DEPARTMENT OF THE ARMY TECHNICAL MANUAL

FIELD (FOURTH ECHELON) AND DEPOT MAINTENANCE MANUAL CHARGER, BATTERY PP-2926/U (NSN 6130-00-500-0069)

This copy is a reprint which includes current pages from Changes 1 and 2.

HEADQUARTERS, DEPARTMENT OF THE ARMY
22 MARCH 1962

Changes in force: C 1 and C 2.

TM 11-6130-225-45
C2

CHANGE
No. 2

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, *2 June 1981*

FIELD (FOURTH ECHELON) AND DEPOT MAINTENANCE MANUAL
CHARGER, BATTERY PP-29261U
(NSN 6130-00-500-0069)

TM 11-6130-225-45, 22 March 1962, is changed as follows:
The title of this manual is changed as shown above.
The following warnings are added to the inside front cover:

WARNING
Charger, Battery PP-2926/U weighs 195 pounds.
BE CAREFUL when moving. Mechanical lift required.



5 SAFETY STEPS TO FOLLOW IF SOMEONE IS THE VICTIM OF ELECTRICAL SHOCK

1. **DO NOT TRY TO PULL OR GRAB THE INDIVIDUAL**
2. **IF POSSIBLE, TURN OFF THE ELECTRICAL POWER**
3. **IF YOU CANNOT TURN OFF THE ELECTRICAL POWER, PULL, PUSH, OR LIFT THE PERSON TO SAFETY USING A DRY WOODEN POLE OR A DRY ROPE OR SOME OTHER INSULATING MATERIAL**
4. **SEND FOR HELP AS SOON AS POSSIBLE**
5. **AFTER THE INJURED PERSON IS FREE OF CONTACT WITH THE SOURCE OF ELECTRICAL SHOCK, MOVE THE PERSON A SHORT DISTANCE AWAY AND IMMEDIATELY START ARTIFICIAL RESUSCITATION**

Page 2. Paragraph 1c is superseded as follows:

1.1 Indexes of Publications

Refer to the latest issue of DA PAM 310-4 to determine whether there are new editions, changes, additional publications or modification work orders pertaining to the equipment.

Paragraph 1*d* is superseded as follows:

1.2 Reporting Errors and Recommending Improvements

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) direct to: Commander, US Army Communications and Electronics Materiel Readiness Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, New Jersey 07703. In either case, a reply will be furnished direct to you.

Paragraph 1.3 through 1.6 are added after paragraph 1.2.

1.3 Maintenance Forms, Records and Reports

a. Reports of Maintenance and Unsatisfactory Equipment. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by TM 38-750, The Army Maintenance Management System.

b. Report of Item and Packaging Discrepancies. Fill out and forward SF 364 (Report of Discrepancy (ROD)) as prescribed in AR 735-112/DLAR 4140.55/NAVSUPINST 4440.127E/AFR 400.54/MCO 4430.E.

c. Discrepancy in Shipment Report (DISREP) (SF 361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33B/AFR 7518/MCO P4610.19C and DLAR 4500.15.

1.4 Reporting Equipment Improvement Recommendations (EIR)

If your battery charger needs improvement, let us know. Send us and EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Tell us why a procedure is hard to perform. Put it on an SF 368 (Quality Deficiency Report). Mail it to Commander, US Army Communications and Electronics Materiel Readiness Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, New Jersey 07703. We'll send you a reply.

1.5 Administrative Storage

Administrative storage of equipment issued to and used by Army activities will have preventive maintenance performed before storing. When removing the equipment from administrative storage, the performance test and adjustment procedure should be performed to assure operational readiness. Original packing case may be used when repacking equipment for shipment for repair.

1.6 Destruction of Army Electronics Materiel

Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-244-2.

By Order of the Secretary of the Army:

E. C. MEYER
General, United States Army
Chief of Staff

Official:

J. C. PENNINGTON
Major General, United States Army
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Ft Richardson (CERCOM Ofc) (2)
Units org under fol TOE:
29-207 (2)
29-610 (2)
29-134 (1)
29-136 (1)

NG: State AG (3)

USAR: None

For explanation of abbreviations used, see AR 310-50.

TECHNICAL MANUAL
FIELD (FOURTH ECHELON) AND DEPOT MAINTENANCE MANUAL,
CHARGER, BATTERY PP-2926/U

TM 11-6130-225-45
CHANGE No. 1

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D.C., *7 March 1963*

TM 11-6130-225-45, 22 March 1962, is changed as follows:

Page 17.

22. Insulation Breakdown Test
(fig. 4)
(Superseded)

a. Test Equipment and Materials.
(1) Insulation Breakdown Test Set AN/GSM-6.
(2) One 12-inch extension lead (similar in size to L1, L2, and L3) with battery clip connected to one end.

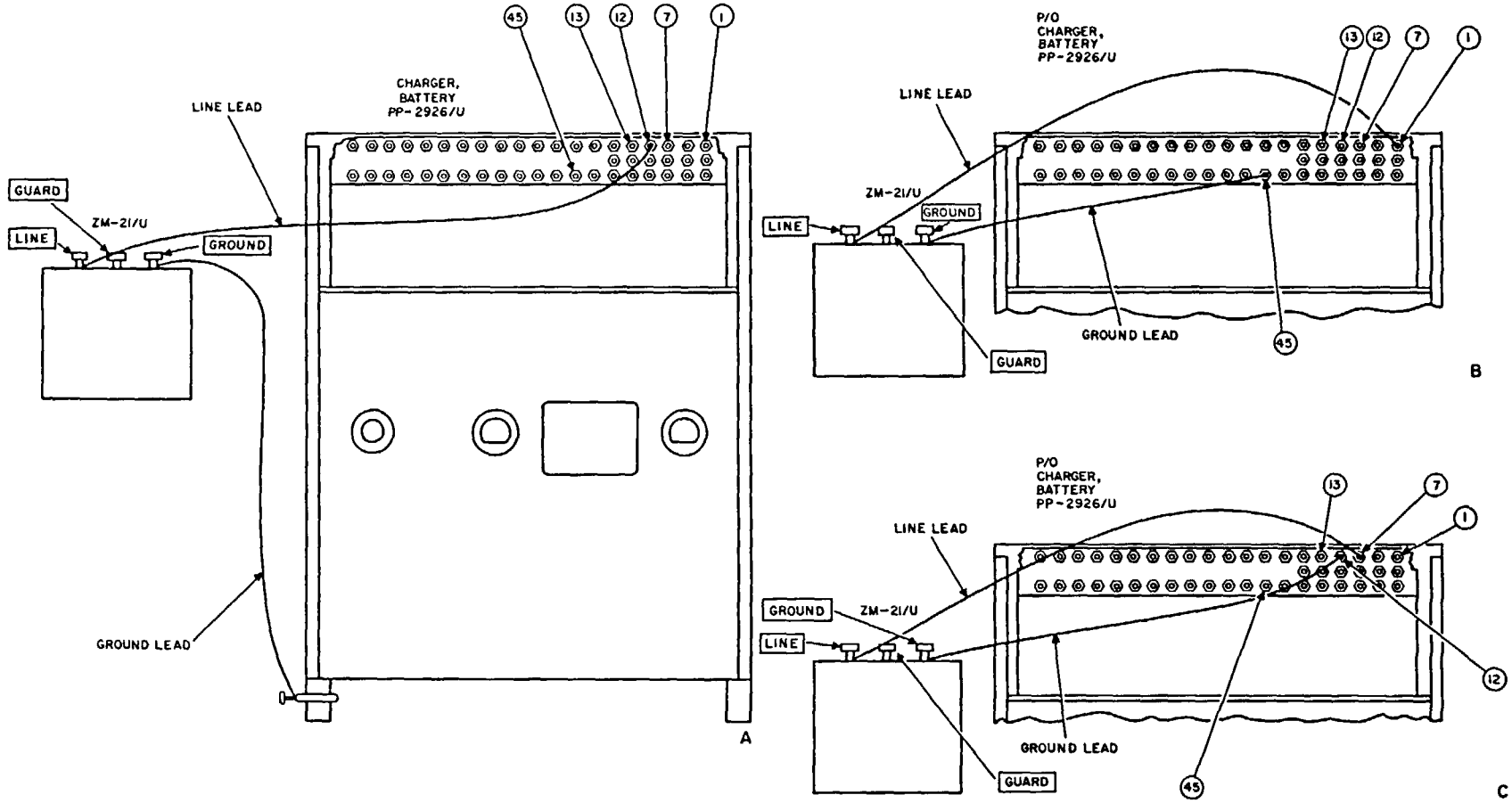
b. Test Connections and Conditions.
(1) All power to charger, battery PP-2926/U is off.
(2) The output connector is connected to the negative (-) output terminal of the AN/GSM-6.
(3) The terminal strap is connected to the positive (+) output terminal.
(4) The high-voltage caution plate of the AN/GSM-6 is against the output terminal.
(5) The ground lead of Insulation Breakdown Test Set AN/GSM-6 is connected to the chassis of the PP-2926/U.
(6) Leads L1, L2, and L3 are disconnected from TB1.
(7) All shorting links are removed from TB1.

c. Initial Test Equipment Settings.
(1) AMMETER MULTIPLIER switch set to 1,000.
(2) Kilovoltmeter polarity switch set to - (negative).
(3) Voltmeter range switch set to 5.
(4) Voltage control turned to 0.

d. Procedure.

Step No.	Test equipment control settings	Equipment under test control	Test procedures settings	Performance standards
1	.....	.....	Connect the output cable of AN/GSM -6 to the PP-2926/U as follows.	
			a. Connect the high-voltage connec-r tor of AN/GSM-6 to the conductor of lead L1 of PP-2926/U.	*a*. None.
			b. Connect a guard wire from guard connector of AN/GSM-6 to the insulation of conductor L1.	*b*. None
2	High-voltage caution plate raised and secured with chain			
3	Circuit breaker at ON	.....	Press high-voltage push switch of AN/GSM-6	None
4	.....	.....	Turn voltage control clockwise while watching the kilovoltmeter and mi-croammeter. Continue until maxi-mum voltage (2,688 v) of test is reached	Reading of approximately 2 7 kilovolts on 5 kv scale

Step No.	Test equipment control settings	Equipment under test control	Test procedures settings	Performance standards
5	.....	.....	Maintain this voltage for 1 minute.....	No insulation breakdown. Defective insulation is indicated by opening of the circuit breaker switch lighting of the DC OVERLOAD INDICATOR, or increased wavering of the microam-- meter pointer of the AN/GSM-6.
6	.....	.....	If there is no indication of leakage in step 4 and 5 above, move the high-voltage connector to L2 and L3, terminals 2, 5, 8, 11, 14, and 17 of TB1, and to one end of 200-ampere fuse, F4 in turn. Repeat the procedure described in steps 1 through 5 for each terminal. When checking terminals 2, 5, 8, 11, 14, and 17 of TB1 and fuse F4, use the extension cord and battery clip.	None.
7	.....	.....	Connect the battery clip to the terminal under test and connect the high-voltage connector to the bare end of the wire. Wrap the guard wire around the insulation.	No insulation breakdown for any position of step 6. Defective insulation is indicated by opening of the circuit breaker switch, lighting of the DC OVERLOAD indicator, or increased wavering of the microammeter pointer of the AN/GSM-6.



TAGO 8232-A

Figure 4.1. Test setup for insulation resistance test.

Add paragraph 22.1.

22.1. Insulation Resistance Test

(fig. 4.1)
(added)

a. Test Equipment and Materials. Ohmmeter ZM-21/U.

b. Test Connections and Conditions.

(1) Disconnect all external leads from charger, battery PP-2926/U.

(2) Disconnect rectifiers CR1A from terminal 44, CR1B from terminal 45, and CR1C from terminal 46 of terminal board TB1.

(3) Apply insulation resistance test as indicated in the following procedure:

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control	Test procedures settings	Performance standards
1	.....	.....	Connect test lead from ground terminal of ZM-21/U to cabinet of PP-2926/U(A fig. 4.1).	
2	.....	.....	Connect test lead from LINE terminal of ZM-21/U to terminal 12 on TB1 of PP-2926/U.	
3	.....	.....	Turn hand generator crank of ZM-21/U to operating speed.....	Minimum of 10 megohms resistance on ZM-21/U.
4	.....	.....	If no leakage is detected, test further by moving lead from LINE terminal of ZM-21/U to terminals 1, 7, 13, and 45 in turn, and turn hand generator to operating speed each time lead is Moved to a new terminal.	Minimum of 10 megohms resistance is read on each terminal.
5	.....	.....	Connect test lead from GROUND terminal of ZM-21/U to terminal 45 of TB1 on PP-2926/U.	
6	.....	.....	Connect test lead from LINE terminal of ZM-21/U to terminal 1 of TB1 PP-2926/U (B fig. 4.1).	
7	.....	.....	Turn hand generator on ZM-21/U to operating speed.....	Read minimum of 10 megohms resistance on ZM-21/U.
8	.....	.....	If no leakage is detected, test further by moving lead from lead line terminal of ZM-21/U to terminals 7, 12, and 13 of TB1 in turn. Turn hand generator of ZM-21/U to operating speed each time a lead is moved to a new terminal.	Read minimum of 10 megohms resistance on each terminal.
9	.....	.....	Connect test lead from ground terminal of ZM-21/U to terminal 12 of TB1 on PP-2926/U (C fig. 4.1).	
10	.....	.....	Connect test lead from leadline terminal of ZM-21/U to terminal 7 of TB1 on PP-2926/U.	
11	.....	.....	Turn hand generator of ZM-12/U to operating speed.....	Read minimum of 10 megohms resistance on ZM-21/U.
12	.....	.....	If no leakage is detected, test further by moving lead from lead line terminal of ZM-21/U to terminals 1, 13, and 45 of TB1. Turn hand generator of ZM-21/U to operating speed each time a lead is moved to a new terminal.	Read minimum of 10 megohms resistance on ZM-21/U for each terminal.

