TM 11-6125-238-35

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

FIELD AND DEPOT MAINTENANCE MANUAL

INVERTER, VIBRATOR PP-1703/U

Headquarters, Department of the Army, Washington 25, D.C.

2 December 1963

WARNING

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT

Be careful when working on the 115-volt ac output circuit. Serious injury or death may result from contact with its terminals. Never connect or disconnect the input cable with the POWER switch in the ON position.

DON'T TAKE CHANCES!

CHAPTER 1
FUNCTIONING OF PP-1703/U

1. Scope

a. This manual contains instructions for field and depot maintenance for Inverter, Vibrator PP-1703/U. It includes instructions appropriate to third, fourth, and fifth echelons for troubleshooting, testing, repairing the equipment, and replacing maintenance parts. It also lists materials and test equipment for third, fourth, and fifth echelon maintenance.

b. Throughout this manual, Inverter, Vibrator PP-1703/U is referred to as *inverter.*

c. The complete technical manual for this equipment includes TM 11-6125-238-12.

d. The direct reporting, by the individual user, of errors, omissions, and recommendations for improving this equipment manual is authorized and encouraged. DA Form 2028 will be used for reporting these improvements. This form may be completed using pencil, pen, or typewriter. DA Form 2028 will be completed in triplicate and forwarded by the individual using the manual. The original and one copy will be forwarded direct to: Commanding Officer, U. S. Army Electronics Materiel Support Agency, ATTN: SE LMS-MP, Fort Monmouth, New Jersey, 07703. One information copy will be furnished to the individual's immediate supervisor (officer, noncommissioned officer, supervisor, etc).

Note: For other applicable forms and records, see paragraph 3, TM 11-6125-238-120.

e. Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to this equipment. Department of the Army Pamphlet No. 310-4 is an index of current technical manuals, technical bulletins, supply bulletins, lubrication orders, and modification work orders available through publications supply channels. The index lists the individual parts (-10, -20, -35P, etc) and the latest changes to and revisions of each equipment publication.

2. Functioning of Equipment (fig. 1)

a. General.

(1) Inverter, Vibrator PP-1703/U is a portable unit which converts primary power (24-, 26-, 28-, or 30-volt storage battery) to 115 volts alternating current (ac) at 60 cycles per second (cps) by use of a vibrator and a step-up power transformer with a center-tapped primary. The vibrator mechanism is an interrupter or high-speed reversing switch that automatically opens and closes sets of contacts by m a g n e t i c action when direct-current (dc) power is applied to it. The vibrator changes the pure dc from the storage battery into pulsating dc by a driver contact (pin 2) and two pairs of power or interrupter contacts (pins 1 and 6). The driver contact (pin 2) operates the flexible reed (or armature) in the same manner as an electrical buzzer. The power contacts (pins 1 and 6) connect one terminal of the storage battery alternately to one end of the center-tapped primary of transformer T1 and then to the other. The center tap is connected through switch S1 to the other terminal of the storage battery.

(2) This automatic and rapid switching of storage battery connections to the primary of T1 produces pulses of current through opposite halves of the primary. These current pulses flow in alternate directions through the primary because of the action of the power contacts that

