Compact type transmission line arrester
- An advanced solution for lightening problem

Line arrester for transmission line

Flashover by lightening is the major factor of line faults in transmission systems. Line arrester would be much more effective solution to reduce the fault on overhead transmission lines, compared with another countermeasures such as differential insulation system, implementation of multiple shielding wires or reduction of tower footing resistance.

In Japan, more than 50,000 sets of Zinc oxide line aresters, which interrupt power frequency follow current within 1/2 cycle, have been installed on the important lines in higher isoklonic areas since 1980's, and their performance has been proved.

Basic design of line arrester

For overhead transmission lines, reliability of insulation performance as well as free of maintenance is especially required. Further more, successful re-close operation must be assured if the arrester was failed by unexpected larger magnitude of lightening surge. From this point of view, external series gap type arrester has been used in Japan. As shown in Fig.1, the polymer arrester unit is mounted with the external series gap. The gap is designed to withstand switching surge and power frequency over voltage in the system. Since the arrester unit is isolated from high voltage, no deterioration of arrester unit due to continuous energizing is considered.

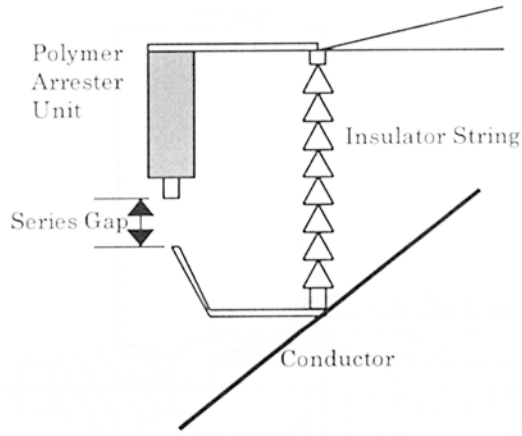

Fig.1 External series gap type line arrester

Compact type line arrester

Based on the above proven technology, more compact type of line arrester was developed. Because of compactness and lightweight, it can be installed easily like arcing horn for insulator string. Though it is designed to withstand smaller lightneing impulse current than that of the present design, it still has enough performance to prevent back flashover when used in shielded systems. That is, good cost performance is expected including installation work. Technical data of the compact type line arrester is shown in Table 1.

Using EMTP (Electro-Magnetic Transient Program) analysis, the expected frequencies of lightening fault before and after installation of line arrester were compared. As shown in the bottom column of Table 1, the compact type has enough lightening current discharge capacity.

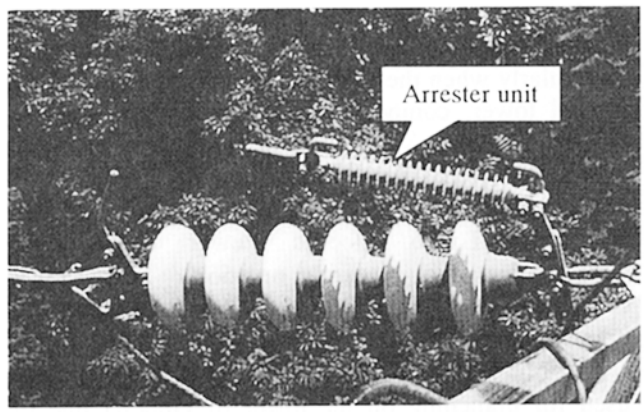

Photo 1 69kV Compact type line arrester

Table 1 Technical data

Item	Compact type	Present type
System voltage	33 to 161kV	33 to 500kV
Max. discharge current (4/10i s wave)	30kA	100kA
Over duty operation	Pressure relief	
Housing material	Silicon rubber	Silicon or EP rubber
Mass of arrester unit (for 69kV system)	Approx. 2kg	Approx. 10kg
Effect to prevent tripping by lightening	Approx. 95 %	> 99 %

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Development of Composite Insulator Termination for XLPE Cable

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Until today porcelain has been used as insulating materials outdoors due to the successful results obtained for many years.

During recent 20 years, with the improvement of the characteristic of the composite insulation materials including silicone rubber, the use of composite insulators, which have light weight, high mechanical strength and contamination resistant characteristics with phase-to-phase spacer and tension insulator, has become popularized. Furthermore, in recent years the application of composite insulators is advancing also in bushing.

Along with a FRP cylinder that has superior mechanical strength surrounded by silicone rubber cover and shade with excellent electric performance, a composite insulator has a structure with the metal fittings helping to mount it firmly on FRP at both sides.

