



# UHF-PD-MONITORING AND ON-SITE-COMMISSIONING-TEST OF 400 KV XLPE-INSULATED CABLE CIRCUITS AT JEBEL ALI / DUBAI



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## 1. ABSTRACT

This paper describes experiences with Partial Discharge measurements of after installation tests of six 400 kV XLPE insulated single core underground cable systems in Jebel Ali/Dubai tested with AC series resonant voltages.

Considering the importance of the power station permanent PD monitoring will be performed at 36 GIS cable terminations after commissioning.

A new system applying UHF sensors and acquisition was developed, suitable for any kinds of HV XLPE cable terminations like transformer sealing ends, cable terminations for metal-clad substations and outdoor sealing ends based on past experiences during investigations on site.

The measuring equipment for UHF-PD monitoring on HV power cable systems is especially designed for on-line high sensitive continuous partial discharge monitoring in three-phase high voltage power equipment.

Transient signals generated by possible PD inside the terminations of the HV power cable will be detected and processed to get information about the insulation status.

The results of the PD monitoring are further evaluated with different software tools. For continuous monitoring the PD parameters are transmitted and displayed permanently.

The acquired raw PD data are not only used to generate an alarm signal in case of increased PD activity but more functions are realized for the evaluation of the fault severity such as PRPDA,  $H(v, \text{phase})$ ,  $v(t)$ ,  $n(t)$ ,  $I(t)$ ,  $H(\text{phase})$ ,  $V_{\text{peak}}(\text{phase})$ ,  $V_{\text{mean}}(\text{phase})$  and  $H(v)$ .

## KEYWORDS

High Voltage Cables Circuits – UHF/PD Monitoring – Commissioning Test – On Site Test

## 2. INTRODUCTION

Most defects observed in today's extra high voltage (EHV) cable systems cause partial discharges (PD) in the accessories under AC stress. Combining AC testing and sensitive PD measurements results in best test efficiency.

In addition, fact is that all the power cables with polymer isolation are tested in the factory according to IEC 60840 and IEC 62067 with the best methods and with calibrated PD-measuring systems in screened test rooms with high sensitivity.

After transport and laying the oversheath test and corrosion

protection test are performed on power cables using high DC voltage between metal sheath or screen and ground. If the sheath is undamaged it can also be confirmed that the polymer isolation is intact and no mechanical damages occurred during transport and laying. The isolation of cable is still in the good PD-free condition as tested with the routine test at the manufacturer site.

However, for the assembly of the terminations and joints on the cable ends one works again directly on the isolation. Here errors can occur. Therefore a partial discharge test is very important with a focus on the terminations and joints after jointing.

This requirement has led to a development of new measurement systems for PD-On-Site-Tests on HV- and EHV-XLPE cable systems. In dependence on the special conditions in the network we work with the UHF-PD measurement method.

This paper reports on present Brugg Cables' and LDIC's successful efforts to measure PD in the accessories after jointing in the EHV-XLPE cable systems and describes the UHF-PD measurement method.

## 3. PROJECT DESCRIPTION

Brugg Kabel AG, Switzerland, has been awarded and has successfully commissioned a 400 kV cable project in Dubai. The project consists of (Fig. 1):

- Six 400 kV XLPE cable systems for connections between the HV-side of the Unit Step-up Transformers and the 400 kV Substation bays with different cable lengths (120...320 m),
- 36 pcs GIS-sealing ends with pre-fabricated and pre-tested stress-cones manufactured from silicone,
- 18 pcs UHF-PD sensors with ground-connexion and TNC connector,
- 18 pcs UHF-PD sensors without ground-connexion and TNC connector,
- one complete On-line UHF-PD Monitoring System supplied by Lemke Diagnostics GmbH (LDIC) from Germany.

All HV cables and accessories have had successfully passed a Type Test, a Pre-qualification Test and the Routine Tests in the factory according to IEC 62067.