Evaluation of ***VoltShield*** Insulator Surface Treatment on third rail insulators (type BR 120 & BR 140)

Introduction

VoltShield is a surface treatment designed to work with porcelain insulators to enhance their surface electrical performance under polluted conditions. Tests have shown that by chemically bonding with the glazed surface of standard porcelain insulators, ***VoltShield*** modifies the surface properties of these insulators leading to marked improvements in surface electrical performance under wet, polluted conditions. The most significant benefit of using ***VoltShield*** is that the performance of tried and trusted porcelain insulators can be improved further using ***VoltShield*** in wet highly polluted conditions.

VoltShield is applied to the surface as a liquid and quickly bonds to glazed porcelain insulator surface whilst at the same time polymerising to form a continuous surface treatment. This modified surface is highly hydrophobic - i.e. rapidly sheds water from its surface in a similar way to that observed when water is poured over a highly waxed paint finish. This highly hydrophobic surface prevents water films forming on the surface of treated insulators and moreover helps to prevent the build up of contamination on the surface of the insulator under wet polluted conditions. This results in a reduction in surface leakage currents across the surface of insulators treated with ***VoltShield*** - inevitably reducing the likelihood of insulator flash-over failures under wet, polluted conditions.

In order to determine the Electrical tests on third rail insulators type BR 120 & BR 140 were performed at the HVL Tamworth, High Voltage Laboratory under standard IEC 60060 wet test conditions on both New and ***VoltShield*** treated insulators. (HVL Test Report Ref: HV 381)

Description of Test

Insulators were tested individually, free standing in an earthed metal tray container sitting in a water bath of depth 13mm to represent the earthed metal clamp arrangement.

A high voltage terminal from the test voltage supply was attached to the terminal lug ear of the live metal part of the insulator by means of a crocodile clip. (see fig 1 below)

Using a standard rain spray nozzle arrangement, artificial rain of known characteristic was used to wet the surface of the insulator under test (as prescribed in IEC 60060) for the prescribed period prior to application of the power frequency voltage.

The power frequency test voltage was applied to each insulator under test, in turn, and raised steadily until flashover occurred. The relative flashover voltages were measured and recorded

