TM 11-6625-320-35

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

FIELD AND DEPOT MAINTENANCE MANUAL

VOLTMETER METER ME-30A/U AND VOLTMETERS, ELECTRONIC ME-30B/U AND ME-30C/U

This reprint includes all changes in effect at the time of publication; changes 2 and 3.

HEADQUARTERS, DEPARTMENT OF THE ARMY

8 AUGUST 1961

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT

Be careful when working on the 115- and 230-volt ac line connections. Serious injury or death may result from contact with these terminals.

DON'T TAKE CHANCES!

RADIATION HAZARD

Tube type OB2WA, used in Voltmeter, Meter ME-30A/U and Voltmeters, Electronic ME-30B/U and ME-30C/U, contains a small amount of radioactive material. This tube is potentially hazardous when broken. Contact qualified medical personnel immediately in case of an accidental cut. For further instructions, refer to TM SIG 225.

WARNING

When selenium rectifiers fail, because of burnout or arc-over, poisonous fumes and compounds are released. The fumes have a strong odor and should not be inhaled. *Provide adequate ventilation immediately and do not handle the rectifier until it has cooled.*

TM 11-6625-320-35
***C 3**

CHANGE }
No. **3** }

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., *6 May 1965*

DS, GS, and Depot Maintenance Manual

VOLTMETER, METER ME-30A/U AND VOLTMETERS, ELECTRONIC ME-30B/U and ME-30C/U

TM 11–6625–320–35, 8 August 1961, is changed as follows:

Note: parenthetical reference to previous changes (example "page 1 of C 2") indicates that pertinent material was published in that change.

Page 3, paragraph 1.2 (page 1 of C 2). Delete and substitute.

1.2 Reporting of Equipment Manual Improvements

The direct reporting by the individual user of errors, omissions, and recommendations for improving this manual is authorized and encouraged. DA Form 2028 (Recommended Changes to DA Publications) will be used for reporting these improvements. This form will be completed in triplicate using pencil, pen, or typewriter. The original and one copy will be forwarded direct to Commanding General, U. S. Army Electronics Command, ATTN: AMSEL-MR-(NMP)-MA, Fort Monmouth, N.J. 07703. One information copy will be furnished to the individual's immediate supervisor (officer, noncommissioned officer, supervisor, etc.).

Page 86, (page 6 of C 2). Delete appendix in its entirety and substitute the following appendixes:

***This change supersedes TM 11-6625-320-35P, 21 March 1960, including C 3, 29 June 1964.**

APPENDIX I
REFERENCES

Following is a list of applicable references available to DS, GS, and depot maintenance repairmen of Voltmeter, Meter ME-30A/U, and Voltmeters, Electronic ME–30B/U and ME–30C/U:

DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (types 4,6, 7,8, and 9), Supply Catalogs (type CL), Supply Bulletins, Lubrication Orders, and Modification Work Orders
TA 11–17	Signal Field Maintenance Shops
TA 11–100(11–17)	Allowances of Signal Corps Expendable Supplies for Signal Field Maintenance Shops
TB SIG 225	Identification and Handling of Radioactive Signal Items
TB SIG 355–1	Depot Inspection Standard for Repaired Signal Equipment
T13 SIG 355–2	Depot Inspection Standard for Refinishing Repaired Signal Equipment
TB SIG 355–3	Depot Inspection Standard for Moisture and Fungus Resistant Treatment.
TM 11–2535B	Meter Test Set TS-682A/GSM-1
TM 11–5097	Spectrum Analyzers TS–723A/U, TS–723B/U, TS–723C/U and TS–723D/U
TM 11–5134–15	Signal Generators SG–299/U, SG-299A/U, SG–299B/U, and SG–299 C/U
TM 11–5527	Multimeters, TS–352/U, TS-352A/U, and TS–352B/U
TM 11–5551B	R.F. Signal Generator Set AN/URM–25B
TM 11–5551D	R.F. Signal Generator Set AN/URM–25D
TM 11–5551E	R.F. Signal Generator Set AN/URM-25F
TM 11–6625-203-12	Operator and Organizational Maintenance: Multimeter AN/URM–105, including Multimeter ME–77/U.
TM 11–6625–219–12	Operator's and Organizational Maintenance Manual: Oscilloscope AN/USM-81
TM 11–6625–219–35	Field and Depot Maintenance Manual: oscilloscope AN/USM–81.
TM 11–6625-261-12	Operator's and Organizational Maintenance Manual: Audio Oscillators TS-382A/U, TS-382B/U, TS–382D/U, TS–382E/U and TS–382 F/U
TM 11–6625–261-35	Field and Depot Maintenance Manual: Audio oscillators TS-382A/U, TS-382B/U, TS–382D/U, TS–382E/U and TS–382F/U
TM 11-6625–274–12	operator's and Organizational Maintenance Manual: Test Sets Electron Tube TV–7/U, TV–7A/U, TV–7B/U, and TV–7D/U
TM 11-6625-274-35	Field and Depot Maintenance Manual: Test Sets, Electron Tube TV–7/U, TV–7A/U, TV–7B/U, and TV–7D/U
TM 11–6625-320-12	Operator's and Organizational Maintenance Manual: Voltmeter, Meter ME–30A/U and Voltmeters, Electronic ME–30B/U and ME-30C/U
TM 38-750	Army Equipment Record Procedures

APPENDIX II
BASIC ISSUE ITEMS

Section I. INTRODUCTION

1. General

a. This appendix lists the quantities of repair parts for general support and depot maintenance and is a basis for requisitioning authorized parts. It is also a guide for depot maintenance in establishing initial levels of spare parts.

b. Columns are as follows:

(1) *Source, maintenance, and recoverability code.* Source, maintenance, and recoverability codes indicate the supply service responsible for supply, the maintenance category at which an item is stocked, categories at which an item is installed or repaired, and whether an item is repairable or salvageable. The source code column is divided into four parts.

(a) *Column A.* This column indicates the material code and designates the area of responsibility for supply. AR 310-1 defines the basic numbers used to identify the materiel code. If the part is Signal materiel responsibility, the column is left blank.

(b) *Column B.* This column indicates the point within the maintenance system where the part is available. "P" indicates that the repair part is a high mortality part; procured by commodity commands, stocked in and supplied from the supply depot system, and authorized for use at indicated maintenance categories. "P1" indicates that the repair part is a low mortality part; procured by commodity commands, stocked only in and supplied from *key* depots, and authorized for installation at indicated maintenance categories.

(c) *Column C.* This column indicates the lowest maintenance category authorized to install the part. "O"—Organizational maintenance (operator and organizational). "H''—General support maintenance.

(d) *Column D.* Not used.

(2) *Federal stock number.* This column lists the 11-digit Federal stock number.

(3) *Designation by model.* The dagger (†) indicates model in which the part is used and further, by its position, designates the "Item No." by which the item is identified, and the quantity used in each model where the quantity varies.

(4) *Description.* Nomenclature or the standard item name and brief identifying data for each item are listed in this column. When requisitioning, enter the nomenclature and description.

(5) *Unit of issue.* The unit of issue is each unless otherwise indicated and is the supply term by which the individual item is counted for procurement, storage, requisitioning, allowances, and issue purposes.

(6) *Expendability.* Nonexpendable items are indicated by NX. Expendable items are not annotated.

(7) *Quantity incorporated in unit.* This column lists the quantity of each part found in a given assembly, component, or equipment.

(8) *Direct support.* No parts authorized for stockage at this level.

(9) *General support.* The numbers in this column indicate quantities of repair parts authorized for initial stockage for use in general support maintenance. The quantities are based on 100 equipments to be maintained for a 15-day period.

(10) *Depot.* The numbers in this column indicate quantities of repair parts authorized for depot maintenance and for initial dockage for maintenance, and for supply support to lower categories. The entries are based on the quantity required for rebuild of 100 equipments.

(11) Illustration. The "Item No." column lists the reference symbols used for identification of the items in the illustration or text of the manual.

2. Parts for Maintenance

When this equipment is used by Signal service organizations organic to the theater headquarters or communication zones to provide theater communications, those repair pa- authorized up to an including general support are authorized for stockage by the organization operating this equipment.

3. Additional Repair Parts Authorization

An asterisk indicates that an item is not authorized for stuckage but if required, may requisitioned for immediate use only.

4. Electron Tubes

The consumption rates given for tubes are conservative theoretical estimates and are provided for use only when more complete information, such as data based on operating experience, is not available. These figures are based on levels and requirements for equipment actually in use, not on authorizations or equipment stored in depots.

5. Requisitioning Information

a. The allowance factors are based on 100 equipments. In order to determine the number of parts authorized for initial stockage for the specific number of equipments supported, the following formulat will be used and carried out to two decimal places.

$$\text{Specific number of equipments supported} \times \frac{\text{allowance factor}}{100} = \text{Number of parts authorized for initial stockage.}$$

b. Fractional values obtained from above computation will be rounded to whole numbers as follows:

(1) When the total number of parts authorized is less than 0.5, the quantity authorized will be zero.

(2) When the total number of parts authorized is between 0.5 and 1.0, the quantity authorized will be one.

(3) For all values above one, fractional values below 0.5, will revert to the next lower whole number and fractional value 0.5 and above will advance to the next higher whole number.

c. The quantities determined in accordance with the above represent the initial stockage for a 15-day period.

Section II. FUNCTIONAL PARTS LIST

SOURCE CODE A	B	C	D	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL						DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	MAINTENANCE ALLOWANCE: DIRECT SUPPORT	GENERAL SUPPORT	DEPOT	ILLUSTRATION: FIG. NO.	ITEM NO.
											VOLTMETERS, ELECTRONIC ME-30A/U: ME-30B/U; ME-30C/U AND ME-30E/U								
				6625-669-0742							VOLTMETERS, ELECTRONICS ME-30A/U, ME-30B/U, ME-30C/U and ME-30E/U range: 0 to 300 vac in 12 steps; -60db to +50db in 12 steps;		NX						
											±1% accuracy at 400 cps; 1 milliamp sensitivity; input impedance data: 10 meg; oper; power reqt: ac 105 to 125v or								
											or 210 to 250v, 50 to 1000 cps, single ph; over all dim 10 in x 14-3/4 in x 18 in; metal case with enameled finish								
											NOTE: Model Column 1 refers to ME-30A/U: Column 2 refers to ME-30B/U; Column 3 refers to ME-30C/U; Column 4 refers to								
											ME-30E/U								
	P1	O		5935-511-6495	†	†					ADAPTER, CONNECTOR: Cornish p/n 1482			1		0.5	2.0		P1
	P1	H		6625-668-9409	†						AMMETER: Hewlett-Packard p/n 112-6			1		0.7	2.0		M1
	P1	H		6625-792-2627		†					AMMETER: Dubrow pn 513-A100			1		0.7	2.0		M1
	P1	H		6625-684-5174			†				AMMETER: Phaostron dwg No. 607C138			1		0.7	2.0		M1
	P1	H						†			AMMETER: panel type; 40 scale div; marked decibels; SigC dwg SM-B-331381 ††L4Ab32-026			1		0.7	2.0		M1
	P1	O		6625-694-1181	†						BAIL, CABINET TILTING: Hewlett-Packard pn 400D-S-324			1		0.4	2.0		O5
	P1	O		6625-321-4040	†	†	†				BUMBER, RUBBER: 1 in od; 13/16 in o/a h; Hewlett-Packard pn 5M-S-707			4		0.9	4.0		
	P1	O						†			BUMPER, RUBBER: Synthetic rubber; 27/32 in od x 11/16 in h; Atlantic India Rubber Works pn 257 ††14Ab32-012			4		0.9	4.0		MP5 thru MP8
	P1	H		5975-843-4192 5975-843-4192	†			†			BUSHING, STRAIN RELIEF: Hyman Mfg pn SR-6P			1 1		0.5 0.5	2.0 2.0		O2 MP12
	P1	H		6145-500-1726	†	†					CABLE, POWER, ELECTRICAL: 3 No. 18 AWG; 300v; Cornish pn 3701 (Authorized allowances will be a minimum of or a multiple of 8 ft)	ft		8		*	160.0		
	P1	H		6145-537-3713			†				CABLE, POWER, ELECTRICAL: MIL type CO-02AGF(2/18)SJ-0355 (Authorized allowances will be a minimum of or a multiple of 84 in)	ft		7		*	140.0		
	P1	H		6145-548-1258			†				CABLE, POWER, ELECTRICAL: MIL type CO-02MGF(2/18)0310	ft		7		*	140.0		W2
	P1	O		5920-823-3246	†	†					CAP, ELECTRICAL: Littelfuse pn 342003-SA-2			1		0.5	2.0		E9
	P1	O		5920-892-8318				†			CAP, ELECTRICAL: plastic; 5/8 in lg x 5/8 in dia; Bussman pn 9345-1/2			1		0.5	2.0		E9

SOURCE CODE A	B	C	D	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL						DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	MAINTENANCE ALLOWANCE DIRECT SUPPORT	GENERAL SUPPORT	DEPOT	ILLUSTRATION FIG. NO.	ITEM NO.
											ME-30A, B, C AND E/U (continued)								
	P1	H						†			CAPACITOR, FIXED, CERAMIC, DIELECTRIC: 4 uf; 25 vdc General Instrument pn MIL-4-25 ††L4Ab32-178			1		0.7	2.0		C32
	P1	H		5910-101-4821				†	†		CAPACITOR, FIXED, CERAMIC, DIELECTRIC: 10 uuf ±0.25%; 500 vdc; MIL type CC21CH100C			1		0.5	2.0		C15
	P1	H		5910-578-5523	†						CAPACITOR, FIXED, CERAMIC, DIELECTRIC: 10 uuf ±0.5%; 500 vdc; MIL type CC21CH100D			1		0.5	2.0		C15
	P1	H		5910-556-9428		†					CAPACITOR, FIXED, CERAMIC, DIELECTRIC: 10 uuf ±0.5 uuf; 500 vdcw; Aerovox pn HI-9-CL-1			1		0.5	2.0		C15
	P1	H		5910-643-8979 5910-643-8979	†	†	†				CAPACITOR, FIXED, CERAMIC, DIELECTRIC: 10,000 uuf +100% -0%; 500 vdc; Aerovox pn BPD.01			2 2		0.9 0.9	4.0 4.0		C3,C35 C3,C40
	P1	H		5910-853-4243					†		CAPACITOR, FIXED, CERAMIC, DIELECTRIC: 10,000 uuf ±10%; 500 vdc; Mil type CK63AW103M			2		1.9	6.0		C3,C40
	P1	H		5910-985-0892				†			CAPACITOR, FIXED, ELECTROLYTIC: 1 uf ±10%; 400 vdc; SigC dwg SM-B-331344; Cornell-Dubilier pn PJ4W1			2		1.4	8.0		C35,C36
	P1	H		5910-284-5302	†						CAPACITOR, FIXED, ELECTROLYTIC: 4 uf 60 vdcw; Fansteel Metallurgical pn PP4B60A1			1		0.5	2.0		C31
	P1	H		5910-556-9432		†	†				CAPACITOR, FIXED, ELECTROLYTIC: 4 uf; 45 vdcw; Pyramid pn ML4-45			1		0.9	4.0		C32
	P1	H		5910-644-3743	†						CAPACITOR, FIXED, ELECTROLYTIC: 8 uf -15% +20%; 300 vdcw; Fanstell Metallurgical pn PP8B30A			1		0.9	4.0		C20
	P1	H		5910-556-9436		†	†				CAPACITOR, FIXED, ELECTROLYTIC: 8 uf; 25 vdcw; Pyramid pn ML8-25			1		0.9	4.0		C18
	P1	H		5910-724-6620				†			CAPACITOR, FIXED, ELECTROLYTIC: 8 uf, 5 vdc; SigC dwg 331372			1		0.5	2.0		C28
	P1	H		5910-543-1175		†					CAPACITOR, FIXED, ELECTROLYTIC: 3 sect; 20 uf; 450 vdc ea; Sprague pn TVL3780J			2		1.4	8.0		C6,C20
	P1	H		5910-666-7013	†						CAPACITOR, FIXED, ELECTROLYTIC: 3 sect; 20 uf, 40 uf; 450 vdc; Sprague pn D-16651			3		1.1	6.0		C1,C17, C30
	P1	H		5910-537-5383			†	†			CAPACITOR, FIXED, ELECTROLYTIC: 3 sect 20 uf; 450 vdc ea; MIL type CE33F200R			2		1.4	8.0		C2A,B,C C29A,B,C
	P1	H		5910-667-6593	†	†	†				CAPACITOR, FIXED, ELECTROLYTIC: 25 uf 25 vdcw; Mallory pn TC26			1		0.9	4.0		C34
	P1	H		5910-892-7976			†	†			CAPACITOR, FIXED, ELECTROLYTIC: 2 sect; 40 uf; 450 vdc ea; MIL type CE42C400R			1		0.9	4.0		C13A,B
	P1	H		5910-556-9433		†					CAPACITOR, FIXED, ELECTROLYTIC: 40 uf 450 vdcw; Sprague pn TVL1725J			2		1.4	8.0		C13,C19
	P1	H		5910-724-6623			†	†			CAPACITOR, FIXED, ELECTROLYTIC: 40 uf 500 vdc; SigC dwg SM-B-331345			1		0.9	4.0		C37

SOURCE CODE A	B	C	D	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL						DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	MAINTENANCE ALLOWANCE DIRECT SUPPORT	GENERAL SUPPORT	DEPOT	ILLUSTRATION FIG. NO.	ITEM NO.
											ME-30A, B, C AND E/U (continued)								
	P1	H		5910-857-8655				†			CAPACITOR, FIXED, ELECTROLYTIC: 1,000 uf; 6 vdc; SigC dwg SM-B-331343			1		0.9	4.0		C34
	P1	H		5910-556-9434 5910-556-9434	† 	 †					CAPACITOR, FIXED, ELECTROLYTIC: 2,000 uf; 15 vdcw; Sprague pn TVL1168J			2 2		1.4 1.4	8.0 8.0		C37,C39 C38,C39
	P1	H		5910-195-3145			†	†			CAPACITOR, FIXED, ELECTROLTYIC: 2,000 uf; 15 vdc; MIL type CE41C202E			2		1.4	8.0		C38,C39
	P1	H		5910-174-9964				†			CAPACITOR, FIXED, MICA DIELECTRIC: 10 uuf ±10%; 500 vdc; MIL type CM15B100K			1		0.5	2.0		C17
	P1	H		5910-577-1495			†				CAPACITOR, FIXED, MICA DIELECTRIC: 10 uuf ±10%; 500 vdc; MIL type CM20B100K			1		0.5	2.0		C17
	P1	H		5910-101-5823		†					CAPACITOR, FIXED, MICA DIELECTRIC: 22 ohms ±10%; 500 vdc; MIL type CM20B220K			1		0.5	2.0		C17
	P1	H		5910-101-5654 5910-101-5654	† 	 †					CAPACITOR, FIXED, MICA DIELECTRIC: 68 uuf ±5%; 500 vdc; MIL type CM20C680J			1 1		0.5 0.5	2.0 2.0		C26 C27
	P1	H		5910-666-7154			†				CAPACITOR, FIXED, MICA DIELECTRIC: 68 uuf ±5%; 500 vdc; MIL type CM15B680J			1		0.5	2.0		C27
	P1	H		5910-100-8108				†			CAPACITOR, FIXED, MICA DIELECTRIC: 68 uuf ±5%; 500 vdc; MIL type CM20B680J			1		0.5	2.0		C27
	P1	H		5910-101-5617		†					CAPACITOR, FIXED, MICA, DIELECTRIC: 100 uuf ±10%; 500 vdc; MIL type CM20B101K			1		0.5	2.0		C33
	P1	H		5910-101-4884 5910-101-4884		†	†	 †			CAPACITOR, FIXED, MICA, DIELECTRIC: 510 uuf ±5%; 500 vdc; MIL type CM20B511J (Used with ME-30B/U, order No. 39132-PH-58 only)			1 1		0.5 0.5	2.0 2.0		C33 C40
	P1	H		5910-191-9364 5910-191-9364	† 	 †					CAPACITOR, FIXED, MICA, DIELECTRIC: 680 ohms ±10%; 500 vdc; MIL type CM30E681K			1 1		0.5 0.5	2.0 2.0		C22 C23
	P1	H		5910-636-3764			†	†			CAPACITOR, FIXED, MICA, DIELECTRIC: 680 uuf ±10%; 500 vdc; MIL type CM20B681K			1		0.5	2.0		C23
	P1	H		5910-101-3984 5910-101-3984	† 	 †	†	†			CAPACITOR, FIXED, MICA, DIELECTRIC: 1,800 uuf ±10%; 500 vdc; MIL type CM30B182K			1 1		0.5 0.5	2.0 2.0		C24 C26
	P1	H		5910-666-7820	†	†	†				CAPACITOR, FIXED, MICA, DIELECTRIC: 4,700 uuf ±5%; 500 vdcw; Sangamo pn CR-1247			1		0.5	2.0		C5
	P1	H		5910-101-3843				†			CAPACITOR, FIXED, MICA, DIELECTRIC: 4,700 ohms ±10%; 500 vdc; MIL type CM35D472K			1		0.5	2.0		C43
	P1	H		5910-101-3847				†			CAPACITOR, FIXED, MICA, DIELECTRIC: 4,700 uuf ±10%; 500 vdc; MIL type CM35B472K			1		0.5	2.0		C5
	P1	H		5910-666-8874 5910-666-8874	† 	 †					CAPACITOR, FIXED, MICA, DIELECTRIC: 8,200 uuf ±5%; 300 vdcw; Sangamo pn CR-06282			1 1		0.5 0.5	2.0 2.0		C28 C31
	P1	H		5910-100-8081				†			CAPACITOR, FIXED, MICA, DIELECTRIC: 8,200 uuf ±10%; 500 vdc; MIL type CM35B822K			1		0.5	2.0		C31

SOURCE CODE A	B	C	D	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	MAINTENANCE ALLOWANCE DIRECT SUPPORT	GENERAL SUPPORT	DEPOT	ILLUSTRATION FIG. NO.	ITEM NO.
						ME-30A, B, C AND E/U (continued)								
	P1	H		5910-100-8083	† †	CAPACITOR, FIXED, MICA, DIELECTRIC: 9,100 uuf ±5%; 500 vdc; MIL type CM35B912J (Used on ME-30B/U, order 39139-PP-58 only)			1		0.5	2.0		C31
	P1	H		5910-642-6254 5910-642-6254	† † †	CAPACITOR, FIXED, PAPER, DIELECTRIC: 1 uf ±10%; 400 vdcw; Sangoma pn 300410			2 2		0.9 0.9	4.0 4.0		C32,C33 C35,C36
	P1	H		5910-667-5087 5910-667-5087	† † †	CAPACITOR, FIXED, PAPER, DIELECTRIC: 1 uf -15 to +25%; 200 vdcw; Astron pn MQCS-2-1M			1 1		0.5 0.5	2.0 2.0		C29 C28
	P1	H		5910-665-0588	†	CAPACITOR, FIXED, PAPER, DIELECTRIC: 1 uf ±10%; MIL type CP11A3KB105K3			1		0.5	2.0		C24
	P1	H		5910-667-5088 5910-667-5088	† † †	CAPACITOR, FIXED, PAPER, DIELECTRIC: 2 uf -15 +25%; 200 vdcw; Astron pn MQCS-2-2M			1 1		0.5 0.5	2.0 2.0		C25 C24
	P1	H			†	CAPACITOR, FIXED, PAPER, DIELECTRIC: 2 uf ±5%; 100 vdc; MIL type 1A2FB205K2 ††L4Ab32-031			1		0.5	2.0		C24
	P1	H			†	CAPACITOR, FIXED, PAPER, DIELECTRIC: 1,000 uuf ±5%; 600 vdc; General Instrument pn 374-43 ††L4Ab32-151			1		0.5	2.0		C1
	P1	H		5910-667-7841 5910-667-7841	† † †	CAPACITOR, FIXED, PAPER, DIELECTRIC: 10,000 uuf ±10%; 600 vdcw; Ord pn 8495097			1 1		0.5 0.5	2.0 2.0		C2 C1
	P1	H		5910-642-6259 5910-642-6259	† † †	CAPACITOR, FIXED, PAPER, DIELECTRIC: 33,000 uuf ±10%; 600 vdcw; Sprague pn 73P33396			1 1		0.5 0.5	2.0 2.0		C19 C21
	P1	H		5910-666-8840 5910-666-8840	† † †	CAPACITOR, FIXED, PAPER, DIELECTRIC: 51,000 uuf ±5%; 600 vdcw; Sprague pn 73P51356			6 7		1.7 2.0	12.0 14.0		C7 thru C12 C7 thru C12,C21
	P1	H		5910-666-6977 5910-666-6977	† †	CAPACITOR, FIXED, PAPER, DIELECTRIC: 470,000 uuf ±10%; MIL type CP05A1KE474K			4 4		1.7 1.7	10.0 10.0		C18,C23, C27,C36 C20,C25, C30,C45
	P1	H		5910-646-4806	†	CAPACITOR, FIXED, PAPER, DIELECTRIC: 500,000 uuf +20% -10%; 600 vdcw; Sangamo pn 330405			4		1.7	10.0		C20,C25, C30,C41
	P1	H		5910-724-8884	†	CAPACITOR, FIXED, PAPER, DIELECTRIC: 500,000 uuf ±5%; 400 vdc; S1gC dwg SM-B-331384			4		1.4	8.0		C20,C25, C30,C41
	P1	H		5910-724-8012	†	CAPACITOR, FIXED, PAPER, DIELECTRIC: 510,000 uuf ±5%; 600 vdc; S1gC dwg SM-B-331385			1		0.5	2.0		C21
	P1	H		5910-724-8012	†	CAPACITOR, FIXED, PAPER, DIELECTRIC: 510,000 uuf ±5%; 600 vdc; General Instruments pn 376-23			6		1.7	12.0		C7 thru C12,C21
	P1	H		5910-563-1885	†	CAPACITOR, VARIABLE: 5-80 uuf; 175v; Arco pn 463			2		1.1	6.0		C6,C14, C16
	P1	H		5910-667-6640	†	CAPACITOR, VARIABLE: 7 uuf to 45 uuf; 500 vdcw; Erie pn TS2A			3		1.1	6.0		C14,C16, C21
	P1	H			†	CAPACITOR, VARIABLE, AIR, DIELECTRIC: 9 uuf to 18 uuf; Elmenco pn 482 ††L4Ab32-197			2		0.5	4.0		C14,C16
	P1	H			†	CAPACITOR, VARIABLE, AIR, DIELECTRIC: 9 uuf to 18 uuf; Elmenco pn 483 ††L4Ab32-198			1		0.4	2.0		C6

