New Products

Development and Delivery of an Easy-Assembly Rubber-Block Joint for 66-kV XLPE-Insulated Cable

VISCAS announces that they have developed an easy-assembly rubber-block joint (ERJ) for 66-kV XLPE-insulated cables, and have recently delivered units to Tokyo Electric Power Company.

The rubber block joint (RBJ) using main insulation of unitized structure--also known as one-piece structure, can be field-assembled and offers extremely stable quality, currently constitutes the mainstream of joints for XLPE-insulated cable. Specifically the VISCAS RBJ is a cold-shrinkable joint (CSJ), which is expanded at the factory prior to delivery. It can then be fastened to the cable in the field simply by loosening the expanded spiral core, earning it high marks for ease of assembly and minimal skill requirement.

Here we announce the development of the ERJ which applies new technology to peripheral components of the RBJ, effecting even easier assembly.

1. ERJ CHARACTERISTICS

Figure 1 shows the structure of the easy-assembly rubber-block joint (ERJ), and its main features (advantages over the conventional RBJ) may be summarized as follows:

- It is of a design that eliminates the metal protective tube and waterproof compound, adopting a newly developed thick non-flammable water barrier tube (power tube), that is fitted over the rubber block and shielding, and shrunk. And since there is no metal tube, a protective cover has been adopted that can be mounted later to protect against external damage.
- When there is only the tube, water barrier performance at the ground wire outlet presents a problem, but the design provides that the grounding wire is connected to the outside via a ground holder (long holder) fitted to the cable sheath and tube, so that even if the joint itself is immersed in water inside the manhole, there is no seepage into the internal insulation.
- Dressing of the rubber block ends conventionally required repeated wrap with several layers of conductive tape, but we have developed a roll (the C roll) that is thick and in the shape of a rod, yet is still easy to wrap, so that wrapping a few times is all that is needed to complete the dressing.
- When forming the shielding layer on the rubber block, it was necessary in the past to wrap braided tape several times, but we have fabricated a novel metal mesh in sleeve form (a shield mesh sleeve), which only needs to be fitted over.
- In dressing the cable shielding layer, the wire shield and flat-braided copper wire have conventionally been pressure bonded, bound together and soldered, but by adopting a coil spring in the shape of a roll (roll spring) and a clip in the shape of a key (sheath bond clip) we have been able to eliminate the pressure bonding operation and achieve a solder-free process.
- In dressing the insulating shield of the cable, conventionally glass shaving and sandpapering are followed by fitting and shrinking the tube for smoothing the surface (to make a simple mirror surface) but by use of an insulating shield cutting tool an operation is performed in which glass shaving is applied only to the electrically important parts of the insulating shield followed by sandpapering.

2. PERFORMANCE EVALUATION

For the ERJ, for which assembly can be accomplished in a short time, the partial discharge characteristics immediately after assembly are important, and as shown in Table

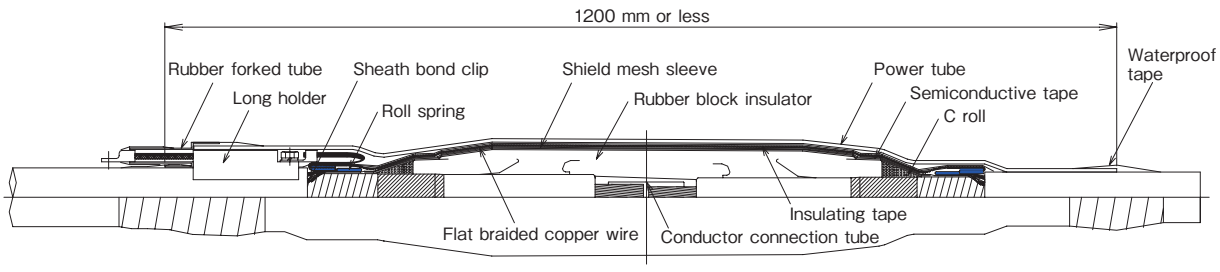

Figure 1 Structure of easy-assembly rubber-block joint (ERJ).

1, as a result of inspections of multiple samples within two hours after mounting, it was confirmed that partial discharge did not occur.

Also, with respect to thermal expansion due to energizing of the cable, offset tests simulating field assembly conditions were carried out and no problems were found (Figure 2 and Table 2). In addition we also confirmed water barrier performance at immersion to 10 m, cable restraining force, non-flammability, etc., and were able to obtain type certification by Tokyo Electric Power Company.

Table 1 Result of voltage withstand tests.

Test item	Conditions	Results
Partial discharge test	85 kV for 10 min * within 2 hr of mounting rubber block	No partial discharge (No partial discharge confirmed even at 140 kV)
Commercial frequency withstand voltage	130 kV for 1 hr	Satisfactory
Lightning impulse withstand voltage	±485 kV, 3 times	Satisfactory
Anti-corrosion layer lightning impulse withstand voltage	-40 kV, 3 times with joint submerged in water	Satisfactory

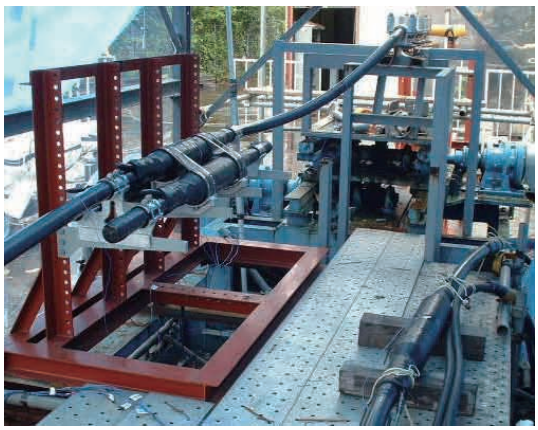

Figure 2 Testing set-up for offset section loading test.

Table 2 Results of offset section loading test.

Test item		Conditions	Results
Offset section loading test	Sample cable	66 kV 1 x 500 mm^2 (insulation thickness 10 mm)	Satisfactory
	Amount of stretch	Yearly: 42.6 mm, 30 cycles Daily: 7.4 mm, 10,800 cycles	
	Offset configuration	Length: 1350 mm Width: 800 mm	
	Heat cycle	RT ~ 90°C: 25 cycles RT ~ 105°C: 5 cycles	
	Test voltage	65 kV for 30 days	
Residual performance	AC withstand voltage	130 kV for 1 hr	Satisfactory
	Lightning impulse breakdown	-20 kV in 3-times steps to breakdown	-960 kV
Strip-down examination		Check for internal slippage, deformation or other abnormality	None

3. DELIVERY TO IN-SERVICE LINE

Delivery of a total of 24 ERJ units for 2 circuits for 600 mm^2 use, which is the largest for 66-kV XLPE-insulated PVC Sheathed Triplex cable, for conversion work on Tokyo Electric Power's Ohgami Line, began this year. At present work on one circuit has been completed and it has gone into commercial service. We have also fully implemented separation of materials and construction (assembly done not by our company but by a construction company), and at the present point have received orders for more than 120 units.

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Figure 3 View of assembled ERJ on site.

Figure 4 View of assembled ERJ with protection cover.