EVOLUTION IN METHOD AND PERFORMANCE FOR BONDING THE METAL SCREEN OF UG HV POWER CABLE

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ABSTRACT

The paper presents the economical reasons for expanding the cable shipping length, the different technical obstacles that have to be overcome and the resulting evolution of the performances required by the increase in potential stresses applied to the secondary insulation.

Different novelties in bonding diagram such as "direct cross bonding" are explained, highlighting their benefit as well as their prerequisites and drawbacks.

The use of longer shipping lengths as well as of "direct cross-bonding" method supposes that an accurate and thorough study of the electrical stress applied to joint shield break is carried out as part of the basic design of the link.

New concept of the electrical components around the cable joint is presented and its benefits on classic design are explained.

PRESENT AND FUTURE

Economy is leading the world. For many years the standard shipping length for UG HV and EHV cable was in the range of 500m, sometimes less.
This value was due to different limitations such as:

- Production equipment like impregnating tanks, take-up units, etc.
- Testing equipment like maximum current of test transformers or maximal capacitance of the test object
- Transport in term of drum size and weight
- Last but not least regulation restriction on the maximum standing voltages along the metal sheath/screen.

By having longer lengths per shipping drum the hardware cost, the labour cost and the civil work cost are reduced. Costs of maintenance are also linked to the number of accessories along a UG power line.

- *Civil work cost*

It is including the cost of joint bays and associated pits that house the cross-bonding boxes.

- *Labour cost*

Mounting joint can represent 25 percent of the total installation cost.

- *Hardware cost*

Hardware encompasses the joints with their possible monitoring system as well as the bonding leads and cabinets with or without SVL's.

In fact the limitation on maximum sheath standing voltages put a brake to an increase of the unitary shipping length. Some countries were limiting the maximum standing to values as low as 65V. Some are still. The graph in Fig.1 shows that keeping such limit prevents any kind of change in the maximum allowed distance between joints. However the demand for UG transmission line tends toward larger transmission capacity then the problem of standing voltages has become more and more penalising.
In France the maximum allowed standing voltage for line where public access is prohibited is 400V. That particular feature of the French regulation makes possible the extension of shipping lengths up to 2000m and more.

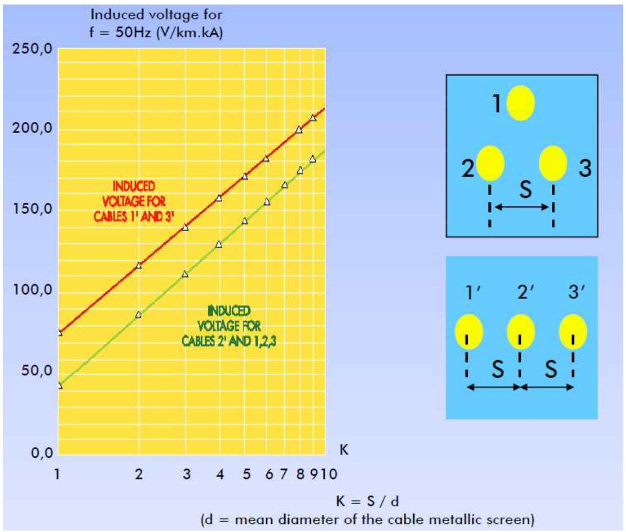

Fig.1 induced voltage versus the ratio of cable spacing over metal screen diameter

When the obstacle of maximum standing voltage is removed there is still to address the problem of induced voltage under short-circuit condition.
Combining longer lengths and short-circuit current that can reach 63kA and even more makes necessary to take care of the rating of the SVL that are protecting the screen interruption of joints.
Another direction to reduce the cost of UG cable power line is to decrease the amount of protections put on the different joints along the route, irrespective of the section length between them. This second track has been called "direct cross-bonding". .