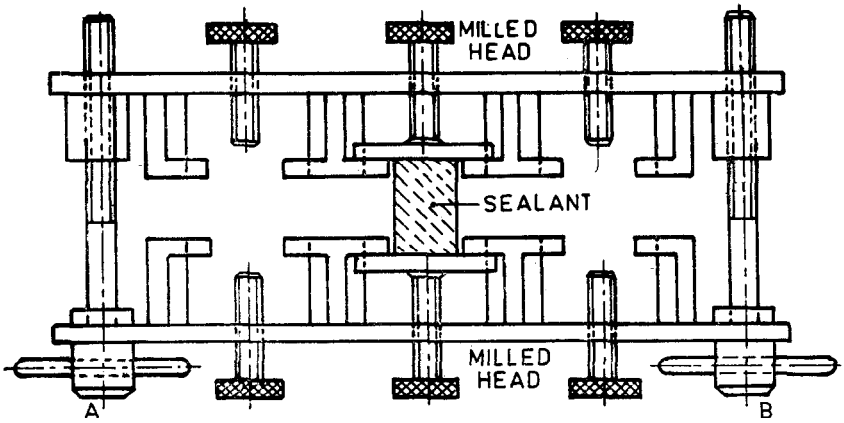


FIG. 2 TYPICAL ASSEMBLY HOLDING DEVICE FOR CYCLIC ADHESION TEST

6.1.6 *Test Surfaces*

a) Clean plate glass (nominal thickness 6 mm).

b) Stainless steel complying with the requirements of IS : 6911-1972*.

c) Untreated aluminium alloy 64430 WP plate as specified in IS : 736-1974†.

d) Portland cement mortar. Each mortar test surface shall consist of a block of not less than 12 mm nominal thickness, stored for 24 h in an enclosure at 25 ± 2°C and 50 ± 5 relative humidity. Prepare the cement mortar blocks as follows:

i) Mix one part by dry mass of ordinary Portland cement complying with IS : 269-1976‡ with 1½ parts by dry mass of sand complying with IS : 650-1966§ and add water to a water cement ratio of 0·35 to 0·40. The grain size of sand shall be such that 100 percent by mass shall pass through a 850 μm IS sieve complying with IS : 460 (Part 1)-1985‖ and 0 to 10 percent by mass shall pass through a 600 μm IS sieve complying with IS : 460 (Part 1)-1985‖. Ensure that the sand is thoroughly washed and dried before use.

*Specification for stainless steel plate, sheet and strip.

†Specification for wrought aluminium and aluminium alloys, plate (for general engineering purposes) (*second revision*).

‡Specification for ordinary and low heat Portland cement (*third revision*).

§Specification for standard sand for testing of cement (*first revision*).

‖Specification for test sieves: Part 1 Wire cloth test sieves (*third revision*).

ii) Transfer the mortar immediately to a rigid mould in about four layers each being thoroughly compacted on a suitable vibrating table.

iii) Cure the blocks in the moulds for 24 h in an atmosphere of not less than 90 percent relative humidity.

iv) Remove the blocks from the moulds and cure for further 28 days in water at room temperature using a volume of water not less than 400 ml per block.

v) Dry the blocks at a temperature of 110°C in an oven for at least 12 hours and store in the enclosure for at least 28 days at 25 ± 2°C and 65 percent relative humidity. If the blocks are not required for immediate use and are subsequently stored under alternative or uncontrolled conditions, store them for at least further seven days at 25 ± 2°C and 65 percent relative humidity before use.

6.1.7 Twelve softwood spacer bars, 12 mm × 19 mm × 50 mm.

6.2 Preparation of Test Assemblies — Six test assemblies shall be prepared; three using glass as one substrate with aluminium as the other, and three using stainless steel as one substrate with cement mortar as the other. These assemblies may be made by using:

a) plates of the test surface material, approximately 50 mm × 50 mm × 6 mm, such as clear plate glass or aluminium;

b) plates of the test surface material, approximately 50 mm × 50 mm and less than 6·0 mm thick, if the material has sufficient rigidity to withstand deformation under testing, as in the case of stainless steel;

c) relatively thin plates of the test surface material, approximately 50 mm × 50 mm, securely bonded to faces of a rigid substrate, also approximately 50 mm × 50 mm; and

d) cement mortar blocks approximately 50 mm × 50 mm.

6.3 Cleaning of Test Surfaces — Before constructing the test assemblies, the test surfaces shall be cleaned as follows.

6.3.1 *Clear Plate Glass, Aluminium, Stainless Steel* — Cleaning of these surfaces shall be as specified in **3.2.**

6.3.2 *Mortar* — Loose dust shall be removed by hand-brushing with a clean, stiff bristle brush and stored for 24 h at 25 ± 2°C and 50 ± 5 percent relative humidity. If it is found after the preparation of the block that the surface has any cavity greater than 2 mm diameter on the test area, the block shall be rejected.

