

# Water Termination Systems



## Testing Applications

Perform routine and type testing on shielded high voltage cables including partial discharge measurements, impulse voltage testing, and tan delta (loss factor) measurements.



## Temporary Cable Test Terminations

The cable is prepared in the same way as for slip-on terminations; i.e., by stripping the cable to the outer semiconducting layer and removing the outer semiconducting layer. The WTS series includes terminations from 100 kV to 800 kV for a maximum cable diameter of 180 mm over the outer semiconducting layer. Since the WTS series offers excellent partial discharge performance, sensitive PD measurements may be performed up to the rated voltage of the terminations. In conjunction with a PD detector with fault location capability, precision defect location along the length of the cable is possible. The tan delta measurement on extruded cables poses great demands on measurement techniques due to the very low tangent delta values. Reliable loss factor measurement with the tangent delta bridge is facilitated by the tangent delta probe of the water terminations, which results in a shielded measurement bypassing stray leakage currents which affect measurement results.

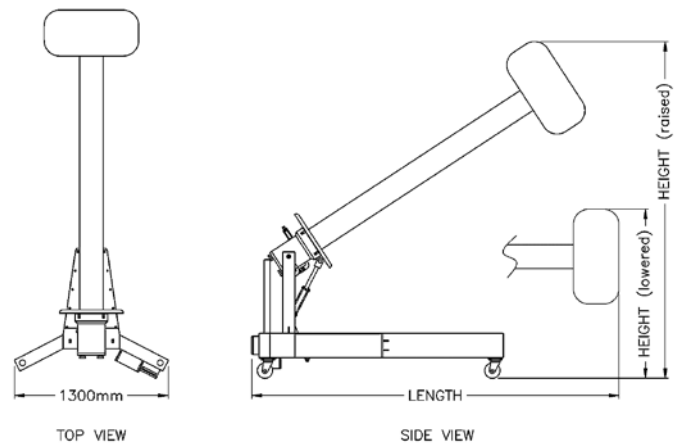
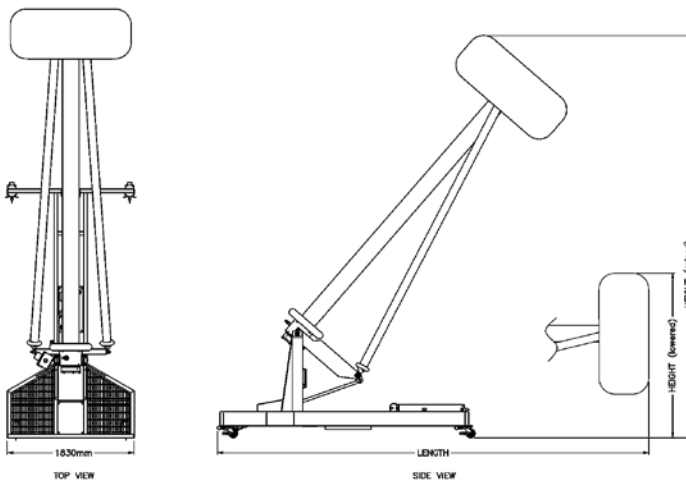
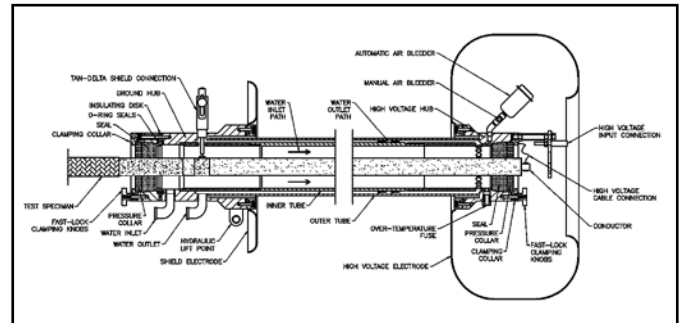
A single water termination consists of a pair of concentric fiberglass tubes through which precisely regulated de-ionized water is circulated. The diagram represents the cross section of a termination with the main components identified. With a test specimen properly installed in the termination, the water passes from the ground end of the assembly, along the length of the cable to the high voltage end, and then returns along the exterior cross section of the tubes to exit the termination at the ground end.

