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IS 12027 (1987): silicone-based water repellents [CED 41: Waterproofing and Damp-Proofing]



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Indian Standard
SPECIFICATION FOR
SILICONE-BASED WATER REPELLENTS

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

Indian Standard

SPECIFICATION FOR SILICONE-BASED WATER REPELLENTS

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**AMENDMENT NO. 1 JANUARY 2001
TO
IS 12027 : 1987 SPECIFICATION FOR SILICONE-
BASED WATER REPELLENTS**

(*Page 7, Appendix A*) — Substitute the following for the existing matter

'A-1 For the purpose of carrying out the tests detailed in Appendices B to G, the minimum number of samples of bricks and stone required are as follows:

- a) For Class A materials, Class A bricks with water absorption not more than 15 percent conforming to IS 1077 and
- b) For Class B and C materials, Limestone slab conforming to IS 1128 or Class B bricks conforming to IS 1077.'

(CED 41)

Reprography Unit, BIS, New Delhi, India

Indian Standard

SPECIFICATION FOR SILICONE-BASED WATER REPELLENTS

0. FOREWORD

0.1 This Indian Standard was adopted by the Bureau of Indian Standards on 21 April 1987, after the draft finalized by the Waterproofing and Damp-proofing Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 Silicone-based water repellents, when applied to masonry surfaces, generally extend their life and protect them from spalling, cracking, efflorescence and other types of damages caused by absorption of water. It may, however, be mentioned that their use for waterproofing of roofs, tanks, etc, is not recommended. Silicones function by imparting durable water repellent film on the surface of capillary pores of the masonry to a depth of about 1.5 to 3.0 mm depending upon the porosity of the masonry surface. Silicone films do not seal the pores of cracks on the masonry and the permeability of masonry to vapour and gases is not seriously impaired for performance tests. This standard is intended to specify the requirements and give guidance to the users for the selection of the appropriate type of water repellent for application to various types of masonry.

0.3 In the formulation of this standard, due weightage has been given to international coordination among the standards and practices prevailing in different countries in addition to relating it to the practice in the field in this country.

0.3 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.

1. SCOPE

1.1 This standard prescribes the requirements for silicone-based water repellents.

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

1.1.1 These water repellents can be applied to masonry generally free from cracks exceeding 0.10 mm in width, to confer water repellency without appreciable change of colour or appearance other than that imparted by fugitive dye.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

2.1 Silicones — A material which contains silicone-oxygen-silicone links and also hydrocarbon groups attached directly to the silicone.

2.2 Silicone Formulation — A silicone solution in a volatile solvent or an aqueous emulsion, the non-volatile content of both consisting mainly of silicones.

2.3 Aqueous Siliconate Solution — An aqueous solution of an alkali metal salt of silicone, the non-volatile content of which consists mainly of silicone.

3. CLASSIFICATION

3.1 Silicone repellents may be classified in three categories based on their performance test (*see* Notes 1 and 2) as mentioned in **3.1.1**, **3.1.2** and **3.1.3**

NOTE 1 — Some silicone repellent may meet the test requirements of both Class A and Class B materials and may be marked accordingly

NOTE 2 — Where the type of surface to be treated cannot be identified Class B repellent should be used.

3.1.1 Class A — Silicone formulations for clay brickwork, hydraulic cement-based materials, and natural and cast stone masonry of a predominantly siliceous nature.

3.1.2 Class B — Silicone formulations for natural and cast stone masonry of a predominantly calcareous nature and calcium silicate brick-work.

3.1.3 Class C — Aqueous siliconate solution for natural and cast stone masonry of a predominantly calcareous nature.

4. CONSISTENCY

4.1 The water repellent shall be of such consistency that it can be readily applicable to masonry by brushing or spraying. When

applied, it shall not substantially change the dry appearance of the treated surface from that of the untreated surface, apart from the effect of any fugitive dye.

5. PERFORMANCE REQUIREMENTS

5.1 Silicone based water repellents shall comply with the test requirements specified in 5.2 to 5.6. The tests shall be carried out on the appropriate substrates specified in Appendix A. Samples for testing shall be taken in accordance with 6.

