



Si-COAT® RTV Silicone
High Voltage Insulator Coating



Si-COAT RTV Silicone High Voltage Insulator Coating Solves your most difficult insulation challenges



Power outages due to polluted insulators that flashover are an expensive problem; power supply reliability is reduced, industry suffers production downtime, and the costs to repair flashover damage is very high. Maintaining the cleanliness of insulators through repeated maintenance is also a costly exercise.



Insulator flashover results from contamination that settles on the insulator surface. When combined with environmental moisture, leakage current develops, which can lead to flashover. Older methods to prevent flashover such as frequent water washing or greasing are time consuming. Instead, coat your insulators with maintenance-free Si-COAT RTV Silicone High Voltage Insulator Coating (HVIC); the coating that has proven itself to give the best extended-term flashover protection, even in the most adverse of conditions.

THE LEADING EDGE TECHNOLOGY OF Si-COAT YIELDS UNSURPASSED POWER SYSTEM RELIABILITY AND ECONOMICS

Through their ground-breaking, patented and patent-pending technology, the engineers and scientists of CSL Silicones Inc. bring you Si-COAT HVIC. With this advanced product, immediate benefits and economics previously unheard of in the electric power industry are realized.

Beyond superior performance, Si-COAT was designed for a greatly extended service life and reduced system maintenance requirements. The polymers used as the backbone for Si-COAT HVIC coatings were specifically engineered and crafted by CSL's chemists for service in high voltage and high pollution environments. Additionally, the coating is almost entirely unaffected by UV light, aggressive weathering and acid rain.

**THE LONG SERVICE LIFE OF Si-COAT HVIC HAS BEEN
CONCLUSIVELY DEMONSTRATED ON MILLIONS OF
INSULATORS INSTALLED ACROSS THE GLOBE SINCE 1987**



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Prevents Leakage Current Leading to Flashovers

A major cause for concern for the power industry is pollution-related leakage current. This nuisance can lead to transmission inefficiencies and unplanned outages. This costs utilities around the world heavily – both financially and in terms of credibility. The ramifications are far reaching, right down to the erosion of a country's economic and political health.

The engineering behind Si-COAT HVIC starts with a proprietary technique of siloxane polymerization. Apart from the polymer, contributing to the high performance of Si-COAT HVIC is the optimized grain size of metal hydrate.

The 13-micron metal hydrate particle employed in Si-COAT HVIC balances the need for maximized metal hydrate surface area with the need for a free flow of essential low molecular weight siloxane (LMWS) to the coating's surface. The discovery by CSL of this optimum grain size is the basis for Si-COAT HVIC's patent.

The tangible benefit realized by the user of Si-COAT HVIC is a near complete elimination of leakage current and increased system reliability. This directly impacts the utility's finances, as more power is available for sale. As well, because the repetitive practice of water washing or greasing of insulators is eliminated, maintenance expenses are reduced.

Maintenance-Free, Unbeaten Performance

Si-COAT HVIC has been aggressively tested by the IEEE, the US Department of Energy and other leading authorities and laboratories around the world. With its flawless track record, Si-COAT is the most trusted technology in solving insulator contamination issues today.

Time and again, Si-COAT has set the benchmark in the field of RTV insulator coatings, establishing performance standards that cannot even be attained by non-ceramic (composite) insulators or the 'latest generation' and 'PLUS' versions of coatings put out by competitors.

Installations in service for over 25 years continue their outstanding performance, saving the end-user maintenance expenses and reliability concerns. According to one European utility, the cost to apply Si-COAT in their switchyards is recovered within a year due to the savings from eliminating water washing and the avoidance of expenses related to outages.

By virtue of its ability to nearly eliminate all leakage current, Si-COAT has achieved remarkable results in very harsh conditions around the world. Consultation by CSL Silicones Inc. has helped utilities from far corners all over the world recover losses in ways no other insulating technology can.

An investment in Si-COAT HVIC as a critical system component, when worked out in case-by-case detail, invariably presents an exceptionally attractive return on investment (ROI) and payback period.

PREVENT AND ELIMINATE THE EXPENSE OF INSULATOR FLASHOVERS WITH Si-COAT HVIC

"ALSTOM Transmission and Distribution has carried out a new Transmission System under Phase IV Project in Qatar during 1996-98. The system consists of 220 kV and 132 kV totalling 300km network.

