AVTM651017J
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Instruction Manual AVTM651017J
for
Impulse Generator/Cable Test System
Catalog No. 651017

High-Voltage Equipment
Read the entire manual before operating.

Aparato de Alto Voltaje
Antes de operar este producto lea este manual enteramente.

Megger

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SECTION 1

Introduction

RECEIVING INSTRUCTIONS

Check the equipment received against the packing list to ensure that all materials are present. Notify Megger of any shortage. Telephone 1-800-723-2861.

Examine the instrument to determine if any damage occurred during transit. If damage is discovered, file a claim with the carrier at once and notify Megger of its nearest authorized sales representative, giving a detailed description of the damage.

This instrument has been thoroughly tested and inspected to meet rigid specifications before being shipped. It is ready for use when set up as indicated in this manual.

SYSTEM OVERVIEW

The Impulse Generator/Cable Test System locates cable faults by the high-voltage impulse method on cables rated up to 25 kV ac phase-to-phase. This system combines three related functions: dc proof testing, dc cable fault burning, and impulsing. A common power supply is used.

The system is housed in a sturdy metal cabinet using welded construction throughout to withstand the rigors of transport and operation in field vehicles. See Figure 1. It is expected that in normal use the system will be transported in a truck or van. There are rectangular base skids on the bottom of the cabinet if permanent installation in a van or trailer is desired.

Mode of operation is selectable by a three-position MODE SELECTOR switch which may be set to GROUND, PROOF/BURN, or IMPULSE. A self-contained power supply powers the system when the MODE SELECTOR switch is set to PROOF/BURN or IMPULSE. In the Proof/Burn mode, the system provides a continuous dc output which is used for the burn operation as well as for proof testing. When in the Impulse mode, a high-voltage capacitor is periodically charged and discharged to produce a high-energy pulse. This pulse is used as a traceable signal for cable fault location.

Figure 1: Impulse Generator/Cable Test System

The following is a brief description of the system operating modes:

Proof Mode

The proof test is performed to determine whether cable insulation is good or bad. The cable under test is raised to the required voltage and held there for a prescribed period of time. If the insulation can withstand this voltage, the proof condition has been met and the cable is good. If the insulation is faulty (internal breakdown), the proof condition has not been met and additional testing is required to locate the fault.

Burn Mode

The burn mode is used to alter the electrical characteristics of the cable fault so that it will break down within the impulse voltage range of the system. This change is produced by burning the cable fault, so as to char the walls of the fault and reduce its internal resistance. Reduced fault resistance means that the fault will break down at a lower voltage and will permit the use of the Impulse mode to produce a detectable arc or the use of a time domain reflectometer (TDR) to measure the distance to the fault.

Impulse Mode

In the Impulse mode of fault location, a high-voltage surge of energy is applied to the defective cable. This impulse travels along the cable until it reaches the fault location where the voltage causes an arc to occur and a large current to pass through the return paths. The fault location along the cable length can be readily detected using an acoustic or electromagnetic impulse detector.

Section 2

Safety

This equipment and the cable to which it is connected are sources of high-voltage electrical energy. All persons performing or assisting in tests must use all practical safety precautions to prevent contact with energized parts of the test equipment and related circuits. Persons actually engaged in the test must stand clear (by at least 3 ft) of all parts of the complete high-voltage circuit unless the system is de-energized and all parts of the test circuit are grounded. Persons not directly involved with the work must be kept away from test activities by suitable barriers, barricades or warnings. An interlock circuit is provided to enable the operator to enclose all parts of the complete high-voltage circuit within a secure area. The interlock circuit should be used to shut off input power automatically upon unauthorized entry into the high-voltage area.

- Safety is the responsibility of the user.
- Misuse of this high-voltage equipment can be extremely dangerous.
- The purpose of this equipment is limited to use as described in this manual. Do not use the equipment or its accessories with any device other than specifically described.
- Never connect the test equipment to energized equipment or use in an explosive atmosphere.
- A qualified operator should be in attendance at all times while the test equipment is in operation.
- The safety ground jumpers and surge grounds must be properly connected (refer to Section 5).
- Refer to IEEE 510-1983 "IEEE Recommended Practices for Safety in High-Voltage and High-Power Testing" and follow the applicable safety recommendations.
- Observe the safety warnings marked on the equipment.

Treat all terminals of high-voltage power equipment as a potential electric shock hazard. There is always the potential of voltages being induced at these terminals because of proximity to energized high-voltage lines or equipment. Always use a safety ground stick to ground the high-voltage conductor. A safety ground jumper must then be installed between the high-voltage conductor and ground of the cable under test. The ground connection must be the first made and the last removed. Any interruption of the grounding connection can create an electric shock hazard.

Systems of this type should not be used to fault locate on direct-buried unshielded or secondary cable. Dangerously high differences in potential may be developed in the current return path to the system.

Systems of this type should not be used to fault locate on any cable which is likely to be near enough to an energized cable to allow a burn through of the insulation of the energized cable. This situation may occur when the cables are located in a common trench, duct, or tray.

High-voltage electrical impulses and resultant current pulses create special safety problems because a large, rapidly changing current, even across small values of impedance, can generate high-voltage levels. Two separate and distinct grounds are provided: the chassis ground and the surge ground. The chassis ground, which must be connected to a good local earth ground, is designed to protect the operator by preventing a difference of potential between the chassis and the ground in the immediate vicinity. The surge ground is designed to return the impulse current back to the capacitor.

WARNING

The low-voltage lead of the output cable must not be extended because this introduces excessive impedance in the return path.

On completion of a test, even after power has been removed from the system, energy can still be stored in the impulse capacitor and cable under test. To discharge the cable and capacitor, immediately after use, set the MODE SELECTOR switch to GROUND. This places a solid ground on the output cable, power supply, and impulse capacitor.

WARNING

Never assume that the coaxial output cable or the cable under test is completely discharged, even after following the above procedures. Always use a safety ground stick to ground any conductive part of the circuit and then apply safety ground jumpers before touching any connections.

This system operates from a single-phase power source. It has a three-wire power cord and a two-pole, three-terminal grounding type connector. The voltage to ground from either pole of the power source must not exceed the maximum rated operating voltage, 120 V ac. Before making connection to the power source, determine that the system is adjusted to match the voltage of the power source, and has a suitable two-pole, three-terminal grounding type connector. The power source must have a high rupture fuse or circuit breaker rated no higher than 15 A.

The power input plug must be inserted only into a mating receptacle with a ground contact. Do not bypass the grounding connection. Any interruption of the grounding connection can create an electric shock hazard. Determine that the receptacle is correctly wired before inserting the plug.

To avoid electric shock hazard, operating personnel must not remove the system protective covers. Component replacement and internal adjustments must be made by qualified service personnel only.

Users of high-voltage equipment should note that high-voltage discharges and other sources of strong electric or magnetic fields may interfere with the proper functioning of heart pacemakers. Personnel using heart pacemakers should obtain expert advice on the possible risks before operating this equipment or being close to the equipment during operation.

If the system is operated in accordance with the safety precautions in this manual and if all grounds are correctly made, rubber gloves are not necessary. As a routine safety procedure, however, some users require that rubber gloves be worn, not only when making connections to the high-voltage terminals, but also when manipulating controls. Megger recommends this excellent safety practice.

The following warning and caution notices are used in this manual where applicable and should be strictly observed.

WARNING

Warning, as used in this manual, is defined as a condition or practice which could result in personal injury or loss of life.

CAUTION

Caution, as used in this manual, is defined as a condition or practice which could result in damage to or destruction of the equipment or apparatus under test.

Megger has made formal safety reviews of the initial design and any subsequent changes. This procedure is followed for all new Megger products and covers areas in addition to those included in applicable ANSI standards. Regardless of these efforts, it is not possible to eliminate all hazards from electrical test equipment. For this reason, every effort has been made to point out in this instruction manual the proper procedures and precautions to be followed by the user in operating the system and to mark the system itself with precautionary warnings where appropriate. It is not possible however to foresee every hazard which may occur in the various applications of this system. It is therefore essential that the user, in addition to following the safety rules in this manual, also carefully consider all safety aspects of the test before proceeding.