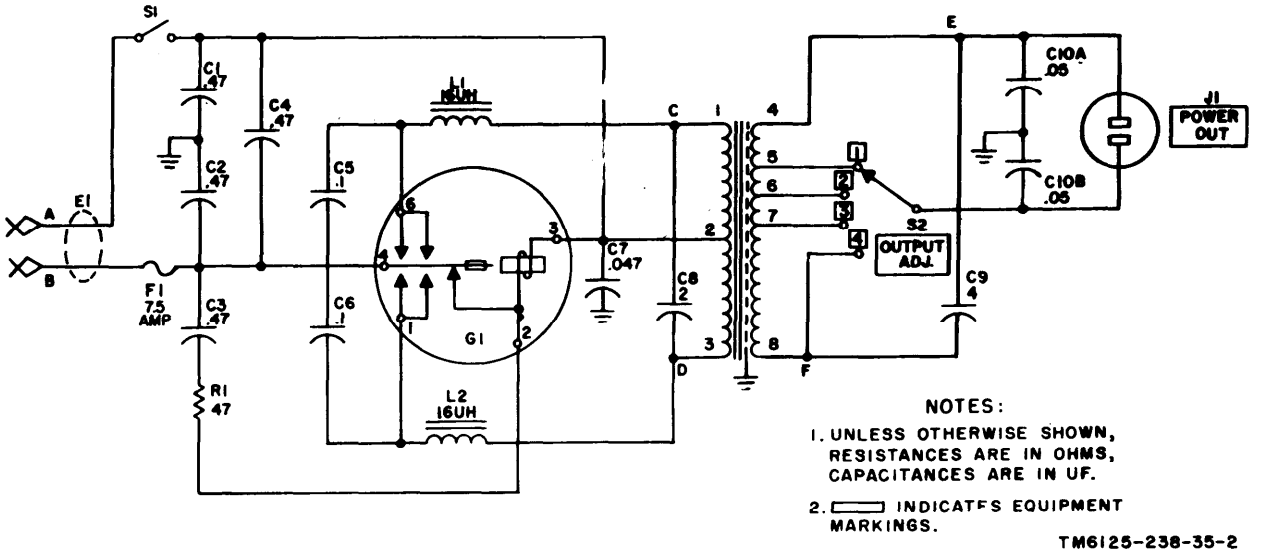

Figure 1. Inverter, Vibrator PP-11703/U, schematic diagram.

interrupt and switch the current flow. This interruption and reversal of primary current causes a corresponding changing magnetic field around the primary that induces an alternating voltage in the secondary. Because of the transformer step-up ratio, the induced ac voltage in the secondary is many times greater than the primary voltage.

b. Driver Contact. The vibrator actuating coil and the transformer T1 primary are in separate circuits. The actuating coil is in series with the driver contact. When POWER switch S1 is at the Opposition (closed), the actuating coil is energized and magnetically pulls the reed away from the driver contact. This opens the driver contact and deenergizes the actuating coil. The vibrating reed then springs back, closes the driver contact, and again energizes the actuating coil. The electrical and physical characteristics of these components (especially the physical dimensions and weight of the vibrating reed) are such that the vibrating reed repeats this cycle and vibrates at a rate of 60 cps.

c. *Power or Interrupter Contacts.* When the vibrating reed is pulled toward the actuating coil, one pair of power contacts (pin 1) is closed. This completes the dc circuit through one transformer section (pins 2 and 3), and a pulse of current flows. When the vibrating reed is released, it breaks this circuit and springs back to the opposite pair of power contacts (pin 6). This completes the dc circuit through the other transformer section (pins 1 and 2), and a pulse of current flows through the other half of the transformer primary.

d. Transformer. Regardless of the polarity of the battery clips, current flows through the primary of the transformer first in one direction and then in the opposite direction as the vibrator closes the alternate pairs of power contacts. These alternating pulses through the primary produce an alternating output in the secondary. Because the reed vibrates at approximately 60 cps, the output frequency is approximately 60 cps. The output voltage waveform is approximately a square wave.

3. Input Circuit

(fig. 1)

a. Actuating Coil. The actuating coil circuit extends from clip lead A, through POWER switch S1, terminal 3 of vibrator G1, the actuating coil, the driver contact, the vibrating reed, and fuse F1, to clip lead B. The circuit is closed when POWER

switch S1 is set to the ON position, and is interrupted 60 times per second by the making and breaking of the driver contact.

b. Primay of Transformer T1. There are two branch circuits through the primary of T1; one through the upper half (pins 1 and 2), the other through the lower half (pins 2 and 3). One branch extends from clip lead A, through S1, terminal 2 (the center tap) of T1, terminal 1 of Tl, choke coil L1, pin 6 of vibrator G1 and its paired power contacts, the vibrating reed, and fuse Fl, to clip lead B. The other branch is similar except that it extends from clip lead A, through S1, terminal 2 of Tl, terminal 3 of T1, choke coil L2, pin 1 of vibrator G1 and its paired power contacts, the vibrating reed, and fuse F1, to clip lead B. Current flows alternately in the upper (pins 1 and 2) and lower (pins 2 and 3) sections of transformer T1 when the vibrating reed makes contact with the upper and lower power contacts of vibrator G1. This occurs 60 times per second for each pair of contacts. Capacitor C8 (buffer capacitor) is across the primary of T1 to limit the sharp peaks that otherwise would be produced when the power contacts open. This prevents arcing and a resulting pitting of the power contacts.

c. Input Circuit Filters.

(1) Capacitor C4 filters out radio frequency (rf) hash from across the input leads.

(2) Capacitors Cl and C2 filter out rf hash from across each of the clip leads (A and B) and chassis ground.

(3) Capacitors C5 and C6 reduce rf hash across the upper and lower pairs of vibrator contacts (pins 6 and 1).

