

Users Manual

Phenix Technologies Inc.



VACUUM INTERRUPTER TEST SET

Model Number 660-10P

Version 3.3

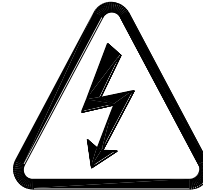
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GENERAL SAFETY PRECAUTIONS



CAUTION



HIGH VOLTAGE

This equipment is capable of providing POTENTIALLY LETHAL VOLTAGES! Improper operation or test practices may result in injury or death to the operator or surrounding personnel.

The operation of High Voltage test equipment should only be performed by personnel familiar with HIGH VOLTAGE testing and safety procedures. The operator of this equipment must be aware of all hazards associated with High Voltage testing. The operator is responsible for himself and others in close proximity of the testing area.

Some General Safety Practices for working with High Voltage Test Equipment have been listed below for your reference.

- Become familiar with your instrument before performing an actual test
- Know your work area, check that all circuits are de-energized and locked out.
- Never work alone; always work with another qualified worker.
- Mark off entire work area with barriers and warning tape.
- Make all personnel aware of your testing activities.
- Be aware of dangerous conditions that may arise from energizing a test specimen.
- Never modify test equipment, modifications to equipment could introduce an unknown hazard or hinder a designed-in safety feature.
- DO NOT operate damaged equipment. Remove power, and do not use the equipment until safe operation can be verified by service-trained personnel.

Phenix Technologies, Inc. assumes no liability for unsafe or improper use of test equipment.

SECTION 1: SPECIFICATIONS

GENERAL SPECIFICATIONS

- Tests up to 24.9 kV class interrupters in accordance with ANSI C37.60 specifications
- Portable two-piece unit
- Rugged construction for field use
- Security/Safety interlock circuit
- Digital, direct-reading output kilovoltmeter with memory feature
- Digital, direct-reading output currentmeter
- LCD display for easy reading in direct sunlight
- Digital dwell timer, 1-999 seconds
- Selectable rate of rise, 500 and 3000 volts per second
- Failure indicator with reset switch
- Programmable output voltage setpoint control. Digital, pushbutton potentiometer and dual-speed, electromechanical controller with output voltage feedback insure correct test voltage regardless of ramp rate or power supply fluctuations. There is no test voltage overshoot such as is associated with meter-relay type meters.
- Single-ended high voltage test transformer develops 0-60 kVAC with respect to ground potential.

TECHNICAL SPECIFICATIONS

INPUT: 120 VAC, 6 A, 60 Hz **or** 220 VAC, 3 A, 50 Hz

OUTPUT: 0-60 kVAC (single-ended) at 10 mA

DUTY CYCLE: 5 minutes ON/15 minutes OFF @ 10 mA

METERING:

Voltmeter: 3 1/2 digit LCD display
Range: 0-60.0 kVAC
Accuracy: +/-1% FS

Currentmeter: 3 1/2 digit LCD display
Range: 0-10.0 mA
Accuracy: +/-1% FS

TIMER: Adjustable, 3 digit, 1-999 seconds

DIMENSIONS (approximate):

Controls: 15" W x 10.5 D x 13" H; 31 lbs.
(381 mm W x 267 mm D x 330 mm H; 14 kg)