Section 3

Specifications

ELECTRICAL

Power Input:	120 V ac at 60 Hz (50 Hz optional)
Recommended source:	NEC 15 A, 120 V single phase
Recommended ground:	Solid metallic with a resistance of less than 5 Ω
Voltage (rms):	120 V nominal rating, 102 to 132 V operating range
Current maximum (rms):	4.5 A continuous on BURN mode 4.5 A pulsing in IMPULSE mode
Frequency:	60 Hz
Optional Power Input:	220 or 240 V at 50 or 60 Hz (must be specified)
Recommended source:	NEC 15 A 240 V single phase
Recommended ground:	Solid metallic with resistance less than 5 Ω
Voltage (rms):	240 V full rating, 204 to 264 V operating range 220 V full rating, 198 to 242 V operating range
Current maximum (rms):	2.5 A continuous in BURN mode 2.5 A pulsing in IMPULSE mode
Impulse Mode Output	
Peak voltage:	15 kV continuously variable 0 to full voltage
Capacitance:	5 μF at 15 kV
Stored energy:	563 joules (watt-secs) at maximum voltage
Peak current:	Approximately 8 kA (25-ft output cable) short-circuited
Polarity:	Negative with respect to ground
Impulse rate:	Variable, 1 to 5 seconds
Internal energy discharge time:	Less than 10 seconds to 1% of starting value
Test energy discharge time:	Less than 10 seconds to 1% of starting value for a test cable capacitance of 5 μF (time proportional to load capacitance)

Proof Mode Output

Voltage:	25 kV maximum, continuously variable, 0 to 25 kV
Polarity:	Negative with respect to ground
Voltage build-up time:	5 kV per second initial rate for 5 μF test cable
Discharge time:	Less than 10 seconds to 1% of starting value for a test cable capacitance of 2 μF. Time proportional to load capacitance
Current:	30 mA @ 25 kV continuous 50 or 60 Hz

Burn Mode Output

Voltage:	25 kV continuous at 30 mA, 50 or 60 Hz
Current:	Short circuit 30 mA rms continuous

METERING

Kilovoltmeter:	0 to 30 kV, Proof/Burn mode 0 to 15 kV, Impulse mode 3 ½ in. taut band ±2% full scale accuracy
Milliammeter:	0 to 100 μA, Proof/Burn mode 0 to 1 mA, Proof/Burn mode 0 to 10 mA Proof/Burn mode 0 to 50 mA, Proof/Burn mode and Impulse modes 3 ½ in. taut band ±2% full scale accuracy

NOTE

Meter indicates charge delivered to capacitor in Impulse mode; average indicating in 1 and 10 mA ranges, rms indicating in 50 mA range.

PHYSICAL CHARACTERISTICS

Dimensions:	13 ½ in. square x 27 in. high (34 x 69 cm)
Weight:	75 lb (34 kg)

ENVIRONMENTAL

Temperature range:	-4 to 122°F (-20 to 50°C) (operating) -22 to 131°F (-30 to 55°C) (storage)
Altitude:	7500 ft (2286 m) maximum Voltage derates at higher altitudes
Humidity:	Operation and storage limits 5 to 95% rh noncondensing conditions
Climate:	Operation prohibited in direct rain or snow

CABLES SUPPLIED

- 25-ft permanently connected shielded output cable with clamps for conductor and shield.
- 15-ft, 3-wire input cord with standard cap.
  (NEMA 5 -15P) 120 V
  (NEMA 6 -15P) 240 V
- 15-ft No. 8 AWG grounding cable with clamp

SAFETY FEATURES

The output cable and impulse capacitor are isolated from the chassis to eliminate the possibility of transient voltages between the chassis and the local earth when impulsing. Also this reduces the possibility of current flow in other spurious paths and reduces the possibility of damage to other equipment.

The ZERO START interlock prevents energizing output at elevated voltages.

The separate chassis grounding connection and the power cable provide a redundant ground connection.

Automatic resistance grounding of the power supply output, the impulse capacitors, and the load on shutdown is provided.

Manual grounding using the MODE SELECTOR switch provides an emergency backup or override of the automatic resistance grounding.

Circuit breakers provide overload protection on the input power circuits.

Metering circuits are of passive design for reliability.

An external interlock connection provides a means to shut off input power in an emergency.

OPERATING FEATURES

A permanently connected output cable for all modes of operation and an internal switch eliminate the need to interchange output connections manually.

The ammeter becomes the charge meter during impulsing to read the charging current as an indication of the fault condition.

An enclosed conductive impulse switch with an opaque body ensures quiet, flashless, and dependable operation from 0 to 15 kV.

Negative output polarity conforms to U. S. standard practice.

Flexible, shielded output cable (specially terminated) for long service life and convenience.

Large removable hanger mounted on the rear of the unit stores accessory cables.

The coaxial output cable design allows unused cable to remain coiled on hanger, thus eliminating need to uncoil the entire length.

A modular control panel provides ease of operation and accessibility for service.

Two high-energy-absorbing discharge resistors provide for quick, safe charge dissipation of both the impulse capacitor and the load.

System is adaptable to station use or to installation in van or trailer.

Power is supplied from either a system line service or from a portable engine-generator, 1.5 kVA contractor type (capable of starting heavy loads.)

Section 4

Description

CONTROLS, INDICATORS, AND CONNECTORS

Top Panel (Fig. 2)

POWER ON/OFF: Circuit breaker applies and removes input power and switches on the high voltage if all interlocks are satisfied.

HV ON: Red lamp, when lit, indicates that output voltage is energized.

LINE ON: Amber lamp, when lit, indicates that input power is being supplied to the system.

MODE SELECTOR: Three-position switch with IMPULSE, PROOF/BURN or GROUND settings; selects mode of operation or provides for grounding of output and impulse capacitor.

OUTPUT VOLTAGE CONTROL: Variable autotransformer adjusts the high-voltage output from minimum to maximum.

IMPULSE RATE: Potentiometer adjusts repetition rate of impulse.

Viewing window: Shows location and condition of the internal grounding arms of MODE SELECTOR switch.

Voltmeter: Two-range meter indicates output voltage level.

VOLTMETER RANGE: Switch selects appropriate range.

Ammeter: Four-range meter indicates output current level. In Proof/Burn mode, the ammeter indicates total dc current output of high-voltage supply. In Impulse mode, momentary needle deflection indicates the amount of input current required to recharge the impulse capacitors after each impulse. A 60 percent (or 30 mA) scale deflection indicates maximum recharging.

AMMETER RANGE: Four-position switch with X0.1, X1, X10, and X50 range settings; monitors output current of high-voltage supply in Proof/Burn mode; must be set to X50 to operate in Impulse mode.

CAL: Ammeter and voltmeter calibration can be adjusted through panel after removing cover screw below each meter.

Figure 2: Control Panel

Back Panel (Fig. 3)

EXTERNAL INTERLOCK: Provides for connection of door interlocks and dead man's switches. Connection may be made using two-wire, 18 gauge, or larger, neoprene insulated cable. A mating plug P1 is provided with a shorting wire in the event that a test area interlock is not used. It is suggested that the customer remove the short circuit from the plug and that the plug be connected to a suitable test area interlock system. The system must be constructed so that the interlock switches are closed when the test area gate or gates are closed. The interlock wiring must be run as a twisted pair to minimize electromagnetic coupling into the system. This interlock system should be connected to pins A and B on plug P1. When the interlock loop is opened the test is automatically terminated.

WARNING

When the external interlock circuit is open and the POWER ON/OFF switch (CB1) is on, the complete interlock circuit is energized at 120 V ac. The interlock circuit wiring must be insulated for 120 V ac.

INPUT POWER cord: Three-conductor, 18-gauge, 15 ft., connects input power and safety grounding.

HV OUTPUT cable: Coaxial cable provides high-voltage output. The white lead is the high-voltage center conductor (red band); the black lead is the shield and low-voltage return.

SURGE PULSE OUTPUT: Output of high frequency current transformer used in the current impulse method.

GROUND: Wing nut accepts ground cable. Permanently attached, insulated #8 AWG stranded conductor, 15 ft, provides a redundant local safety ground connection.

Refer to the Glossary at the end of this manual for an explanation of symbols used on the system chassis.

Figure 3: Back Panel

CIRCUIT DESCRIPTIONS

The Impulse Generator/Cable Test System is a modular unit, designed for ease of serviceability. The following is a functional description of each of the major assemblies which make up the system. The sequence of each description duplicates the power flow from input to output. See the schematic diagram shown in Figure 4.

Control Panel Assembly

This assembly is the most complex part of the system and contains nearly all of the control components. It includes Measuring Circuit Assembly, Part No. 23587, which has related calibration, shunting, protection, and switching circuits.