(4) Choke coil L1 keeps rf hash out of the upper half (pins 1 and 2) of the primary of Tl; choke coil L2 keeps rf hash out of the lower half (pins 2 and 3) of the primary of T1.

(5) Capacitor C3 and resistor R1 prevent arcing across the vibrator driver contact.

4. Output Circuit

(fig. 1)

a. Output Circuit Theory. The 60-cps pulses applied to the primary of transformer T1 produce a 60-cps, 115-volt ac voltage in the secondary of T1. The secondary of T1 is switched by OUTPUT ADJ. switch S2 to keep the output voltage constant for an input power source of 24, 26, 28, or 30 volts, as follows:

(1) For an input power source of' 24 volts, S2 is set to position 4, the secondary winding of T1 is pins 4 and 8, and the output power is 80 watts maximum.

(2) For an input power source of 26 volts, S2 is set to position 3, the secondary winding of T1 is pins 4 and 7, and the output power is 67 watts maximum.

(3) For an input power source of 28 volts, S2 is set to position 2, the secondary winding is pins 4 and 6, and the power output is 53 watts maximum.

(4) For an input power source of 30 volts, *S2* is set to position 1, the secondary winding is pins 4 and 5, and the output power is 40 watts maximum.

b. Output Circuit Filters. Capacitor C9 (buffer capacitor) is across the secondary of T1 to limit the sharp peaks that otherwise would be produced when the power contacts open. This prevents arcing and a resulting pitting of the power contacts. Capacitors C10A and C10B prevent rf hash from being applied across the terminals of POWER OUT receptacle J1. The junction of these two capacitors C10A and C10B is connected to chassis ground to prevent rf potentials from being pet up between either output lead and chassis.

CHAPTER 2
TROUBLESHOOTING

Warning: When servicing Inverter, Vibrator PP-1703/U, be extremely careful of high voltages. Always disconnect the input cable from the storage battery before making any repairs or resistance checks.

5. Troubleshooting Procedures

a. General. The first step in servicing a defective inverter is to localize the fault. Localization means tracing the fault to a defective part responsible for the abnormal condition. Some faults, such as burned-out resistors, arcing, or shorted transformer, and burned-out or stuck vibrator, can often be located by sight, smell, and hearing. The majority of faults, however, must be isolated by checking resistances.

b. Localization. The tests listed below aid in isolating the source of trouble. To be effective, the procedure should be followed in the order given. First, trouble should be localized to a single circuit; then the trouble may be isolated within that circuit by appropriate resistance measurements. The service procedure is summarized as follows:

(1) *Inspection.* The purpose of inspection is to locate any visible trouble. Through this inspection alone, the repairman frequently may discover the trouble or determine the circuit in which the trouble exists. This inspection is valuable in avoiding additional damage to the inverter that could occur through improper servicing methods.

(2) *Resistance measurements.* Resistance measurements (para 8) may prevent further damage to the inverter from possible short circuits caused by faulty components.

(3) *Troubleshooting chart.* The trouble symptoms listed in the troubleshooting chart (para 7) provide additional information for localizing trouble.

(4) *Intermittent troubles. In all* of the tests, the possibility of intermittent troubles should not be overlooked. If present, this type of trouble often may be made to appear by tapping or jarring the equipment.

(5) *Resistor and capacitor color-code Magrams.* Resistor and capacitor color-code diagrams (fig. 4 and 5) are provided to aid maintenance personnel in determining the value, voltage rating, and tolerance of capacitors and resistors.

c. *General Precautions.* Whenever the inverter is serviced, observe the following very carefully:

(1) When the chassis assembly is removed from the case, points having dangerous voltages are exposed.

(2) Careless replacement of parts often cause additional faults.

(3) Before a part is unsoldered, note the position of the leads. If the part such as a transformer has a number of connections, tag each of its leads.

(4) Be careful not to damage other leads; pull or push them out of the way.

(5) Do not allow drops of solder to fall into the chassis, because they may cause short circuits.

(6) A carelessly soldered connection may create a new fault. It is very important to make well-soldered joints, because a poorly soldered joint is one of the most difficult faults to find.