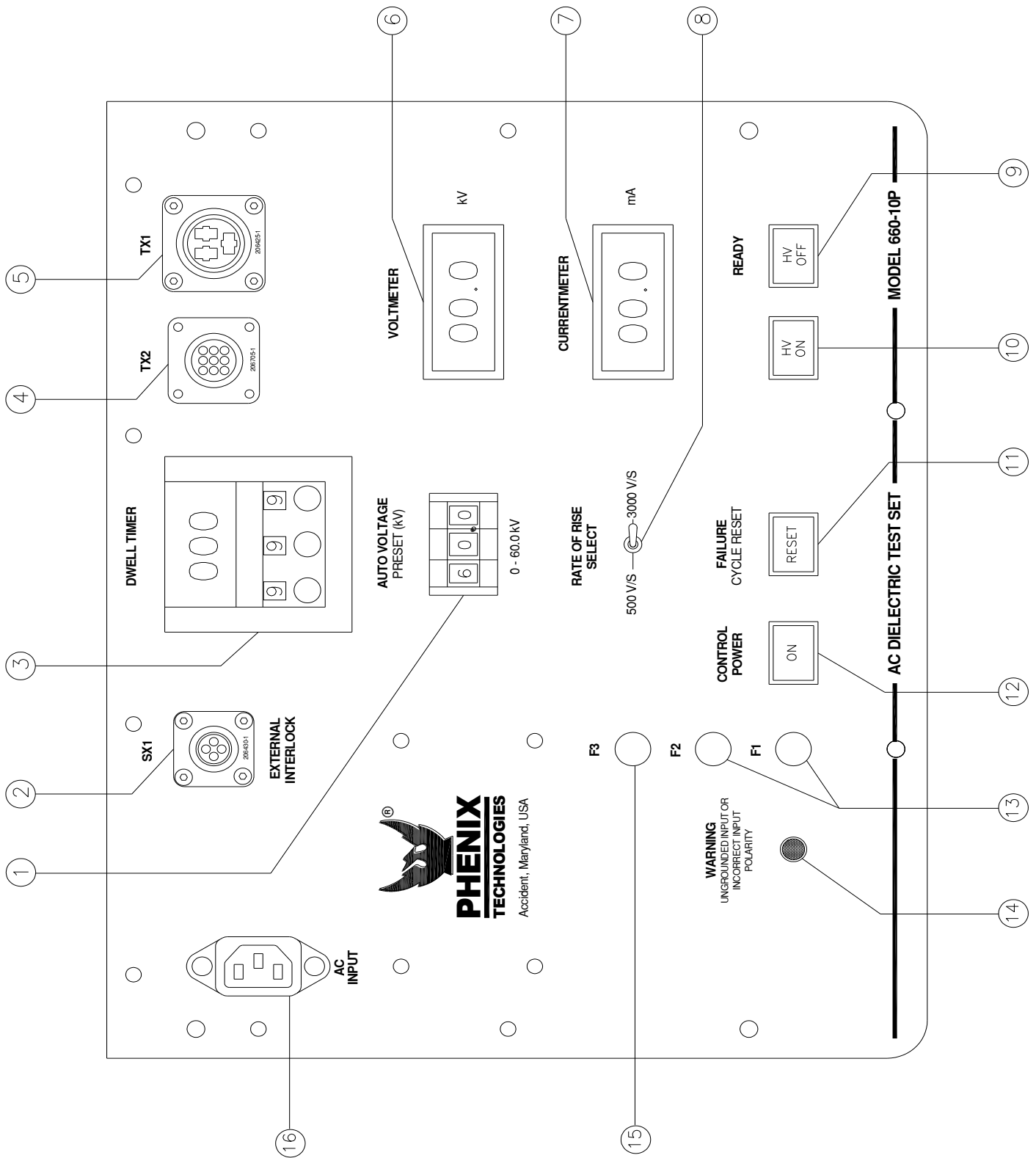
HV Transformer: 14" W x 14" D x 17" H; 66 lbs.
(356 mm W x 356 mm D x 432 mm H; 30 kg)

SECTION 2: CONTROL AND METERING DESCRIPTION

(Paragraphs are keyed to FIGURE 1)

1. Auto Voltage Preset. Press (+) and (-) buttons to select desired test level. Range 00.0 to 60.0 kV.
2. SX1 Connector. Provision for connecting external interlocking switching loop. Open loop prevents high voltage turn on.
3. Dwell Timer. Rotate knobs to preset desired test dwell time. Test time is displayed digitally.
4. TX2 Connector. Connect mating cable to high voltage tank. Metering circuits.
5. TX1 Connector. Connect mating cable to high voltage tank. Power circuits.
6. Output Voltmeter. Dual function digital meter displaying output voltage or failure voltage directly in kilovolts.
7. Output Currentmeter. Digital currentmeter to directly display the test current in milliamperes.
8. Rate of Rise Select. Switch to select desired rate of rise (500 V/S or 3000 V/S).
9. HV Off Switch/Ready Indicator. Press to turn high voltage off and to abort testing cycle. Lights when high voltage can be turned on.
10. HV On Switch/Indicator. Press to turn high voltage on and to start testing cycle. Lights when high voltage is on. High voltage will not turn on until Ready indicator is lit or if Failure indicator is lit.
11. Failure Indicator/Cycle Reset Switch. Lights to show that failure has occurred, or cycle has completed. Press to reset memory meter, cycle and failure detector circuits so that testing may proceed.
12. Control Power On Switch/Indicator. Press to turn on control power. Lights to show that control power is on.
13. Input Power Fuses F1 and F2. Connect power cord to main power source. Main fuses to protect entire test set (10A/120V or 5A/220V).
14. Fault Indicator. Lights if unit not grounded or line and neutral inputs are reversed. Correct fault so light is out before operating unit.
15. F3 Fuse. Protects primary circuit of high voltage transformer (5A Slo Blow/120V or 5A/220V).
16. Power Input Connector.

