Phenix Technologies offers a complete line of the most advanced AC Dielectric Test Systems with voltage and power ratings to meet your testing requirements.
Phenix Technologies AC Dielectric Test Systems are designed to perform high voltage AC tests by measuring dielectric breakdown and dielectric strength of electrical equipment and insulating materials at commercial power frequencies. Our systems function in compliance with IEC 60060, IEEE 4, IEC 60270 and other recognized national and international industry testing standards.

**Products requiring dielectric testing include:**
- Rotating Machines
- Cable Joints/Splices
- Power Cables
- Switchgear (Air, Gas, Oil)
- Bushings
- Transformers, Shunt Reactors
- Instrument Transformers
- Fuses
- Lightning Arrestors
- Insulation Materials (Oil, Paper)
- Connectors
- Power Capacitors
- HV Components
- Coils
- Insulators
- Circuit Breakers
- Transmission Line Hardware
- Personal Protective Equipment (Rubber Goods) for Live Work

Phenix Technologies offers a variety of physical configurations suitable for many installation requirements and options to add significant testing capabilities. Our test systems are equipped with state-of-the-art programmable logic controllers with PC-based software to provide remote control, data acquisition, and automation capabilities for refined results.

**Design Categories**

Phenix Technologies AC Dielectric Test Systems are produced in two general design categories: **Conventional or Compensated**

**Conventional** type designs are recommended for lower power requirements in which compensation is uneconomical or when the test object contains a large resistive component. The transformer and the regulator are rated for 100% of the test set’s output power. It is the most versatile system and will test virtually any type of load.

In a **Compensated** design, the main power in the regulator is reduced with respect to the output power. Most commonly this is achieved through use of a low voltage reactor connected across the primary windings of the high voltage transformer. Primary compensation is typically variable in steps and can offer a near-perfect compensation.

**Recognized Worldwide for Leadership and Innovation in Technology**

Phenix Technologies has supplied AC Dielectric Test Systems for over 40 years. As a worldwide leader in high voltage, high current, and high power testing equipment, we have earned a reputation for high quality and custom-built equipment to meet our customers’ exact requirements. Phenix is ISO 9001:2008 compliant which ensures high quality processes in both engineering and production to give our customers superior product reliability and years of service.

**Phenix Technologies offers:**
- Stand-alone, modular, caster-, truck-, trailer-, or skid-mounted systems
- Safety features to protect personnel and equipment
- Calibration Certificate traceable to NIST issued with every unit
- Detailed operator’s manual
- Long-term customer support from fully experienced and knowledgeable staff

**Safety and Design Features**

Phenix designs in substantial safety features to protect personnel and equipment from potential injury, loss, or damage. To protect against flashovers or short circuits, our units have an adjustable electronic overload circuit. The circuit has a total response time of less than 30 milliseconds. The test sets have an input circuit breaker and backup overload protection in the primary input of the high voltage transformer. All test sets have additional standard protections including:
- Main power circuit breaker on regulator cabinet
- Operator key start
- Zero start interlock
- Emergency off mushroom pushbutton
- Slow and fast acting overload protection
- Surge protection on all meters and relays
- Overvoltage and overcurrent controls
- External interlock protection
- Controls in metal cabinet with provision for separate ground lead
- Overload circuit adjustable from 10% to 110% of rated current; includes indication with reset
The AC Dielectric Test System consists of three main components: the controls, the power regulator, and the high voltage transformer. Our standard control package incorporates a state-of-the-art intuitive control system with a touch screen. The power regulator is based on our line of rugged and reliable variable auto transformers. The high voltage transformer is constructed of copper windings surrounded by a high quality steel core. The resulting system is a high quality design that provides many years of reliable service.

Phenix Technologies uses the latest development in computer-assisted controls. Our configuration creates ease in setup and simplicity in testing. The test system features a full-color touch screen liquid crystal display and Ethernet port to select automation modes through a remote personal computer interface. Functions and metering include:

- Auto Ranging Voltmeter
- Bar graph displays % kV
- Auto Ranging Current Meter
- Bar Graph displays % A
- Peak Memory Voltmeter
- Failure Memory Voltmeter
- Peak Memory Current Meter
- Auto Voltage
- Dwell Timer
- Auto Step
- Auto Sequence
- Over Voltage
- Over Current
- Duration Timer
- Motorized Regulator
- Motorized Tap Selector
- Variable Ramp Rate
- Burn Mode (optional)

Also included are calibration and service modes. All adjustments needed for yearly recalibration are simply made by adjusting a few numbers in the software. The service mode assists and simplifies maintenance, and helps in the diagnosis of failed components in the rare cases that may be necessary.
A high precision measuring system is designed to enable accurate measurement of voltages and currents. The metered information is displayed on the Operator Interface Panel. The values displayed on the Operator Interface Panel are performed as a function of the programmable logic controller (PLC). The following metering measurements are displayed:

**AC Voltage** is measured by means of peak responding circuitry and is displayed in its peak/√2 value. **Accuracy:** ± (0.8% of Reading + 0.2% of Range to least significant digit (LSD))

**AC Current** is measured by means of true RMS conversion. **Accuracy:** ± (0.8% of Reading + 0.2% of Range to LSD)

**Duration and Dwell Timers.** Time is displayed in an HOURS:MINUTES:SECONDS format from 0000:00:00 to 9999:59:59.

**Maximum Test Voltage Memory Meter.** The maximum applied test voltage level is retained and displayed.

**Failure Voltage Memory Meter.** The applied test voltage level at the time of a specimen failure is retained and displayed.

**Maximum Current Memory Meter.** The maximum current level reached during a test is retained and displayed.

Specialty test applications may be included as options within our designs. Please consult one of Phenix Technologies Sales Representatives for further information.

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**Software**

Phenix Technologies PC based software provides innovative features through a user friendly interface. The operator enters specific test parameters, or recalls previous test “recipes” for easy test duplication. Test results can be displayed, stored to a database, or printed.

**Test Results**

Test results can be viewed in table or chart format and show real-time voltages, current, step, dwell, and duration data. Report generating options allow for a concise or detailed print-out of data.

**Test History**

The software collects all saved test results in a database for easy recall and review. Search, sort, and printing of previous test results can be performed.

**Test Profiles**

Create new test profiles or “recipes” by selecting a custom test, cycle test, or step test and then choosing a tap value. A screen opens to enter test criteria desired, and the test profile is saved, and may be run or downloaded. Quickly recall previous profiles by test type, description, or ID value.
Voltage Regulator

The regulator is an air-insulated, variable autotransformer. Housed in a rugged steel cabinet, the regulator may contain the operator control panel to save space and simplify setup procedures. The regulator cabinet includes a main input circuit breaker and a contactor for high voltage ON/OFF. It is also designed with a limit switch to provide zero start interlock. The cabinet also may be ordered with options such as a writing desk for operator personnel.

SIZE OF THE POWER REGULATOR
(by output kVA based on 1 hour ON/1 hour OFF Duty Cycle)

<table>
<thead>
<tr>
<th>Input</th>
<th>Output Current</th>
<th>L</th>
<th>W</th>
<th>H</th>
<th>Weight</th>
<th>L</th>
<th>W</th>
<th>H</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>208 V</td>
<td>230V</td>
<td>20.3 kVA</td>
<td>22.5 kVA</td>
<td>10.1 kVA</td>
<td>11.2 kVA</td>
<td>49 A</td>
<td>98 A</td>
<td>70 A</td>
<td>24 A</td>
</tr>
<tr>
<td>400 V</td>
<td>480V</td>
<td>19.6 kVA</td>
<td>23.5 kVA</td>
<td>39.2 kVA</td>
<td>47.0 kVA</td>
<td>98 A</td>
<td>98 A</td>
<td>148 A</td>
<td>24 A</td>
</tr>
<tr>
<td>118.4 kVA</td>
<td>142.0 kVA</td>
<td>138.4 kVA</td>
<td>166.0 kVA</td>
<td>296 A</td>
<td>296 A</td>
<td>346 A</td>
<td>346 A</td>
<td>24 A</td>
<td>24 A</td>
</tr>
<tr>
<td>192.0 kVA</td>
<td>230.0 kVA</td>
<td>158.0 kVA</td>
<td>189.6 kVA</td>
<td>395 A</td>
<td>395 A</td>
<td>420 A</td>
<td>420 A</td>
<td>24 A</td>
<td>24 A</td>
</tr>
<tr>
<td>237.2 kVA</td>
<td>284.6 kVA</td>
<td>296.8 kVA</td>
<td>356.1 kVA</td>
<td>525 A</td>
<td>525 A</td>
<td>640 A</td>
<td>640 A</td>
<td>24 A</td>
<td>24 A</td>
</tr>
</tbody>
</table>

NOTE: Dimensions and weight may vary with final design.

1) Higher power regulators may be quoted upon project specific request
2) Regulator output current is calculated by multiplying the high voltage transformer output voltage x high voltage transformer output current, dividing by the input (mains) voltage and then multiplying by 1.05 to account for losses. (Voutput * Ioutput)/ Vinput)* 1.05 =Regulator Output Current. The appropriate regulator is then selected based on the current and duty cycle of the system. Regulator dimensions include control mounting.
3) If the controls are mounted in a separate control console, the height of the regulator will be reduced by approximately 5” (127mm).
4) Regulator accepts input mains voltages from 208-240V or from 380-600V.
5) Additional components such as line filters, burn chokes and compensation reactors will increase power regulator cabinet dimensions.
6) Testing in severe environmental conditions will affect the size and design of the enclosure for both the regulator and the HV transformer.
AC dielectric tests for many test specimens use high current/high power that requires a separate HV transformer. The transformer will be one of two types: a grounded (dead) steel tank with a high voltage output bushing; or a cylinder type that uses fiberglass cylinders to achieve the required high voltage isolation. Cylinder type units can be designed to be stacked to obtain either higher output voltages (series) or higher currents (parallel). Both types are filled with mineral oil.