The characteristics of the water, including such parameters as its conductivity, flow rate, and temperature are controlled via the water conditioning unit. The purpose of the deionized water is to provide a voltage gradient along the length of the fiberglass tubes in order to decrease or eliminate voltage stress (and in turn partial discharge) near the ends of the conductor and points at which the cable passes through the grounded portions of the test equipment.

Water with too low of a conductivity will not grade the voltage away from the high voltage electrode, which results in an area of high electric field stress. Water with too high of a conductivity will result in an increase in water temperature due to losses generated by increased current flow in the water. Because increased temperature results in an increase in conductivity, the system then has the likelihood of becoming unstable, because the water conditioning unit does not contain the capacity to cool the water to below the initial circulating temperature. For this reason, the water terminations must be operated according to the specified conductivity range, which represents the minimum and maximum water conductivities for a variety of cable diameters up to rated test voltage.

## Design Features

- Short stripping lengths for minimum cable waste
- Robust design for years of dependable service
- Casters and pull handles for quick and easy maneuvering
- Hydraulic lift system, motorized or manual
- Drip-free quick connections
- Tangent delta probe



## Water Conditioner

Designed for use with cable terminations that use water as the resistive medium.

The major components of the conditioning unit consist of a process water holding tank, a de-ionization tank, brine water tank (used to raise water conductivity), water pump, water to water heat exchanger, connections for external cooling water, connections for two cable terminations, and control unit.

A Programmable Logic Controller (PLC-based controls) is used to control the various valves, monitor flow rates, pressures, and temperatures of each termination circuit, monitor/adjust the conductivity of the water, and monitor the flow in the internal and external cooling circuits.

An interlock circuit is provided for the customer to wire into their high voltage circuit. The interlock circuit opens when a condition exists that may cause damage to the terminations, cable, etc.; such as no or low flow, over temperature, or conductivity out of range. A separate interlock circuit is provided for each test mode as described below.

Two operating modes are available, AC Test mode and Impulse Test mode.

AC testing of HV plastic insulated cables requires PD free terminations on the cable ends. De-ionized water provides a voltage gradient along the length of the cable terminations in order to decrease or eliminate voltage stress that can cause partial discharges.

In the AC Test mode, de-ionized water is circulated from the process water holding tank, through the cable terminations, and then back into the conditioner. The returning process water then flows through the heat exchanger (to cool the returning water, if needed) and then either through the de-ionization tank (if conductivity is too high) or directly into the holding tank. To conserve water, the cooling water is only circulated through the heat exchanger as needed. After testing is complete, the conditioner will empty the cable terminations back into the process water holding tank.

During Impulse testing, small amounts of brine can be added to the process water from the brine tank to increase the conductivity to the desired level.

## Design Features

- Fully automated operation
- 400 L reservoir tank
- Graphical HMI
- Self-priming pumps
- Motorized ball valves
- Easy change out deionizing resin tank
- Remote control operation
- Master/slave operation of multiple water conditioners

## Specifications

<b>Input Power</b>	240 VAC, 50/60 Hz, 20 Amperes
<b>Cooling Power</b>	120 kW or 90kW
<b>Duty Cycle</b>	Limited only by Process Water Upper Temperature Limit
<b>Maximum Ambient Temperature</b>	<40°C (104°F)
<b>Process Water Upper Temperature Limit</b>	54°C (130°F)
<b>Process Water Tank Volume</b>	400 Liter (105 Gal)
<b>Resistive Medium</b>	De-ionized water
<b>Conductivity Range of Process Water</b>	0.1 to 1.0mS/cm (AC Mode)
<b>Typical Lifetime of Deionizing Resin</b>	3-6 months (Depends on Contaminant Levels)
<b>Heat Exchanger</b>	Water to Water Type
<b>Ionized Water Tank Volume</b>	76 Liter (10 Gal)
<b>Recommended Water</b>	Distilled Water
<b>Cooling Water Requirements (Customer Supply)</b>	
<b>Maximum Allowed Temperature</b>	20°C (68°F)
<b>Minimum Flow Rate</b>	45 L/min (11.9 Gal/min) Alarm if <56 L/min (<15 Gal/min)
<b>Minimum Allowed Pressure</b>	2 Bars (30 psi)
<b>Maximum Allowed Pressure</b>	5 Bars (73 psi)
<b>Dimensions</b>	62" L x 56" W x 96" H (1575 mm L x 1422 mm W x 2438 mm H)
<b>Weight</b>	1540 lbs (699 kgs)