In comparison with porcelain insulators, composite insulators have a number of advantages in contamination resistance, safety, workability and cost. Particularly when the termination is to be mounted on a steel tower, composite insulators have become a dominant choice for such a use due to such characteristics as safety, workability, etc.

Beginning in 1996, Furukawa Electric Co.,Ltd with the Tokyo Electric Power carried out development and research on 66kV and 154kV composite insulator terminations for tower-mounted branch line.

The 66kV composite insulator terminations were used for branching on the tower of Oihama line of Tokyo Electric Power Co. in the year, 2000. This marked the first application of composite insulator termination in Japan.

Development of the 154kV class composite insulator termination has substantially been completed, and the composite insulator termination is at the stage where practical application is possible.

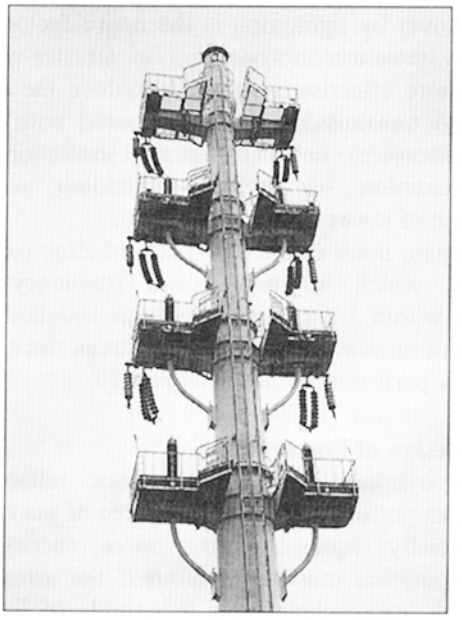

Photo.1. 66kV Oihama line No.1 tower
(Outdoor termination with composite insulator)

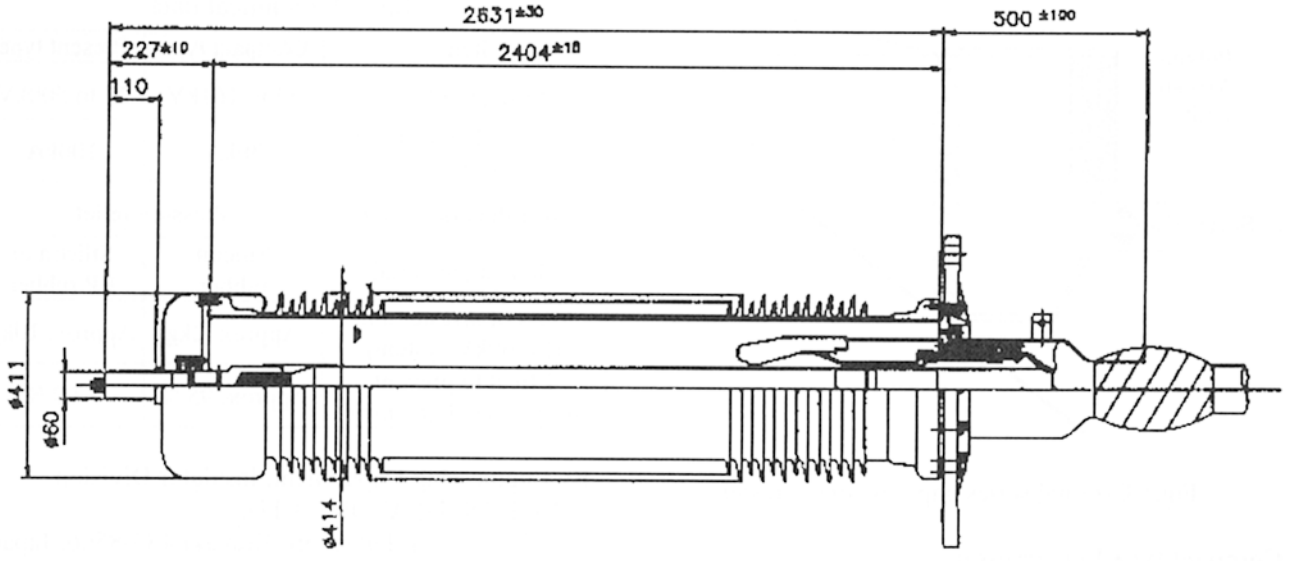

Fig.1. Structure of the 154kV composite insulator termination

TOSHIBA High Voltage and High Power Testing Laboratory

Accredited Testing Laboratory

TOSHIBA Testing Laboratory is the first accredited High Voltage and High Power Testing Laboratory in Japan. TOSHIBA quality systems have been officially accredited based on ISO/IEC guide25 by the Japan Accreditation Board for Conformity Assessment (JAB) in 1999. Moreover, TOSHIBA is a member of the Short-circuit Testing Liaison, the global forum for international collaboration between organizations.