SOURCE CODE A	B	C	D	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	MAINTENANCE ALLOWANCE DIRECT SUPPORT	GENERAL SUPPORT	DEPOT	ILLUSTRATION FIG. NO.	ITEM NO.
						ME-30A, B, C AND E/U (continued)								
	P1	H		5910-556-9437 5910-556-9437 5910-556-9437	† † †	CAPACITOR, VARIABLE, AIR, DIELECTRIC: 25 uuf to 280 uuf; Arco pn 464			3 1 1		1.1 0.5 0.5	6.0 2.0 2.0		 C22
	P1	H		5910-556-9440	† † † †	CAPACITOR, VARIABLE, CERAMIC, DIELECTRIC: 1.5 uuf to 7 uuf; 500 vdcw; MIL type CV11A070			1		0.4	2.0		C4
	P1	O		5935-636-7145	† †	CONNECTOR, PLUG, ELECTRICAL: UP-121M			1		0.5	2.0		P1
	P1	O		5935-518-9653	† †	CONNECTOR, PLUG, ELECTRICAL UP-120M:			1		0.5	2.0		P1
	P1	H		6625-338-2697	†	DETENT, CABINET, BAIL: Hewlett-Packard pn 400D-M-318			2		0.5	4.0		O4
	P1	O		5960-262-3763	† † † †	ELECTRON TUBE: MIL type 0B2WA			1		2.4	100.0		V9
	P1	O		5960-262-0151	† † † †	ELECTRON TUBE: MIL type 6AU5GT			1		2.4	100.0		V7
	P1	O		5960-188-0943	† † † †	ELECTRON TUBE: MIL type 6AX5GT			1		3.6	100.0		V6
	P	O		5960-230-5307	† † † †	ELECTRON TUBE: MIL type 6CB6			6		29.4	600.0		V1 thru V5,V8
	P1	O		5920-142-7383	†	FUSE, CARTRIDGE: MIL type F02G1R00A			1		2.5	20.0		F1
	P1	O		5920-284-9220	† †	FUSE, CARTRIDGE: MIL type F02G1R00B			1		2.5	20.0		F1
	P1	O		5920-636-0963	†	FUSE, CARTRIDGE: MIL type F03G1B00B			1		2.5	20.0		F1
	P1	O		5920-284-9203	† † †	FUSEHOLDER: Littelfuse pn 342003-SA-1			1		0.5	2.0		XF1
	P1	H		5920-732-4495	†	FUSE, HOLDER: Bussnam pn FHN-264			1		0.5	2.0		XF1
	P1	H		5325-281-6593	†	GROMMET, RUBBER: Herman H. Smith pn 2172			13		0.5	2.0		MP38, MP40 thru MP51
	P1	H		5340-222-2618	†	HANDLE, LUGGAGE: Leather; Phila Briefcase pn 800			1		0.4	2.0		
	P1	H		5940-315-3725	† † †	INSULATOR, BUSHING: Hewlett-Packard pn 54M-S-354			2		0.5	4.0		E7,E8
	P1	O		5355-160-6099	† † †	KNOB: Kurz-Kasch pn S-311-64L			1		0.5	2.0		O1
	P1	O		5355-160-5910	†	KNOB: MIL type MS90120-2B01			1		0.5	2.0		MP33

SOURCE CODE A	B	C	D	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP §	QTY IN UNIT	MAINTENANCE ALLOWANCE DIRECT SUPPORT	GENERAL SUPPORT	DEPOT	ILLUSTRATION FIG. NO.	ITEM NO.
						ME-30A, B, C AND E/U (continued)								
	P1	H		6250-725-1160	†	LAMP, HOLDER: MIL type LH50FR2			1		0.5	2.0		XDS1
	P1	O		6240-155-8706 6240-155-8706	† † † †	LAMP, INCANDESCENT: LM-52			1 1		2.5 2.5	20.0 20.0		I1 DS1
	P1	O		6210-288-6019	† † †	LENS, INDICATOR LIGHT: Dialco pn S			1		0.7	4.0		
	P1	H		6210-299-4099	† † †	LIGHT, INDICATOR: Dialco pn 810BF			1		0.5	2.0		
	P1	H		5940-503-5969	†	POST, BINDING: Hewlett-Packard pn 54M-S-411			2		1.1	6.0		E1,E3
	P1	H		5940-642-4427 5940-642-4427	† † †	POST, BINDING: James Millen pn 37222			2 2		1.1 1.1	6.0 6.0		E2,E3 TP1,TP2
	P1	H			†	POST, BINDING: H. H. Smith pn 208 ††L4Ab32-064			4		1.7	10.0		E10 thru E13
		H		6130-635-8279	†	RECTIFIER, METALLIC: GE pn GRS22GB1AT1			1		0.7	3.0		SR1
	P1	H		6130-542-6153	†	RECTIFIER, METALLIC: Sarks Tarzian pn 604B			1		0.7	3.0		SR2
	P1	H		6130-682-3444	†	RECTIFIER, METALLIC: IT & T pn 367M4593			1		0.7	3.0		SR1
	P1	H			†	RECTIFIER, METALLIC: selenium; half wave rectification; 12 v rms input rating; MIL type RS205150B5401 ††L4Ab32-226			1		0.7	3.0		CR3
	P1	H		5905-502-9694	† †	RESISTOR, FIXED, COMPOSITION: 3.3 ohms ±10%; 1/2w; MIL type RC20GF3R3K			1		0.5	2.0		R6
	P1	H		5905-190-8883 5905-190-8883	† †	RESISTOR, FIXED, COMPOSITION: 10 ohms ±5%; 1/2w; MIL type RC20GF100J			1 1		0.5 0.5	2.0 2.0		R6A,R6B, R6C R6
	P1	H		5905-279-3521	† †	RESISTOR, FIXED, COMPOSITION: 15 ohms ±5%; 1/2w; MIL type RC20GF150J			1		0.5	2.0		R13
	P1	H		5905-251-7757	† †	RESISTOR, FIXED, COMPOSITION: 27 ohms ±10%; 1/2w; MIL type RC20GF270K			1		0.5	2.0		R12
	P1	H		5905-252-4018 5905-252-4018	† † †	RESISTOR, FIXED, COMPOSITION: 47 ohms ±5%; 1/2w; MIL type RC20GF470J Item Nos: R12, R21, R33, R42, R51			4 5		1.4 1.7	8.0 10.0		R24,R31, R40,R49 See desc column
				5905-252-4018	†				5		1.7	10.0		R12,R25, R33,R42 R51
	P1	H		5905-196-7242	† †	RESISTOR, FIXED, COMPOSITION: 150 ohms ±10%; 1/2w; MIL type RC20GF151K			1		0.5	2.0		R13
	P1	H		5905-192-3973 5905-192-3973	† † † †	RESISTOR, FIXED, COMPOSITION: 470 ohms ±5%; 1/2w; MIL type RC20GF471J			2 2		0.9 0.9	4.0 4.0		R9,R67 R8,R65

SOURCE CODE A	B	C	D	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	MAINTENANCE ALLOWANCE DIRECT SUPPORT	GENERAL SUPPORT	DEPOT	ILLUSTRATION FIG. NO.	ITEM NO.
						ME-30A, B, C AND E/U (continued)								
	P1	H		5905-195-6806	† † † †	RESISTOR, FIXED, COMPOSITION: 1,000 ohms ±5%; 1/2w; MIL type RC20GF102J			1		0.5	2.0		R2
	P1	H		5905-195-6451	†	RESISTOR, FIXED, COMPOSITION: 4,700 ohms ±10%; 1/2w; MIL type RC20GF472K			1		0.5	2.0		R22
	P1	H		5905-249-4200 5905-249-4200	† † † †	RESISTOR, FIXED, COMPOSITION: 9,100 ohms ±5%; 1/2w; MIL type RC20GF912J			1 1		0.5 0.5	2.0 2.0		R3 R4
	P1	H		5905-107-6531	†	RESISTOR, FIXED, COMPOSITION: 10,000 ohms ±5%; 1/2w; MIL type RC20GF103J			3		1.1	6.0		R4,R5,R8
	P1	H		5905-279-2518 5905-279-2518	† †	RESISTOR, FIXED, COMPOSITION: 430,000 ohms ±5%; 1/2w; MIL type RC20GF434J			1 2		0.5 0.9	2.0 4.0		R50 R32,R50
	P1	H		5905-279-2515	†	RESISTOR, FIXED, COMPOSITION: 470,000 ohms ±5%; 1/2w; MIL type RC20GF474J			2		0.9	4.0		R62,R68
	P1	H		5905-279-2516 5905-279-2516 5905-279-2516	† † †	RESISTOR, FIXED, COMPOSITION: 510,000 ohms ±5%; 1/2w; MIL type RC20GF514J			2 2 1		0.9 0.9 0.5	4.0 4.0 2.0		R30,R39 R32,R41 R41
	P1	H		5905-279-2514 5905-279-2514	† † † †	RESISTOR, FIXED, COMPOSITION: 560,000 ohms ±5%; 1/2w; MIL type RC20GF564J			2 2		0.9 0.9	4.0 4.0		R25,R26 R28,R31
	P1	H		5905-279-1759 5905-279-1759	† † † †	RESISTOR, FIXED, COMPOSITION: 750,000 ohms ±5%; 1/2w; MIL type RC20GF754J Item Nos: R14 thru R19, R36, R37 Item Nos: R14 thru R19, R39,R40			8 8		2.0 2.0	15.0 15.0		See desc column See desc column
	P1	H		5905-192-3982 5905-192-3982	† † † †	RESISTOR, FIXED, COMPOSITION: 1 megohm ±10%; 1/2w; MIL type RC20GF105K			2 2		0.9 0.9	4.0 4.0		R45,R46 R48,R49
	P1	H		5905-279-1865	† † †	RESISTOR, FIXED, COMPOSITION 10 megohms ±5%; 1/2w; MIL type RC20GF106J			2		0.9	4.0		R3,R5
	P1	H		5905-665-6051 5905-665-6051	† † † †	RESISTOR, FIXED, COMPOSITION: 10 ohms ±10%; 1w; MIL type RC32GF100K			1 1		0.9 0.9	3.0 3.0		R68 R59
	P1	H		5905-279-2635 5905-279-2635	† † † †	RESISTOR, FIXED, COMPOSITION: 33 ohms ±10%; 1w; MIL type RC32GF330K			1 1		0.7 0.7	3.0 3.0		R65 R57
	P1	H		5905-279-2544 5905-279-2544	† † † †	RESISTOR, FIXED, COMPOSITION: 51 ohms ±5%; 1w; MIL type RC32GF510J			1 1		0.7 0.7	3.0 3.0		R54 R55
	P1	H		5905-279-2601 5905-279-2601	† † † †	RESISTOR, FIXED, COMPOSITION: 120 ohms ±10%; 1w; MIL Type RC32GF121K			3 3		1.6 1.6	9.0 9.0		R38,R47, R53 R37,R46, R54
	P1	H		5905-279-2607 5905-279-2607	† † † †	RESISTOR, FIXED, COMPOSITION 680 ohms ±10%; 1w; MIL type RC32GF681K			1 1		0.7 0.7	3.0 3.0		R58 R64
	P1	H		5905-279-2551 5905-279-2551	† † † †	RESISTOR, FIXED, COMPOSITION: 2,400 ohm ±5%; 1w; MIL type RC32GF242J			2 1		0.9 0.5	4.0 2.0		R35,R44 R36
	P1	H		5905-279-3837	† † †	RESISTOR, FIXED, COMPOSITION: 2,700 ohms ±5%; 1w; MIL type RC32GF272J			1		0.7	3.0		R45

SOURCE CODE A	B	C	D	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL						DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	MAINTENANCE ALLOWANCE DIRECT SUPPORT	GENERAL SUPPORT	DEPOT	ILLUSTRATION FIG. NO.	ITEM NO.
											ME-30A, B, C AND E/U (continued)								
	P1	H		5905-537-6460 5905-537-6460	†		†	†	†		RESISTOR, FIXED, COMPOSITION: 3,300 ohms ±10%; 1/2w; MIL type RC32GF332K			1 1		0.7 0.7	3.0 3.0		R51 R52
	P1	O		5905-299-2020 5905-299-2020	†		†	†	†		RESISTOR, FIXED, COMPOSITION: 27,000 ohms ±5%; 1w; MIL type RC32GF273J			1 1		0.5 0.5	2.0 2.0		R56 R61
	P1	H		5905-299-2014 5905-299-2014	†		†	†	†		RESISTOR, FIXED, COMPOSITION: 47,000 ohms ±10%; 1w; MIL type RC32GF473K			4 4		1.7 1.7	10.0 10.0		R21,R32, R41,R50 R27,R38, R47,R56
	P1	H		5905-279-2644	†	†	†	†			RESISTOR, FIXED, COMPOSITION: 110,000 ohms ±5%; 1w; MIL type RC32GF114J			1		0.7	3.0		R1
	P1	H		5905-279-1714	†	†	†	†			RESISTOR, FIXED, COMPOSITION: 220,000 ohms ±10%; 1w; MIL type RC32GF224K			1		0.7	3.0		R7
	P1	H		5905-299-1997 5905-299-1997	†		†	†	†		RESISTOR, FIXED, COMPOSITION: 270,000 ohms ±10%; 1w; MIL type RC32GF274J			1 1		0.7 0.7	3.0 3.0		R55 R60
	P1	H		5905-107-3260 5905-107-3260	†	†					RESISTOR, FIXED, COMPOSITION: 430,000 ohms ±5%; 1w; MIL type RC32GF434J			1 1		0.7 0.7	3.0 3.0		R48 R50
	P1	H		5905-299-1993 5905-299-1993	†		†	†			RESISTOR, FIXED, COMPOSITION: 470,000 ohms ±10%; 1w; MIL type RC32GF474K			2 2		0.9 0.9	4.0 4.0		R59,R63 R64,R68
	P1	H		5905-249-4198 5905-249-4198	†		†	†	†		RESISTOR, FIXED, COMPOSITION: 8,200 ohms ±10%; 2w; MIL type RC42GF822K			2 2		1.1 1.1	6.0 6.0		R20,R22 R20,R23
	P1	H		5905-185-8521 5905-185-8521	†		†	†	†		RESISTOR, FIXED, COMPOSITION: 10,000 ohms ±10%; 2w; MIL type RC42GF103K			1 1		0.7 0.7	3.0 3.0		R52 R53
	P1	H		5905-249-4243 5905-249-4243	†		†	†	†		RESISTOR, FIXED, COMPOSITION: 27,000 ohms ±10%; 2w; MIL type RC42GF273K Item Nos: R33, R34, R42, R43, R57, R60, R61 Item Nos: R34, R35, R43, R44, R63, R66, R67			7 7		2.5 2.5	20.0 20.0		See desc column See desc column
	P1	H		5905-552-2440		†	†	†			RESISTOR, FIXED, FILM: 10 ohms ±10%; 1/2w; MIL type RN70B10R0F			2		0.9	4.0		R26,R71
	P1	H		5905-556-3343		†	†	†			RESISTOR, FIXED, FILM: 267 ohms ±1%; 1/2w; MIL type RN70B2670F			1		0.7	2.0		R29
	P1	H		5905-578-4861				†			RESISTOR, FIXED, FILM: 8,250 ohms ±1%; 1/2w; MIL type RN70B8251F			1		0.5	2.0		R24
	P1	H		5905-552-2442				†			RESISTOR, FIXED, FILM: 100,000 ohms ±1%; 1/2w; MIL type RN70B1003F			1		0.5	2.0		R70 –
	P1	H		5905-556-5915		†	†	†			RESISTOR, FIXED, FILM: 132,000 ohms ±10%; 1/2w; MIL type RN70B1323F			1		0.5	2.0		R69
	P1	H		5905-204-6321	†						RESISTOR, FIXED, FILM: 8,200 ohms ±5%; 1w; Corning Glass pn N25, 8,200 ±5%;			1		0.5	2.0		R23
	P1	H		5905-556-5911		†	†				RESISTOR, FIXED, FILM: 8,200 ohms ±1%, 1w; MIL type RN75B8201F			1		0.5	2.0		R24

SOURCE CODE A	B	C	D	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	MAINTENANCE ALLOWANCE DIRECT SUPPORT	GENERAL SUPPORT	DEPOT	ILLUSTRATION FIG. NO.	ITEM NO.
						ME-30A, B, C AND E/U (continued)								
	P1	H		5905-542-8837	†	RESISTOR, FIXED, FILM: 100,000 ohms ±1%; 1w; MIL type RN75B1003F			1		0.5	2.0		R64
	P1	H		5905-279-7190	†	RESISTOR, FIXED, FILM: 132,000 ohms ±5%; 1w; Electra Mfg pn DC-1			1		0.7	2.0		R62
	P1	H		5905-337-6369	†	RESISTOR, FIXED, WIRE WOUND: 10 ohms ±1%; 270 ohms ±0.5%; 10 ohms ±1%; Hewlett-Packard pn 400D-S-405			1		0.5	2.0		R28A,B,C
	P1	H		5905-682-1280	†	RESISTOR, FIXED, WIRE WOUND: 20 +43.34 +136.74 +432.260 ohms ±.25%; 1/2w; Disbrow Development pn 607-B131			1		0.5	2.0		R11A,B,C,D
				5905-682-1280	† †				1		0.5	2.0		R9A,B,C,D
	P1	H			†	RESISTOR, FIXED, WIRE WOUND: 125 ohms ±5%; 2.5w; MIL type RS2C-2 ††L4Ab32-055			1		0.5	2.0		R25
	P1	H		5905-259-4634	† † †	RESISTOR, FIXED, WIRE WOUND: 125 ohms ±10%; 2w; Dale Products type CS-2,125			1		0.5	2.0		R27
	P1	H		5905-769-4287	†	RESISTOR, FIXED, WIRE WOUND: 632.24 ohms ±1/4%; Orion Electric Corp pn RP101			1		0.5	2.0		R9
	P1	H		5905-337-6370	† †	RESISTOR, FIXED, WIRE WOUND: 2 sect; 1,365.7 ohms 4,306.1 ohms ±0.2%; Hewlett-Packard pn 400D-26D-PS			1		0.5	2.0		R10A,B
				5905-337-6370	†				1		0.5	2.0		R10,R11
	P1	H		5905-985-6051	†	RESISTOR, FIXED, WIRE WOUND: 5,671.8 ohms ±1/4%; Orion Electric pn RP102			1		0.5	2.0		R10
	P1	H		5905-204-6322	†	RESISTOR, VARIABLE: 4 ohms ±20%; 1w; Muter type A			1		0.5	2.0		R66
				5905-204-6322	†				1		0.5	2.0		R58
	P1	H			† †	RESISTOR, VARIABLE: 4 ohms ±10%; 2w; MIL type RA20NASA4ROA ††L4Ab32-056			1		0.9	4.0		R58
	P1	H		5905-257-7493	†	RESISTOR, VARIABLE: 5,000 ohms ±10%; 2.5w; Centralab pn 21-010-357			1		0.5	2.0		R29
				5905-257-7493	† †				1		0.5	2.0		R30
	P1	H		5905-539-2479	†	RESISTOR, VARIABLE: 5,000 ohms ±10%; 2w; MIL type RV4LAYSA502A			1		0.9	4.0		R30
	P1	H		5960-669-6876	† † † †	SEMICONDUCTOR DEVICE, DIODE: MIL type 1N82A			2		1.1	6.0		CR1,CR2
	P1	O		5960-272-9094	† † † †	SHIELD, ELECTRON TUBE: MIL type TS102U02			6		1.7	10.0		E3 thru E8
	P1	O		5960-295-7652		SHIELD, ELECTRON TUBE: MIL type TS102U03			1		0.5	2.0		E2
	P1	O		5960-264-3004	† †	SHIELD, ELECTRON TUBE: MIL type TS103U02			1		0.5	2.0		EV3
	P1	H		5935-260-0517	† † † †	SOCKET, ELECTRON TUBE: MIL type TS101P01			2		1.1	4.0		XV6,XV7
	P1	H		5935-260-0516	† † †	SOCKET, ELECTRON TUBE: MIL type TS102P01 Item Nos: XV1 thru XV5, XV8,XV9			6		2.4	18.0		XV1 thru XV5,XV8
				5935-260-0516	†				7		2.6	21.0		See desc column

SOURCE CODE A	B	C	D	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	MAINTENANCE ALLOWANCE DIRECT SUPPORT	GENERAL SUPPORT	DEPOT	ILLUSTRATION FIG. NO.	ITEM NO.
						ME-30A, B, C AND E/U (continued)								
	P1	H		5915-643-8365	†	SUPPRESSOR, PARASITIC: Hewlett-Packard pn 608A-S-415-5, REV A			1		0.5	2.0		L1
	P1	H		5930-296-4515	† † †	SWITCH, ROTARY: Hewlett-Packard pn 400D-S-401			1		0.7	3.0		S1
	P1	H			†	SWITCH, ROTARY: 12 position; 3 moving 13 fixed cont; SigC dwg SM-A-331341 ††L4Ab32-210			1		0.7	3.0		S1
	P1	H		5930-259-8422	† †	SWITCH, TOGGLE: AH & H pn 20994-NV			1		0.7	3.0		S2
	P1	H		5930-655-1514	† †	SWITCH, TOGGLE: MIL type MS35058-22			1		0.7	3.0		S2
	P1	H		5950-645-5610	†	TRANSFORMER, POWER, STEP-DOWN AND STEP-UP Hewlett-Packard pn 910-113			1		0.5	2.0		T1
	P1	H		5950-556-9442	† †	TRANSFORMER, POWER, STEP-UP AND STEP-DOWN: Dulron pn 513-B127			1		0.5	2.0		T1
	P1	H		5950-089-2000	†	TRANSFORMER, POWER STEP-DOWN AND STEP-UP: pri wndg, 115v 60 cps 1 phase; sec. wndgs, 6.3v, 1.5 amp 6.3v, 2.75 amp, 7.3v, 0.1 amp, 840v 75 ma; SigC dwg SM-D-331338			1		0.5	2.0		T1

By Order of the Secretary of the Army:

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

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

Distribution:

Active Army

USASA (2)
CNGB (1)
CC-E (7)
Dir of Trans (1)
CofEngrs (1)
TSG (1)
CofSptS (1)
USARADBD (5)
USAAESWBD (5)
USCONARC (5)
USAMC (5)
ARADCOM (5)
ARADCOM Rgn (2)
OS Maj Comd (4)
LOGCOMD (2)
USAMICOM (4)
USAECOM (30)
USACDCEA (1)
USACDCCBRA (1)
USACDCCEA (1)
USACDCOA (1)
USACDCQMA (1)
USACDCTA (1)
USACDCADA (1)
USACDCARMA (1)
USACDCAVNA (1)
USACDCARTYA (1)
USACDCSWA (1)
USACDCCEA Ft Huac
MDW (1)
Armies (2) except
  4th USA (5)
  7th USA (5)
  EUSA (5)
Corps (2)
USAC (3)
11th Air Aslt Div (3)
1st FA Msl Bde (5)
507th USASA Gp (5)
508th USASA Gp (5)
318th USASA Bn (5)
319th USASA Bn (5)
320th USASA Bn (5)
177th USASA Co (5)
182nd USASA Co (5)
183rd USASA Co (5)
184th USASA Co (5)
226th USASA Co (5)
251st USASA Co (5)
600th USASA Co (5)
102nd USASA Det (5)
104th USASA Det (5)
Instl (2) except
  Ft Monmouth (70)
  Ft Gordon (10)
  Ft Huachuca (10)
  Ft Carson (21)
  Ft Lee (5)
  Ft Ritchie (5)
  Ft Devens (5)
Svc Colleges (2)
Br Svc Sch (2) except
  USASESCS (40)
  USAAMS (5)
  USAIS (5)
  USAOGMS (5)
  USAARMS (5)
  USA Cmbt Survl Sch (5)
GENDEP (2)
Sig Sec, GENDEP (5)
Sig Dep (12)
Army Dep (2) except SAAD (30)
  TOAD (14), FTWOAD (10)
  LEAD, NAAD (5), SHAD (3)
  SVAD (5), CHAD (3), ATAD (10)
  Lexington-Blue Grass (14)
  GCAD, ERAD, PUAD (5)
USAMERCC (5)
USASCC (4)
Army Tml Comd (1)
Army Tml (1) except OART (5)
USAECOM (Philadelphia) (11)
USA Rsch Spt Gp (Ft Belvoir) (5)
1st USASA Fld Sta (5)
2nd USASA Fld Sta (5)
4th USASA Fld Sta (5)
9th USASA Fld Sta (5)
12th USASA Fld Sta (5)

13th USASA Fld Sta (5)	Units org under fol TOE: (2 copies each except as indicated)	
14th USASA Fld Sta (5)		
15th USASA Fld Sta (5)	11-5	11-155
USATC AD (2)	11-6	11-156
USATC Armor (2)	11-8	11-157
USATC Inf (2)	11-15	11-158
USATC Engr (2)	11-16	11-165
USASTC (2)	11-35	11-167
WRAMC (1)	11-36	11-215
Army Pic Cen (2)	11-37	11-216
USAINTC (5)	11-38	11-237
USAATC (5)	11-39	11-247
USACDCEC (5)	11-55	11-337
WSMR (5)	11-56	11-500(AA-AE) (4)
Sig Fld Maint Shops (2)	11-57	11-555
AMS (1)	11-58	11-557
USASMC (2)	11-67	11-558
USAERDAA (2)	11-68	11-587
USAERDAW (13)	11-95	11-592
NLABS (5)	11-97	11-597
MAAG, Taiwan (5)	11-98	11-608
USACA, Taiwan (5)	11-117	29-56

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.

TM 11-6625-320-35
*C 2

Field and Depot Maintenance Manual

VOLTMETER, METER ME-30A/U AND VOLTMETERS, ELECTRONIC ME-30B/U AND ME-30C/U

CHANGE
No. 2

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., *19 December 1963*

TM 11-6625-320-35, 8 August 1961, is changed as indicated so that the manual also applies to the following equipment:

Nomenclature	*Order No.*	*Serial No.*
Voltmeter, Electronic ME-30C/U	4443-PP-61	451 and above

Add" (or 34.1)" (as added by C 1, 20 December 1961) after" 34" in the following places:

Page 24, paragraph 13c(1), line 7.

Page 26, paragraph 16a, line 13.

Page 58, paragraph 18b, last line, and paragraph 18c, line 4.

Page 68, paragraph 27m, line 3.

Page 3, paragraph 1d. Delete subparagraph d.

Add paragraphs 1.1 and 1.2 after paragraph 1.

1.1. Index of Publications

Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to your equipment. DA Pam 310-4 is an index of current technical manuals, technical bulletins, supply manuals (types 4, 6, 7, 8, and 9) supply bulletins, lubrication orders, and modification work orders which are 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.

1.2. Reporting of Equipment Manual Improvements

The direct reporting, by the individual user, of errors, omissions, and recommendations for improving this manual is authorized and encouraged. DA Form 2028 (Recommended changes to DA technical manual parts lists or supply manual 7, 8 or 9) will be used for reporting these improvements. This form will be completed in triplicate using pencil, pen, or typewriter. The original and one copy will be forwarded direct to Commanding Officer, U. S. Army Electronics Materiel Support Agency, ATTN: SELMS-MP, Fort Monmouth, N. J., 07703. One information copy will be furnished to the individual's immediate supervisor (officer, noncommissioned officer, supervisor, etc.).

