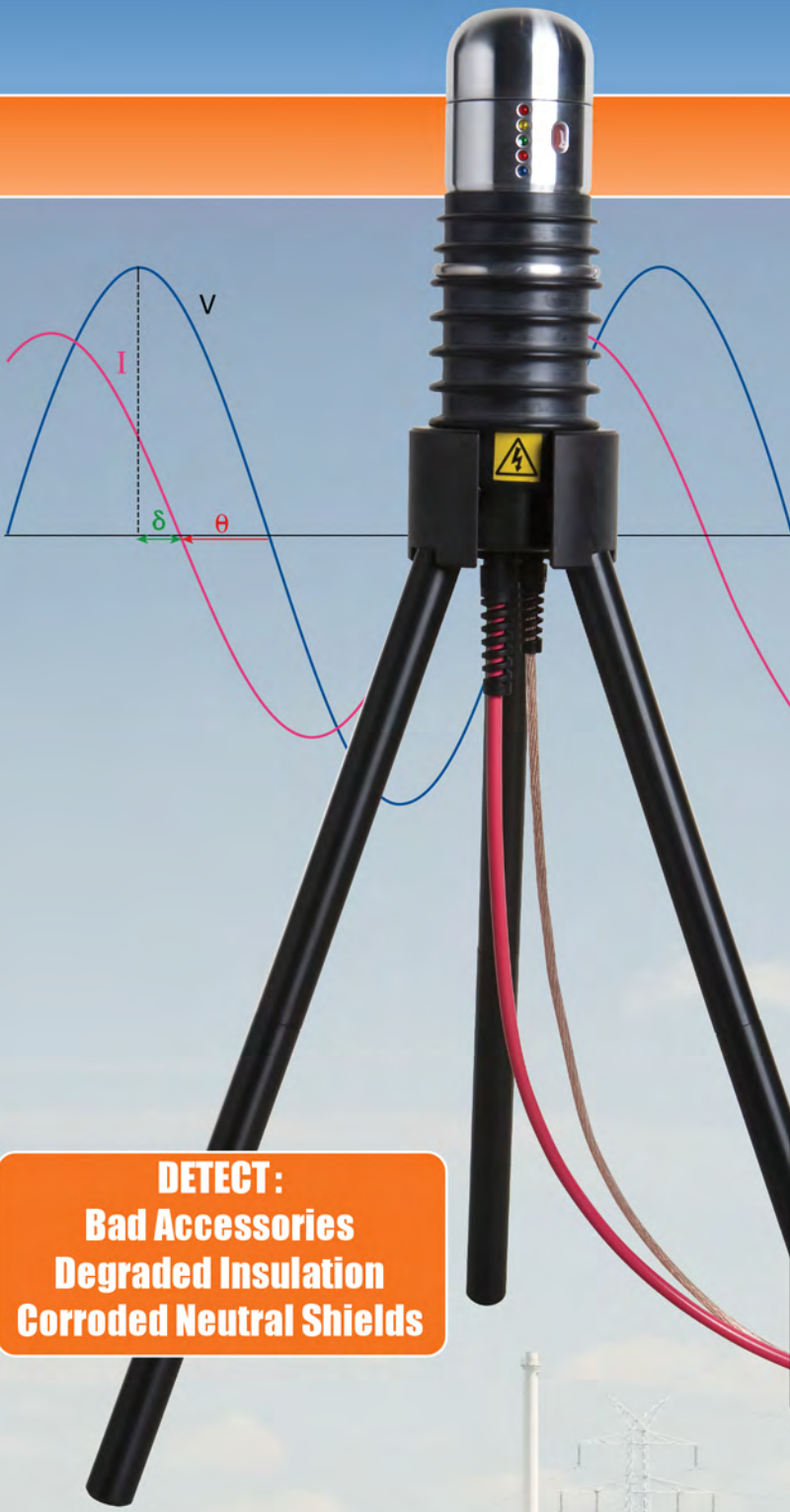


Tan Delta Diagnostic Testing System

TD SERIES



DETECT:
Bad Accessories
Degraded Insulation
Corroded Neutral Shields



**Detect Water Tree
Degradation**



HV Diagnostics
INC.

