Dust Cycle Test - An Advanced Contamination Test Method

Current contamination test methods

Withstand voltage characteristics of contaminated insulators have been evaluated by clean fog and salt fog methods prescribed in IEC60507, as standard test methods, which have been applied widely for the purpose of commercial test as well as experimental study. By the way, these test method are very effectively for contamination mainly containing sea salt, but it is very difficult to make evaluation of insulators having cumulative contamination derived from such as fine sand in desert area and industrial contaminants. Recent year, DCM has been proposed as a new test method, which seems effective to study the insulator behavior in such cumulative contamination area [1].

Dust cycle test

Seven years ago, a new approach named “Dust Cycle Method (DCM)” was proposed by STRI. The specimen insulators are subjected initially to a chamber with dry environment as shown in Fig. 1, and test is making in accordance with test sequence shown in Fig.2. The components of dust, quantity of fog/rain and drying in the sequence are able to vary according to the actual environmental conditions.

An example of test results simulated industrial contamination

Industrial contamination of insulators generally occurs under dry and breeze conditions with occasional wetting due to fog and rain. Table 1 shows contamination degree after 1, 2 and 4 cycles of tests. Contamination degree of SDD of the outer rib type insulator was about 10% of that on the fog type insulator. This result is in good interrelation with exposure test results at Shanghai in China.

Fig. 1 Inside of Test chamber of DCM equipment

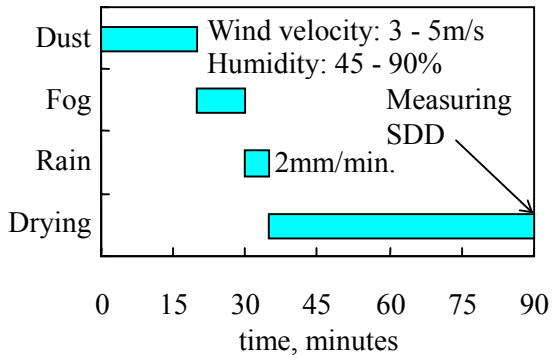
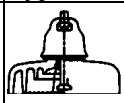
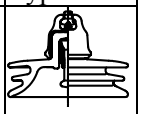


Fig. 2 Test sequence of single cycle

Table 1 Ratio of SDD(Bottom, Fog=100)

Specimens / Test condition		Normal type	Fog type	Outer-rib type
				
DCM	1cycle	37	100	10
	2cycles	72	100	11
	4cycles	156	100	12
1 year exposure at Shanghai, CHINA		-	100	10-20

Reference

[1] "Natural and Artificial Ageing and Pollution Testing of Polymeric Insulators", CIGRE TF 33.04.07, June 1999.

By NGK High Voltage Laboratory
NGK INSULATORS, LTD.
1155 Tagami, Futaebori, Komaki 485-8566, Japan.
Tel:+81-568-72-3127, Fax:+81-568-72-3932
http://www.ngk.co.jp

Thermal Deterioration Diagnosis by Optical Fiber Sensors for Induction Motors

A novel non-destructive optical diagnosis for insulating resins of induction motors has been developed. The key feature of this diagnosis is the use of light sources of two wavelengths to measure the change in reflective absorbance (ΔA_R) between the two wavelengths which decreases the effect of coil surface roughness. Then, chemical kinetics is used to predict the lifetimes of the insulating resins. When resins darken with age, the ΔA_R increases. This means that the cross-linking density in the insulating resin increases due to thermal oxidation, so that conjugation in the resin expands, and the electronic transition absorption (equivalent to reflective absorbance A_R) increases. When the cross-linking density of a resin increases, its elasticity corresponding to the material's life increases, resulting in cracks produced by vibration or heat cycling. This diagnosis detects the extent of aging of an insulating resin as a chemical structure change, non-destructively, before any cracks are formed.