Phenix Technologies transformers use copper windings and a high permeability steel core to provide units with a long, reliable, and efficient service life.
The cascaded cylinder type transformers are contained in an oil-filled enclosure characterized by its cylindrical shape. The enclosure is vertically divided into three sections. Two sections are fiberglass isolating sections separated by a steel center section floating at half the transformer's potential. The core is constructed out of high quality grain oriented laminated steel surrounded by layer type copper windings. Each transformer is equipped with balancing and tertiary windings which transfer power to the next module in the cascade. The tertiary windings also allow the operation of modules in parallel without having to un-stack the cascade.

Each transformer is equipped with surge arrestors and a temperature gauge mounted in the steel section of the cylinder. For units with continuous duty cycles, either radiators or a forced oil cooling system are used to meet the extra cooling requirements. Cylinder type transformers are designed for indoor, low pollution environments.

### Interconnect Cables

Phenix Technologies supplies a shielded, multi-conductor control cable from the regulator to the transformer. Phenix includes a standard control cable of 20 feet (6m) for units up to 200 kV; 30 feet (9m) for units 200-300 kV; and 40 feet (12m) for those above 300 kV. If a separate control cabinet is ordered, a control cable from the regulator is also included. Special length control cables or power cabling are optional items. If ordered, power cables must be in compliance with local codes.

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**CASCADeD CyLINDeR Type**

<table>
<thead>
<tr>
<th>Power Ratings kVA</th>
<th>Voltage Rating kV</th>
<th>Output Current mA</th>
<th>Individual Cylinder Length</th>
<th>Individual Cylinder Weight lbs</th>
<th>Cascade Total Length</th>
<th>Cascade Total Weight lbs</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 (140)</td>
<td>500 (700)</td>
<td>500 (700)</td>
<td>49 inches</td>
<td>117 lbs</td>
<td>241 inches</td>
<td>29,320 lbs</td>
</tr>
<tr>
<td>400 (560)</td>
<td>1000 (1400)</td>
<td>1000 (1400)</td>
<td>65 inches</td>
<td>117 lbs</td>
<td>2970 lbs</td>
<td>40,785 lbs</td>
</tr>
<tr>
<td>800 (1120)</td>
<td>2000 (2800)</td>
<td>2000 (2800)</td>
<td>76 inches</td>
<td>117 lbs</td>
<td>2970 lbs</td>
<td>50,044 lbs</td>
</tr>
<tr>
<td>250 (350)</td>
<td>500 (700)</td>
<td>500 (700)</td>
<td>88 inches</td>
<td>102 lbs</td>
<td>2970 lbs</td>
<td>43,650 lbs</td>
</tr>
<tr>
<td>500 (700)</td>
<td>1000 (1400)</td>
<td>1000 (1400)</td>
<td>95 inches</td>
<td>117 lbs</td>
<td>2970 lbs</td>
<td>58,422 lbs</td>
</tr>
<tr>
<td>1000 (1400)</td>
<td>2000 (2800)</td>
<td>2000 (2800)</td>
<td>100 inches</td>
<td>117 lbs</td>
<td>2970 lbs</td>
<td>76,060 lbs</td>
</tr>
<tr>
<td>300 (420)</td>
<td>500 (700)</td>
<td>500 (700)</td>
<td>91 inches</td>
<td>126 lbs</td>
<td>2970 lbs</td>
<td>52,470 lbs</td>
</tr>
<tr>
<td>600 (840)</td>
<td>1000 (1400)</td>
<td>1000 (1400)</td>
<td>91 inches</td>
<td>126 lbs</td>
<td>2970 lbs</td>
<td>55,336 lbs</td>
</tr>
<tr>
<td>1200 (1680)</td>
<td>2000 (2800)</td>
<td>2000 (2800)</td>
<td>100 inches</td>
<td>126 lbs</td>
<td>2970 lbs</td>
<td>80,470 lbs</td>
</tr>
<tr>
<td>750 (1050)</td>
<td>1000 (1400)</td>
<td>1000 (1400)</td>
<td>108 inches</td>
<td>126 lbs</td>
<td>2970 lbs</td>
<td>84,880 lbs</td>
</tr>
<tr>
<td>1400 (2100)</td>
<td>2000 (2800)</td>
<td>2000 (2800)</td>
<td>110 inches</td>
<td>126 lbs</td>
<td>2970 lbs</td>
<td>88,390 lbs</td>
</tr>
<tr>
<td>2800 (3920)</td>
<td>4000 (5600)</td>
<td>4000 (5600)</td>
<td>119 inches</td>
<td>126 lbs</td>
<td>2970 lbs</td>
<td>91,000 lbs</td>
</tr>
<tr>
<td>800 (1120)</td>
<td>1000 (1400)</td>
<td>1000 (1400)</td>
<td>116 inches</td>
<td>126 lbs</td>
<td>2970 lbs</td>
<td>83,775 lbs</td>
</tr>
<tr>
<td>1600 (2240)</td>
<td>2000 (2800)</td>
<td>2000 (2800)</td>
<td>116 inches</td>
<td>126 lbs</td>
<td>2970 lbs</td>
<td>104,720 lbs</td>
</tr>
<tr>
<td>2400 (3360)</td>
<td>3000 (4200)</td>
<td>3000 (4200)</td>
<td>112 inches</td>
<td>126 lbs</td>
<td>2970 lbs</td>
<td>123,425 lbs</td>
</tr>
<tr>
<td>3600 (5040)</td>
<td>4000 (5600)</td>
<td>4000 (5600)</td>
<td>112 inches</td>
<td>126 lbs</td>
<td>2970 lbs</td>
<td>125,000 lbs</td>
</tr>
<tr>
<td>2400 (3360)</td>
<td>3 x 300 = 1200</td>
<td>3 x 300 = 1200</td>
<td>112 inches</td>
<td>126 lbs</td>
<td>2970 lbs</td>
<td>181,880 lbs</td>
</tr>
</tbody>
</table>