6.4 Priming of Test Surfaces — After being cleaned, all surfaces, for which priming is recommended shall be primed according to the sealant manufacturer's or supplier's directions. Primer shall be applied only over the area to which the sealant is intended to adhere.

6.5 Preparation of Test Assemblies — Each test assembly shall be prepared using two spacer bars, 19 mm × 12 mm × 50 mm, sandwiched between the test plates to form a cavity 12 mm × 12 mm × 50 mm down the middle of the test surface (*see* Fig. 1). One end of the cavity may be sealed with masking tape.

Before assembly of the test sample, the softwood spacer bars shall be wrapped in siliconized release paper or coated with the recommended release agent. The cavity shall be carefully filled with sealant either by spatula or by extrusion gun, taking care to prevent voids and occlusion of bubbles. Any material protruding at the end shall be tooled off flush with the assembly.

6.6 Curing of Test Assemblies — The test assemblies shall be cured for 21 days at the conditions specified in **3.4**.

The assembly shall be clamped securely to prevent movement throughout the curing period.

6.7 Test Procedure — Test the six assemblies as follows:

a) Place the assemblies with spacers still in position in the oven at 70 ± 2°C for 4 days.

b) Cool the specimens for at least 2 h under laboratory conditions, then remove the spacers and immerse the assemblies in distilled or de-ionized water for 24 h at 25 ± 2°C. Immerse concrete/ stainless steel specimens in a separate bath from the other specimens.

c) Dry the surfaces of the assemblies and place them in a suitable device (*see* Fig. 2) for separating the parallel test surfaces. Then place the device with the contained test assemblies in the enclosure maintained at — 15 ± 2°C for not less than 16 hours.

d) After this conditioning period, extend the test assemblies, still at — 15 ± 2°C, by increments of 1·0 ± 0·1 mm every 3 min until the compound has been extended to a total width of 24 mm. Maintain the assemlies at this extension for 24 h at a temperature of — 15 ± 2°C.

e) Remove the assemblies from the enclosure and allow them to stand for 4 h at 25 ± 2°C with all tensile stress removed. At the end of this period, compress the assemblies at a rate of 5 mm to 6 mm per min until the distance between the compressed surface is 12 mm; then place in the oven at 70 ± 2°C in this compressed state for 4 days.

Repeat the procedure starting at (b).

Repeat the procedure again, starting at (b) and completing the test at the end (d).

Examine the specimens for loss of adhesion or cohesion whilst in the extended position; the depth of any crack may be measured using a 0·025 mm feeler gauge, 2 mm wide graduated in 1·0 mm units.

Estimate the total area of failure (length × depth) of each specimen and report in mm^2.

7. TEST FOR ADHESION IN PEEL

7.1 Apparatus and Accessory Materials — The following apparatus and materials are required.

7.1.1 Testing machine capable of a jaw separation at the rate of 50 ± 5 mm per minute and calibrated to record the force.

7.1.2 *Test Surfaces*

a) Two pieces, approximately 125 mm × 75 mm, of untreated aluminium alloy 64430 WP as specified in IS : 736-1974*.

b) Two pieces, approximately 125 mm × 75 mm, of stainless steel conforming to IS : 6911-1972†.

c) Two blocks of cement mortar, approximately 125 mm × 75 mm × 25 mm, as specified in **6.**

7.1.3 Paper masking tape, 25 mm wide.

7.1.4 Twelve spacer bars, 125 mm × 1·5 mm × 1·5 mm, preferably metal.

7.1.5 Degreased 150 μm IS mesh, 0·112 mm phosphor-bronze screen, 225 mm × 75 mm, to be used as a flexible backing material.

7.1.6 Twelve mm diameter steel or glass rod, 150 mm long.

7.1.7 Enclosure maintained at 40 ± 2°C and 95 ± 5 percent relative humidity.

7.1.8 Enclosure maintained at 25 ± 2°C.

7.2 Cleaning of Test Surfaces — Before constructing the test assemblies, the test surface shall be cleaned as described in **6.3.**

*Specification for wrought aluminium and aluminium alloys, plate (for general engineering purposes) (*second revision*).

†Specification for stainless steel plate, sheet and strip.

7.3 Priming of Test Surfaces — The surface shall be primed, if required, in accordance with the manufacturer's or supplier's instructions. Primer shall be applied only over the surface to which the sealant is intended to adhere.