High voltage tests and high power tests are carried out in accordance with IEC, JEC, ANSI, JEC and any national standards. After successful results of the tests, TOSHIBA will issue a Test Certificate for the tested objects.

TOSHIBA have the high voltage reference divider (rated voltage 500kV) made by HAEFELY. It is traceable to PTB (Physikalsch-Technische Bundesanstalt) in Germany. Our main measuring system is fully calibrated with its reference system according to standardized IEC60060-2.

Typical Test Products

The most products for power systems can be tested in the TOSHIBA Testing Laboratory.

Typical test products are:

Circuit breaker	Disconnecting switch
Earthing switch	Transformer
Current Transformer	Potential transformer
Reactor	Surge arrester
Bushing	Bus
Cable	load switch
Resister	Terminal
Relay	Fuse
Semi-conductor	Switchboard
DC circuit breaker	On load tap changer

Test Facilities

High voltage testing Laboratory has a 2300kV AC testing transformer made by TOSHIBA shown Photo. 1, 6000kV impulse generator and 2000kV DC generator. High power testing laboratory has 6600MVA(0.06s after short circuit) short circuit generator made by TOSHIBA shown Photo. 2 and 5.4MJ capacitor bank for synthetic breaking test. Tests in the class of 1000kV equipment are carried out. These facilities perform the maximum world level tests.

Test and Analysis Services

Not only test service of high voltage and high power for distribution system or transmission system, but also many analysis services can be provided. For example, transients analysis, arc phenomena analysis, three dimensional electric field analysis, etc. are available.

We welcome inquiries about electrical tests and technical assistance, and can comply with your requirements.

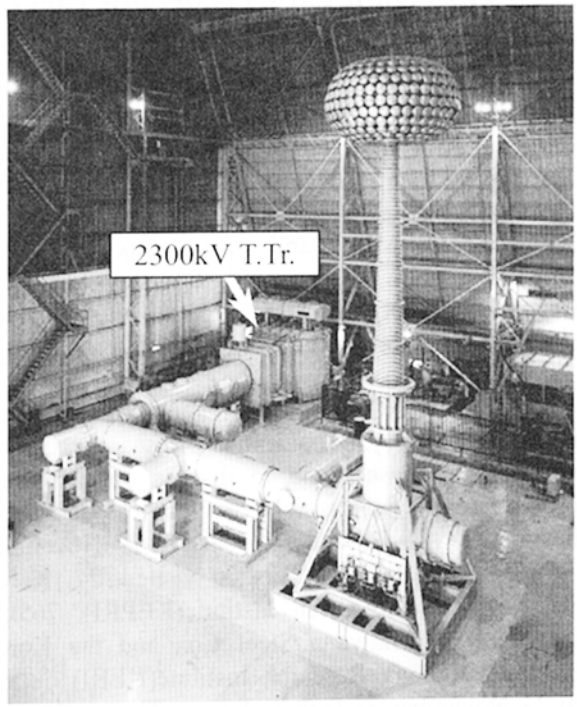

Photo. 1 2300kV AC testing transformer

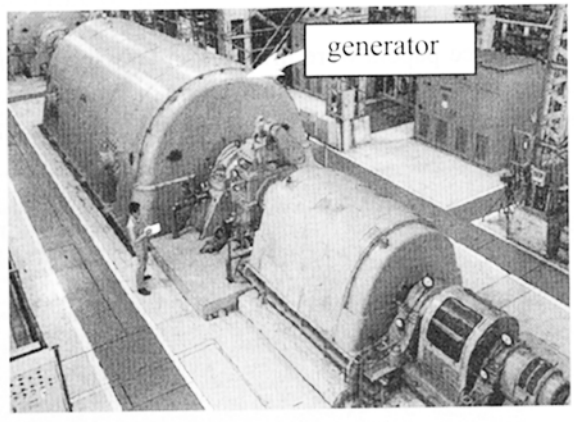

Photo. 2 6600MVAshort circuit generator (0.06s after short circuit)

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