TM 11-6130-243-35

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

DIRECT SUPPORT, GENERAL SUPPORT AND DEPOT MAINTENANCE MANUAL

POWER SUPPLY PP-4606/G

This copy is a reprint which includes current pages from Change 1.

HEADQUARTERS, DEPARTMENT OF THE ARMY

6 FEBRUARY 1967

WARNING

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT

High voltages and currents exist in this equipment. Serious injury or death may result from contact with the input and output connections. De-energize the equiqment before connecting or disconnecting the load to be powered, before changing jumper connections, and before performing any maintenance. Discharge all capacitors before performing maintenance.

DON'T TAKE CHANCES!

CHANGE
No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON DC, *3 December 1981*

Direct Support, General Support, And Depot Maintenance Manual POWER SUPPLY PP-4606/G (NSN 6130-00-504-0327)

TM 11-6130-243-35, 6 February 1967, is changed as follows:
1. Title of the manual is changed as shown above.
2. New or changed material is indicated by a vertical bar in the margin of the page.
3. Remove and insert pages as indicated below:

Remove	*Insert*
None	A through C (FRONT OF MANUAL)
i	i/(ii blank)
1-1 and 1-2	1-1 and 1-2
A-1	A-1(A-2 blank)

4. File this change sheet in front of the publication for reference purposes.

By Order of the Secretary of the Army:

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

Official:

ROBERT M. JOYCE
Brigadier General, United States Army
The Adjutant General

Distribution:
To be distributed in accordance with DA Form 12-31, Direct Support and General Support Maintenance requirements for All Fixed and Rotor Wing Aircraft.

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 WOODEN POLE OR A 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

WARNINGS

DANGEROUS VOLTAGES (220 vac, and 440 vac) exist in this equipment. When equipment is operated with covers open or removed, DO NOT touch exposed connections or components. SERIOUS INJURY OR DEATH MAY RESULT. Deenergize the equipment before connecting or disconnecting the battery to be charged, and before performing any maintenance. Follow all precautions listed in TB 385-4.

Avoid personal injury. Power Supply PP-4606/G weighs 375 pounds; be careful when moving. A mechanical lift is required.

Adequate ventilation should be provided while using TRICHLOROTRIFLUOROETHANE. Prolonged breathing of vapors should be avoided. The solvent should not be used near heat or open flame; the products of decomposition are toxic and irritating. Since TRICHLOROTRIFLUOROETHANE dissolves natural oils, prolonged contact with skin should be avoided. When necessary, use gloves which the solvent cannot penetrate. If the solvent is taken internally, consult a physician immediately.

TECHNICAL MANUAL
No. 11-6130-243-35

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, *6 February 1967*

DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE MANUAL

POWER SUPPLY PP-4606/G (NSN 6130-00-504-0327)

*This manual supersedes TM 11-6130-243-35, 28 September 1966.

CHAPTER 1
FUNCTIONING OF EQUIPMENT

1-1. Scope

a. This manual contains direct support, general support, and depot maintenance instructions for Power Supply PP-4606/G (power supply). It includes instructions appropriate for troubleshooting, testing, and repairing the equipment. It also lists tools, materials, and test equipment required for maintenance, Functional analysis of the equipment is covered in this chapter.

b. The complete technical manual for this equipment includes TM11-6130-243-12.

c. 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-Electronics Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, NJ 07703. In either case, a reply will be furnished direct to you.

NOTE

For applicable forms and records, see paragraph 1-3, TM11-6130-243-12.

1-2. Index of Technical Publications

Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes, modification work orders (MWO'S) or additional publications pertaining to the equipment.

1-3. Block Diagram (fig. 1-1)

Three-phase, wye-connected primary input power is applied to the input circuit consisting of circuit breaker switch CB1, the tap board, VOLTAGE ADJUST switch S2, indicator lamp DS1, and power transformer T1. The tap board connects the input powerlines to the primary windings of power transformer T1. Jumpers are connected between various terminals on the tap board to permit operation of the power supply from either 220- or 440-volt alternating current (at) power mains. With circuit breaker switch CB1 set to POWER ON, input power is applied through the jumpers on the tap board and VOLTAGE ADJUST switch S2 to the primary windings of stepdown power transformer T1 and indicator light DS1. The input circuit to transformer Tl is wye-connected, the output circuit from the transformer is delta-connected. VOLTAGE ADJUST switch S2 controls application of input power to specific taps of the primary windings of transformer T1. The ac output voltages from the secondary windings of the transformer is converted to a pulsating direct current (dc) voltage by full-wave rectifiers CR1 through CR6 and filtered by the network consisting of capacitors C1 through C8 and inductor L1. Resistors R1 and R2 comprise a load network across the rectifiers. The power supply current and voltage are monitored by DIRECT CURRENT AMPERES meter M1 and DIRECT CURRENT VOLTS meter M2. Resistor R3 is the ammeter shunt resistor. Resistor R4 is the meter movement series resistor used to establish the deflection sensitivity of the ammeter. AMMETER switch S1 (spring-loaded to the OFF position) connects the ammeter to the output circuit when depressed to the READ position.

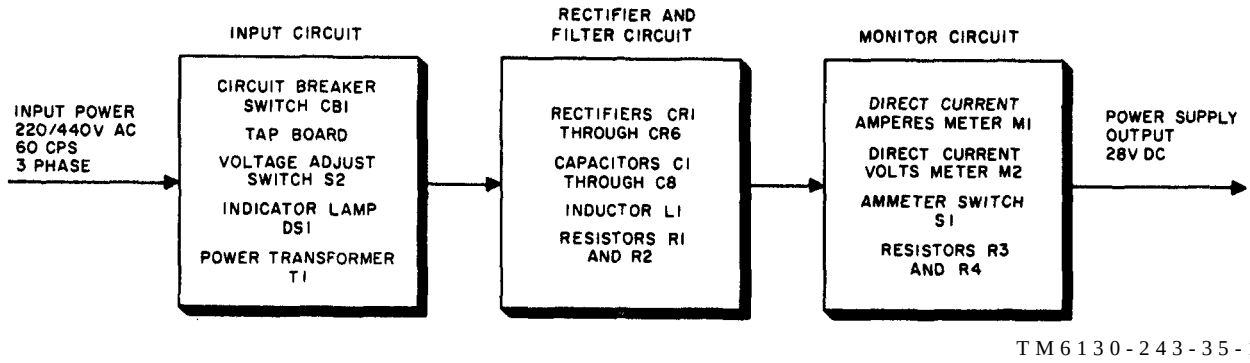


Figure 1-1. Power Supply PP-4606/G block diagram.

1-4. Input Power (fig. 4-4).

a. The power supply is designed to operate from either 220- or 440-volt, 60-cycle, 3-phase power mains. To provide for correct connection of the power mains to the primary windings of input power transformer T1, a tap board is provided on the rear of the power supply. Wire links are connected between specific terminals on the tap board, depending upon the voltage of the power mains from which the power supply is to be operated. Figures 1-2 and 1-3 are simplified schematic diagrams that show how the primary windings are wye-connected to the power mains. Refer to the complete schematic diagram (fig. 4-4) while studying the two simplified schematic diagrams. For simplicity, VOLTAGE ADJUST switch S2 is not shown on the simplified schematic diagrams; however, assume that it is at the fully clockwise position (HIGH) for the discussions in *b* and *c* below.

b. When the power supply is arranged to operate with 220-volt input power, wire links are connected between specific terminals on the tap board as shown by the short heavy lines in figure 1-2. The six primary windings of input transformer T1 are thus parallel-connected into a wye configuration which corresponds to the wye configuration of the input power mains. When circuit breaker switch CB1 is at POWER ON, input power is routed from the 220-volt terminals of the circuit breaker through the wire links on the tap board and the VOLTAGE ADJUST switch (not shown on fig. 1-2) **to** each parallel-connected pair of primary windings in each leg of the wye. VOLTAGE ADJUST switch S2 controls the voltage in the secondary windings of transformer T1 by controlling the number of turns energized in the primary windings. (Energized turns decrease and secondary winding voltages increase as switch S2 is turned clockwise.)

c. When the power supply is arranged to operate with 440-volt input power, wire links are connected between a different group of specific terminals on the tap board as shown by the short heavy lines in figure 1-3. The six primary windings of input transformer T1 are now series-connected into a wye configuration. When circuit breaker switch CB1 is at POWER ON, input power is routed from the 440-volt terminals of the circuit breaker through the wire links on the terminal board and the VOLTAGE ADJUST switch (not shown on fig. 1-3) to each series-connected pair of primary windings in each leg of the wye.

1-5. Output Circuit (fig. 4-4)

a. The output circuit includes the three secondary windings of power transformer T1, diode rectifiers CR1 through CR6, surge-suppressor capacitors C3 through C8, bleeder resistors R1 and R2, choke L1, and filter capacitors C1 and C2. The secondary windings of the power transformer are connected in a delta

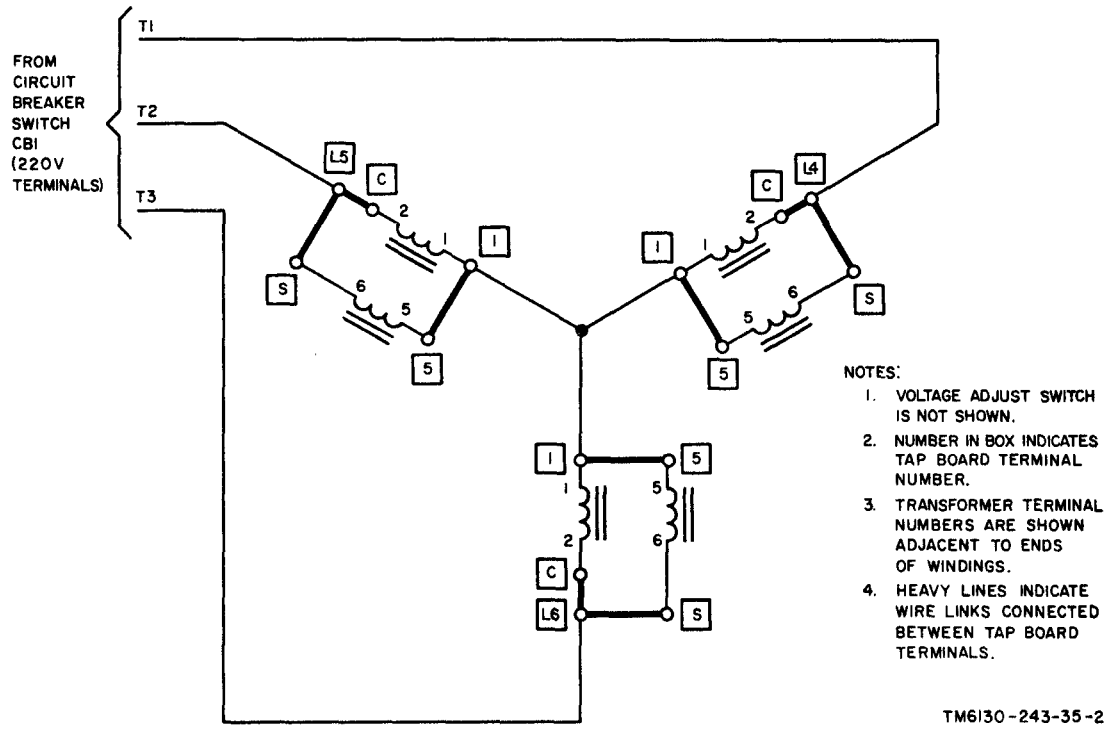


Figure 1-2. Connections to power transformer primary windings for 220-volt input, simplified schematic diagram.

