Perform tests on utility distribution and power transformers in accordance with IEC 60076 and ANSI / IEEE C57 standards.

- verify a manufacturer’s test and design data prior to installation
- after repair or upgrade
- when a major disruptive event occurs, such as a lightning strike
- for preventive/predictive maintenance

Testing Applications

Models Available

- TTS35
- TTS65
- TTS155
- TTS175
- TTS200
- TTS250
- TTS500
- TTS750
- TTS1000

Model TTS155
Phenix Technologies offers a complete line of Transformer Test Systems for testing distribution to small power transformers, three phase or single phase. Consisting of a variable power supply, step-up transformer, and high accuracy metering package controlled by an industrial microprocessor, the TTS series is a ready-to-test solution for a wide range of transformer testing applications.

All of Phenix Technologies’ Transformer Test Systems are built in our western Maryland facility. This includes fabrication of the cabinet, winding of the power transformer, regulator construction, assembling of the components, programming, and final pre-shipment testing. Our ISO9001 compliance ensures optimum standards of quality are met through each step of the process resulting in a superior test system with an excellent service life.

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Quality Construction Ensures Reliability

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PHENIX Transformer Test Systems are designed to perform tests in accordance with IEC 60076 and ANSI / IEEE C57.12, standards, latest edition. These tests include:

- Excitation Current Measurement
- Excitation Loss (No-Load or Core Loss)
- Impedance Voltage Measurement
- Full Load Current
- Copper Loss (Load Loss)
- Temperature Measurement (Heat Run)

Additional testing capability with optional system components include:

- Applied Potential Test
- Induced Potential Test
- Winding Resistance Measurement
- Turns Ratio and Phase Displacement
- Insulation Resistance

Design and Safety Features

- Main and control power circuit breakers
- Zero Start interlock
- Emergency off mushroom switch
- Slow-and fast-acting protective devices on power transformer, regulator, measurement system, and other critical components
- Raise and Lower pushbuttons with Off Zero indicator
- Motorized control of output voltage with adjustable rate of rise
- Motorized tap selector with indicators
- Auto-ranging wattmeter and voltmeter with direct readout
- Four-wire measurement system for accurate readings
- Test mode selector with indicator
- RMS and AVERAGE responding voltmeters, displayed simultaneously
- Provision for external security circuit with indicator
- System calibration traceable to NIST (National Institute of Standards and Technology, USA)
- Foot switch
- Flashing red warning light
- Recessed jacks for output leads
- Fork truck and overhead lifting provisions
- Two copies of operation/maintenance manual
The power regulating system of a PHENIX TTS varies between three different options. The system may be equipped with one of two types of variable transformers determined by the power rating of the test system; a lower power system utilizes a toroidal type regulator and a larger system utilizes a column type regulator. For additional detailed information on Voltage Regulators refer to PHENIX brochure #70106. The third option is a variable frequency power supply that can generate frequencies of 50/60 Hz as well as higher frequencies needed for induced testing.

Precision Power Regulation

- 10-40°C, indoor/outdoor in fair weather
- Humidity <95% non-condensing
- Altitude <3300 ft (1000 meters)

Environmental Conditions

Model TTS155 with Control Console and AC Hipot Transformer
Phenix Technologies uses the latest development in computer-assisted controls. The Human Machine Interface (HMI) allows the programming of automation features of the test set. Easy step-by-step instructions guide the operator through each test procedure. Set-up maps for each test are provided to reduce costly connection mistakes. The system calculates corrected losses, efficiency, regulation, and percent impedance.

All output meters are displayed on the LCD screen. Data acquisition and report generation of the test results are performed via computer and WIN TTS testing software with all required interface cables included. The HMI eliminates a large number of relays and meter wiring which increases reliability. In addition to the test results database, the system is equipped with a recipe database that allows recall of a previously entered testing template reducing testing time and increasing efficiency.

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.

**Controls and Metering**

**Instrumentation**

A high precision microprocessor-based measuring system is designed into the PHENIX Transformer Test System. This enables accurate measurement of output power, voltages, and currents. The metered information is displayed on the HMI. The values displayed on the HMI are performed as a function of the programmable logic controller (PLC). The following metering measurements are displayed:

**Voltmeter**
Six 5-digit displays showing True RMS and Average readings simultaneously
Accuracy is ±0.5% of reading +LSD

**Currentmeter**
Three 5-digit displays showing True RMS reading
Ranges: 0-1.00/10.00/100.0/1000 A(1)
Accuracy: ±0.5% of reading +LSD
(1) or alternatively, depending on system design
Three 5-digit displays showing True RMS reading
Ranges: 0-20.00/200.0/2000 A
Accuracy: ±0.5% of reading +LSD

**Wattmeter**
±0.5% of reading +LSD at 1.0 pF
±1.5% of reading +LSD at 0.3 pF
±3.0% of reading +LSD at 0.1 pF

**Temperature**
One 4 ½-digit display
Range: 10-120. 00°C
Accuracy: ±1°C

(2) Phenix Technologies also offers test systems with high measuring accuracy required for transformers that operate at very low power factors. For these types of systems, please consult with your Phenix Technologies Sales Representative.
## THREE PHASE