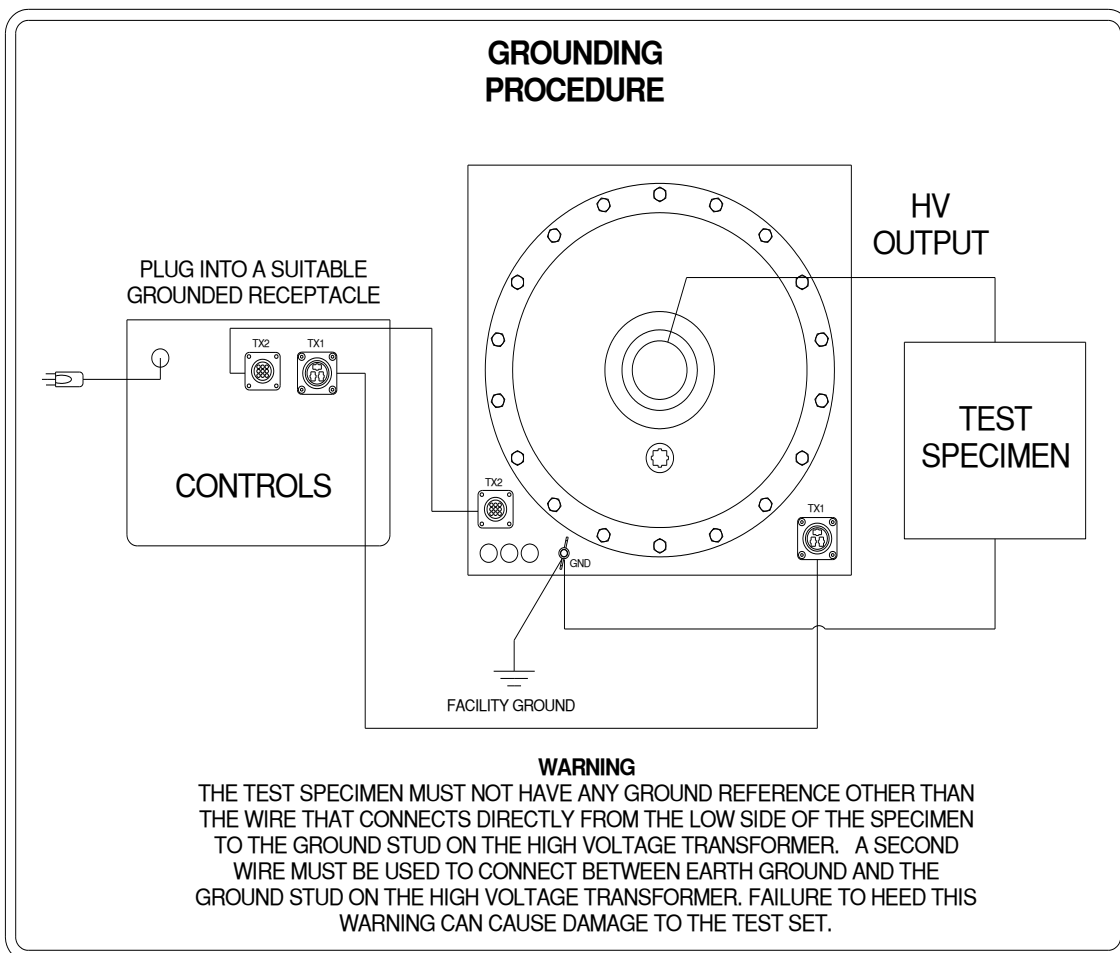
Figure 1



SECTION 3: CONNECTIONS AND GROUNDING

- Position set in the desired location.
- Ground set by use of ground terminal on base of high voltage transformer.
- Connect TX1 and TX2 cables between controls and high voltage transformer.
- Connect SX1 - external interlock circuit as appropriate.
- Connect return lead, provided, to low side of test specimen.
- Connect high voltage output to high side of test specimen.
- Connect main power cord to appropriate receptacle.

