Study Committee B1

Insulated Cables

Paper 10142_2022

Emerging asset management strategies for OF cable technologies in North America

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Motivation

- OF Cable technology is the backbone of transmission UG in North America
- Ageing pipe-type infrastructure presents a challenge and requires attention
- Industry is looking for different options to maintain reliable power delivery at a reasonable cost while mitigating any negative aspects of maintenance and conversion activities

Method/Approach

- Paper analyzed and systemized different approaches into four groups
- Standard approach - Replacement of pipe-type OF cables with same technology
- Replacement of HPFF cables and their accessories with LPP technology
- Partial conversion of HPFF to solid dielectric technology by utilizing transitional products
- Full conversions of HPFF circuits to solid-dielectric

Objects of investigation

- Current state of HPFF
- Different emerging projects in IOUs
- New technologies like high-stressed cables and "hybrid" pipe-type / XLPE systems

Experimental setup & test results

- HPFF:
  - Operational issues like fluid leaks due to pipe corrosion and loss of material
  - One North American cable manufacturer and three to four accessory suppliers create a bottleneck for the new and spare parts
  - Four to five specialized contractors to install, maintain or repair HPFF cable systems limit the maintenance options and raises the costs
- Examination of new technologies – benefits and limitations

Discussion

- Approach #1: still deployed but to limited extent; it is used in cases where existing HPFF paper circuits are not expected to grow in load and where cost of maintenance does not justify capital investments required for conversion to solid-dielectric technology
- Approach #2: LPP technology offers lower dielectric losses than conventional paper, resulting in smaller cable diameters and pipe sizes, with longer cable pulling lengths and fewer manholes and joints
- Approach #3: used to extend the life of existing OF circuits by partially converting OF sections to extruded; several projects in recent years, especially for 3-c cable systems, where there are less constraints than with pipe-type cable systems in terms of pressures, space, and ampacities (e.g. Providence River relocation)
- Approach #4: ultimate challange - Holy Grail: effectively utilize existing pipe-type infrastructure to integrate solid dielectric cable technology and eliminate fluid related issues; main issue – limits in ampacity

Voltage level	XLPE Insulation Thickness (CS9)	Paper insulation thickness (CS2)	LPP insulation thickness (CS2)
115 kV	15 mm	9.5-10.7 mm	6.3 mm
138 kV	18 mm	11.2-12.4 mm	6.9-7.6 mm
161 kV	20 mm	14.6 mm	-
230 kV	23 mm	15.4-18.9 mm	11.4 mm
345 kV	26 mm	23-25.9 mm	15.2 mm