By Order of the Secretary of the Army:

EARLE G. WHEELER,
General, United States Army,
Chief of Staff.

Official:

J. C. LAMBERT,
Major General, United States Army,
The Adjutant General.

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Sig Fld Maint Shops (3)
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USA Mbl Spt Cen (1)
Units org under fol TOE's:
11-7 (2)
11-16 (2)
11-57 (2)
11-97 (2)
11-117 (2)
11-155 (2)
11-157 (2)
11-500 (AA-AC) (4)
11-557 (2)
11-587 (2)
11-592 (2)
11-597 (2)

NG: State AG (3); units-same as active Army except allowance is one copy to each unit.
USAR: None.
For explanation-of abbreviations used, see AR 320-50.

WARNING

EXTREMELY DANGEROUS VOLTAGES

(208 volts, 230 volts, or 460 volts, 3 phase alternating current) are used in the operation of this equipment.

SEVERE INJURY OR

DEATH ON CONTACT

may result if operating personnel fail to observe safety precautions.

TURN OFF THE EXTERNAL POWER DISCONNECT SWITCH BEFORE CHANGING TAP LEADS OR TERMINAL BOARD CONNECTIONS OF CHARGER, BATTERY PP-2926/U.

DON'T TAKE CHANCES!

WARNING
Charger, Battery PP-2926/U weigh 195 pounds.
BE CAREFUL when moving. Mechanical lift required.

Technical Manual
No. 11-6130-225-45

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *22 March 1962*

CHARGER, BATTERY PP-2926/U

CHAPTER 1
THEORY

1. Scope

a. This manual covers field and depot maintenance for Charger, Battery PP2926/U. It includes instructions appropriate to fourth and fifth echelons for troubleshooting, testing, and repairing specified maintenance parts. It also lists tools, materials, and test equipment for fourth and fifth echelon maintenance. Detailed functions of the equipment are covered in this section.

b. The complete technical manual for this equipment includes TM 11-6130-22512.

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1.6 Destruction of Army Electronics Materiel

Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-244-2.

2. General

a. Battery Charger PP-2926/U (battery charger) operates on a power input from a three phase four-wire source, and produces the required direct-current (dc) output to be used for charging either 18-cell lead-acid or 30-cell nickel-iron type storage batteries. Input power can be connected from a 3 phase, 60 cps source of 208, 230, or 460 volts; adjustments within the battery charger permit any of these three voltage levels to be used. A tapped resistor in series with the charging circuit is used to regulate the output current and voltage, as required, for the battery to be charged.

b. For lead-acid type batteries, initial charging rates for discharged batteries are approximately one-sixth of their ampere-hour ratings. As the battery becomes charged, its counter electromotive force (cemf) increases and the rate of current flow through the output circuit is reduced below the initial rate. Whim the voltage per-cell of the battery under charge reaches a predetermined level, relay K6 energizes. This action increases the series resistance in the output circuit to provide a finishing charge rate (approximately 30 percent of the initial rate), and operates a preset timer. When the timer knob returns to zero, the battery charger turns off automatically.

c. For nickel-iron type batteries, initial charging rates for discharged batteries are approximately one-fifth of their ampere hour ratings. As the battery becomes charged, its cemf increases and the rate of current flow through the output circuit is reduced below the initial rate. When the voltage per-cell of the battery under charge reaches a predetermined level, relay K6 energizes. This action starts a preset timer. When the timer knob returns to zero, the battery charger turns off automatically.

3. Input Control Circuit

(fig. 9)

a. The input control circuit of the battery charger turns power on and off. Power is furnished to the control circuit through one phase of the power input, between lead L3 and the neutral lead LO. Lead L3 is connected to either terminal 13 or terminal 14 on terminal board TB1 (TM 11-6130-225-12), according to the voltage rating of the power input. When timer B1 is set for any time other than zero, switch S4 is closed. When power switch S3 is set at either LEAD-ACID ON or NICKEL-IRON ON and the access door is closed to close interlock switch S5, the input circuit is completed. Relays K1 and K2 energize, closing contacts 1-2 and 3-4 of K1 and contacts 1-2 of K2 to apply input power to the primaries of transformers T1, T2, and T3 to start operation of the battery charger. Pilot lamp DS1 lights to show that power has been applied to the PP-2926/U.

b. Contacts 2-4 of relay K3 remain open at this time. The motor for timer B1 is not operating, and the time set on its dial does not change.

c. If the heat rises in the battery charger, thermal overload protective switches S1 and S2 detect the heat rise and open the control circuit. Switch S1 is mounted on the top of the core of transformer T3, and switch S2 is mounted on the bus bar of rectifier CR1. When either switch is actuated, the power is turned off automatically, and remains off until the switch cools enough to again close its contacts. The circuit is restored when the thermal switch contacts close. Switches S1 and S2 cannot be reset manually.

d. If operation is required with the access door open, pull the plunger of switch S5 to close the interlock. Closing the access door or pressing in on the plunger restores the automatic safety feature of interlock switch S5.

4. AC Power Input Adjustments

a. Power may be furnished from a 208-, 230-, or 460-volt 3-phase source. Each of the transformer primary windings is tapped, with each tap connected to a terminal on terminal board TB1. Transformer secondary voltage is standardized through a system of connecting leads and shorting links (TM 11-6130-225-12) and the output voltage is identical regardless of which input voltage is being used. Variations of input voltage within the normal tolerances will be reflected as proportional variations in the output.

b. The connections of leads L1, L2, and L3, and of the shorting links, are described and illustrated in TM 11-6130-225-12.

5. Blowers

Blowers B2 and B3 are used to cool the transformers, rectifier, and output current regulating resistors R1 and R2. Blower B2, located over the rectifier, is connected to terminals 7 and 9 of terminal board TB1, and is turned on automatically when power is applied to transformer T2. Blower B3, located over transformer T2, is connected to terminals 1 and 3 of terminal board TB1, and is turned on automatically when power is applied to transformer T1. In each case, the primary connections are arranged so that the correct voltage is applied to each blower, regardless of the actual input voltage.

6. Rectification

The secondary voltage outputs from transformers T1, T2, and T3 are delta connected at terminals 44, 45, and 46 of terminal board TB1. Rectifier CR1 is a three-phase full-wave rectifier which accepts the three input voltages from the secondary of the transformers and produces a dc output (fig. 9).

7. Current Regulation

a. General. Charger, Battery PP-2926/ U is used for charging either lead-acid or nickel-type batteries throughout a wide range of ampere hour ratings. The output current is regulated for the type and ampere hour rating of the battery by connecting series resistor R1 and R2 into the battery charging circuit. The resistors are tapped to permit the selection of the proper amount of series resistance for each application.

b. Lead-Acid Type Batteries. Charging, of lead-acid type batteries requires the application of a high charging rate for a period of up to 6 hours, depending on the battery condition, followed by a finishing charge for approximately 1 hour. Two tap leads are used to provide the required series resistance values for these conditions. The appropriate connections for tap leads X and Y, corresponding to the ampere-hour rating of the battery being charged, are described in TM 11-6130-225-12.

c. Nickel-Iron Type Batteries. Charging of nickel-iron type batteries requires the application of a high charging rate for the full period of charge, depending on the battery condition, followed by a continued application of the same charging rate for approximately 1 hour. The two tap leads are connected to the same terminal on terminal board TB1 (shorting across contacts 1-2 of relay K4) for this type of operation, and the same amount of series

resistance is used for both the initial and the finishing periods. The appropriate terminals to which the tap leads are to be connected is described in TM 11-6130-225-12.

d. Output Indications. Ammeter M1, on the front panel, indicates the resultant rate of current flow to the battery being charged, and voltmeter M2 shows the voltage of the battery being charged. The current expected at initial operating time for a discharged battery is shown in TM 11-6130-225-12. As charging continues, the voltage per-cell of the battery increases and its cemf increases. This produces a gradual decrease in the rate of current flow, with a corresponding gradual increase in the indicated voltage. If a battery is only partially discharged when it is connected to the battery charger, the initial current rate will be correspondingly less than the rated amount given in TM 11-6130-225-12. The final rate of current flow for nickel iron type batteries is about 65 percent of the initial rate. For lead-acid type batteries, the regular charging circuit is continued until current is reduced to about 65 percent of the initial rate. At this point relay K6 operates and the circuit is changed to provide a finishing charge rate, about 30 percent of the initial rate, during the timed finishing cycle.

8. Output Control

a. Relay K4. This relay, together with relay K6, controls the output charge rate of the PP-2926/U. Direct current is applied through the normally closed contacts 1 and 3 of relay K3, which are in series with a portion of the winding of relay K4 (terminals 5 and 6), and normally closed contacts 4 and 6. Relay K4 is energized at this time and opens contacts 4 and 6, causing current to flow through the entire winding (from terminals 3 to 5) and through limiting resistor R3. Contacts 1 and 2 of relay K4 close connecting tap lead Y to the output for the initial charge rate condition. Capacitor C1 prevents arcing across contacts 4 and 6 when they open.

b. Relay KS. Relay K5 provides a means for completing the current path to the battery being charged. Contacts 3 and 4 of relay K2, which are in series with the winding of relay K5, close when power is applied to the charger. The method by which relay K5 is energized is similar to that of relay K4. Resistor R4 is a current limiting resistor and capacitor C2 prevents arcing across contacts 4 and 6 when they open. When relay K5 is energized, contacts 1-2 of relay K5 close the circuit to the battery being charged.

c. Relay K6 (fig. 3). Relay K6, located on the front of the PP-2926/U, is a voltage sensitive type unit. This relay is energized when the voltage per cell of nickel-iron batteries under charge reaches a satisfactory level. When the batteries reach this level, the cemf of the battery will cause the output current to be reduced and the output voltage to increase. When the battery condition produces the voltage (shown on voltmeter M2) which corresponds to the fully charged state, relay K6 energizes. The basic relay sensitivity (42.7 volts) is satisfactory for lead-acid type batteries. When power switch S3 is set at NICKEL-IRON ON, the resistance tapped in resistor R5 is series-connected to regulate the sensitivity to 50.8 volts (across resistor R5 and relay K6) for nickel-iron type batteries. When relay K6 is energized, it closes contacts 3-4 in series with relay K3. This will energize relay K3 and start the timer.

d. Relay K3. Relay K3 is energized to start timer B1 when contacts 3-4 of relay K6 close (c above). Contacts 2-4 of relay K3 close to complete a path through which the motor of timer B1 is connected to input power; timer B1 operates until its dial returns to zero, at which time the entire battery charger is turned off (para 9). Resistor R6 limits relay current. Contacts 1-3 of relay K3 are in series with the coil of relay K4; when they open, relay K4 is deenergized, opening contacts 1 and 2 of K4. Tap lead Y is. disconnected from the output, and tap lead X provides the effective output tap. For nickel-iron type batteries, this does not affect the output, but for lead-acid type batteries, it establishes the finishing charge condition.

9. Shutdown

a. Automatic. Battery charging will continue until the voltage per-cell of the battery has been improved to a standard charged state. An added time interval, normally 1 hour, is set with timer B1 when charging begins. After the timer motor has operated through the period of time required to turn its dial back to zero, switch S4 opens. This opens the control circuit and automatically turns off power to the PP-2926/U.

b. Manual. If desired, the PP-2926/U may be turned off at any time by setting power switch S3 at OFF, by returning the knob of timer B1 to zero, or by opening the hinged access door.

CHAPTER 2

TROUBLESHOOTING

Section I. GENERAL TROUBLESHOOTING INFORMATION

Warning: **When servicing the PP-2926/U, be extremely careful to avoid contact with the high voltages. Always disconnect the power source from the PP-2926/U before removing any of the cabinet panels for access to the interior of the unit. When power is required for testing with the panels removed, the input voltage is present under the fuse cover at fuses F1, F2, and F3, (fig. 1) relays K1 and K2, and the right end of terminal board TB1 (terminals 1 through 18).**

10. General Instructions

The procedures in this chapter supplement those described in TM 11-6130-225-12. The systematic troubleshooting procedure, which begins with the operational checks performed at an organizational level, is carried to a higher level in this chapter. Sectionalizing, localizing, and isolating techniques used in the troubleshooting procedures are more advanced.