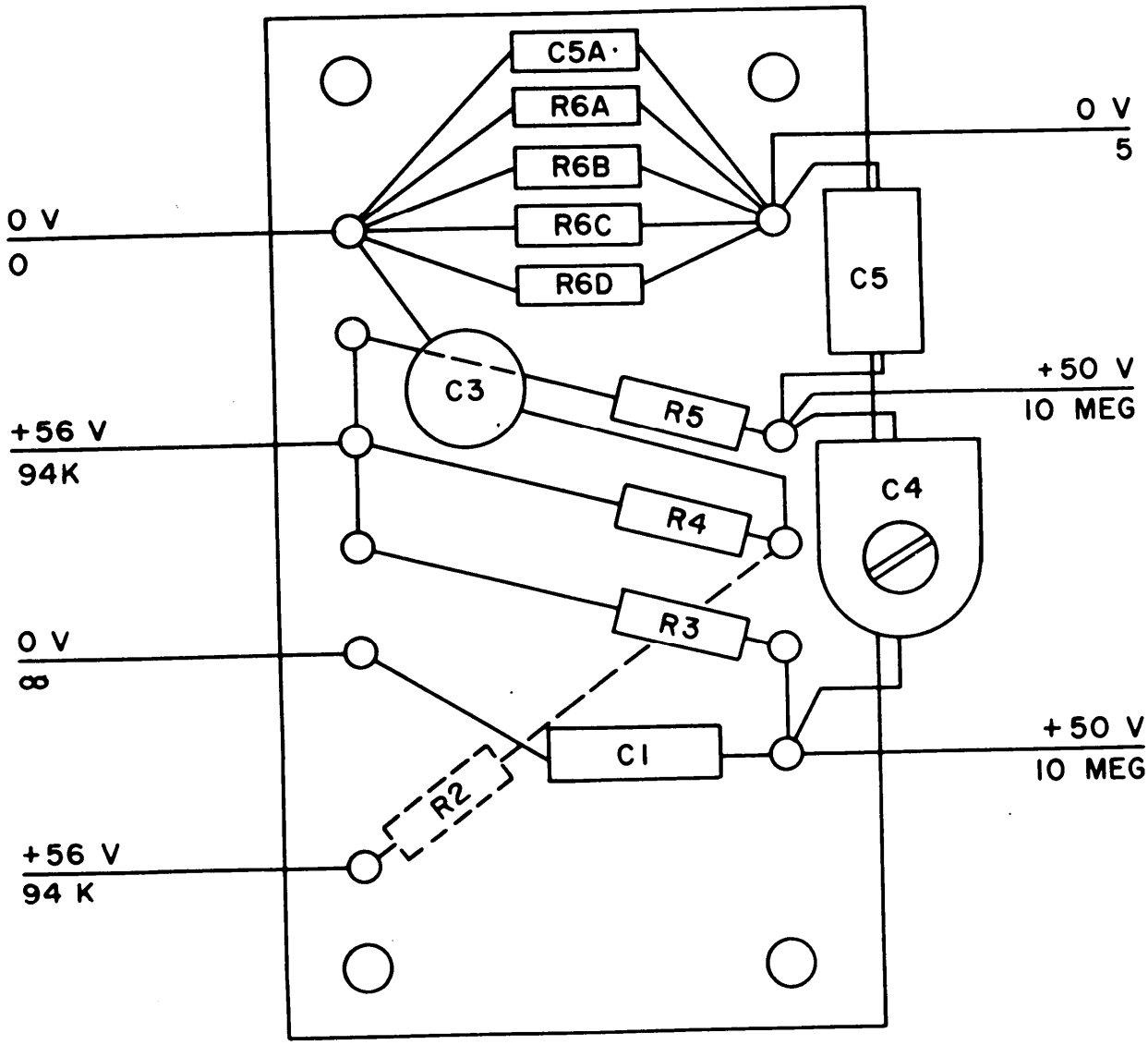
Paragraph 2, chart, "ME-30C/U" column (as changed by C 1, 20 December 1961). Under "C31, 9,100 uuf" add: (In equipments with serial numbers 451 and above, C31 is 8,200 uuf).

Page 53, figure 34 (as changed by C 1,20 December 1961). Make the following changes:

Delete the caption and substitute: *ME-30C/U (serial numbers 1 through 450), terminal board E1, parts location and voltage and resistance diagram.*

Add figure 34.1 after figure 34.

***This change supersedes C 1, 20 December 1961, and replaces Signal Corps Repaired Equipment Standard No. REP-1117, 14 August 1956.**



NOTES.

1. ALL RESISTANCE VALUES IN OHMS.
2. 115 V AC INPUT
3. VOLTAGE READINGS ABOVE LINE, RESISTANCE TO GROUND BELOW LINE.
4. VOLTAGES MEASURED WITH VTVM

TM6625-320-35-CI-I

Figure 34.1. ME-30C/U Serial numbers 451 and above), terminal board E1, parts location and voltage and resetance diagram.

Page 65, paragraph 24a, chart. Delete the last item in the chart and substitute:

Test equipment	Technical manual
Oscilloscope AN/USM-81 Signal Generator SG-299/U	TM 11-6625-219-12 TM 11-5134-15

Page 67, paragraph 27. Make the following changes:

Subparagraph b, first line. Change "TS-38A/U" to: TS-382A/U.

Subparagraph b, last line. Change "AN/USM-50" to: Oscilloscope AN/USM-81.

Subparagraph e, line 3. Change AN/USM-50" to: Oscilloscope AN/USM-81.

Page 68, paragraph 27g, line 5. Change" AN/USM-50" to: Oscilloscope AN/USM-81.

Page 69, paragraph 29, chart. Add the following items to the chart:

Nomenclature	Federal stock No.	Technical manual
Oscilloscope AN/USM-81	6625-701-4038	TM 11-6625-219-12
Signal Generator SG-299/U	6625-624-3516	TM 11-5134-15

Page 72, figure 40. Make the following changes: Delete connections "A" and "B" to TS-723A/U and substitute a wire making connection with the upper jack of the METER receptacle. Left section of illustration, CN-16B/U. Change "TEST LEADS P/O (TS-382 D/U)" to: TEST LEADS P/O TS-352B/U.

Page 73, paragraph 32. Change paragraph heading to read: 32. Amplifier Gain Test.

Subparagraph c, chart. Make the following changes:

In Step No. 1, "Test equipment control settings" column, fourth line from the last, change'' TS-l6B/U" to: CN–16B/U.

Delete Steps No. 3 and 4.

Add figure 40.1 after paragraph 32.

Add paragraph 32.1 after figure 40.1.

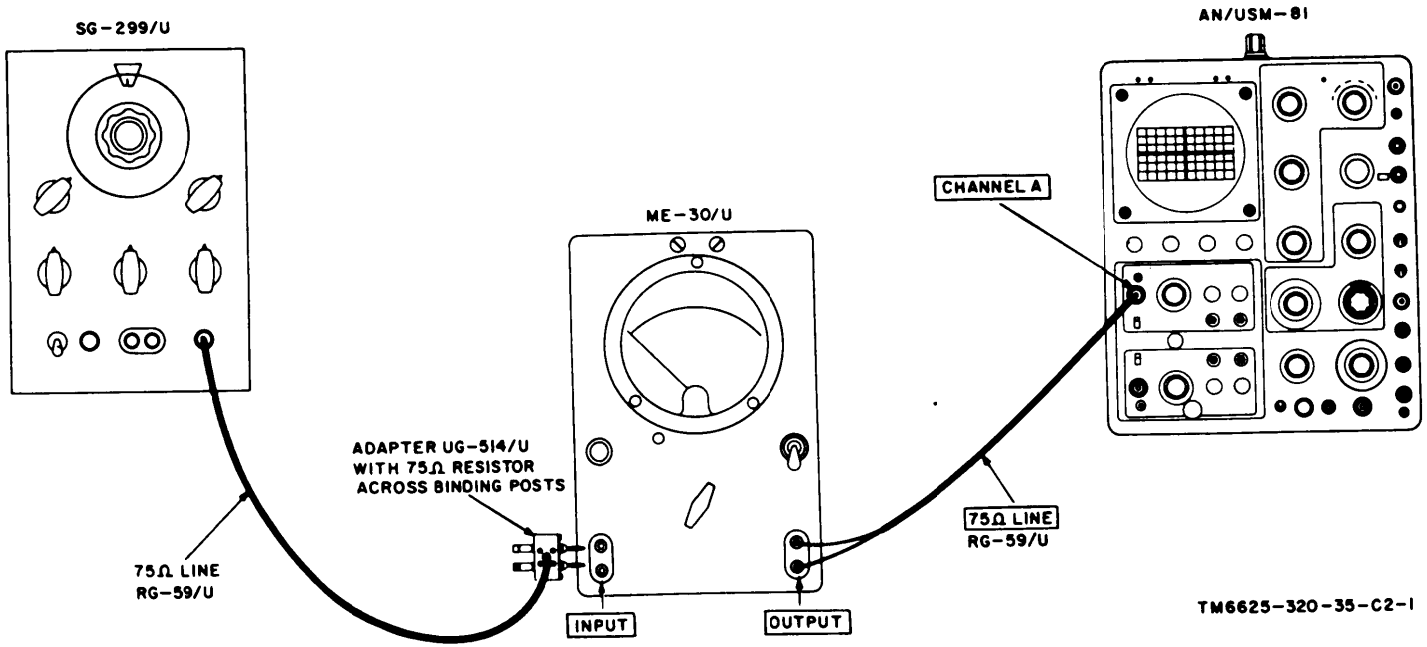


Figure 40.1. Amplifier distortion test.

32.1. Amplifier Distortion Test

a. Test Equipment and Materials.
Signal Generator SG-299/U
Oscilloscope AN/USM-81 with (AM-1839/USM)

b. Test Connections and/or Conditions. Connect the equipment to the ME-30(*)/U as shown in figure 40.1, with the output of ME-30(*)/U connected to CHANNEL A of the preamplifier.

c. Procedure. This procedure is applicable to Voltmeter ME-30A/U and Voltmeters, Electronic ME-30B/U and ME-30C/U.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	*SG-299/U* FREQUENCY: 4 RANGE: X10 75 OHM ATTN: 0 DB OUTPUT AMPLITUDE: 75 OHMS output connector. Power switch: ON. *AN/USM-81* (MX-2330/G) TRIGGERING MODE: AC FAST TRIGGER SLOPE: INT + TIME/CM: MILLI SEC 1 *(AM-1839/USM)* MODE: A ONLY CHANNEL A switch DC. POLARITY: NORMAL	Set range switch to 1 VOLT 0 DB.	Adjust OUTPUT AMPLITUDE 75 ohm control of SG-299/U for 0.8-volt indication on the ME-30(*)/U (0-1.0 scale). Make the following settings and adjustments on AN/USM-81 (MX-2330/G) to obtain sharpest, brightest, and stable trace on crt screen: FOCUS, INTENSITY, ASTIGMATISM, SCALE ILLUMINATION, AND STABILITY TRIGGERING LEVEL; and adjust MULTIPLIER for a display of 3 to 5 cycles on the crt screen. Observe the shape of the square wave displayed on crt screen.	The ME-30(*)/U indicates 0.8 volt. Approximately 4 complete cycles of a square wave are displayed on the crt screen. The top of the square wave is straight. (It may be tilted slightly.) The steady amplitude deviation from a straight line is less than the width of the line.
2	All control settings are the same as in step 1 except the following: *SG-299/U* RANGE: X 100 *AN/USM-81 (AM-2330/G)* TIME/CM: MICRO SEC 100.	Same as step No. 1	Same as step 1	The ME-30(*)/U indicates 0.8 volt. Approximately 4 complete cycles of a square wave are displayed on the crt screen. The square wave shape has no deformation in risetime (no overshoot), the top is flat, and no distortion due to decay (no ringing).
3	Same as in step 2 except as follows: RANGE: X 100K TIME/CM: MICRO SEC 10.	Same as step No. 1	Same as step 1	Same as step 2.

Page 83, paragraph 35b, function column. Add under "Amplifier distortion":

Display of square wave on crt screen.

"Performance Standard" column. Delete "2 percent maximum" and substitute:

Top of square wave is straight. (It may be tilted slightly.) Steady amplitude deviation from straight line is less than the width of the line. No distortion of the square wave due to decay (no ringing).

Delete section II.

Page 85. Add chapter 5 after chapter 4.

CHAPTER 5

DEPOT INSPECTION STANDARDS

41. 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.

42. Applicable References

a. Repair Standards. Applicable procedures of the Army depot performing this test and its general standards for repaired electronic equipment form a part of the requirements for testing this equipment.

b. Technical Publication. The technical publication applicable to the equipment to be tested is TM 11-6625-320-12, Operator's and Organizational Maintenance Manual, Voltmeter, Meter ME-30A/U and Voltmeters Electronic ME-30B/U and ME-30C/U.

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

43. Test Facilities Required

Item	Technical manual	Common name
RF Signal Generator AN/URM-25F	TM 11-5551E	Rf signal generator
Audio Oscillator TS-382(*)/U	TM 11-6625-261-12	Audio oscillator
Meter Test Equipment AN/GSM-1	TM 11-2535	Meter test set
Analyzer, Spectrum TS-723(*)/U	TM 11-5097	Spectrum analyzer
Transformer, Variable CN-16(*)/U	None	
Multimeter TS-352(*)/U	TM 11-5527	Multimeter

44. Tests for Depot Inspection Standards

Perform the tests listed in paragraphs 32 through 34.

45. Test Data Summary

Function	*Performance standard*
a. Amplifier gain (maximum output voltage at full scale meter deflection).	0.15 volt minimum
b. Display of square wave on crt screen.	Top of square wave is straight. (It may be tilted slightly). Steady amplitude deviation from straight line is less than width of the line. No distortion of square wave due to decay (no ringing).
c. Voltage regulation	±2 percent
d. Calibration	±2 percent
e. Frequency response.	±2 percent

Page 86, appendix. Make the following changes: Delete the eighth reference. Add the following references to the appendix:

DA Pamphlet No. 3104	Index of Technical Manuals, Technical Bulletins, supply Manuals (Types 4, 6, 7, 8 and 9), Supply Bulletins, Lubrication Orders, and Modification Work Orders.
TB SIG 355-1	General Standards for Repaired Signal Equipment.
TB SIG 355-2	General Standards for Refinishing Repaired Signal Equipment.

TB SIG 355-3	Specific Standards for Moisture and Fungus Resistant Treatment.
TM 11-5134	Signal Generator SG-299/U.
TM 11-6625-219-12	Operator and Organizational Maintenance Manual: Oscilloscope AN/USM-81.
TM 11-6625-261-12	Operator and Organizational Maintenance Manual: Audio Oscillator TS-382A/U, TS-382B/U, TS-382D/U, TS-382E/U, and TS-382F/U.

Page 99, figure 50 (as changed by C 1, 20 December 1961).

Make the following changes:

Add" (NOTE 12)" under C31 (Top right).

Add the following to the notes:

12. C31 IS 8,200 uuf IN EQUIPMENTS WITH SERIAL NUMBERS 451 AND ABOVE.

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.

Distribution:

Active *Army:*

DASA (6)
USASA (2)
CNGB (1)
CSigO (7)
CofT (1)
CofEngrs (1)
OCofSpts (1)
TSG (1)
USACECDA (1)
USACECDA, Monmouth Ofc (1)
USCONARC (5)
USAMC (5)
USASMCOM (1)
USAECOM (7)
USAMICOM (4)
ARADCOM (2)
ARADCOM Rgn (2)
OS Maj Comd (3)
OS Base Comd (2)
LOGCOMD (2)
MDW (1)
Armies (2)
Corps (2)
Instl (2) except
Ft Monmouth (63), Ft Gordon (5)
Ft Hancock (4), Ft Huachuca (10)
USATC AD (2)
USATC Armor (2)
USATC Engr (2)
USATC FA (2)
USATC Inf (2)
USASTC (3)
GENDEP (OS) (2)
Sig See, GENDEP (5)
Sig Dep (OS) (12)
Army Dep (2) except
Lexington (12), Pueblo (8)
Tobyhanna (12), Granite City (8)
Sacramento (28), Blue Grass (8)
Ft Worth (8), Atlanta (8)
Svc Colleges (2)
Br Svc Sch (2)
WRAMC (2)
USA Tml Cored (1)
Army Tml (1)
USAOSA (1)
POE (1)
AMS (1)
Army Pic Cen (2)
USA Mbl Spt Cen (1)
USA Elct Mat Agcy (25)
Chicago Proc Dist (1)
Sig Fld Maint Shops (3)
USA Elct RD Actv (Ft Huachuca) (2)
USA Elct RD Actv (White Sands) (13)
WSMR (5)
Yuma PG (2)
USA Corps (3)
USASCC (4)
USA Avn & Sur Mat Cored (1)
USAECDA (1)
USACBRCDA (1)
USAMSCDA (1)
USAOCDA (1)

USAQMCDA (1)
USATCDA (1)
USAADCDA (1)
USAARMCDA (1)
USAAVNCDA (1)
USAARTYCDA (1)
USASWCDA (1)
USAPRDC (6)
USAINTC (5)
CSTATC (5)
1st USASA Fld Stat (5)
White House Army Comm Agcy (5)
USA Elct RD Lab (5)
1st FA Msl Bde (5)
USARADBD (2)
USAAESWBD (2)
Detroit Arsenal (5)
MAAG (China) (5)
USACDEC (5)
507th USASA GP (5)
508th USASA GP (5)
318th USASA Bn (5)
319th USASA Bn (5)
320th USASA Bn (5)
321st USASA Bn (5)
177th USASA Co (5)
182nd USASA Co (5)
183rd USASA Co (5)
184th USASA Co (5)
251st USASA Co (5)
252nd USASA Co (5)
102nd USASA Det (5)
104th USASA Det (5)
76th USASA Sp Opns Unit (5)
2nd USASA Fld Sta (5)
4th USASA Fld Sta (5)
9th USASA Fld Sta (5)
12th USASA Fld Sta (5)
13th USASA Fld Sta (5)
14th USASA Fld Sta (5)
Units org under fol TOE:
11-5 (2)
11-6 (2)
11-7 (2)
11-8 (2)
11-15 (2)
11-16 (2)
11-35 (2)
11-36 (2)
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11-165 (2)
11-167 (2)
11-215 (2)
11-216 (2)
11-237 (2)
11-500 (AA-AE) (RM-RU) (2)
11-555 (2)
11-557 (2)
11-558 (2)
11-587 (2)
11-592 (2)
11-597 (2)
11-608 (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.

Technical Manual
No. 11-6625 -320-3S

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, Do C., *8 August 1961*

VOLTMETER, METER ME-30A/U AND VOLTMETERS, ELECTRONIC ME-30B/U AND ME-30C/U

*This manual together with TM 11-6625-320-12, 21 June 1960, supersedes TM 11-5132, 16 October 1957; C1, 8 April 1958; C2, 26 August 1958; C3, 9 January 1959; C4, 10 December 1959.

CHAPTER 1

THEORY

Section I. GENERAL

1. Scope

a. This manual covers field and depot maintenance for Voltmeter, Meter ME-30A/U and Voltmeters, Electronic ME-30B/U and ME-30C/U. It includes instructions appropriate to fourth and fifth echelons for troubleshooting, testing, calibrating, and repairing the equipment; replacing maintenance parts 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 the theory section.

b. The complete technical manual for this equipment includes TM 11-6625-320-12, TM 11-6625-320-12P, and TM 11-6625-320-35P.

c. In this manual, when reference is to all three models, the word voltmeter will be used. Specific models will be referred to as ME-30A/U, ME-30B/U, and ME-30C/U.

d. Forward comments concerning this manual to the Commanding Officer, U. S. Army Signal Materiel Support Agency, AT TN: SIGMS-PA2d, Fort Monmouth, N. J.

Note. For applicable forms and records, see paragraph 2, TM 11-6625-320-12.

2. Internal Differences in Models

Internal differences are listed in the chart below. For external differences and other internal differences see TM 11-6625-320-12.

Item[a]	ME-30A/U	ME-30B/U	ME-30C/U
Chassis mounting position to front panel.	Vertical.	Horizontal.	Vertical.
Tube and component locations.	Similar to ME-30C/U.	Unlike ME-30A/U or ME-30C/U.	Similar to ME-30A/U.
Designation of resistors and capacitors.	Unlike ME-30B/U or ME-30C/U.	Similar to ME-30C/U.	Similar to ME-30B/U.
T1 terminal designations.	Unlike ME-30B/U or ME-30C/U.	Similar to ME-30C/U.	Similar to ME-30B/U.
Value differences of resistors and capacitors in electrical circuitry.	None.	C33, 100 uuf.	C33, 33-510 uuf.
	C34, 500 uf.	C34, 500 uf.	C34, 1,000 uf.
	C30C, 20 uf.	C37, 40 uf.	C37, 40 uf.
	C16, 7-45 uuf.	C14, 5-80 uuf.	C14, 5-80 uuf.
	C14, 7-45 uuf.	C16, 5-80 uuf.	C16, 5-80 uuf.
	None.	R22, 4,700 ohms.	R22, 4,700 to 9,100 ohms.
	C19, .033 uf.	C21, .033 uf.	C21, .051 uf.
	C21, 7-45 uuf.	C22, 25-280 uuf.	C22, 25-280 uuf.
	R12, 27 ohms.	R12, 100 ohms.	R12, 47 ohms.
	R13, 150 ohms.	R13, 15 ohms.	R13, 15 ohms.
	R6A, R6B, and R6C. (See note 4 and 6, fig. 45.)	R6 and R6A. (See note 4 and 6, fig. 47.)	R6A, R6B, R6C, R6D, and C5A. (See note 6 and 8, fig. 49.)
	C6, 9-180 uuf.	C6, 5-80 uuf.	None.
	L1, 19 uh.	None.	None.
	C28, 8,200 uuf.	C31, 8,200 uuf.	C31, 9, 100 uuf.

Item[a]	ME–30A/U	ME–30B/U	ME–30C/U
Terminal numberings of switch S1B (front).	Unlike ME-30B/U or ME-30C/U.	Same as ME-30C/U.	Same as ME-30B/U
Terminal numberings of switch S1B (rear), (S1B (front) on ME-30A/U).	Unlike ME-30B/U or ME-30C/U.	Same as ME-30C/U.	Same as ME-30B/U.
Terminal board locations. All three models use different terminal board designations and vary as to the mounted components.	Similar to ME-30C/U.	Unlike ME-30A/U or ME-30C/U.	Similar to ME-30A/U.
Terminal numberings of switch S1A (rear).	Unlike ME-30B/U. or ME-30C/U.	Same as ME-30C/U.	Same as ME-30B/U.

[a]Other differences consist of equivalent capacitors and resistors of the same values in all models but are identified by different reference designations (fig. 46, 48, and 50).

Section II. UNIT THEORY

3. Block Diagram Analysis, Amplifier Section

a. General (fig. 1).

(1) The voltmeter is a measuring device for alternating current (ac) signals over a broad band of frequencies. The calibration of the meter permits expression of the magnitude of these signals in terms of voltage, decibels (db), or decibels referred to 1 milliwatt in 600 ohms (dbm). It is also used as an ac voltage amplifier over a broad band of frequencies for low level signals. Signal paths are shown in the block diagram (fig. 1) and discussed in paragraphs 3 and 4. For complete circuit details, refer to the overall schematics (fig. 46, 48, and 50) and stage analysis in paragraphs 5 through 11.

(2) Amplification of the signal voltage is provided by four stages which comprise a degenerative-type amplifier (tubes V2-V5). The four stages provide a net gain of approximately 55 to 60 db over the rated frequency band of the voltmeter. Frequency compensating networks in the plate circuit of each stage and in the coupling between stages, and cathode degeneration at low frequencies provide an extremely stable amplifier over the wide frequency band of 10 cycles per second (cps) to 4 megacycles (mc).

(3) Frequency response of the amplifier stages with respect to tube transconductance (mutual conductance) (g_m) and line voltage variations results in relatively constant amplification.

(a) In A, figure 2, the relative response of the amplifier stages is plotted against frequency for several g_m values with constant line voltage. As indicated by these curves, the frequent y response of the amplifier stages is largely independent of tube aging and the difference in g_m values between original and replacement tubes.

(b) In B, figure 2, the relative response of the amplifier stages is plotted against frequency for several values of line voltage. As indicated by these curves, changes of approximately 10 percent in line voltages have a negligible effect on the frequency response of the amplifier.

b. Input Voltage Divider. The input signal is applied to the input voltage divider through the INPUT binding posts. The purpose of the input voltage divider, which consists of a switch and a resistive and capacitive network, is to attenuate the signal by a ratio of 1,000 to 1 when any one

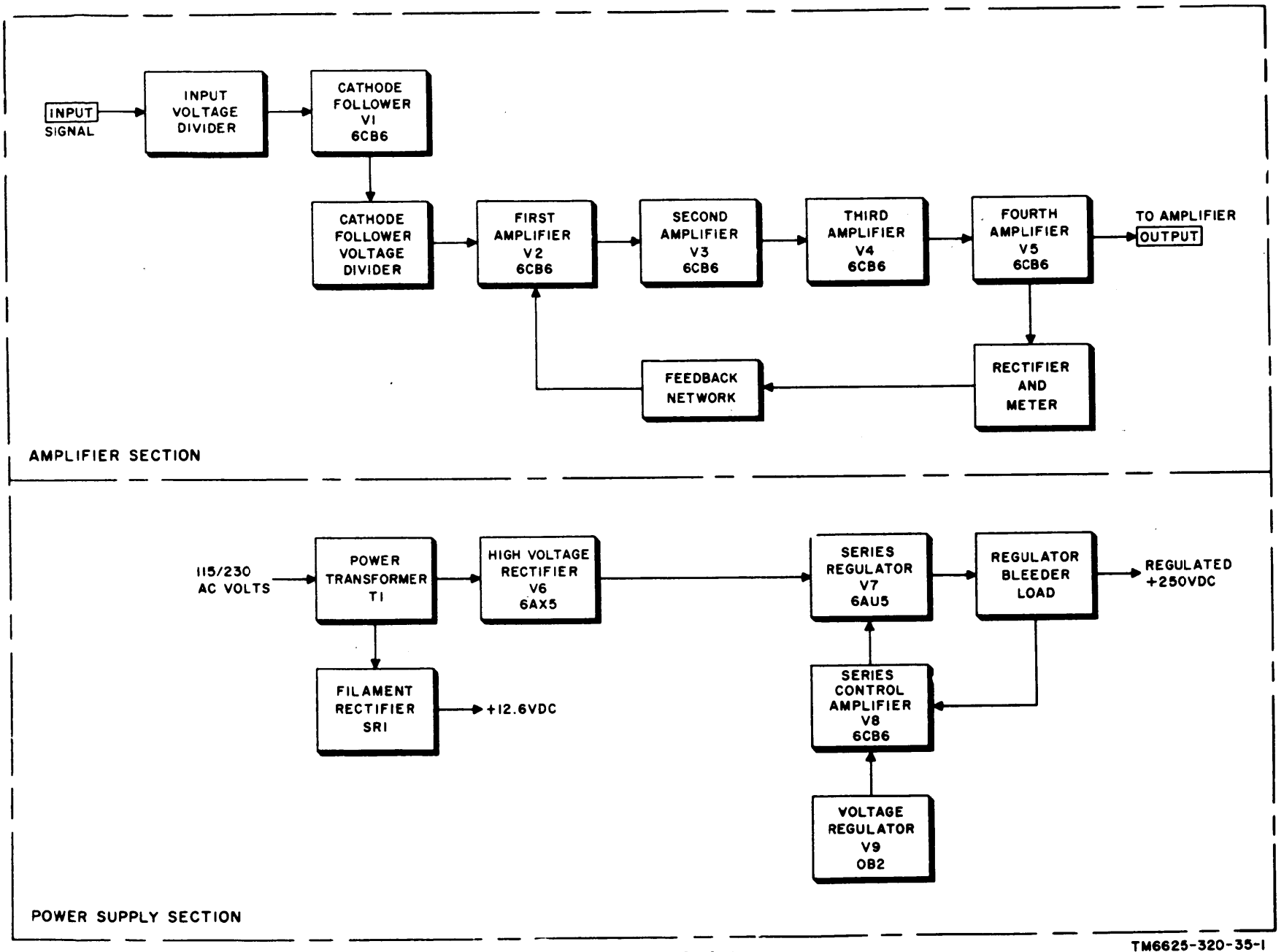


Figure 1. Voltmeter, block diagram.