(Further instructions on test connections may be found in ANSI C37-60.)



SECTION 4: OPERATION INSTRUCTIONS

1. Check connections, power and ground to test set and specimen under test (refer to ANSI C37-60).
2. Turn on control power.
3. Select the desired voltage test level.
4. Select the desired rate of rise.
5. Select the desired dwell time (1-999 seconds).
6. When ready to start test, press HV on switch. (If unit does not operate at this point, check for open interlock circuit.)
7. Voltage will rise to the predetermined level, at the predetermined rate of rise, dwell for the predetermined time, lower and shut off automatically.
8. If failure occurs, the memory meter will record the failure voltage and the high voltage will shut off. Press reset to proceed with further testing.
9. To perform another test, reset the cycle by pressing reset and go back to #3.

NOTE: If it is desired to abort a test in process, press the high voltage off switch.

SECTION 5: RECALIBRATION

DO NOT ATTEMPT THIS CALIBRATION UNLESS QUALIFIED TO WORK ON ENERGIZED HIGH VOLTAGE TEST EQUIPMENT!!

Voltmeter-Normal Mode

1. Connect a standard voltmeter with a range of 0-60 kVAC from the high voltage terminal of the test transformer to ground.
2. Remove Front Panel perimeter screws and carefully lift and support panel in raised position.
3. Turn on high voltage and raise output until 48 kVAC is read on standard meter.
4. Locate R8 Output Adjustment calibration potentiometer on (A2) PCB 1175.
5. Adjust voltmeter calibration potentiometer until panel meter agrees with standard.
6. Raise and lower output and compare panel meter with standard at various points.
7. Shut off high voltage and disconnect standard meter.

Voltmeter-Failure Mode

1. Verify that the panel meter has been previously calibrated in the Normal Mode before proceeding.
2. Remove Front Panel perimeter screws and carefully lift and support panel in raised position.
3. Turn on high voltage and raise output until 50 kVAC is read on panel meter.
4. Using a hot stick, bring a ground wire into proximity of the high voltage output causing a flashover.
5. Locate R3 PRI VM CAL potentiometer on the main circuit board PCB 1150.
6. Adjust voltmeter calibration potentiometer until panel meter agrees with voltage present before flashover.
7. Repeat to verify setting.

Currentmeter

1. Connect set to a load that will draw approximately 10 milliamperes AC.
2. Connect a standard currentmeter with a range of 0-10 milliamperes AC.
3. Remove Front Panel perimeter screws and carefully lift and support panel in raised position.

RECALIBRATION

4. Locate Current Output Adjustment calibration potentiometer, R1, on (A3) PCB 1078.
5. Turn on high voltage and raise output until 10 milliamperes is read on standard meter.
6. Adjust currentmeter calibration potentiometer until panel meter agrees with standard.
7. Raise and lower output and compare panel meter with standard at various points.
8. Shut off high voltage and disconnect standard meter.

Overcurrent Trip Adjustment

1. Connect a load that will draw approximately 11 milliamperes at 20-50 kVAC.
2. Remove Front Panel perimeter screws and carefully lift and support panel in raised position.
3. Locate Overcurrent Adjustment calibration potentiometer, R3, on (A4) PCB 1020.
4. Energize output and raise to 11 milliamperes AC.
5. Adjust calibration potentiometer on PC 1020 until set trips off.
6. Press reset.
7. Energize output and verify overload trip point.