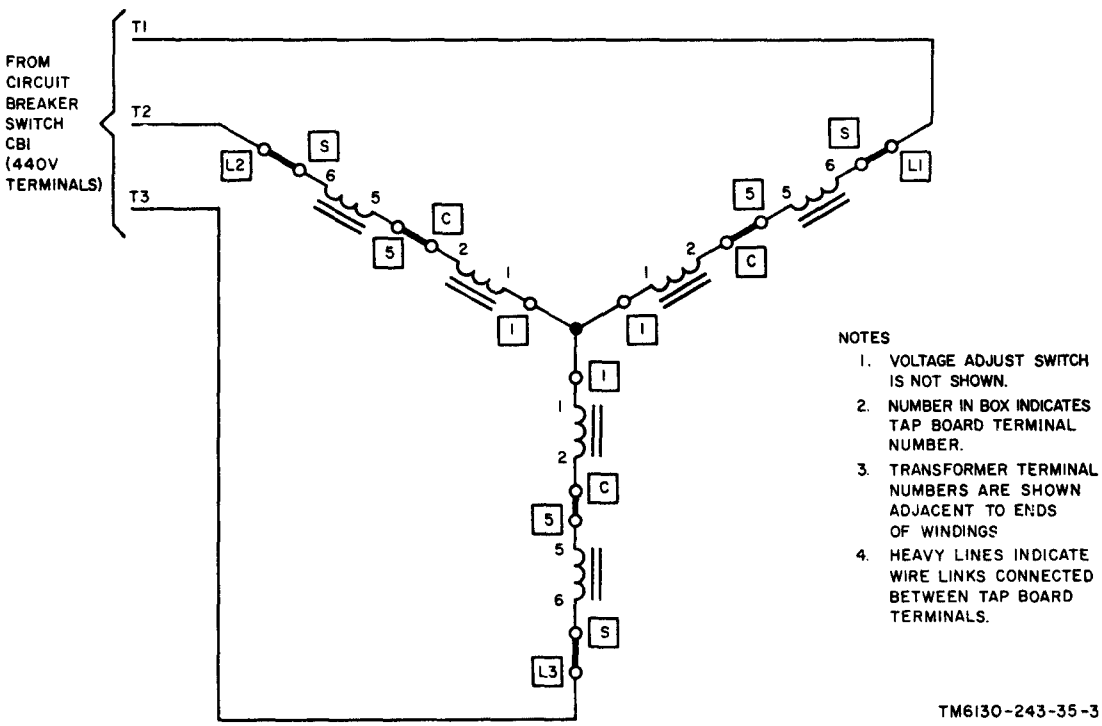


Figure 1-3. Connections to power transformer primary windings for 440-volt input, simplified schematic diagram.

configuration as shown in the simplified schematic diagram (A, fig. 1-4). Each secondary winding applies an ac voltage to a bridge rectifier circuit consisting of four of the six diodes CR1 through CR6. The middle secondary winding of transformer T1 (fig. 4-3) is associated with the bridge rectifier consisting of diodes CR2, CR3, CR5, and CR6 as shown in the simplified schematic diagram (B, fig. 1-4). Similarly, the top secondary winding of transformer T1 is associated with diodes CR1, CR2, CR4, and CR5 while the bottom winding is associated with diodes CR1, CR3, CR4, and CR6. The simplified schematic diagram (fig. 1-4) shows only those diodes associated with the middle winding.

b. When the half-cycle of the ac voltage occurs, making secondary winding terminal 9 positive with respect to terminal 10 (B, fig. 1-4), diodes CR3 and CR5 become forward-biased and diodes CR2 and CR6 become reverse-biased. Electrons flow from terminal 10 through diode CR3, resistors R1 and R2 diode CR5, terminal 9, and to terminal 10. The current pulse thus produced causes a dc voltage of the polarity indicated on figure 1-4 to appear across resistors R1 and R2. During the other half-cycle, diodes CR2 and CR6 become forward-biased and diodes CR3 and CR5 become reverse-biased. Electrons flow from terminal 9 through diode CR2, resistors R1 and R2, diode CR6, terminal 10, and to terminal 9. This current pulse also causes a dc voltage of the same polarity to appear across resistors R1 and R2.

c. The dc voltage pulses appearing across resistors R1 and R2 are applied to the choke-input filter consisting of inductor L1 and capacitors C1 and C2. The filter network smoothes the ripple and assists in power supply regulation. As a result, the output voltage approaches the average value of voltage produced by the bridge rectifiers. Bleeder resistors R1 and R2 also provide a discharge path for capacitors C1 and C2.

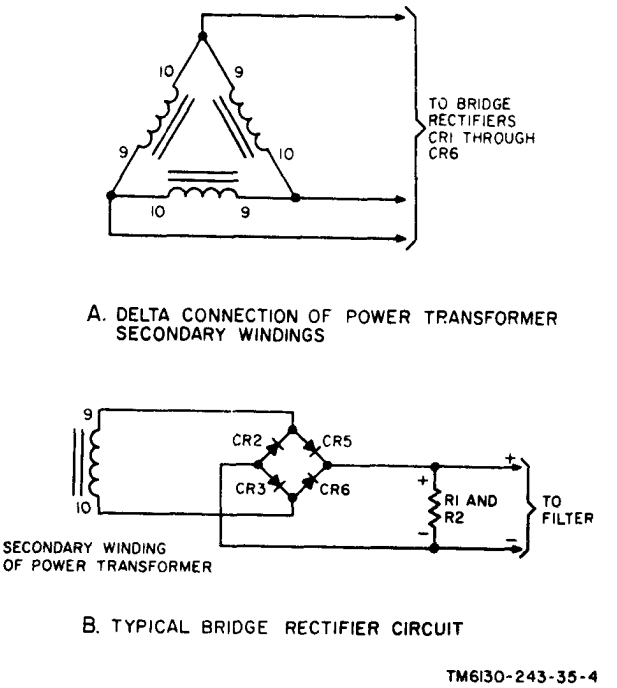


Figure 1-4. Power supply output circuit, simplified schematic diagram.

1-6. Monitor Circuit
(fig. 4-4)

DIRECT CURRENT VOLTS meter M2 is connected across the output of the power supply and monitors the output voltage. DIRECT CURRENT AMPERES meter M1 monitors output current whenever spring-loaded AMMETER switch S1 is set to the READ (depressed) position. With switch S1 depressed, load current flowing through low-resistance shunt resistor R3 produces a small voltage drop which is proportional to the current. Although the scale of DIRECT CURRENT AMPERES meter M1 is marked to indicate amperes, the meter is actually a millivoltmeter which measures the voltage across shunt R3. Resistor R4 is a calibrating resistor for meter M1. When AMMETER switch S1 is released to the OFF position, the switch creates a short circuit across R3, R4, and M1.

CHAPTER 2

TROUBLESHOOTING

Warning: **When servicing the power supply, be extremely careful of the high voltages.**

2-1. General Instructions

Troubleshooting at the direct support, general support, and depot maintenance categories includes all the techniques outlined for organizational maintenance and any special or additional techniques required to isolate a defective part. Paragraph 2-4d provides the troubleshooting chart to be used by the repairman.

2-2. Organization of Troubleshooting Procedures

a. General. The first step in servicing a defective power supply is to localize the fault, which means tracing the fault to defective circuit responsible for the abnormal indication. The second step is to isolate the fault, which means locating the defective part or parts. Some defective parts, such as burned resistors and shorted transformers, can often be located by sight, smell, and hearing. Most defective parts, however, must be isolated by checking voltages and resistance.

b. L.ocalization and Isolation. The first step in tracing trouble is to locate the circuit or part at fault by the following methods:

(1) *Visual inspection.* The purpose of visual inspection is to locate faults without testing or measuring circuits. All meter indications or other visual signs should be observed and an attempt made to localize the fault to a particular part.

(2) *Operational test.* Operational tests frequently indicate the general location of trouble. In many instances, the test will help in determining the exact nature of the fault. The operator's daily preventive maintenance services inspection chart (TM11-6130-243-12) contains a good operational test.

(3) *Troubleshooting chart.* The troubleshooting chart (para 2-4d) lists symptoms of common troubles and gives corrective measures (or references). Such a chart cannot include all trouble symptoms that may occur; therefore, the repairman should use this chart as a guide in analyzing symptoms that may not be listed.

(4) *Resistor and capacitor color code diagrams.* Color code diagrams for resistors and capacitors (figs. 4-2 and 4-3) provide pertinent resistance, voltage rating, and tolerance information.

2-3. Test Equipment Required

The following chart lists test equipment required for troubleshooting Power Supply PP-4606/G and the associated technical manuals.

Test equipment	Technical manual
Multimeter TS-352B/U ---	TM 11-5527
Analyzer ZM-3A/U ------	TM 11-5043-12

2-4. Localizing Troubles

c. General. The troubleshooting chart *(d* below) outlines procedures for localizing troubles and for isolating troubles within

the various circuits of the power supply. Refer to figures 2-1 through 2-4 for parts location. Refer to the schematic diagram (fig. 4-4) to identify circuit components. Voltage and resistance measurements are given in paragraph 2-5. Depending on the nature of the operational symptoms, one or more of the localizing procedures will be necessary. When trouble has been localized to a particular circuit, use voltage and resistance measurements to isolate the trouble to a particular part.

b. Use of Chart. When an abnormal symptom is observed in the equipment, look for a description of the symptom in the Symptom column and perform the corrective measure in the *Corrective measures* column.

c. Conditions to Test. All checks outlined in the troubleshooting chart are to be conducted with the power supply connected to a 220- or 440-volt power source, with the tap board wired for use. The output cables should be connected to a load.

d. Troubleshooting Chart.

