



KINECTRICS

a **BWXT** company

HV/EHV Transmission Cables Field Testing

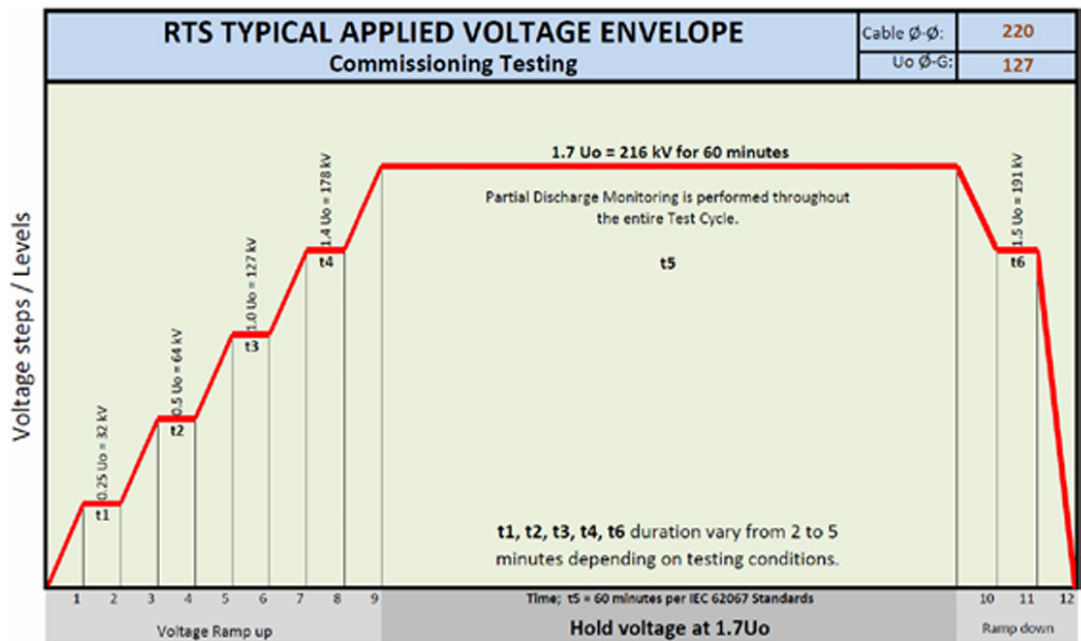
Expert Capabilities for Reliable Commissioning and Maintenance Testing - Worldwide



HV/EHV CABLE COMMISSIONING TESTING

With many decades of experience in high voltage testing, Kinectrics is uniquely qualified to perform commissioning testing on high voltage (HV) and extra high voltage (EHV) transmission cables. Kinectrics is the pioneer and the most experienced company in North America with regards to HV and EHV cable testing with or without partial discharge (PD) measurement. As the only independent service provider in North America and one of few in Europe, Kinectrics owns a fleet of resonant test systems (RTS 230 V, 83 A, 22 MVA) and, with its vast experience and know-how, can perform HV tests on very long cables up to 500 kV. Test voltage is raised in steps, as shown in the graph below, to ensure cable conditioning and proper commissioning test.

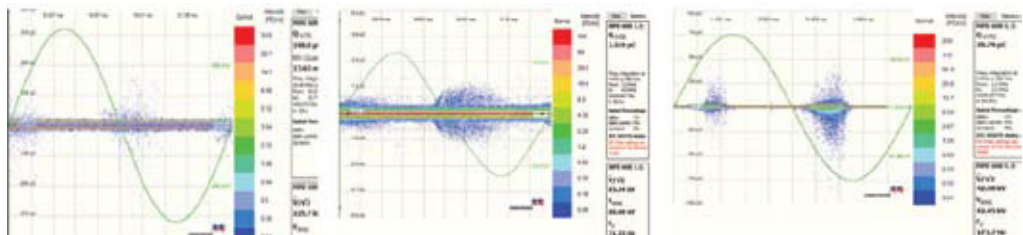
Reliability of the transmission cables is one of the foundations of the system stability and Kinectrics can provide assurance that the system is free of gross and latent defects. This is based on the high voltage test performed according to the international standards, namely: IEC 60840, IEC 62067, AEIC CS9, ICEA S-108-720, and HD 632 SCT 36.



PARTIAL DISCHARGE DIAGNOSTICS

The diagnosis of PD measurement on long cables cannot be based on single- or two-end PD measurement due to dispersion and attenuation of PD in the cable and impedance mismatch of the accessories. Therefore, Kinectrics developed a distributed PD measurement system that allows for monitoring of all accessories during the test, providing high quality data and good foundations for the diagnosis. The system does not need external power and can run on batteries for months. Commissioning testing may include other tests, not only high voltage and PD.