SECTION 6: PARTS LIST

| ITEM | DESCRIPTION | QTY | PART NO. |
|------------------|---------------------------------|-----|----------|
| | <u>Control Unit</u> | | |
| PCB1150 | PCB 1150 Assy | 1 | 31115011 |
| PCB1023 | PCB 1023 Autovoltage Ckt | 1 | 31102301 |
| PCB1020 | PCB 1020 Overcurrent Ckt | 1 | 31102002 |
| PCB1078 | PCB 1078 Currentmeter Ckt | 1 | 31107813 |
| PCB1175 | PCB 1175 Voltmeter Ckt | 1 | 31117505 |
| | <u>Motor / Variac Assy</u> | | |
| MOTOR | Motor Bodine 744KC-22T5 | 1 | 1560715 |
| T3 (120 V) | Variac 501 Staco | 1 | 1890120 |
| T3 (220 V) | Powerstat 05F305 | 1 | 1890330 |
| LL,UL,ZS | Limit Switch U3L-121-DB | 3 | 1866015 |
| " " | Cams | 3 | 41000002 |
| | Cam Shaft | 1 | 40500030 |
| | Motorized Variac Bracket | 1 | 40400135 |
| | <u>Front Panel</u> | | |
| BULBS | 6.3V Mini Bulbs EAO | 4 | 1420143 |
| CON 3,5 | 3 Ckt CON .1 | 2 | 1152250 |
| CON 14 | 4 Ckt CON .1 | 1 | 1152260 |
| CON 4,6 | 10 Ckt CON .1 | 2 | 1152210 |
| CON 7,11 | 8 Ckt CON .1 | 2 | 1152285 |
| CON 9,10 | 6 Ckt CON .1 | 2 | 1152270 |
| F1,F2,F3 | Fuse Holder | 3 | 1603920 |
| F1,F2 (120 V) | Fuse 10 Amp 250V 3AG | 2 | 1603610 |
| F3 (120 V) | Fuse 5 Amp 250V SB | 1 | 1603628 |
| F1,F2,F3 (220 V) | Fuse 5 Amp, 3AG | 3 | 1603605 |
| HANDLES | Front Panel Handles | 2 | 2101710 |
| LENS(W) | White EAO Lens | 1 | 1422153 |
| LENS(R) | Red EAO Lens | 1 | 1422150 |
| LENS(G) | Green EAO Lens | 1 | 1422151 |
| LENS(B) | Blue EAO Lens | 1 | 1422148 |
| LP5 | 115V Neon 1/3W | 1 | 1423260 |
| LINE CORD | 18-3 Power Cord | 1 | 1077167 |
| M1,2 | Panel Meter 3 1/2 Digit LCD | 2 | 1506400 |
| Power Input | Power Input Receptacle | 1 | 1153328 |
| R1 | Pushbutton Pot 10K | 1 | 1761094 |
| RESIST | 56 KOhm, .5W, 10% (120V) | 2 | 1713300 |
| RESIST | 120KOhm .5W, 1% (220V) | 2 | 1724050 |
| SW1 | EAO Latch 2P 31-262 | 1 | 1860265 |
| SW2,3 | EAO Mom 1P 31-121 | 2 | 1860120 |
| SW4 | EAO Mom 2P 31-122 | 1 | 1860125 |
| SW5 | Switch Toggle | 1 | 1865010 |
| SX1 | 4 Pin Amp Chassis Connector | 1 | 1151162 |
| SX1 | 24-20 AWG Female Pins | 2 | 1151174 |
| SX1 Plug | 4 Pin Cable Plug | 1 | 1151162 |
| SX1 Plug | Male Solder Pins | 2 | 1151176 |
| SX1 Plug | Cable Clamp | 1 | 1151186 |
| TX1 | High Current Receptacle, Female | 1 | 1151179 |
| TX1 | High Current Pins, Female | 2 | 1151184 |
| TX2 | 9 Pin Amp Chassis Connector | 1 | 1151154 |

| | | | |
|-------|---------------------|---|---------|
| TX2 | 24-20 AWG Male Pins | 4 | 1151170 |
| TIMER | Panel Timer ATC365 | 1 | 1480170 |