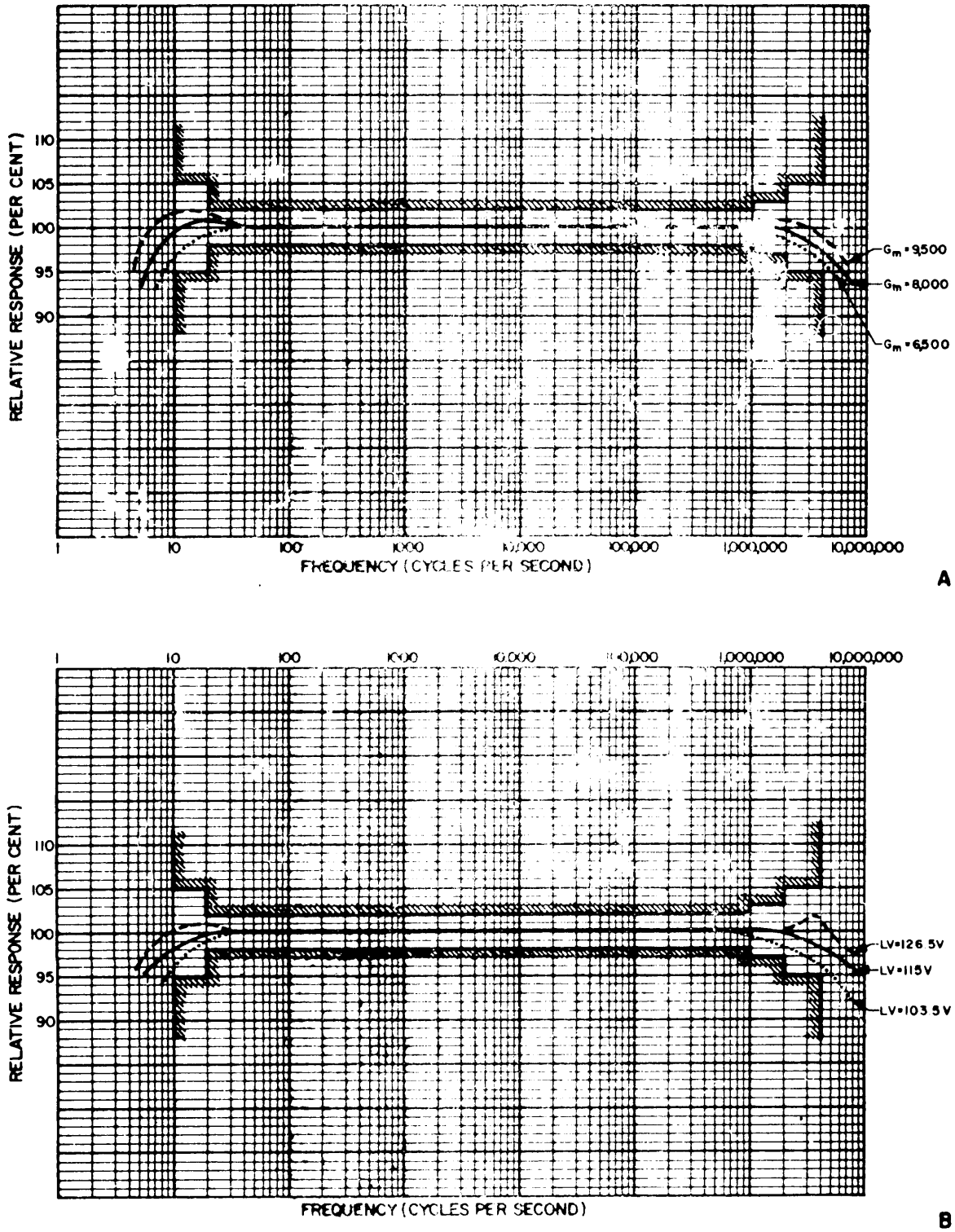


Figure 2. Typical amplifier stages frequency response curves.

of the higher six voltage ranges is used. The output of this circuit is coupled to cathode follower V1.

c. Cathode Follower. This stage, which receives the signal from the input volt age divider, decouples the following amplifier stages from the circuitry under test. The following stage, cathode follower voltage divider, makes up the cathode circuitry of cathode follower V1.

d. Cathode Follower Voltage Divider. This stage is a tapped resistive network containing a switch. The switch may be used in any one of 12 positions. Six of the tapped resistor positions are repeated when the switch is rotated through 12 positions. Even though the 6 positions are repeated as the switch is fully rotated, 12 voltage ranges are available because the switch is ganged to the switch in the input voltage divider. The output of the cathode follower voltage divider is coupled from the switch to the grid of the first amplifier through a resistor.

e. First Amplifier. This stage consists of a frequency compensated network and tube amplifier V2, which amplifies the output of the cathode follower voltage divider and in turn couples the signal to the second amplifier. A signal from the feedback network is also fed into the cathode circuit of V2. This signal degenerates the amplification factor of V2 and helps to develop overall stabilization of the voltmeter.

f. Second and Third Amplifiers. These two stages are similar in circuitry and application. Each is an amplifier tube, V3 and V4, used in association with frequency compensated circuits. The purpose of these two stages is to receive the output signal from the first amplifier, amplify it, and in turn, couple it to the grid of the fourth amplifier.

g. Fourth Amplifier. The fourth amplifier consists of a frequency compensated circuit and tube amplifier V5. This stage serves two purposes. It produces an output at the plate of V5 which is applied to the rectifier-meter stage for voltage indications. It also produces an output in the cathode of V5 which is fed to the OUTPUT terminals. This output is used when the voltmeter is used as a broadband amplifier.

h. Rectifier and Meter Circuit. This stage rectifies the plate output of V5 and activates M1 which indicates the root mean square (rms) value of the ac signal under measurement. Part of the V5 plate signal which flows through the rectifier-meter circuit becomes the activating current in the feedback network.

i. Feedback Network. The feedback network is a resistive-capacitive network. It determines the magnitude and phase of the signal which is taken as part of the V5 plate output and coupled to the cathode of V2 through the feedback network.

4. Block Diagram Analysis, Power Supply Section

(fig, 1)

a. Power Transformer. Operating ac power is applied to the primary winding of power transformer T1. The secondary outputs are fed to the high voltage rectifier and the various filament circuits.

b. High Voltage Rectifier. The high voltage rectifier rectifies one of the power transformer secondary outputs and in turn applies the rectified output to the series regulator.

c. Series Regulator. The series regulator, which controls the rectified output current of the power supply, feeds this current to the regulator bleeder load.

d. Regulator Bleeder Load. The regulator bleeder load acts as a bleeder load for the power supply and also couples the B+ supply voltage to the amplifier section. It also supplies a proportional amount of the B+ supply voltage to the series control amplifier.

e. Series Control Amplifier. The series control amplifier, which is controlled by the B+ supply voltage, controls the amount of current passed by the series regulator,

f. Voltage Regulator. The voltage regulator main-tains a constant cathode bias on the series control amplifier.

g. Filament Rectifier. The filament rectifier rectifies one of the secondary winding outputs of the power transformer, The rectified output supplies direct current (dc) filament voltage to the cathode

follower and the first three amplifiers in the amplifier section.

5. Stage Analysis, Input Voltage Divider (fig. 3, 4, and 5)

a. A signal at the INPUT binding posts passes through the dc blocking capacitor C1 (C2 in the ME-30A/U) to the input voltage divider. For the six low VOLTS ranges (.001 to .3), the input signal from C1 goes to the grid of V1 through contacts 2 and 1 (9 and 5 in the ME-30A/U) of switch S1A (rear) and parasitic suppressor resistor R8 (R9 in the ME-30A/U).

b. For the six high volts ranges (1 to 300), the input signal is attenuated 1,000 to 1 as a result of the position of switch SIA (rear) and the electrical makeup of the voltage divider network. Part of the divider network is resistive and is made up of R3, R4, and R2. One end of R2 is ac grounded through C2A (C1A in the ME-30A/U). The other part of the divider network is mainly capacitive. It is made up of C4 and C5 in series, and both in series with a parallel combination of components. The parallel components are: R6 and R6A in the ME-30B/U; R6A, R6B, R6C, R6D, and C5A in the ME-30C/U; or R6A, R6B, and R6C in the ME-30A/U.

(1) At low frequencies, the impedance of capacitors C4 and C5 is high enough so that the voltage division is determined mainly by the ratio of the resistors in the resistive branch, Under these conditions, the input signal portion across R4, R2, and C2A (R2, R3, and C1A in the ME-30A/U) is coupled to the grid of V1 through R5, contacts 1 and 3 (3 and 5 in the ME-30A/U) of switch SIA (rear), and R8 (R9 in the ME-30A/U).

(2) As the frequency of the input signal increases, the capacitive branch impedance becomes low in comparison to the resistive branch impedance. The voltage division is then determined by the capacitive branch. Under these conditions, the input signal portion across C5 and the parallel combination of R6

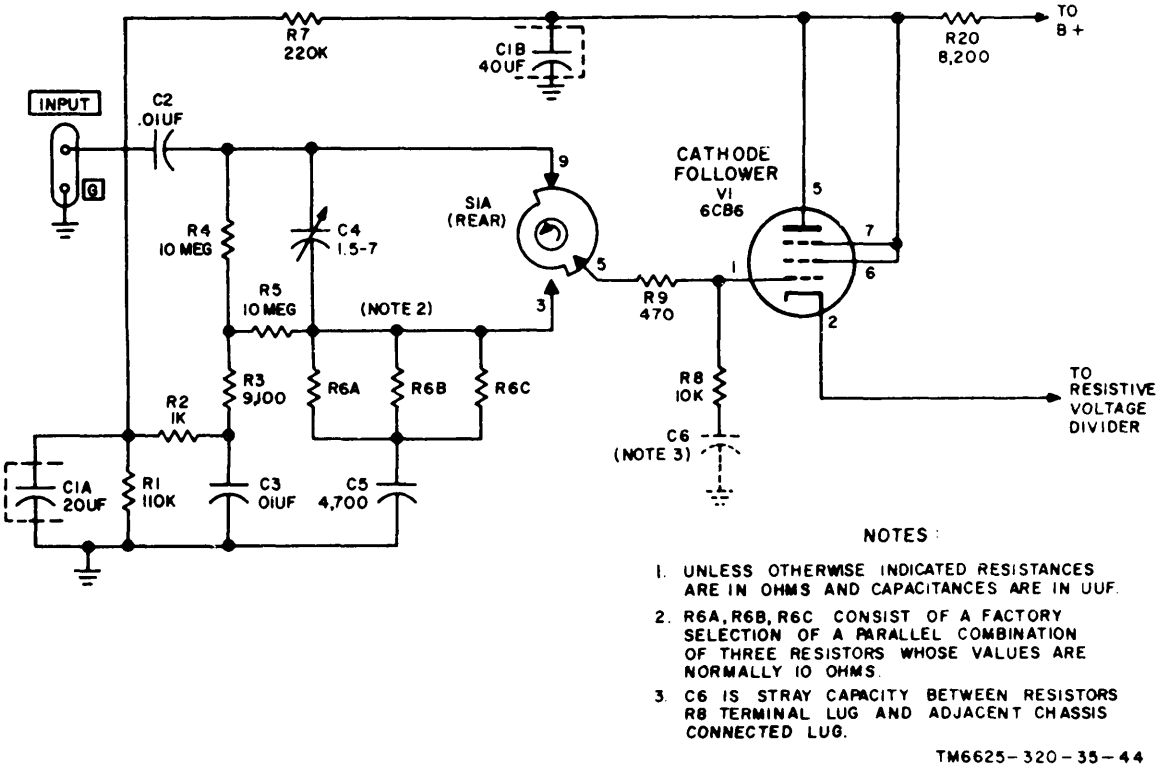


Figure 3. ME-30A/U, input voltage divider circuit, partial schematic diagram.

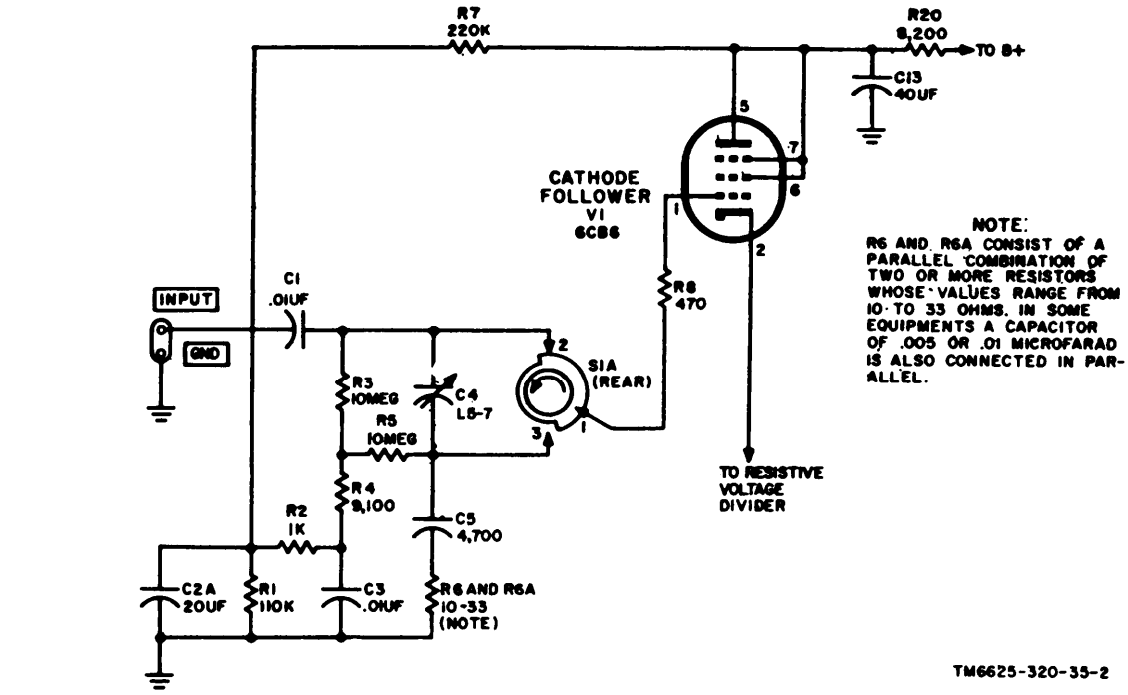


Figure 4. ME-30B/U, input voltage divider circuit, partial schematic diagram.

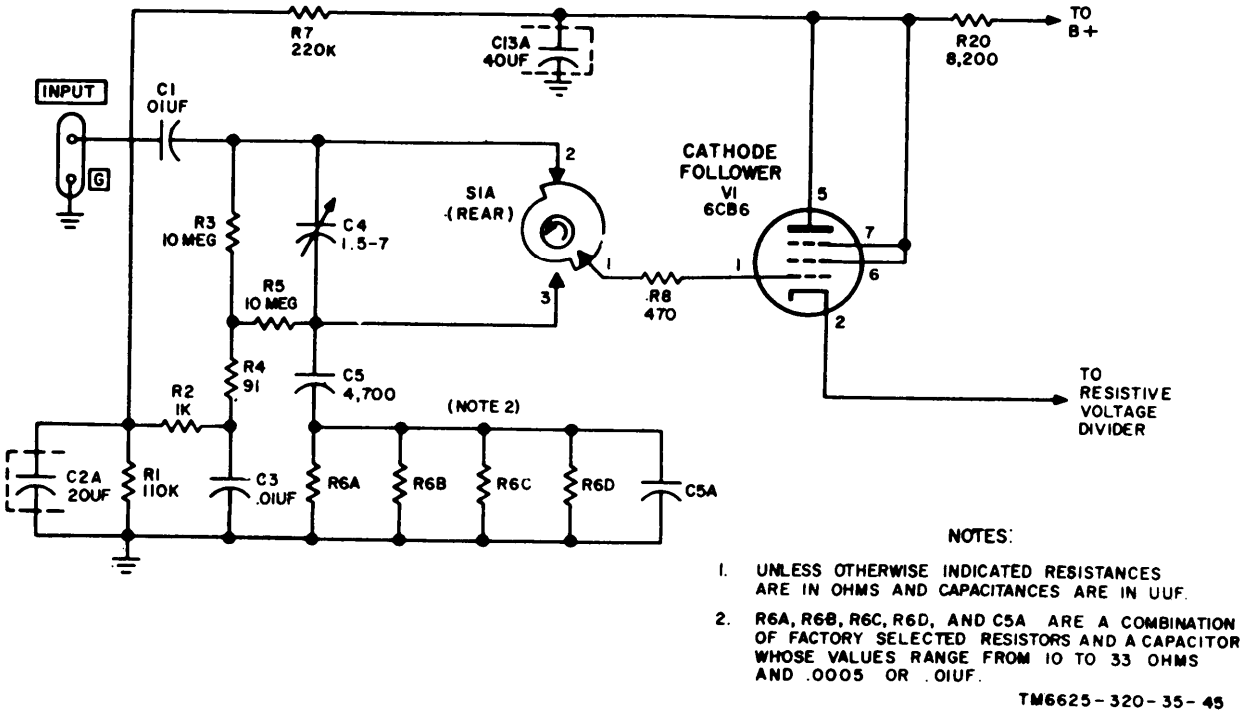


Figure 5. ME-30C/U, input voltage divider circuit, partial schematic diagram.

and R6A (in the ME-30B/U; R6A, R6B, R6C, R6D, and C5A in the ME-30C/U; or R6A, R6B, and R6C in the ME-30A/U) is coupled to the grid of VI through contacts 1 and 3 (3 and 5 in the ME-30A/U) of switch S1A (rear) and R8 (R9 in the ME-30A/U).

c. Resistor R5 decouples the resistive and capacitive branches. This aids in maintaining proper voltage division when the frequency of the input signal changes. Resistors R6 and R6A in the ME-30B/U function as part of a frequency compensating network. The same is true of R6A, R6B, R6C, R6D, and C5A in the ME-30C/U; and R6A, R6B, and R6C in the ME-30A/U. They provide the necessary resistance in series with C4 and C5 to adjust for a constant voltage division at the higher frequencies.

d. Resistors R7 and R1 form a dc voltage divider system. The dc voltage applied is the same as applied to the plate of V1. That portion of the voltage across R1 is applied as a fixed bias to the grid of V1 through R2, R3, R4, and R8 (R9 in the ME-30A/U) on the low voltage ranges and through R2, R4, R5, and R8 (R2, R3, R5, and R9 in the ME-30A/U) on the high voltage ranges.

e. Capacitor C2A (C1A in the ME-30A/U) provides an ac short to ground for the resistive network of R2, R4, and R3 at the lower frequencies and is also part of the ac decoupling circuit between B+ voltage and the input ac circuit.

f. Capacitor C3 is part of a decoupling network made up of C3 and R2. The decoupling is between the B+ voltage and the ac input circuit at the higher frequencies.

g. In the ME-30A/U circuit only (fig. 3), R8 and stray capacitance C6 function as part of the frequency compensating network at the higher frequencies.

6. Stage Analysis, Cothode Follower

(fig. 3, 4, and 5)

The cathode follower, V1, decouples the amplifier circuitry and cathode follower voltage divider from the input circuit. This circuitry arrangement permits voltage range switching without loading the circuitry under test. The signal which is applied to the grid of V1 from the input voltage divider through tube action is developed across the divider system in the cathode circuit. B+ voltage to the plate, suppressor grid, and screen grid is coupled from the power supply through a decoupling network composed of R20 and C13 (C13A in the ME-30C/U and C1B in the ME-30A/U).

Note. Because of the similarity of the circuits in the ME-30A/U, the ME-30B/U, and the ME-30C/U, the remaining portion of theory in chapter 1 will be explained in terms of component reference designations of the ME-30B/U. For example: Whatever explanation is applied to R11 in the ME-30B/U will also apply to the equivalent resistor R10A in the ME–30C/U and R10A in the ME-30A/U (fig. 46, 48, and 50). All exceptions will be explained in the text.

7 Stage Analysis, Cathode Follower Voltage Divider

(fig. 6, 7, and 8)

The cathode follower voltage divider consists of a resistive voltage divider located in the cathode circuit of V1 and switch S1B (front). The divider is tapped at six points to provide the six positions each for the high or low voltage ranges. This results in a total of 12 ranges for measurements. The t appeal points are connected to the terminals of switch SIB (front) through individual resistance-capacitance (rc) networks. In turn, the signal is taken from the wiper arm of switch SIB (front) and coupled to the grid of first amplifier V2 through parasitic suppressor resistor R21.

a. Range Selector Switch. Range selector switch S1 consists of two ganged wafers, switch S1A (rear) (fig. 4) and switch SIB (front and rear) (fig. 6). Switch SIB has two sets of contacts, front and rear. The ME-30A/U instead of designating a SIB (rear) designates the same switch portion as S1C (rear) (fig. 46). The relationship between the contacts for each switch wafer and the VOLTS ranges of the voltmeters are given in (4) below.

(1) When switch S1 (fig. 4) is on any one of the six lower VOLTS ranges (.001 to 3), the signal voltage is coupled by capacitor C1 through

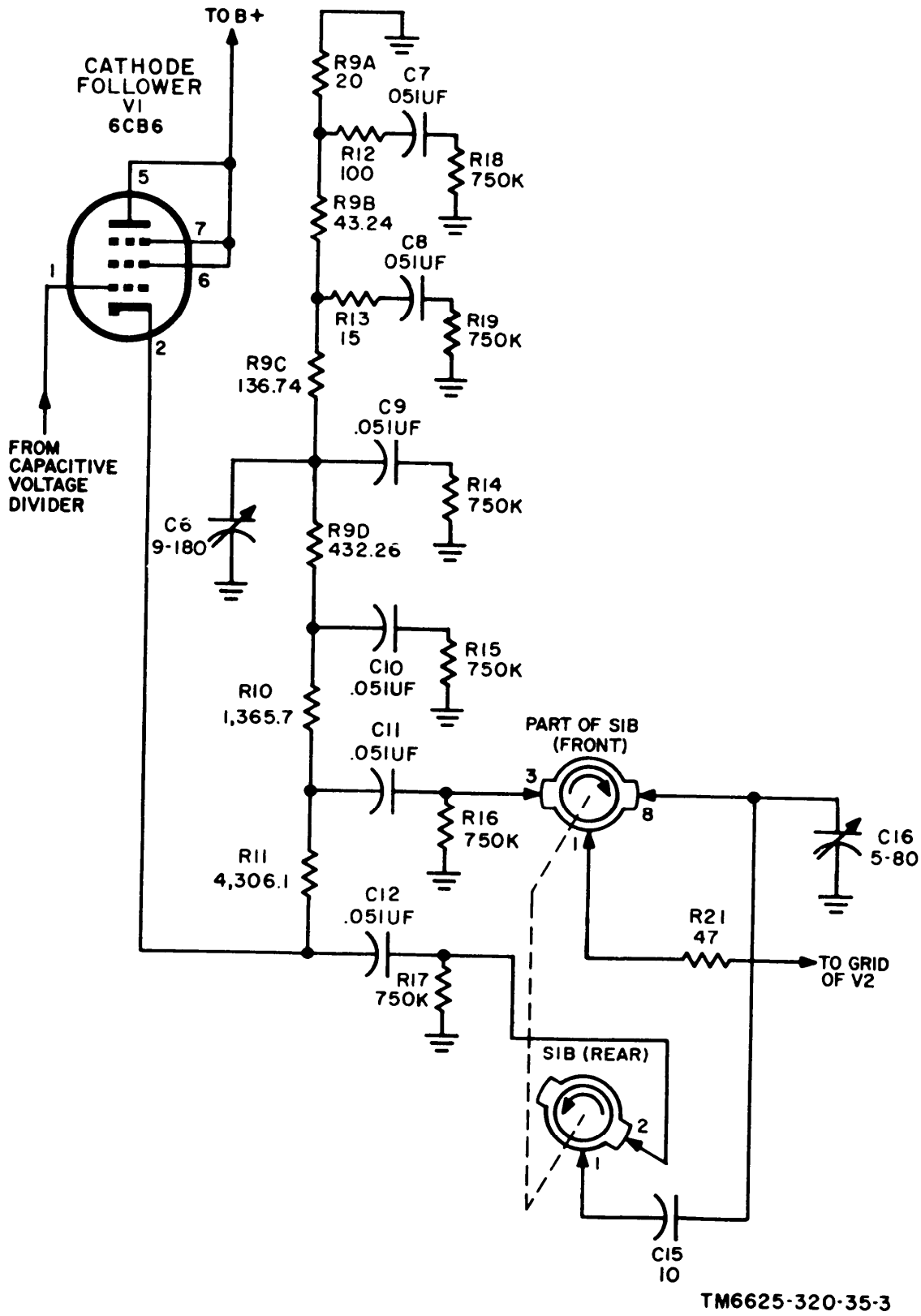


Figure 6. ME-30B/U, cathode follower voltage divider, .003 and 3 VOLTS ranges position, partial schematic diagram.

(3) On the .01 or 10 VOLTS ranges (fig. 7), variable capacitor C14 is added to the circuit through switching contact 9 of switch S1B (front). On the .003 or 3 VOLTS ranges (fig. 6), variable capacitor C16 and capacitor C15 are added to the circuit through switching contact 8 of switch SIB (front) and switching contacts 2 and 1 of switch SIB (rear). The additional capacitances inserted on these four ranges become parts of frequency compensation networks.

(4) The following chart provides the relationship between range selector switch S1 contacts and the VOLTS voltage ranges of the voltmeter.

VOLTS ranges	Range selector switch section	Switch contacts		
		ME–30A/U	ME–30B/U	ME–30C/U
.001 to .3 1 to 300	S1A (rear)	5 and 9 5 and 3	1 and 2 1 and 3	1 and 2 1 and 3
.001 and 1 .003 and 3 .01 and 10 .03 and 30 .1 and 100 .3 and 300	S1B (front)	7 and 9 7, 10, and 4 7, 11, and 5 7 and 12 7 and 1 7 and 2	1 and 2 1, 3, and 8 1, 4, and 9 1 and 5 1 and 6 1 and 7	1 and 2 1, 3, and 8 1, 4, and 9 1 and 5 1 and 6 1 and 7
.003 and 3	S1B (rear) (S1C (rear) in the ME-30A/U)	6 and 9	1 and 2	1 and 2

b. Resistive Voltage Divider (fig. 6).