Symptom	Probable trouble	Corrective measures
1. Indicator lamp DS1 does not light when circuit breaker switch CB1 is at POWER ON.	*a.* No ac power is applied to power supply.	*a.* Check for input voltage.
	b. Defective circuit breaker switch CB1.	*b.* Check circuit breaker switch CB1; replace if defective.
2. Indicator lamp DS1 lights but no output voltage is present, regardless of position of VOLTAGE ADJUST switch S2.	*a.* Open in output circuit.	*a.* Check for loose connections, broken leads or faulty components.
	b. Open inductor L1.	*b.* Replace inductor L1.
	c. Defective power transformer T1.	*c.* Replace power transformer T1.
	d. Defective VOLTAGE ADJUST switch S2.	*d.* Replace VOLTAGE ADJUST switch S2.
3. Low output voltage.	*a.* Open capacitor C1 or C2.	*a.* Check capacitors C1 and C2; replace if defective.
	b. Defective resistor R1 or R2.	*b.* Check resistors R1 and R2; replace if defective.
	c. Defective rectifier CR1, CR2, CR3, CR4, CR5, or CR6.	*c.* Replace defective rectifiers.
	d. Defective power transformer T1.	*d.* Replace power transformer T1.
4. Output voltage does not change when VOLTAGE ADJUST switch S2 is switched from one position to another.	*a.* Defective VOLTAGE ADJUST switch S2.	*a.* Replace VOLTAGE ADJUST switch S2.
	b. Defective power transformer T1.	*b.* Replace power transformer T1.
5. Indication on DIRECT CURRENT VOLTS meter M2 differs from voltage present at output.	Defective DIRECT CURRENT VOLTS meter M2.	Replace direct CURRENT VOLTS meter M2.
6. With S1 depressed to READ, no indication on DIRECT CURRENT AMPERES meter M1.	*a.* Power supply not connected to load.	*a.* Check connections to load.
	b. Defective AMMETER switch S1.	*b.* Replace AMMETER switch S1.
	c. Defective M1.	*c.* Replace M1.
7. Indication on DIRECT CURRENT AMPERES meter M1 differs from current present at output.	*a.* Defective shunt resistor R3.	*a.* Replace shunt resistor R3.
	b. Defective DIRECT CURRENT AMPERES meter M1.	*b.* Replace DIRECT CURRENT AMPERES meter M1.
	c. Defective calibration resistor R4.	*c.* Replace calibration resistor R4.

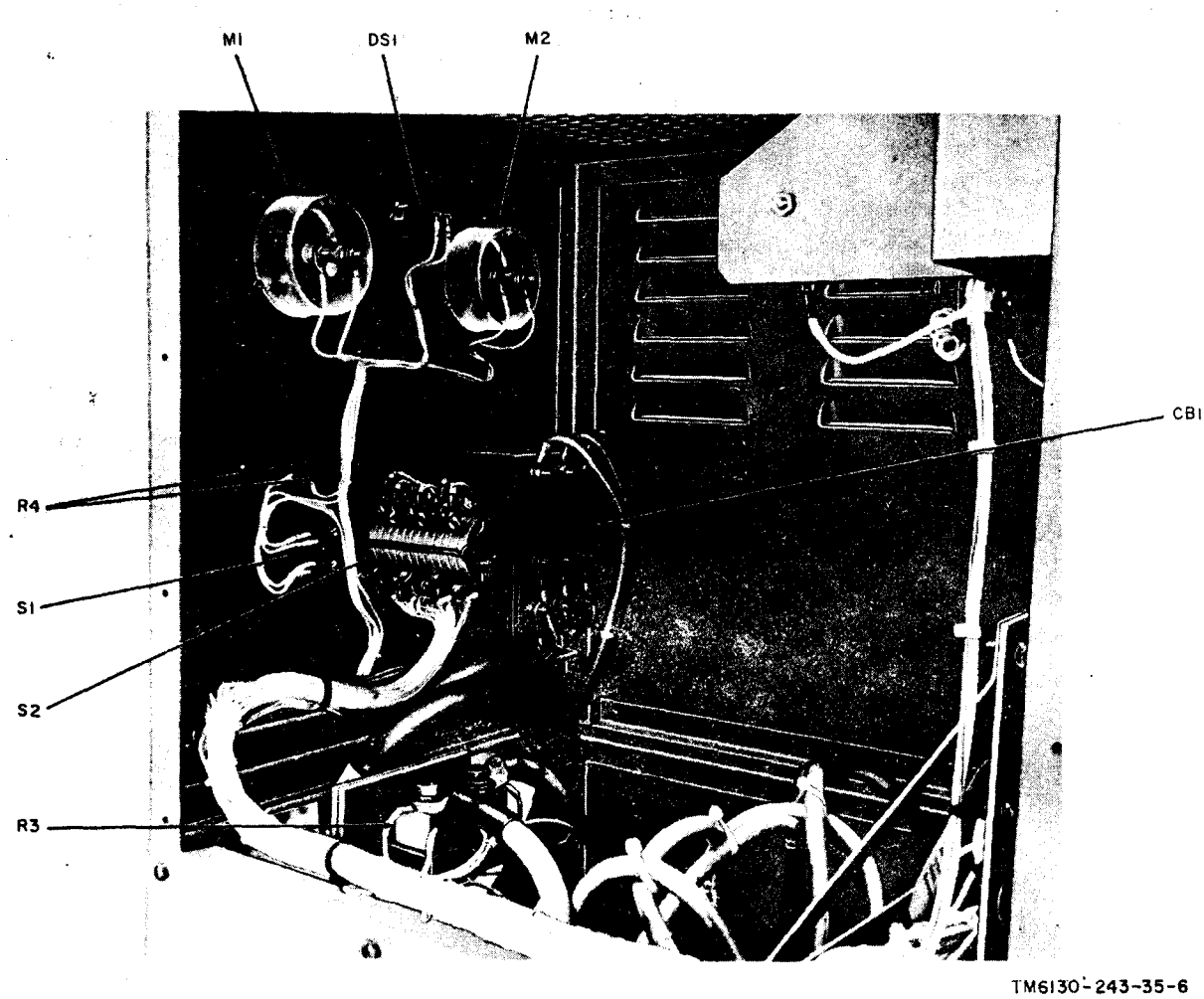


Figure 2-1. Power supply, rear oblique view of right side with right side panels removed.

2-5. Additional Troubleshooting Data

a. Voltage Outputs of Power Transformer T1. The voltage output data of power transformer T1 is provided as an aid to troubleshooting. The transformer has three secondary windings, designated by terminals 9 and 10 for each secondary winding. Each secondary winding voltage for both 220- and 440-volt ac input and for each setting of the VOLTAGE ADJUST switch is listed below:

Input power	VOLTAGE ADJUST switch position	Ac voltage indication across terminal 9 and 10 (approx)
220 volts ac	LOW	20
	NOM	22
	HIGH	24.5
440 volts ac	LOW	20
	NOM	22
	HIGH	24.5

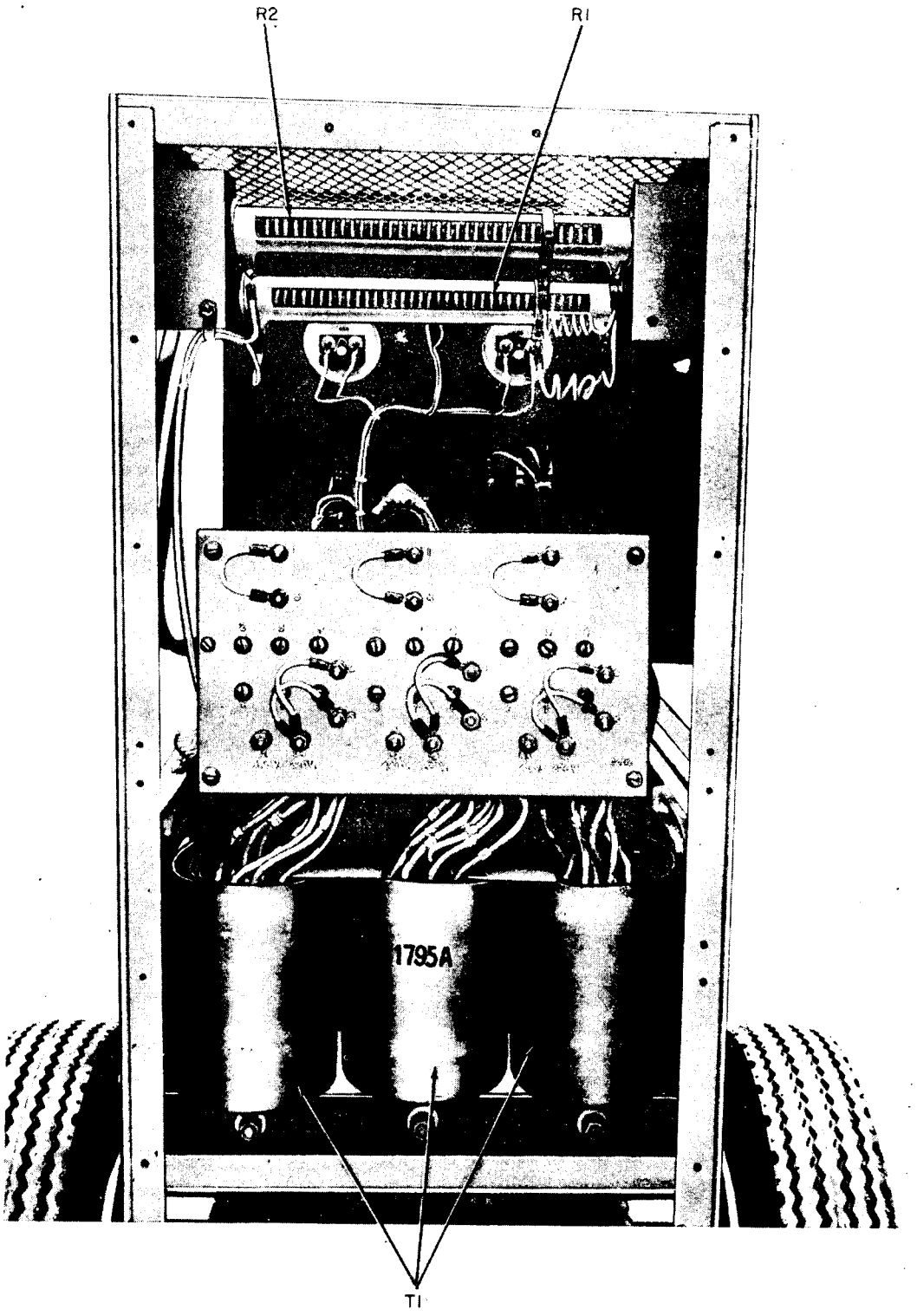


Figure 2-2. Power supply, rear view with rear panels removed.