PARTS LIST

| <u>PCB1150</u> | | | |
|----------------|---|---|---------|
| A1-A4 | PCB Connector 22-P-Card Edge | 4 | 1152565 |
| A1-A4 | Card Edge Guides | 8 | 1152571 |
| C1,2 | Capacitor 1000uf 50V Elect | 2 | 1098940 |
| C3,4,6 | Capacitor 2.2uf 50V | 3 | 1094438 |
| C5 | Capacitor 3300uf 25V Elect | 1 | 1099331 |
| C7,8 | Capacitor .1uf 20V | 2 | 1093020 |
| C9,10,11 | Capacitor .01uf 1kV | 3 | 1092050 |
| X1,2,3 | 8 Pin Phoenix Conn & Plug | 3 | 1152608 |
| CON3,5 | 3 Ckt Hdr .1 | 2 | 1152251 |
| CON14 | 4 Ckt Hdr .1 | 1 | 1152261 |
| CON13 | 4 Ckt Hdr .156 | 1 | 1152263 |
| CON4,6 | 10 Ckt Hdr .1 | 2 | 1152211 |
| CON7,11 | 8 Ckt Hdr .1 | 2 | 1152286 |
| CON9,10 | 6 Ckt Hdr | 2 | 1152271 |
| D1-8,13 | Diode 1N4007 | 9 | 1780025 |
| D9-12 | Transzorb 18V (1N6279A) | 4 | 1780068 |
| K1 | Relay 3 Pole 120V Coil | 1 | 1700610 |
| K1 | Socket | 1 | 1157600 |
| K2-10 | Relay 4 Pole 120V Coil | 9 | 1701305 |
| K2-10 | Relay Socket | 9 | 1157600 |
| MOV1,2 | Movistor 130V | 2 | 1606100 |
| MOV2 (220V) | Movistor 275V | 1 | 1606110 |
| PCB1150 | PCB 1150 Rev. B | 1 | 1111502 |
| R1 | Pot 1500 Ohm 25W | 1 | 1761010 |
| R2 | Resistor 90.9K Ohm .5W 1% | 1 | 1723800 |
| R2 (220V) | Resistor 90.9K Ohm .5W 1% 2 pcs. Series | 2 | 1723800 |
| R3,8 | Pot 5K Type 64W | 2 | 1761054 |
| R4 | Resistor 5.1K Ohm .5W 1% | 1 | 1722110 |
| R5 | Resistor 200 Ohm 10W | 1 | 1740400 |
| R6 | Resistor 1500 Ohm 10W | 1 | 1742050 |
| R9 | Resistor 49.9K Ohm .25W 1% | 1 | 1734050 |
| R11,12 | Resistor 10K Ohm .25W | 2 | 1722600 |
| REG1 | Voltage Reg 15V 1A (7815) | 1 | 1794010 |
| REG2 | Voltage Reg 15V 1A (7915) | 1 | 1794015 |
| REG3 | Voltage Reg 5V 3A (LM323) | 1 | 1794040 |
| SG1 | Spark Gap 90V | 1 | 1605510 |
| SW1 | Toggle Switch PCB | 1 | 1865010 |
| T1 | Transformer "MPC-Y-15" | 1 | 1894340 |
| TP1-7 | Test Points | 7 | 1356300 |
| T2 (220V) | P8620 230/115V 05F305 | 1 | 1894425 |

PARTS LIST

| <u>Miscellaneous</u> | | | |
|----------------------|--------------------------------------|----|----------|
| M1 Protection Bd | Voltmeter Surge Protection Board | 1 | 31126501 |
| M2 Protection Bd | Currentmeter Surge Protection Board | 1 | 31126500 |
| TX1 Cable | Complete TX1 Cable (Power) | 1 | 30110013 |
| TX1 Cable | High Current Plug, Female Pins | 1 | 1151180 |
| TX1 Cable | High Current Plug, Male Pins | 1 | 1151181 |
| TX1 Cable | High Current Pins, Male | 2 | 1151182 |
| TX1 Cable | High Current Pins, Female | 2 | 1151184 |
| TX1 Cable | Cable Clamp, Size 17 | 2 | 1151188 |
| TX2 Cable | Complete TX2 Cable (Signal) | 1 | 30010013 |
| TX2 Cable | 9 Pin Cable Plug, Size 13 | 2 | 1151164 |
| TX2 Cable | 24-20 AWG Female Pins | 10 | 1151174 |
| TX2 Cable | Cable Clamp, Size 13 | 2 | 1151187 |
| LP1 (Key Sw Opt) | 115V Neon 1/3 W | 1 | 1423260 |
| SW1 (Key Sw Opt) | EAO 2 Pole Key Switch | 1 | 1860296 |
| <u>HV Unit</u> | | | |
| TX1 | High Current Receptacle – Male Pin | 1 | 1151178 |
| TX1 | High Current Pins - Male | 2 | 1151182 |
| TX1 | Receptacle Protector Cap, Size 17 | 1 | 1151196 |
| TX2 | 9 Male Pin Receptacle, Size 13 | 1 | 1151154 |
| TX2 | Contact Pins – 24-20 AWG, Male | 2 | 1151170 |
| TX2 | Receptacle Protector Cap, Size 13 | 1 | 1151195 |
| R2 | 470 Ohm Resistor | 1 | 1740990 |
| SG1 | 90V Spark Gap | 1 | 1605110 |
| R1 | 200 Megaohm Resistor – 2 pcs. Series | 2 | 1748410 |
| HV Cable | HV Output Cable – 5 ft. | 1 | 30070001 |
| Boot | Red Boot – Alligator | 1 | 1352131 |
| Clip | 100 Amp Alligator | 1 | 1353020 |
| Return Cable | Return Cable – 10 FT., Black | 1 | 30080002 |
| Ground Cable | Ground Cable – 10 FT., 10 Ga. | 1 | 30080003 |
| RTN/GND Cable | Boot – Black | 2 | 1353041 |
| RTN/GND Cable | Clip - Alligator | 2 | 1353042 |