(1) Resistors R9A through R9D, R10, and R11 in the cathode circuit of cathode follower V1 constitute a resistive voltage divider with taps that provide six output voltages. The resistive voltage divider is connected to the switching contacts of switch S1B.

(2) The maximum voltage that can be applied through the voltage divider to the grid of first amplifier V2 for full scale meter deflection is approximately 0.001 volt. The resistive voltage divider is arranged so that with range selector switch S1 in any position, and the voltage applied at the INPUT binding posts not in excess of the top limit of that range, the voltage applied to the grid of first amplifier V2 does not exceed approximately 0.001 volt. For example, with switch S1 on the 300 VOLTS range, and no more than 300 volts applied at the INPUT binding posts, the voltage on the grid of V2 is not more than approximately 0.001 volt.

c. Coupling to Switch S1B. The output path from each tap in the resistive voltage divider (resistors R9A-R9D, R10, and R11) includes a resistance capacitance network (resistors R14-R19 and capacitors C7-C12). These networks provide the means of coupling the signal voltage to switch S1B. The resistors are the grid return to ground for the first amplifier V2. Resistors R12 and R13 are current limiting resistors.

d. Range Selector Switching Action. Since the voltage applied to the grid of the tube V1 is reduced to 1,000th of its applied value on each of the high voltage ranges, the output circuit of tube V1 is identical for each pair of ranges. Figures 6, 7, and 8 are representative partial schematic diagrams illustrating switch S1 position on the .003 and 3 VOLTS ranges ((1) below), .01 and 10 VOLTS ranges ((2) below), and

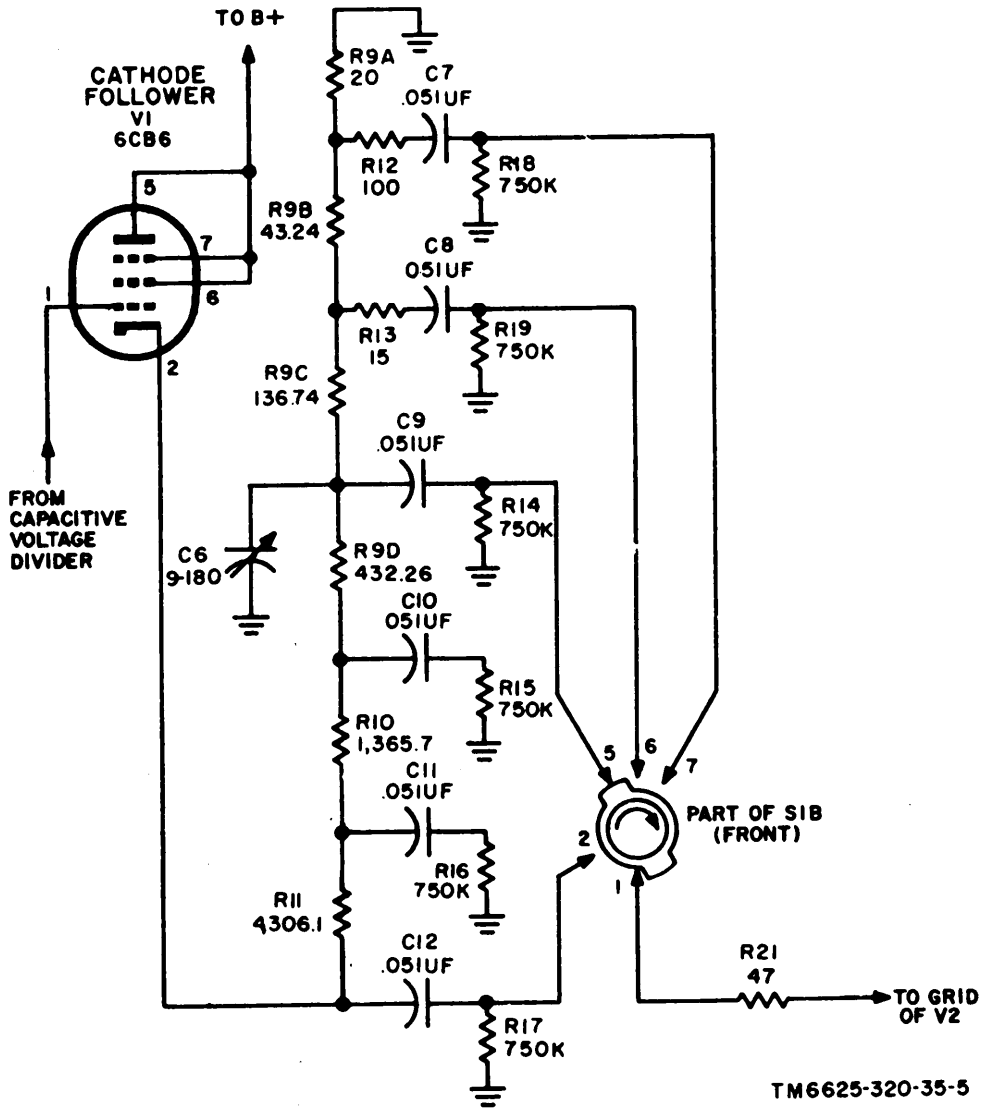


Figure 8. ME-30B/U, cathode follower voltage divider, .03 and 30 VOLTS ranges position, partial schematic diagram.

.03 and 30 VOLTS ranges ((3) below) respectively.

(1) .003 and 3 VOLTS ranges (fig. 6 The signal voltage at the output of the cathode follower for these two VOLTS ranges is taken from the junction of resistors R10 and R11, and coupled through capacitor C11, contacts 3 and 1 of switch SIB (front), and parasitic oscillation suppressor resistor R21 to the grid of first amplifier V2. Capacitor C15 and C16 serve as frequency compensation components on these ranges.

(2) *.01 and 10 VOLTS ranges* (fig. 7). The signal voltage at the output of the cathode follower for these two VOLTS ranges is taken at the junction of resistors R10 and R9D. The voltage is coupled through capacitor C10, contacts 4 and 1 of switch SIB (front), and resistor R21 to the grid of first amplifier V2. To aid in the adjustment of frequency response on these ranges, capacitor

C14 is added to the circuit between contact 9 of switch SIB (front) and ground.

(3) *.03 and 30 VOLTS ranges* (fig. 8). The signal voltage at the output of the cathode follower for these two VOLTS ranges is taken at the junction of resistors R9C and R9D. The voltage is coupled through capacitor C9, contacts 5 and 1 of switch SIB (front), and resistor R21 to the grid of first amplifier V2. Capacitor C6 provides for adjustment of frequency responses on these and the .1 and 100, and .3 and 300 VOLTS ranges. Although capacitor C6 is in the circuit for all ranges of the voltmeter, it has little or no effect on ranges other than those specified. There is no equivalent capacitor for C6 in the ME-30A/U.

(4) *Other ranges.* The signal voltages at the output of the cathode follower for the remaining VOLTS ranges (.001 and 1, .1 and 100, and .3 and 300) are traced in a similar manner ((3) above). The differences that exist are in the switching contacts of switch S1B and in the points tapped from the resistive voltage divider.

8. Stage Analysis, Amplifiers

(fig. 9)

a. First Amplifier.

(1) The signal voltage from switch S1B (front) is applied through parasitic oscillation suppressor resistor R21 to the grid of V2. The signal voltage from V2 is coupled through the resistor-capacitor network which consists of R28, C20, R31, and C21, and developed across R32. Resistor R32 is the control grid return resistor for V3. Resistor R33 suppresses parasitic oscillation. Frequency compensation results from the circuitry arrangement of the series combination of R28, C20, and R31 being in parallel with C21. As the frequency of the signal being measured or amplified increases, C21 becomes the predominant conductor. At extremely low frequencies, due to the high impedance of C21, the series group which consists of R28, C20, and R31, is the predominant conductor. Also aiding in the compensation of frequency are R22 and C17.

Note. The ME-30A/U has no equivalent resistor and capacitor for R22 and C17 which are contained in both the ME-30B/U and the ME-30C/U.

(2) Resistors R26, R29, R30, R71, and C22 comprise the feedback network (para 10). Resistor R30 is adjusted to obtain the necessary ratio between amplifier gain and feedback to obtain the correct full scale indication on meter M1. The value of current required through the rectifier bridge to provide full scale deflection of the meter is approximately 2.2 milliamperes (ma) rms. Capacitor C22 provides adjustment for frequency response compensation at the higher frequencies. The feedback signal is developed across R26. This in turn affects the signal through V2. Operating bias for V2 is obtained by use of cathode resistor R25 being bypassed by C18.

(3) Resistors R23 and R24 are plate voltage dropping resistors. Resistor R27 is the screen grid voltage dropping resistor. Capacitors C2B and C19 are the screen grid and plate bypass capacitors, respectively.

b. Second Amplifier.

(1) The signal voltage developed across grid resistor R32 is applied through parasitic oscillation suppression resistor R33 to the grid of V3. The amplified signal from V3 is coupled through the resistor-capacitor network which consists of R39, C25, R40, and C26, and developed across R41. Resistor R41 is the control grid return resistor for V4. Resistor R42 suppresses parasitic oscillation. Frequency Compensation results from the circuitry arrangement of the

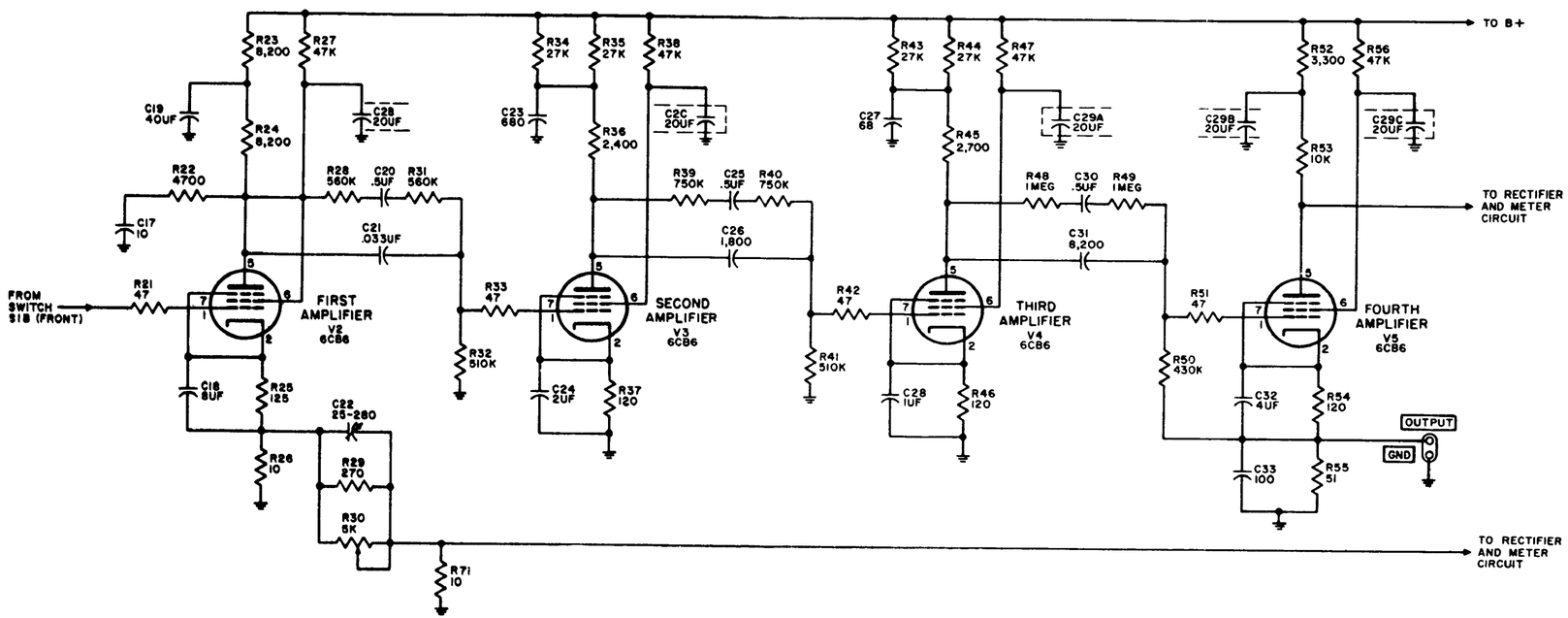


Figure 9. ME-30B/U, amplifiers, partial schematic diagram.

TM6S25-320-35-49

series combination of R39, C25, and R40 being in parallel with C26. As the frequency of the signal being measured increases, C26 becomes the predominant conductor. At very low frequencies, due to the high impedance of C26, the series group which consists of R39, C25, and R40, is the predominant conductor.

(2) Operating bias for V3 is obtained by use of cathode resistor R37 being bypassed by C24.

(3) Resistor R34, R35, and R36 are plate voltage dropping resistors. Resistor R38 is the screen grid voltage dropping resistor. Capacitor C2C and C23 are the screen grid and plate bypass capacitors, respectively.

Note. Only the ME-30A/U (fig. 46) contains L1 in the plate circuit of V3. Induotor L1 is used to aid the frequency response of this stage,

c. Third Amplifier.

(1) The signal voltage developed across grid resistor R41 is applied through parasitic oscillation suppressor resistor R42 to the grid of V4. The amplified signal voltage from V4 is coupled through the resistor-capacitor network which consists of R48, U30, R49, and C31, and developed across R50 and the parallel combination of C33 and R55. Resistor R50 is the control grid return resistor for V5. Resistor R51 suppresses parasitic oscillation. Frequency compensation results from the series combination of R48, C30, and R49 being in parallel with C31. As the frequency of the signal being measured increases, C31 becomes the predominant conductor. At low frequencies, due to the high impedance of C31, the series group which consists of R48, C30, and R49, is the predominant conductor.

(2) Operating bias for V4 is obtained by use of cathode resistor R46 being bypassed by C28.

(3) Resistors R43, R44, and R45 are plate voltage dropping resistors. Resistor R47 is the screen grid voltage dropping resistor. Capacitor C29A and C27 are the screen grid and plate bypass capacitors, respectively.

d. Fourth Amplifier.

(1) The signal voltage developed across grid resistor R50 is applied through parasitic oscillation suppressor resistor R51 to the grid of V5. The amplifier signal voltage from the plate of V5 is applied to the rectifier and meter circuit and R71.

(2) Tube V5 circuitry is also arranged to produce a cathode follower output. The cathode follower output at the junctioti of R54 and R55 is connected to the OUTPUT terminals. The impedance, looking into the OUTPUT terminals, is approximately 50 ohms. Capacitor C33 aids the high frequency stability of the fourth amplifier and has negligible effect on output impedance over the entire frequency range of the amplifier.

Note., In the ME-30A/U only, the equivalent of C33 is not used.

(3) Resistors R52 and R53 are plate voltage dropping resistors. Resistor R56 is the screen grid voltage dropping resistor. Capacitors C29B and C29C are the plate and screen grid bypass capacitors, respectively.

(4) Operating bias for V5 is obtained by use of cathode resistor R54 being bypassed by C32.

9. Stage Analysis, Rectifier and Meter Circuit

(fig. 10)

a. General. The rectifier and meter circuit Is arranged in a bridge-type circuit with a crystal diode and capacitor in each branch and a dc milliammeter connected across the midpoints. The diode connection provides full wave rectification of the input signal to the meter.

(1) The action for the rectifier and meter circuit may be analyzed as

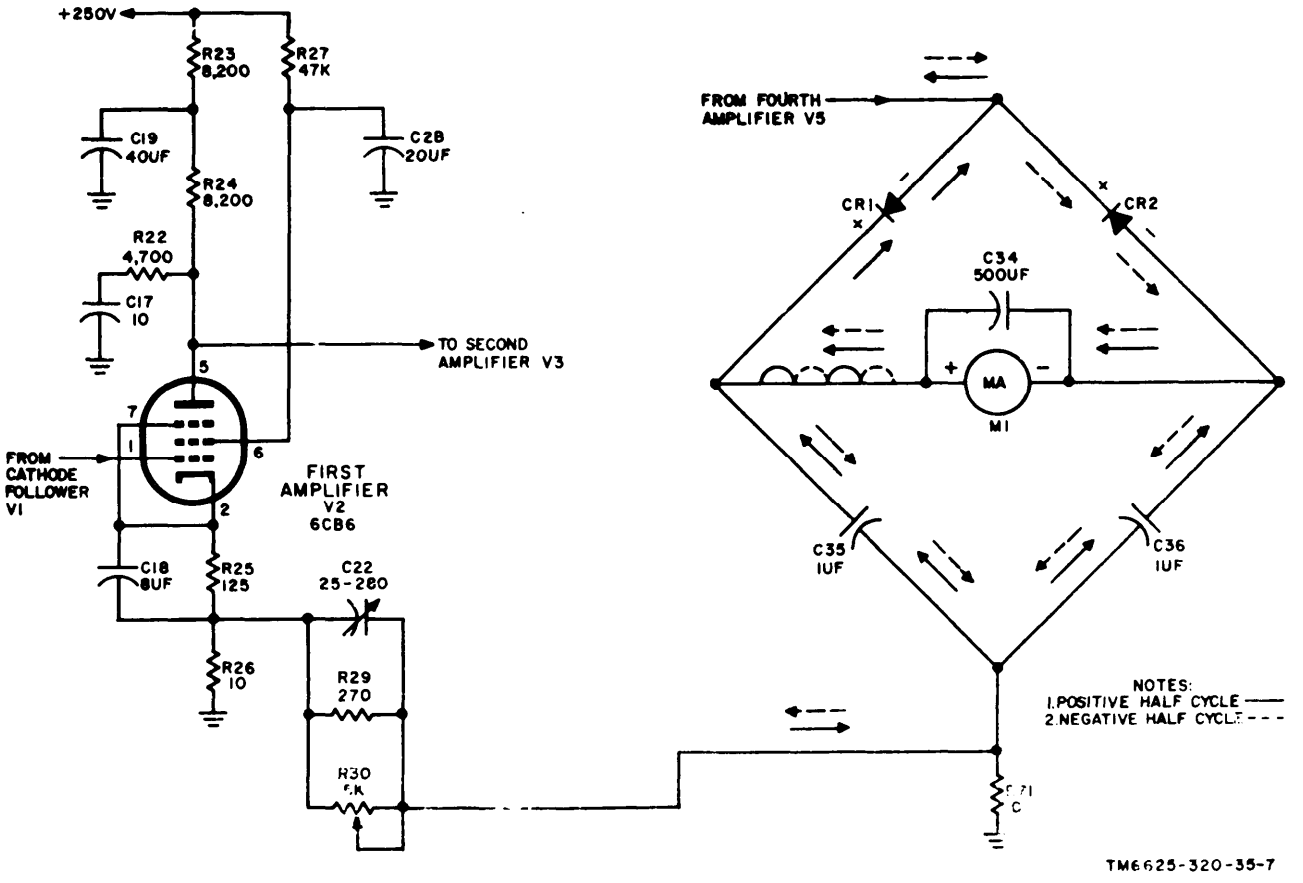


Figure 10. ME-30B/U, rectifier and meter circuit, with amplifier feedback loop, partial schematic diagram.

follows. Assume initially that no power is applied to the circuit. Under these conditions C35 and C36 are not charged. The amount of electrons on one plate of C35 or C36 is equal to the amount of electrons on its corresponding plate. When power is applied to the circuit, the plate potential of V5 causes an electron flow. The electron flow is from the upper plates of C35 and C36, through the meter and rectifier circuit, plate circuit of V5, power supply, ground, parallel combination of R71 and the negative feedback circuit (R26, C22, R29, and R30), and to the lower plates of C35 and C36. The electron flow continues until C35 and C36 are charged to a potential equal to the positive potential at the plate of V5.

(2) Now assume that the ac output signal of V5 is such that the plate potential is going positive. Capacitors C35 and C36 charge to a greater potential. For circuit tracing purposes, the electron flow path can be started from the upper plates of C35 and C36. Electrons from C36 are blocked by CR2 and flow through M1, deflecting the meter pointer. This electron flow joins the flow from C35 and the total flow is through CR1, plate circuit Of V5, power supply, ground, parallel combination of R71 and feedback network, and to the lower plates of C35 and C36. Capacitor C34 smooths out the pulsating dc and provides a bypass for any ac component which may be present in the meter circuit.

(3) On the alternate half of the cycle, the polarity of the applied ac signal is reversed. The potential

applied to the meter and rectifier circuit at the plate of V5 now decreases. This lowering of the potential across C35 and C36 permits the capacitors to discharge. The discharge path is through the feedback network, V2, power supply, ground, V5, and CR2. A portion of this flow reaches C36. The balance of the electrons flow through M1 and then to C35. The direction of the electron flow through M1 is the same as that which occurs during the positive half cycle. The half cycles alternately continue with a resulting unidirectional current flow through the meter on each half cycle.

c. Meter Accuracy. The current through meter M1 is proportional to the average value of the waveform of the voltage applied to the input of the rectifier circuit. Calibration of the meter in rms volts is based on the ratio which exists between the average and effective (rms) values of a voltage which is a sine wave. Because of this, deviation in a waveform from that of sine wave may result in inaccuracy of the meter indication. The ratio of average to effective values in a sine wave is .9 to 1. When harmonic or spurious voltages are present, this ratio may vary. The degree of variation depends on the magnitude and phase relation between harmonic and fundamental frequencies. The effect of harmonics on voltage measurements is given in TM 11-6625-320-12 and provides an indication of the limits of possible error.

10. Stage Analysis, Feedback Network
(fig. 10)

The feedback network consists of R71, R30, R29, C22, and R26. The adjustment of C22 controls the phase of the feedback current at the higher frequencies. Resistor R30 controls the amount of feedback current. Fixed resistors R71, R26, and R29 are selected values to produce a desired design value of feedback. The phase of the feedback current in R26 is opposite to that of the signal that exists there because of the tube action of V2. This classifies the feedback as being negative. The purpose of the negative feedback is to obtain stabilization of the overall amplifier gain.

11. Stage Analysis, Power Supply Section
(fig. 11)

a. Power Transformer.

(1) *Primary windings.*

(a) When the voltmeter is arranged to operate from 115-volt ac source, the primary windings of T1 are connected in parallel (TM 11-6625-320-12) and in series with time delay fuse F1. The fuse prevents overloading the power supply.

(b) When the voltmeter is arranged to operate from a 230-volt ac source, the primary windings are connected in series (TM 11-6625-320-12) and in series with F1.

(2) *Secondary windings.*

(a) Secondary windings between terminals 1 and 3 and center tapped at terminal 2 provide power for the high voltage rectifier V6.

(b) Secondary winding between terminals 4 and 5 supply ac filament voltage for power supply tubes V6, V7, and V8.

(c) Secondary windings between terminals 9 and 6 are two windings in series. The two in series are used for the filament voltages of amplifier tubes V1 through V4. The single winding between terminals 7 and 6 is used for the ac filament voltage of fourth amplifier V5 and current to the power indicator lamp.

b. High Voltage Rectifier. Full wave rectification is obtained through the dual plate action of V6 connected to the center tapped secondary high voltage winding of T1. Capacitor C37 filters this output as it flows to the regulating portion of the power supply.

c. Series Regulator. Tube V7, series regulator, controls the amount of current which flows to the output load and

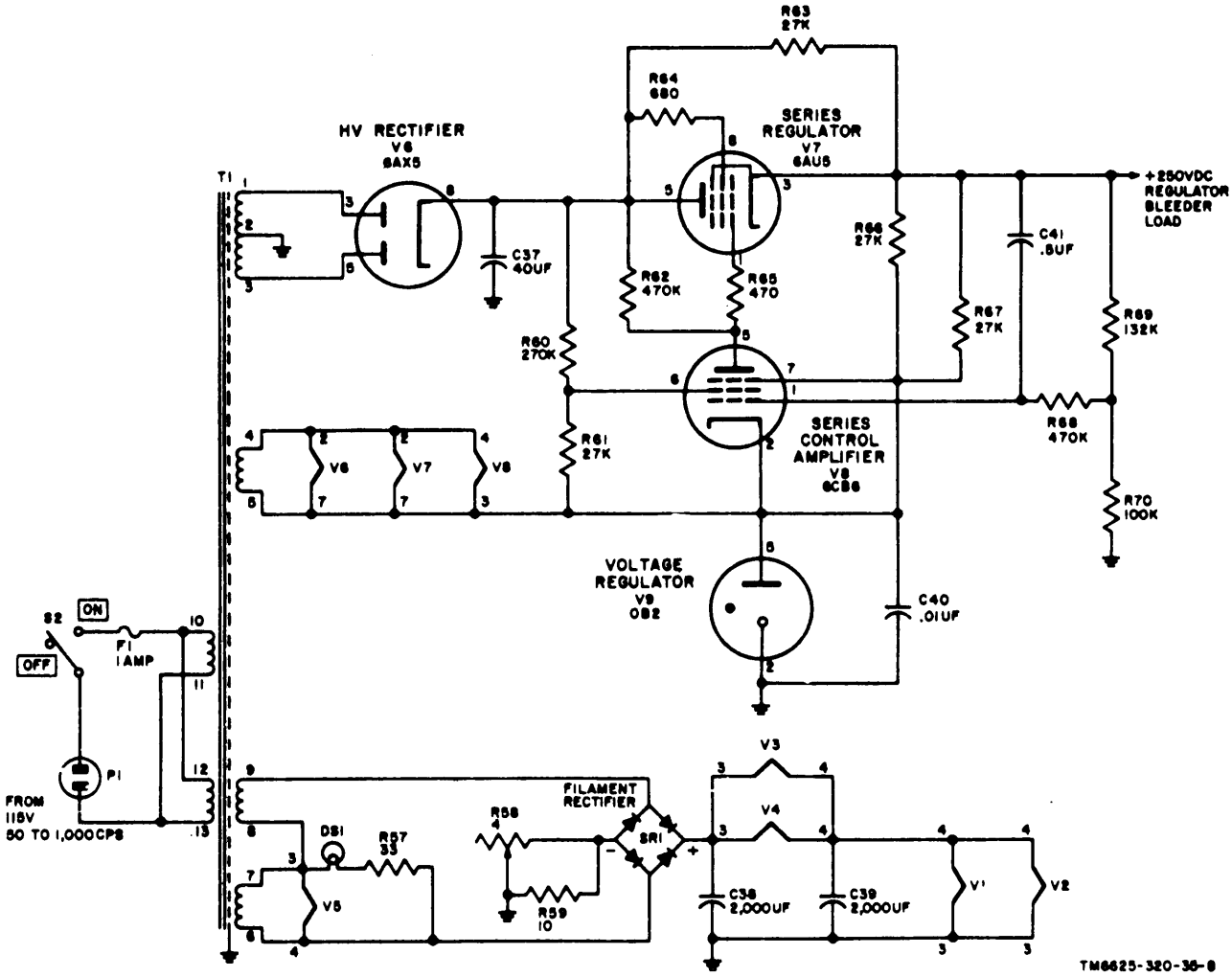


Figure 11. ME-30B/U, power supply, partial schematic diagram.

bleeder load. Resistor R64 is a screen grid voltage dropping resistor. Resistor R63 is in parallel with V7 and is part of the overall series impedance.

d. Regulator Bleeder Load. The total bleeder load is made up of two parallel branches. One branch consists of R69 in series with R70. The other parallel branch is made up of R66 in parallel with R67 and both in series with V9. Resistors R66 and R67 also produce the ionizing current of V2. Resistors R69 and R70 form a voltage divider system which determines the amount of grid bias applied to V8 through R68. Resistor R68 together with R70 forms the grid to ground return resistance for V8. Capacitor C41 prevents the regulator from responding to undesirable surge pulses which may be imposed on the V8 control grid.

e. Voltage Regulator. Voltage regulator V9 maintains a constant cathode bias on V8. A self-biasing resistor in the cathode circuit of V8 would produce results which are opposite to those desired. Capacitor C40 prevents undesirable surge pulses from affecting the regulating action of V9.

f. Series Control Amplifier.