Overhead line insulators are SEDIVER toughened glass and one third are coated with CSL Silicones Inc.'s Si-COAT 570 RTV silicone product. This coating was selected for its long-term sustainable hydrophobicity.

On this project, Si-COAT 570 has now been working in the coastal salt fog, heavy industrial and urban pollution since early 1996 without wash maintenance work."

ALSTOM T&D, Paris, France



The Science of Si-COAT HVIC

How it works

Si-COAT HVIC performs by virtue of the low molecular weight siloxane (LMWS) that naturally migrates from within the body of the coating to its surface. Because of its low surface free energy, the LMWS builds up on the coating's surface to a maximum one molecule thick layer, also known as the 'monolayer'. As contaminants come to rest on the monolayer of LMWS, the LMWS quickly encapsulates the contaminant particle. This phenomenon is again a result of the LMWS' very low surface free energy. A second feature of the LMWS is its very high dielectric strength. The encapsulated contaminant particle is effectively physically and electrically isolated from moisture (i.e. rain, fog or dew). Thus, the continuous path required for leakage current flow is broken.

The Cause and Effect of Leakage Current

Pollution from various sources (industrial, salt fog, fertilizer dust, etc.) contaminates the insulator surface.

The pollution combined with environmental moisture (rain, fog, dew, etc.) creates an electrically conductive film on the insulator surface.

The electrolytic film of water on the insulator's surface promotes leakage current.

An insulator experiencing leakage current is prone to reduced reliability and requires regular maintenance.

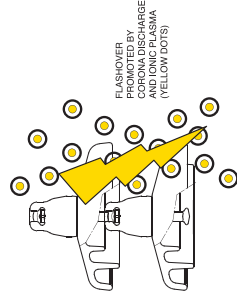
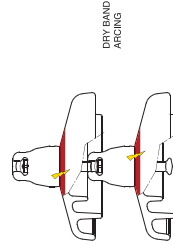
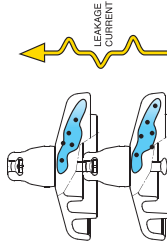
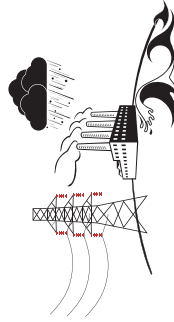
Leakage current also represents a loss of electric power, which is a financial loss.

Leakage current flowing across areas of lower diameter generates heat due to the higher current density in this area. Greater heat promotes the development of a 'dry band'.

Because the dry band creates a disruption in the voltage profile across the insulator, small surface discharges arise. This phenomenon is known as "dry band arcing".

Excessive dry band arcing leads to corona discharge. Effectively, an ionic gaseous plasma is created, which surrounds the insulator. The plasma is electrically conductive.

The development of such plasma is the final step to catastrophic failure in the form of a flashover.



How Si-COAT HVIC Prevents Leakage Current

Coating the insulator with Si-COAT HVIC eliminates leakage current. The coating (grey) secretes a monolayer of LMWS (green). LMWS can be thought of as an oil.

LMWS: very low surface energy + very high dielectric strength.

As contamination particles (black) come to rest on the surface of the coating, they come in direct contact with the microscopic LMWS.

Within a few minutes the contamination particles become microencapsulated by the LMWS.

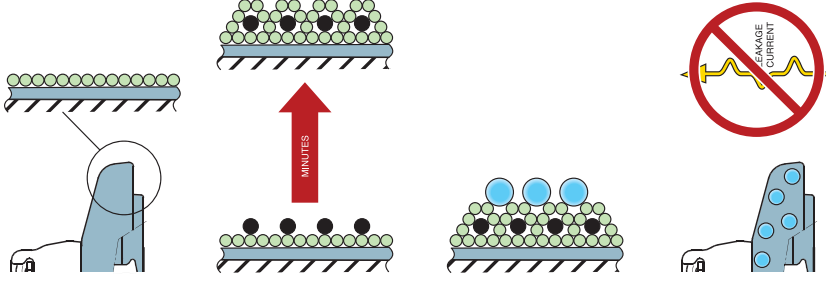
This is possible due to the very low surface energy characteristic of the LMWS.

Water (blue) that may collect on the surface is physically and electrically isolated from the contamination particles. Electrical isolation is by virtue of the very high dielectric strength of the LMWS.

Further, the water forms in discrete droplets due to the very low surface energy of the LMWS. This is known as hydrophobicity. The elimination of water filming further discourages leakage current.