SECTION 7: MAINTENANCE

No solution or chemical stronger than ordinary mild soap and water solution should be applied to the cabinet area of this unit. Care must be used when cleaning the meter faces and console panel. Abrasives may remove printing and descriptive titles and scratch meter faces. When cleaning, always have unit disconnected from power source. Never attempt to clean inside the unit as the cleaning solution may cause damage to the electronic components.

In the event it becomes necessary to replace any parts, a complete description can be found with the supplied parts list.

SECTION 8: RETURNED MATERIAL

If for any reason it should become necessary to return this equipment to the factory, the Service Department of Phenix Technologies, Inc. must be given the following information:

Name Plate Information
Model Number
Serial Number
Reason for Return
Cause of Defect

If Phenix Technologies, Inc. deems return of the part appropriate, it will then issue an "Authorization for Return".

If return is not deemed advisable, other inspection arrangements will be made.

NOTE: Material received at this plant without the proper authorization shall be held as "Customer's Property" with no service until such time as the proper steps have been taken.

Your cooperation is requested in order to ensure prompt service.

SECTION 9: PARTS ORDERING INFORMATION

Replacement parts are available from Phenix Technologies, Inc.

Changes to Phenix Technologies' products are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest technical improvements developed in our Engineering Department. It is, therefore, important when ordering parts to include the serial number of the unit as well as the part number of the replacement part.

When your purchase order is received at our office, a representative of Phenix Technologies will contact you to confirm the current price of the part being ordered. If a part you order has been replaced with a new or improved part, an Applications Engineer will contact you concerning any change in part number.

Your order for replacement parts should be sent to:

Replacement Parts Department
Phenix Technologies, Inc.
75 Speicher Drive
Accident, Maryland 21520

SECTION 10: RECOMMENDED SPARE PARTS

In order to maintain your set in full operating condition with a minimum of down time, the following spare parts should be kept on hand to avoid unnecessary phone calls, expensive modes of shipment, delays in repairs, etc. Pricing is available upon request.

| <u>Quantity</u> | <u>Description</u> | <u>Part Number</u> |
|-----------------|---------------------------------|--------------------|
| 5 | Pilot Light Bulb 6.3V | 1420143 |
| 5 | Fuse 10Amp 3AG (120V)(F1,2) | 1603610 |
| 5 | Fuse 5 Amp Slow Blow (120V)(F3) | 1603628 |
| 5 | Fuse 5 Amp 3 AG (220V)(F1-3) | 1603605 |
| 1 | Panel Meter 3 ½ Digit LCD | 1506400 |

SECTION 11: ANSI C37.60-1981

Standard Requirements for Overhead, Pad Mounted, Dry Vault and Submersible Automatic Circuit Reclosers and Fault Interrupters for AC Systems.

Copies of standards may be obtained from:

The Institute of Electrical and Electronic Engineers, Inc.
345 East 47th Street
New York, NY 10017

(800)678-IEEE

SECTION 12: ELECTRICAL SCHEMATICS

| <u>Drawing Number</u> | <u>Description</u> |
|-----------------------|--|
| 1. 31117505 | Peak Detector Circuit (PC 1175) |
| 2. 31102002 | Overload Circuit (PCB 1020) |
| 3. 31107813 | Digital Meter Circuit (PCB 1078) |
| 4. 31102301 | Auto/Overvoltage Circuit (PCB 1023E) |
| 5. 9607029 | Oil Vacuum Interrupter Test Set (120V) |
| 6. 9607030 | Oil Vacuum Interrupter Test Set (220V) |