5.2 Early Water Repellency — When the water repellent has been applied as described in Appendix B and the test described in Appendix C has been carried out, the water repellency shall be such that no pool of water shall be completely absorbed within 10 minutes.

5.3 Absorption of Water — The relative absorption of water through treated and untreated faces when determined by the method described in Appendix D shall not be more than 10 percent for any one of three test specimens.

5.4 Evaporation of Water — The evaporation ratio of water as determined in Appendix E shall be not less than 10 percent.

5.5 Durability

5.5.1 Class A Repellents — When the water repellent is tested as described in Appendix F, it shall meet the requirements of 5.2, 5.3 and 5.4 after a period of 12 months weathering.

5.5.2 Class B and C Repellents — When the water repellent is tested as described in Appendix G, it shall meet the requirements of 5.2, 5.3 and 5.4 after a period of 12 months weathering.

NOTE — It is intended that this test should be carried out only once on each new formulation of silicone-based water repellent. It is both unnecessary and impracticable to use the test as a routine check.

6. SAMPLING

6.1 After thorough shaking of the containers, approximately equal samples totalling not less than 600 g in weight, shall be taken at random from not less than 1 in 20 of the original and previously unopened containers. The samples shall be thoroughly mixed together and then divided into triplicate samples, each weighing not less than 200 g. These latter samples shall be placed in clean, dry, airtight containers of such size that they are nearly filled by the sample. Each

container shall be sealed and marked with full details and the date of sampling.

6.2 For Class A and B materials, solvent resistant containers shall be used. If metal containers are used, the same shall be free from lead and even lead solders shall not be used for soldering.

6.3 For Class C materials, glass, polyethylene, mild steel, stainless steel and other materials resistant to caustic soda should be used.

7. PACKING AND MARKING

7.1 Packing — The materials, if in bulk, shall be packed in steel drums. For Class A and B materials, other solvent resistant containers free from lead and lead-solder shall be used. For Class C materials, polyethylene containers shall be used.

7.1.1 The package shall be securely closed and legibly and indelibly marked with the following information:

- a) The class of repellent — Class A, B and C;
- b) Name of the manufacturer;
- c) Weight of the material in the package;
- d) Recognized trade-mark, if any;
- e) Date, month and year of manufacture;
- f) The appropriate flammability mark, if the flash-point is below 23°C;
- g) Self-life and storage requirements; and
- h) Solids contents.

7.2 The packages may also be marked with the Standard Mark.

NOTE — 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 thereunder. The Standard Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by BIS and operated by the producer. Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

APPENDIX A

(Clause 5.1)

BRICK AND STONE SAMPLES

A-1. For the purpose of carrying out the tests detailed in Appendices B to G, the minimum number of samples of brick and stone required are as follows:

- | | |
|---|---|
| a) Class A materials (Appendices C, D, E and F) | Class A bricks with water absorption not less than 15 percent conforming to IS : 1077-1976* |
| b) Class B and C materials (Appendices C, D, E and G) | Limestone slabs conforming to IS : 1128-1974† |

APPENDIX B

(Clause 5.2)

**SELECTION AND PREPARATION OF TEST SPECIMEN
FOR USE IN THE TESTS DETAILED IN
APPENDICES C, D, E, F AND G**

B-1. CLASS A REPELLENTS

B-1.1 Select 7 bricks free from cracks wider than 0.15 mm and from other imperfections on one nominal 190 × 90 mm face (the 'test face').

B-2. CLASS B AND C REPELLENTS

B-2.1 Select 7 limestone slabs each 150 mm × 150 mm × 25 mm in size with a tolerance of ± 0.5 cm on each dimension and free from cracks and imperfections on one 150 mm and 25 mm face (the 'test face'). If there is a visible continuous calcite vein in any slab the face selected for test shall be, as near as possible at right angles to such vein. The face opposite the 'test face' should be numbered so as to make the face to be treated, easily identifiable.

*Specification for common burnt clay building bricks (*third revision*).

†Specification for limestone (slab and tiles) (*first revision*).

B-3. DRYING

B-3.1 Dry the selected specimens for 72 hours at $50 \pm 2^\circ\text{C}$ in a well-ventilated oven and allow to cool to room temperature over a period of 24 hours either in the oven or on a wire rack in a dry airtight container.