11. Organization of Troubleshooting Procedures

a. General. The first step in servicing a defective PP-2926/U is to sectionalize the fault. Sectionalization means tracing the fault to the input or output portion of the unit. The second step is to localize the fault. Localization means tracing the fault to a defective circuit responsible for the condition. Some faults, such as burned-out resistors, arcing, and shorted transformers, can often be located by sight, smell, and sound. The majority of faults, however, must be isolated by checking voltages and resistances.

b. Sectionalization. The tests given in (1) and (2) below will reduce unnecessary work, and aid in tracking trouble in a defective battery charger. Charger, Battery PP-2926/U is a single unit, and is theoretically divided into a power input portion and a power output portion. All alternating current (ac) circuits are included in the power input, and all dc circuits are included in the power output portion. Determine whether the fault is in the ac portion or the dc portion as follows:

(1) *Visual inspection*. The purpose of visual inspection is to locate faults without testing or measuring instruments. The meter readings on the front panel of the battery charger can aid in this inspection.

(2) *Operational tests*. Operational tests frequently indicate the general location of trouble. In many instances, the tests will help in determining the exact nature of the fault. A series of operational tests is given in TM 11-6130-225-12.

c. Localization. The tests given in (1), (2), and (3) below will aid in isolating the trouble. First, localize the trouble to the input or the output, and then isolate the trouble within that portion of the circuit by voltage, resistance, and continuity measurements. Use the following methods of trouble localization:

(1) *Voltage and resistance measurements*. Use the overall schematic diagram (fig. 9) to find the value of the components. Use the table of resistances for relay coils (para 14) to find normal readings, and compare them with the readings taken.

(2) *Troubleshooting chart*. The trouble symptoms listed in the chart (para 13) will aid in localizing trouble to a component part.

(3) *Intermittent troubles*. In all these tests, the possibility of intermittent troubles should not be overlooked.

If present, this type of trouble often maybe made to appear by tapping or jarring the equipment. Check the wiring and connections to the components of the battery charger.

12. Test Equipment Required

Multimeter TS-352/U and Voltmeter TS443/U are required for troubleshooting. Multimeter TS-352/U is used for continuity tests, resistance and ac or dc voltage measurements. Voltmeter TS-443/U is used for dc voltage measurements.

13. Localizing Troubles

a. General. Procedures are outlined in the following chart for localizing troubles to the input or output portion of the battery charger, and for localizing troubles to a particular part. Parts location is shown in figure 1.

b. Use of Chart. The troubleshooting chart is designed to supplement the operational checks outlined in TM 11-6130-225-12. If previous operational checks have resulted in reference to a particular item of this chart, go directly to the referenced item. If no operational symptoms are known, repeat the operational checklist and proceed until the trouble is identified.

c. Removal of Side, Rear, and Top Panels.

Warning: **When servicing the PP-2926/ U, be extremely careful to avoid contact with the high voltages. Always disconnect the power source from the PP-2926/U before removing any of the cabinet panels for access to the interior of the unit. When power is required for testing with the panels removed, the input voltage is present under the fuse cover at fuses F1, F2, and F3 relays K1 and K2 and at the right and of terminal board TB1 (terminals 1 trough 18).**

The components in Charger, Battery PP2926/U can be easily reached by removing the side, rear, and top panels of the cabinet. Proceed as follows:

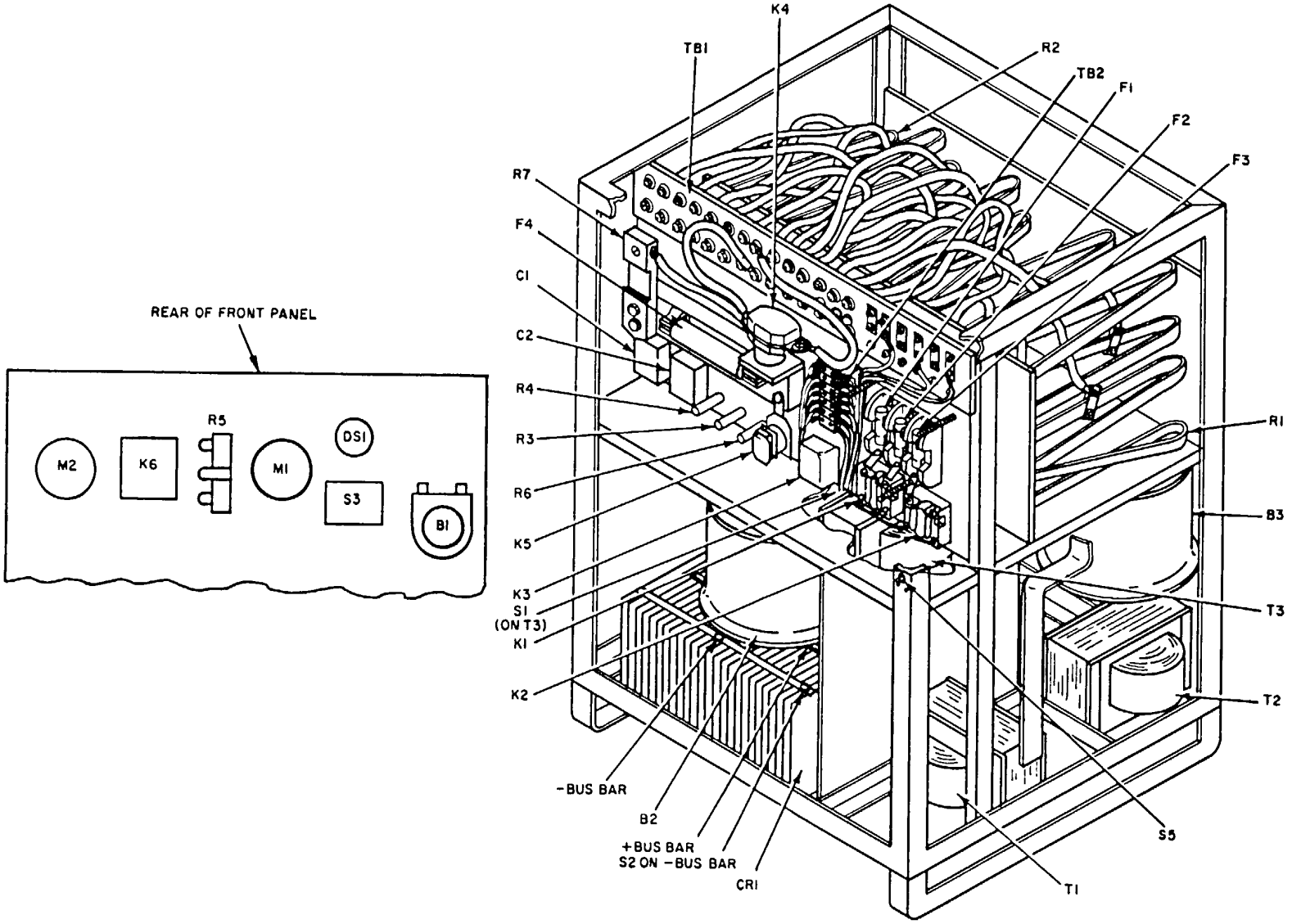
(1) Loosen the two elbow connector clamps (at the left side panel) which hold the output cable leads. Remove all mounting screws which attach the left side panel to the frame of the battery charger. Pull the side panel away from the frame while feeding the output cable leads through the connectors. If desired, the output cable leads may be disconnected from the bus bar on CR1 and terminal 2 of relay K5 and removed completely from the connectors. Reconnect the leads (after removal from the panel) to complete the circuit through the output cable for testing. Refer to figure 10 for lead connections, and be careful to observe polarity.

(2) If power leads are connected to the battery charger, loosen the clamp on the connector through the right side panel. Remove all mounting screws which attach the right side panel to the frame. Pull the side panel away from the frame, feeding the power leads through the connector. Disconnect the power leads from the upper terminals of F1, F2, and F3, and from terminal 12 on TB1.

(3) Unscrew the two eyebolts that go through the corners of the top panel, and remove the screws which attach it to the frame. Remove the top panel.

(4) Remove the mounting screws which attach the rear panel to the frame of the battery charger, and remove the rear panel.

d. Removal of Front Panel. To reach the components mounted at the rear of the front panel, or within the battery charger behind the front panel, remove the mounting screws that attach the front panel to the frame and pull it straight out away from the frame. The cable which connects the front panel components to the other circuits of the battery charger has enough slack to permit the front panel to be moved out and provide access to these components. Pull the plunger of interlock switch S5 to overcome the interlock control if operation is required while the front panel is removed from the battery charger.



TM 6130-225-15-8

Figure 1. Charger, Battery PP-2926/U, component location.

e. Conditions for Tests. Operational checks require that a power input be connected (TM 11-6130-225-12). Be sure that a power disconnect switch (TM 11-6130-225-12) is available in the power input line to control the power to the battery charger. Disconnect the battery to be charged and the input power during all resistance and continuity checks.

f. Troubleshooting Chart.

Note: **Perform the operations given in the operational checklist (TM 11-6130-225-12) before using this chart, unless trouble has already been localized.**

Item	Indication	Probable trouble	Procedure
1	Pilot lamp does not light with the power switch on and timer set for any time other than zero.	Interlock open	Close access door or pull plunger of interlock switch to close interlock.
		Lamp burned out	Replace lamp.
		Links and leads not properly arranged.	Arrange links and leads properly, considering power source voltage (TM 11-6130-225-12).
		Power source lead LO not connected.	Connect lead LO to terminal 12 on TB1.
2	Pilot lamp lights, but relays K1 and K2 do not operate.	Thermal switch S1 or S2 open; interlock switch S5 open.	Place power switch to OFF and external disconnect switch to OFF, Measure resistance between terminals 8 and 9 of TB2. Resistance reading should be approximately 109 ohms.
3	Neither blower motor operates-	Relay K1 not operating	Measure resistance between terminals 8 and 9 of TB2. Resistance-reading should be approximately 109 ohms. If resistance is high (218 ohms or more) relay K1 is open.
		Relay K1 contacts 1-2 and 3-4 open.	Clean and/or bend contacts as required for continuity when relay is energized.
4	Blower motor B3 operates, but B2 does not operate.	Fuse F2 blown	Replace fuse F2.
		Leads for B2 disconnected	Reconnect leads on TB1 (TM 11-6130-225-12).
		Blower motor defective	Replace blower motor.
		Relay K1 contacts 1-2 open	Check relay K1 (step 3 above).
5	Blower motor B2 operates, but B3 does not operate.	Fuse Fl blown	Replace fuse F1.
		Leads for B3 disconnected	Reconnect leads on TB1 (TM 11-6130-225-12).
		Relay K1 contacts 1 and 2 open.	Check relay K1 (step 3 above).
		Blower motor defective	Replace blower motor.
6	Voltmeter M2 reads 0 volt dc; ammeter M1 reads zero current,	Tap lead Y not connected	Connect tap lead Y (TM 11-6130-225-12).
7	Voltmeter M2 reads low voltage; ammeter M1 reads low current.	Transformer T1, T2, or T3 not operating.	Place external disconnect switch to OFF and disconnect the 3 black leads at the front of terminals 44, 45, and 46 of TB1. Place external disconnect switch to ON, place power switch of PP-2926/U to ON, and check for equal ac volts between each of the three pairs of terminals (44-45, 44-46 and 45-46)
		Defective CR1	Connect the negative lead to terminal 27 of TB1. Check for equal resistance between terminal-27 of TB1 and each of the disconnected black Leads. Connect the positive lead to terminal 4 of TB2. Check for equal resistance between terminal 4 of

Item	Indication	Probable trouble	Procedure
			TB2 and each of the disconnected black leads.
8	Voltmeter M12 reads low voltage; ammeter M1 reads high current.	Tap leads X (and Y) not correctly connected.	Connect tap leads correctly (TM 11-6130-225-12).
9	Voltmeter M2 reads high voltage; ammeter M1 reads zero current.	Fuse F4 blown	Replace fuse F4.
		Relay K5 not energized	Check contacts 3-4 of relay K2. Clean and/or bend contacts as required for continuity when energized. Check coil connections (terminals 3, 5, and 6) for relay K5.
		Relay K5 contacts 1-2 open	Check voltage across output with dc voltmeter; no voltage indicates open K5 contacts 1-2.
		Defective output cable or connector p1.	Repair or replace cable or connector as required.
		Output connector P1 not connected to battery.	Connect to battery.
10	Voltmeter M2 reads high voltage; ammeter M1 reads low current; relay K6 not energized.	Tap leads X (and Y) not correctly connected.	Connect tap leads correctly (TM 11-6130-225-12).
		Relay K6 coil 1-2 open	Check coil connections and continuity for relay K6, terminals 1-2
		Relay K4 not energized	Check coil connections 6-5 of relay K4.
			Check normally closed contacts 4-6 of relay K4 for continuity.
			Check normally closed contacts 1-3 of relay K3 for continuity.
		Relay K4 contacts 1-2 open	Check for voltage indication on voltmeter M2 with tap lead Y disconnected; any voltage indicates K4 contacts 1-2 closed.
11	Relay K4 chatters	Resistor R3 open	Replace resistor R3.
12	Relay K5 chatters	Resistor R4 open	Replace resistor R4.
13	Relay K4 overheats	Capacitor C1 shorted	Replace capacitor C1.
14	Relay K5 overheats	Capacitor C2 shorted	Replace capacitor C2.
15	Relay K6 energizes too early (lead-acid operation).	Relay sensitivity not properly adjusted.	Adjust relay sensitivity (para 17).
16	Relay K6 energizes too early (nickel-iron operation).	Switch S3 set at LEAD-ACID ON.	Correct switch position.
		Resistor R5 set too low-	Increase resistance of R5 (para 18).
17	Relay K6 energizes for lead-acid operation, but does not energize for nickel-iron operation.	Resistor R5 open	Replace resistor R5.
		Resistor R5 set too high	Decrease resistance of R5 (para 18).
		Defective switch S3B	Replace switch S3.
18	Relay K6 energizes at normal time, but timer does not operate and relay K4 remains energized.	Relay K6 contacts 3-4 open	Clean and/or bend contacts 3-4 as required for continuity when relay is energized.
		Resistor R6 open	Replace resistor R6.
		Relay K3 coil 5-6 open	Replace relay K3.
19	Relay K6 energizes at normal time, deenergizing relay K4, but timer does not operate.	Normally open contacts 2-4 of relay 3B do not close.	Clean and/or bend contacts 2-4 as required for continuity when relay is energized.
		Timer motor B1 defective	Replace timer B1.
20	Operation normal, except automatic shutdown does not occur.	Timer switch S4, on motor B1, defective.	Replace timer B1.

