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APPLICATION GUIDE | TRANSMISSION & DISTRIBUTION

POWERSIL® SILICONE COATING FOR ELECTRICAL INSULATORS AND APPARATUS

CONTENTS

1 CHARACTERISTICS

POWERSIL® is Wacker Chemie AG's brand name for special silicone-based electrical insulation materials for the T&D industry. WACKER offers materials and solutions in this field that have been developed in collaboration with renowned manufacturers for more than five decades.

When severely contaminated and wet, insulators and apparatus made with porcelain, glass or epoxy resin can be prone to pollution flashovers. That is why these structures are cleaned regularly or, alternatively, covered with hydrophobic silicone pastes as a short-term solution.

Silicone high-voltage insulator coatings (HVICs) represent a durable, economical alternative.

POWERSIL® HVICs show their resistance and protection against flashovers in various types of pollution and environmental conditions (e.g., industrial, coastal, desert climates). Their long-lasting hydrophobicity and outstanding hydrophobicity transfer have been optimized over decades through continuous improvements. POWERSIL® HVICs are one-component silicone elastomer dispersions composed of polydimethylsiloxanes, a crosslinking agent, specially selected fillers and additives, and a hydrocarbon solvent with a high evaporation rate.

The curing reaction itself takes place when the material is exposed to atmospheric moisture. It begins with the formation of a skin on the surface of the layer and gradually continues inwards. Curing takes place at temperatures between 10 °C and 50 °C and is largely complete after 8 to 24 hours, depending on temperature, relative humidity and thickness. Typical material properties are listed in Table 1.

Table 1: Typical Material Characteristics for POWERSIL® HVIC

Property	Standard	POWERSIL® 567	POWERSIL® N 552	POWERSIL® N 553
Hardness	ISO 868	Shore A 45	Shore A 60	Shore A 60
Color		Light grey, transparent	White, light grey	Dark grey
Viscosity, dyn. 10 s^{-1}, 23 °C	DIN EN ISO 3219	1400 mPa s	5000 mPa s	5000 mPa s
Flash point	DIN 51755	7 °C	19 °C	19 °C
Skin-over time 23 °C/50% RH		13 min	12 min	12 min
Specific gravity (uncured)	DIN EN ISO 1183-1 A	0.81 g/cm^3	1.11 g/cm^3	1.11 g/cm^3
Specific gravity (cured)	DIN EN ISO 1183-1 A	1.10 g/cm^3	1.41 g/cm^3	1.41 g/cm^3
Solids content by weight		34%	71%	71%
Solids content by volume		25%	57%	57%
Diel. strength, 1 mm sheet	IEC 60243-1	> 28 kV/mm	> 28 kV/mm	> 28 kV/mm
Tracking resistance	IEC 60587	1 A 4.5	1 A 4.5	1 A 4.5

These figures are intended as a guide only and should not be used in preparing specifications.

2 APPLICATION GUIDELINES

2.1 Substrate Preparation

All surfaces to be coated must be clean and dry. This will help to achieve a proper adhesion of the POWERSIL® HVIC to the substrate. High-pressure water washing is an effective cleaning method to remove common contaminants, such as accumulated dust and salts. More tenacious contaminants, such as cement dust, require a dry, slightly abrasive cleaning, such as crushed walnut shells mixed with limestone powder. As a guideline for cleaning IEEE Std. 957-2005 [1] can be used.

Previously greased insulators should be prepared by removing the grease. The surface is then wiped with cloth rags and solvent (e.g., mineral spirits) to remove all grease residues.

2.2 Coating Preparation

POWERSIL® 567, POWERSIL® N 552 and POWERSIL® N 553 come ready to use. No further dilution is necessary. Nevertheless, the POWERSIL® coating should be homogenized thoroughly to ensure even spraying results. This can be done by stirring the material in the drum or by shaking or rolling the drum. Next, dispense the material into the application device or connect the device to the drum.

2.3 Spray Equipment

POWERSIL® 567, POWERSIL® N 552 and POWERSIL® N 553 coatings are dispersions in a combustible solvent. Therefore, explosion-proof devices must be used during application. The type of equipment varies in terms of cost and features. Conventional air sprayers consist of an air-pressurized material pot, which delivers fluid through a short hose to a spray gun. The low-pressure stream of sprayable materials is finely atomized via pressurized air at the gun tip. This equipment is generally less expensive but provides a limited degree of control over the spray pattern and the quality of finish. The overspray can be significant, especially under windy conditions. The capacity in the fluid pot is limited to a few liters and the pot must be carried by the operator.