Model WTS100-15



Model WTS250-140-160



Model WTS300-115 (front)



Model WTS300-115 (back)

Model <sup>1</sup>	Cable Diameter	Rated Voltage		Partial Discharge	Length	Strip Length	Height	Weight	Water Conditioner Model
		AC kV	LI	At Un					
<b>WT100-115</b>	115 mm	100	275	<2pC	1760 mm 69"	1590 mm 81"	2060 mm 573 lbs.	260 kgs	<b>WC90(1)</b>
<b>WT100-140</b>	140 mm	100	275	<2pC	1760 mm 69"	1590 mm 81"	2060 mm 584 lbs	265 kgs	<b>WC90(1)</b>
<b>WT200-115</b>	115 mm	200	400	<2pC	2280 mm 89"	2040 mm 90"	2300 mm 595 lbs	270 kgs	<b>WC90(1)</b>
<b>WT200-140</b>	140 mm	200	400	<2pC	2280 mm 89"	2040 mm 90"	2300 mm 606 lbs	275 kgs	<b>WC90(1)</b>
<b>WT300-115</b>	115 mm	300	700	<2pC	2280 mm 89"	2530 mm 105"	2670 mm 617 lbs	280 kgs	<b>WC90(1)</b>
<b>WT300-140</b>	140 mm	300	700	<2pC	2280 mm 89"	2530 mm 105"	2670 mm 617 lbs	280 kgs	<b>WC90(1)</b>
<b>WT350-115</b>	115 mm	350	800	<2pC	3050 mm 120"	2750 mm 110"	2795 mm 634 lbs	288 kgs	<b>WC90(1)</b>
<b>WT350-140</b>	140 mm	350	800	<2pC	3050 mm 120"	2750 mm 110"	2795 mm 639 lbs	290 kgs	<b>WC90(1)</b>
<b>WT400-115</b>	115 mm	400	950	<2pC	3300 mm 129"	3010 mm 115"	2930 mm 661 lbs	300 kgs	<b>WC120(1)</b>
<b>WT400-140</b>	140 mm	400	950	<2pC	3300 mm 129"	3010 mm 115"	2930 mm 661 lbs	300 kgs	<b>WC120(1)</b>
<b>WT500-140</b>	140 mm	500	1200	<2pC	3825 mm 150"	3470 mm 129"	3285 mm 750 lbs	340 kgs	<b>WC120(1)</b>

Note: Above units may be equipped with a manual hydraulic or a motorized hydraulic lift

Model <sup>1</sup>	Cable Diameter	Rated Voltage		Partial Discharge	Length	Strip Length	Height	Weight	Water Conditioner Model
		AC kV	LI	At Un					
<b>WT600-180<sup>2</sup></b>	180 mm	600	1400	<2pC	5120 mm 201"	3950 mm 192"	4890 mm 1918 lbs	870 kgs	<b>WC90(2)</b>
<b>WT700-180<sup>2</sup></b>	180 mm	700	1600	<2pC	5660 mm 222"	4430 mm 210"	5340 mm 1962 lbs	890 kgs	<b>WC90(2)</b>
<b>WT800-180<sup>2</sup></b>	180 mm	800	1700	<2pC	6200 mm 244"	4900 mm 228"	5800 mm 1006 lbs	910 kgs	<b>WC90(2)</b>

Note <sup>1</sup>: Additional models available upon request

Note <sup>2</sup>: All units are equipped with a motorized hydraulic lift

## Recommended Spare Parts

- Reserve Resin Bottles
- Seal Casting Resin
- Replacement Inner Tubes
- Replacement Outer Tubes
- Spare Water Valves



**PHENIX**  
TECHNOLOGIES

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