- Expert testing operation, PD monitoring and diagnostic capabilities
- Individual assessment of joints, terminations, and cable sections
- Non-invasive and intrinsically safe testing method
- Localizing PD activity within a cable system
- Sensitivity Assessment
- In compliance with IEEE and IEC standards



HV/EHV CABLE MAINTENANCE TESTING

Apart from commissioning of new cable lines, Kinectrics performs maintenance testing and condition assessment of service-aged cables. The scope of the maintenance programs of HV and EHV cables depends on the type of the main insulation (extruded, fluid filled), installation type (land, submarine), complexity, and local conditions (heat/cold, water/desert, etc.).

Kinectrics provides consulting services, training and technical presentations to help utilities maintain reliable high voltage links. Maintenance tests may include tests in addition to the high voltage test with PD.

COMPREHENSIVE COMMISSIONING CABLE TESTING AND DIAGNOSTIC SERVICES

High Voltage Testing

- AC testing for cables with extruded insulation (XLPE, EPR)
- AC or DC testing for fluid filled cables (PILC, LPFF, HPFF)
- Partial Discharge (PD) Measurement

Low Voltage Testing

- Dielectric Spectroscopy (DS)
- Time Domain Reflectometry (TDR)
- Optical Time Domain Reflectometry (OTDR)
- Line Impedance Resonance Analysis (LIRA/FDR)
- DC Sheath Resistance Measurement
- Jacket Integrity Test
- Contact Resistance Test

System Testing

- Sheath Voltage Limiter (SVL) Testing
- Bonding Performance (Induced Voltage Measurement)
- Positive and Zero Sequence Impedance Measurement
- Capacitance Measurement
- DTS and Thermal Rating (Ampacity) Calculations and Verification

Failure Analysis

- Forensic services including chemical and mechanical analysis
- Numerical modeling of accessories (thermal & mechanical)
- System Studies (Lightning & Switching Impulse, AC/DC)



Kinectrics has established a long-term record of success in HV transmission class electrical cable testing for numerous international clients. The table below lists some of the major tests completed to date.

UNPARALLELED EXPERIENCE

Kinectrics has successfully commissioned:



Over 6500 km of HV/EHV onshore and offshore cables



Up to 500 kV cable class system



Approximately 7000 joints tested for PD



85 km of cable at once (with multiple RTS systems in parallel configuration)



The most jointed AC cable system with approximately 65km of cable



The highest voltage cable system in Europe while simultaneously monitoring PD activity on all cable accessories using our Daisy Chain system

Test Performed	Voltage	Cable Type	Location
AC Withstand + PD	275 kV	XLPE	UK
AC Withstand + PD	230 kV	XLPE	USA
AC Withstand + PD	230 kV	XLPE	USA
AC Withstand + PD	165 kV	XLPE	Denmark
AC Withstand	150 kV	Subsea	Greece
AC Withstand + PD	138 kV	XLPE	USA
AC Withstand + PD	138 kV	XLPE	USA
AC Withstand + PD	132 kV	XLPE	UK
AC Withstand + PD	230 kV	XLPE	USA
Soak + Online PD	400 kV	XLPE	UK
AC Withstand + PD	165 kV	XLPE	Denmark
Soak + Online PD	155 kV	XLPE	Denmark
AC Withstand + PD	138 kV	XLPE	USA
AC Withstand + PD	138 kV	XLPE	USA
AC Withstand + PD	230 kV	XLPE	Canada
AC Withstand + PD	220 kV	XLPE	Middle East
AC Withstand	132 kV	XLPE	Caribbean
AC Withstand + PD	345 kV	XLPE	USA
AC Withstand + PD	345 kV	XLPE	USA
AC Withstand + PD	320 kV	XLPE	Canada
AC Withstand + PD	345 kV	XLPE	USA
AC Withstand + PD	220 kV	XLPE	USA
AC Withstand	138 kV	XLPE	Mexico
AC Withstand	138 kV	XLPE	Mexico
AC Withstand + PD	380 kV	XLPE	Middle East
AC Withstand	345 kV	XLPE	USA
AC Withstand + PD	220 kV	XLPE	Middle East
AC Withstand + PD	138 kV	XLPE	USA
AC Withstand + PD	400 kV	XLPE	UK
AC Withstand + PD	170 kV	XLPE	Denmark
AC Withstand + PD	400 kV	Subsea	UK
AC Withstand + PD	345 kV	XLPE	USA
AC Withstand + PD	138 kV	XLPE	USA
AC Withstand + PD	132 kV	XLPE	UK
AC Withstand + PD	110 kV	XLPE	UK
AC Withstand + PD	72 kV	XLPE	USA
AC Withstand + PD	72 kV	XLPE	USA
AC Withstand	400 kV	Subsea	Denmark
AC Withstand + PD	400 kV	XLPE	Germany
AC Withstand + PD	400 kV	XLPE	Germany
AC Withstand + PD	220 kV	XLPE	Germany
AC Withstand + PD	220 kV	XLPE	Austria
AC Withstand + PD	400 kV	XLPE	Sweden
AC Withstand + PD	220 kV	Subsea	Belgium



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