



# JICABLE'07

## Rapporteur's Session Report

### C.5.1 SESSION : CABLE SYSTEMS

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Papers 1 and 2 dealt with semi-conducting shields. In the first one, is emphasized the correlation between carbon black ionic and sulfur content or screen smoothness and performance. In the second one is remarked the importance of the quality control of an effective mixing, in particular about pelleted carbon black. To obtain this goal, high filter levels must be incorporated. For this, the authors suggest the use of Buss kneader screw (which oscillates in synchronization with its rotation) in contrast to conventional screw-type machines.

Paper 3 claims the benefits of silane as a stabiliser in XLPE (for low voltage wire and cable). The paper deals specially with benefits of different stabiliser packages on : grafting yield, crosslinking and heat aging.

Papers 4 and 5 dealt with the XLPE cable performance experiences all over the world. In paper 4, it is given an interesting view of the improvement in the performance of XLPE cables in Central Europe, emphasizing the poor experience with the first generation of them arriving to the good performance of the second generation, insulated with WRT (water tree retardant) compounds.

Paper 5 confirms a similar experience in North America (USA and Canada) The first XLPE insulated cables of the late 1960's hoped a life of 20-30 years but microcavities degraded many of them after 10 to 15 years in service. Thanks to research and testing, XLPE insulation has attained high-quality compounding equipment, free of contamination. The paper outlines some of the common practices that leads to XLPE -insulated cables with long reliable service life.

Paper 6 informs us about the first Japanese essays in order to develop some recycling technology of XLPE. Given the increasing interest in reducing environmental damages, it is encouraging to see the first outcomes in this field, attempting to re-utilize the XLPE in insulation functions.

Papers 7,12,13,14 and 15 Terminal, connectors and cable lugs are the subject.

Paper 7 shows an innovative connector with step less shear bolts. The authors claim that this new technology introduces an important improvement with regard to the multi range shear bolt which has been the start of art in screw technology until today.

Paper 8 exposes some studies carried in Japan over surge propagation and protection of underground distributions cables :

- (1) simulation of surge behaviour in cable line demands careful determination of parameter (i.e. relative permittivity).
- (2) surge is reflected double voltage at the end of the cable.
- (3) as cable length increases, the end of the cable is further from the arrester and the reflected surge voltage is increased.
- (4) in the real underground distribution system, the reflected voltage surge is propagated through various paths of distribution lines and reflected double again at the other end, risking the threaten of insulation.

Paper 9 deals with the chemical rejuvenation experience trying to extend medium voltage cable life 40 years. Authors show recent advances in cable life extension technology. The paper addresses important factors required to understand long-term post injection reliability. The mechanisms of cable failure which are addressed by the newest injection technology are briefly reviewed. Three commercially available chemistry choices are compared.

Paper 10 deals with Dielectric System of Submarine Electro Hydraulic Umbilical up to 35 kV studied in Brazil. The umbilical application could be interconnected offshore oil platforms or supply energy for down-hole, oil pumps. Real data for the different dielectric systems under investigation are presented, discussed and confronted with current standard. An economic analysis is also done. The paper describes the methodology development for evaluating and validating of the electrical system design for application in a depth up to 3000 m.

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Paper 11 refers to Korean development of underground distribution cable for water blocking (reducing risk of water tree) and reducing stress on semiconductor layers (protrusions). The authors use LLDPE compound instead of conventional PVC as outer jacket material. The jacket structure was also changed from embedding to encapsulating structure. They use super smooth class semiconductor compounds as a conductive screen. This new cables have better AC breakdown voltage after aging test, they have been installed in Korean Distribution System from late 2006

Paper 12 informs us of the successfully development of a pre-moulded joint (PMJ) using silicone rubber for 230 kV class, which passed the test in accordance with IEC Standard 62067.

Paper 13 clarifies RTE (the French Electricity transmission Operator) and EDF R&D works on optimisation concerns for future underground links and on adjustment of existing networks necessities. The working group concludes with the definition of a specific method to qualify transition joints allowing connections between dissimilar cables that leads to a reliable answer for the requirements of the French Grid.

Paper 14 deals with Japanese developments on Transition Joints (TJ) for up to 154 kV power cables. TJ are classified in : the straight through joint (DJ), the Y-branch type joint (YJ) and 3 cores straight through joints (3cDJ). Each joint was designed compact compared with the conventional joint. The development test of both types for 154 kV cables has been completed (satisfying IEC 60840 –170 kV- standard). The 77 kV 3cDJ joint has been tested according to JEC 3401 (satisfying specifications of IEC 60840-111 kV).The development test is being executed now.

Paper 15 informs us of Japanese development on 275 kV Y-branch pre-fabricated transition joints. The demand of Y-branch joint box increasing all over the world given the need of expansion of existent networks (mainly oil-insulated) with XLPE insulated cables. The paper introduces (1) Upgrading of manufacturing inspection for 275 kV YCB,(2) performance evaluation of installed YJB at the time of rapid temperature change in the manhole and (3).

*We are pleased to have worked on this minute with Chairman A Valdenegro as we are very interested in the different topics he develops.*

*All have the particularity to reduce cost or increase the characteristics of cables and joint taking into account the environment, the durable energies, the recycling of materials which represent a world and a scientists concern as far as the industrial development is concerned.*