14. Dc Resistances of Relay Coils and Transformer Windings

a. Relay Coil Resistances. The dc resistances, of the relays are given in the following chart. There are two values shown for relays K4 and K5; each relay contains two windings. To measure the resistance values, disconnect all wires to coil terminals 3, 5, and 6, and measure resistance between pairs of terminals while they are disconnected from the circuit.

Relay	Terminals	Ohms
K1	5-6	217
K2	5-6	217
K3	5-6	300
K4	5-6	8
	3-5	124
K5	5-6	8
	3-5	124
K6	1-2	2,000

b. Transformer Winding Resistances. All transformer windings are such that the resistance is less than 1 ohm for any primary or secondary winding.

Section II. REPAIRS

15. General Parts Replacement Techniques

Warning: **When servicing the PP-2926/ U, be extremely careful to avoid contact with high voltages. Always disconnect the power source from the PP-2926/U before removing any of the cabinet panels for access to the interior of the unit. When power is required for testing with the panels removed, powerinput voltage is present under the fuse cover at fuses F1, F2, and F3; relays K1 and K2; and at the right end of terminal board TB1 (terminal 1 through 18).**

Most of the parts in Charger, Battery PP-2926/U can be reached easily and replaced without special procedures. A cover over the parts inside the right portion of the access door protects personnel from accidentally contacting any ac input power connections. Remove the three wingnuts and the cover for access to fuses F1, F2, and F3; the right portion of terminal board TB1; and the upper contacts of relays K1 and K2.

a. All wiring, between parts mounted on the front panel and the other components of the battery charger, is in the form of a cable and attached to terminal board TB2 on the subpanel inside the access door. Mounted on the front panel are timer B1 (including switch S4), ammeter Ml, power switch S3, pilot lamp DS1, resistor R5, relay K6, and voltmeter M2. The leads are harnessed into a cable and are color coded as shown in figure 10. To remove the front panel completely from the battery charger, remove all lead terminations at the right side of terminal board TB2, and remove the cable assembly.

b. All parts, which are mounted on the vertical subpanel, are accessible for testing through the hinged access door at the top of the front panel. If a part is to be replaced, remove the subpanel from its mounting to obtain access to the rear panel.

c. Side, rear, and top panels are removable for access to all parts mounted within the cabinet of the battery charger (para 13c).

d. There are three sets of bus bars on rectifier CR1 (fig. 1). The bar toward the front panel is the negative bus bar, the one at the top center is the positive bus bar, and the three shorter bars at the rear are the three-phase ac input bus bars which are located over CR1A, CR1B, and CR1C, respectively.

16. Resistor Tap Connections

a. Series resistors R1 and R2 (fig. 1) regulate the output current for each specified load by providing a variety of resistance values to be selected by the operator. Twenty-five taps are connected from the appropriate physical points along the surface of the resistors to numbered terminals on terminal board TB1. The appropriate connection for each load is shown in TM 11-6130-225-12.

b. Each tap is made by connecting two flat straps across the surface of the resistor, and connecting a cable from the tapped point to the appropriate terminal on terminal board TB1. A typical arrangement of the parts involved for connecting a tap is shown in figure 2.

c. The physical location of each tap determines its regulating effect. The proper position for each tap is measured by a

dynamic test. Determine the proper position for each tap as follows:

(1) Connect a 0.475-ohm 10-kilowatt (kw) resistance across the output cable terminations. Connect the resistance to a mating connector and connect it to output connector P1 during these tests.
(2) Connect tap leads X and Y to terminal 29 on terminal board TB1.
(3) Operate the battery charger for at least 5 minutes to permit heating of the internal load resistors.
(4) Use Voltmeter TS-443/U to measure dc voltages between the terminals on terminal board TB1 as follows:

Measure between terminals	De voltage
29 - 31	5.8
29 - 33	23.1
29 - 35	32.3
29 - 37	35.0
29 - 39	37.1
29 - 41	37.2
29 - 43	37.2
29 - 28	37.1
29 - 19	37.6
29 - 30	37.2
29 - 20	38.0
29 - 32	37.5
29 - 21	39.6
29 - 34	37.4
29 - 22	41.0
29 - 36	37.7
29 - 23	41.9
29 - 38	38.6
29 - 24	42.6
29 - 40	39.8
29 - 25	43.4
29 - 42	41.1
29 - 26	43.8
29 - 27	44.4

(5) If any of the indicated voltages do not match the amount shown in the chart, trace the lead from the rear of the affected terminal on terminal board TB1 to the tap connection on resistor R1 or R2, and adjust the position of the tap for the correct indication.

17. Adjustment of Relay K6

a. Relay K6 is a voltage sensitive relay on the front panel. It is adjusted to energize when the voltage across its coil is 42.7 volts or more, at a temperature of 77° F (25° C).

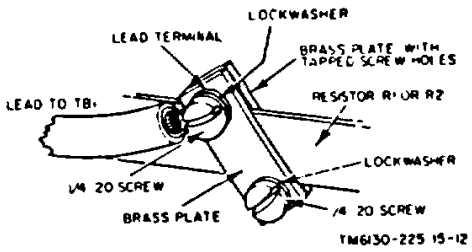


Figure 2. Typical resistor tap connection.

b. Test the voltage at which the relay becomes energized as follows:

(1) Connect a three-phase variable transformer to the input of the battery charger.
(2) Connect Voltmeter TS-443/U across the coil leads of relay K6, terminals 1-2.
(3) Set timer B1 for 60 minutes, and set power switch S3 at LEADACID ON.
(4) Adjust the input voltage with the variable transformer until Voltmeter TS-443/U indicate s approximately 40 volts.
(5) Observe the armature of relay K6 through the glass cover. See that relay K6 is not energized. If it is, reduce the input voltage until relay K6 is deenergized.
(6) Increase the input voltage gradually. Note the reading on Voltmeter TS-443/U at the time the relay energizes.
(7) If the voltage ((6) above) is 42.7 volts +1 percent, the relay is adjusted satisfactorily. If the voltage is not within this range, adjust relay K6 as directed in, *c* below.

c. If relay adjustment is required, proceed as follows:

(1) Press a screwdriver against the soft metal seal over the mounting screw which holds the cover to the base. Break the seal. Remove the screw and the cover.
(2) Without turning the adjusting screw (fig. 3), move the screw and adjusting nut to free the nut from its molded seat; stretch the spring to permit this movement.

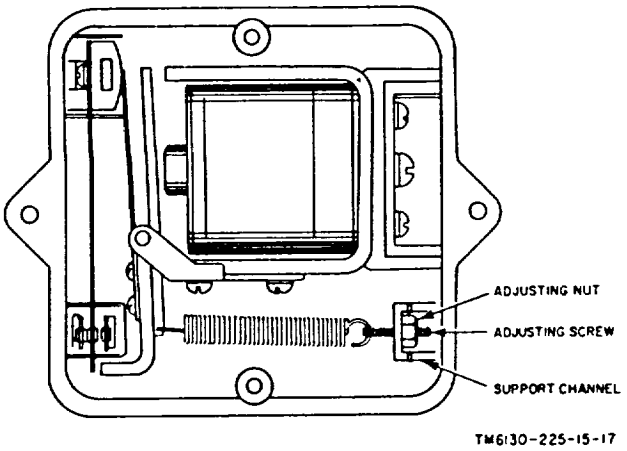


Figure 3. Relay K6, front view.

(3) Carefully turn the adjusting nut one-sixth of a turn and release, allowing it to reseat. Turn clockwise to increase the voltage sensitivity.

(4) See that the flats of the adjusting nut are firmly seated in the support channel.

(5) Replace the cover and fasten with the cover screw.

(6) Replace the sensitivity test (*b* above).

(7) If necessary, repeat the procedure given in (1) through (5) above until the sensitivity is within the required range.

18. Adjustment of Resistor R5

a. Variable tapped resistor R5 is series-connected with relay K6 for nickel-iron type batteries. It effectively increases the voltage at which relay K6 becomes energized. This compensates for the difference in terminal voltage, between the two types of batteries which maybe charged with the battery charger, at the time during the charge cycle when finishing rates should be applied.

b. Resistor R5 (fig. 1) is adjusted after relay K6 has been adjusted (para 17), so that an applied voltage of 50.8 volts across the resistor and relay in series will cause the relay to be energized. The temperature should be approximately 77° F (25° C) for proper adjustment conditions.

c. To test the voltage at which the relay becomes energized, proceed as follows:

(1) Connect a three-phase variable transformer to the input of the battery charger.

(2) Connect Voltmeter TS-443/U across the series circuit which includes relay K6 and resistor R5. Connect the voltmeter positive (+) lead to terminal 1 of K6, and the negative (-) lead to terminal 5 of S3.

(3) Set timer B1 for 1 hour, and set power switch S3 at NICKEL-IRON ON.

(4) Adjust the voltage applied to P1 with the variable transformer until Voltmeter TS-443/U indicates approximately 45 volts.

(5) Observe the armature of relay K6 through the glass cover. See that relay K6 is not energized. If it is, reduce the input voltage until relay K6 is deenergized.

(6) Increase the input voltage gradually. Note the reading on Voltmeter TS-443/U at the time the relay energizes.

(7) If the voltage given in (6) above is 50.8 volts ±1 percent, the relay is adjusted satisfactorily. If the voltage is not within this range, turn off the power and loosen the screw that holds the sliding tap on resistor R5, move the tap, and tighten the screw again.

CHAPTER 3

FOURTH ECHELON TESTING PROCEDURES AND FIFTH ECHELON FINAL TESTING

Section I. FOURTH ECHELON TESTING PROCEDURES

19. General

a. Testing procedures are prepared for use by Signal Field Maintenance Shops and Signal Service Organizations responsible for fourth echelon maintenance of signal equipment to determine the acceptability of repaired signal equipment. These procedures set forth specific requirements that repaired signal equipment must meet before it is returned to the using organization. The testing procedures may also be used as a guide for the testing of equipment that has been repaired at third echelon if the proper tools and test equipments are available. A summary of the performance standards is given in paragraphs 24, 25, and 26.

b. Comply with the instructions preceding the body of each chart before proceeding to the chart. Perform each testing sequence. Do not vary the sequence. For each step, perform all the actions required in the *Test equipment control settings and Equipment under test control settings* columns; then perform each specific test procedure and verify it against its performance standard.

20. Test Equipment and Tools

All test equipment and tools required to perform the testing procedures given in this section are listed in the following charts and are authorized under TA 11-17 and TA 11-100(11-17).

a. Test Equipment.

Nomenclature	Technical Manual
Ammeter ME-65/U	TM 11-487H-1
Multimeter TS-352/U	TM 11-5527
Insulation Breakdown Test Set AN/GSM-6.	TM 11-6625-273-12
Voltmeter TS-443/U	TM 11-487H-I

b. Tools. All the tools required for maintenance are included in Tool Kit TK87/U. The supply manual for this tool kit is SM 11-4-5180-1108.