6. Test Equipment Required

The test equipment required for troubleshooting Inverter, Vibrator PP-1703/U is as follows:

Nomenclature	Federal stock No.	Technical manual
Multimeter TS-352/U	6625-242-5023	TM 11-5527
Dummy load (4):		
164-ohm, 250-watt resistor		
194-ohm, 250-watt resistor		
248-ohm, 250-watt resistor		
330-ohm, 250-watt resistor		

7. Troubleshooting

Caution: **If a proper wattage load is not available, use the following valued resistors as a dummy load when troubleshooting the PP-1703/U With voltage applied.**

OUTPUT ADJ. switch position	Primer power (volts dc)	Dummy load (ohms)
1	30	333 (250 watts)
2	28	248 (250 watts)
3	26	194 (250 watts)
4	24	164 (250 watts)

a. General. The troubleshooting chart (b below) is supplied as an aid in locating trouble in the inverter. When the trouble has been localized to a circuit, resistance measurements of this circuit should be sufficient to isolate the defective part. Normal resist a n c e measurements are given in paragraph 8. Perform the checks in the order listed in the chart below. When each check is performed, it is assumed that all previous troubles have been corrected.

b. Troubleshooting Chart.

Item	Indication	Probable trouble	Procedure
1	Vibrator G1 does not operate----	Poor battery contacts ----------	Clean battery clips and battery terminals.
		Fuse F1 burned out----------	Replace fuse.
		Vibrator G1 not properly seated in socket.	Seat vibrator firmly in socket Xl (fig. 4, TM 11-6125-238-12).
		Vibrator defective ----------	Replace vibrator (fig. 4, TM 11-6125-238-12).
		Capacitor C3 shorted ----------	Replace capacitor C3 (fig. 2).
2	Fuse F1 (7. 5-ampere, Federal stock No. 5920-280-8600) burned out.	Vibrator G1 defective ----------	Replace vibrator G1 (fig. 4, TM 11-6125-238-12).
		Capacitor C4, C5, C6, C7, C8, or C9 shorted.	Replace shorted capacitor (fig. 1).
		Defective load circuit ----------	Check load for proper wattage rating.
3	Output voltage low (less than 110 volts ac).	OUTPUT ADJ. switch S2 not properly set.	Set switch S2 properly (para 4a).
		Battery not fully charged -------	Charge or replace battery.
		Vibrator G1 worn ----------	Replace vibrator G1 (fig. 4, TM 11-6125-238-12).
		Coil L1 or L2 or connection is open.	Replace L1 or L2, or repair connection (fig. 2).
4	Output voltage high (above 120 volts ac).	OUTPUT AIM. switch S2 not properly set.	Set switch S2 properly (para 4a).
5	Vibrator hum is heard, but output voltage is 0.	OUTPUT ADJ. switch S2 or connection to S2 is defective.	Repair switch S2 connections or replace switch (fig. 4, TM 11-6125-238-12).
		POWER OUT receptacle J 1 or connections defective.	Repair connections or replace POWER OUT receptacle J1 (fig. 1).
		Primary or secondary of transformer T1 open.	Replace T1 (fig. 1).

8. Resistance Measurements

a. Set POWER switch S1 to OFF.

b. Disconnect the battery clips from the storage battery.