BACKGROUND/APPLICATION

Tan Delta –often referred to as Dissipation Factor or Power Factor – is an excellent diagnostic test that provides an indication as to the quality of the dielectric insulation used in electrical apparatus. By analyzing the dielectric losses in the insulation, the TD Series of test instruments provide the testing engineer with a versatile high voltage diagnostic system that is suitable for testing MV cable such as XLPE, EPR, PE and PILC and a variety of other electrical apparatus such as capacitors, transformers and rotating machines.

For Medium Voltage cables, Tan Delta measurements are the most effective and widely used diagnostic method for detecting water trees and water degradation, the most common aging mechanism found in extruded insulated cables. These degradation mechanisms often go undetected with other common diagnostic techniques such as Partial Discharge. Tan Delta tests are often performed at test voltages below the normal operating voltage of the device under test – minimizing the risk of a cable insulation failure that could otherwise occur during a normal “hipot” or elevated voltage test performed on a weak or aged insulation. Insulation defects can be detected before they cause the cable to ultimately fail in service.

In addition, the Tan Delta diagnostic measurement can be combined with

an acceptance or maintenance VLF withstand test standard to provide an intelligent or SMART VLF test. By analyzing the Tan Delta information in real time, the test engineer can limit the testing time on cables demonstrating good characteristics while maximizing the testing time on cables demonstrating poor insulation characteristics. Likewise, the operator can avoid test failures by detecting highly degraded cables at test voltages at or below the normal operating voltage.

The test engineer gains an enhanced understanding as to the remaining life of their cable asset infrastructure, so as to better plan and prioritize their cable replacement / rejuvenation program and thereby improve their overall reliability.



WIRELESS TECHNOLOGY

PRODUCT DESIGN/DESCRIPTION

The TD series of versatile, portable tan delta measuring systems are the smallest, lightest, most accurate portable TD instruments available. They connect directly to the HV Diagnostics - HVA series of VLF/DC test systems. The TD diagnostic test results are measured quickly and efficiently, taking no more than a few minutes to complete a full test, providing a simple and effective means to perform routine acceptance or maintenance testing on electrical systems.

All TD instruments use universally available C-type alkaline or rechargeable batteries that last up to 10 hours. All models also utilize the widespread Bluetooth™ wireless technology to transmit test results directly to a laptop or PC, thus dramatically eliminating the number of cables, power supplies and grounding connections required for correct operation and hookup.

Five bright LEDs on the head of the unit provide local information about the status of communication, battery power and TD evaluation.

TD Data Collection, Analysis and Reporting Software

The TD Control Center software is the heart of the TD test data collection, analysis and report generation. The Software is supplied free with every TD test instrument and software upgrades are also made available at no charge to our customers.

The TD Control Center is simple to setup and easy to use on any Windows™ compatible PC/Laptop with TD test data being available within about a minute of commencing a test – most other instruments on the market take several minutes to start recording valid TD test results.

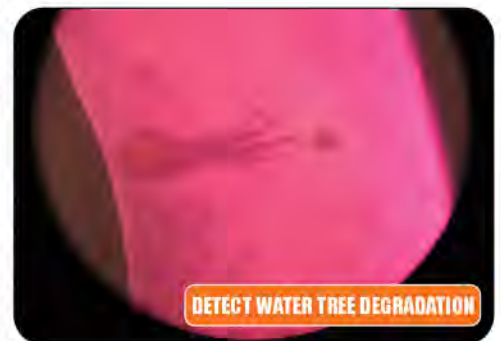
All 3 phases are recorded and displayed in one electronic file allowing for easy comparison and evaluation. After the completion of each voltage cycle, a new TD test data point is captured and tabulated by the software. The TD test data is also displayed as a function of voltage and time in graphical format. In addition, capacitive load, charging current, applied voltage, TD standard deviation as well as the voltage and current waveform can all be displayed and recorded with the associated date and time stamp.

