Close and Return

APPLICATION OF TEMPERATURE SENSING AND DYNAMIC STRAIN MONITORING TO SUBSEA CABLE TECHNOLOGY

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ABSTRACT

Installation and operation of HV subsea cables is always challenging. When the cable enters water, first hand measurement and examination are not possible and secondary sources such as underwater video are used to monitor the status of the cable. With Distributed Temperature and Strain Sensing use is made of the Fibre Optic usually embedded in the cable construction for telecom purposes. The fibre is used as a continuous sensor and can supply thermal as well as stress/strain dynamic information to a monitoring station.

KEYWORDS

Subsea cable, Temperature Monitoring, Dynamic Stress Strain monitoring

INTRODUCTION

Power cable links can be critical assets in project commercial viabilities. In the Oil and Gas market power links are used to energise offshore installations. Outages have tangible commercial implications. Large scale offshore wind parks rely upon HV power cables for the export of the power to the land based power network. Inter-turbine power cables are configured in such a way as not to have major impact on power export in case of cable failure. However, export cables can limit power output unless sufficient redundancy is included in the wind farm scheme.
If due to capital constraints overcapacity/redundancy cannot be built into the systems, the cables become critical assets to project commercial performance.

In the last 15 years, temperature monitoring based on fibre-optic cable technologies have become common on land at voltages above 132kV. Application of this technology to subsea cables with the addition of dynamic strain mapping means project risks are managed more effectively through better asset life management (extensive condition monitoring means more effective maintenance).

SUBSEA CABLE ISSUES

Most longer length high voltage subsea cable installations are challenging and as a result there are risks that have to be mitigated [1].
Usual issues encountered:

- Routine testing equivalent to land cables cannot be carried out due to cable length
- HV XLPE subsea cables are normally dry core designs with lead sheaths – susceptible to fatigue
- Commissioning tests are even more limited than routine tests therefore any defects introduced as a result of transport or installation are likely to be undetected
- Quantitative installation data is limited especially if a two pass operation is required (laying and then trenching), mainly visual records are available (ROV surveys)
- Post commissioning cables are still at risk due to external damage as well as environmental effects such as scour and sediment migration. Exposed cables can vibrate in strong currents and thus susceptible to fatigue failure. Cables buried to much greater depth than expected can overheat and fail due to thermal runaway.
- Dynamic cable sections may be exposed to conditions outside of their design criteria (large oscillations, greater bending movement)

If not managed, most of these issues can lead to cable commissioning failures and early mortality problems. Some, like scour and sediment can be unpredictable with a few years of no change followed by a changing pattern of seabed movement.
Most HV three core XLPE cables have an embedded Fibre Optic (FOC) cable in one of the interstices, usually provided for trip protection and communication purposes. With the advances in using this technology as temperature and strain sensors a new way of monitoring key assets can be implemented.

SENSING TECHNOLOGY

Figure 1 shows a cross section of a typical HV power cable with a 6/12/16/24 FO cable laid up in one of the interstices. Lead sheath is used to provide an impermeable water barrier around each core.

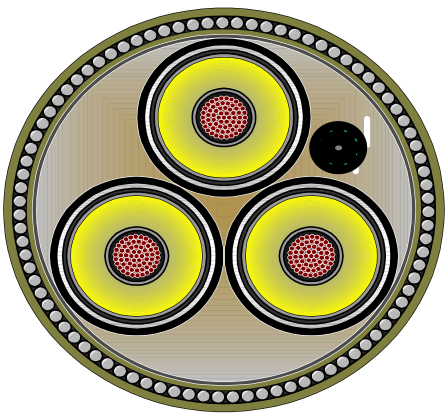

Figure 1 HV XLPE 3C Power Cable