The phenomenon described above provides very long term protection. The long service life of Si-COAT has been conclusively demonstrated on millions of insulators installed across the globe since 1987.

Si-COAT affords such long term reliability due to its rich and dense reserves of LMWS. Further, the unique and patented formula ensures LMWS migration to the coating surface remains unimpeded.



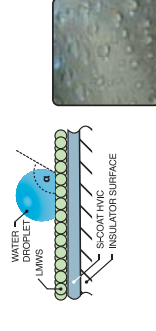
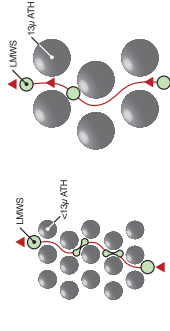
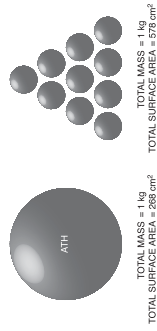
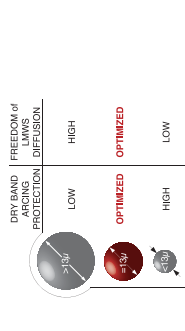
The Science of Si-COAT HVIC

The Optimum Formulation

Silicones intended for high voltage service must contain a critical ingredient named "ATH". Some low-quality products exclude the ATH and replace it with very inexpensive quartz fillers. While quartz-filled product is promoted as the latest generation of technology, do not be fooled. ATH is essential. The Si-COAT HVIC patent is based on the discovery that the optimum size of ATH is 13-microns.

The purpose of the ATH is to protect the silicone in case surface discharges should occur under adverse conditions. Without ATH, the silicone may burn.

Protection is provided by the surface of the ATH particle. On a per unit mass basis, the surface area of ATH is increased by making the particles smaller in size.



An insulator freshly coated with Si-COAT HVIC demonstrates excellent hydrophobicity.

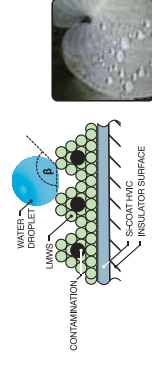
The degree of hydrophobicity is measured by the contact angle formed between a water droplet and the coating surface.

In the case of fresh Si-COAT, $\alpha = 120^\circ$ on average.

Unsurpassed Performance Phenomena

In most cases, Si-COAT achieves ultra-hydrophobicity, which is an extreme contact angle greater than 150° .

The abundance of LMWS in Si-COAT combined with contamination particles creates a hydrophobic microtexture on the surface of the coating. Science has named this phenomenon the "Lotus Leaf Effect". As on a lotus leaf, water simply rolls away and vanishes.



Because Si-COAT HVIC develops ultra-hydrophobicity the coating has a tendency to remain dry by quickly shedding off water.

An insulator that remains dry is an insulator that remains at its highest insulating performance.

Si-COAT HVIC is suitable for use on overhead transmission & distributions lines and in substations.

Si-COAT is also suitable for use at all voltage levels including the latest UHV projects.



THE BENEFITS of Si-COAT HVIC

Si-COAT eliminates the need for repetitive maintenance of contaminated insulators with directly measurable benefits:

- Reduced maintenance expenses
- Increased system reliability and efficiency
- Increased revenue potential
- Reduced environmental impact

In fact, in almost all cases, maintenance washing of insulators coated with Si-COAT is discouraged as this prematurely depletes the LMWS.

Trust the science inside Si-COAT HVIC to solve your most difficult insulation challenges.



Si-COAT RTV Silicone High Voltage Insulator Coating

General Product Information

"We were in serious trouble by the reason of clinker and cement particles sticking on the surfaces of insulators until meeting with CSL Silicones. Such that, every year at least once a year, all insulators at the substation were washed.

Sometimes, electricity was becoming cut off because some insulators were cracked. Leakage current (flashover) was occurring during rainy days.

We have been without any maintenance outages, and no maintenance works have been required for insulator cleaning. No leakage current has evolved after silicone application. Thanks, to CSL Silicones.

After application of the silicone covering, no action is needed for cleaning.

Energy interruptions sourced by earth leakage faults in substation and consequent production losses will be minimized with this application."