Figure 1 shows the developed diagnostic apparatus. The optical sensor consists of two optical fiber cables (one for light transmission, the other for light reception; each with a length of about 3 m and core diameter of 1 mm), two kinds of near IR laser diodes (LD) as light sources, and an optical power meter (Si-photodiode) as a detector, and so it is very compact and lightweight (less than 2 kg). The optical fiber cables have a bundle structure (diameter of elemental glass fiber is 50 μm), like an image fiberscope, so very little fluctuation of transmission loss is observed when they are bent. The two wavelengths should be chosen from 600nm to 900nm according to the spectroscopic characterization of an insulating resin. In these wavelengths, there are several commercialized LDs, for example, 635, 650, 670, 780, 830 nm-LD.

As this apparatus can be operated using batteries, it is suitable for diagnosing electric equipment, such as induction motors in the field.

By Dr. Y. Takezawa
Hitachi Research Laboratory, Hitachi, Ltd.
7-1-1 Omika-cho, Hitachi-shi, Ibaraki, 319-1292 Japan.
Tel:+81-294-52-7548, Fax:+81-294-52-7632
E-mail:ytakeza@hrl.hitachi.co.jp

Fig. 1. Developed diagnostic apparatus.

Fig. 2. The optical probe on the coil surface of an induction motor

The introduction of Multi Range Plug-in Cable Sealing End

The overview

It developed as the underground distribution cable sealing end part which is used for Um=36kV voltage class gas insulated equipment (i.e. Switch gears, switches and transformer) in 1999.
Connection work at the site is very easy. Because it is plug-in type sealing end.
Moreover the bushing is designed to fit with various size of cable.

The good point of the cable sealing end part

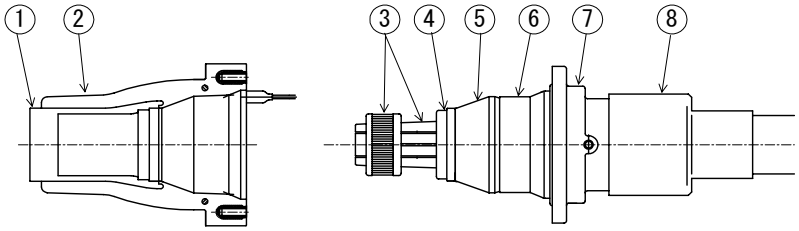
The main good points of the cable sealing end part are as follows.

1) It is the plug-in connection structure, which separates the bushing parts of equipment and the cable sealing end parts.
2) Connection work is completed in the site when connection material is included into the cable and inserted into the bushing.
3) The insulation material of bushing is excellent epoxy resin in the electric character and the mechanical character.
4) This bushing is able to insert the XLPE cable of the various size (Um=24～36kV,Conductor cross section=70～630mm^2).
5) To improve the free degree of the arrangement, flange shape of bushings is designed to 144mm square
6) This bushing parts have two designs for choice, “With test point” and “Without test point”.
7) The small bushing of the exclusive using for the voltage tap is prepared.

The performance

Maximum operating voltage	Um=36kV
Nominal current	1250A
Applicable cable conductor size	Um=24～36kV Conductor cross section:70-630mm^2
Power frequency withstand voltage	81kV･5min
Partial discharge extinction voltage	Not more than 10pC at 30kV Not more than 20pC at 36kV
Impulse withstand voltage	±170kV for 10times
Direct current withstand voltage	－108kV for 30minutes

The structure of the cable sealing end



Bushing parts
①Conductor
②Epoxy resin
Sealing end parts
③Plug unit
④Stopper ring
⑤Pre-molded stress relief cone
⑥Compression unit
⑦Protecting cover
⑧Heat shrinkable tube

←The appearance whole aspect of Cable sealing end

← Bushing parts for Cable sealing end

→ Bushing parts for Voltage tap termination

SHOWA ELECTRIC WIRE
& CABLE CO., LTD.
Address
1-1, Minami-Hasimoto 4-chome,
Sagamihara, Kanagawa
229-1133, JAPAN
PHONE: +81(42) 774-0046
FACSIMILE: +81(42)773-6537