### Maximum Test Capability

<table>
<thead>
<tr>
<th>Model</th>
<th>kVA</th>
<th>[kVA]</th>
</tr>
</thead>
<tbody>
<tr>
<td>TTS35</td>
<td>580</td>
<td>[290]</td>
</tr>
<tr>
<td>TTS65</td>
<td>1000</td>
<td>[500]</td>
</tr>
<tr>
<td>TTS100</td>
<td>1650</td>
<td>[825]</td>
</tr>
<tr>
<td>TTS155</td>
<td>2580</td>
<td>[1300]</td>
</tr>
<tr>
<td>TTS175</td>
<td>2900</td>
<td>[1450]</td>
</tr>
<tr>
<td>TTS200</td>
<td>3300</td>
<td>[1650]</td>
</tr>
</tbody>
</table>

### Heat Run Test Capability

<table>
<thead>
<tr>
<th>1</th>
<th>240V**</th>
<th>2</th>
<th>300V**</th>
<th>3</th>
<th>480V**</th>
<th>4</th>
<th>600V**</th>
<th>5</th>
<th>1000V**</th>
<th>6</th>
<th>1600V**</th>
<th>7</th>
<th>2400V**</th>
</tr>
</thead>
</table>

*Based on a 6.00% transformer impedance, 5 min ON / 15 min OFF duty cycle.

**All tap voltages double during optional induced mode; example, 0-3.6 kV tap becomes 0-7.2 kV during induced mode.

### Model Dimensions (approx.)

<table>
<thead>
<tr>
<th>L x W x H</th>
<th>Weight (approx.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TTS35 48x60x68” 1219x1524x1727 mm</td>
<td>2150 lbs, 975 kgs</td>
</tr>
<tr>
<td>TTS65 48x64x78” 1219x1626x1981 mm</td>
<td>2650 lbs, 1202 kgs</td>
</tr>
<tr>
<td>TTS100 48x64x80” 1219x1626x2032 mm</td>
<td>3400 lbs, 1542 kgs</td>
</tr>
<tr>
<td>TTS155 48x64x80” 1219x1626x2032 mm</td>
<td>3600 lbs, 1633 kgs</td>
</tr>
<tr>
<td>TTS175 48x80x90” 1372x2032x2286 mm</td>
<td>4800 lbs, 2177 kgs</td>
</tr>
<tr>
<td>TTS200 54x80x90” 1372x2032x2286 mm</td>
<td>4800 lbs, 2177 kgs</td>
</tr>
</tbody>
</table>

### HIGH POWER THREE PHASE

### Maximum Test Capability

<table>
<thead>
<tr>
<th>Model</th>
<th>kVA</th>
<th>[kVA]</th>
</tr>
</thead>
<tbody>
<tr>
<td>TTS35</td>
<td>3000</td>
<td>[1650]</td>
</tr>
<tr>
<td>TTS65</td>
<td>4150</td>
<td>[4075]</td>
</tr>
<tr>
<td>TTS100</td>
<td>8300</td>
<td>[4150]</td>
</tr>
<tr>
<td>TTS155</td>
<td>12500</td>
<td>[6250]</td>
</tr>
<tr>
<td>TTS175</td>
<td>16500</td>
<td>[8250]</td>
</tr>
</tbody>
</table>

### Heat Run Test Capability

<table>
<thead>
<tr>
<th>1</th>
<th>0.3kV**</th>
<th>2</th>
<th>1.5kV**</th>
<th>3</th>
<th>2.1kV**</th>
<th>4</th>
<th>3.6kV**</th>
<th>5</th>
<th>5.0kV**</th>
</tr>
</thead>
</table>

*Based on a 6.00% transformer impedance, 5 min ON / 15 min OFF duty cycle.

**All tap voltages double during optional induced mode; example, 0-2400 V tap becomes 0-4800 V during induced mode.

### Model Dimensions (approx.)

<table>
<thead>
<tr>
<th>Model</th>
<th>Dimensions (approx.)</th>
<th>Weight (approx.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TTS200</td>
<td>70x102x98” 1778x2591x2489 mm</td>
<td>6800 lbs, 3084 kgs</td>
</tr>
<tr>
<td>TTS250</td>
<td>70x102x102” 1778x2591x2591 mm</td>
<td>7000 lbs, 3175 kgs</td>
</tr>
<tr>
<td>TTS500</td>
<td>76x104x102” 1930x2642x2591 mm</td>
<td>7500 lbs, 3402 kgs</td>
</tr>
<tr>
<td>TTS750</td>
<td>92x116x102” 2337x2946x2591 mm</td>
<td>11000 lbs, 4990 kgs</td>
</tr>
<tr>
<td>TTS1000</td>
<td>96x130x102” 2439x3302x2591 mm</td>
<td>14000 lbs, 6350 kgs</td>
</tr>
</tbody>
</table>