Main power is brought in via cable W1 which is fitted with a standard NEMA connector. For voltages other than 120 V ac, an input buck-boost autotransformer is used. This is located internally. Notice that, although there is a white and black wire identification, either of these wires may be elevated above the neutral. Thus, the system will work from phase-to-neutral or phase-to-phase mains. The ground wire (green wire) is connected internally to the chassis. A redundant ground connection is made to the chassis with a wing nut and ground cable W2.

Input power is brought directly to POWER ON/OFF switch CB1 which is a two-pole, 4.5 A circuit breaker. Both input wires are interrupted and have overcurrent protection. This circuit arrangement allows for connection to sources other than the U.S. standard. On the load side of the circuit breakers are MOV surge arresters RV1 and RV2 which are provided for suppression of transients coming into the system and being generated within the system and for suppression of transients radiating back through the power line. Relay K1 serves as a contactor for the system to control the main power to the output circuit as well as to the control circuits. Relay contacts K1A and K1B feed the variable autotransformer T1 (OUTPUT VOLTAGE CONTROL.)

The interlock circuitry of K1 forces a selection of one of the two operating modes. The interlock circuitry is also brought out to connect to an external interlock. A conventional ZERO START circuit forces the OUTPUT VOLTAGE CONTROL to be turned to its most counterclockwise condition before the system can be energized. This prevents a start-up with output voltage present. Switches S3 and S4 are controlled by the positioning of the MODE SELECTOR, where S3 is closed in the PROOF/BURN position, and S4 is closed in the IMPULSE position. The AMMETER RANGE switch must be set to X50 to enable operation in the Impulse mode. The kilovoltmeter and milliammeter mounted on the control panel have identical movements and are of a ruggedized taut band type.

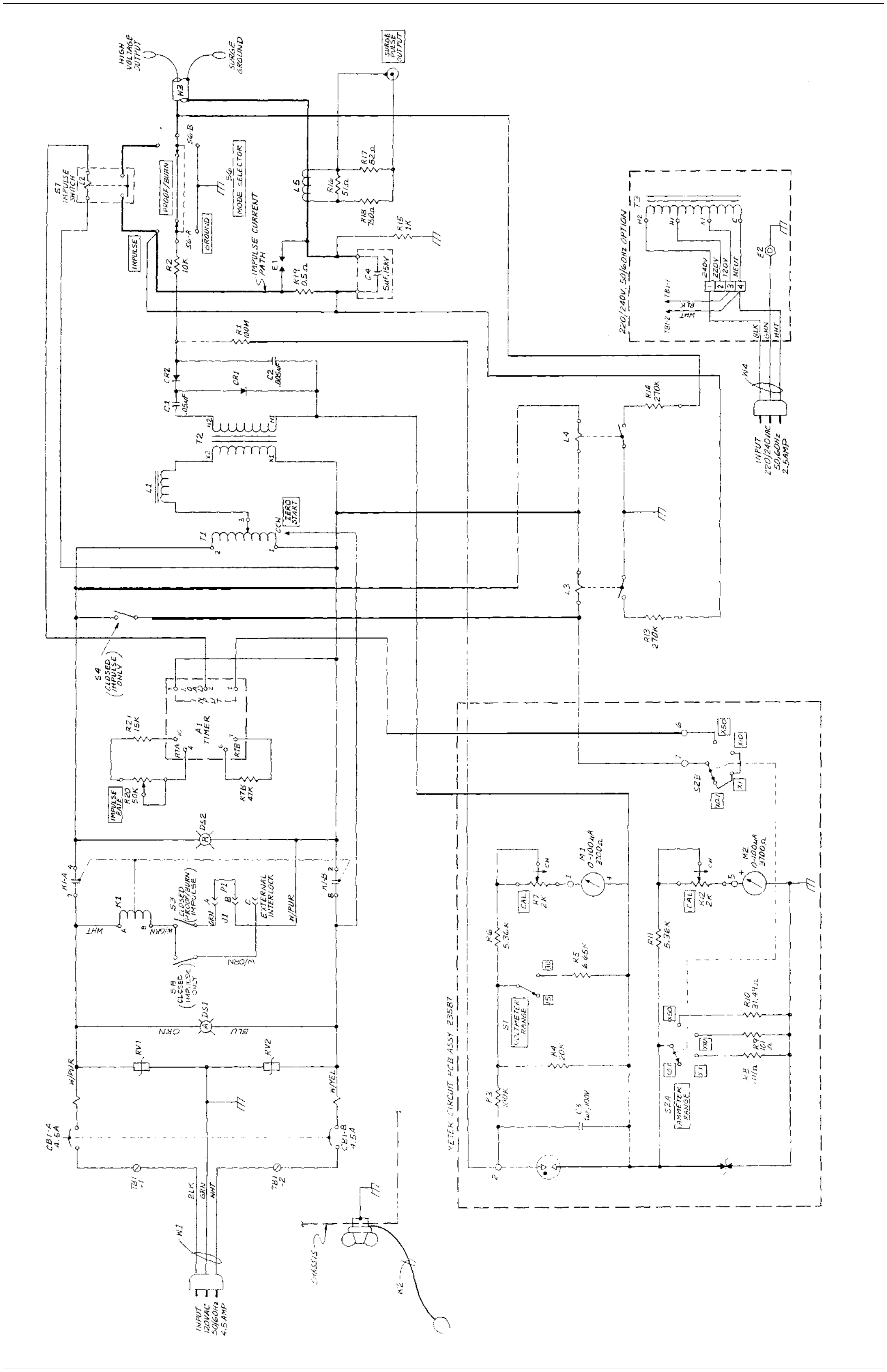

Figure 4: System Schematic Diagram

Current Limiting Choke

Current limiting or ballast choke L1 limits the amount of current that can be drawn from the line and allows the system to operate under short-circuit output conditions without tripping the circuit breaker. It also limits the current when the power supply is charging the impulse capacitors.

High-Voltage Power Supply and Impulse and Discharge Assembly

The voltage applied to the primary circuit of T2 is stepped up, then rectified by the half-wave voltage doubler circuit consisting of coupling capacitor C1, rectifier assemblies, and output capacitor C2. Resistor R1 is the voltmeter divider that feeds M1 and measures the voltage present on C2. The high-voltage output from C2 passes through the peak current limiting resistor R2 to the pole of MODE SELECTOR switch S6.

This panel also contains the impulse switch and the discharge assembly. The impulse switch is solenoid operated with an ohmic double break contact so that the impulse capacitor may be discharged to voltages of less than 500 V. This is useful in low-voltage circuit testing.

The discharge assembly is composed of two resistors (R13 and R14) rated 270 kΩ, 135 W each. Two gravity-drop, solenoid-operated switches complete the device. This assembly provides a fail-safe discharge for the external load and the internal capacitor.

Mode Selector Assembly

The MODE SELECTOR assembly permits the use of a single output cable and eliminates the need for reconnecting when changing from PROOF/BURN to IMPULSE or GROUND. The MODE SELECTOR is a large high-voltage switch consisting of two moveable arms and three sets of fixed contacts. When set to PROOF/BURN, this switch connects the high-voltage power supply directly to the output cable. When the MODE SELECTOR is set to IMPULSE, one arm (A) of this switch connects the high-voltage power supply to the impulse capacitors, providing the charge path for the impulse capacitors. Another arm (B) of this switch connects the impulse capacitor to the output cable via the impulse switch.

In the Ground mode, the MODE SELECTOR connects both the high-voltage power supply and the output cable to ground. A viewing window is situated so that these grounding connections can be easily seen. In Proof/Burn and Impulse modes, cams on the MODE SELECTOR shaft will close corresponding interlock switches. It should be noted that moving the MODE SELECTOR while in the high-voltage positions will automatically cause the system to trip out and discharge both the internal impulse capacitor and the output cable and load.

CAUTION

This is not the recommended method for removing high voltage and may cause damage to the cable under test.

Impulse Capacitor

The impulse capacitor is located at the bottom of the main assembly and rated 5 μF, 15 kV. The operating life of this capacitor is 200,000 impulses at full rating. However, if the capacitor is operated at 18,000 V, the number of impulses is reduced to 75,000; thus, it is necessary to control any use of the capacitor at overvoltage. This capacitor is insulated by air and by solid insulation from the chassis ground; the only surge ground component is the shield of the output cable.

Section 5

Setup

The following steps serve as a general guide for setting up operation. Before proceeding, read, understand, and observe all safety precautions contained in this manual. Refer to Section 2.