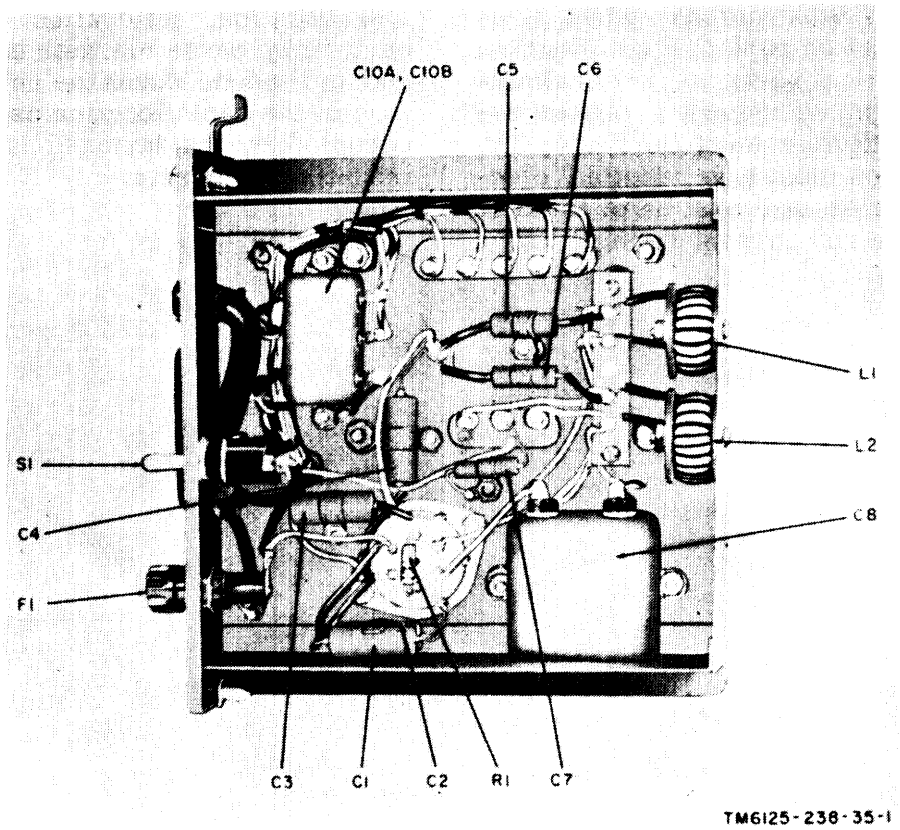

Figure 2. lnverter, Vibrator PP-1703/U, bottom view of chassis,

c. Set OUTPUT ADJ. switch S2 to position 1.

d. Set POWER switch S1 to ON.

e. Refer to the lettered test points in figure 1. The fo11owing approximate point-to-point measurements should be obtained:

Points of measurement	Resistance (ohms)
A to B	100
C to D	Less than 1
E to F	9.5

f. The following measurements on socket Xl (fig. 4, TM 11-6125-238-12), with vibrator G1 removed, should be obtained:

Points of measurement	Resistance (ohms)
1 to 6	3
3 to 6	1.5
3 to 1	1.5
1 to chassis ground	∞
2 to chassis ground	∞
3 to chassis ground	00
4 to chassis ground	∞
6 to chassis ground	∞

9. Replacement of Parts

All of the parts in Inverter, Vibrator PP-1703/U can be easily reached and replaced without special procedures, When replacing parts, observe the following directions:

a. Tagging Leads. Tagging the leads is essential to insure correct rewiring when a part is replaced. Before unsoldering any leads, tie together the leads that are attached to each part. Use small tags or short pieces of adhesive tape to identify all wires in accordance with their numbered connections. Identify every lead that is to be removed.

b. Parts and Substitutions. When damaged parts must be replaced, use identical parts. If identical parts are not available and the damaged component is beyond repair, a substitution must be made. The part substituted must have identical electrical properties and must be of equal or higher voltage and current rating.

C. *Location.* Relocation of substituted parts may cause vibrator hash and is not recommended. Mount the new or replaced part in the same location as that formerly occupied by the damaged part. Fasten all mountings securely.

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CHAPTER 3

FOURTH ECHELON TESTING PROCEDURES

10. General

a. Testing procedures are prepared for use by Electronic Field Maintenance Shops and Electronic Service Organizations responsible for fourth echelon maintenance of electronic equipment to determine the acceptability of repaired electronic equipment. These procedures set forth specific requirements that repaired electronic equipment *must* meet before it is returned to the using organization. The testing procedures may also be used as a guide to equipment repaired at third echelon if the proper tools and test equipments are available.

b. Comply with the instructions preceding the body of each chart before proceeding with 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.

11. Test Equipment and Materials

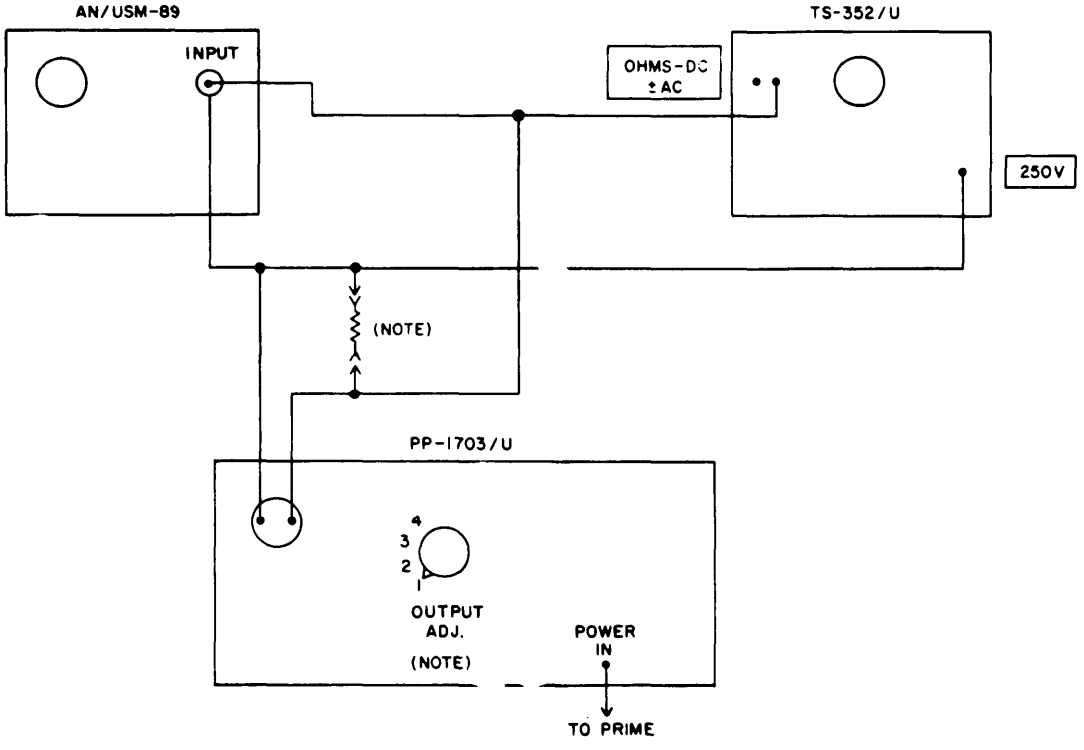
The test equipment and materials required to perform the testing procedures given in this chapter are listed in the following chart and are authorized under TA 11-17, Signal Field Maintenance Shops, and TA 11-100 (11-17), Allowance of Signal Corps Expendable Supplies for Signal Field Maintenance Shop, Continental United States.