(1) The series control amplifier V8 controls the a m o u n t of current passed by series regulator V7 to the load. This is mainly the result of the control of biasing on V7 by V.

(2) The control acts in the following manner.

(a) If the output load of the power supply increases, more current required, the voltage across the

load and divider R69 and R70 reduces. Any voltage reduction across R70 increases the bias on V8 and the grid becomes less positive with respect to ground. This reduction of bias on V8 causes V8 to conduct less current. The decreased current through V8 increases the voltage between plate and cathode of V8. The voltage across R62 decreases at the same time. The total bias on V7 from cathode to control grid is made up of the voltage drops across R65, plate to cathode voltage of V8, and the voltage drop across R66. The polarity of this biasing voltage is such that when V8 decreases conduction, plate to cathode voltage increasing, the net bias on V7 becomes more positive at grid with respect to cathode. This in turn increases the amount of current passed by V7. The increased current to the load restores the original value of voltage applied to the load.

(b) If the output load of the power supply decreases (less current required), the voltage across the load and the divider R69 and R70 increases. An increase in voltage across R70 decreases the bias on V8. The decreased bias on V8 causes it to conduct more. The increase in conduction increases the voltage drop across R62 and decreases the voltage across V8 from plate to cathode. The decreased potential across V8 increases the bias on V7. The increased bias on V7 decreases the current passed to the output load. This results in the voltage of the output load returning to the original value. Resistors R60 and R61 form a voltage divider which supplies screen grid current to V8.

g. Filament Rectifier. Selenium rectifier SR1 is used to form a full wave bridge rectifier to supply dc filament voltage to V1, V2, V3, and V4. The power to the rectifiers are coupled from the series connected secondary winding of T1 connected between terminals 9 and 8, and 7 and 6. Filter capacitors C38 and C39 reduce the ac component of the rectified dc pulsating current, Resistors R58 and R59 control the value of voltage applied to the filaments.

CHAPTER 2
TROUBLESHOOTING

Section I. GENERAL TROUBLESHOOTING TECHNIQUES

Warnings:

1. Certain points located throughout the chassis of the voltmeter operate at voltages above 250 volts. Do not touch these points while power is applied. Be very careful when handling or testing any part of the voltmeter while it is connected to the power source.

2. When selenium rectifiers fail, because of burnout or arc-over, poisonous fumes and compounds are released. The fumes have a strong odor and should not be inhaled. *Provide adequate ventilation immediately and do not handle the rectifier until it has cooled.*

12. General Instructions

Troubleshooting at field and depot maintenance level includes all the techniques outlined for organizational maintenance and any special or additional techniques required to isolate a defective part. The field maintenance and depot procedures are not complete in themselves but supplement the procedures described in TM 11-6625-320-12. The systematic troubleshooting procedure, which begins with the operational and sectionalization checks that can be performed at an organizational level, must be completed by means of sectionalizing, localizing, and isolating techniques. Section II provides troubleshooting procedures which must be performed at field maintenance level.

13. Organization of Troubleshooting Procedures

a. General. The first step in servicing a defective voltmeter is to sectionalize the fault. Sectionalization means tracing the fault to a major component. The second step 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 and arcing and shorted transformers can often be located by sight, smell, and hearing. The majority of faults, however, must be localized by checking voltages and resistance.

b. Sectionalization. The voltmeter consists of the amplifier section and the power supply section. The first step in tracing trouble is to locate the section at fault by the following methods:

(1) *Visual inspection.* The purpose of visual inspection is to locate faults without testing or measuring circuits. All visual signs should be observed.

(2) *Operational tests.* Operational tests may indicate the general location or trouble. In some cases, the tests will help to determine the nature of the fault. The equipment performance check list (TM 11-6625-320-12) is an operational test.

c. Localization. The tests listed below will aid in isolating the trouble. First, localize the trouble to a single stage or circuit, and then isolate the troubl\e within that circuit by voltage, resistance, and continuity measurements.

(1) *Voltage and resistance measurements.* Use resistor and capacitor color codes (fig. 44 and 45) to find the value of the components. Use voltage and resistance diagrams (fig. 17 and 18, ME-30A/U; 24-28, ME-30B/U; or 17, 34, 35, and 36, ME-30C/U) to find normal readings, and compare them with readings taken.

(2) *Troubleshooting chart.* The trouble symptoms listed in the chart (para 16d) 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 may be made to appear by tapping or jarring the equipment. Check the wiring and power connection of the voltmeter.

(4) *Signal substitution.* Signal substitution procedures enable the repairman to localize a trouble to a stage. A signal generator and an oscilloscope are units of test equipment that may be used in signal substitution procedures.

Caution: Do not change wiring or component location because the calibration may be affected.

14. Test Equipment Required

The following chart lists test equipment and the associated technical manuals used for troubleshooting the voltmeter.

Test equipment	Technical manual
Multimeter AN/URM-105	TM 11-6625-203-12
Voltmeter, Meter ME-30A/U or Voltmeters. Electronic ME-30B/U and ME-30C/U.	TM 11-6625-320-12
Audio Oscillator TS-382A/U . .	TM 11-2684A
Test Set, Electron Tube TV-7/U.	TM 11-6625-274-12

Section II. TROUBLESHOOTING VOLTMETER

Caution: Do not attempt removal or replacement of parts before reading the instructions in paragraph 20.

5. Checking B+ Circuits for Shorts

a. When to Check. When any of the folowing conditions exists, check for short circuits and clear the trouble before applying power.

(1) When the voltmeter is being serviced and the nature of the abnormal symptom is not known.

(2) When abnormal symptoms reported from operational tests indicate possible power supply trouble.

b. Conditions for Test. Prepare for a short-circuit test as follows:

(1) Remove the panel chassis from its case.

(2) Remove all tubes.

c. Measurement. Make the resistance measurement indicated in the following chart. If abnormal results are obtained, make the additional isolating checks outlined. When the faulty part is found, repair the trouble before applying power to the unit.

Short-circuit test		
Point of measurement	Normal inoication	Isolating procedure
Between junction of R64 and R60, terminal board TB2 (A, fig. 26), and ground (ME-30B/U).	Resistance reading of approximately 160K ohms.	If resistance is zero, check for shorted filter capacitor C37 (C30C in the ME-30A/U), or for short-circuited high voltage wiring of the power supply section.
Between junction of R58, R59 and R55 terminal board RB1 (A, fig. 18), and ground (ME-30A/U).		If resistance is low, check for a shorted screen or plate bypass capacitor in amplifier section or for shorted C40 (C30 in the ME-30A/U) in the power supply section.
Between junction of R60 and R64, terminal board E2B (B, fig. 35), and ground (ME-30C/U).		If the resistance is higher than normal, check for an open resistor in the power supply section, the plate and screen circuit of V1, or the grid biasing circuit of V1.

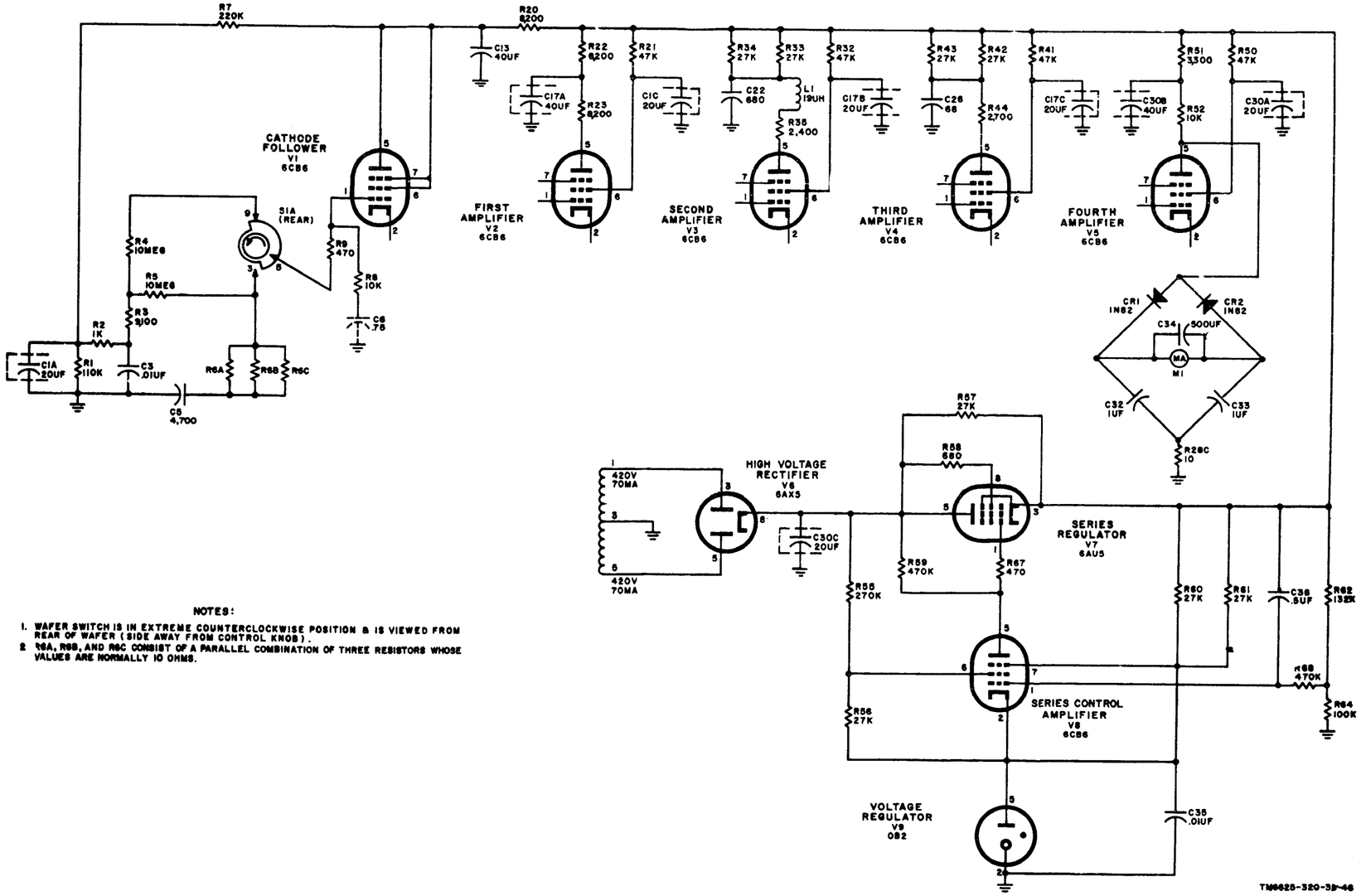
16. Localizing Troubles

a. General. In the troubleshooting chart *(d* below), procedures are out 1 i n e d for localizing troubles to a stage within the various sections of the voltmeter. Parts locations are indicated in figures 13-16, and 18, ME-30A/U; 20-23 and 25-28, ME-30B/U; or 30-36, ME-30A/U. A simplified schematic diagram of B+ voltage distribution is shown in figure 12, ME-30A/U; 19, ME-30B/U; or 29, ME-30C/U. Voltage and resistance measurements are shown in figures 17 and 18, ME-30A/U; 24-28, ME-30B/U; or 17, 34, 35, and 36 ME-30C/U. 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 state, use voltage and resistance measurements to isolate the trouble of a particular part.

b. Use of Chart. The troubleshooting chart is designed to supplement the operational checks detailed in TM 11-6625-320-12. 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, begin with item 1 of the equipment performance checklist (TM 11-6625-320-12) and proceed until a symptom of trouble appears.

Caution: If operational symptoms are not known, or if they indicate the possibility of short circuits within the voltmeter, make the short-circuit check described in paragraph 15 before applylng power to the unit.

c. Condition to Tests. All checks outlined in the chart are to be conducted with the voltmeter connected to a power source.



NOTES:

1. WAFER SWITCH IS IN EXTREME COUNTERCLOCKWISE POSITION & IS VIEWED FROM REAR OF WAFER (SIDE AWAY FROM CONTROL KNOB).
2. R6A, R6B, AND R6C CONSIST OF A PARALLEL COMBINATION OF THREE RESISTORS WHOSE VALUES ARE NORMALLY 10 OHMS.

Figure 12. ME-30A/U, B+ voltage distribution.

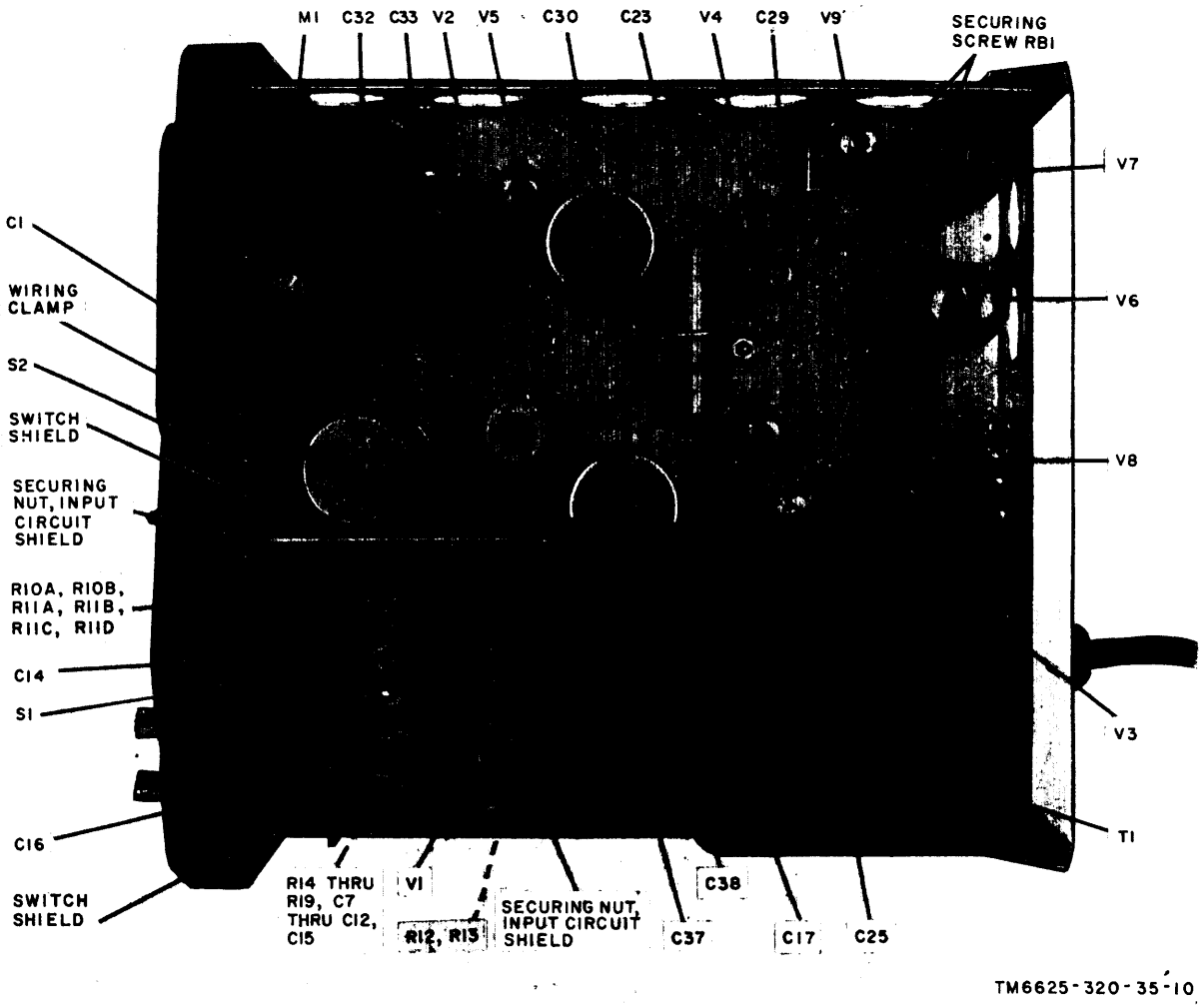


Figure 13. ME-30A/U, right side of chassis, case removed, location of parts.

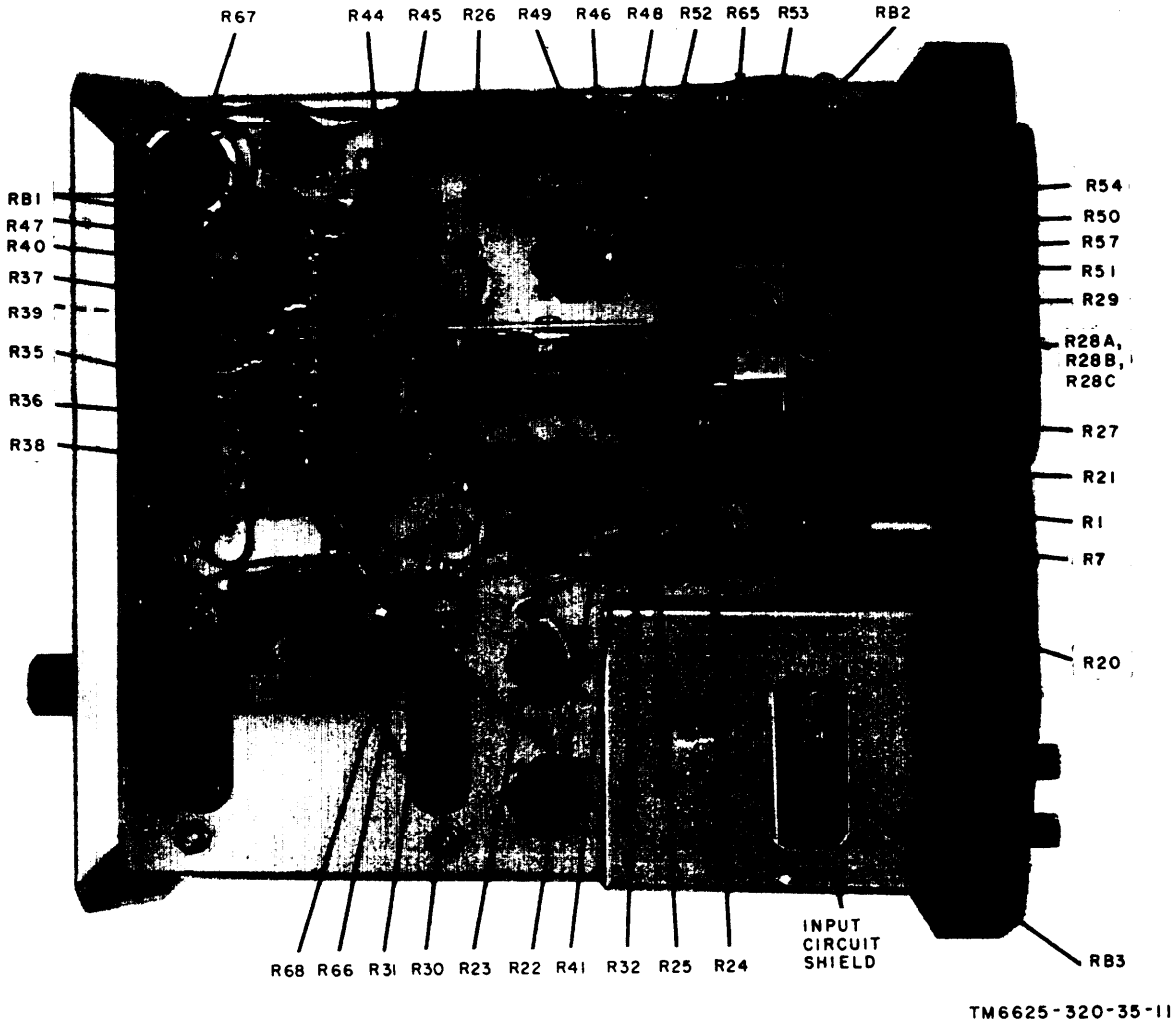


Figure 14. ME-30A/U, left side of chassis, case removed, location of parts.

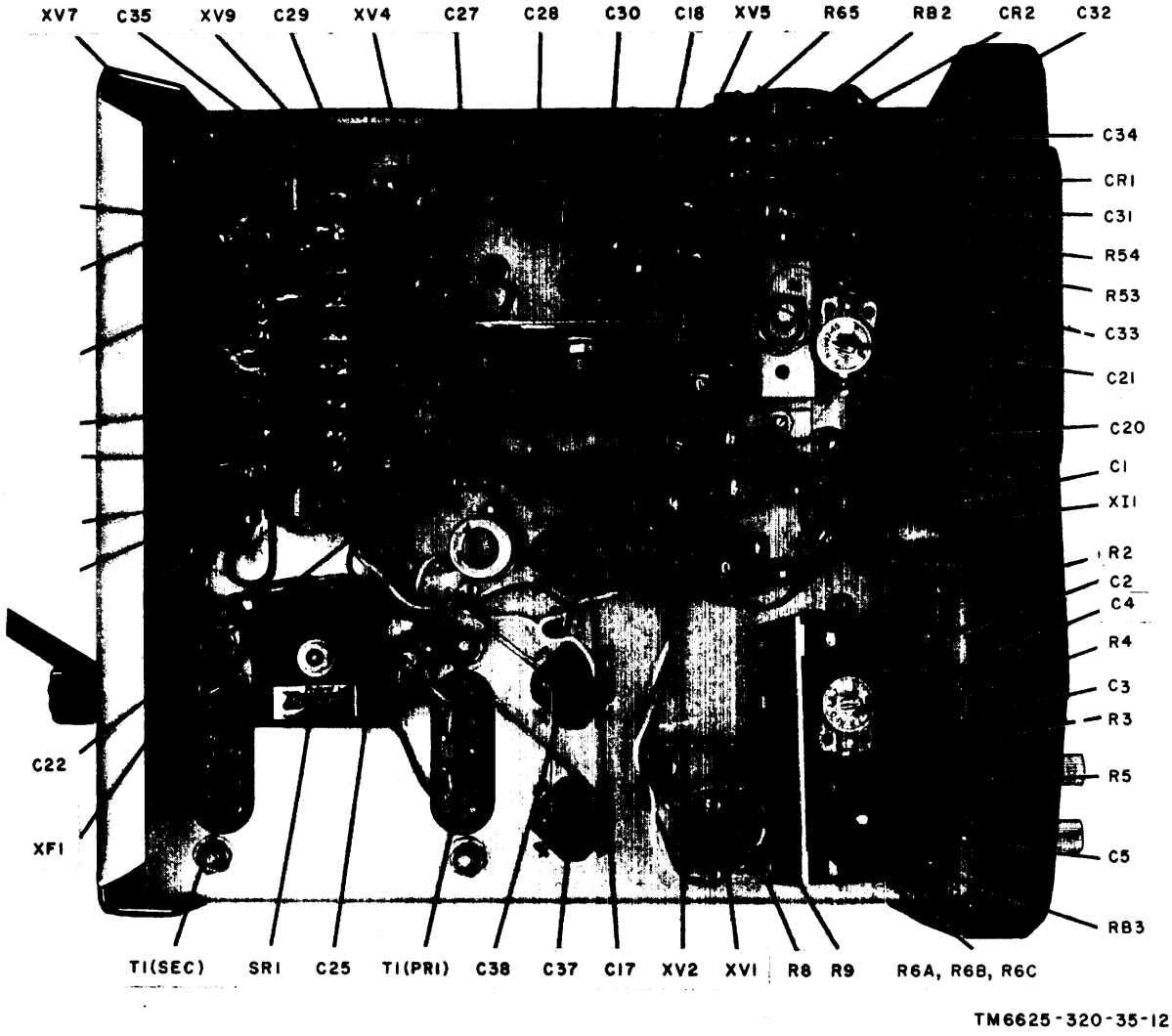


Figure 15. ME-30A/U, left side of chassis, case and input circuit shield removed, location of parts.