21. Physical Tests and Inspection

a. Test Equipment and Materials. None required.

b. Test Connections and Conditions. Remove the top, side, and rear panels from the cabinet (para 13c). Overcome interlock by pulling the plunger of switch S5 for operation with the access door opened.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control	Test procedures settings	Performance standards
1	N/A	Controls may be set at any position	*a.* Inspect all controls and mechanical assemblies for loose or missing screws, bolts, or nuts.	*a.* Screws, bolts, and nuts are tight; none missing.
			b. Inspect connector and fuseholders for looseness and damage.	*b.* No looseness or damage is evident.
2	N/A	Controls may be set in any position	Rotate timer knob through its full range, from 0 to 180 (minutes).	Operates evenly; not loose.
3	N/A	Controls may be set in any position	*a.* Inspect case and chassis for damage, missing parts, and condition of finish and panel lettering. *Note*: Touchup painting is recommended instead of refinishing whenever practicable Screwheads, binding posts, receptacles, and plated fastener parts will not be painted or polished with abrasives.	*a.* No damage or missing parts evident. External surfaces Intended to be painted do not show bare metal. Panel lettering is legible.

Figure 4 superseded by Change 1

22. Insulation Breakdown Test

(fig. 4)

(Superseded)

a. Test Equipment and Materials.

(1) Insulation Breakdown Test Set AN/GSM-6.

(2) One 12-inch extension lead (similar in size to L1, L2, and L3) with battery clip connected to one end.

b. Test Connections and Conditions.

(1) All power to charger, battery PP-2926/U is off.

(2) The output connector is connected to the negative (-) output terminal of the AN/GSM-6.

(3) The terminal strap is connected to the positive (+) output terminal.

(4) The high-voltage caution plate of the AN/GSM-6 is against the output terminal.

(5) The ground lead of Insulation Breakdown Test Set AN/GSM-6 is connected to the chassis of the PP-2926/U.

(6) Leads L1, L,2, and L3 are disconnected from TB1.

(7) All shorting links are removed from TB1.

c. Initial Test Equipment Settings.

(1) AMMETER MULTIPLIER switch set to 1,000.

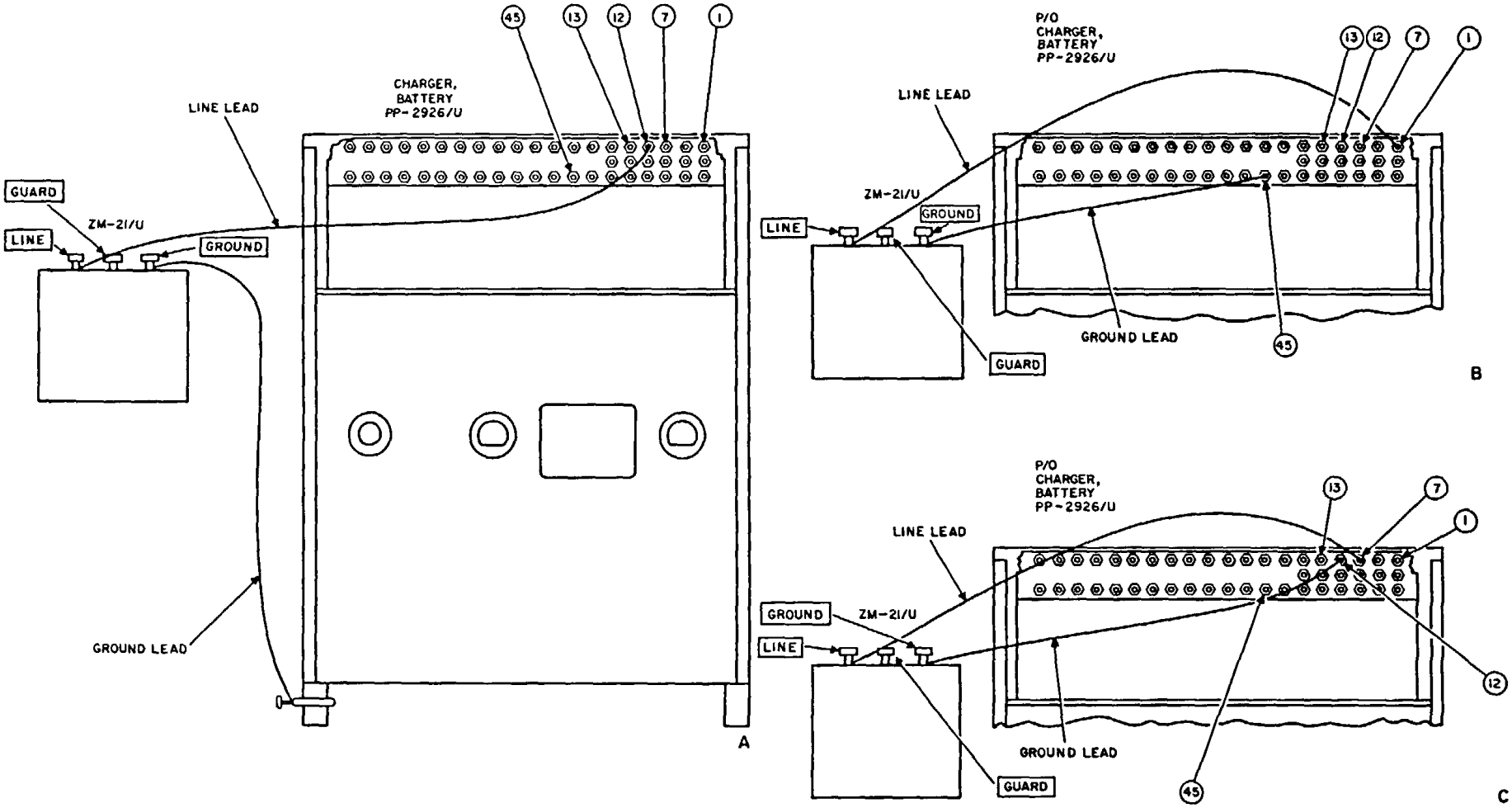
(2) Kilovoltmeter polarity switch set to - (negative).

(3) Voltmeter range switch set to 5.

(4) Voltage control turned to 0.

d. Procedure.

Step No.	Test equipment control settings	Equipment under test control	Test procedures settings	Performance standards
1	.....	.....	Connect the output cable of AN/GSM-6 to the PP-2926/U as follows. *a*. Connect the high-voltage connector of AN/GSM-6 to the conductor of lead L1 of PP-2926/U. *b*. Connect a guard wire from guard connector of AN/GSM-6 to the insulation of conductor L1.	*a.* None. *b*. None
2	High-voltage caution plate raised and secured with chain			
3	Circuit breaker at ON	.....	Press high-voltage push switch of AN/GSM-6.	None
4	.....	.....	Turn voltage control clockwise while watching the kilovoltmeter and microammeter. Continue until maximum voltage (2,688 v) of test is reached	Reading of approximately 2.7 kilovolts on 5 kv scale
5	.....	.....	Maintain this voltage for 1 minute.	No insulation breakdown. Defective insulation is indicated by opening of the circuit breaker switch lighting of the DC OVERLOAD INDICATOR, or increased wavering of the microammeter pointer of the AN/GSM-6.
6	.....	.....	If there is no indication of leakage in steps 4 and 5 above, move the high-voltage connector to L2 and L3, terminals 2, 5, 8, 11, 14, and 17 of TB1, and to one end of 200-ampere fuse, F4 in turn. Repeat the procedure described in steps 1 through 5 for each terminal. When checking terminals, 2, 5, 8, 11, 14, and 17 of TB1 and fuse F4, use the extension and battery clip.	None.
7	.....	.....	Connect the battery clip to the terminal under test and connect the high-voltage connector to the bare end of the wire. Wrap the guard wire around the insulation.	No insulation breakdown for any position of step 6. Defective insulation is indicated by opening of the circuit breaker switch, lighting of the DC OVERLOAD indicator, or increased wavering of the microammeter pointer of the AN/GSM-6.



TM6130-225-45-20

Figure 4.1. Test setup for insulation resistance test.

22.1. Insulation Resistance Test

(fig. 4.1)

(added)

a. Test Equipment and Materials. Ohmmeter ZM-21/U.

b. Test Connections and Conditions.

(1) Disconnect all external leads from charger, battery PP-2926/U.

(2) Disconnect rectifiers CR1A from terminal 44, CR1B from terminal 45, and CR1C from terminal 46 of terminal board TB1.

(3) Apply insulation resistance test as indicated in the following procedure:

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control	Test procedures settings	Performance standards
1	.....	.....	Connect test lead from ground terminal of ZM-21/U to cabinet of PP-2926/U(A fig. 4.1).	
2	.....	.....	Connect test lead from LINE terminal of ZM-21/U to terminal 12 on TB1 of PP-2926/U.	
3	.....	.....	Turn hand generator crank of ZM-21/U to operating speed	Minimum of 10 megohms resistance on ZM-21/U.
4	.....	.....	If no leakage is detected, test further by moving lead from LINE terminal of ZM-21/U to terminals 1, 7, 13, and 45 in turn, and turn hand generator to operating speed each time lead is moved to a new terminal.	Minimum of 10 megohms resistance is read on each terminal.
5	.....	.....	Connect test lead from GROUND terminal of ZM-21/U to terminal 45 of TB1 on PP-2926/U.	
6	.....	.....	Connect test lead from LINE terminal of ZM-21/U to terminal 1 of TB1 PP-2926/U (B fig. 4.1).	
7	.....	.....	Turn hand generator on ZM-21/U to operating speed	Read minimum of 10 megohms resistance on ZM-21/U.
8	.....	.....	If no leakage is detected, test further by moving lead from leadline terminal of ZM-21/U to terminals 7, 12, and 13 of TB1 in turn. Turn hand generator of ZM-21/U to operating speed each time a lead is moved to a new terminal.	Read minimum of 10 megohms resistance on each terminal.
9	.....	.....	Connect test lead from ground terminal of ZM-21/U to terminal 12 of TB1 on PP-2926/U (C fig. 4.1).	
10	.....	.....	Connect test lead from leadline terminal of ZM-21/U to terminal 7 of TB1 on PP-2926/U.	
11	.....	.....	Turn hand generator of ZM-12/U to operating speed	Read minimum of 10 megohms resistance on ZM-21/U.
12	.....	.....	If no leakage is detected, test further by moving lead from lead line terminal of ZM-21/U to terminals 1, 13, and 45 of TB1. Turn hand generator of ZM-21/U to operating speed each time a lead is moved to a new terminal.	Read minimum of 10 megohms resistance on ZM-21/U for each terminal.

23. Testing Input Current

a. *Test Equipment and Materials*. Multimeter TS-352/U, Ammeter ME-65/U, a three-phase variable transformer, and a resistance load bank consisting of a 0.475-ohm, 10-kilowatt resistance are required. If a suitable load is not available, one can be made from ten 1-kw strip heaters and two 54-inch pieces of 1-1/2-inch angle iron. Use strip heaters such as those used in electrical baseboard heating.

(1) Bend each angle iron to form a triangle approximately 18 by 18 by 18 inches. These triangles are used as mounting brackets.
(2) Mount the strip heaters on these brackets.
(3) Provide an output terminal on each angle iron.

b. Test Connections and Conditions. Connect the equipment as shown in figure 5 and use the information given under Test procedure in the following chart. When the load is in use, provide forced air cooling.

c. Procedure.

Caution: Before removing or replacing any fuse, be sure that all power into the PP-2926/U is disconnected.

Step No.	Test equipment control settings	Equipment under test control	Test procedures settings	Performance standards
1	*TS-352/U* Function: Vac Range: 500V	Power OFF ---------- Attach tap leads X and Y to terminal 29 to TB1. Connect shorting links between terminals 2-5, 8-11, 14-17, 3-6, 9-12, and 15-18 on TB1. Connect L1, L2, and L3 to terminals 2, 8, and 14 on TB1.	Disconnect input power. Remove cover over fuses and remove fuse F1.	None.
2	ME-65/U Range: 50A	Pull plunger of S5 to close interlock	Connect ME-65/U lead to terminals of fuseholder of F1. Connect TS-352/U to terminal 12 (LO) and and one side of fuse (fig. 5).	None. None.
3	----------	Set the timer knob at 60 minutes. Power switch to either LEAD-ACID ON or NICKEL-IRON ON.	Adjust variable transformer for 208-volt input to PP-2926/U.	TS-352/U reads 208 volts. ME-65/U reads input current of 8.7 amperes ±10 percent.
4	----------	Power switch to OFF----------	Main disconnect switch to OFF.	
5	----------	Push in on plunger of S5 to close interlock.	Replace fuse Fl.	
6	Same as steps 1 and 2.			
7	----------	----------	Remove fuse F2 and connect ME-65/U leads to terminals of fuse-holder of fuse F2 (fig. 5). Move the 500V lead of TS-352/U to one side of fuseholder F2. Leave common lead connected to terminal 12 (LO) (Step 2).	
8	----------	Pull plunger of S5 to close interlock	Connect power to PP-2926/U.	
9	----------	Timer switch to 60 minutes. Power switch to either LEAD-ACID ON or NICKEL-IRON ON.	Adjust variable transformer for 208-volt input.	TS-352/U reads 208 volts. ME-65/U Reads input current of 8.7 amperes ±10 percent.