1. Observing all safety precautions, be sure all equipment is de-energized. Identify the faulted cables; obtain access to both ends; and erect barriers.
2. Discharge cable under test by applying a ground using a safety grounding stick (not supplied). Connect a safety ground jumper (not supplied) from the high-voltage conductor of the cable under test to the specimen ground (the ground conductor of the cable under test).

WARNING

Failure to apply a safety ground jumper to the cable under test prior to system connection can be extremely dangerous.

   a. Choose a location that meets the following conditions:

3. Both the high-voltage conductor and shield of the cable to be tested must be accessible.
   a. An electrical service suitable for the system must be available within 15 ft of the chosen location unless a special longer input cord is supplied or an extension cord is available. The service ground wire must be connected to a secure low-resistance ground.
   b. A secure low-resistance ground (less than 5 Ω) must be located within 15 ft of the system. A driven ground is often used. This ground is called the local earth ground and is used to maintain the surrounding area at the same potential as the system.
   c. The system must be within 25 ft of the terminal of the cable under test unless a special longer output cable has been supplied.
   d. The testing area should be as dry as possible.
   e. There should be no flammable material stored in the vicinity.
   f. There should be adequate ventilation in the test area.
   g. Warning lights or beacons are recommended.
4. For installation in vans or trailers:
   a. Locate the van or trailer so that it can be safely parked; set the brakes or block the wheels.

b. The system must be located within 25 ft of the terminal of the cable under test unless a longer output cable has been supplied.

c. A secure low-resistance ground (less than 5 Ω) must be located within 15 ft of the van or trailer. A driven ground is often used. This ground is called the local earth ground and is used to maintain the surrounding area at the same potential as the system. Provide a ground bond between the van or trailer frame and the GROUND wing nut on the system chassis.

d. The location must also be within 15 ft of a service outlet of appropriate voltage, frequency, and power, unless the system includes a longer input cord or if the system includes an engine-generator. The service ground wire must be connected to a secure low-resistance ground.

e. The location should be as dry as possible.

f. There should be no flammable material stored in the vicinity.

g. Set up suitable barriers to protect the operator from traffic hazards and to prevent intrusion by unauthorized personnel. Warning lights or beacons are recommended.

5. After a satisfactory location for the system has been selected, connect the system ground cable between the GROUND wing nut on the system chassis and the local earth ground (refer to step 3c or 4c).

6. Connect the output surge ground (low-voltage return lead of the high-voltage output cable) to the specimen ground (grounded shield of the cable under test).

WARNING

Do not extend the surge ground. Be sure that this connection is made to a secure low-resistance ground (less than 5Ω), usually the driven ground of the power system located in the vicinity of and connected to the specimen ground

7. Connect the output cable high-voltage lead to the faulted high-voltage conductor of the cable under test, making a firm, low-resistance connection. Be sure that the exposed conductor and clamp are sufficiently insulated to withstand the test voltage. Refer to Section 8 for minimum air clearance tabulations.

8. Connect any other conductor of the cable under test to the specimen ground making firm short connections.

9. Be sure that the POWER ON/OFF circuit breaker is set to OFF, the MODE SELECTOR switch is set to GROUND, and the OUTPUT VOLTAGE CONTROL is set to ZERO START. .

10. Connect the power input cable to the service outlet.

11. For vans or trailers having a motor-driven generator:

a. Make sure that the ground and neutral of the generator are securely tied to the machine frame and the chassis of the vehicle. Be sure that the vehicle chassis is connected to the local earth ground.

b. Start the engine-generator and allow it to warm up sufficiently to ensure normal stable operation.

c. Check the engine-generator voltage to ensure proper input voltage for the system.

12. Operation from a portable engine-generator:

The system can be operated from a portable engine-generator when a service line is not available. An engine-generator suitable for sustained operation must be rated at a minimum of 1.5 kVA. It must be equipped with a good governor that responds to load change rapidly but without excessive overshoot. The electrical output should be matched to the rated input voltage, frequency, and power.

a. Locate the engine-generator in a well-ventilated area at least 10 ft from the system.

b. Store spare fuel in a suitable safety container well away from both the engine-generator and the system.

c. Provide a ground bond between the engine-generator frame and the local earth ground. Be sure that the green neutral wire is bonded to the engine-generator frame. These leads should be no longer than 25 ft and should be equivalent to No. 8 AWG or larger.

d. Start the engine-generator and allow it to warm up sufficiently to ensure normal stable operation.

e. Check the engine-generator voltage to ensure proper input voltage for the system.

f. Connect the test system to the motor-generator using the input cord.

WARNING

Do not refuel the engine-generator while it is running.

When these setup procedures have been completed, the test may be conducted in accordance with the procedures given in Section 6.

Section 6

Operation

PRELIMINARY CHECK

Be sure to read and understand Section 2, Safety, before operating this system. To ensure a safe test setup, perform the following procedure:

WARNING

This procedure does not test the integrity of the driven grounds. Separate tests must be performed using ground testing equipment. This test only determines whether the test system is properly bonded to the cable under test.

1. Ensure that the setup procedures detailed in Section 5 have been performed.
2. Ensure that the safety ground jumper between the high-voltage conductor and the shield (specimen ground) of the cable under test remains in place for this test.
    a. The safety ground jumper must be connected directly to the conductors of the cable under test.
    b. This test checks the test system bonds to the cable under test. The high-voltage output lead and surge ground connections to the cable under test must be connected directly to the conductors of the cable under test at positions different than those used for the safety ground jumper. Direct contact of the safety ground jumper to the high-voltage output lead or surge ground defeats the purpose of the bonding test. Contact of the safety ground jumper to the high-voltage output lead or surge ground should only be through the conductors of the cable under test.
3. The connections made in step 2 complete a low-resistance path from the system's high-voltage output cable, through the high-voltage conductor of the cable under test, through the safety ground jumper, through the ground conductor (shield) of the cable under test (specimen ground), through the surge ground back to the system's high-voltage power supply.
4. Set the MODE SELECTOR to PROOF/BURN.
5. Set the OUTPUT VOLTAGE CONTROL firmly to ZERO START.
6. Set the AMMETER RANGE switch to X50 for the Burn mode or to X0.1, X1 or X10 for the Proof mode.
7. Set the POWER circuit breaker to ON. The amber LINE ON lamp will light indicating that power is being supplied to the system, and the red HV ON lamp will light indicating that power is available to the high-voltage power supply.

8. Slowly raise the test voltage while being careful not to exceed 500 V on the system voltmeter. Continue to increase the test voltage until either the milliammeter reaches 30 mA or the kilovoltmeter reaches 500 V. With a current reading of 30 mA and an output voltage of 500 V or less, the cable shield has an adequate ground connection and the required high-voltage testing may be performed.

WARNING

Do not continue testing if the current or voltage requirement is not met. This is an indication that the shield ground connection is inadequate.

9. Set the OUTPUT VOLTAGE CONTROL to ZERO START. Set the MODE SELECTOR to GROUND. Remove the safety ground jumper.
10. Proceed with the required testing.

PROOF/BURN MODE OPERATION

Depending upon the test requirement, the Proof/Burn mode is used to conduct a proof test and/or to burn down a fault.

If failure of a proof test occurs at **less than 15 kV**, the operator may (1) stop the test to prevent further fault damage, or (2) continue to apply high voltage to burn down the fault resistance, further reducing the voltage, or (3) transfer to the Impulse mode for fault-locating purposes.

If failure of the proof test occurs at **more than 15 kV**, the operator may (1) stop the test to prevent further fault damage or (2) continue to apply voltage to burn down the fault resistance, reducing the voltage to less than 15 kV for application of the Impulse mode.

To conduct either a proof test or a burn down:

1. Set the MODE SELECTOR to PROOF/BURN.
2. Set POWER circuit breaker to ON. The amber LINE ON lamp lights indicating that power is being supplied to the system.
3. Set the AMMETER RANGE switch to X50 mA for the Burn mode and X0.1, X1 or X10 for the Proof mode.
4. Set the OUTPUT VOLTAGE CONTROL firmly to ZERO START. The red HV ON lamp lights indicating that power is available to the high-voltage power supply.
5. Raise the OUTPUT VOLTAGE CONTROL to the desired level of voltage or current.

   5.1 A proof test is made by gradually increasing the OUTPUT VOLTAGE CONTROL from zero in small increments so that the output voltage reaches the desired level within 10 seconds and not exceeding 60 seconds, and by then holding that voltage for the prescribed period of time with no further adjustment of the OUTPUT VOLTAGE

CONTROL. Failure is indicated by inability of the kilovoltmeter to stabilize at the desired voltage without readjustment.

