

ON-LINE CONDITION ASSESSMENT ON ELECTRICAL ASSETS



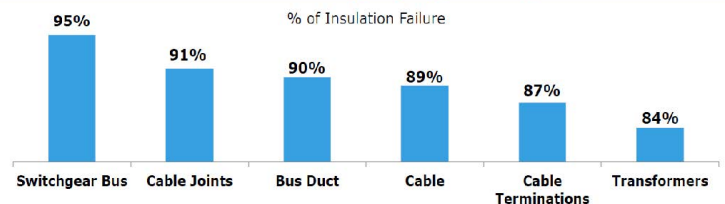
Partial discharge occurs in weaknesses within the insulation system of high voltage components.

The phenomenon breaks down the insulation until a breakdown occurs!

Installation error, manufacturing defects, mechanical damage or aging lead to partial discharges.

With strategic measurements through the grid, the source of the PD activity is located.

More than 80% of failures in HV/MV assets are related to Partial Discharge (PD) activity



This is WHY we are strongly committed to on-line, accurate & reliable PD testing

Source: 493-1997 - IEEE Recommended Practice for the Design of Reliable Industrial and Commercial Power Systems (Gold Book)

ANY ELECTRICAL EQUIPMENT FROM 3kV AND ABOVE



CRITICAL DEFECTS DETECTED ON HV AND MV



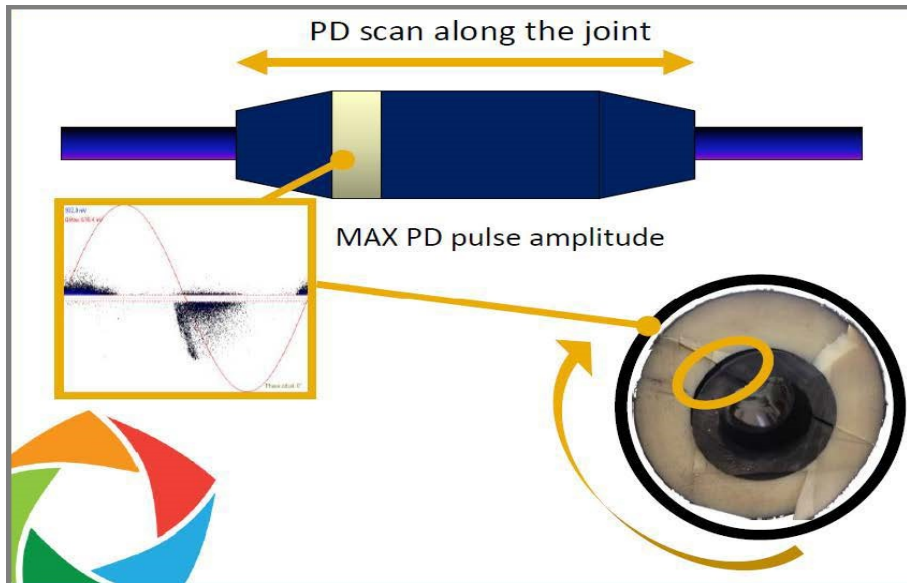
AVOIDED FAULTS



ON-LINE TESTING WITHOUT SERVICE INTERRUPTION



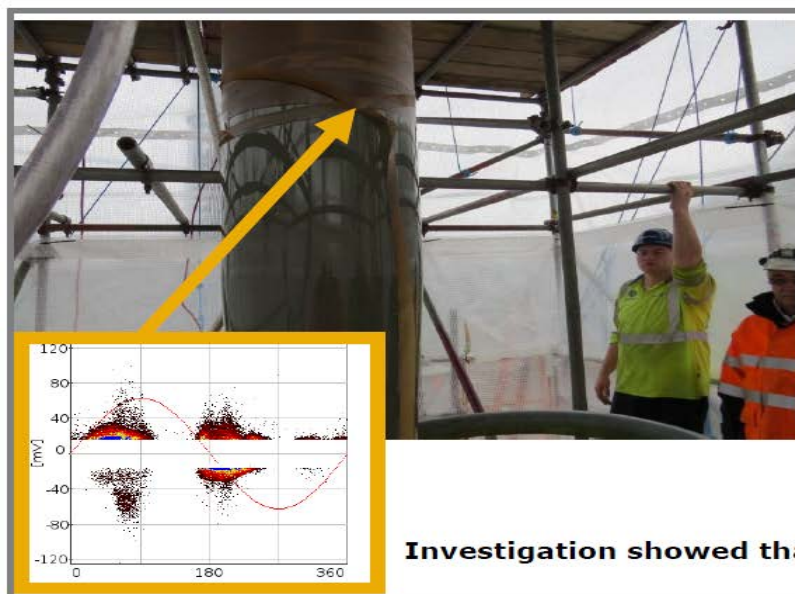
