



**LIQUID DIELECTRIC TEST SET MANUAL**  
**MODEL NUMBER LD60**  
**VERSION 3.3**

**Phenix Technologies**

75 Speicher Drive  
Accident, MD 21520  
USA  
www.PhenixTech.com  
Phone: (301) 746-8118  
Fax (301) 895-5570  
E-mail: [info@phenixtech.com](mailto:info@phenixtech.com)

# TABLE OF CONTENTS

	<u>Section Number</u>
DANGER / GENERAL SAFETY PRECAUTIONS	
DESCRIPTION	1
SPECIFICATIONS	2
INSTALLATION AND GROUNDING INSTRUCTIONS	3
OPERATING INSTRUCTIONS	4
RECALIBRATION	5
ELECTRICAL SCHEMATICS	6
MAINTENANCE AND TROUBLESHOOTING	7
PARTS LIST	8
PARTS ORDERING INFORMATION	9
RETURNED MATERIAL	10

**DANGER / WARNINGS**  
**WARNING !!**



**DANGER**

**Grounding of this unit is necessary for the safe operation of this equipment. Disconnect inputs before ungrounding this equipment.**

## **DANGER / WARNINGS**

### **GENERAL SAFETY PRECAUTIONS**



**This equipment can produce 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: DESCRIPTION

The Liquid Dielectric Test Set, Model LD60, is designed to test and measure the dielectric breakdown of insulating oil used in transformers, capacitors, bushings, etc. in accordance to ASTM D877 and ASTM D1816. The standard test set also satisfies the requirements of IEC, VDE, and BS standards.

The test set is of portable type built into a rugged carrying case. Below and protected by the cover is the control panel with the voltmeter as well as the high voltage test compartment. The test compartment is provided with a see-through lid interlocked to the test circuit with a limit switch to ensure full safety for the operation.

As options, the test set can be supplied with two different kinds of test cells, either TC/VDE test cell with VDE electrodes according to ASTM D1816, or TC/DE test cell with 1-inch flat electrodes according to ASTM D877. Other cells are available upon request.

The test set is fully automatic. Just put the prepared test cell in the test compartment, set voltage rate of rise switch to correct position, close test chamber lid and switch to start position. It will automatically raise the voltage to the breakdown level, indicate "failure" and the breakdown level can be read on the voltmeter.

### SAFETY FEATURES

- Center tapped high voltage transformer.
- The test cell is isolated from the supply when the protective lid is raised.
- Fast acting relay in series with the high voltage winding and the test cell ensures immediate cutout at flashover above specified current levels.
- Control lamp indicating AC power on.
- Control lamp indicating failure.
- Fast acting fuses are located both in the input to the test set and in the primary of the high voltage transformer.

### OTHER FEATURES

- Input switch, fuse, and power indicator lamp.
- Motorized output voltage control from 0 to 60,000 volts with three selectable speeds of 500, 2000 and 3000 volts per second.
- Single range memory voltmeter connected across transformer primary calibrated to output voltage level records breakdown voltage for the test sample.
- The test compartment is provided with a 115 volt outlet for convenient plug-in of motor driven stirrer when testing to ASTM D1816 standards.

## SECTION 2: SPECIFICATIONS

<b>Input Voltage/Current</b>	Single Phase, 120 Volts at 60 Hz, 5 Amps <b>or</b> 220 Volts at 50 Hz, 2.5 Amps (Check Specification Tag)
<b>Output Voltage/Power</b>	0-60,000 Volts at 500 VA (momentary), Maximum Voltage to Earth is 30,000 Volts
<b>Rate of Rise</b>	Selectable—500/2000/3000 Volts/Second
<b>Memory Voltmeter</b>	Scale of 0-60,000 Volts, Accuracy 1% of Full Scale
<b>Dimensions</b>	21 1/4" W x 16 3/4" D x 13 3/4" H (540 mm W x 426 mm D x 350 mm H)
<b>Weight</b>	50.5 lbs. (22.9 kg) - 120 V 53.5 lbs. (24.26 kg) - 220 V

## **SECTION 3: INSTALLATION AND GROUNDING INSTRUCTIONS**

1. Place the test set on a table or similar flat surface.
2. Make sure that the test set is level.
3. Open the cover.
4. Check that your input voltage corresponds with the input of the test set.
5. Check that your supply outlet provides a ground.
6. Connect the power cord to the outlet.
7. The test set is now installed and ready for operation.