5.2 A burn down is accomplished by gradually increasing the OUTPUT VOLTAGE CONTROL to the proof test voltage level, or until the output current develops to a maximum of 30 mA, then readjusting as necessary to maintain either condition until the output voltage falls below 15 kV or below any other imposed limit for impulse voltage.

At this point the operation may be discontinued and transferred to the Impulse mode, or it may be continued to reduce further the voltage across the fault at the discretion of the operator. However, it is advisable not to reduce the voltage below that which is necessary to achieve breakdown in the Impulse mode because the lower the breakdown voltage, the weaker will be the resulting signal, even when a much higher impulse voltage is applied.

6. If desired for proof testing purposes, switch the AMMETER RANGE to X0.1, X1 or X10 and observe the current. Switch back to X50 before burning.

   6.0 The X50 range reads the rms value for burning control.

   6.1 The X0.1, X1 and X10 ranges read the true dc value for proof testing purposes.

7. To shut down or to transfer to the Impulse mode, refer to "Shutdown or Transfer Procedure" at the end of this section.

IMPULSE MODE OPERATION

With a few exceptions, cable faults can usually be impulsed at any voltage higher than the breakdown voltage that developed in the Proof/Burn mode. If it does not break down below the proof test level or within the 15 kV limit of the Impulse mode, the Proof/Burn mode must be applied to reduce further the breakdown voltage. The Impulse mode can also be applied directly without prior testing to determine whether a fault may be impulsed without need to burn down.

To impulse a fault, perform the following procedure:

1. Set the MODE SELECTOR to IMPULSE.
2. Set the POWER circuit breaker to ON. The amber LINE ON lamp lights indicating that power is being supplied to the system.
3. Set the AMMETER RANGE switch to X50. The unit will not function in the impulse mode without this switch set to X50.
4. Set the OUTPUT VOLTAGE CONTROL knob firmly to ZERO START. The red HV ON lamp will light.
5. Raise the OUTPUT VOLTAGE CONTROL to the desired level.

CAUTION

Operating at voltages in excess of 15 kV in the impulse mode may damage the impulse capacitor. Do not exceed rated voltage for any extended period of time.

5.1 To determine the minimum impulse breakdown level of the fault, increase the voltage every 10 seconds in small increments, say every 2 kV, starting at 2 kV until breakdown is observed. A slight increase will enhance a clean-cut breakdown. Some users prefer not to impulse above this minimum breakdown level; on the other hand, if a stronger impulse signal is to be used, increase the voltage according to the following step 5.2.

5.2 To impulse at rated voltage or at some other limit below rated voltage, increase the voltage every 10 seconds, starting with large increments but approaching the limit gradually so as not to overshoot that point. If the fault had been burned down previously, the initial breakdown will usually occur before the final voltage is reached.

5.3 If the fault fails to break down before reaching the proof test voltage level of the cable, it will be necessary to transfer to the Proof/Burn mode to burn down the fault and reduce the voltage.

6. To shut down or to transfer to the Proof/Burn mode, refer to "Shutdown or Transfer Procedure."

SHUTDOWN OR TRANSFER PROCEDURE

CAUTION

Never move the MODE SELECTOR during a test because shutdown will occur and damage to the cable under test or to the system could result.

1. If shutdown or transfer is desired from the Proof/Burn mode, turn the OUTPUT VOLTAGE CONTROL fully counterclockwise, then set the POWER switch to OFF. This will automatically operate the discharge assembly and reduce the output voltage. The MODE SELECTOR may now be moved to another position.
2. If shutdown or transfer is desired from the Impulse mode, turn the OUTPUT VOLTAGE CONTROL fully counterclockwise, allow the impulse switch to operate once, then turn the POWER switch to OFF. This will automatically operate the discharge assembly and reduce the voltage. The MODE SELECTOR may now be moved to another position.
3. During a temporary or permanent shutdown, disconnect the power cord from the source. Set the MODE SELECTOR switch to GROUND. Check that the kilovoltmeter reads zero and chick through the viewing window that the moving arms on the MODE SELECTOR switch are in the GROUND position. When properly grounded, the moving arms will be engaged in the large ground bar electrode.

4. To disconnect the setup, manually ground the output cable high-voltage lead with a safety ground stick and then apply safety ground jumpers.

WARNING

Never assume that the coaxial output cable or the cable under test is completely discharged, even after following the above procedures. Always use a safety grounding stick to ground any conductive part of the circuit and then apply safety ground jumpers before touching any connections.

5. Remove the test clamps from the conductor and the shield or ground.

WARNING

Leave the safety ground jumpers in place to drain any relaxation charge for a period of at least four times as long as the test voltage had been applied.

Section 7

Service

ROUTINE MAINTENANCE

This system is constructed to withstand normal conditions of field testing encountered by public utilities and industrial plants. To maintain this equipment properly, a planned program of routine maintenance for all major components should be performed every six months. In abnormally dirty areas or in difficult environments, routine maintenance may be required more often.

WARNING

This is a high-voltage system which can produce and contain dangerous voltages. Service or repair of this equipment should be performed only by qualified persons who are aware of high-voltage hazards and the necessary precautions routinely taken to prevent injury.

Before any inspection, service, or repair, the system must be completely disconnected from the power supply and from any cable under test. The manual ground must be closed and must remain closed for at least 15 minutes before access is gained to the interior of the chassis.

WARNING

When it is necessary to touch the terminals of any of the capacitors, all terminals of the capacitor should be grounded using a safety ground stick and then bonded together with safety ground jumpers, before any connections are removed from the capacitor.

If company policy requires that a defect report be provided to personnel performing maintenance, this report should be consulted prior to examining the system and the items noted on the report should be investigated at the appropriate point in the maintenance procedure.

1. Examine all cables to locate any loose or damaged terminals.
2. Inspect and clean the outer jacket of the output cable; check for breaks in this jacket. As a temporary repair, and only if the shield is intact, apply at least four layers of vinyl tape over any such damage. Replace the damaged output cable as soon as practical.

WARNING

If the output cable is not properly maintained, unexpected voltages may be accessible to operating personnel.

3. Check all controls to be sure that they operate freely.
4. Wipe the entire case clean and check for damage.

5. Check top panel for any damage to meters, switches, lights, etc.

WARNING

The impulse capacitor may be charged to a lethal voltage. This capacitor should be discharged using a safety ground stick before attempting repairs.

6. Remove the sides from the case by removing six screws in each panel. Apply a safety ground jumper across the terminals of the impulse capacitor.
7. Check to see that all screws, nuts and balls are tight.
8. Examine all electrical connections; check for evidence of corrosion or fracture.
9. Check the operation of the MODE SELECTOR to be sure that it engages properly in all positions.
10. Clean all bushings and electrical insulating supports with a clean soft cloth. Do not use solvents. Clean, low-pressure air may be used.
11. Inspect resistors for burned sections or loose bonds. Check capacitors for oil leaks or evidence of case swelling.
12. Inspect and adjust the impulse switch.

    a. Remove the impulse switch from its position inside the chassis (see Fig. 5) by disconnecting all leads from the switch, then removing the four mounting screws located on the back plate of the switch.

    b. Inspect the inside of the switch by removing the screws holding the bottom plate which drops out of the container.

    c. Clean the inside of the switch by wiping vigorously with a soft cloth.

    d. To replace the shaft or the moveable arm, remove the groove pin that holds the shaft to the armature of the solenoid. Use care when removing the pin to avoid tearing the shaft body. The contact assembly can now be removed and the defective shaft or moveable arm can be replaced. Reassemble, observing that the groove in the pin should be located on either side.

    e. To replace the stationary contacts (which should be replaced in pairs), loosen the outside nuts and tap lightly on the stud to loosen the contact body. Remove and replace.

    f. To replace the solenoid, remove the groove pin holding the shaft to the armature of the solenoid. Remove the four screws holding the solenoid body; reverse this procedure for reassembly.