HIGHEST PERFORMANCE FOR COMPLEX PD DIAGNOSIS AND DEFECT LOCALIZATION



- HV joint
- PD scan along and around the joint by simply moving the Pry-Cam

Results with Pry-Cam:

- Accurate defect localization
- Total cost saving

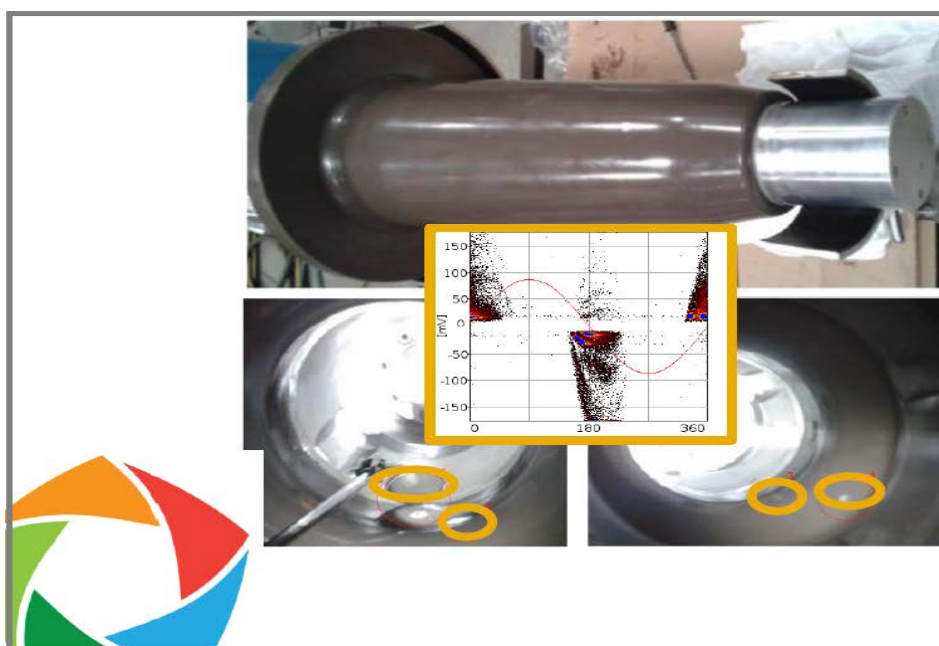


- OF Termination having high levels of dissolved gas
- Potential loss of generation and explosion risk

Results with Pry-Cam:

- Internal PDs found on phase B in few minutes
- Faults prevention

Investigation showed that papers were loose/unwinding



- 6 HV terminations investigated

Results with Pry-Cam:

- Accurate and reliable diagnosis
- Detection of 4 PDs on 2 terminations
- Faults prevention

PD surveillance on cable installations while SOAK test



All new critical cable connections should be controlled for partial discharges (PD) when they are energized for the first time!

Poor workmanship, manufacturing defects, transport damage and excavation damage can generate insulation weaknesses which in turn cause partial discharges.