10	----------	Power switch to OFF ----------	Disconnect all input power to PP-2926U. Remove all test leads and replace fuse F2.	
11	----------	Push plunger of S5 to its center position to set interlock.		
12	Same as steps 1 and 2.			
13	----------	----------	Disconnect Input power, remove fuse F3, and connect TS-352/U leads to terminal 12 (LO) and one side of fuse F3 (fig. 5). Connect ME-65/U lead to terminals of fuseholder F3.	
14	----------	----------	Connect input power to PP-2926/U.	
15	----------	Timer switch to 60 minutes. Power switch to either LEAD-ACID ON or NICKEL IRON-ON.	Adjust variable transformer for 208-volt input.	
16	----------	Pull plunger of switch S5 to close interlock. interlock.	----------	ME-65/U reads 9.6 amperes ±10 percent Input current. TS-352/U reads 208 volts.
17	----------	Power switch to OFF.		
18	Same as steps 1 and 2.			
19	----------	Push plunger of S5 to its center position to set interlock. Attach tap lead X or Y to terminal 29 on TB1. Connect shoring links between terminals 1-4, 7-10, 13-16, 3-6, 9-12, and 15-18 on TB1. Connect L1, L2, and L3 to terminals 1, 7, and 13 on TB1.	Disconnect input power to PP-2926/U. Remove fuse Fl. Connect ME-65/U Leads to terminals of fuseholder of F1. Connect TS-352/U to LO on TB1 and fuse terminal of F1 as shown on figure 5.	
20	----------	Turn power switch to either LEAD-ACID-ON or NICKEL-IRON-ON and pull plunger out to close interlock. Set timer switch to 60.	Adjust variable transformer for 230-volt input.	ME-65/U reads 8.6 amperes ±10 percent. TS-352/U reads 230 volts.
21	----------	Turn power switch to OFF-	Disconnect input power to PP-2926/U. Replace fuse F1.	
22	----------	Push-in plunger of S5 to its center position to set interlock.		
23	----------	----------	Remove fuse F2. Connect ME-65/U leads to terminals of fuseholder. Connect TS-352/U to terminal 12 of TB1 and one side of fuseholder of F2 (fig. 5). Connect power to PP-2926/U.	
24	----------	Timer switch to 60 minutes. Turn power switch to either LEAD-ACID ON or NICKEL-IRON ON.		
25	----------	Pull plunger of S5 to overcome interlock	Adjust variable transformer to 230-volt input.	TS-352/U reads 230 volts. ME-65/U reads 8.6 amperes ±10 percent.
26	----------	Turn power switch to OFF.		

27	----------	Push plunger of S5 to its center position to set interlock.	Disconnect power input to PP-2926/U. Replace fuse F2.	
28	----------	----------	Remove fuse F3 and connect ME-65/U leads to terminals of fuseholder of F3. Connect TS-352/U to terminal 12 of TB1 and one side of fuseholder of F3.	
29	----------	Pull out plunger of S5 to overcome interlock.		
30	----------	Timer switch to 60 minutes. Turn power switch to LEAD-ACID ON or NICKEL-IRON ON.	Adjust variable transformer for 230-volt input.	TS-352/U reads 230 volts. ME-65/U Reads 8.9 amperes ±10 percent.
31	----------	Turn power switch to OFF-	Disconnect power input to PP-2926/U. Replace fuse F3.	
32	----------	Push plunger of S5 to its center position to set interlock.		
33	Same as steps 1 and 2.	Connect shorting links between terminals 3-4, 9-10, and 15-16 on TB1. Connect leads L1, L2, and L3 to terminals 1, 7, and 13 on TB1. Timer to 60 minutes. Turn power switch to LEAD-ACID ON and NICKEL-IRON ON.	Remove fuse F1 and connect ME-65/U to terminals of fuseholder. Connect TS-352/U to terminal 12 of TB1 and one side of fuseholder of fuse F1 as shown in figure 5. Connect input power to PP-2926/U.	None.
34	----------	Pull plunger of S5 to close interlock	Adjust variable transformer to 460-volt input.	ME-65/U reads 4.6 amperes ±10 percent. TS-352/U reads 460 volts.
35	----------	Disconnect input power to PP-2926/U; replace fuse F1. Turn power switch to OFF.		
36	----------	Push in on plunger of S5 to its center position to set interlock.		
37	----------	----------	Remove fuse F2 and connect ME-65/U leads to terminals of fuseholder of F2. Connect TS-352/U to terminal 12 of TB1 and one side of fuseholder of F2.	
38	----------	Timer switch to 60 minutes. Turn power switch to LEAD-ACID ON or NICKEL-IRON ON. Pull plunger of S5 to close interlock.	Connect input power to PP-2926/U. Adjust variable transformer to 460-volt input.	ME-65/U reads 5.0 amperes ±10 percent. TS-352/U reads 460 volts.
39	----------	Turn power switch to OFF ----------	Disconnect power input to PP-2926/U.	
40	----------	Push plunger of S5 to its center position to set interlock.		
41	----------	----------	Remove fuse F3 and connect ME-65/U leads to terminals of fuseholder of F3. Connect TS-352/U to terminal 12 and one side of fuseholder of F3. Connect input power to PP-2926/U. Adjust variable transformer to 460-volt input.	

42	----------	Timer switch to 60 minutes. Turn power switch to LEAD-ACID ON or NICKEL-IRON ON.		
43	----------	Pull plunger of S5 to close interlock	Disconnect power input to PP-2926/U	ME-65/U reads 5.04 amperes ±10 percent. TS-352/U reads 460 volts.
44	----------	Timer switch to ZERO ---------- Power switch to OFF.	Disconnect all test leads on PP-2926/U.	

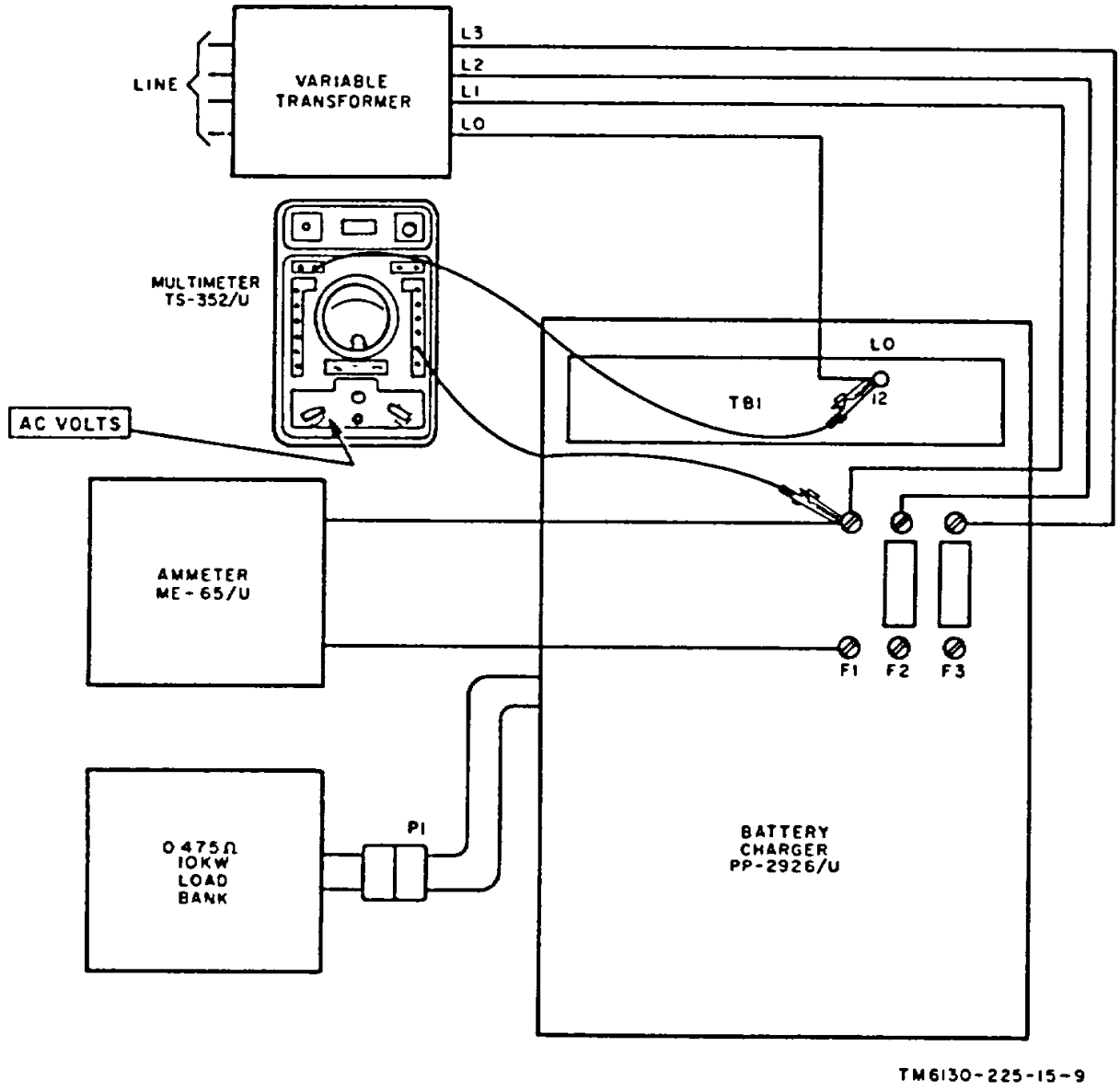


Figure 5. Test setup for testing input current.

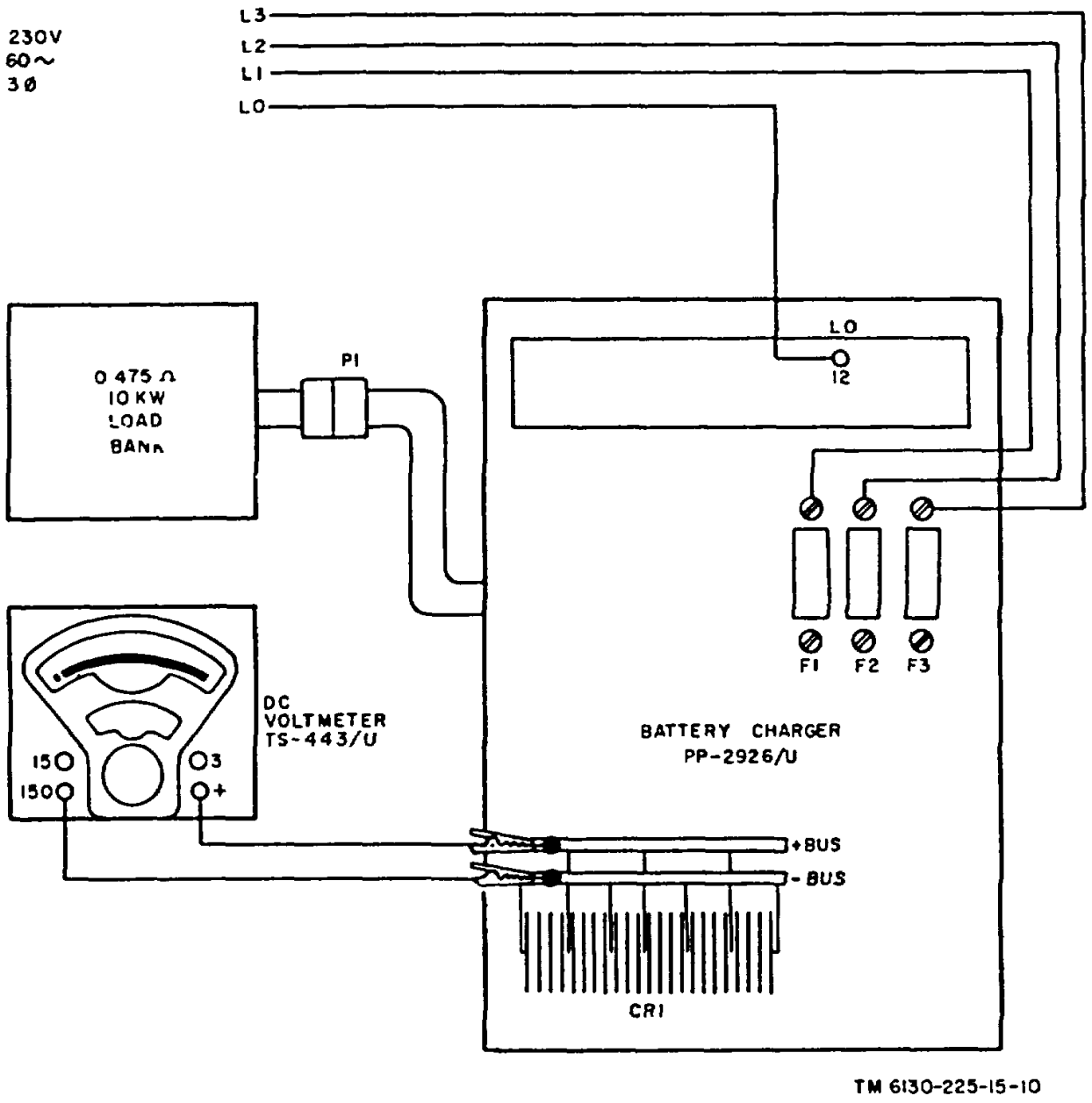


Figure 6. Test setup for rectified voltage output.

