Tank-Type Variable Frequency AC Resonant Test Systems
above 100 kV

PHENIX TECHNOLOGIES

Testing Applications

Variable Frequency Resonant Test Systems are generally used where a lightweight, transportable unit is a requirement. Primary application is cable and rotating machine testing. Other test objects which are capacitive in nature such as cables, generators, and motors may also be tested. Non-mobile systems for factory or laboratory use are also available.

- **Low weight,** transportable, **easy to set-up**
- **Pure sinusoidal** output voltage
- Complies with **IEC 60517**, **IEC 62271-203,** and **IEC's frequency range** of **20** to **300 Hz**
- Virtually **maintenance free**, no movable internal parts

Theory of Operation

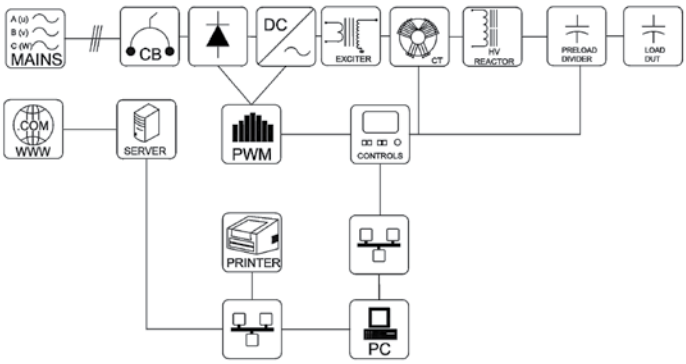
A Variable Frequency Resonant Test System takes advantage of resonance theory. To achieve resonance, the capacitive reactance (test object) has to equal the inductive reactance (high voltage reactor). In a Variable Frequency Resonance System, the reactor is non-variable; therefore, the frequency of the circuit is adjusted until resonance is achieved. This adjustment of the resonant circuit is commonly referred to as "tuning". Once resonance has been achieved only the resistive (real) losses in the circuit have to be supplied. The output voltage and the incoming power drawn from the mains is a function of the "Q" or quality factor of the circuit. The higher the system Q, the lower the incoming power requirement.

CABLE | CIRCUIT BREAKER VACUUM INTERRUPTER | GENERATOR G | GIS SWITCHGEAR | INSULATION MATERIALS | MOTOR

Tank-Type Reactors

Phenix Technologies' reactors are constructed in a grounded, painted steel tank encapsulating the oil insulated reactor coils. One of the main features of tank-type reactors is the capability to offer multiple output taps via a tap switch or multiple output bushings. When multiple reactors are connected in parallel, very high currents can be achieved. The unique reactor coil design is manufactured of radially laminated magnetic cores enclosed by copper windings. The use of high quality materials results in a low loss, high Q reactor. This design provides a lightweight and transportable test system. Tank-type reactors operate in series resonance mode.

System Diagram VRTS Tank Type



Precision Measurement System

A high precision measuring system is designed to enable accurate measurements of voltages and currents. The metered information is displayed on the Human Machine Interface (HMI). The values displayed on the HMI are performed as a function of the Programmable Logic Controller (PLC).

Our systems function in compliance with IEC 60060, IEEE 4, and other recognized national and international industry testing standards.

Calibration Certificate traceable to NIST (National Institute of Standards and Technology, USA) is issued with every system. ISO17025 traceable voltmeter calibration is available as an option upon request.

Electronic Power Regulator

At the heart of the system is a specially designed electronic regulator that converts the mains service into a variable voltage, variable frequency power source that is ideally suited for use with a Variable Frequency Resonant Test System. The excellent resolution and frequency stability maintain a reliable, controllable resonant test circuit.

High Voltage Protection

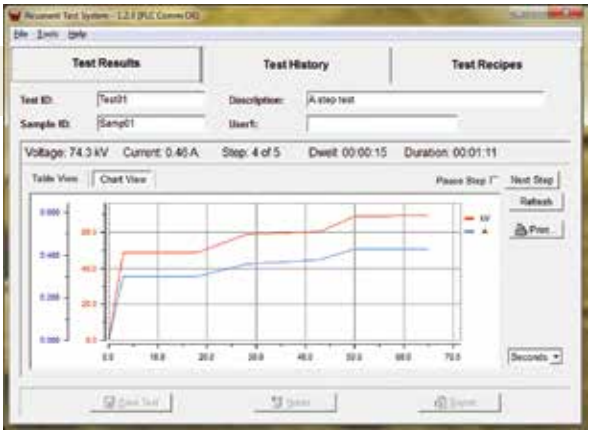
High voltage protection or dampening impedances are supplied to provide protection to the system when a test object breakdown or flashover occurs. Fast transients are blocked and shunted to ground without causing damage to the high voltage components.