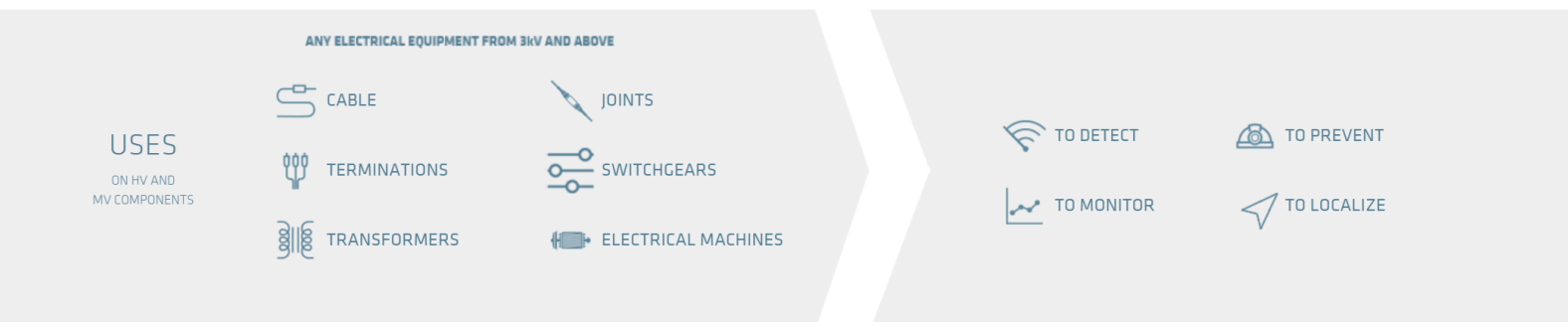
The PD activity will over time cause a breakdown!

SOAK test with PD surveillance

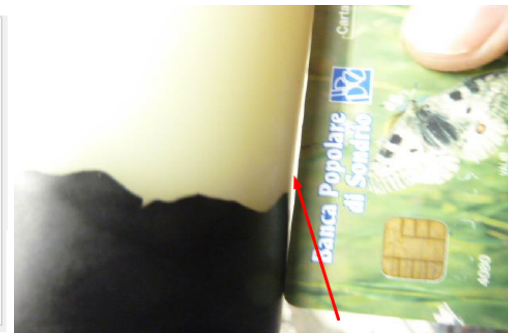
- Data is collected during the first 4 hours under SOAK
- Data collected during the last 4 hours under SOAK
- Data is collected during the first 4 hours with load
- Total 2 days on site

A SOAK test it self will only reveal significant errors!

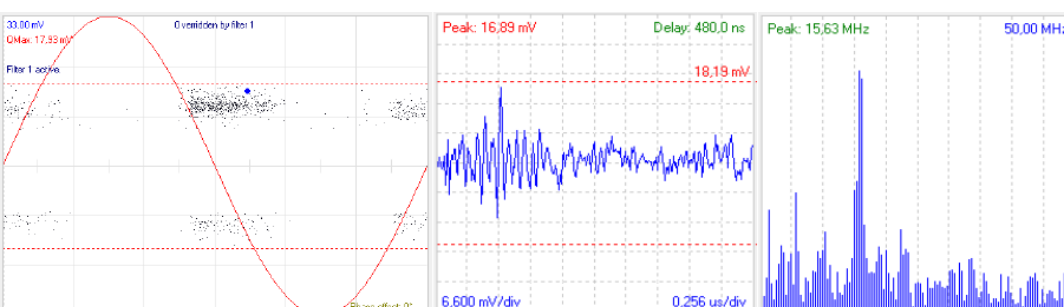
A SOAK test combined with PD surveillance will reveal small defects which over time will cause a breakdown!



PD surveillance SOAK test 220 kV joint



PD surveillance SOAK test 145 kV GIS termination



COMMISSIONING WITH VLF PD/TD



NEKA AS specializes in testing high voltage cables. We perform commissioning of new installations.

The cable diagnosis is a three-part commissioning that ensures that the quality of the installation is satisfactory

Commissioning and cable diagnostics

VLF COMMISSIONING WITHSTAND TESTING WITH DIAGNOSTICS

At $2.3-3 U_0$, 33 kV kabel
15 min to 1 hour testing time

TDR 'FINGERPRINTING'

To identify joint positions along the cable

TAN DELTA (TD) DIAGNOSTIC TEST

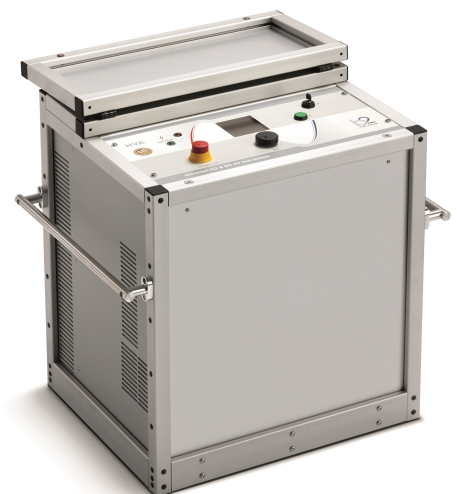
At $1,5 U_0$ for 66 kV kabel
Evaluating the dielectric condition of cables and other electrical equipment such as transformers or rotating machines.