7.4 Test Procedure — Prepare and test two specimens for each test surface.

a) Place a strip of 25 mm paper masking tape across the width of the test surface, along and parallel to the lower edge of the plate. This will leave an exposed area of 100 mm × 75 mm.

b) Spread sealant, previously conditioned at 25 ± 2°C in a closed container, on the surface of the plate to a minimum thickness of 2 mm over the area from the top edge of the plate to the bottom of the masking tape and the entire width of the plate (i.e. 125 mm × 75 mm). Insert the spacer bars on the long edge of the plate. Smear the backing material with sealant over an area of 125 mm × 75 mm at one end, forcing the sealant into the backing material using a spatula. Then lay the impregnated material over the sealant on the test surface without entrapping the air, with the coated surface downwards. Roll the backing material with the rod to obtain a thickness of sealant of 1·5 mm between the backing material and the test surface (Fig. 3).

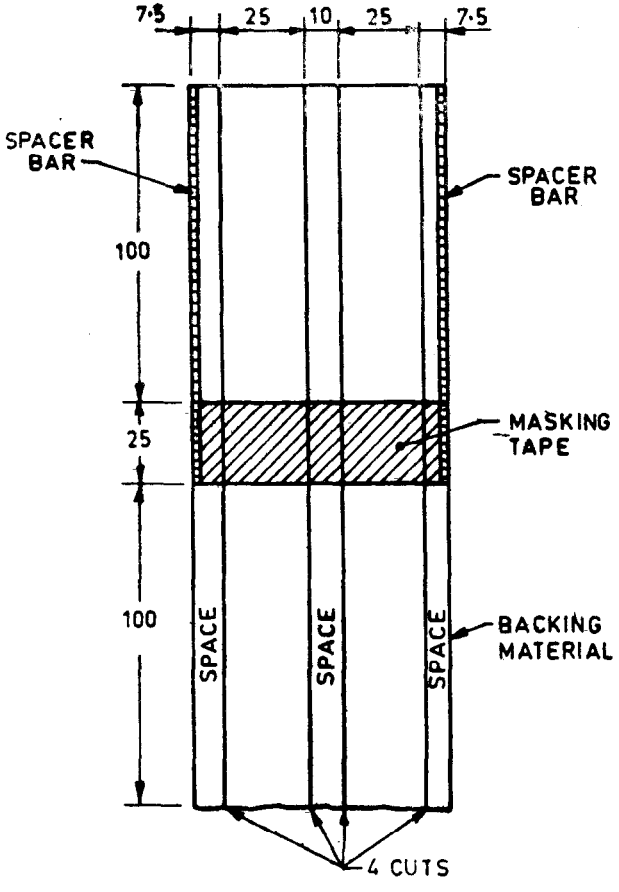
c) Cure the specimen for the first seven days at the conditions specified in **3.4**, after which it shall dry for 4 h at 25 ± 2°C. Then coat the backing material with a layer 1 mm thick or less of the fresh compound to minimize adhesion failure. Cure the specimen for the remaining 14 days of the curing period at standard conditions.

d) Cut through the backing material and sealant to the test surface with a sharp knife leaving two 25 mm wide strips of sealant and backing material on each panel, separated by a space approximately 10 mm wide. Immerse the test specimens in distilled or de-ionized water for 7 days at 25 ± 2°C.

e) Immediately after removing the specimen from the water, wipe it dry and release from the test surface the phosphor-bronze screen covering the masking tape. Then place the specimen in the testing machine and peel back the backing material at an angle of 180°. The rate of separation of the jaws of the machine shall be 50 ± 5 mm per min. Pull the backing material for one minute after a reasonably steady value has been achieved and record the average value over that one minute.

Report the mean average peel strength of each test strip and estimate the area of failure of adhesion to the test surface.

If the backing material separates from the sealant during the test, disregard the results and repeat the test on the same surface.



All dimensions in millimetres.

FIG. 3 DIAGRAM OF THE ADHESION IN PEEL TEST

8. TEST FOR ADHESION IN PEEL AFTER SUNLAMP IRRADIATION THROUGH GLASS

8.1 Apparatus and Accessory Materials — The following apparatus and materials are required.

8.1.1 Testing machine as described in **7.1.1**.

8.1.2 Two pieces of clear plate glass, 125 mm × 75 mm and approximately 6 mm thick.

8.1.3 Paper masking tape, 25 mm wide.

8.1.4 Four metal spacer bars, 125 mm × 1·5 mm × 1·5 mm.

8.1.5 Thin flexible backing material (phosphor-bronze screen) and described in **7.1.5.**

8.1.6 Twelve mm diameter steel or glass rod, 15 mm long.

8.1.7 300 W sunlamp.

8.1.8 Enclosure maintained at a temperature of 40 ± 2°C at 95 ± 5 percent relative humidity.

8.1.9 Enclosure maintained at 25 ± 2°C.

8.2 Cleaning of Test Surfaces — Before constructing the test assemblies the glass surface shall be cleaned as described in **3.2.**

8.3 Priming of Test Surfaces — The surface shall be primed, if required, in accordance with the manufacturer's or supplier's instructions. Primer shall be applied only over the surface to which the sealant is intended to adhere.