## SECTION 4: OPERATING INSTRUCTIONS

### Operation with TC/DE Test Cell (ASTM D877 Standard)

1. Adjust the test cell electrode by the use of the measuring rod located on the test cell in the following manner.
  - a. Remove the measuring rod by unscrewing it from its threaded holder.
  - b. Release the setscrew, which holds the adjustable electrode in place on the test cell.
  - c. Place the measuring rod between the electrodes.
  - d. Move the adjustable electrode in until snugly against the measuring rod.
  - e. Moderately tighten setscrew to secure this position.
  - f. Remove the measuring rod and place it in the holder for safekeeping. (Distance between the electrodes should be 0.100 of an inch if measuring rod is not used.)
2. Fill the test cell with test sample of oil according to standards procedure.
3. Place the test cell in the test chamber of the unit and close chamber lid.
4. Turn on AC power switch.
5. Select 3000 volts per second rate of rise.
6. Move the start switch to start position when stand time requirements have been met.
7. High voltage will come on; the unit will automatically raise the voltage to the desired rate per second until failure occurs.
8. If a failure occurs, the voltage will shut off, the failure light will illuminate, and the breakdown voltage will be indicated on the kilovolt meter.
9. To return to zero, switch the stop-reset switch to stop/reset.
10. Continue test as per ASTM D877.
11. Remove the test sample of oil and repeat the above procedure for other samples.

**NOTICE:** The voltmeter may continue to rise slightly after the failure indicator is tripped. This meter response delay should be ignored. The final voltage reading is the breakdown point.



## OPERATING INSTRUCTIONS

### Operation with TC/VDE Test Cell (ASTM D1816)

1. Adjust the test cell electrode gap using the double end gauge rod in the following manner.
  - a. Remove the gauge rod and hex key from the storage block on the side of the cell.
  - b. Loosen the setscrew that holds the moveable electrode in place.
  - c. Place the desired end of the gauge, either .080 or .040 diameter, between the electrodes.
  - d. Hold the movable electrode snugly against the gauge rod while moderately tightening the setscrew.
  - e. Remove the gauge rod and replace it and the hex key back into storage.
2. Fill the test cell with test sample of oil according to standards procedure.
3. Place the test cell in the test chamber of the unit.
4. Plug cord of stirrer into chamber receptacle.
5. Close chamber cover.
6. Turn on AC power switch.
7. Set the rate of rise to 500 volts per second.
8. Move the start switch to start position when stand time requirements have been met.
9. High voltage will come on; the unit will automatically raise the voltage at the desired rate per second until failure occurs.
10. If a failure occurs, the voltage will shut off, the failure light will illuminate, and the break-down voltage will be indicated on the kilovolt meter.
11. To return to zero, switch the stop-reset switch down as labeled.
12. Continue test as per ASTM D1816.
13. Remove the test sample of oil and repeat the above procedure for other samples.

## OPERATING INSTRUCTIONS

### Operation with optional LDCU (Liquid Dielectric Comparison Unit)

1. Make sure power to LD set being checked is turned off.
2. Place the comparison cell in the test chamber of the unit. Plug LDCU ground lead into ground jack. Close transparent cover.
3. Turn on Input Power switch.
4. Set the Rate of Rise to the slowest speed.
5. Move the Start/Stop switch to the Start position.
6. High voltage will come on; the unit will automatically raise the voltage at the selected rate per second.
7. Allow voltage to rise on the LDCU until it reaches 60 KV.
8. Move the Start/Stop switch to the Stop position at this time.
9. Unit under test and comparison cell should be in agreement. If a discrepancy is found, LD unit being checked should be sent for recalibration.
10. Turn Input Power switch off and back on to shut off high voltage and reset unit.
11. Check 15 KV, 30 KV, and 45 KV settings.

### Calibration of LDCU

LDCU unit should be sent to OEM factory for recalibration at periodic intervals, not to exceed 12 months.

## **SECTION 5: RECALIBRATION**

Recalibration of this test set is normally not necessary.

For any internal changes, modifications, or calibrations found necessary, please return to the factory.

**SECTION 6: ELECTRICAL SCHEMATICS**

	<u>Drawing Number</u>	<u>Description</u>
1.	9101060	LIQUID DIELECTRIC TEST SET PCB1019 E
2.	31114000	LD60 VM CIRCUIT



## SECTION 7: MAINTENANCE AND TROUBLESHOOTING

### Maintenance

No maintenance is required besides the control of fuses and control lamps located on the front panel. Ratings of these are described in the parts list.

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 description can be found with the supplied parts list.

### Troubleshooting

No "power on".

- Have you plugged in the power cord?
- Is voltage available in the wall outlet?
- Check fuse F1.
- Check the control lamp for "Input power".

The test procedure does not start.

- Is "Input power" turned on?
- Is the compartment lid closed? Check that the micro switch is clicking when closing the lid.
- Have you turned the toggle switch to start position?
- Have you reset the test set before start-up?

The voltmeter does not show any reading.

- Check test procedure start as above.
- Check fuse F2.