24. Testing Rectified Voltage Output

a. Test Equipment and Materials. Dc Voltmeter TS-443/U and resistance load bank consisting of 0.475-ohm kilowatt resistance.
b. Test Connections and Conditions. See figure 6 and information under Test procedures.
c. Test Procedures.

Step No.	Test equipment control settings	Equipment under test control	Test procedures settings	Performance standards
1	*TS-443/U* Range: 150V	Tap leads X and Y connected to terminal 29 on TB1. Power leads L1, L2, and L3 connected to terminals 2, 9, and 14 on TB1. Shorting links connected between terminals 2-5, 8-11, 14-17, 3-6, 9-12, and 15-18 on TB1.	Input voltage 208 volts. Connect TS-443/U to + and - bus bars of rectifier.	
2	----------	Turn external disconnect switch to OFF. Turn power switch to NICKEL-IRON ON or LEAD-ACID ON.	Allow unit to warm up for at least 5 minutes.	TS-443/U reads 64.5 volts dc ±1/2 percent.
3	*7S-443/U* Range: 150V	Turn power switch to OFF. Tap leads X and Y connected to terminal 29 on TB1. Power leads L1, L2, and L3 connected to terminals 1, 7, and 13. Connect shorting links between terminals 1-4, 7-10, 13-16, 3-6, 9-12, and 15-18.	Input voltage 230 volts. Connect TS-443/U to + and - bus bar of rectifier.	
4	----------	Turn external disconnect switch to ON. Turn power switch to ON.	----------	TS-443/U reads 64. 5 volts dc *1/2 percent.
5	----------	Pull plunger of S5 to overcome interlock and allow unit to warm up for at least 5 minutes.		
6	Same as step 1.	Place external disconnect switch to OFF. Place power switch to OFF. Tap leads to terminal 29 on TB1. Power leads L1, L2, and L3 connected to terminals 1, 7, and 13. Shorting links connected between terminals 3-4, 9-10, and 15-16 of TB1.	Input voltage 460 volts. Connect TS-443/U to + and - bus bars of rectifier.	
7	----------	Place external disconnect switch to ON. Turn power switch to either LEAD-ACID ON or NICKEL-IRON ON.		
8	----------	Pull plunger of S5 to close interlock and allow unit to warm up for approximately 5 minutes.	----------	TS-443/U reads 64.5 volts *1/2 percent.
9	----------	Turn power switch to OFF.		
10	----------	Push plunger of S5 to its center position to set interlock.		

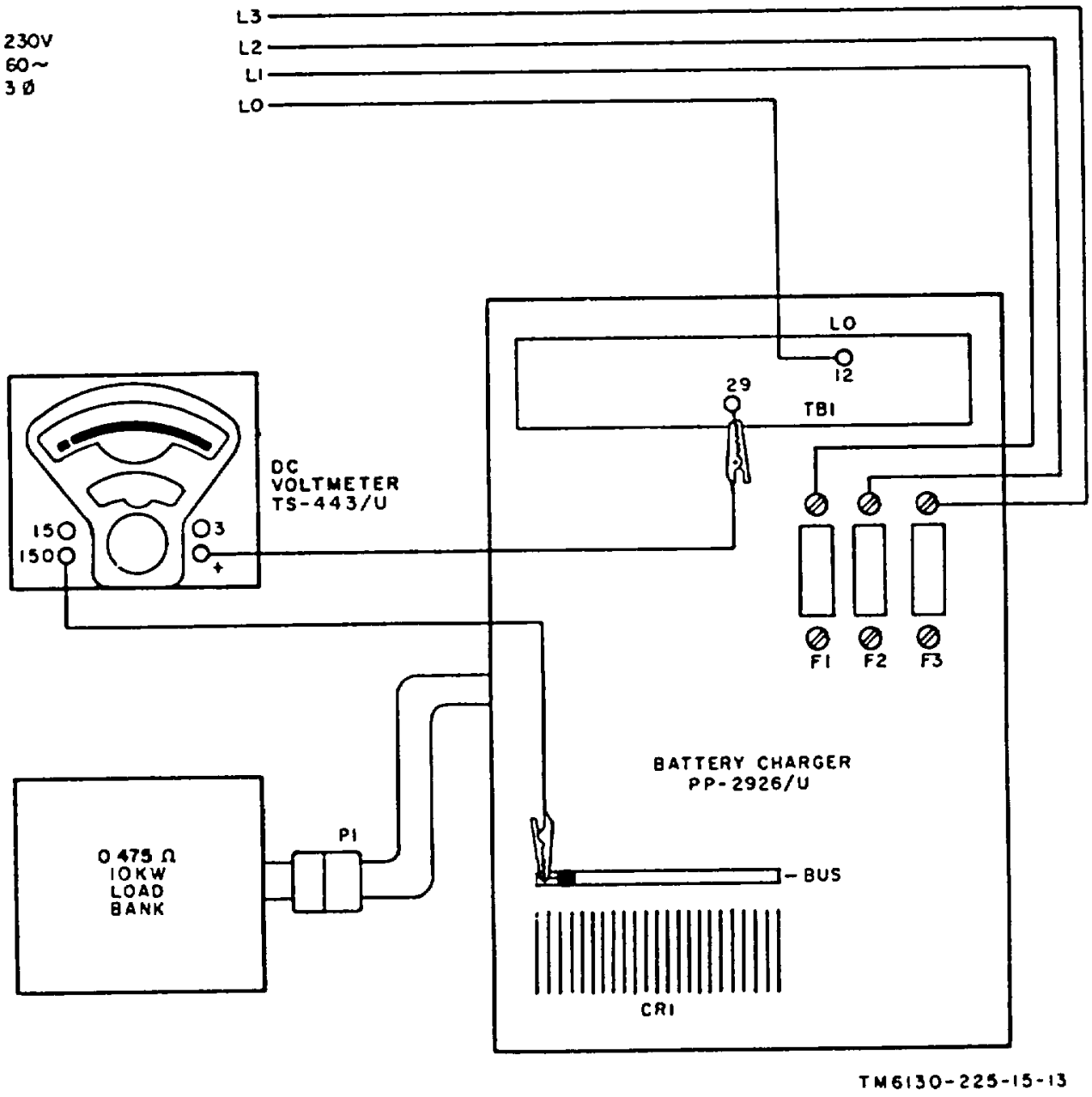


Figure 7. Test setup for testing output tap adjustments.

25. Testing Output Tap Adjustments

a. Test Equipment and Materials. Dc Voltmeter TS-433/U and resistance load bank consisting of 0.475-ohm 1-kilowatt resistance are required.
b. Test Connections and Conditions. See figure 17 and information under Test procedure. Input voltage: 230-volt, 60 cps, 3-phase.
c. Procedure.

Step No.	Test equipment control settings	Equipment under test control	Test procedures settings	Performance standards
1	TS-443/U Range: 150V	Tap leads X and Y attached to terminal 29 on TB1. Timer knob at 60 minutes. Power switch at ON. Shorting links between terminals 1-4, 7-10, 13-16, 3-6, 9-12, and 15-18 on TB1. Input leads to terminals 1, 7, and 13 on TB1. Pull plunger of S5 to overcome interlock. Push in on plunger of S5 to set interlock and turn off power to PP-2926/U.	*a*. Connect TS-443/U + lead to terminal 29 on TB1 and - lead to - bus on CR1. *b*. Turn power on and permit unit to warm up for at least 5 minutes. *c*. Remove TS-443/U leads.	a. None. b. TS-443/U reads 17 volts dc +1/2 percent. c. None.
2	Same as Step 1.	Same as step 1 ---------- ***Caution: Be sure power is turned off each time a test lead is changed.***	*a*. Connect TS-443/U + lead to terminal 31 on TB1 and - lead to terminal 29 on TB1. *b*. Turn power on and permit unit to warm up for at least 5 minutes. *c*. Read voltage between taps. *d*. Move TS-443/U e lead to tap 33 on TB1. Read voltage. *e*. Move + lead to tap 35 on TB1. Read voltage. *f*. Move + lead to tap 37 on TB1. Read voltage. *g*. Move * lead to tap 39 on TB1. Read voltage. *h*. Move + lead to tap 41 on TB1. Read voltage. *i*. Move + lead to tap 43 on TB1. Read voltage. *j*. Move + lead to tap 28 on TB1. Read voltage. *k*. Move + lead to tap 19 on TB1. Read voltage. *l*. Move + lead to tap 30 on TB1. Read voltage. *m*. Move + lead to tap 20 on TB1. Read voltage. *n*. Move + lead to tap 32 on TB1. Read voltage.	*a*. None. *b*. None. *c*. 5.8 volts de ±1/2 percent. *d*. 23.1 volts dc ±1/2 percent. *e*. 32.3 volts dc ±1/2 percent. *f*. 35.0 volts dc ±1/2 percent. *g*. 37.1 volts dc ±1/2 percent. *h*. 37.2 volts dc ±1/2 percent. *i*. 37.2 volts dc ±1/2 percent. *j*. 37.1 volts dc ±1/2 percent. *k*. 37.6 volts de ±1/2 percent, *l*. 37.2 volts dc ±1/2 percent. *m*. 38.0 volts dc ±1/2 percent. *n*. 37.5 volts dc ±1/2 percent.

			o. Move + lead to 21 on TB1. Read voltage.	*o*. 39.6 volts dc ±1/2 percent.
			p. Move + lead to tap 34 on TB1. Read voltage.	*p*. 37.4 volts dc ±1/2 percent.
			q. Move - lead to tap 22 on TB1. Read voltage.	*q*. 31.0 volts dc ±1/2 percent.
			r. Move + lead to tap 36 on TB1. Read voltage.	*r*. 37.7 volts dc ±1/2 percent.
			s. Move + lead to tap 23 on TB1. Read voltage.	*S*. 41.9 volts de ±1/2 percent.
			t. Move + lead to tap 38 on TB1. Read voltage.	*t*. 38.6 volts dc ±1/2 percent.
			u. Move + lead to tap 24 on TB1. Read voltage.	*u*. 42.6 volts de ±1/2 percent.
			v. Move + lead to tap 40 on TB1. Read voltage.	*v*. 39.8 volts dc ±1/2 percent.
			w. Move + lead to tap 25 on TB1. Read voltage.	*w*. 43.4 volts dc ±1/2 percent.
			x. Move + lead to tap 42 on TB1. Read voltage.	*x*. 41.1 volts dc ±1/2 percent.
			y. Move + lead to tap 26 on TB1. Read voltage.	*v*. 43.8 volts dc ±1/2 percent.
			z. Move + lead to tap 27 on TB1. Read voltage.	*z*. 44.4 volts dc ±1/2 percent.