8.4 Test Procedure — Prepare two specimens as described in **7.4** (a), (b) and (c) and test them as follows:

a) Continuously expose the glass side of the assemblies to the radiation from the sunlamp for 96 h at a distance of 300 mm from the surface of the lamp and normal to the axis of the lamp (Fig. 4). Provide ventilation so that the temperature of the glass surface of the specimen does not exceed 50°C. Do not test more than two specimens at the same time under one lamp. (The lamp has a useful life of 200 h which should not be exceeded).

b) After the exposure, cut through the backing material and the sealant to the base of the test surface with a sharp knife, leaving two 25 mm wide strips of sealant and backing material on each panel separated by a space approximately 10 mm wide. Immerse the test specimens in distilled or de-ionized water for 7 days at 25 ± 2°C.

c) Immediately after removing the specimens from the water, wipe them dry and release from the test surface the backing material covering the masking tape. Place the specimen in the testing machine and peel back the backing material at an angle of 180°. The rate of separation of the jaws of the machine shall be 50 ± 5 mm per min. Pull the backing material for one minute after a reasonably steady value has been achieved and record the average value over that one minute.

Report the mean average peel strength of each test strip and estimate the area of failure of adhesion to the the test surface.

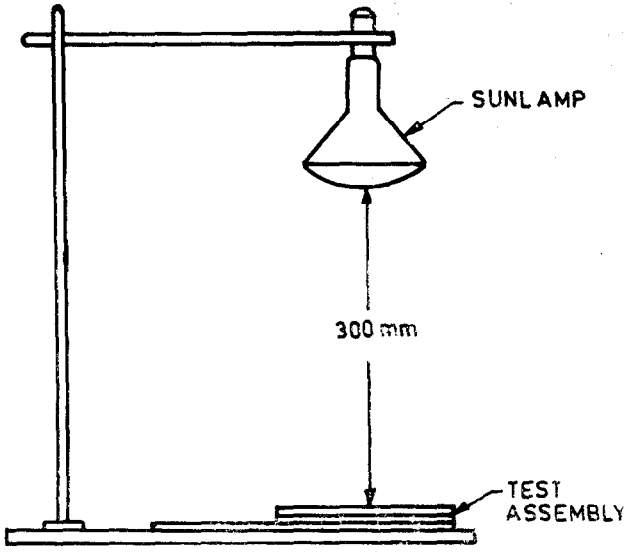


FIG. 4 SUNLAMP IRRADIATION THROUGH GLASS

If the backing material separates from the sealant during the test, disregard the results and repeat the test on the same surface.

9. TEST FOR ADHESION AFTER HEAT AGEING

9.1 Apparatus and Accessory Materials — The following apparatus and materials are required.

9.1.1 Enclosure maintained at 40 ± 2°C and 95 ± 5 percent relative humidity.

9.1.2 Ventilated oven with fan, controlled at 70 ± 2°C.

9.1.3 Testing machine capable of a jaw separation rate of 5 mm to 6 mm per min and capable of recording the force required to extend the specimen.

9.1.4 Twelve softwood spacer bars, 12 mm × 19 mm × 50 mm, wrapped with release paper or treated with recommended release agent.

9.1.5 *Test Surfaces*

a) Clean plate glass;

b) Stainless steel complying with the requirements of IS : 6911-1972*;

c) Untreated aluminium alloy 64430 WP as specified in IS : 736-1974†;

d) Portland cement mortar complying with the requirements of **6.1.6** (d).

9.2 Preparation of Test Assemblies — Six test assemblies shall be prepared, three using glass as the first substrate with aluminium as the other, and three using stainless steel as the first substrate with cement mortar as the other. The assemblies shall be made as described in **6.2.**

9.3 Curing of Test Assemblies — The test assemblies shall be cured for 21 days at the conditions specified in **3.4.** The assemblies shall be clamped securely to prevent movement throughout the curing period.

9.4 Test Procedure — Test the six test specimens as follows:

a) Remove the specimens from the curing chamber and place them, with spacers still in position, in the oven at 70 ± 2°C for 7 days.

b) Cool the specimens for at least 2 h under laboratory conditions, then remove the spacers and place each assembly in the grips of the tensile testing machine and extend the sealant by 100 percent, that is, 24 mm at a rate of 5 mm to 6 mm per min. Record the force required to obtain this extension. Hold the assembly at 100 percent extension for 24 h and examine for loss of adhesion or cohesion as described in **6.7** (e).

*Specification for stainless steel plate, sheet and strip.

†Specification for wrought aluminium and aluminium alloys, plate (for general engineering purposes) (*second revision*).

(*Continued from page* 2)

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INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	Unit	Symbol
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	Unit	Symbol
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	Unit	Symbol	Definition
Force	newton	N	1 N = 1 kg.m/s^2
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2