Nomenclature	Federal stock No.	Technical manual
Multimeter TS-352/U	6625-242-5023	TM 11-5527
Oscilloscope AN/USM-89	6625-701-5236	TM 11-6625-328-12
Dummy Load (4):		
164-ohm, 250-watt resistor		
194-ohm, 250-watt resistor		
248-ohm, 250-watt resistor		
333-ohm, 250-watt resistor		

12. Physicol Tests and Inspections

a. Test *Equipment. No* test equipment necessary.
b. Test Connections and Conditions.
(1) No connections necessary.
(2) Remove chassis from its case.
c. *Procedure.*

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	None	Control may be in any position.	a. Inspect case and chassis for damage, missing parts, and condition of paint. *Note:* Touchup painting is recommended in lieu of refinishing whenever practical; screwheads, binding posts, receptacles, and other plated parts will not be painted or polished with abrasives. *b.* Inspect control and mechanical assemblies for loose or missing screws, bolts, and nuts. *c.* Inspect all connectors, sockets, receptacles, and fuseholders for looseness, damage or missing parts.	*a.* No damage evident or parts missing. External surfaces intended to be painted will not show bare metal. Panel lettering will be legible. *b.* Screws, bolts, and nuts will be tight; none missing. *c.* No loose parts or damage. No missing parts.
2	None	Control may be in any position.	*a.* Rotate the panel control throughout its limit of travel. *b.* Inspect dial stops for damage or bending, and for proper operation. *c.* Operate switch ----------	*a.* Control will rotate freely, without binding or excessive looseness. *b.* Stops will operate properly, without evidence of damage. *c.* Switch will operate properly.



NOTE:

OUTPUT ADJ. SWITCH POSITION, PRIME POWER, AND DUMMY LOADS ARE AS FOLLOWS:

OUTPUT ADJ. SWITCH POSITION	PRIME POWER (VOLTS DC)	DUMMY LOAD
1	30	333Ω, 250 WATTS
2	28	248Ω, 250 WATTS
3	26	194Ω, 250 WATTS
4	24	164Ω, 250 WATTS

FOR ALL ABOVE CONDITIONS, AN/USM-89 INDICATES 60 CPS ± 3 CPS AND TS-352/U INDICATES 115 VAC ± 5 VAC.

TM 6125-238-35-3

Figure 3. Operational tests, connection diagram.

13. Operational Tests

a. Test Equipment and Material.

Multimeter TS-352/U
Oscilloscope AN/USM-89
Dummy load (4):
164-ohm, 250-watt resistor
194-ohm, 50-watt resistor
248-ohm, 250-watt resistor
333-ohm, 250-watt resistor

b. Test Connections and Conditions. Connect the equipment as shown in figure 3.

c. Procedure.