For the purpose of Appendix E, 3 bricks and 3 blocks should, after drying, be set aside untreated.

B-3.2 Preparation of Test Solution — When the silicone water repellents are supplied in concentrated form, it should be diluted in the following manner:

a) *Class A and B Materials*

Test solution should be prepared by simply diluting the silicone water repellent with mineral spirit or xylene. The mineral spirit should conform to the following specifications:

- | | |
|----------------------------------|----------------------------|
| i) Minimum flash-point | 27°C |
| ii) Boiling Range | 135 to 185°C |
| iii) Minimum Kauri-butanol value | 34 |

b) *Class C Materials*

The test solution should be prepared by diluting the silicone-based water repellent with distilled water.

B-3.2.1 Concentration of Test Solution — The concentration of the test solution shall be as follows:

- | | |
|-----------------------------------|----------------------------|
| For Class A and Class B Materials | 5 ± 0.2 percent solids |
| For Class C Material | 3 ± 0.2 percent solids |

B-4. TREATMENT

B-4.1 The remaining specimens are then treated in preparation for the tests described in Appendices C, D, E, F and G. Treatment is carried out in a shallow tray approximately $350 \times 150 \times 25$ mm and the test solution is poured to a depth of approximately 10 mm.

B-4.2 The tray may be made of polyethylene which is not attached by the silicone solution; if metal containers are used, the same should be free from lead and in case of Class C material, the metal should be resistant to caustic soda solution. A layer of wire gauze or other similar separating medium, which is not attached by the silicone

solution used, should be laid on the bottom of the tray in order to avoid inadequate treatment due to contact between the specimen and the bottom of the tray.

The tray is then placed on a balance weighing accurately 0.1 g and its mass with the solution noted. Each test specimen is then placed singly, with the selected test face downwards, in the tray for 15 seconds, removed, and held with the treated face downwards for a further 10 seconds to allow draining back into the tray. It is then placed treated face uppermost and stored indoors at a temperature of $25 \pm 5^{\circ}\text{C}$. Immediately after the removal of the specimen and draining, the mass of the tray and the solution is recorded and the amount of solution absorbed by the specimen is determined by difference to the nearest 0.1 g.

The solution in the tray is made up to approximately the original depth with further water repellent before the next specimen is treated.

B-4.3 If solution pick-up of any brick is less than 4 g or of any block is less than 1 g, the specimen shall be discarded and not used in the subsequent tests. If all bricks and blocks meet these minimum pick-up requirements, then they may be used, as appropriate, in the tests.

APPENDIX C

(Clause 5.2)

METHOD OF TESTING EARLY WATER REPELLENCY

C-1. CLASS A MATERIALS

C-1.1 Use 3 treated bricks prepared according to Appendix B.

C-2. CLASS B AND C MATERIALS

C-2.1 Use 3 treated slabs prepared according to Appendix B.

C-3. PROCEDURE

C-3.1 Place the specimens, 3 days after the treatment, on a level bench with the treated faces upwards. Discharge 3 separate pools, each of 1 ml of distilled or de-ionized water, onto the test face of each specimen from a burette, the tip of which almost touches the surface. The pools shall be observed after 10 minutes, and then removed by blotting with filter paper.

APPENDIX D

(Clause 5.3)

D-1. METHOD OF MEASURING AND ABSORPTION OF WATER

D-1.1 The 3 bricks or slabs used for the test in Appendix C shall then be stored in a dry air-tight container at $27 \pm 2^\circ\text{C}$ for a further 11 days and shall then be weighed to the nearest 1 g and recorded a_1 , b_1 , and c_1 ,

D-1.2 They shall be placed, treated face downwards on a pad of absorbent cotton wool in a tray to which clean water maintained at $25 \pm 2^\circ\text{C}$ is then added so that the water level is maintained at ± 3 mm of the treated face. Care should be taken to ensure that the specimens are neither touching each other nor the sides of the tray. Water shall be added from time to time to maintain the level; covering the tray with a polythene sheet helps to cut down loss by evaporation. The specimens shall be removed 7 days later and adhering water removed by shaking and blotting quickly with a suitable filter paper. The specimens shall be weighed again, each to the nearest 1 g and recorded a_2 , b_2 and c_2 .