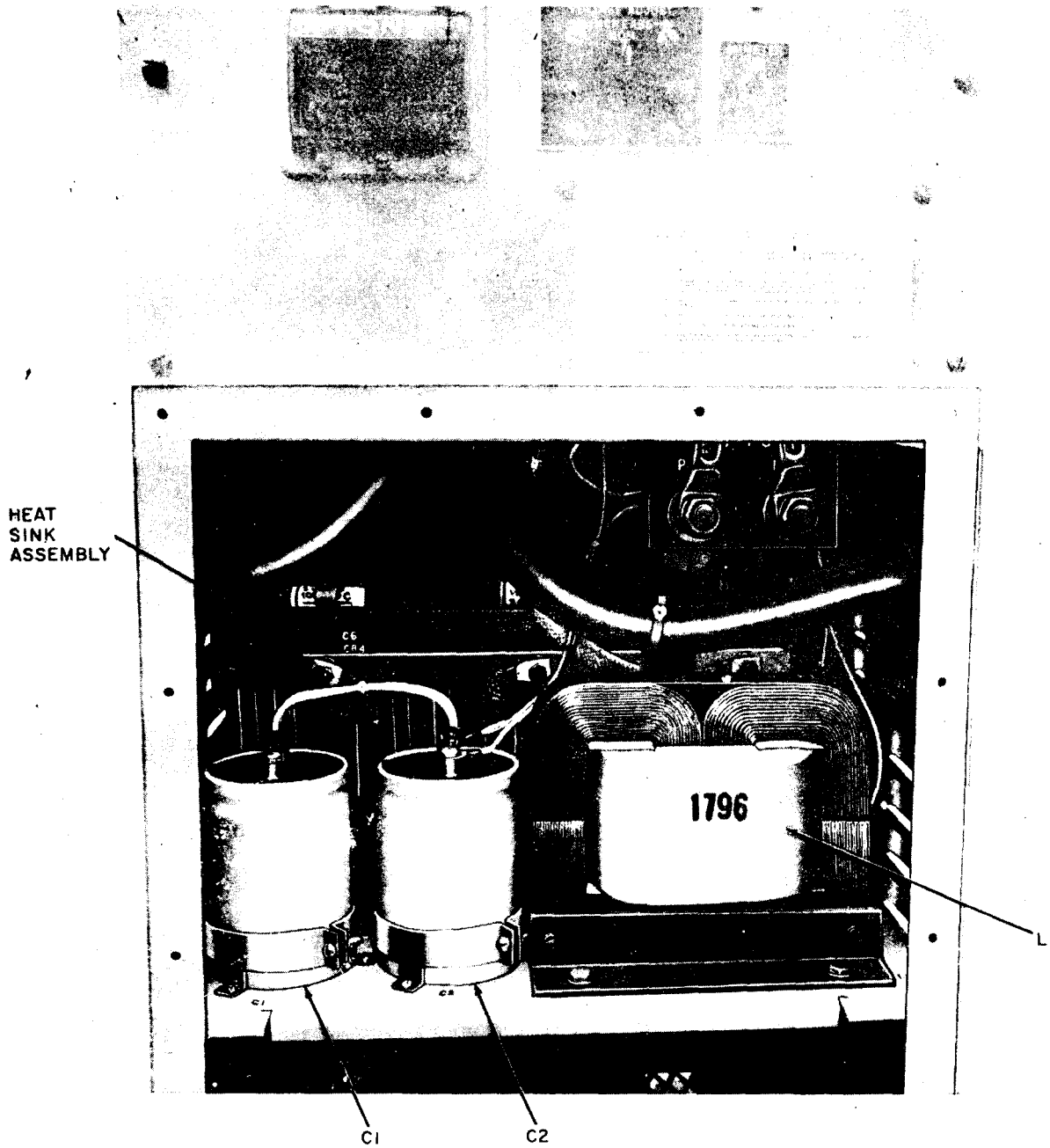


Figure 2-3. Power supply, front view with bottom front panel removed.

b. Dc Resistance of Transformers and Coils. The dc resistance data ((3) below) is provided as an aid to troubleshooting. When using the data, observe the following:

Caution: **Do not measure resistance of the windings when input power is applied to the power supply and when the circuit breaker switch is at POWER ON. Place the circuit breaker switch to off (down) and disconnect the input power cord.**

(1) Before making resistance measurements of the windings, determine

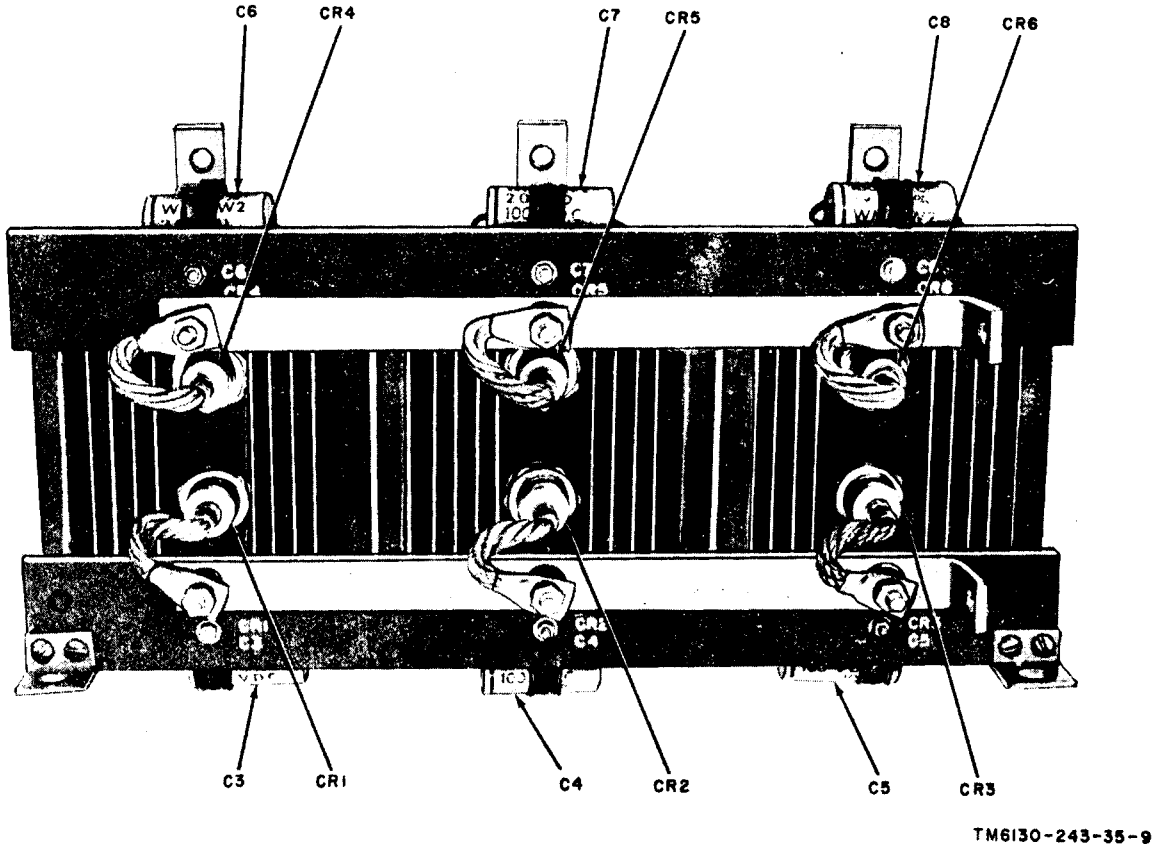


Figure 2-4. Power supply, heat sink assembly removed from unit.

that faulty operation is probably caused by a faulty transformer or coil. To do this, follow the trouble-shooting procedures in paragraph 2-4d.

(2) Do not use the resistance measurements as the sole basis for discarding a transformer or coil as defective. Resistances may vary from one transformer or coil to another because of broad winding tolerances during manufacture. The values given in the chart ((3) below) are typical average values for all groups of transformer windings and coils.

(3) Dc resistances of transformers and coils are as follows:

Transaformer and coil	Terminals	Resistance (ohms)
T1	1–2	Less than 1
	1–3	Less than 1
	1–4	Less than 1
	5–6	Less than 1
	5–7	Less than 1
	5–8	Less than 1
	9–10	Less than 1
L1	1–2	Less than 1

2-6 Capacitor Test

Filter capacitors C1 and C2 are rated at 10,000 microfarads (μf), 50 volts dc; capacitors C3 through C8 are rated at 2 μf, 100 volts dc. Test each capacitor (figs. 2-3 and 2-4 with Analyzer ZM-3A/U. Refer to the

schematic diagram (fig. 4-4) for connection of the capacitors.

2-7. General Parts Replacement Techniques

All power supply parts, except diode rectifiers, can be reached and replaced easily without special procedures. The six diode rectifiers must be replaced in accordance with the specialized procedure given in paragraph 2-8. Refer to figures 2-1 through 2-4 for the location of all parts. Connect replaced items according to the schematic diagram (fig. 4-4).

2-8. Replacement of Diode Rectifiers

a. The following chart lists the tools required to replace the diode rectifier in the power supply.

Tool	Federal stock No.
Wrench, crowfoot, 9/16 in.–1/4 drive	5120–541–4074
Wrench, torsion, 1/4 in. square, male drive, 5–50 inch-pounds	5120–542–4489

b. The six diode rectifiers are mounted on a heat sink assembly (fig. 2-4). When a diode is removed, the replacement diode must be of the same type and mounted with the same orientation as the removed part. Diodes CR1, CR2, and CR3 are type 1N4587; diodes CR4, CR5, and CR6 are type 1N4587R.

c. Replace any diode rectifier as follows:

(1) Before proceeding, make sure that the circuit breaker switch is in the off (down) position and that the input power cable is disconnected from the power mains.

(2) Remove the hardware that secures the diode pigtail and capacitor pigtail to the bus bar on the heat sink. Do not discard hardware.

(3) Make note of the diode type; diode 1N4587 is color-coded white and diode 1N4587R is color-coded violet.

(4) Remove a defective diode by removing the nut and lockwasher that secure the diode to the bus bar.

(5) Apply a coating of Dow Corning Heat Sink Compound No. 340 to the mating flat surfaces on the heat sink only and replace the diode with one of the same type. Install the mounting hardware and torque to 30 inch-pounds; use the crowfoot wrench and torsion wrench.