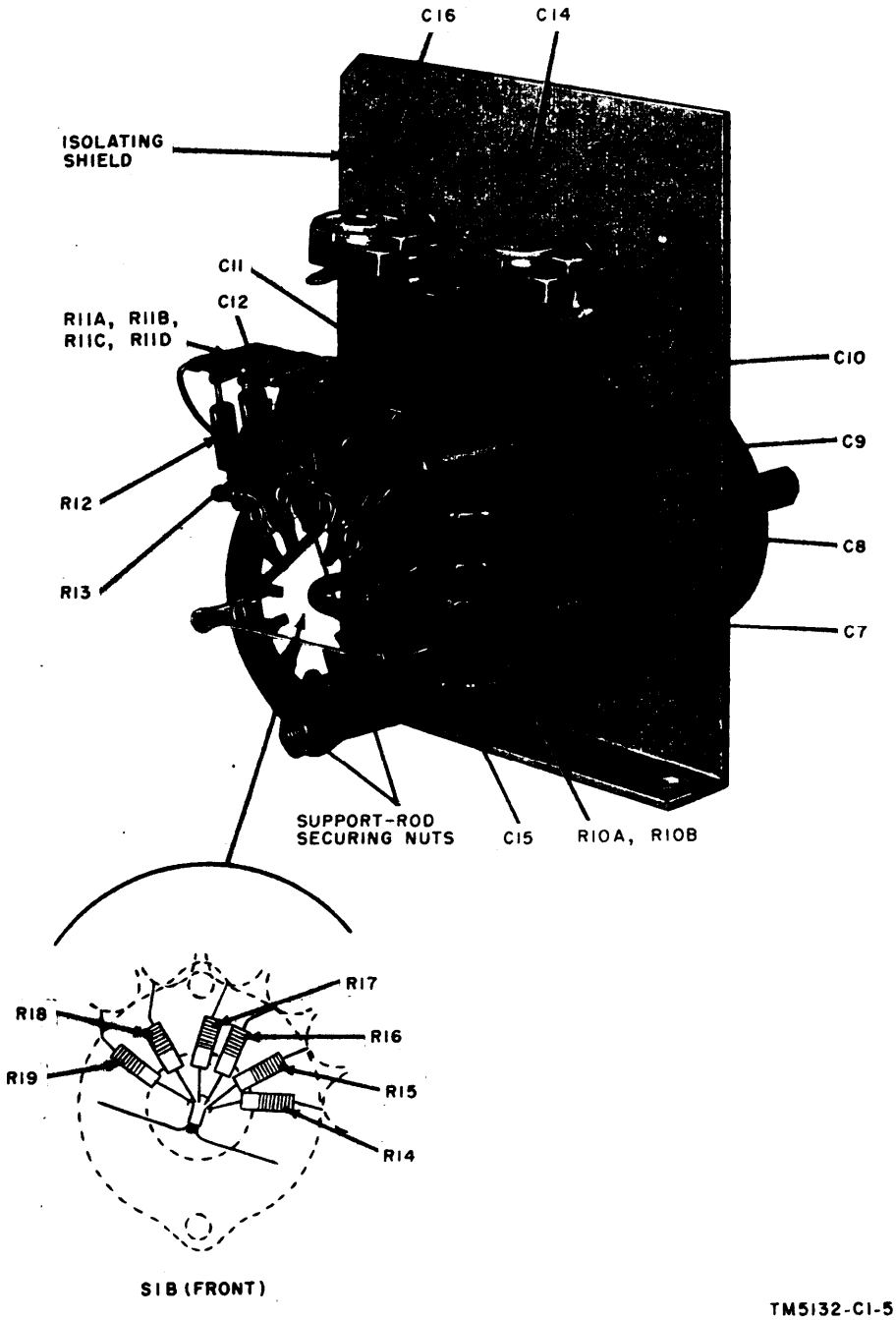
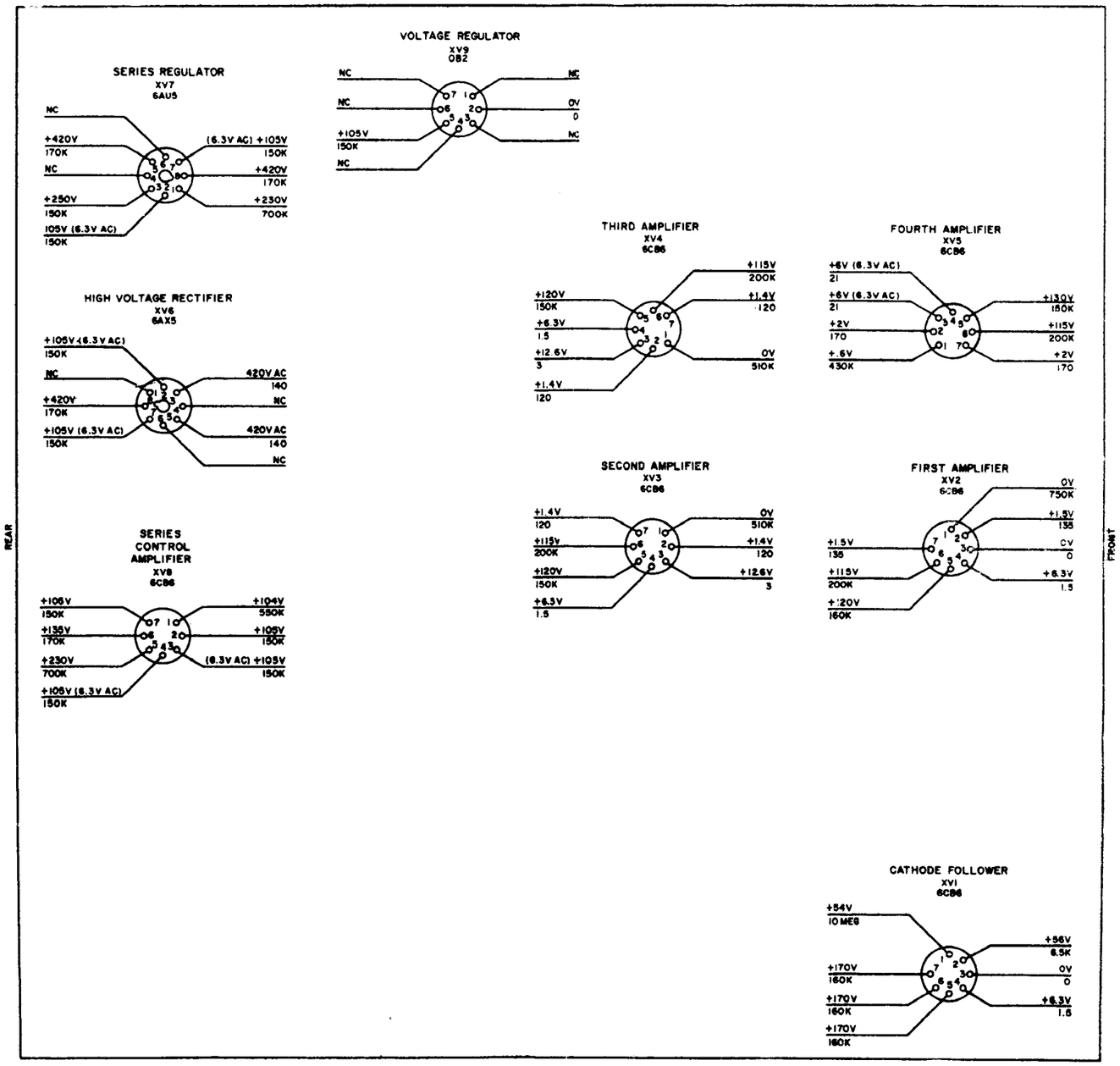


Figure 16. ME-30A/U, location of parts mounted on switch S1, rear view.



NOTES:

1. DC VOLTAGE MEASUREMENTS TO GROUND WITH 115V AC INPUT.
2. VOLTAGE READINGS ABOVE LINE, AND RESISTANCE READINGS BELOW LINE.
3. AC RECTIFIER PLATE VOLTAGES AND RESISTANCES ARE MEASURED TO GROUND. AC FILAMENT VOLTAGES ARE MEASURED BETWEEN TERMINALS INDICATED.
4. DC VOLTAGE MEASURED WITH VTVM.
5. NC INDICATES NO CONNECTIONS.
6. UNLESS OTHERWISE SPECIFIED, ALL RESISTANCE VALUES ARE IN OHMS.

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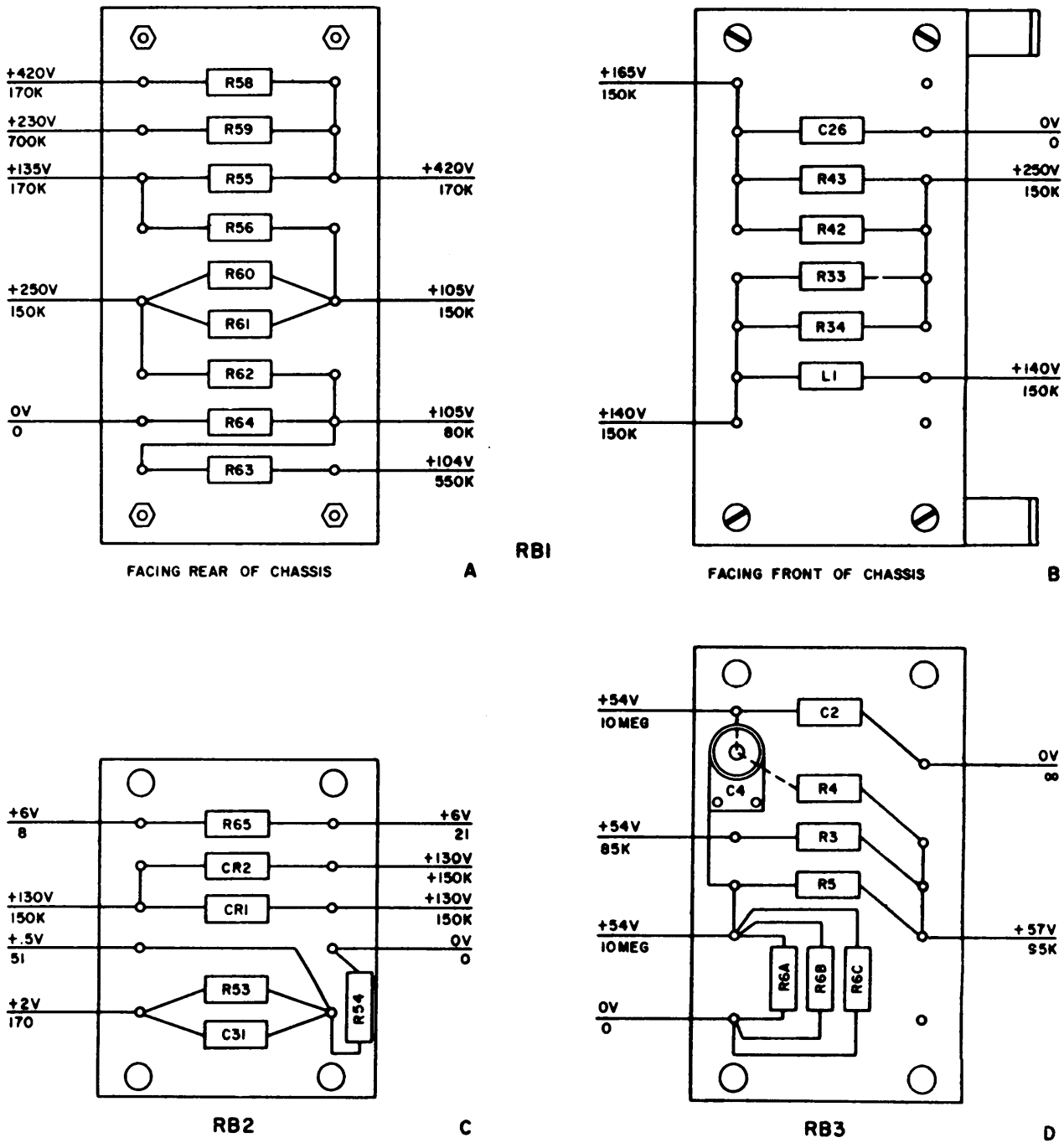
Figure 17. ME-30A/U and ME-30C/U, tube socket voltage and resistance diagram.



NOTES:

1. 115V AC INPUT.
2. ALL RESISTANCE VALUES ARE IN OHMS.
3. VOLTAGE READINGS ABOVE LINE AND RESISTANCE TO GROUND BELOW LINE.
4. VOLTAGES MEASURED WITH VTVM.

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Figure 18. ME-30A/U, terminal boards, parts location and voltage and resistance diagram.

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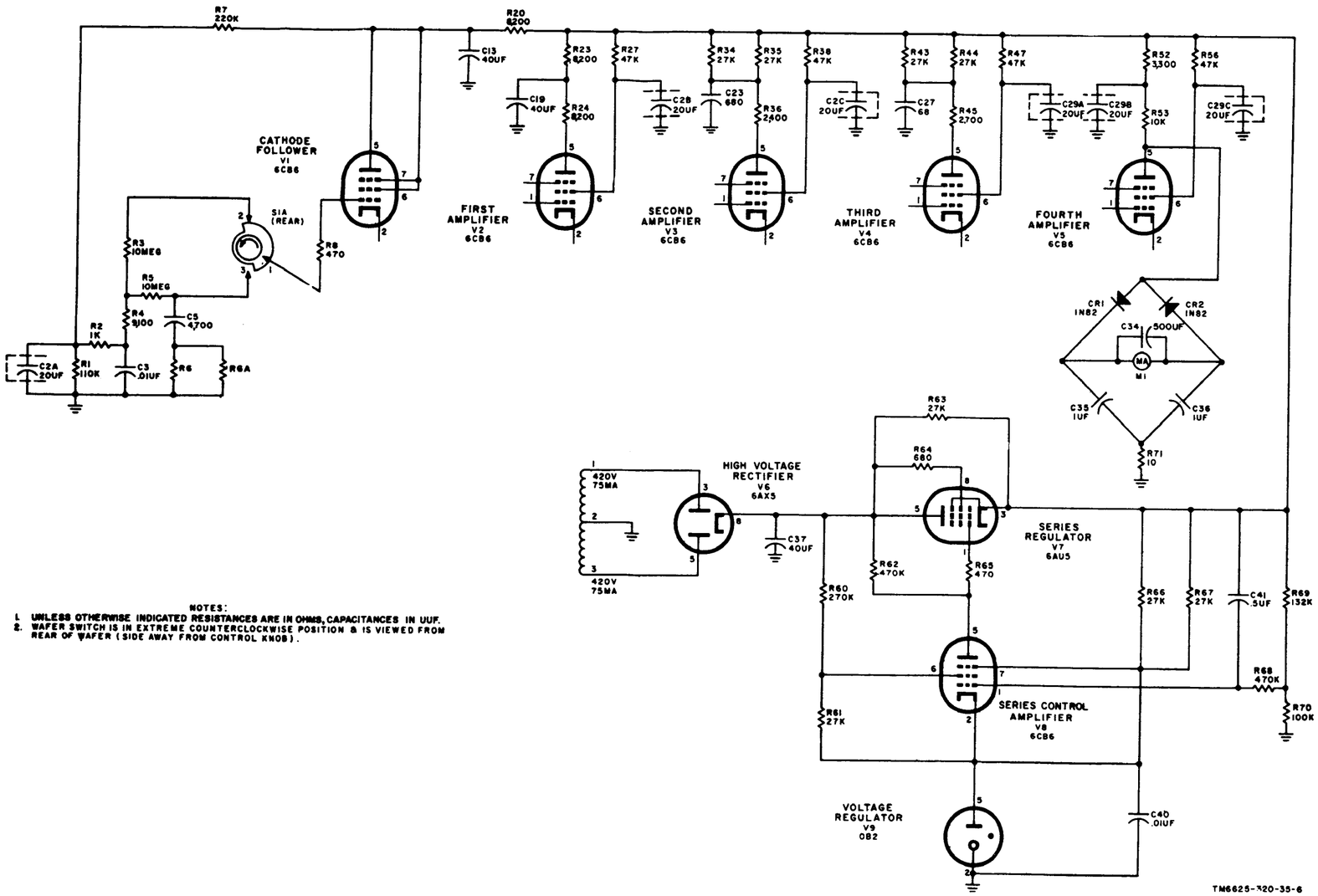

NOTES:
1. UNLESS OTHERWISE INDICATED RESISTANCES ARE IN OHMS, CAPACITANCES IN UUF.
2. WAFER SWITCH IS IN EXTREME COUNTERCLOCKWISE POSITION & IS VIEWED FROM REAR OF WAFER (SIDE AWAY FROM CONTROL KNOB).

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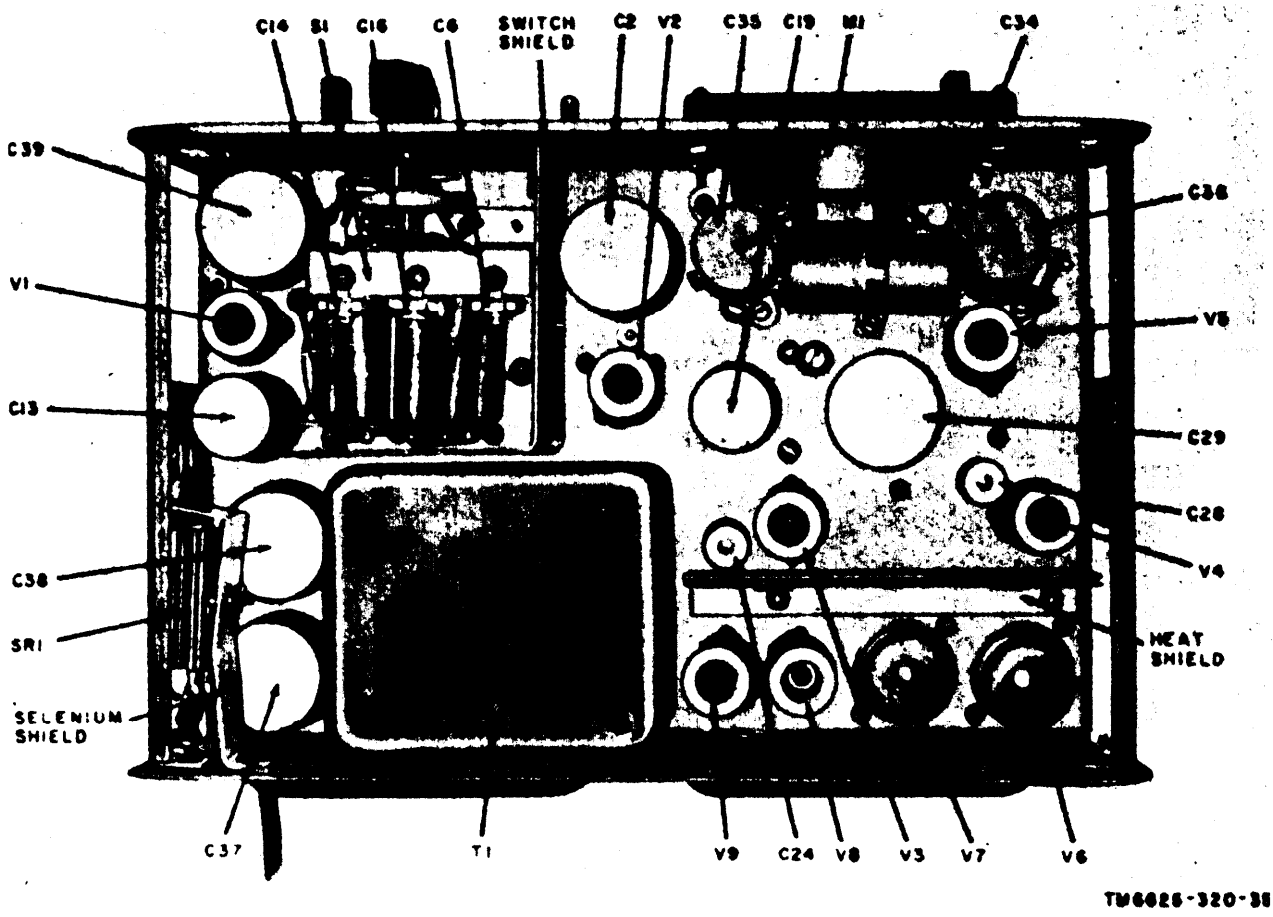


Figure 20. ME-30B/U, top of chassis, case removed, location of parts.

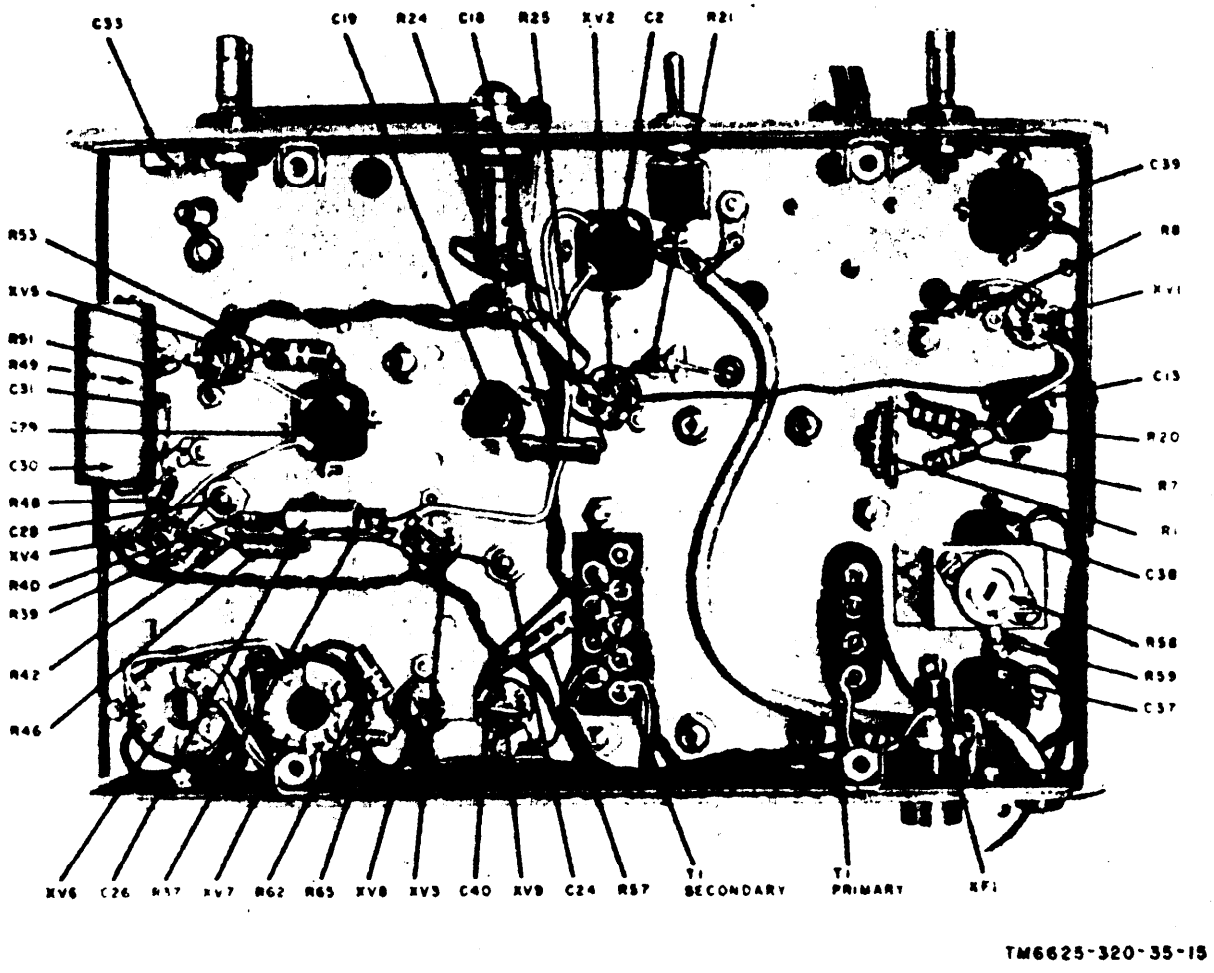


Figure 21. ME-30B/U, bottom of chassis, case, shields, and terminal boards removed, location of parts.

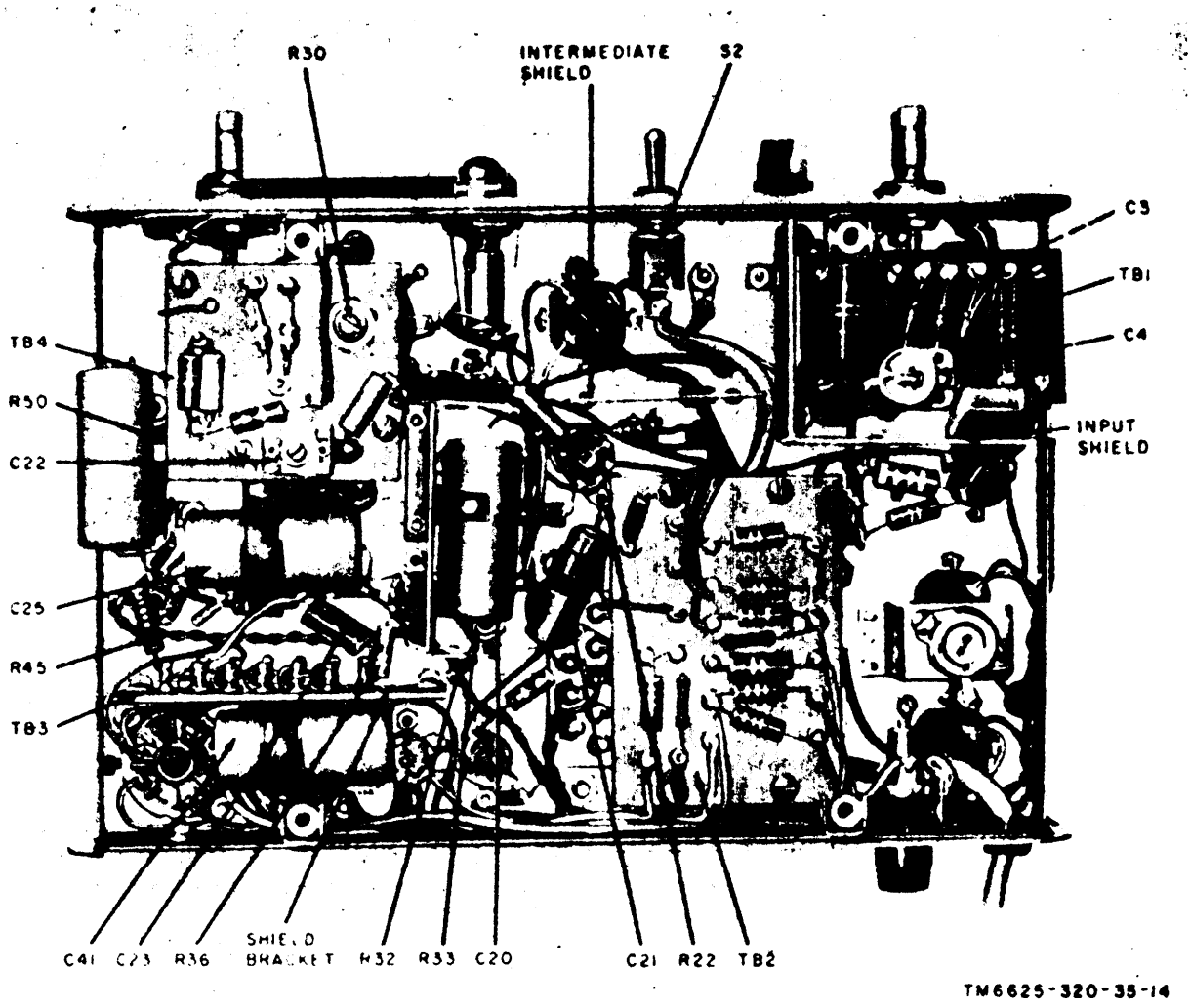
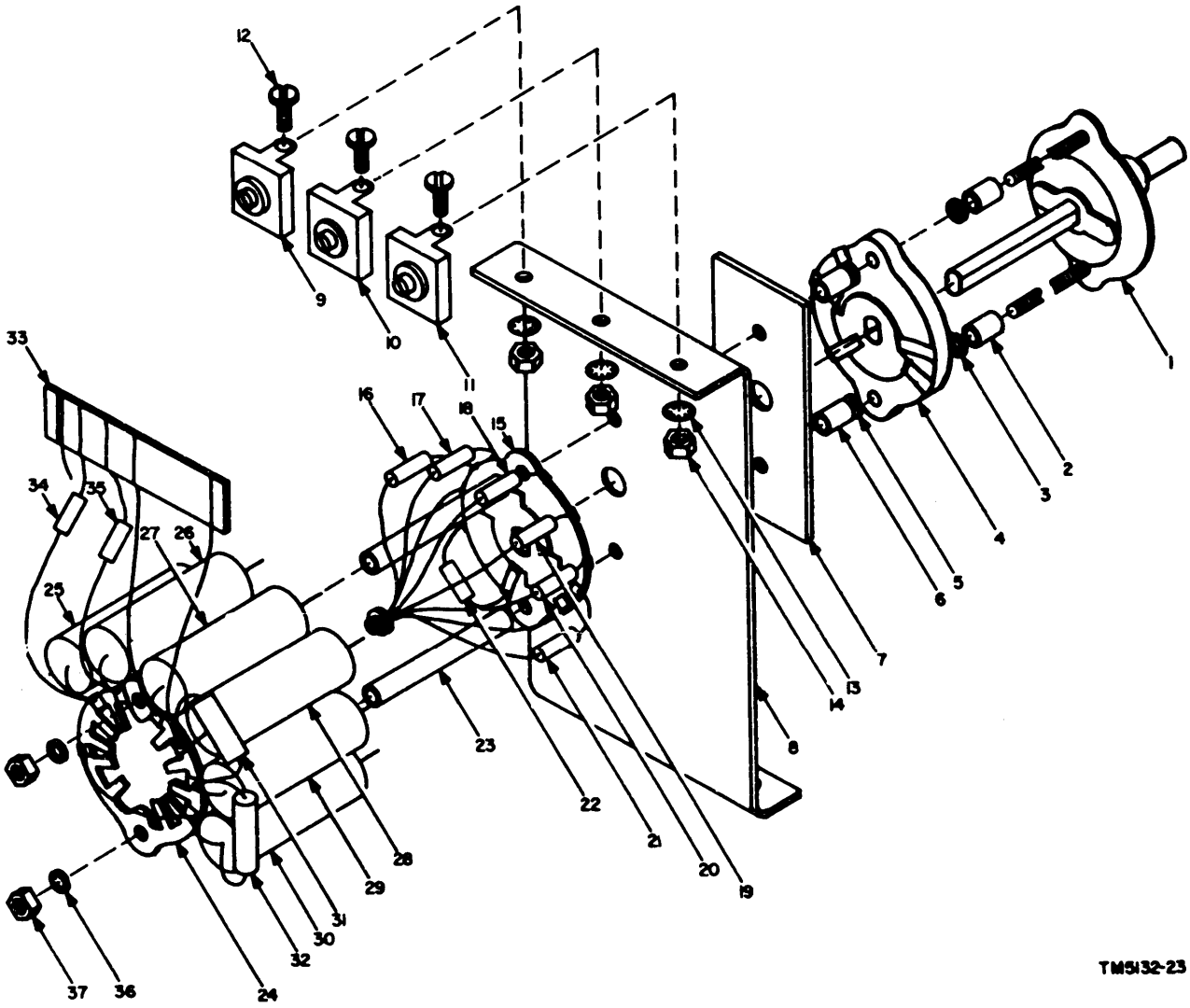


Figure 22. ME-30B/U, bottom of chassis, case removed, location of parts.