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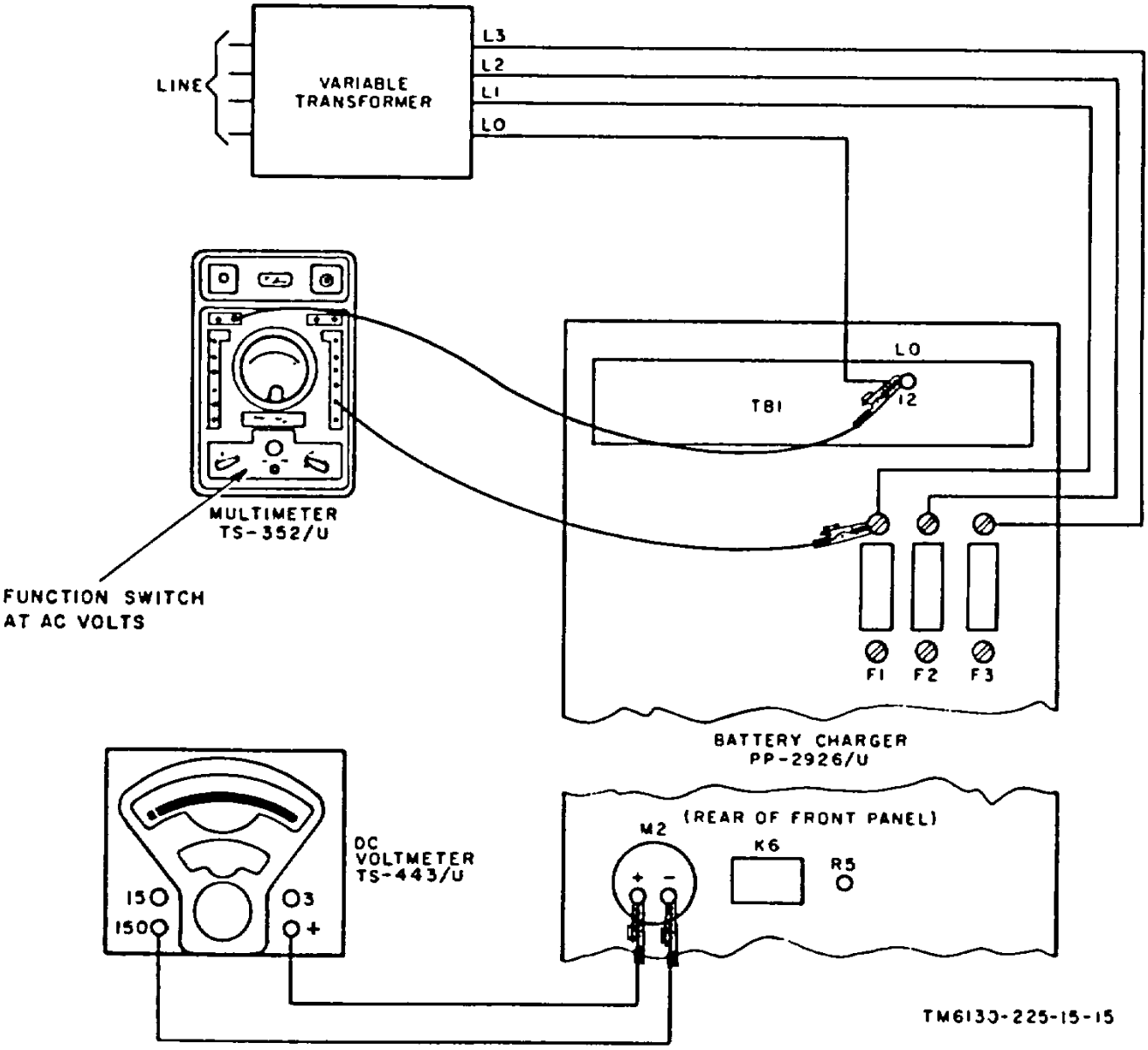

Figure 8. Test setup for testing sensitivity adjustments.

26. Testing Sensitivity Adjustments

a. Test Equipment and Materials. Dc Voltmeter TS-443/U, Multimeter TS-352/U, and variable input power transformer are required.
b. Test Connections and Conditions. See figure 8 and information under Test procedure.
c. Procedure.

8tep No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	*TS-433/U* Range: 150V *TS-352/U* FUNCTION: AC VOLTS Range: 250V	Tap leads X and Y attached to terminal 29 on TB1. Timer knob at 60 minutes. Power switch at LEAD-ACID ON. Shorting links between terminals 1-4, 7-10, 13-16, 3-6, 9-12, and 15-18 on TB1. Power leads to terminals 1, 7, 13 on TB1. Pull plunger of S5 to close interlock.	*a.* Adjust input voltage to approximately 200 volts ac. *b*. Observe relay K6. *c*. Increase input voltage gradually until K6 is energized. Read actuating voltage on TS443/U. *d*. Reduce Input voltage to de-energize K6.	*a*. None. *b*. Not energized. *c*. 42.7 volts dc ±2 percent. *a*. None.
2	Same as step 1.	Power switch at NICKEL-IRON ON. All other controls and connections same as step 1.	*a*. Adjust input voltage to approximately 200 volts ac. *b*. Observe relay K6. *c*. Gradually increase input voltage until K6 is energized. Read actuating voltage on TS-443/U.	*b*. None. *c*. Not energized. 50.8 volts dc ±1 percent.

27. Fifth Echelon Final Testing

The fifth echelon final testing procedures are the same as those for fourth echelon (para 19 through 26). Equipment that meets the performance standards stated in these tests will furnish satisfactory operation equivalent to that of new equipment.

CHAPTER 4

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

28. Disassembly of Equipment

Warning:
Before disassembling the PP2926/U, be sure that all ac input power is disconnected.

Disassembly procedures for Charger, Battery PP-2926/U consists of the following:

a. Remove the three wingnuts and remove the cover over the fuse panel and ac input leads.

b. Disconnect the four power leads which enter the unit through the connector mounted in the right side panel of the cabinet.

c. Loosen the clamp on the connector through which the power leads pass through the side panel.

d. Remove the power leads.

e. Tighten the clamp on the connector to retain it for reuse.

f. Replace the fuse cover and secure it with the three wingnuts.

g. Tape the output leads and output connector P1 to the left side panel and/or the bottom of the cabinet.

29. Repackaging for Shipment or Limited Storage

See TM 11-6130-225-12 for suggested sample packaging method. Support the front panel of the battery charger to prevent damage to the glass portions of the meters and relay K6, and to the timer control and power switch.

Section II. DEMOLITION OF MATERIEL TO PREVENT ENEMY USE

30. Authority for Demolition

Demolition of the equipment will be accomplished only upon the order of the commander. The destruction procedures outlined in paragraph 31 will be used to prevent further use of the equipment.

31. Methods of Destruction

Use any of the following methods to destroy the equipment.

a. Smash. Smash the controls, switches, resistors, capacitors, relays, transformers, fans, and meters; use sledges, axes, handaxes, pickaxes, hammers, or crowbars.

b. Cut. Cut the output cable; use axes, handaxes, or machetes.

c. Burn. Burn cords and technical manuals; use gasoline, kerosene, oil, flame throwers, or incendiary grenades.

d. Bend. Bend panels and cabinet.

Warning:
Be extremely careful with explosives and incendiary devices. Use these items only when the need is urgent.

e. Explode. If explosives are necessary, use firearms, grenades, or TNT.

f. Dispose. Bury or scatter the destroyed parts in slit trenches, foxholes, or throw them into streams.

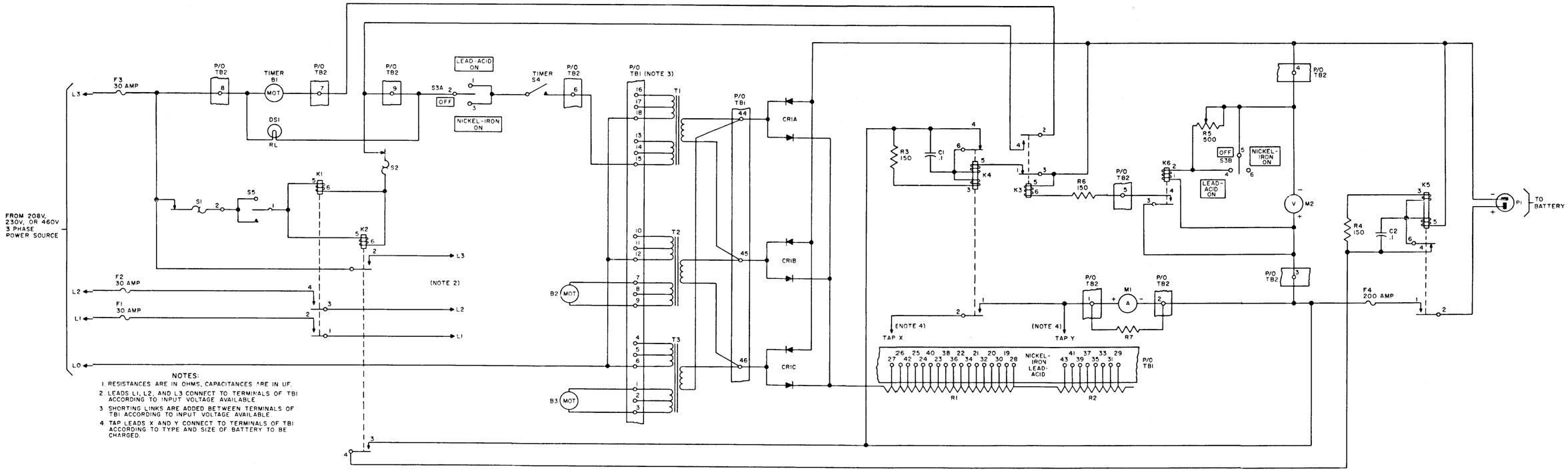

Figure 9. Battery Charger PP-2926/U, schematic diagram.

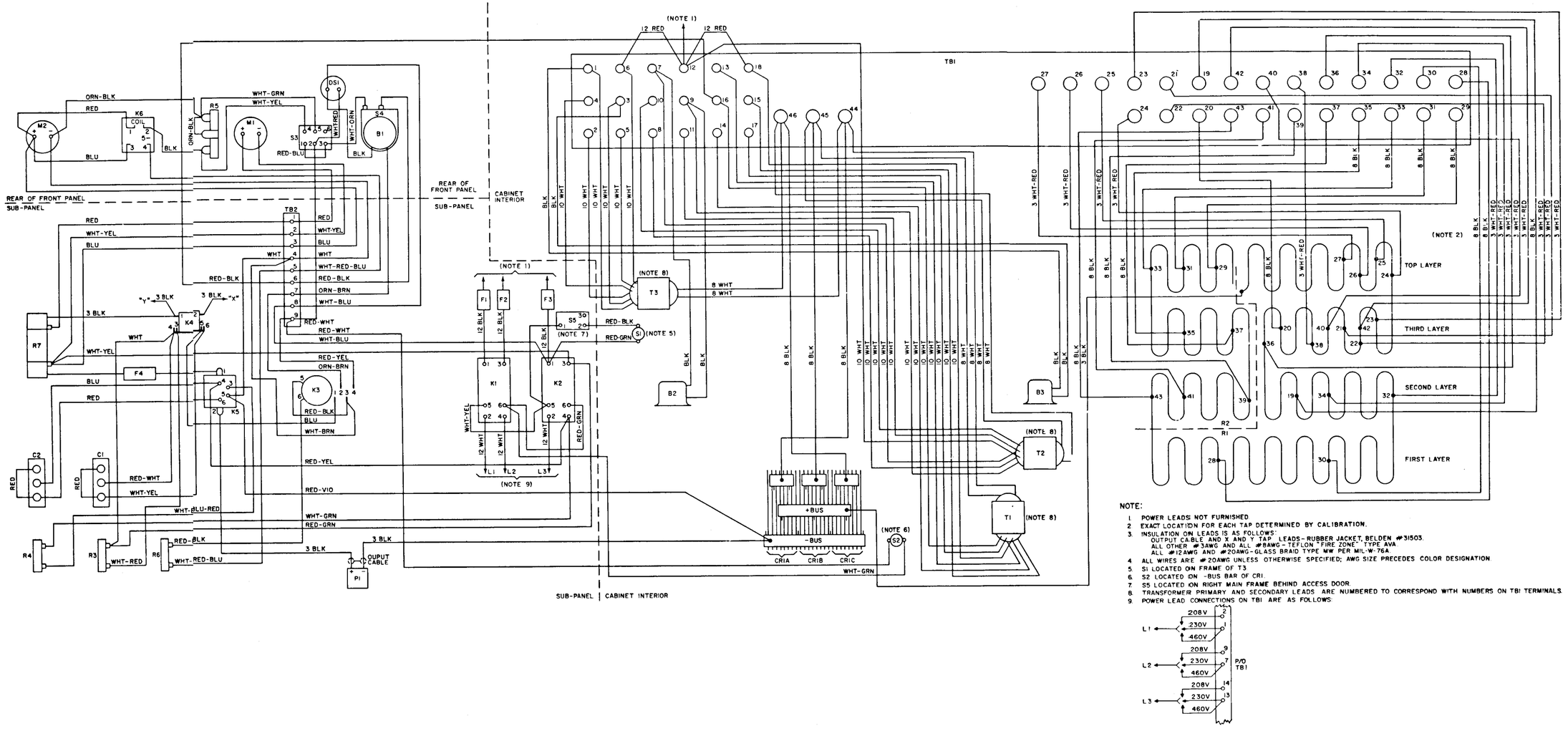

Figure 10. Battery Charger PP-2926/U, wiring diagram.

APPENDIX

REFERENCES

DA Pamphlet 310-4	Military Publications: Index of Technical Manuals, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders
SM 11-4-5180-R08	Stock List of Components of Sets, Kits and Outfits for Tool Kit, Radar and Radio Repairman TK-87/U
TA 11-17	Signal Field Maintenance Shops
TA 11-100(11-17)	Allowances of Signal Corps Expendable Supplies for Signal Field Maintenance Shops
TM 11-487H-1	Electronic Test Equipment
TM 11-5527	Multimeters TS-352/U, TS-352A/U, and TS-352B/U
TM 11-6130-225-12	Operator and Organizational Maintenance Manuals: Charger, Battery PP-2926/U
TM 11-6625-273-13	Operation and Organizational Maintenance: Insulation Breakdown Test Set AN/GSM-6

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USA Sig Msl Spt Agcy (13)
Sig Fld Maint Shops (3)
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JBUSMC (2)
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11-57 (2)
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11-117 (2)
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11-592 (2)
11-597 (2)

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USAR: None.

For explanation of abbreviations used, see AR 320-50.

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