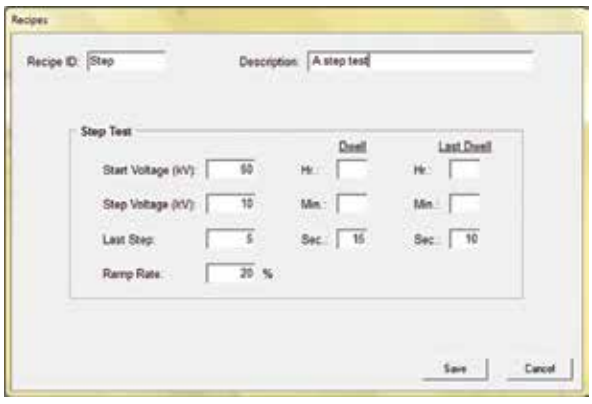
Designed for Transportation and On-Site Testing

Testing of rotating machinery requires a system that is easily transported and packaged for frequent movement. Transport containers, sturdy shipping boxes and accessories such as shielded high voltage cables for the Variable Frequency Resonant Test System can be supplied by Phenix Technologies.

Advanced Controls

Phenix Technologies uses the latest development in computer-assisted controls. Our configuration creates ease in set-up and simplicity in testing. The test system features a full-color, liquid crystal display and Ethernet port to select automation modes through a remote personal computer interface. The controls allow the operator to easily perform repeatable testing. All test data is collected by the data acquisition software and stored for later recall or test report generation.





HV Tank Type Reactors

(Sizes and weights are approximate for standard designs and may vary with custom orders)

Model	VOLTAGE Tap 1	Optional Tap 2	Max kVA	Length (m)	Width (m)	Height (m)	Weight (tons)
8TX160-13000	160 kV	Optional	13000	2.54	2.92	2.58	22.5
Load 30 Hz	2.69 µF	–	Duty Cycle 1 Hour On / 1 Hour Off, 3 Cycles per Day				
Load 50 Hz	1.61 µF	–					
Load 60 Hz	1.35 µF	–					
8TX180-22000	180 kV	Optional	22000	2.54	2.32	2.58	26.8
Load 30 Hz	3.60 µF	–	Duty Cycle 1 Hour On / 1 Hour Off, 3 Cycles per Day				
Load 50 Hz	2.16 µF	–					
Load 60 Hz	1.80 µF	–					
8TX265-6000	265 kV	160 kV	6000	7.0	3.5	2.2	16.4
Load 30 Hz	0.45 µF	1.25 µF	Duty Cycle 1 Hour On / 1 Hour Off, 6 Cycles per Day				
Load 50 Hz	0.26 µF	0.74 µF					
Load 60 Hz	0.22 µF	0.62 µF					
8TX265-13000	265 kV	160 kV	13000	2.54	2.92	2.58	22.5
Load 30 Hz	0.98 µF	2.69 µF	Duty Cycle 1 Hour On / 1 Hour Off, 6 Cycles per Day				
Load 50 Hz	0.59 µF	1.61 µF					
Load 60 Hz	0.49 µF	1.34 µF					
8TX265-22000	265 kV	160 kV	22000	2.54	2.92	2.58	31.7
Load 30 Hz	2.69 µF	4.55 µF	Duty Cycle 1 Hour On / 1 Hour Off, 3 Cycles per Day				
Load 50 Hz	1.61 µF	2.73 µF					
Load 60 Hz	1.35 µF	2.27 µF					

DIMENSIONS & WEIGHT	Length inches (mm)	Width inches (mm)	Height inches (mm)	Weight lbs (kgs)
Power Supply	85 (2159)	38 (965)	80 (2032)	3200 (1451)
Control Console	44 (1118)	30 (762)	32 (813)	175 (79)

Other designs available upon request

* Current Limited Tap

** Load Indication does not include Divider Capacitances

Multiple Taps / Accessories / Mobile Control Rooms / Transportation Trailers

PHENIX can provide accessories to complete your on-site test system; such as, removable bushings, plug-in high voltage cables, transport trailers, accessory trailers. The ability to add multi output taps from the same reactor significantly extends the testing capability of the system. PHENIX reactors are typically compatible with systems of similar design and may be added in parallel to extend the test range of the system. Control rooms are an option which provide a safe and comfortable environment for the operator.

High Voltage Filters

High Power Tank-type Resonant Test Systems are typically equipped with high voltage filters which facilitate highly sensitive PD measurements. The filters are designed to use high quality low parasitic capacitance design which offer excellent high frequency blocking characteristics. Filter networks of one or stages may be employed to offer additional noise reduction. The filters are connected to the output of the Resonant Test Set and are electrically located between the reactor and the load.

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