Automatic Reporting:

With some test instruments on the market, you spend more time generating a test report than you do performing the actual physical test. At the click of a mouse, the Tan Delta Control Center generates a report within seconds of completing a test in either a summarized single page or detailed multiple page format. Each TD test can be saved electronically in PDF, CSV or XML Excel™ file format. TD Test reports can then easily be stored, emailed, printed or additional analyzed.



HVA SERIES
VLF POWER SUPPLY



DETECT WATER TREE DEGRADATION



AUTOMATIC TEST REPORTING

TD Report for Phase A, X6
System used SN: GH0300.06A003

Start 8/5/2006 3:11:02 PM
Mean (11): TD 0.5 E-3, Std Dev. 0.00 %, 1.9 kVrms, 0.055 mA, 0.1 Hz, 46 nF

#	TD [E-3]	Voltage [rms]	Current [mA]	Load Cap.	Duration
1	0.5	1.9 kV	0.055 mA	46 nF	0 min
2	0.5	1.9 kV	0.055 mA	46 nF	0 min
3	0.5	1.9 kV	0.055 mA	46 nF	0 min
4	0.5	1.9 kV	0.055 mA	46 nF	0 min
5	0.5	1.9 kV	0.055 mA	46 nF	0 min
6	0.5	1.9 kV	0.055 mA	46 nF	0 min
7	0.5	1.9 kV	0.055 mA	46 nF	1 min
8	0.5	1.9 kV	0.055 mA	46 nF	1 min
9	0.5	1.9 kV	0.055 mA	46 nF	1 min
10	0.5	1.9 kV	0.055 mA	46 nF	1 min
11	0.5	1.9 kV	0.055 mA	46 nF	1 min

Start 8/5/2006 3:13:28 PM
Mean (15): TD 0.5 E-3, Std Dev. 0.00 %, 3.9 kVrms, 0.111 mA, 0.1 Hz, 45 nF

#	TD [E-3]	Voltage [rms]	Current [mA]	Load Cap.	Duration
1	0.5	3.9 kV	0.111 mA	45 nF	0 min
2	0.5	3.9 kV	0.111 mA	45 nF	0 min
3	0.5	3.9 kV	0.111 mA	45 nF	0 min
4	0.5	3.9 kV	0.111 mA	45 nF	0 min
5	0.5	3.9 kV	0.111 mA	45 nF	0 min
6	0.5	3.9 kV	0.111 mA	45 nF	0 min
7	0.5	3.9 kV	0.111 mA	45 nF	1 min
8	0.5	3.9 kV	0.111 mA	45 nF	1 min
9	0.5	3.9 kV	0.111 mA	45 nF	1 min
10	0.5	3.9 kV	0.111 mA	45 nF	1 min
11	0.5	3.9 kV	0.111 mA	45 nF	1 min
12	0.5	3.9 kV	0.111 mA	45 nF	1 min
13	0.5	3.9 kV	0.111 mA	45 nF	2 min
14	0.5	3.9 kV	0.111 mA	45 nF	2 min
15	0.5	3.9 kV	0.111 mA	45 nF	2 min

Start 8/5/2006 3:15:54 PM
Mean (13): TD 0.5 E-3, Std Dev. 0.00 %, 5.9 kVrms, 0.168 mA, 0.1 Hz, 45 nF

#	TD [E-3]	Voltage [rms]	Current [mA]	Load Cap.	Duration
1	0.5	5.9 kV	0.168 mA	45 nF	0 min
2	0.5	5.9 kV	0.168 mA	45 nF	0 min
3	0.5	5.9 kV	0.168 mA	45 nF	0 min
4	0.5	5.9 kV	0.168 mA	45 nF	0 min
5	0.5	5.9 kV	0.168 mA	45 nF	0 min
6	0.5	5.9 kV	0.168 mA	45 nF	0 min
7	0.5	5.9 kV	0.168 mA	45 nF	1 min
8	0.5	5.9 kV	0.168 mA	45 nF	1 min
9	0.5	5.9 kV	0.168 mA	45 nF	1 min
10	0.5	5.9 kV	0.168 mA	45 nF	1 min
11	0.5	5.9 kV	0.168 mA	45 nF	1 min
12	0.5	5.9 kV	0.168 mA	45 nF	1 min
13	0.5	5.9 kV	0.168 mA	45 nF	2 min