PARTIAL DISCHARGE (PD) TEST

At $1,5 U_0$ for 66 kV kabel
To indicate and localise points of weakness and insulation imperfections

Commissioning according to; IEEE 400.2 or IEC 60502-2

- Good insulation will be unaffected
- Reveals; Production deviations, poor workmanship, and aging
- Uses sinusoidal, 0.1Hz HV waveform
- Up to 30 km cable can be tested



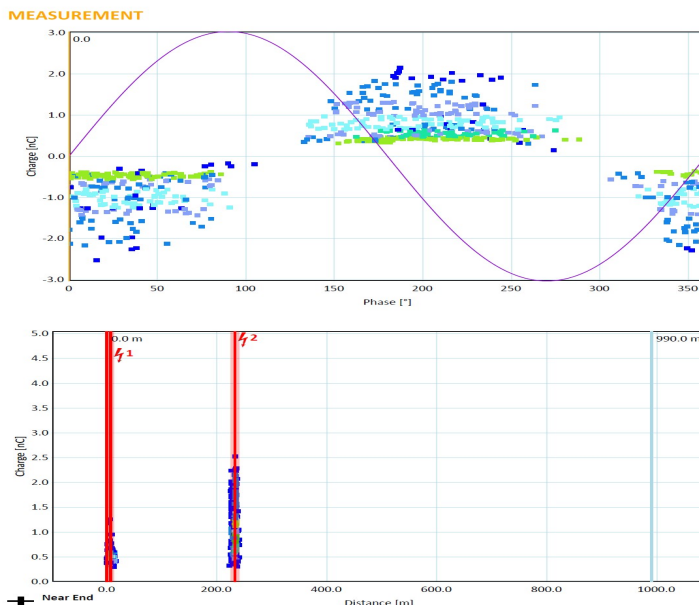
COMMISSIONING WITH VLF PD/TD

Benefits of VLF PD & TD Diagnostic Testing

- Complete assessment of the quality of the cablesystem. This helps to ensure that the installation is satisfactory and does not have weaknesses present that will fail at a later date
- Commissioning with VLF PD / TD verifies the installation and gives the owner a fingerprint of the cable installation for future control
- VLF partial Discharge (PD) reveals cable faults and the fault location.
- VLF Tandelta (TD) uncovers the general aging of the insulation and creates a fingerprint of the insulation system



PD mapping with PRPD and location on cable



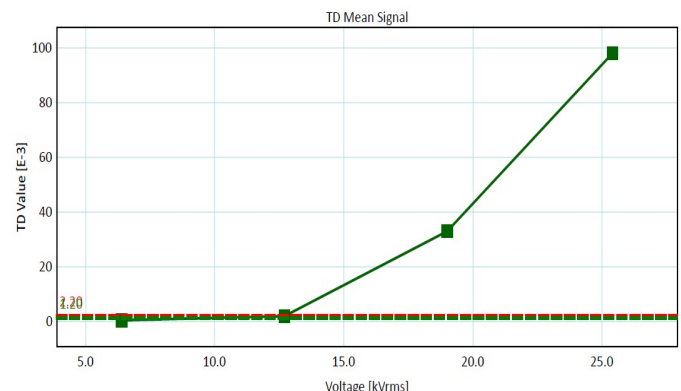
Defects in cable, joints and terminations are uncovered along the entire cable. The test also provides information about the type of fault, inception voltage and severity.

TD analysis according to IEEE 400.2

Phase P2 Overview

	6.4 kV	12.7 kV	19.0 kV	25.4 kV
Mean TD [E-3]	0.46	2.00	33.0	98.0
Standard Deviation TD [E-3]	< 0.1	0.22	0.24	0.27
Mean RMS Voltage	6.4 kV	12.7 kV	19.0 kV	25.4 kV
Mean RMS Current	10.1 μ A	18.6 μ A	27.8 μ A	37.3 μ A
Mean Load C	2.3 nF	2.3 nF	2.3 nF	2.3 nF

TD PHASE DIAGRAMM



TD analysis reveals the general aging of the insulation system in cable, joints and terminations. The values are checked against the requirements of IEEE 400.2.