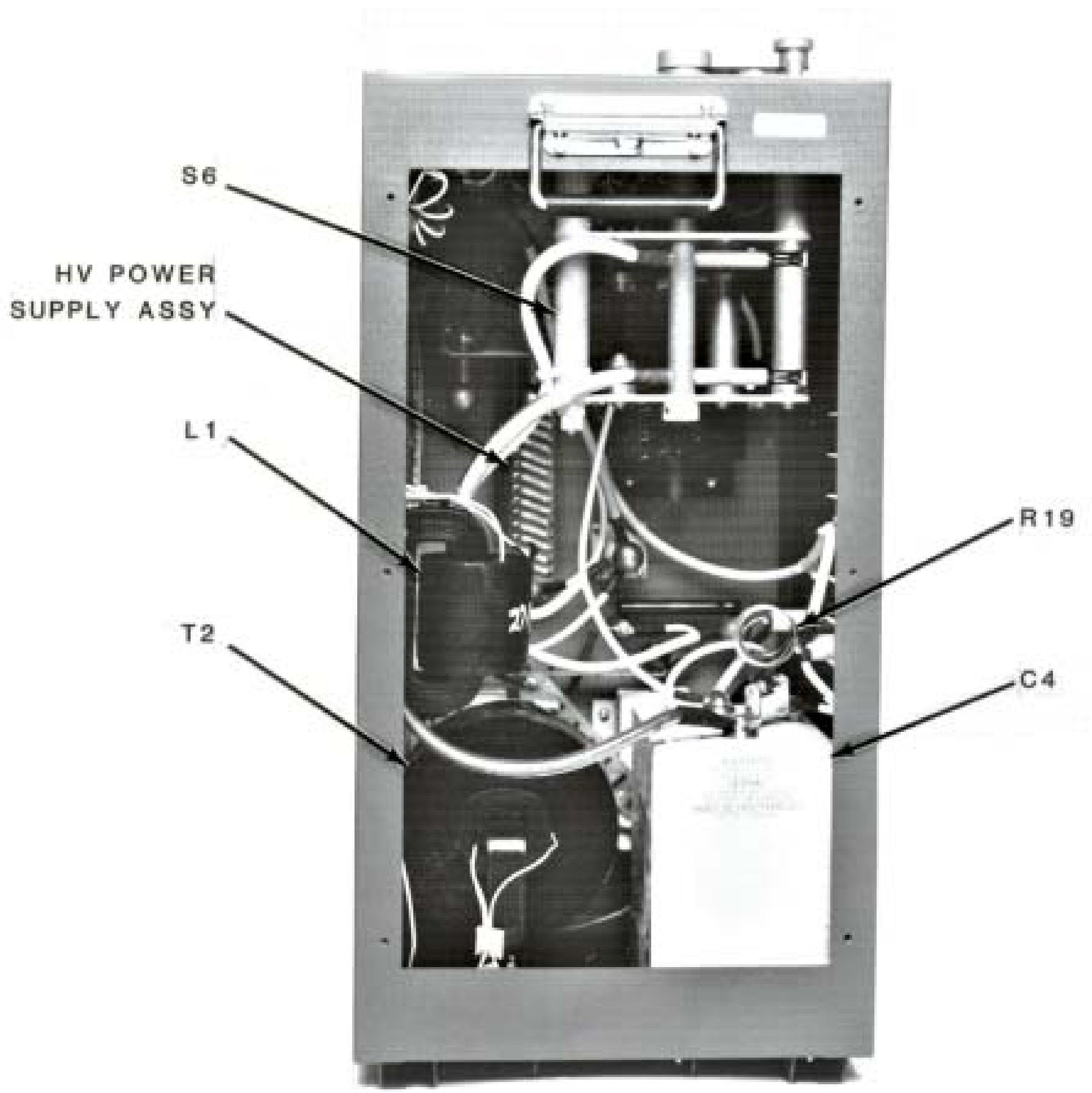

Figure 5: Chassis Interior View

g. Readjustment of the switch is usually not necessary unless a component is replaced or if the generator fails to impulse at low voltage (approximately 500 V). This is done by loosening the four screws holding the solenoid just enough to allow it to slide up and down. Connect an ohmmeter across the stationary contacts and insert a 3/64 in. shim between the solenoid body and armature. Slide the solenoid, shim, and armature combination until the meter indicates contact. Tighten nuts, remove shim, reinstall switch.

13. Check surge grounds:

    a. Coil the output cable around the cleats and place the output cable low-voltage return clamp so that it is well insulated from ground.

    b. Disconnect resistor R15 between the impulse capacitor case and chassis. Measure the path between the output cable low-voltage return clamp and the chassis ground terminal with a megohmmeter. This path should measure in excess of 5 MΩ. Reconnect resistor R15 between the capacitor case and chassis.

    c. If a dielectric test set is available, the surge ground may be tested to ground at voltage up to 5 kV.

14. Before replacing the covers, clean the viewing window with a soft dry cloth, then replace the side panels by reversing the procedure in step 6.
15. After performing routine maintenance, make a Performance Check in accordance with the procedure given in Section 8.

TROUBLESHOOTING

If the system fails to operate properly, the following troubleshooting guide will be useful in determining the cause of the malfunction. It notes possible equipment malfunctions as observed during operation or checkout and suggests the possible cause and the means of identifying the defective component. See the schematic diagram, Figure 4, and Figures 8 and 9 for help in locating the components. Refer to Section 9 when ordering replacement parts.

Special equipment required for servicing the system is identified where applicable. Refer to Section 2, Safety.

WARNING

This is high-voltage equipment and may contain dangerous voltages. Repairs must only be made by qualified personnel who are familiar with such hazards and the routine precautions required to prevent injury.

Before any service is attempted, the input and output must be completely disconnected and the MODE SELECTOR must be set to GROUND for at least 15 minutes. Any trouble reports should be reviewed. The troubleshooting guide does not suggest wiring or hardware defects as possible causes because these must be considered in every case and are not specific to this system.