(6) Secure the pigtail lug of the diode and the pigtail of the capacitor to the bus bar on the heat sink; use the hardware previously removed.

2-9. Adjustment of Variable Resistors R1 and R2

a. With no load connected to the power supply and VOLTAGE ADJUST switch S2 set to NOM. set the circuit breaker switch to POWER ON.

b. Check to see that DIRECT CURRENT VOLTS meter indicates 28.5 volts. If the indication is not 28.5 volts, set the circuit breaker switch to off and perform the procedures in *c* through *h* below.

Warning: **Do not touch the interior components of the power supply unless the circuit breaker switch is set to the off (down) position.**

c. Remove the top left side panel of the power supply to gain access to resistors R1 and R2.

d. Loosen the sliding contacts on resistors R1 and R2.

e. Reposition the sliding contacts slightly.

f. Set the circuit breaker switch to POWER ON and check to see whether DIRECT CURRENT VOLTS meter M2 indicates 28.5 volts.

g. Repeat the procedures in *e* and *f* above until DIRECT CURRENT VOLTS meter indicates 28.5 volts; always turn the power supply off before adjusting resistor sliding contacts.

h. Set the circuit breaker switch to the off position. Tighten the sliding contacts on resistors R1 and R2; replace top left panel of the power supply.

CHAPTER 3

GENERAL SUPPORT TESTING PROCEDURES

3-1. General

a. Testing procedures are prepared for use by field maintenance shops and service organizations responsible for general support maintenance of electronic equipment to determine the acceptability of repaired equipment. These procedures set forth specific requirements that repaired equipment *must* meet before it is returned to the using organization. These procedures may also be used as a guide for testing equipment that has been repaired at direct support, if the proper tools and test equipments are available. A summary of the performance standards is given in paragraph 3-7.

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

3-2. Test Equipment, Tools, and Materials

All test equipment, tools, and materials required to perform the testing procedures given in this chapter are listed in *a, b,* and *c,* below and are authorized under TA 11-17, Signal Field Maintenance Shops; and TA 11-100(11-17), Allowances of Signal Corps Expendable Supplies for Signal Field Maintenance Shops, (Continental United States).

a. Test Equipment.

Nomenclature	Federal stock No.	Technical manual
Ammeter ME–65/U	6625–237–9312	None
Multimeter TS–352B/U	6625–242–5023	TM 11–5527
Low Voltage Circuit Tester TV–100	4910–092–9136	None
Voltmeter ME–30(*)/U[a]	6625–669–0742	TM 11–6625–320–12
Ohmmeter ZM–21A/U	6625–246–5880	TM 11–2050

[a]Indicates Voltmeter, Meter ME–30A/U, Voltmeter, Electronic ME–30B/U, ME–30C/U, or ME–30E/U.

b. Tools. All the tools required are included in Tool Kit, Electronic Equipment TK-100/G and Tool Kit, Electronic Equipment TK-105/G.

c. Materials.

Nomenclature	Federal stock No.
Resistance element, 0.41–ohm, 3,400-watt (3 required)	5905–259–5909
Wire, electrical stranded; #0 AWG	6145–822–8431
Mating Connector (dc output)	5935–236–4640

3-3. Physical Tests and Inspections

a. Test Equipment and Materials. None required.

b. Test Connections and Conditions. No connections are necessary. Remove power supply left and right side panels.

c. *Procedure.*

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under Test		
1	None.	Controls may be in any position.	*a.* Inspect case and chassis for damage, missing parts, and condition of paint. *Note.* Touchup painting is recommended instead of refinishing whenever practical; screwheads, binding posts, receptacles, and other plated parts will not be painted or polished with abrasives.	*a.* No damage evident or parts missing. External surfaces intended to be painted will not show bare metal. Panel lettering will be legible.
			b. Inspect all controls and mechanical assemblies for loose or missing screws, bolts, and nuts.	*b.* Screws, bolts, and nuts will be tight. None missing.
			c. Inspect meters for loose, damaged, or missing parts.	*c.* No loose, damaged, or missing parts.
2	None.	Controls may be in any position.	*a.* Rotate VOLTAGE ADJUST switch to each of its positions.	*a.* Switch will rotate freely without binding or excessive looseness.
			b. Operate circuit breaker switch CB1.	*b.* Circuit breaker switch CB1 will operate properly.

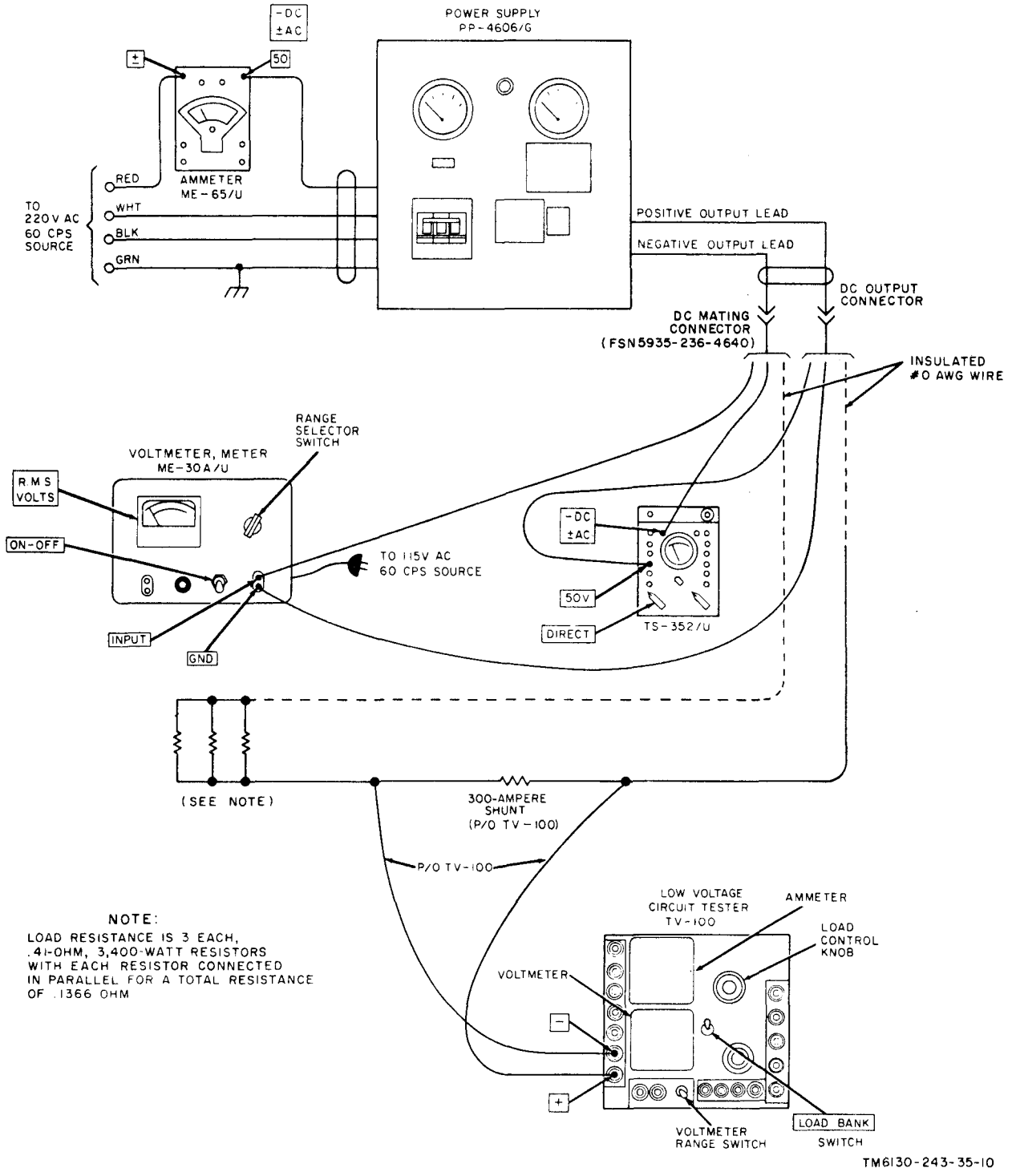


Figure 3-1. Connection diagram for power output, regulation, and ripple tests at 220-volt input.

3–4. Power Output, Regulation, and Ripple Tests at 220-Volt Input

a. Test Equipment and Materials.

(1) Voltmeter, Meter ME–30(*)/U.
(2) Ammeter ME–65/U.
(3) Multimeter TS–352B/U.
(4) Low Voltage Circuit Tester TV–100.
(5) Resistance element, 0.41-ohm, 3,400-watt, 3 required.
(6) Power cable (as fabricated).
(7) Mating connector (FSN 5935–236–4640).

b. Test Connections and Conditions. Connect the equipment as shown in figure 3–1. (This test is written for operation of the power supply at 220 volts ac). *Do not* connect the load and the TV–100 to the power supply until instructed to do so in the procedure given in *c* below.

c. Procedure.

Step No.	Control settings: Test equipment	Control settings: Equipment under test	Test procedure	Performance standard
1	*ME–65/U* Ammeter range: 20 *TS–352B/U* Function: DC VOLTS *ME–30(*)/U* ON-OFF switch: ON Range selector switch: 3	Circuit breaker switch: OFF VOLTAGE ADJUST switch: NOM	*a.* Connect links on the tap board of PP–4606/G for 220-volt operation.	*a.* None.
			b. Connect the PP–4606/G to a 220-volt, 60 cps, three phase ac source. *Note.* For this step, do not connect the load to the positive and negative output leads.	*b.* None.
			c. Set the circuit breaker switch on the PP–4606/G to the POWER ON position. Observe the indication on the 0 to 50 scale of the TS–352B/U. *Note.* If reading is not within ±2.5 volts of 28.5 volts, set VOLTAGE ADJUST switch on PP–4606/G to LOW or HIGH position. If correct reading is obtained at either of the switch settings, the PP–4606/G meets the performance standard requirements.	*c.* Reading is 28.5 volts ±2.5.
			d. Observe DIRECT CURRENT VOLTS meter on PP–4606/G.	*d.* Reading is within ±5 percent of reading on TS–352B/U.
			e. Set circuit breaker switch on PP–4606/G to *off*.	*e.* None.
			f. Connect load (three 0.41–ohm, 3,400–watt resistors, connected in parallel for a total resistance of 0.1366 ohm). Connect TV–100 to measure output current. Set circuit breaker switch on PP–4606/G to POWER ON. Observe indication on the TS–352B/U.	*f.* Reading is within 9 percent of reading obtained in *c* above.
			g. Observe indication on the TV–100 ammeter.	*g.* Reading is 200 amperes ±15.
			h. Depress AMMETER switch on PP–4606/G and observe indication on DIRECT CURRENT AMPERES meters.	*h.* Reading is within ±5 percent of reading obtained in *g* above.
			i. Observe the indication on the 0 to 3 volts scale of the ME–30(*)/U.	*i.* Reading is less than 1.3 volts.
			j. Observe the indication on ME–65/U.	*j.* Reading is less than 18 amperes.
			k. Set circuit breaker switch on PP–4606/G to off position and disconnect load.	*k.* None.