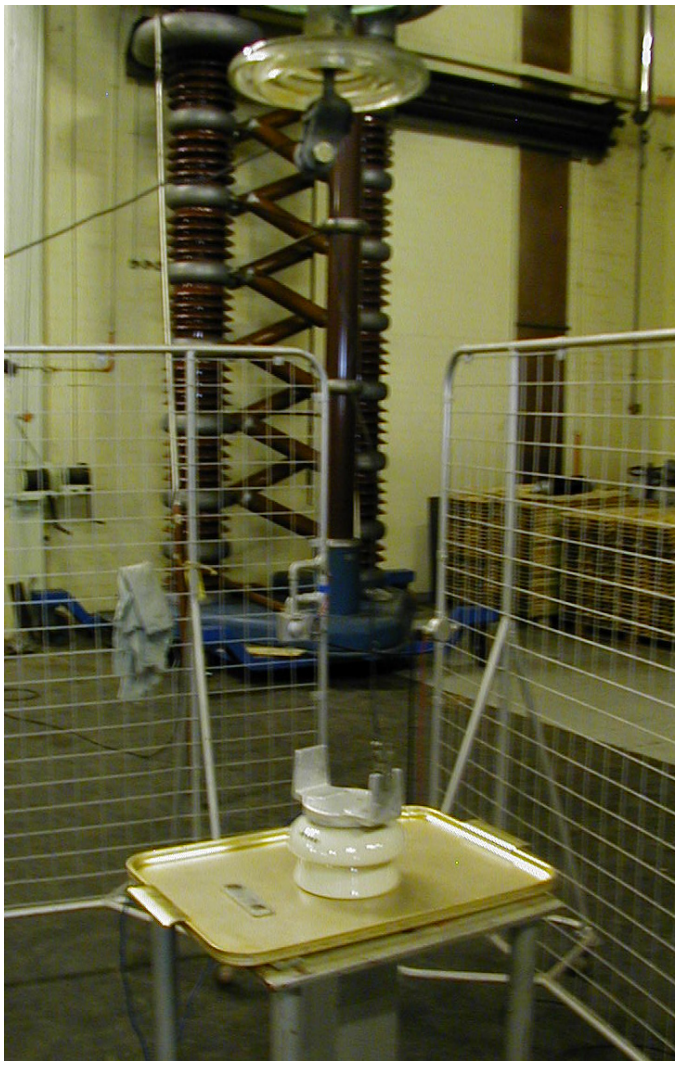

Figure 1 Test Set-up

Results

Water was dispersed from the ***VoltShield*** treated insulators in a markedly different manner than those insulators that were untreated. A greater mobility of the deposited water droplets was also observed due to the hydrophobic action of the ***VoltShield*** treatment. When the test voltage was applied, the ***VoltShield*** treated insulators also exhibited less visual corona activity prior to flashover.

The lower corona activity on the ***VoltShield*** treated insulators under wet conditions occurs because the discrete water droplets which form on the surface of these treated insulators reduces the likelihood of the formation of a continuous film of water across the surface of the insulator to earth. By contrast, the untreated insulators, showing a marked lack of discrete water droplets on their surface, demonstrated by significantly greater electrical corona activity due to its hydrophilic surface tendency. *(see photographs in figs 2 and 3 below))*

Figure 3 Un-treated Insulator

Analysis

The table below sumarises the results of a number of flashover tests carried out on two third rail insulator types (BR120 and BR140) which were both untreated and treated with ***VoltShield.*** The data within this table clearly shows that the addition of ***VoltShield*** to the insulator significantly enhances the insulators wet power frequency flashover performance. ***i.e. increased by 9% in the case of the BR120 insulator and by as much as 18% in the case of the larger BR140 insulator.***

Test Data

VoltShield treated insulator demonstration - Wet test to IEC 60060											
							Flashover kV				
	Sample type	**1**	**2**	**3**	**4**	**5**	**Mean**		**Mean of mean**		**Ratio**
Untreated	**BR120 std**	27	26	25	25	27	26				
Untreated	Repeat	29	25	25	27	26	26.4		26.2		
Treated	Sample 1	30	31	30	29	32	30.4				
Treated	Sample 2	26	29	28	29	31	28.6		28.47		1.09
Treated	Sample 3	27	25	24	28	28	26.4				
Untreated	**BR 140 std**	28	29	29	30	30	29.2		29.2		
Treated	Sample 1	34	33	38	37	40	36.4				
Treated	Sample 2	35	30	33	38	38	34.8		34.47		1.18
Treated	Sample 3	32	29	30	36	34	32.2				

Data	Precipitation @ 3.10mm/min
	Conductivity 980
	P=758.8mmHg
	Dry temp 21 deg C

Additional demonstration and observation

A slurry mixture of the pollutant base mixture used in the IEC solid layer pollution test (method according to IEC 60507) was used to demonstrate the effective nature of the ***VoltShield*** treatment in defending against the pollution build up on the surface.

A) Kiesulghur mixed to the prescribed normal mix was poured over the treated surface and it was observed that none of the mixture adhered to the surface of the insulator.

B) Kiesulghur at 400% strength c.f. 100% normal mix was poured over the treated surface and it was observed that none of the mixture adhered to the surface of the insulator.

Conclusions

- **The addition of *VoltShield* significantly enhances insulator performance in wet / polluted conditions**

- **Enhanced insulator performance resulting from the use of *VoltShield* in wet / polluted conditions is likely to lead to:**
  - Reduced wet flash-over failures in service
  - A reduction in damage caused by sustained leakage currents
  - Reducing in the build-up of surface pollution on insulators so potentially increasing insulator service life