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	*TS-352/U* Turn FUNCTION switch to AC VOLTS *AN/USM-89* *a.* PWR. OFF-SCALE ILLUM: Counterclockwise *b.* FOCUS: Centered *c.* INTENSITY: Counterclockwise *d.* VERTICAL POSITION: Centered *e.* HORIZONTAL POSITION: Centered *f.* TIME BASE: TIME/DIV: 500 USEC CALIBRATED: Fully clockwise MAG. X1-X5-HORIZ. INPUT: X1 TRIGGER AUTO. AC-DC: AUTO STABILITY: Clockwise TRIG. LEVEL: Counterclockwise *g.* VERTICAL AMP.: VOLTS/DIV.: .1 CALIBRATED: Fully clockwise AC-DC: AC *h.* CALIBRATOR VOLTS PEAK TO PEAK: OFF	(With PP-1703/U connected to 30-volt primary power and 333-ohm, 250-watt resister used as a dummy load). OUTPUT ADJ.: 1	*a.* Set POWER switch on PP-1703/U to ON *b.* Adjust the VOLTS/DIV. switch for a convenient vertical deflection. Turn the TIME BASE STABILITY control slowly counterclockwise until the sweep display becomes stable. Rotate the TIME/DIV. control to obtain the number of cycles of the display desired. If necessary, readjust the TIME BASE STABILITY control.	*a.* The TS-352/U indicates 115 volts ac ±5. *b.* The AN/USM-89 indicates 60 cps ±3.
2	Leave controls in positions last indicated in step 1.	(With PP-1703/U connected to 28-volt primary power and 248-ohm, 250-watt resistor used as a dummy load). OUTPUT ADJ: 2	Same as step 1	Same as step 1.
3	Leave controls in position last indicated in step 1.	(With PP-1703/U connected to 26-volt primary power and 194-ohm, 250-watt resistor used as a dummy load). OUTPUT ADJ.: 3	Same as step 1	Same as step 1.
4	Leave controls in positions last indicated in step 1.	(With PP-1703/U connected to 24-volt primary power and 164-ohm, 250-watt resistor used as a dummy load). OUTPUT ADJ.: 4	Same as step 1	Same as step 1.

CHAPTER 4

DEPOT INSPECTION STANDARDS

14. Applicability of Depot Inspection 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.

15. Applicable References

a. Repair Standards. Applicable procedures of the Signal Corps depot performing these tests and the general standards for repaired electronics equipment, form a part of the requirements for testing this equipment.

b. Technical Publications. The technical publication applicable to this equipment is TM 11-6125-238-12.

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

16. Test Facilities Required

The test equipment and materials required in determining compliance with the requirements of this specific standard are given in paragraph 13a.

17. Tests

Perform the tests given in paragraph 13 to verify the proper operation of the inverter.

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APPENDIX

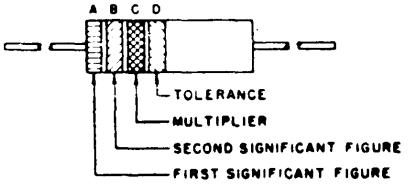
REFERENCES

Following is a list of applicable references available to the field and depot maintenance personnel of Inverter, Vibrator PP-1703/U.

DA Pamphlet 310-4	Index of Technical Manuals, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders.
TM 9-213	Painting Instructions for Field Use.
TM 11-5527	Multimeters TS-352/U, TS-352A/U, and TS-352B/U.
TM 11-6125-238-12	Operator's and Organizational Maintenance Manua1: Inverter, Vibrator PP-1703/U.
TM 11-6625-328-12	Operator's and Organizational Maintenance Manual: Oscilloscope AN/USM-89.
TM 38-750	The Army Equipment Record System and Procedures.

