



# DIELECTRIC SYSTEM FOR SUBMARINE ELECTRO HYDRAULIC UMBILICAL UP TO 35KV



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## ABSTRACT

*The main purpose of this technical paper is to analyse the various kinds of polymeric insulations currently available for use in power cables, with insulation voltage up to 35kV, for application as a component of Submarine Electro Hydraulic Umbilical.*

*The umbilical application could be interconnect offshore oil platforms or supply electrical energy for down hole, deep water, oil pumps.*

*Analysis must take in account the dielectric system, comprised of the conductor shield – insulation – insulation shield. The single and simple analysis of the insulation, in the event of cables for medium voltage, becomes partial and must be complemented by the specification and definition of requirements for the semiconductor materials components for the conductor and the insulation shield.*

*Real data for the different dielectric systems under investigation are presented, discussed and also confronted with current standard.*

*An economic analysis for different dielectric systems is present for a complete evaluation.*

*This paper also describes the methodology, established by the authors, for evaluating and validating of the electrical system design for application in a depth up to 3000m.*

## KEYWORDS

*Electro Hydraulic Umbilical, Polymeric Insulation, Dielectric System.*

## UMBILICAL CABLE APPLICATION

Powering submerged pumps to overcome ultra-deep water pressures, low reservoir pressure, long offsets connections from a central platform, high produced fluid viscosities, extend the life of mature fields or accelerate production on new fields calls for a Electrical Subsea Pump (ESP).



Figure 1 – Submarine Multi-Phase Cable 6/10kV

Each design is property balance mechanical, thermal and electrical evaluation, for static and dynamic operation in subsea application up to 3000 meters water depth and a service life of 25 years.

A typical subsea multiphase pump may need a megawatt or more of electricity and some fields need more than one pump. Normally, each pump is fed by its own Variable Frequency Driver (VFD), requiring one 3-phase cable per pump.

Detailed analysis and rigorous tests are performed to ensure the umbilical systems reliability during installation phase and during throughout service life. Crush, bending, tensile and cycle tests verify umbilical behavior under a broad range of installation and operation scenarios.

A subsea umbilical cable can also be composed by steel tubes, hydraulic hoses, optical and signal cables.



Figure 2 – Electro Hydraulic Umbilical

## DIELECTRIC SYSTEM

The dielectric system can be unique, comprised only by the insulation in the case of low-voltage cables or composed by the conductor screen – insulation – insulation screen in the case of medium and high voltage cables.

The pure and simple analysis of the insulation, in cables for medium or high voltage, becomes partial and must be complemented by the specification and definition of requirements for the semiconductor materials components of the conductor and insulation screen.

## POLYMERIC INSULATIONS

According to its thermo-mechanical behavior, the insulation polymers can be divided into: Thermoplastics and Thermoset compounds.

Due to the thermal limitations of the thermoplastic polymers, in stead state and mainly during short circuit transients, only