**SECTION 8: PARTS LIST**

ITEM	DESCRIPTION	QTY	PART NO.
<b><u>ASSY NO. 8131060, LD60 (120V/240V)</u></b>			
<b><u>FRONT PANEL</u></b>			
A1	PC1140 METERING ASSEMBLY	1	31114000
F1, 2	FUSE HOLDER, 3AGHKP	2	1603920
F1, 2	FUSE, 3AG-5A	2	1603605
F1 (220v)	3AG-3A	1	1603603
PL1	PILOT LAMP, YELLOW LED	1	1420138
PL2	PILOT LAMP, RED LED	1	1420137
	KNOB, (PLEXIGLASS COVER)	1	1350050
M1	METER, 3 ½ DIGIT LCD	1	1506400
MOV6 (120V)	MOVISTOR 130V, V130LA10A	1	1606100
SW1	SWITCH, CH7565K7 TGL2PDT	1	1865005
SW2	RATE OF RISE SWITCH	1	1863037
SW2	KNOB PKAP 50B	1	1355310
SW3	SWITCH, 8832KT TGL SPRING	1	1865025
HINGE	PIANO HINGE	1	40500060
COVER	PLEXIGLASS (SMOKED GRAY)	1	40500070
CAL	HOLE PLUG-1/4"	1	1359925
CORD	LINE CORD 18/3 8'	1	1077183
PANEL	FRONT PANEL	1	42000024
<b><u>CHASSIS</u></b>			
T1 (220 V)	N2X 230/115 STEP DOWN AUTO XFMR-100 VA	1	1894427
CAM	CAM ALUM BORED ½"	3	41000002
MOT1	MOTOR, 744KC1-22T5 BODINE WITH CAP.	1	1560715
PCB ASSY	PCB1019E - LD60 ASSY	1	31101900
RECPT	RECEPTACLE 15 A, 125 V	1	1159902
SPACER	SPACER 3/4X 4-40	2	1350123
SW4-7	SWITCH, U3L-121-DB LIMIT	4	1866015
T3	TRANSFORMER 221 VARIABLE STACO	1	1890105
	MOTOR SHAFT	1	40500030
	MOTOR - VARIAC BRACKET	1	40500020
	CHASSIS	1	40500040
<b><u>HV XFMR</u></b>			
T2	TRANSFORMER, EPOXY CAST	1	38322205
C-CORE	C-CORE	1	1900130
BRKT	TRANSFORMER MOUNTING BRACKET	1	46000067
<b><u>CASE</u></b>			
	CASE WITH HANDLES	1	2100508
	CABLE BRACKET	1	40500050

## PARTS LIST

ITEM	DESCRIPTION	QTY	PART NO.
	<b><u>ASSY NO. 3111941, LD60, PCB 1019 REV. E</u></b>		
C2	CAPACITOR 1 uF 250 V	1	1094130
C1	CAPACITOR .01 uF 1kV	1	1092050
PC BOARD	PCB1019 REV E	1	1110195
X5	3 PIN PHOENIX CONN. & PLUG	1	1152603
X2, X6	4 PIN PHOENIX CONN. & PLUG	2	1152604
X1	5 PIN PHOENIX CONN. & PLUG	1	1152605
X4	8 PIN PHOENIX CONN. & PLUG	1	1152608
X3	16 PIN PHOENIX CONN. & PLUG	1	1152616
K1	KU SERIES RELAY SOCKET	1	1157600
SPACERS	STANDOFF 8-32 X 1 1/2"	4	1350116
SG1,2	SPARK GAP 90 V	2	1605110
MOV1-3	MOVISTOR 130 V, V130LA10A	3	1606100
MOV4,5	V56Z MOVISTOR	2	1606130
K1	RELAY KUP14A153P, 120V, 3 POLE	1	1700610
K3	AROMAT D52E-S-DC48V, 2 POLE	1	1700820
K4	RELAY 1310P-4C-120A, 4 POLE	1	1701305
K2	RELAY 5A, 120V, 2 POLE	1	1701316
R1, 2	RHEOSTAT 1.5 K OHM 25 W	2	1761010
D1-9	DIODE 1N4007	9	1780025
	<b><u>ASSY NO. 31114000, LD60, PCB 1140</u></b>		
	.01 UF 1 KV 18F2727	1	1092050
	4 UF 350 V	1	1094655
	10 UF 20 V 47F386 TAN	1	1095800
	100 UF 35 V 14F3253	1	1098050
	PCB 1140 LD60 METER BD REV A	1	1111401
	1-640454-0 HDR 10 CKT .1	1	1152211
	1-640440-0 CONN 10 CKT .1	2	1152210
	4 POS MINI PCTERMINAL BLOCK 44F2705	1	1155040
	8254 SPCR 1X6-32, M/F	4	1350110
	3 1/2 DIGIT LCD METER DISPLAY	1	1506400
	.175 AMP 3AG FUSE	2	1603595
	1A1119-10 FUSE CLIP	4	1603925
	MOVISTOR V130LA10A	2	1606100
	NE-2 NEON	1	1609990
	.5 W 1 K 10%	1	1711960
	.5 W 5 K 1%	1	1722100
	.5 W 1 MEG 1%	1	1725950
	10 K TYPE 43P 12F4409	1	1761096
	1N4007 (1000 VR, 1.0 A)	4	1780025
	UA7805C, VR +5 V REG	1	1794000
	XFMR DPC 120-8	1	1894314
	XFMR PC16-55	1	1894317
	1N4734A 56V ZENER	1	1780034
	1N6267A 5V TRANSORB	1	1780060



## **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: 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.