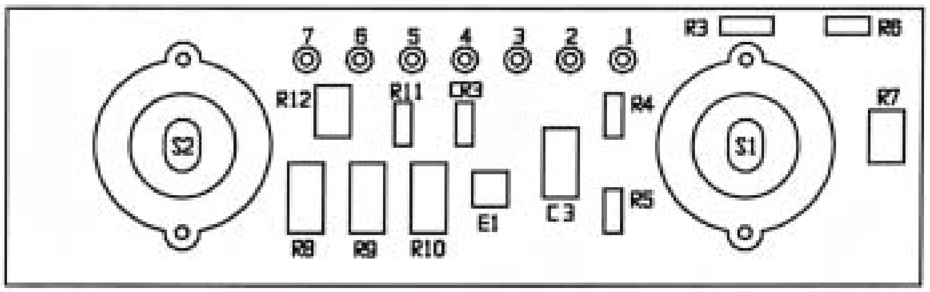

Figure 6: Metering Printed Circuit Board

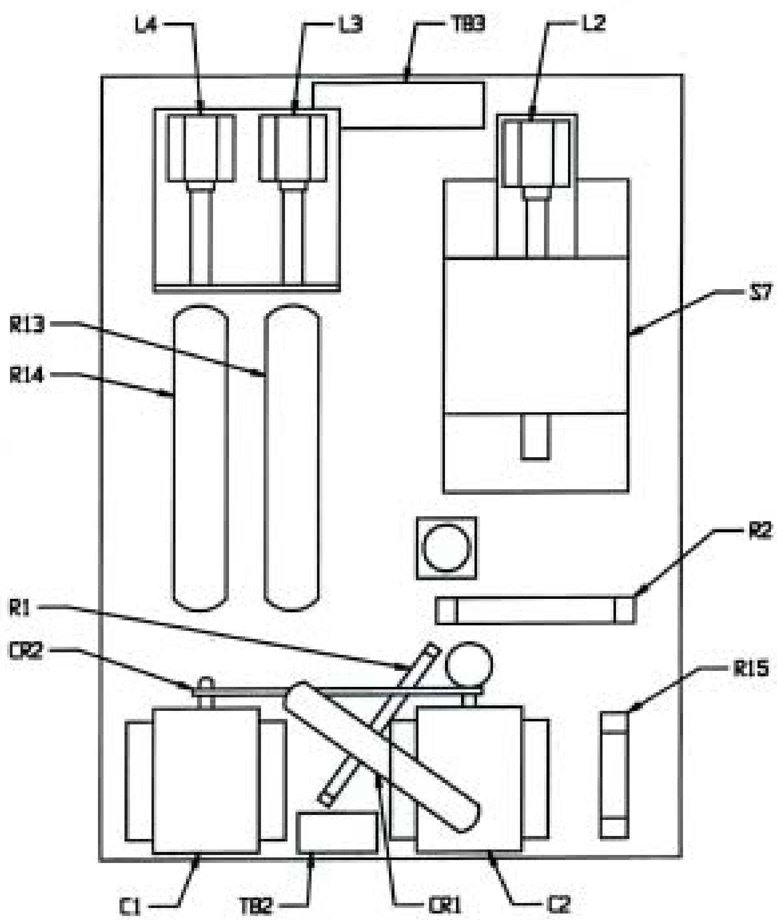

Figure 7: High-Voltage Power Supply and Impulse and Discharge Assembly

TROUBLESHOOTING GUIDE

Malfunction	Possible Cause
CONTROL CIRCUITS	
Circuit breaker (CB1) trips:	Defective CB1.
	Short circuit in line.
	T1 or T2 shorted.
	RV1 and/or RV2 shorted.
Start circuit inoperative:	Open in interlock circuit.
	Check relays and switches for proper operation (K1, S2B, S3, or S4, etc.)
	Check MODE SELECTOR.
IMPULSE MODE	
Low or no output voltage:	Component failure in voltmeter circuit.
	Impulse capacitor short.
	Component failure in high-voltage power supply.
	Defect in high-voltage discharge assembly.
	Open or shorted output cable.
	Impulse switch defective.
Voltage available, no discharge:	Impulse switch defective.
	Timer defective.
PROOF/BURN MODE	
Low or no output voltage:	Defective component in high-voltage power supply.

CALIBRATION OF MILLIAMMETER

Equipment Required

A standard direct current ammeter with the following ranges and accuracies at the reading point is required:

0.1 mA ±1 percent

1 mA ±1 percent

10 mA ±1 percent

50 mA ±1 percent

Procedure

1. Insulate all high-voltage connections from ground and connect the ammeter between the output cable high-voltage conductor and low-voltage ground return lead with the positive terminal to ground.

CAUTION

Be sure all connections are secure, because if a connection should open during a test, damage to the test equipment could result.

2. While operating in the Proof mode, slowly adjust the OUTPUT VOLTAGE CONTROL until the standard ammeter reads 10 mA.
3. Locate and remove the cover screw just below the milliammeter to access the CAL potentiometer and adjust the panel meter. Check the 50 mA range. The standard ammeter should read 19.1 mA when the panel meter reads 30 mA. The difference between the two readings takes into account the effect of the waveform (excess ripple) at this level on the standard meter, but this level is equivalent to 30 mA rms in heating value at a fault. Check the 0.1 and 1 mA range.
4. After calibration, replace the adjustment cover screw.

CALIBRATION OF KILOVOLTMETER

Equipment Required

A standard dc voltmeter is required to perform this calibration. The standard voltmeter must measure with an accuracy of ±1/2 percent at 25 kV. The instrument should preferably not draw more than 0.5 mA. If the dc voltmeter is polarity sensitive, it must be arranged so that the positive terminal is grounded and the negative terminal is elevated to the test voltage.

Procedure

1. Proceeding with due regard to safety, arrange the system and the standard voltmeter so that they can be easily read.
2. Connect the output cable low-voltage return lead to ground and the output cable high-voltage lead to the high-voltage terminal of the standard voltmeter.
3. Locate and remove the cover screw just below the kilovoltmeter to access the CAL potentiometer adjustment. Adjust the mechanical zero of the voltmeter.
4. While operating in the Proof mode, make a direct comparison between the standard voltmeter and the voltmeter of the system. If an error exists, it can be corrected by the adjusting of the kilovoltmeter CAL potentiometer.
5. After calibration replace the adjustment cover screw.

OUTPUT CABLE CHECK

Do not shorten the output cable to less than 20 ft. To check the cable perform the following:

1. Insulate and space the two outboard clamps approximately 1/8 to 1/4 in. apart.
2. Raise the output voltage in the Proof/Burn mode according to the Proof Function Test in Section 8. Breakdown of the gap should occur at approximately 10 kV and at this time the voltmeter reading will decrease and the ammeter reading will increase. If this occurs the cable is satisfactory.

If the output cable is short-circuited, an ammeter reading will be present, but the gap at the output of the test cable will not spark over.

REPLACEMENT OF COMPONENTS ON CONTROL PANEL (Fig. 8)

To replace major components on the control panel:

1. Remove the eight screws holding the panel in place.
2. Disconnect the four high-voltage leads coming from the MODE SELECTOR and the two wires that feed down to the high-voltage power supply.
3. Pull the panel free and turn it upside down. There is a service loop in the cable connections that is long enough to permit resting the panel on top of a table or workbench. This exposes all the electrical components and connections.
4. To reinstall the control panel, reverse the procedure.

REPAIR

Megger offers a complete repair service and recommends that its customers take advantage of this service in the event of equipment malfunction. Please indicate all pertinent information including problem symptoms and attempted repairs. Equipment returned for repair must be shipped prepaid and insured and marked for the attention of the Repair Department.

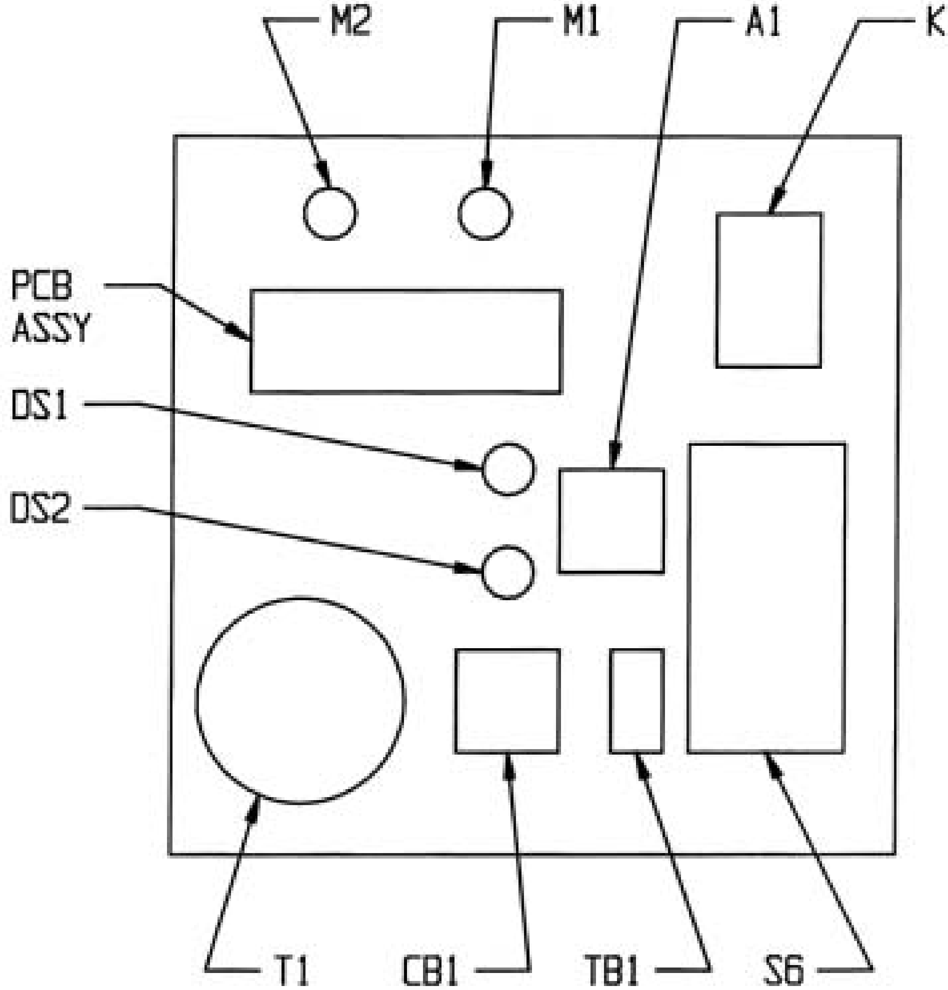

Figure 8: Control Panel, Rear View

Section 8

Performance Check

GENERAL

To verify that the system is operating properly, perform the following performance checks. These checkout procedures may be performed either in the shop after performing routine maintenance or in the field prior to conducting a fault-locating operation. As discussed previously, fault characteristics can vary widely and in some cases can even temporarily clear themselves. For such conditions, the checkout procedure can verify the proper performance of the system so that the problem of fault characteristics can be isolated. Refer to Section 2, Safety.

As a guide in setting up the test, the minimum air clearances tabulated in the following must be maintained between the exposed energized conductor and any adjacent grounds to prevent sparkover. Such sparkover may create a safety hazard. The clearance values shown apply to the direct air path at the point closest to ground.