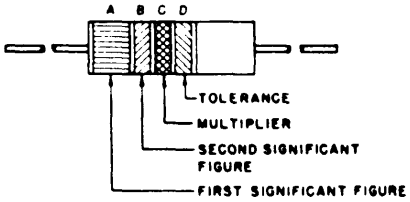
COLOR CODE MARKING FOR MILITARY STANDARD RESISTORS

COMPOSITION-TYPE RESISTORS



BAND A— Equal Width Band Signifies Composition Type

WIREWOUND-TYPE RESISTORS

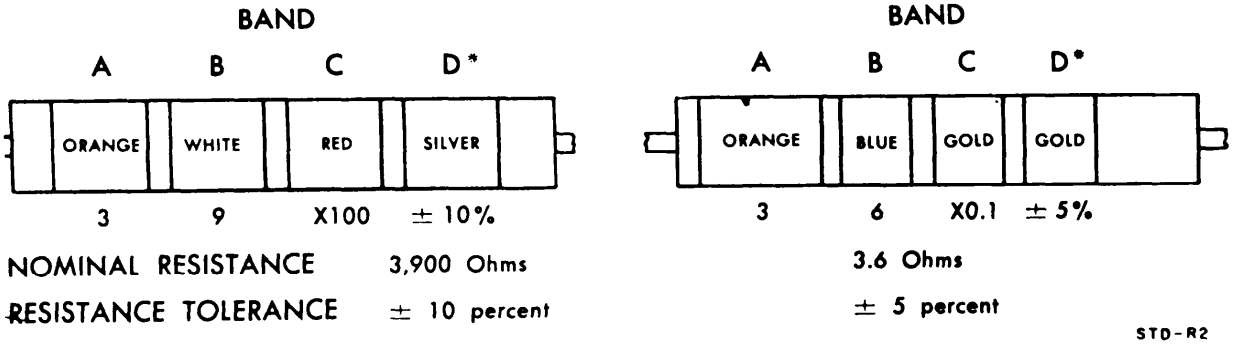


BAND A— Double Width Signifies Wire-wound Resistor

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

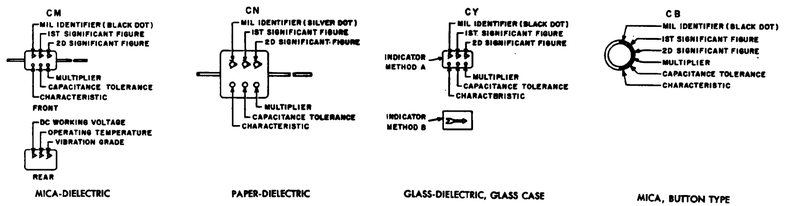


*If Band D is omitted, the resistor tolerance is ±20%, and the resistor is not Mil-Std.

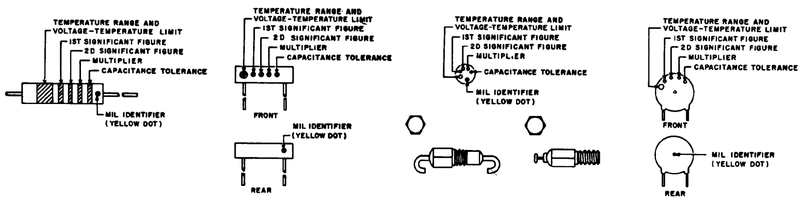
Figure 4. Color-code marking for MIL STD resistors.

COLOR CODE MARKING FOR MILITARY STANDARD CAPACITORS

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



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



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

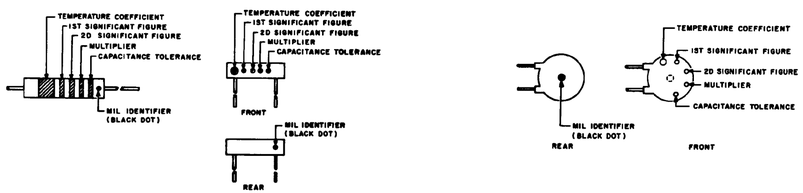


Figure 5. Color-code marking for MIL STD capacitors.

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[4]		± 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.

STD-CE

By Order of 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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USASCC (4)
MDW (1)
Armies (2)
Corps (2)
USATC AD (2)
USATC Armor (2)
USATC Engr (2)
USATC Inf (2)
USASTC(2)
Instl (2) except
Ft Monmouth (63)
Ft Hancock (4)
GENDEP (OS) (2)
Sig Sec, GENDEP (5)
Sig Dep (OS) (12)
A Dep (2) except
Lexington (12)
Sacramento (28)
Toby hanna (12)
Ft Worth (8)
Svc Colleges (2)
Br Svc Sch (2) except
USMA (2)
WRAMC *(2)*
USA Trans Tml Comd (1)
Army Tml (1)
USAOSA (1)
POE(1)
AMS (1)
Army Pic Cen (2)
USA Mbl Spt Cen (1)
USA Elct Mat Agcy (12)
Chicago Proc Dist (1)
Sig Fld Maint Shops (3)
USA Elct RD Actv
Ft Huachuca (2)
White Sands (13)
WSMR (5)
Yuma PG (2)
USA Corps (3)
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Ft Huachuca (10)
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11-597

NG: State AG (3).
US AR: None.
For explanation of abbreviations used, see AR 320-50.

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

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The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 dekagram = 10 grams = .35 ounce
1 hectogram = 10 dekagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*Multiply by*
inches	centimeters	2.540	ounce-inches	newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29,573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	newton-meters	1.356	metric tons	short tons	1.102
pound-inches	newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

PIN: 019891-000