ADANA CEMENT, Adana, Turkey

The patented formulation of Si-COAT HVIC sets the benchmark against which all other solutions are measured. In environments of insulator contamination, Si-COAT regularly outperforms uncoated porcelain or glass insulators, composite (polymeric) insulators, and all other insulator coatings. Si-COAT HVIC applies very smoothly and easily compared to competitive coatings. This translates into a material saving and superior performance characteristics.

The electrical characteristics of the cured coating are significantly better than those of other insulator coatings. No other coating passes independent third party testing with the results achieved by Si-COAT HVIC. In fact, other coating manufacturers will not even subject their products to some of the tests performed on Si-COAT HVIC.

The coating is not affected by UV light, corona discharge, soluble and non-soluble contaminants, airborne chemicals, salt, extreme temperatures or corrosive environments.

Thus, Si-COAT HVIC is suitable for use in almost any service environment.

Unlike the silicones used in composite (polymeric) insulators, no heat is required to cure Si-COAT HVIC. This means the free fluid (LMWS) in the coating is not subject to further reactions during the curing process. Thus, more free fluid is available under actual field service, which dramatically enhances coating performance.

Take advantage of the benefits of Si-COAT HVIC on your next project. You'll come to see that long-term, maintenance-free power supply reliability is a reality.

Si-COAT (570) HVIC – Product Overview

Si-COAT (570) HVIC is a one-part, room temperature vulcanizing (RTV) polysiloxane (silicone) coating. Its unique and patented formulation provides a highly hydrophobic surface for its entire life, which virtually eliminates leakage current on high voltage insulators.

Si-COAT (570hs) HVIC – Product Overview

Si-COAT (570hs) HVIC is much the same as normal Si-COAT (570) HVIC. However, 570hs is formulated with reduced quantities of solvent, which yields a high solids formulation. The high solids content of the material not only reduces the time required to build the desired film thickness, but it also exceeds VOC requirements of most jurisdictions.

The coating is optimized for high volume production in enclosed environments such as inside insulator manufacturing sites or inside mass production insulator coating workshops

"In relation to the application of the product Si-COAT 570 HVIC (High Voltage Insulator Coating), we are completely satisfied after the 1996 application of this product in our substations.

The product had been applied in several electrical substations of distribution in which it was necessary to wash or maintain with a frequency of two times per year in the most unfavorable situation.

After the application of Si-COAT 570 HVIC, it has not been necessary to carry out any wash or maintenance jobs of the insulators since."

ENDESA DISTRIBUCION ELECTRICA,
Seville, Spain



Si-COAT RTV Silicone High Voltage Insulator Coating

A Proven Success



"Our plant supplies the equivalent amount of electricity that a city the size of Seattle uses, and it is a complex task to bring a reactor back on line after an unexpected trip. Our plant is a very important power supplier in our region, and is directly connected to the US Department of Energy 500kV grid.

...because my problem was big, the pressure was on me to do something to prevent future flashovers. The Nuclear Regulatory Commission monitors our performance, and saw these reactor trips as detrimental challenges to our reactor shut down systems. A permanent solution was required. The method of utilizing a coating was selected. The story about how Si-COAT 570 HVIC rose above its competitors during testing is history. We applied it at the next opportunity and have not had a flashover since 1992."

ENERGY NORTHWEST, Columbia Nuclear Generating Station, Washington, USA

"Hydro One Networks Inc. installed Si-COAT RTV Silicone High Voltage Insulator Coating (HVIC) at its Hamilton Beach Transfer Station (TS) in January 1994 to all bushings. Prior to 1994 the station was experiencing flashovers many times a year, which required power washing of the bushings multiple times annually.

Since installation of the Si-COAT HVIC at Hamilton Beach, there has not been a single flashover on the coated bushings, no re-coating has been conducted since then. In the interest of precaution by Hydro One, the coated insulators were power washed once annually only. Feedback from the manufacturer, however, says that power washing of the coating is not necessary.

The Si-COAT HVIC product has given flawless performance."

HYDRO ONE NETWORKS INC., Ontario, Canada

"Just a short note to let you know that the Basslink outage was very successful. I was particularly impressed with the Si-COAT work that was completed on the DC insulators. The coating is very impressive, the product seems to be very effective."

NATIONAL GRID AUSTRALIA PTY LTD., Melbourne, Australia



CSL Silicones Inc.
144 Woodlawn Rd. W.
Guelph, ON, Canada N1H 1B5
+1 519.836.9044
+1 800.265.2753

www.cslsilicones.com

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