HVA TD Report Summary
X6

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Report Information

Cable / Line ID: X6

System Used: GH0300.06A003

Test Start: 8/5/2006 3:11:02 PM

Station / Location: Station HVD

To: MAIN GEAR

End Device: SIEMENS MAIN BREAKER

From: SWITCHYARD

Comment: HOT DRY

Device Under Test: Cable

DUT Voltage Rating: 15.0 kV

Length: 750 FEET

Size: 400MCM

Insulation Type: Other

Measurement Type: Maintenance

Manufacturer: Cable Co

Company: HV Diagnostics

Operator: CG

Region: ATL

Work Order: 1234

Phase A Summary: 0.1 Hz, 45.5 nF

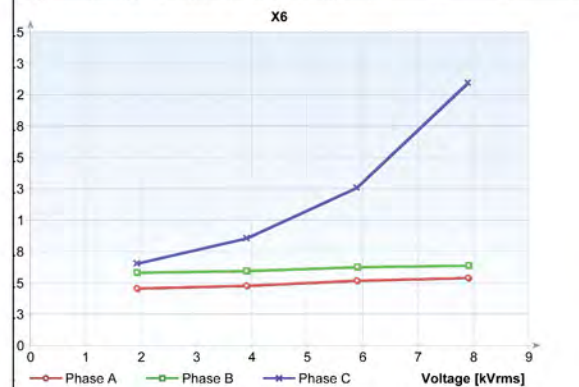
Voltage [kVrms]	1.9	3.9	5.9	7.9		
TD Value [E-3]	0.5	0.5	0.5	0.5		
Std. Dev. [%]	0.00	0.00	0.00	0.00		

Phase B Summary: 0.1 Hz, 40.2 nF

Voltage [kVrms]	1.9	3.9	5.9	7.9		
TD Value [E-3]	0.6	0.6	0.6	0.6		
Std. Dev. [%]	0.00	0.00	0.00	0.00		

Phase C Summary: 0.1 Hz, 40.6 nF

Voltage [kVrms]	1.9	3.9	5.9	7.9		
TD Value [E-3]	0.7	0.9	1.3	2.1		
Std. Dev. [%]	0.00	0.00	0.00	0.01		



TD30 - TD60 - TD90

Technical Data

Technical Data for TD Range of Diagnostic Testing Equipment

Model		TD30	TD60	TD90
Ordering Information (Part #)		700 003	706 003	709 003
Power Supply		2 "C" Type Batteries		
Rated Operating Voltage	RMS: Peak:	1-23kV 33kV	1-44kV 62kV	1-64kV 90kV
Voltage Measurement	Resolution: Accuracy:	0.1kV 1% (of reading)		
Current Measurement	Resolution: Accuracy:	1µA RMS 1% (of reading)		
Frequency Measurement	Range: Resolution:	0.01 to 0.1Hz 0.01Hz		
Tan Delta / Dissipation Factor Measurement	Resolution: Accuracy >15nF: <15nF:	1×10^{-5} $\pm 1 \times 10^{-4}$ $\pm 3 \times 10^{-4}$		
Minimum Load		5nF		
Weight		7 lbs / 3 kgs	11 lbs / 5 kgs	24 lbs / 11 kgs
Dimensions	(Length x Diameter)	9.5" x 3.5" / 240 x 85mm	18" x 5" / 450 x 120mm	26" x 5" / 660 x 120mm
Computer Interface		Bluetooth™		
Accessories Included		Integrated HV and Grounding Cable Bluetooth USB Dongle TD Control Center Software Operating Manual Corona Protection		
Standards	Shock: Vibration: EMC: Safety:	IEC68-2-27 IEC68-2-6 IEC6100-4-2, IEC6100-4-4, EN55011 EN60950, EN50191, EN61010-1		
Environmental	Storage: Operating: Humidity:	-13°F to 158°F / 25°C to 70°C 23°F to 113°F / -5°C to +45°C 80% RH non-condensing		

Note: Due to continuous development the information detailed in this document may change without notice.



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