3-5. Insulation Resistance Test

a. Test Equipment. The only test equipment required is Ohmmeter ZM-21A/U.

b. Test Connections and Conditions. This test is performed with the PP-4606/G disconnected from the ac power source. This test checks the insulation resistance of the primary windings of power transformer T1. The test is written for the PP-4606/G strapped for 220-volt ac operation.

c. Procedure.

(1) Connect the ground lead of the ZM-21A/U to the frame of the PP-4606/G.

(2) Connect the line lead of the ZM-21 A/U to any terminal 1 of the tap board on the rear of the PP-4606/ G.

(3) Operate the ZM-21A/U and observe the indication on the ZM-21A /U meter. The PP-4606/U meets the performance standard if the ZM -21A/U meter reading is greater than 10 megohms.

(4) Disconnect the ZM-21A/U from the PP-4606/G.

GPO 828-507-4

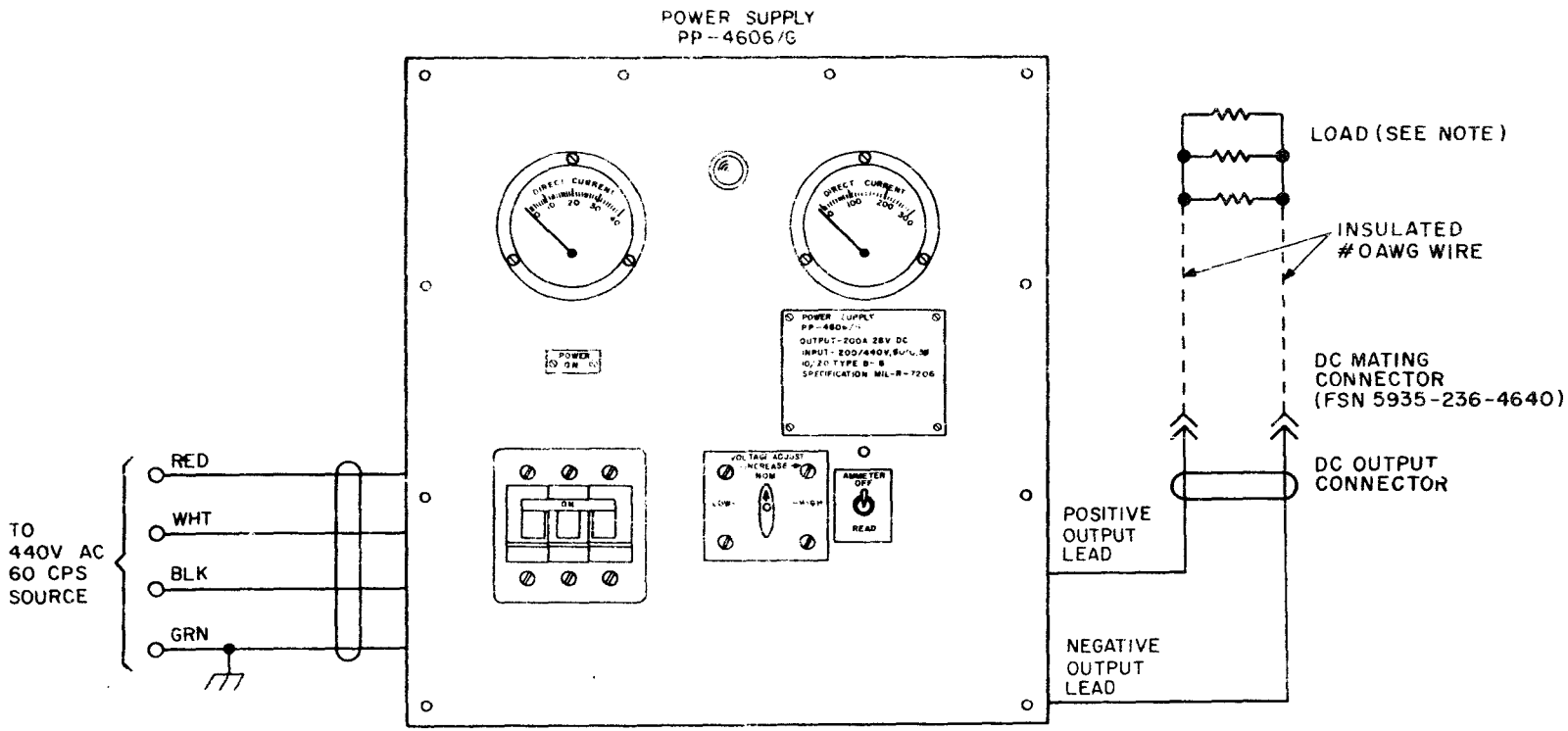


Figure 3-2. Connection diagram for output power test at 440-volt input.

3–6. Output Power Test at 440-Volt Input

a. Materials.

(1) Resistance element, 0.41-ohms, 3,400-watt, 3 each
(2) Power cable (as fabricated).
(3) Mating connector (FSN 5935–236–4640).

b. Test Connections and Conditions. Connect the equipment as shown in figure 3–2. (This test is written for operation of the power supply at 440 volts ac). *Do not* connect the load to the power supply until instructed to do so in the procedure given in *c* below.

c. Procedure;

Step No.	Control settings: Test equipment	Control settings: Equipment under test	Test procedure	Performance standard
1	None.	Circuit breaker switch: off VOLTAGE ADJUST switch: NOM	*a.* Connect links on tap board of Power Supply PP–4606/G for 440-volt operation.	*a. None.*
			b. Connect the PP–4606/G to a 440-volt, 3 phase, ac source.	*b. None.*
			Note. For this step, do not connect the load to the positive output leads.	
			c. Set the circuit breaker switch on the PP–4606/G to the POWER ON position. Observe the DIRECT CURRENT VOLTS meter.	*c.* Reading is 28.5 ±2.5 volts.
			Note. If the reading is not within ±2.5 volts of 28.5 volts, set the VOLTAGE ADJUST switch on the PP–4606/G to the LOW or HIGH position. If the correct reading is obtained at either of the switch setting, the PP–4606/G meets the performance standards requirements.	
			d. Connect the load (three 0.41–ohm, 3,400–watt resistors, connected in parallel for a total resistance of 0.1366 ohms). Observe the indication on the DIRECT CURRENT AMPERES meter.	*d.* Reading is within ±2.5 volts of reading obtained in step *c*.
			e. Depress AMMETER switch on PP–4606/G and observe indication on DIRECT CURRENT AMPERES meter.	*e.* Reading is 200 amperes ±15.
			f. Set circuit breaker switch on PP–4606/G to off position and disconnect load.	*f. None.*

3-7. Test Data Summary

a. Input.

(1) Voltage ----------220 or 440 volts.
(2) Frequency ----------60 cps.
(3) Phase ---------- Three, wye-connected.
(4) Current (each leg at full load) 18 amperes maximum for 220-volt input or 9 amperes for 440-volt input.

b. Output.

(1) Voltage (VOLTAGE ADJUST switch S2 set to NOM)	28.5 volts dc ± 2.5.
(2) Current (maximum)	200 amperes ± 15.
(3) Ripple voltage	5 percent maximum.
(4) Regulation	9 percent maximum.

c. Formulas Used.

$$\% \text{ Regulation} = \frac{E_{NL} - E_L}{E_L} \times 100.$$

$$\% \text{ Ripple} = \frac{E_{RMS}}{E_{DC}}$$

Where:

E_{NL} is dc output voltage measured under no-load conditions.
E_L is dc output voltage measured under full-load conditions.
E_{RMS} is the measured ripple voltage.
E_{DC} is the measured dc output voltage.

CHAPTER 4

DEPOT OVERHAUL STANDARDS

4-1. Applicability of Depot Overhaul Standards

The tests outlined in this chapter are designed to measure the performance capability of a repaired equipment. Equipment that is to be returned to stock should meet the standards given in these tests.

a. Repair Standards. Applicable procedures of the depots performing these tests and the general standards for repaired electronics equipment given in TB SIG 355-1, TB SIG 355-2, and TB SIG 355-3 form a part of the test requirements.

b. Technical Publication. The technical publication applicable to the equipment to be tested is TM11-6130-243-12.

c. Modification Work Orders. Perform all modification work orders applicable to this equipment before making the tests specified. DA Pam 310-4 lists all available MWO's.

4-2. Test Facilities Required

The following items are required for depot testing.

a. Test Equipment.

Item	Federal stock number	Technical manual
Multimeter TS–352B/U	6625–242–5023	TM 11–5527
Low Voltage Test Set TV–100	4910–092–9136	None
Voltmeter, Meter ME–30(*)/U[a]	6625–669–0742	TM 11–6625–320–12
Ohmmeter ZM–21A/U	6625–246–5880	TM 11–2050
Wattmeter TS–430/U (2 required)	6625–649–5393	None

•Indicates ME–30A/U, ME–30B/U, ME–30C/U, or ME–30E/U.

b. Materials.

Nomenclature	Federal stock number
Resistance element, 0.41–ohm, 3,400-watt (3 required)	5905–259–5909
Wire, electrical stranded; #0 AWG	6145–822–8431
Mating connector (dc output)	5935–236–4640

4-3. Power Output, Regulation, Ripple, and Efficiency Test at 220-Volt Input

a. With 220-volt, 3-phase, 60-cps input power, connect the equipment as shown in figure 4-1.

b. With no load connected to the power supply, set the PP-4606/G VOLTAGE ADJUST switch to NOM and the circuit breaker switch to POWER ON. The TS-352B/U should indicate 28.5 volts ± 2.5. If necessary, set the VOLTAGE ADJUST switch to LOW or HIGH to obtain 28.5 volts ± 2.5 on the TS-352B/U. The DIRECT CURRENT VOLTS meter on the PP-4606/G should indicate within ±5 percent of the reading on the TS-352 B/U.

c. Set the circuit breaker switch on the PP-4606/G to off.

d. Connect the load (three each, 0.41-ohm, 3,400-watt resistors connected in parallel for a total resistance of 0.1366 ohm). Connect the TV-100 to measure the output current. Set the circuit breaker switch on the PP-4606/G

to POWER ON. The TS-352B/U should indicate within 9 percent of the reading obtained in *b* above. The TV-100 should indicate 200 amperes ±15. Depress the AMMETER switch on the PP-4606/G. Indication on the DIRECT CURRENT AMPERES meter should be within ±5 percent of the current reading obtained on the TV-100.

e. The ME-30(*)/U should indicate less than 1.3 volts.

f. Both wattmeters (TS-430/U) should indicate less than 7,400 watts total.

g. Set the circuit breaker switch on the PP-4606/G to OFF and disconnect the equipment.