**NOTE:** Dimensions and weight may vary with final design.

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**Phenix Technologies Phone Number:** +1.301.746.8118
Optional System Components

- **Control Desk**: Added table space enhances the operator’s workstation for observing and recording test results.
- **Casters**: Enables easier movement of test system within testing area.
- **Multiple Output Taps**: To extend testing range.
- **Low Voltage Line Filters**: Installed on AC lines to prevent electromagnetic interference (EMI).
  
  Benefit: Low voltage line filters suppress high frequency noise that is present on mains. This noise which interferes with partial discharge measurements is typically generated by electronic switching devices such as motor drives, power supplies and/or ballasts for lights. The filters are high attenuation multi-stage LC filter networks that provide a typical minimum attenuation of about 80 db from 30 kHz to 20 MHz and are connected between the output of the regulator and the primary of the high voltage step-up transformer.
  
- **Double Shielded Input Isolation Transformer**: A two-winding transformer has several purposes. Among them are keeping third and multiple harmonics away from sensitive equipment; also to provide an electrostatic shield between primary and secondary windings to avoid transfer of surge/impulse voltages; softening of high frequency noise from the input side.
  
  Benefit: provides shielding to avoid surge/impulse damages, or to provide a lower level of frequency noise.
- **Burn Choke**: Current limiting choke connected in series with the primary winding offers the capability to “burn” the faults in test specimen at a controlled current. Available with rating from 25-100% of rated kVA.
  
  Benefit: Used in locating faults during cable or insulator testing.
- **High Voltage Filters**: Located between output of high voltage transformer and test circuit to prevent line borne electromagnetic interference (EMI) from passing through.
  
  Benefit: Enables sensitive partial discharge and/or RIV measurements to be made.

- **Coupling Capacitors, Injection Capacitors & Partial Discharge (PD) Measurement Systems**: Coupling capacitors allow passage of AC signals to connect in two circuits while blocking the DC component. Injection capacitors in an AC circuit are an option that permits ongoing calibration for partial discharge measurements. Partial discharge measurement is used to detect breakdown in insulating materials creating arcing or sparks when under high voltage stress.
  
  Benefit: Coupling capacitors are useful in stabilizing voltage and power flow for testing. Injection capacitors ensure continuous review of partial discharge testing. Partial Discharge measuring circuits are critical in measuring cable faults.

- **Standard Capacitors & Tangent Delta (Tan δ) Measurement Systems**: Provides the capability to perform dielectric loss measurements on cable insulation, when assessing the insulation quality of newly manufactured cables, or estimating the insulation quality in service aged cables.

- **Preload and Load Capacitors**: Provide a low loss capacitance typically connected in parallel with the object under test. The preload capacitors are typically used with units equipped with inductive reactive compensation and resistive objects under test. When used in this application, the capacitors provide reactance to compensate the primary compensation and reduce regulator/mains current demand. The other application is to provide additional fault energy/output voltage support in cases where large transients or large partial discharges are expected such as pollution or corona testing.