**IS 12027 (Part 2) : 202X**

***भारतीय मानक***

***Indian Standard***

**जल विकर्षक — विशिष्टि**

**भाग 2 सिलेन आधारित**

*( पहला पुनरीक्षण )*

 **Water Repellents — Specification**

**Part 2 Silane Based**

*( First Revision )*

ICS 91.120.30

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भारतीय मानक ब्यूरो

BUREAU OF INDIAN STANDARDS

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Waterproofing and Damp-proofing Sectional Committee, CED 41

FOREWORD

This Indian Standard (Part 2) (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Waterproofing and Damp-proofing Sectional Committee had been approved by the Civil Engineering Division Council.

Water repellents are substances or treatments applied to materials to prevent the penetration and absorption of water. They work by creating a hydrophobic (water-repellent) barrier on or within the material, which helps protect it from water damage, such as staining, deterioration, and the growth of mold and mildew. Water repellents are commonly used on various building materials, textiles, and other surfaces that need protection from moisture and water.

Water repellents can be categorized on the basis of their chemical composition and raw materials in five category silicone based water repellents, silane based water repellents (including silane-siloxane combinations) fluoropolymer based water repellents, acrylic based water repellents and wax based water repellents. the most commonly used water repellents are silicone based water repellents and silane based water repellents.

Silane-based water repellents work by penetrating deeply into porous materials and chemically bonding with the silanol groups on the surface to make the material hydrophobic. The hydrophobic surface efficiently repels water, minimizing absorption and preventing damage while maintaining the material's appearance.

Silane based water repellents, when applied on a siliceous surface, upon drying, makes the surface water repellent. Being molecular in nature they are able to penetrate in the micro cracks of the surfaces and stop the water ingress by simple saturation by roller brush or spray. Silane based water repellents which are primarily composed of silanes or additionally poly siloxane compounds such as polydimethyl siloxane, dimethyl dichlorosilane, trichlorosilane, tetra methyl silane etc penetrates deeply into the substrate and react with the material to form a hydrophobic barrier within the pores. Thus silane based water repellents maintain the aesthetics of the exposed brickwork, stonework, concrete, plaster and other masonry surfaces while enhancing their durability. It also helps in protecting the exposed treated surfaces by allowing them to dry quickly and from becoming black because of growth of algae and mildew.

The general life expectancy for Silane based water repellents are less for water mix in comparison of solvent mix subjected to the climatic conditions As a general guideline, silane based water repellents are best suited for porous surfaces such as masonry or concrete.

The selection of water repellents depends on a variety of factors that influence the effectiveness, suitability, and longevity of the treatment, such as surface material composition and characteristics, environmental conditions, application method, performance requirements and aesthetic considerations etc.

The standard on Silicone based Water Repellents IS 12027 was first published in 1987. In this revision, the Water Repellents has been grouped into two parts. This standard (Part 2) covers specification for Silane based Water Repellents. The other part in the series is:

Part 1 Silicone based (*under preparation*)

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

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

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 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Indian Standard*

WATER REPELLENTS – SPECIFICATION

**PART 2 SILANE BASED**

*(First Revision)*

 **1 SCOPE**

This standard specifies the requirements, testing methods, and guidelines for the use of silane based water repellents intended for use on the surface having sufficient porosity such as concrete, masonry, porous stones. This impart water repellence through penetrating deeply into porous materials and bonded chemically with the surface to form a hydrophobic barrier.

**2 REFERENCES**

The standards given below contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreement based on this standard are encouraged-to investigate the possibility of applying the most recent editions of the standard indicated below:

|  |  |
| --- | --- |
| *IS No.* | *Title* |
| IS 456 : 2000 | Plain and reinforced concrete — Code of practice (*fourth revision*) |
| IS 12027 (Part 1): 202x | Water repellents – Specification: Part 1 Silicone based (*under preparation*) |
| IS 13435 (Part 1): 2021 | Acrylic based polymer waterproofing materials — Methods of test: Part 1 Determination of solid content (*first revision*)  |
| IS 17863 (Part 3): 2022/ISO 4892-3:2016 | Plastics – Methods of exposure to laboratory light sources: Part 3 Fluorescent UV lamps |

**3 TERMINOLOGY**

For this standard, the following definitions shall apply:

**3.1 Silane Formulation**– A silane or silane-siloxane solution in a volatile solvent or an aqueous solution or emulsion, the non-volatile content of both consisting mainly of silanes or both silanes and siloxanes.

**3.2 Silanes**– A material, which contains silicon connected with alkoxy group and also organic hydrocarbon groups attached directly to the silicon atom.

**3.3 Siloxane** – A material that is a polysiloxane compound for example polydimethylsiloxane

**4 CLASSIFICATION**

Silane based water repellents broadly classified into two categories.