4-4. Insulation Resistance Test

The depot overhaul standards insulation resistance test procedures are the same as those for general support (para 3-5). Equipment that meets the performance standards stated in paragraph 3-5 will furnish satisfactory insulation resistance equivalent to that of new equipment.

4-5. Output Power Test at 440-Volt Input

The depot overhaul standards output power test procedures at 440-volt input are the same as those for general support (para 3-6). Equipment that meets the performance standards stated in paragraph 3-6 will furnish satisfactory output power at 440-volt input equivalent to that of new equipment.

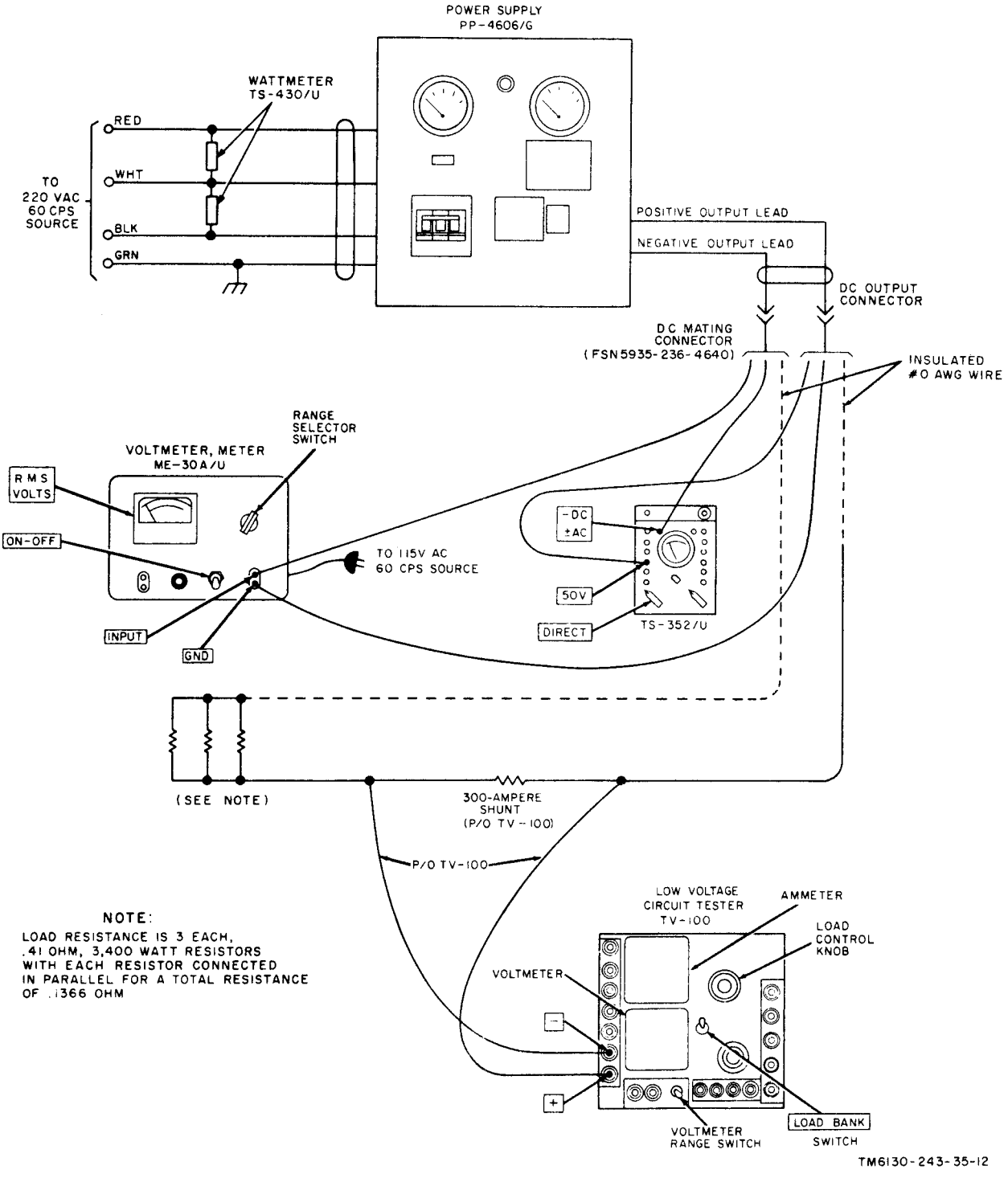
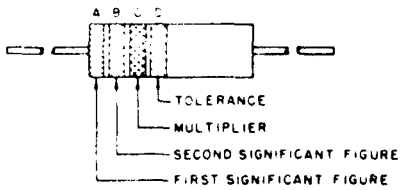


Figure 4-1. Connection diagram for power output, regulation, ripple, and efficiency at 220-volt input.

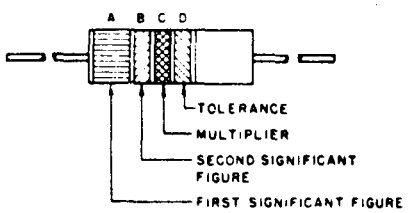
COLOR CODE MARKING FOR MILITARY STANDARD RESISTORS

COMPOSITION-TYPE RESISTORS



BAND A— Equal Width Band Signifies Composition-Type

WIREWOUND-TYPE RESISTORS

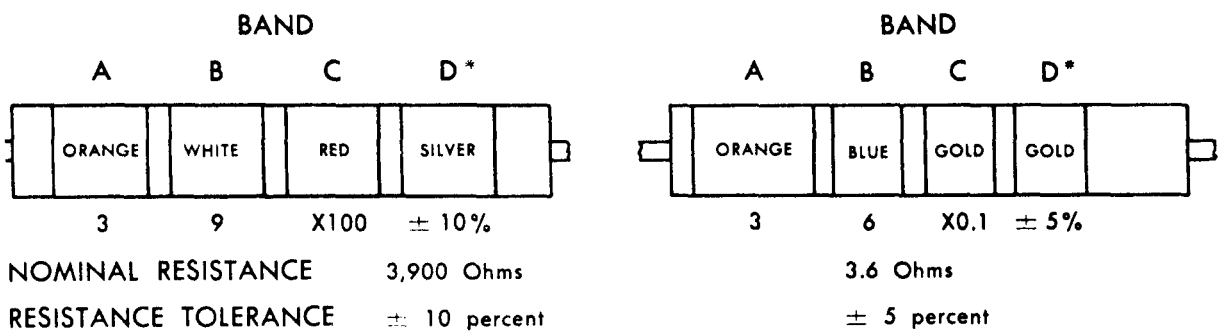


BAND A— Double Width Signifies Wire-wound Resistor

COLOR CODE TABLE

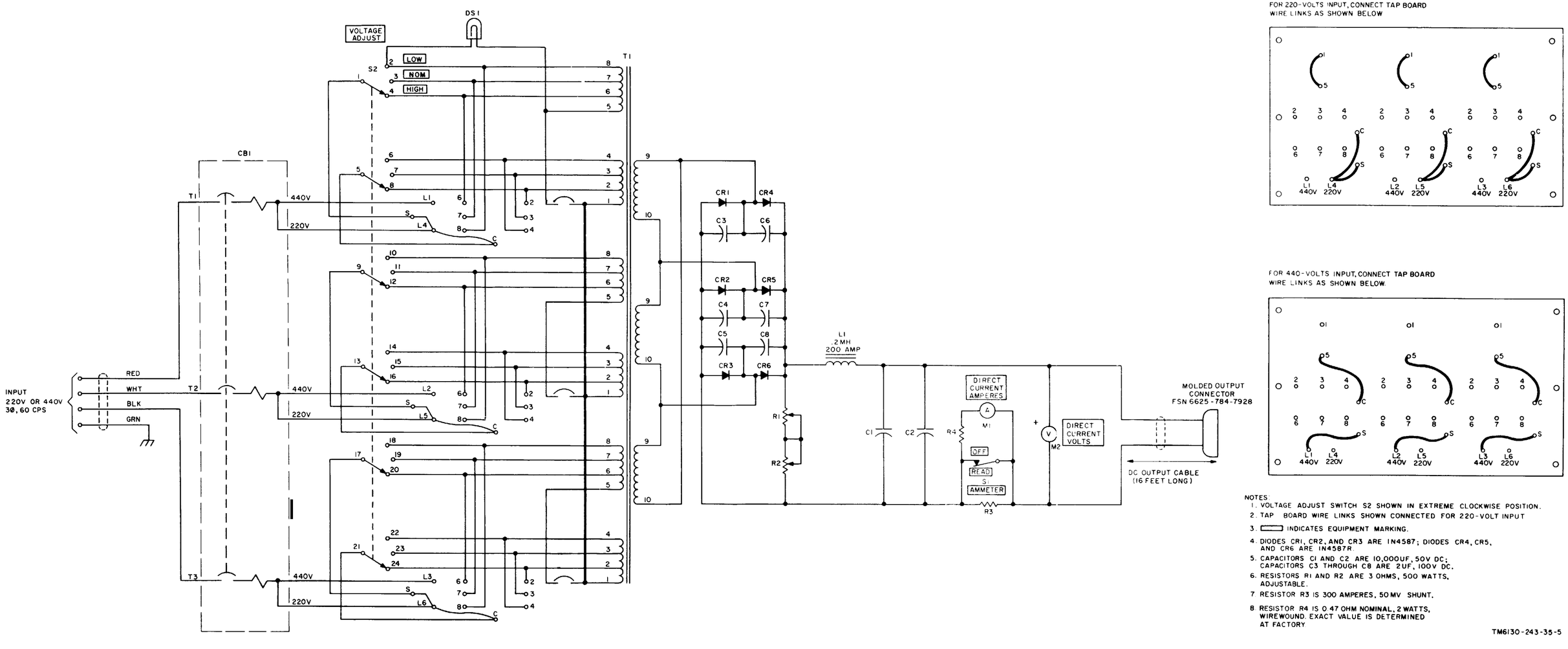
BAND A		BAND B		BAND C		BAND D*	
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)
BLACK	0	BLACK	0	BLACK	1		
BROWN	1	BROWN	1	BROWN	10		
RED	2	RED	2	RED	100		
ORANGE	3	ORANGE	3	ORANGE	1,000		
YELLOW	4	YELLOW	4	YELLOW	10,000	SILVER	± 10
GREEN	5	GREEN	5	GREEN	100,000	GOLD	± 5
BLUE	6	BLUE	6	BLUE	1,000,000		
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7				
GRAY	8	GRAY	8	SILVER	0.01		
WHITE	9	WHITE	9	GOLD	0.1		

EXAMPLES OF COLOR CODING



*If Band D is omitted, the resistor tolerance is ± 20%, and the resistor is not Mil-Std.