### Oil-Filled HV Transformer

<table>
<thead>
<tr>
<th>Model</th>
<th>Dimensions (approx.)</th>
<th>Weight (approx.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TTS200</td>
<td>60x50x84” 1524x1270x2134 mm</td>
<td>7500 lbs, 3402 kgs</td>
</tr>
<tr>
<td>TTS250</td>
<td>65x58x90” 1651x1473x2286 mm</td>
<td>8200 lbs, 3720 kgs</td>
</tr>
<tr>
<td>TTS500</td>
<td>68x75x98” 1727x1905x2489 mm</td>
<td>17000 lbs, 7711 kgs</td>
</tr>
<tr>
<td>TTS750</td>
<td>70x80x104” 1778x2032x2642 mm</td>
<td>19000 lbs, 8618 kgs</td>
</tr>
<tr>
<td>TTS1000</td>
<td>90x104x110” 2286x2642x2794 mm</td>
<td>25000 lbs, 11340 kgs</td>
</tr>
</tbody>
</table>

NOTE: The tables above list the kVA rating of a standard system and the maximum kVA rating of the transformers that may generally be tested by each system. The maximum kVA rating to be tested is based on a transformer impedance of 6.00%. The power ratings are based on a 25% duty cycle (5 min ON/ 15 min OFF). Other duty cycles and custom higher taps are available. Please consult Phenix Technologies for your specific requirements.
APPLIED POTENTIAL TESTING

PHENIX offers a complete line of AC dielectric transformers with a variety of ratings available to meet any need. Applied potential testing is necessary to verify insulation integrity in reference to ground. PHENIX can also integrate an existing hipot with a transformer test system. For detailed specifications, refer to PHENIX brochure #60404.

CAPACITIVE COMPENSATION BANK

To extend the testing range of the TTS, PHENIX can provide capacitive compensation banks. Usually connected between the transformer under test and the test system, PHENIX offers a variety of solutions with manual or automatic capacitor selection.
**INDUCED POTENTIAL TESTING**

A motor generator or electronic power supply can be integrated with the test system to increase the output frequency to perform induced testing. Detection of turn-to-turn insulation integrity is verified. The induced system typically uses the main transformer at double the 50 or 60 Hz tap rating, thus reducing the need for an additional transformer when performing induced testing. Stand-alone induced test stations are optionally available.

**TURNS-RATIO AND PHASE DISPLACEMENT METERING**

The model PATTR-03A three-phase, computerized turns ratio and phase displacement meter has outstanding accuracy and is easily integrated with the testing software for complete remote control and data acquisition. For detailed specifications, refer to PHENIX brochure #20405. The software also supports many other models.

**WINDING RESISTANCE MEASUREMENT**

Quickly and accurately measure winding resistance. Units with 10 A, 35 A and 50 A charging current are available. For detailed specifications, refer to PHENIX brochure #20700. The software also supports many other models.

**INSULATION RESISTANCE MEASUREMENT**

PHENIX offers a complete line of manual or fully automated insulation resistance meters. For detailed specifications, refer to PHENIX brochure #10306.

**PARTIAL DISCHARGE MEASUREMENTS**

PHENIX test systems equipped with an oil-insulated step-up transformer and optional high voltage filters are capable of being used as a source for sensitive partial discharge measurements. The typical PD specification is <50 pC at rated voltage but can be enhanced upon request. Additionally, PHENIX offers a complete line of single- or three-phase Partial Discharge Detectors, RIV Meters, and Coupling Capacitors.

**CONTROL CONSOLES**

PHENIX offers an optional remote console that contains all instrumentation and controls. This option will allow the controls to be placed in protected area or climate-controlled room. For detailed specifications, refer to PHENIX brochure #90103.
AUTOMATED DISTRIBUTION TRANSFORMER TEST SYSTEMS

For the customer interested in increasing production while decreasing labor costs, Phenix Technologies can provide fully-automated distribution transformer test systems designed for high volume testing. The automated test systems are custom-designed and built for the individual needs of the customer. Multiple test stations with single connection hook-ups can be configured to simultaneously perform the customer’s desired testing protocol on each transformer. The industrial microprocessor based test system with HMI has proven to be highly reliable under stringent testing applications. Operator training time is minimal. Both manufacturers and repair facilities benefit greatly from the efficiency of automated test systems. Total test time can be reduced to as low as 90 seconds or less per transformer depending on the tests being performed and the testing sequence.

LARGE POWER TRANSFORMER TESTING SOLUTIONS

Manufacturers and repair facilities that work with very large power transformers face unique challenges when testing is required. Phenix Technologies offers a variety of options such as power supplies, switches, and high accuracy components that can be integrated into a complete test system to meet the customer’s needs.

ON-SITE SERVICES AND CALIBRATION

Long-term customer support is provided from our fully experienced and knowledgeable staff. Phenix Technologies’ service department offers on-site installation and operator training. We support our customers worldwide with a full-line of additional services such as on-site calibration, maintenance, upgrades and repair. Please contact your Phenix Sales Representative or Service Representative for further details.