1. Type A **(**Water Mix); and
2. Type B (Solvent Mix).

**4.1 Type A (Water Mix)**

Type A water repellents are generally used for all types of applications where ease of use, environmental safety, and maintaining the surface’s appearance are important. They work effectively on concrete, masonry, and stone surfaces. Type A water repellent is based on silanes that are susceptible to hydrolysis or silane-siloxane emulsions that are pre-hydrolysed. They may come packaged in a carrier solvent or as an emulsion in water. In the case of silane based water repellent hydrolysis starts once diluted in water and continues to progress when applied substrate. Alcohol is released and the solution / emulsion is converted into a siloxane resin water repellent. Type A water repellent is further diluted with water just before use, in a proportion prescribed by the manufacturer.

**4.2 Type B (Solvent Mix)**

Type B water repellents are generally used for industrial, high-traffic, and exterior applications where deep penetration, high durability, and long-term protection are required. They are effective on concrete, masonry and stone exposed to severe weather conditions and heavy use. Type B water repellents are based on silanes and are supplied in 100 percent form or pre diluted in organic solvents. They can be dissolved as per the manufacturer instruction. Generally, the dilution to achieve reduction in 85 percent water absorption in 24 h. The diluted or as supplied product should be applied on the surface till full saturation or as per the manufacturers recommendation.

**5 APPLICATION**

Silane based water repellents are applied on a surface, which is clean and dry. Wet surfaces will reduce the absorption and lead to poor development of repellency on the surface.  After applying the silane solution, it may be left undisturbed for a minimum period of 24 h or till fully dried.

**6 PERFORMANCE REQUIREMENT**

Silane based water repellents shall comply with the test requirements specified in **6.1** to **6.5**. The Samples for testing shall be taken and prepared as per Annex A.

**6.1 Water Repellency**

Place the treated specimen as per Annex A on the level table with the treated face upward. Discharge three separate pools of 1 ml each of distilled or deionized water on the treated surface from a burette, the tip of which almost touches the surface. The water repellency shall be such that no pool of water shall be completely absorbed within 10 min.

**6.2 Absorption of Water**

Water absorption of test specimen prepared as per Annex A, with coating of silane based water repellent after 24 h immersion in water. The difference of mass of coated cube, before and after immersion, it shall not be more than 5 percent.

**6.3** **Evaporation of Water**

The evaporation ratio of water determined as per Annex C of IS 12027 (Part 1) shall not be less than 10 percent.

**6.4** **Ultraviolet (UV) Radiation**

When sample is expose to the ultraviolet radiation in fluorescent UV lamps as per IS 17863 (Part 3)/ISO 4892-3 for 1 000 h. The sample shall not change the colour and the treated sample shall maintain at least 80 percent of the water absorption determined as per **6.2,** after exposure to UV light for 1 000 h when tested as per **6.2.**

**6.5 Solid Content**

Total solid content in silane based water repellent shall not be less than 8 percent, when tested as per IS 13435 (Part 1).

**6.6 Durability Test**

For durability test sample shall be prepared as per **6.1, 6.2** and **6.3.** After preparation, sample shall be placed in natural weathering conditions for a duration of 12 months in unsheltered placepreferably on a shelf of gauge at least 300 mm above the ground. The sample when tested after 12 months shall achieve at least 60 percent of the performance requirements as per **6.1, 6.2** and **6.3**.

**7 PACKING AND MARKING**

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

1. The  type of repellent – Type A or Type B;
2. Name of the manufacturer;
3. Mass of the material in the package;
4. Recognized trade-mark, if any;
5. Batch number or date, month and year of manufacture;
6. The appropriate flammability mark, if the flash-point is below 23 °C;
7. Shelf-life and storage requirements; and
8. Solid content in percentage.

**7.2** The materials, if in bulk, shall be packed in steel drums or HDPE drums. For Type B water repellents, other solvent resistant containers free from lead and lead-solder shall be used.  For Type A materials, polyethylene containers may also be used.

**7.3** All material supplied either in package or bulk, shall be provided with Product Data Sheet (PDS) and Material Safety Data Sheet (MSDS) in any suitable manner so that information is legible and indelible. PDS must contain the information and instructions for effective and intended use of the product. MSDS contains information related to safety protocols while using the product, such as use of protective equipment, information about safe storage and disposal, possible health risk and intended first aid.

**7.4**The packages may also be marked with the Standard Mark.The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations made thereunder. The details of conditions under which a license for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

**ANNEX A**

(*Clauses* 6, 6.1 *and* 6.2)

**PREPARATION OF TEST SPECIMEN**

For carrying out the test, the samples of water repellent shall be sampled and prepared as follows:

**A-1**After thorough shaking of the containers, approximately equal samples totalling not less than 600 g in weight, shall be taken at random. The samples shall be thoroughly mixed together and then divided into triplicate samples, each weighing not less than 200 g. These 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.