MINIMUM AIR CLEARANCES

Test Voltage	Direct Air Path	Path Along Nylon Rope
5 kV	1-1/4 in.	1-1/4 in.
25 kV	2-5/8 in.	6-1/4 in.

IMPULSE FUNCTION TEST

1. Choose a safe test site as described in Section 5.
2. Connect the chassis ground of the system to a secure low-resistance ground.
3. Connect the low-voltage lead of the output cable to a secure low-resistance ground.
4. Connect the high-voltage lead of the output cable to the same ground as the output low-voltage lead.
5. Connect the input cable to a service outlet of the nameplate rating.
6. Set the MODE SELECTOR to IMPULSE.
7. Set the POWER circuit breaker to ON. The amber LINE ON lamp will light indicating that power is supplied.
8. Set the AMMETER RANGE switch to X50.

9. Set the OUTPUT VOLTAGE CONTROL to ZERO START. The red HV ON lamp will light and the impulse switch will close at a rate determined by the setting of the IMPULSE RATE control.
10. Slowly turn the OUTPUT VOLTAGE CONTROL fully clockwise and observe the following:

    a. Between each discharge the impulse capacitor will charge to approximately 15 kV as indicated on the kilovoltmeter.

    b. At each discharge, the kilovoltmeter needle will swing downward to approximately 5 percent of full scale and then begin to increase as the impulse capacitor completes its charge.

    c. In addition, at each discharge, the milliammeter will swing upward to approximately 60 percent and then begin to fall back as the impulse capacitor completes its charge.
11. These meter indications mean that the impulse portion of the system is operating properly. If these indications are not observed, double check the procedure and refer to Troubleshooting.
12. This completes the impulse function test. Return the OUTPUT VOLTAGE CONTROL to ZERO START, the POWER circuit breaker to OFF, and the MODE SELECTOR switch to GROUND.

PROOF FUNCTION TEST

1. Perform steps 1, 2 and 3 of impulse function test.
2. Position the output cable high-voltage connector in a barricaded high-voltage test area so that it is insulated from ground or any other conductive object by a minimum of 2 ft of air space.
3. Connect the input cable to a service outlet of the appropriate voltage, frequency, and power.
4. Set the MODE SELECTOR to PROOF/BURN.
5. Set the POWER circuit breaker to ON. The amber LINE ON lamp will light indicating that power is being supplied to the system.
6. Set the AMMETER RANGE switch to X1.
7. Set the OUTPUT VOLTAGE CONTROL to ZERO START. The red HV ON lamp will light.
8. Slowly turn the OUTPUT VOLTAGE CONTROL fully clockwise and observe the following:

    a. The kilovoltmeter will indicate 25 kV.

    b. The milliammeter will indicate less than 0.05 mA leakage current on the 1 mA range.

9. These meter indications mean that the proof testing portion of the system is operating properly. If the leakage current is excessive, make sure that the high-voltage output connector is properly insulated before performing troubleshooting. Sometimes it is helpful to put the output connector in a plastic bag to reduce leakage.
10. This completes the proof function test. Return the OUTPUT VOLTAGE CONTROL to ZERO START, the MODE SELECTOR switch to GROUND, and the POWER circuit breaker to OFF.

BURN OPERATION TEST

1. Perform steps 1 through 5 of the impulse function test.
2. Set the MODE SELECTOR to PROOF/BURN.
3. Set the POWER circuit breaker to ON. The amber LINE ON lamp will light indicating that power is being supplied to the system.
4. Set the AMMETER RANGE switch to X50.
5. Set the OUTPUT VOLTAGE CONTROL to ZERO START. The red HV ON lamp will light.
6. Slowly turn the OUTPUT VOLTAGE CONTROL fully clockwise and observe the following:

    a. The kilovoltmeter will indicate less than 500 V.

    b. The milliammeter will indicate 30 mA.

7. These meter indications mean the burn portion of the system is operating properly. If these indications are not observed, then double check the procedure and refer to Troubleshooting.
8. This completes the burn operation test. Return the OUTPUT VOLTAGE CONTROL to ZERO START, the MODE SELECTOR switch to GROUND, and the POWER circuit breaker to OFF.

Section 9

Parts List

Symbol	Description	Qty	Part No.
CONTROL PANEL ASSEMBLY		1	23773
CB1	Circuit breaker	1	6807-17
DS1	Indicator light (amber)	1	27931-2
DS2	Indicator light (red)	1	27931-1
	Bulb	2	27932-1
K1	Relay	1	17831
M1	Voltmeter	1	23779-1
M2	Milliammeter	1	23779-2
PCB	Metering ckt pcb assembly	1	23587
	a. Switch (S1)	1	19831-4
	b. Switch (S2)	1	19831-7
	c. Transient voltage suppressor (CR3)	1	17040-3
	d. Surge voltage protector (E1)	1	10189
RV1, RV2	Varistor	2	3384-2
S5	Switch (zero start contact)	1	14869
S3, S4	Switch (part of S6)	2	19152
S6	Mode selector	1	19955
T1	Variable autotransformer	1	6408-2
HIGH-VOLTAGE POWER SUPPLY AND IMPULSE AND DISCHARGE ASSEMBLY		1	29891
C1	Capacitor	1	18307-8
C2	Capacitor	1	18307-9
CR1,CR2	High-voltage rectifier assembly	2	23686
L2, L3	Solenoid	2	3817-3
R1	Resistor	1	10646-23
R2	Resistor	1	8199-2

Symbol	Description	Qty	Part No.
R13,R14	Resistor	2	27311
R15	Resistor	1	8199-3
S7	High-voltage impulse switch	1	19864
	a. Contact plate & shaft assembly	1	19865
	b. Electrode assembly	2	19870
	c. Housing	1	19874
	d. End plate	2	19874
	e. Base plate	1	19963
	f. Solenoid	1	3817-3
SYSTEM COMPONENTS			
C4	Capacitor	1	29894
J1	Interlock connector	1	10225
J2	BNC connector	1	23485
P1	Shorting plug, interlock	1	10226
R19	Resistor, damping	1	25196-1
T2	High-voltage transformer	1	23652
T3	Step-down transformer (220/240 V only)	1	23650
W1	Input cable assembly	1	19266-3
W2	Ground cable assembly	1	19265-1
W3	Output cable assembly	1	19962-2
-	Cable hanger	1	19961-1
-	Viewing window	1	19863
-	Cover	1	19268-1

GLOSSARY

	High-voltage warning
	Use only in accordance with Instruction Manual.
	Grounding procedures must be followed.
chassis ground	A connection point on a metallic chassis that connects the chassis to earth ground.
ground bond	A short, low-resistance conductor used to securely connect a point in a circuit to ground.
local earth ground	Driven earth ground made before each test, connects to GROUND wing nut on rear of chassis.
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
rms	Root mean square
safety ground jumper	Temporary connection (not supplied) made between the high-voltage conductor of the cable under test to specimen ground.
safety ground stick	An insulated stick (sometimes called a hot stick) with a hook type electrode connected to ground via an insulated cable. In some designs, frequently known as high-voltage discharge sticks, a resistor is connected between the electrode and the ground cable. Both are used to discharge capacitive specimens to ground. They must be suitably rated for the voltage and capacitance of the specimen to be discharged.
specimen ground	Ground conductor (sheath) of the cable under test. Assumed to be connected to the driven ground of the power system.
surge ground	The shield of the coaxial high-voltage output cable, this ground is connected to specimen ground before each test.
sparkover	A disruptive discharge in the form of an arc or spark between two electrical conductors or between a conductor and earth (also called arc-over or flashover).
taut band	A mechanical arrangement whereby the moving element of an instrument is suspended by means of ligaments, usually in the form of a thin flat conducting ribbon, at each of its ends. The ligaments normally are in sufficient tension to restrict the lateral motion of the moving element to within limits that permit freedom of useful motion when the instrument is mounted in any position.
TDR	Time domain reflectometer indicates and measures reflection characteristics of a transmission system.

WARRANTY

Products supplied by Megger are warranted against defects in material and workmanship for a period of one year following shipment. Our liability is specifically limited to replacing or repairing, at our option, defective equipment. Equipment returned to the factory for repair must be shipped prepaid and insured. This warranty does not include batteries, lamps, or similar items, where the original manufacturer's warranty shall apply. We make no other warranty. The warranty is void in the event of abuse (failure to follow recommended operating procedures) or failure by the customer to perform specific maintenance as indicated in this manual.