Figure 4-2. Color code markings for MIL STD resistors.



FOR 220-VOLTS INPUT, CONNECT TAP BOARD WIRE LINKS AS SHOWN BELOW

FOR 440-VOLTS INPUT, CONNECT TAP BOARD WIRE LINKS AS SHOWN BELOW.

NOTES:

1. VOLTAGE ADJUST SWITCH S2 SHOWN IN EXTREME CLOCKWISE POSITION.
2. TAP BOARD WIRE LINKS SHOWN CONNECTED FOR 220-VOLT INPUT
3. ▭ INDICATES EQUIPMENT MARKING.
4. DIODES CR1, CR2, AND CR3 ARE IN4587; DIODES CR4, CR5, AND CR6 ARE IN4587R
5. CAPACITORS C1 AND C2 ARE 10,000UF, 50V DC; CAPACITORS C3 THROUGH C8 ARE 2UF, 100V DC.
6. RESISTORS R1 AND R2 ARE 3 OHMS, 500 WATTS, ADJUSTABLE.
7. RESISTOR R3 IS 300 AMPERES, 50 MV SHUNT.
8. RESISTOR R4 IS 0.47 OHM NOMINAL, 2 WATTS, WIREWOUND. EXACT VALUE IS DETERMINED AT FACTORY

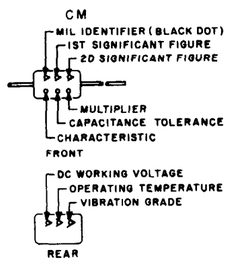
TM6130-243-35-5

GPO 828-507-6

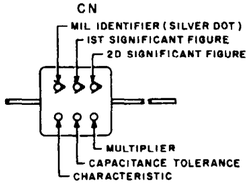
Figure 4-4. Power Supply PP-4606/G, schematic diagram.

COLOR CODE MARKING FOR MILITARY STANDARD CAPACITORS

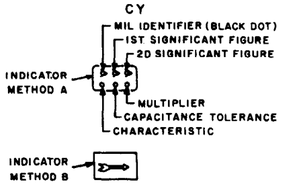
GROUP I Capacitors, Fixed, Various-Dielectrics, Styles CM, CN, CY, and CB



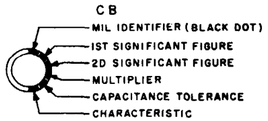
MICA-DIELECTRIC



PAPER-DIELECTRIC

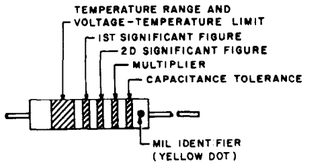


GLASS-DIELECTRIC, GLASS CASE

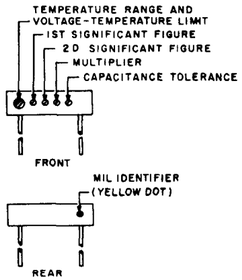


MICA, BUTTON TYPE

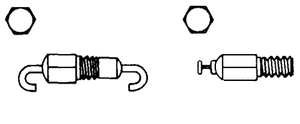
GROUP II Capacitors, Fixed Ceramic-Dielectric (General Purpose) Style CK



AXIAL LEAD

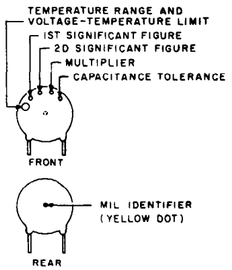


RADIAL LEAD



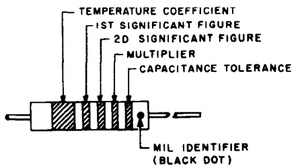
FEED-THROUGH

STAND-OFF

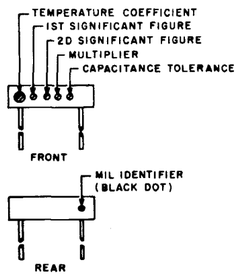


DISK-TYPE

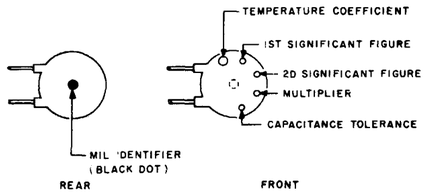
GROUP III Capacitors, Fixed, Ceramic-Dieletric (Temperature Compensating) Style CC



AXIAL LEAD



RADIAL LEAD



DISK-TYPE

COLOR CODE TABLES

TABLE I – For use with Group I, Styles CM, CN, CY and CB

COLOR	MIL ID	1st SIG FIG	2nd SIG FIG	MULTIPLIER[1]	CAPACITANCE TOLERANCE				CHARACTERISTIC[2]				DC WORKING VOLTAGE	OPERATING TEMP. RANGE	VIBRATION GRADE
					CM	CN	CY	CB	CM	CN	CY	CB	CM	CM	CM
BLACK	CM, CY CB	0	0	1			± 20%	± 20%		A				−55° to +70°C	10–55 cps
BROWN		1	1	10					B	E		B			
RED		2	2	100	± 2%		± 2%	± 2%	C		C			−55° to +85°C	
ORANGE		3	3	1,000		± 30%			D			D	300		
YELLOW		4	4	10,000					E					−55° to +125°C	10–2,000 cps
GREEN		5	5		± 5%				F				500		
BLUE		6	6											−55° to +150°C	
PURPLE (VIOLET)		7	7												
GREY		8	8												
WHITE		9	9												
GOLD				0.1			± 5%	± 5%							
SILVER	CN				± 10%	± 10%	± 10%	± 10%							

TABLE II – For use with Group II, General Purpose, Style CK

COLOR	TEMP. RANGE AND VOLTAGE – TEMP. LIMITS[3]	1st SIG FIG	2nd SIG FIG	MULTIPLIER[1]	CAPACITANCE TOLERANCE	MIL ID
BLACK		0	0	1	± 20%	
BROWN	AW	1	1	10	± 10%	
RED	AX	2	2	100		
ORANGE	BX	3	3	1,000		
YELLOW	AV	4	4	10,000		CK
GREEN	CZ	5	5			
BLUE	BV	6	6			
PURPLE (VIOLET)		7	7			
GREY		8	8			
WHITE		9	9			
GOLD						
SILVER						

TABLE III – For use with Group III, Temperature Compensating, Style CC

COLOR	TEMPERATURE COEFFICIENT[4]	1st SIG FIG	2nd SIG FIG	MULTIPLIER[1]	CAPACITANCE TOLERANCE		MIL ID
					Capacitances over 10uuf	Capacitances 10uuf or less	
BLACK	0	0	0	1		± 2.0uuf	CC
BROWN	−30	1	1	10	± 1%		
RED	−80	2	2	100	± 2%	± 0.25uuf	
ORANGE	150	3	3	1,000			
YELLOW	220	4	4				
GREEN	330	5	5		± 5%	± 0.5uuf	
BLUE	470	6	6				
PURPLE (VIOLET)	750	7	7				
GREY		8	8	0.01			
WHITE		9	9	0.1	± 10%		
GOLD	+100					± 1.0uuf	
SILVER							

1. The multiplier is the number by which the two significant (SIG) figures are multiplied to obtain the capacitance in uuf.
2. Letters indicate the Characteristics designated in applicable specifications: MIL–C–5, MIL–C–91, MIL–C–11272, and MIL–C–10950 respectively.
3. Letters indicate the temperature range and voltage-temperature limits designated in MIL–C–11015.
4. Temperature coefficient in parts per million per degree centigrade.

Figure 4-3. Color code marking for MIL STD capacitors.

STD-C2

APPENDIX

REFERENCES

DA Pam 310-4	lndex of Technical Publications.
TB SIG 355-1	Depot Inspection Standard for Repaired Signal Equipment.
TB SIG 355-2	Depot Inspection Standard for Refinishing Repaired Signal Equipment.
TB SIG 355-3	Depot Inspection Standard for Moisture and Fungus Resistant Treatment.
TB 385-4	Safety Precautions for Maintenance of Electrical/EIectronic Equipment.
TM11-487H-l/l	Military Standardization Handbook: Electronic Test Equipment.
TM11-2050	Test Set I-48B and Ohmmeter ZM-21A/U.
TM11-5043-12	Operator's and Organizational Maintenance Manual For Analyzers, ZM-3/U and ZM-3A/U.
TM11-6130-243-12	Organizational Maintenance Manual: Power Supply PP-4606/G.
TM11-6625-320-12	Operator's and Organizational Maintenance Manual: Voltmeter, Meter ME-30A/U and Voltmeters, Electronic ME-30B/U, ME-30C/U, and ME-30E/U.
TM11-6625-366-15	Operator's, Organizational, Direct Support, General Support, and Depot Maintenance Manual: Multimeter TS-352B/U.

TM 11-6130-243-35

By Order of the Secretary of the Army:

HAROLD K. JOHNSON,
General, United States Army,
Chief of Staff.

Official:

KENNETH G. WICKHAM,
Major General, United States Army,
The Adjutant General.

Distribution:

To be distributed in accordance with DA Form 12-36, unclassified requirements for Direct and General Support maintenance literature for all Rotor Wing Accounts (2) plus USASESCS (60).

★ U.S. GOVERNMENT PRINTING OFFICE: 1989 242-451/05892

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

THEN...JOT DOWN THE DOPE ABOUT IT ON THIS FORM. CAREFULLY TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL.

SOMETHING WRONG WITH PUBLICATION

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE

BE EXACT PIN-POINT WHERE IT IS

PAGE NO.	PARA-GRAPH	FIGURE NO.	TABLE NO.

IN THIS SPACE, TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT.

PRINTED NAME, GRADE OR TITLE AND TELEPHONE NUMBER	SIGN HERE

TEAR ALONG PERFORATED LINE

DA FORM 1 JUL 79 2028-2

PREVIOUS EDITIONS ARE OBSOLETE.

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

PIN: 020679-000