**A-2 CONTAINER USE FOR TESTING**

**A-2.1** For Type A water repellents glass, polyethylene, mild steel, stainless steel and other material resistant to caustic soda should be used.

**A-2.2** For Type B water repellents solvent resistant containers shall be used.

**A-3** Specimen used for the testing shall be 150 mm cube of M 25 grade concrete as per IS 456.

**A-4** Dilution of test solution shall be done as per **4.1** and **4.2** or as per manufacturer’s instruction.

**A-5** Dry the specimen of concrete cube to the constant mass at 110 °C ± 2 °C so that they are free from moisture. Apply water repellent as per the manufacturer’s instruction on the dry surface by brush and spray till saturation or manufacturers instruction on coverage. Allow the specimen to dry for as per manufacturer’s instruction at room temperature.

**ANNEX B**

(*Foreword*)

**COMMITTEE COMPOSTION**

Waterproofing and Damp-proofing Sectional Committee, CED 41

| *Organization* | *Representative(s)* |
| --- | --- |
| In Personal Capacity (*A-1, CBRI Colony, Roorkee 247667*) Uttrakhand | DR SUKHDEO R. KARADE (***Chairperson*)** |
| Advanced Concrete & Construction Consultant, Faridabad | SHRI SATISH R VACHHANI |
| Aayka Waterproofers Private Limited, Gurugram | SHRI AJAYA KUMAR HARIT |
| Assess Build Chem Private Limited, Navi Mumbai | ER SAMIR SURLAKER  ER SUNNY SULAKER (*Alternate*) |
| Builders Association of India,  Mumbai | SHRI M. KARTHIKEYAN SHRI SUDIP KUMAR DUTTA (*Alternate*) |
| Cement Manufacturers Association,  New Delhi | SHRI RAJEEB KUMAR SHRI ANJAN KUMAR DEY (*Alternate* I) SHRI SHUBHO CHAKRAVARTY (*Alternate* II) |
| Central Public Works Department, New Delhi | SHRI PREM MOHAN SHRI DINESH K. UJJAINIA (*Alternate*) |
| CSIR-Central Building Research Institute, Roorkee |  DR P. C. THAPALIYAL DR R. SHIVA CHIDAMBARAM (*Alternate* I) SHRI MOHAMMAD REYAZUR RAHMAN (*Alternate* II) |
| Engineers India Limited, New Delhi | SHRI RAJESH GUJRAL MS JYOTSNA SHRIDHAR (*Alternate* I) SHRI ANISH MAHALA (*Alternate* II) |
| Fosroc Chemicals India Private Limited, Bengaluru | ER VIJAY B. KULKARNI  SHRI VAMDEV G. B (*Alternate*) |
| IWL India Limited, Mumbai | SHRI SATYA MITRA BAGGA SHRI AJAY BEHL (*Alternate* I) SHRI ARHAM SHAFIQ RAHMAN *(Alternate* II) |
| Indian Concrete Institute,  Chennai | SHRI SUPRADIP DAS SHRI VIVEK NAIK (*Alternate*) |
| Kasturi Projects Private Limited, Thane | SHRI RAJENDRA K. PAI |
| Master Builders Solutions India Private Limited, Navi Mumbai | SHRI ZAHEER ABBAS |
| National Council for Cement and Building Materials, Faridabad | SHRI P. N. OHJA SHRI SANJAY MUNDRA (*Alternate*) |
| Nina Percept Systems Pvt Ltd, Mumbai | SHRI MEHUL PARIK |
| PIDILITE Industries Limited, Mumbai | SHRI IMRAN UDDIN |
| Polygomma Industries Private Limited, Mumbai | SHRI GAUTAM VORA SHRI VINIT VORA (*Alternate*) |
| Shalimar Tar Products Limited,  New Delhi | SHRI ROHIT VARSHNEY  SHRI APURBA MALLIK (*Alternate* I) SHRI ARNAB KUMAR BHATTACHARYA (*Alternate* II) |
| Sika India Private Limited,  Mumbai | SHRI JASWANTH SOBHANA SHRI ASHISH VASHIST (*Alternate* I) SHRI SUCHARIT SARKAR (*Alternate* II) |
| Sudish’s Institute of Waterproofing and Insulation, Bangalore | SHRI SUDISH M. S. SHRI AATIF AHMED (*Alternate*) |
| BIS Directorate General | SHRI DWAIPAYAN BHADRA, SCIENTIST ‘E’/DIRECTOR AND HEAD (CIVIL ENGINEERING) [REPRESENTING DIRECTOR GENERAL (*Ex*-*Officio*)] |

*Member Secretary*

Dr Manoj Kumar Rajak

Scientist ‘E’/Director

(Civil Engineering), BIS