D-1.3 The specimens shall then be inverted and placed in the tray with the treated face uppermost for 72 hours and after removing all adhering water in the manner described above, the weight again be recorded to the nearest 1 g as a_3 , b_3 and c_3 .

D-1.4 The relative absorption (in percent) shall be calculated according to the formulae:

$$\frac{a_2 - a_1}{a_3 - a_1} \times 100; \quad \frac{b_2 - b_1}{b_3 - b_1} \times 100 \quad \text{and} \quad \frac{c_2 - c_1}{c_3 - c_1} \times 100$$

D-1.5 If one or more of the specimens fails to meet the requirements of 5.3, the test shall be repeated on three fresh specimens. Should any one of these new specimens fail to comply with the requirements of 5.3, the consignment shall be deemed to have failed.

APPENDIX E

(Clause 5.4)

METHOD OF MEASURING EVAPORATION OF WATER THROUGH SURFACES

E-1. CLASS A MATERIAL

E-1.1 After carrying out the tests detailed in Appendices C and D, the

three treated bricks shall be dried at $50 \pm 2^\circ\text{C}$ for 72 hours in a well-ventilated oven and allowed to cool to room temperature over a 24 hour period either in the oven or on a wire rack in a dry air-tight container. These, together with the 3 untreated bricks, shall be used for the test.

E-2. CLASS B AND C MATERIALS

E-2.1 After carrying out the tests detailed in Appendices C and D, the three treated blocks shall be dried at $50 \pm 2^\circ\text{C}$ for 72 hours in a well-ventilated oven and allowed to cool to room temperature over a 24 hour period either in the oven or on a wire rack in a dry air-tight container. These, together with the 3 untreated blocks, shall be used for the test.

E-3. PREPARATION OF SPECIMENS

E-3.1 Cut pieces of a suitable weatherproof impermeable and rigid material, for example, glass to fit all the faces of each slab or brick with the exception of the test face. Place the 6 bricks or slabs in a tray on wire gauze or other supporting medium with the test face upwards and fill the tray to a depth of 10 mm with clean water topping up as necessary to maintain the level. Remove the bricks or slabs after 72 hours and immediately seal all faces other than the test face as follows:

“Wipe away adhering water and seal plates of the rigid material onto all faces other than the test face by applying silicone sealant to the edges of each face and pressing the material into contact. Sealant should also be built up around all edges. Weigh immediately and rapidly to within 1 g and then allow the bricks and slabs to stand freely exposed with the test faces upwards in a well-ventilated room for 7 days at $27 \pm 2^\circ\text{C}$ Re-weigh.”

E-4. DETERMINATION OF RESULTS

E-4.1 If the loss of weight from the 3 treated bricks or slabs is W_1 , W_2 and W_3 and from the untreated bricks or slabs is W_4 , W_5 and W_6 , the evaporation ratio (percent) of water shall be expressed as:

$$\frac{W_1 + W_2 + W_3}{W_4 + W_5 + W_6} \times 100$$

A P P E N D I X F

(Clause 5.5.1)

F-1. DURABILITY TEST (CLASS A REPELLENTS)

F-1.1 Taking the 6 bricks used for carrying out the test in Appendix E, cut away the rigid material from one of the nominal 190 mm × 90 mm faces of each brick. Ensure that there is a drip formed from the silicone sealant around this face. Place the 6 bricks with this face downwards on a shelf of gauge or other perforated material, at least 300 mm above the ground; with the 'test face' of each brick facing south in an external and unsheltered position.

F-1.2 After a period of 12 months exposure to weathering, repeat the tests described in Appendices C, D and E.

A P P E N D I X G

(Clause 5.5.2)

G-1. DURABILITY TEST (CLASS B AND C REPELLENTS)

G-1.1 Taking the 6 slabs used for carrying out the test in Appendix E, cut away the rigid material from one of the 150 mm × 150 mm faces of each slab. Ensure that there is a drip formed from the silicon sealant around this face. Place the 6 slabs with this face downwards on a shelf of gauze or other perforated material, at least 300 mm above the ground, with the test face of each slab facing south in an external and unsheltered position.

G-1.2 After a period of 12 months exposure to weathering, repeat the tests described in Appendices C, D and E.

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