Spray systems with high-pressure pumps allow for longer hose lengths. They move sprayable materials at high pressure through longer hoses to one or several spray guns. The pumps and materials are left in place while the applicator is free to move.

Spray guns come in airless or air-assisted airless models. Airless guns rely solely on the force of the pressurized fluid that flows through a specially designed spraying head to atomize the fluid. Airless guns allow the operator to control the pattern by exchanging the interchangeable tip. Air-assisted models allow the user to adjust the air intake at the head and control the spray pattern more effectively as a result.

2.4 Application Techniques

Attention:

Coating is to be applied on de-energized and grounded equipment or lines only!

All surfaces shall be clean and dry prior to the coating application. Experience shows that a relative humidity above 40% during the coating application is required to achieve proper bonding of the coating to the substrate. POWERSIL® coatings are sprayed in much the same manner as other coatings. Flat, wide spray jets are good for open, accessible surfaces such as the top sides of insulator sheds. Surfaces that are less accessible can be coated more readily with a smaller, circular jet to confine the material to a smaller area. Individual coating thickness may vary from 0.20 mm to 0.25 mm depending on the equipment type and environmental conditions. Two layers of coating are typically required to reach the recommended film thickness. The coating surface must be tack-free before applying a subsequent coat; otherwise, flow will occur, giving rise to drips and runs.

2.5 Safety and Handling

POWERSIL® HVICs are dispersions in a combustible solvent, and therefore explosion-proof equipment has to be used during application. Sparks and open flame should be strictly avoided in the presence of POWERSIL® coatings!

The minimum protective equipment consists of safety glasses or goggles and gloves. An organic vapor respirator is recommended if no exhaust system is available. Comprehensive instructions are given in the corresponding safety data sheets, which are available on the WACKER website. With proper precautions, POWERSIL® HVICs can be safely and efficiently applied both in the workshop and in the field.

2.6 Quality Control after Application

Adhesion to the substrate is of paramount importance for the service behavior of the coating. Full adhesion may take up to two weeks after application and should not be tested before that point. Adhesion can be evaluated according to ISO 2409 [2] using the cross-cut-test with adaptions described in ISO 16276-2 [3] for a coating thickness above 0.25 mm.
The typical average thickness suggested is 0.4 mm to 0.5 mm. The coating thickness will show certain deviations due to spray application. There are two nondestructive tests that can be performed on RTV coatings to verify thickness:

Wet-film gauge: Wet-film gauges give a reading of the applied thickness. To determine the dry-film thickness, subtract the percentage of solvent. For example, 0.60 mm of wet POWERSIL® N 553 coating would provide a cured layer of approximately 0.34 mm.

Ultrasonic thickness gauge: Ultrasonic thickness gauges will read the thickness of the cured silicone coating on the substrate. These gauges must be calibrated and checked prior to use. See IEC TS 62073 [4] for checking surface hydrophobicity.

Additional information on tests and methods to assess RTV coating quality and further application guidelines can be found in Cigre TB 837 [5].

3 RECOATING

As soon as the coating has seriously deteriorated, the coated device should be recoated with a fresh POWERSIL® coating. Make sure that the existing loose coating and pollution layers are properly removed. Adhering contaminants need to be removed as well. Cleaning and drying surfaces before applying the new coating are recommended. Please note: not all of the old coating needs to be removed if it adheres to the surface and has been cleaned. The fresh coating will adhere to an existing clean, well-adhering coating.

References

[1] IEEE Std. 957-2005: IEEE Guide for Cleaning Insulators, 2nd Edition, November 2005
[2] ISO 2409, 2020: Paints and varnishes – Cross-cut test
[3] ISO16276-2. 2007: Corrosion protection of steel structures by protective paint systems – Assessment of, and acceptance criteria for, the adhesion/cohesion (fracture strength) of a coating – Part 2: Cross-cut testing and X-cut testing
[4] IEC TS 62073: Guidance on the measurement of hydrophobicity of insulator surfaces, 2nd Edition, November 2016
[5] CIGRE TB 837: Coating for improvement of electrical performance of outdoor insulators under pollution conditions, WG B2.69, June 2021

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