1 Rotary switch detent (part of switch S1)
2 Spacer, 3/16 in. by 1/4 in. lg, steel
3 Washer, No. 4 flat, steel
4 Switch section, S1A
5 Washer, No. 4 flat, fiber
6 Spacer, 3/16 in. OD by 1/4 in. lg, fiber
7 Switch shield
8 Switch mounting bracket
9 Capacitor C13
10 Capacitor C14
11 Capacitor C6
12 Screw, No. 6–32 by 3/16 in. lg
13 Lockwasher, No. 6, int tooth
14 Nut, No. 6–32 hexagonal
15 Switch section, S1B
16 Resistor R18
17 Resistor R19
18 Resistor R14
19 Resistor R15
20 Resistor R16
21 Resistor R17
22 Capacitor C15
23 Spacer 3/16 in. OD by 1–1/2 in. lg
24 Switch mounting section
25 Capacitor C7
26 Capacitor C8
27 Capacitor C9
28 Capacitor C10
29 Capacitor C11
30 Capacitor C12
31 Resistor R10
32 Resistor R11
33 Resistor R9
34 Resistor R12
35 Resistor R13
36 Lockwasher, No. 4 steel
37 Nut, No. 6–32 hexagonal

Figure 23. ME-30B/U, components mounted on switch S1, exploded view.

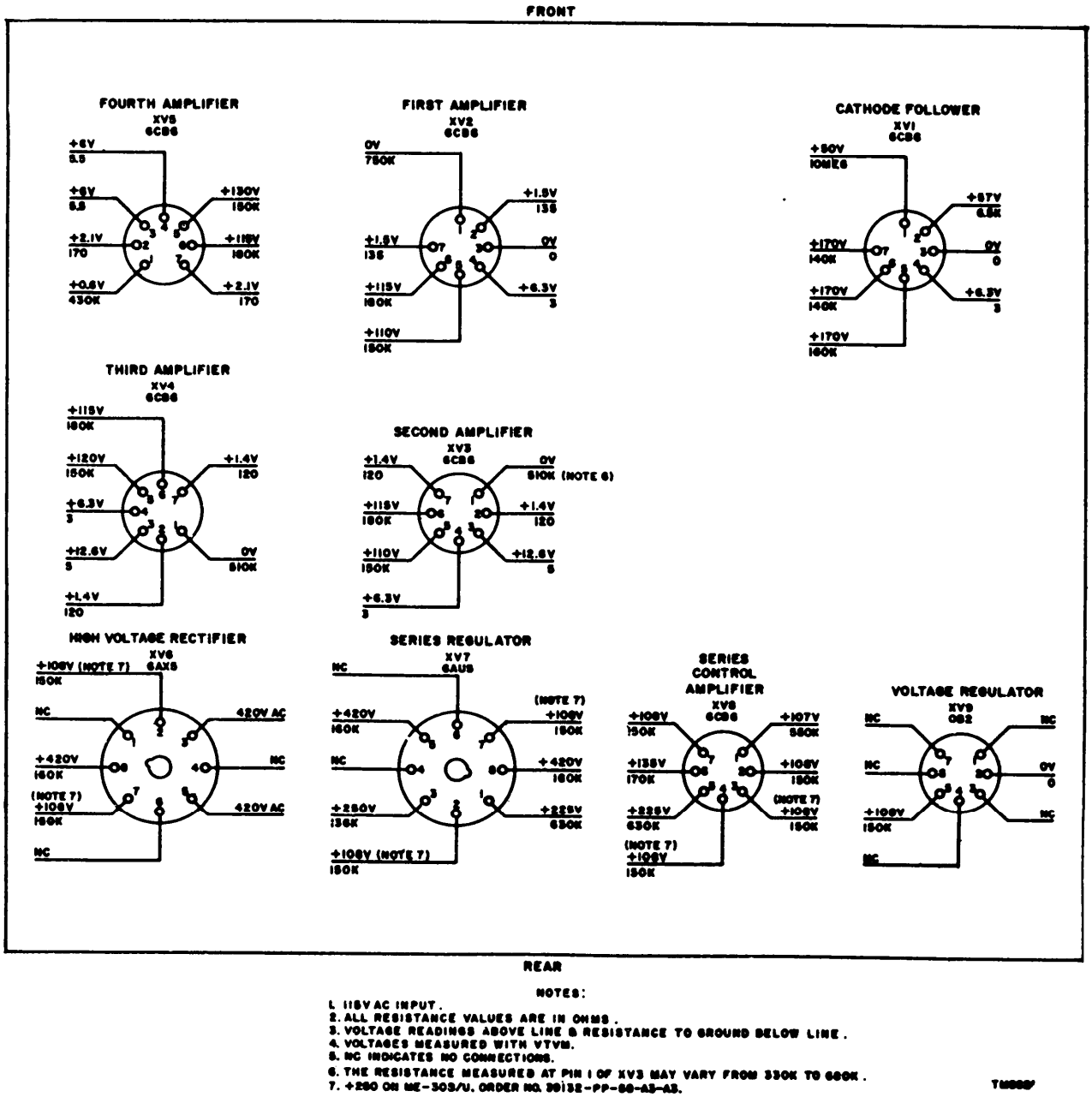


Figure 24. ME-30B/U, tube socket voltage and resistance diagram.

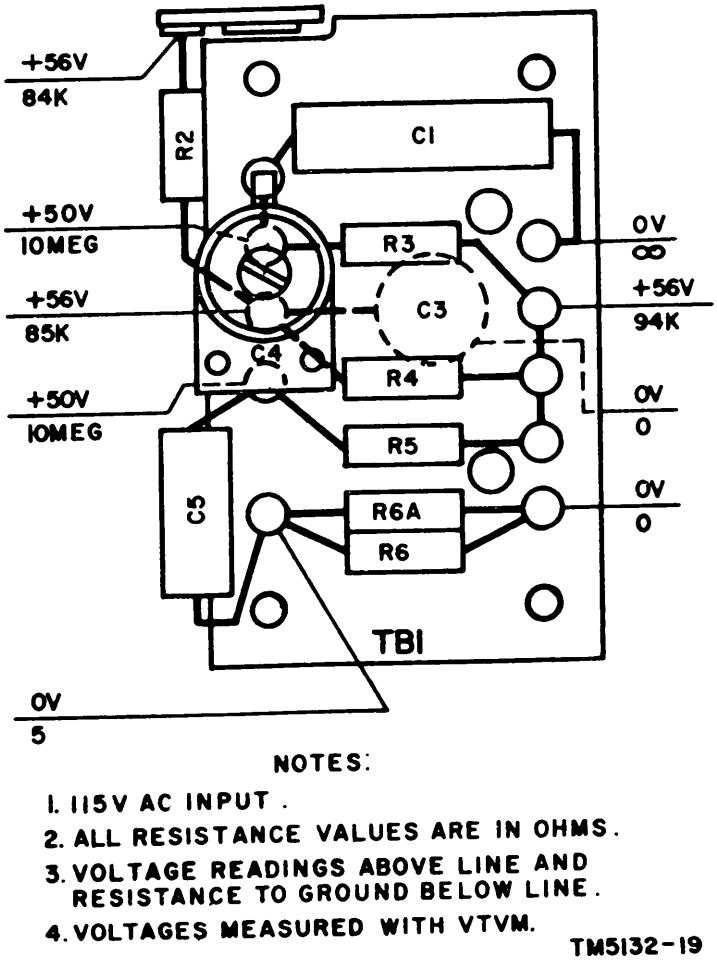


Figure 25. ME-30B/U, terminal board TB1, parts location and voltage and resistance diagram.

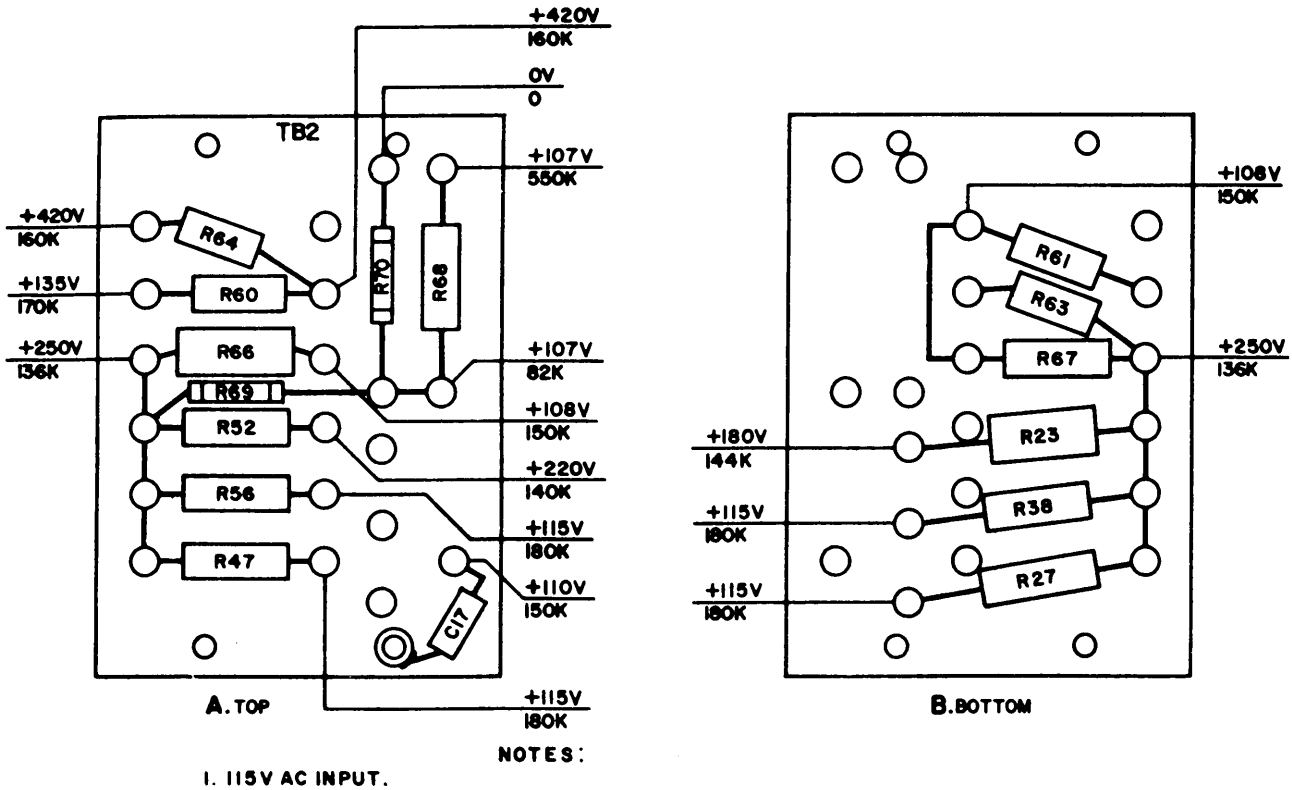


Figure 26. ME-30B/U, terminal board TB3, parts location and voltage and resistance diagram.

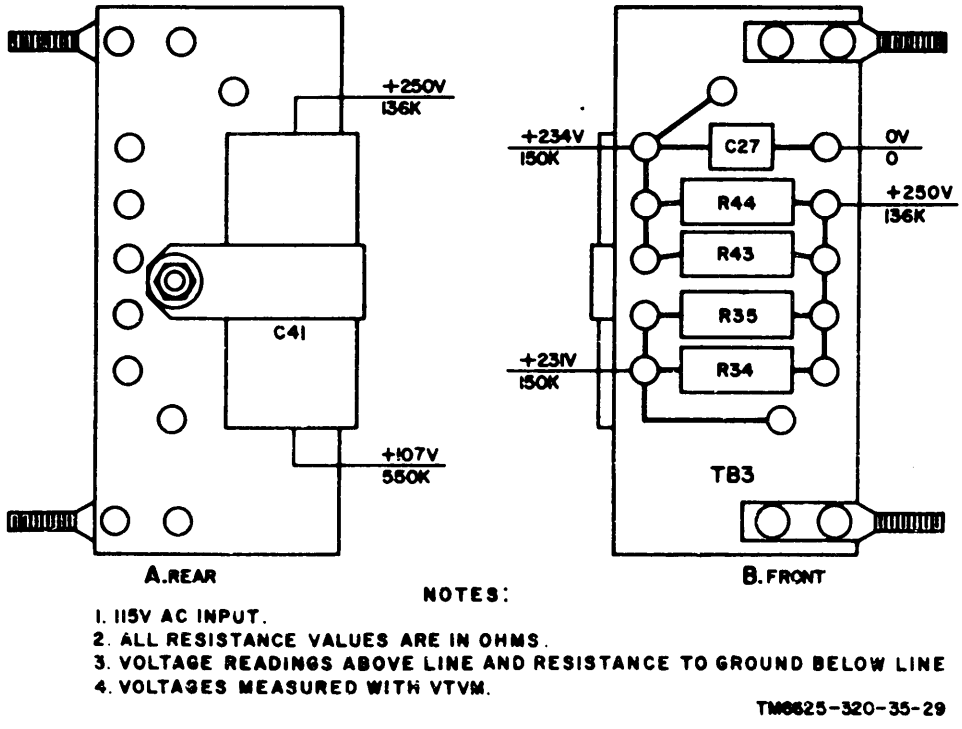


Figure 27. ME-30B/U, terminal board TB3, parts location and voltage and resistance diagram.

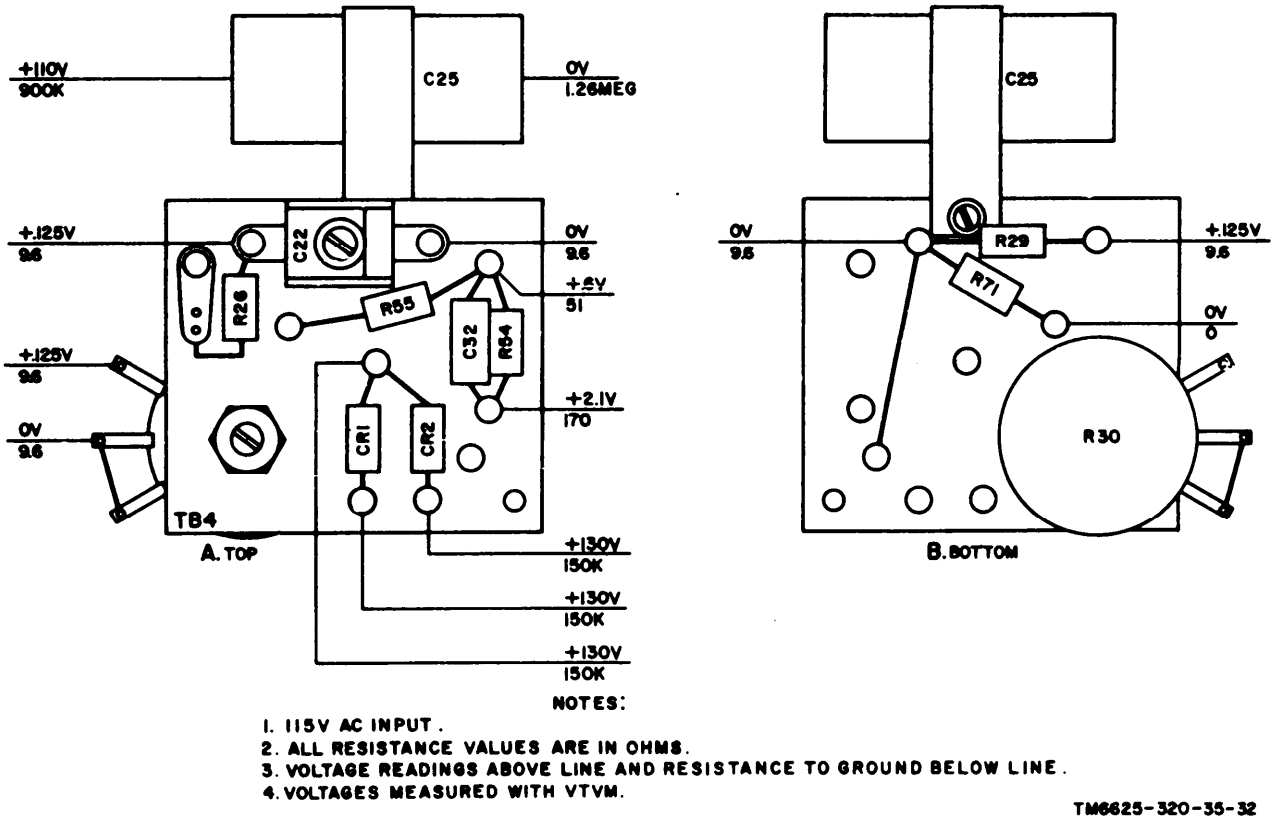
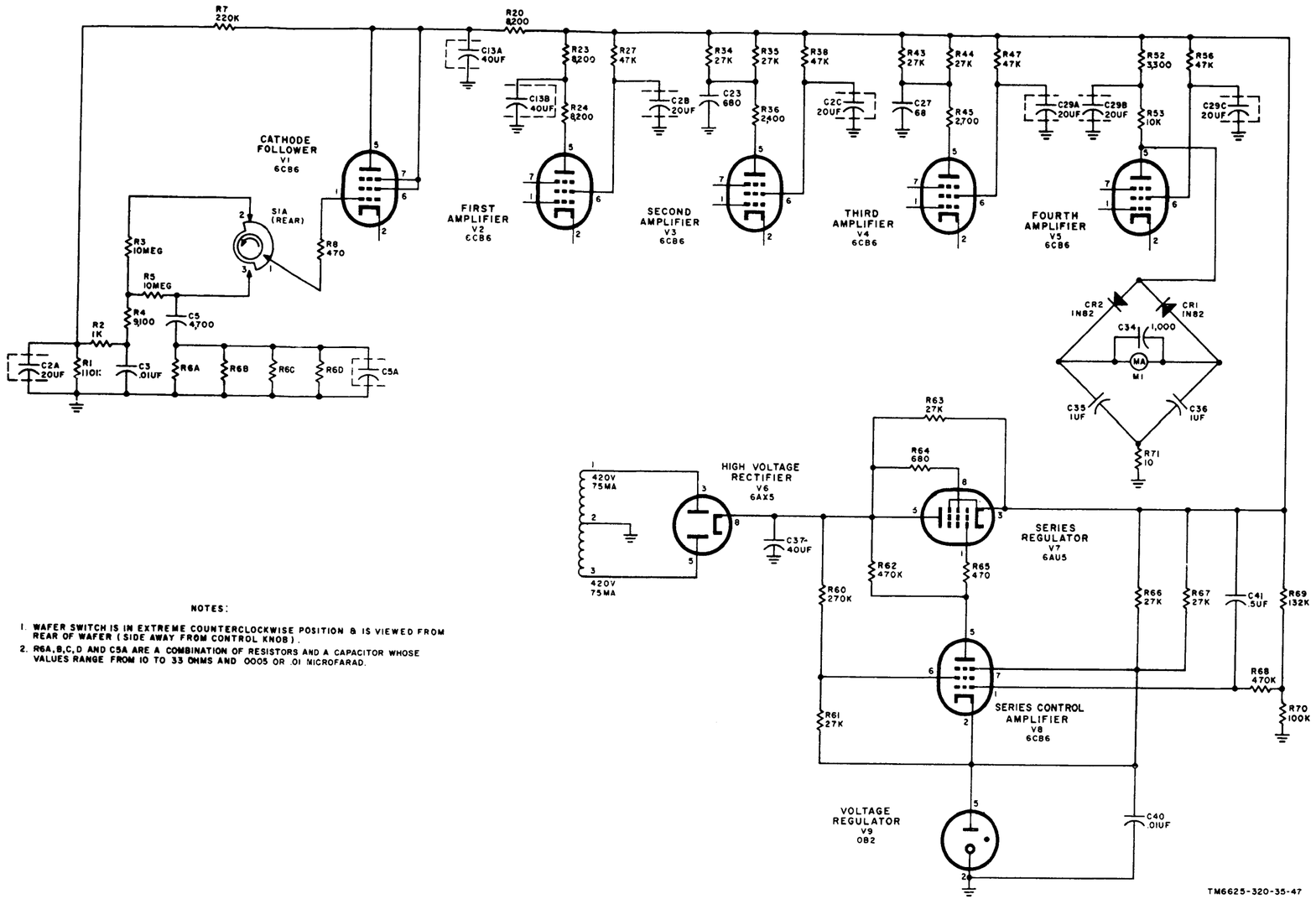


Figure 28. ME-30B/U, terminal board TB4, parts location and voltage and resistance diagram.



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NOTES:

1. WAFER SWITCH IS IN EXTREME COUNTERCLOCKWISE POSITION & IS VIEWED FROM REAR OF WAFER (SIDE AWAY FROM CONTROL KNOB).
2. R6A,B,C,D AND C5A ARE A COMBINATION OF RESISTORS AND A CAPACITOR WHOSE VALUES RANGE FROM 10 TO 33 OHMS AND .0005 OR .01 MICROFARAD.

Figure 29. ME-30C/U, B+ voltage distribution.

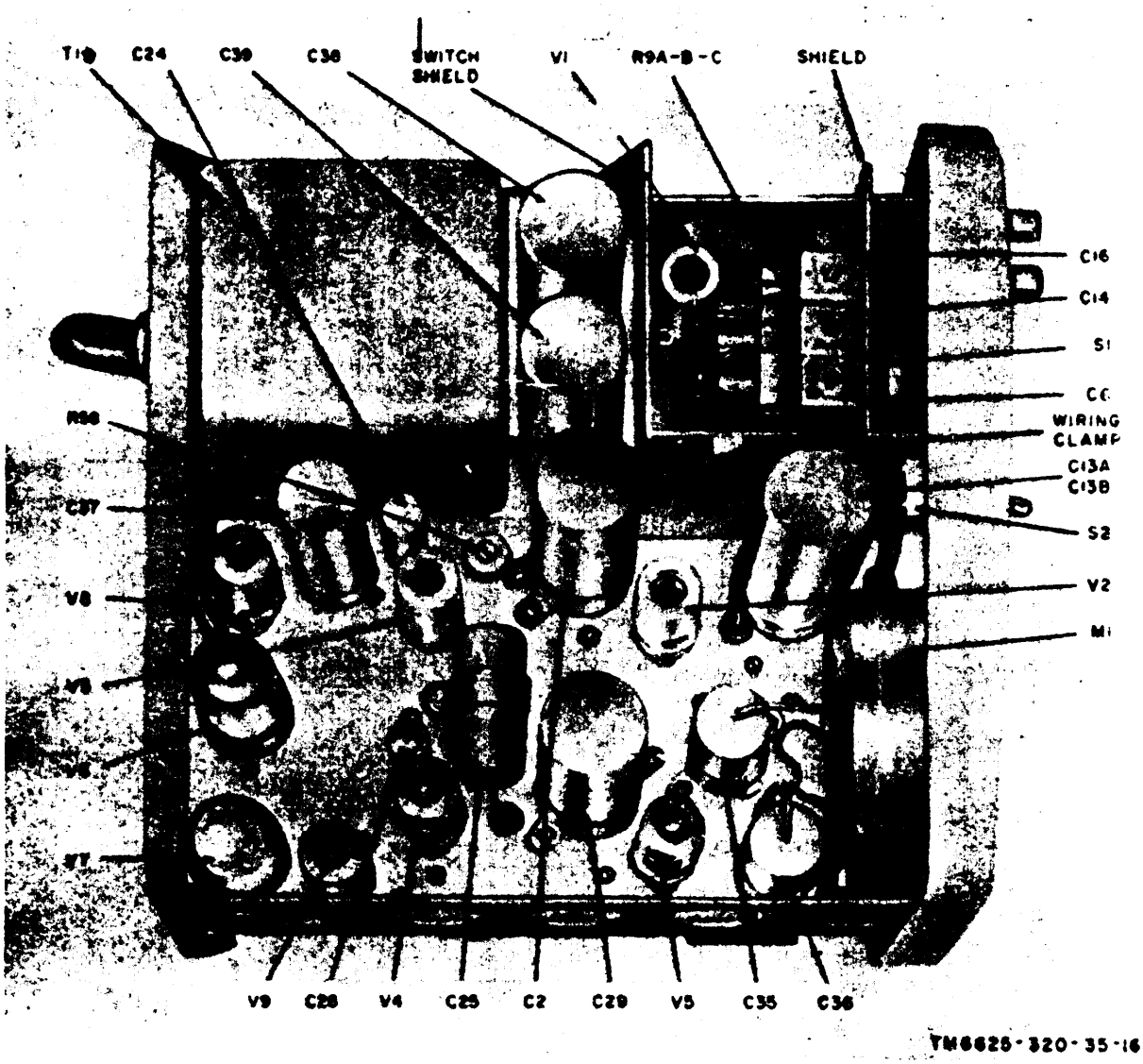


Figure 30. ME-30C/U, right side of chassis, case removed, location of parts.

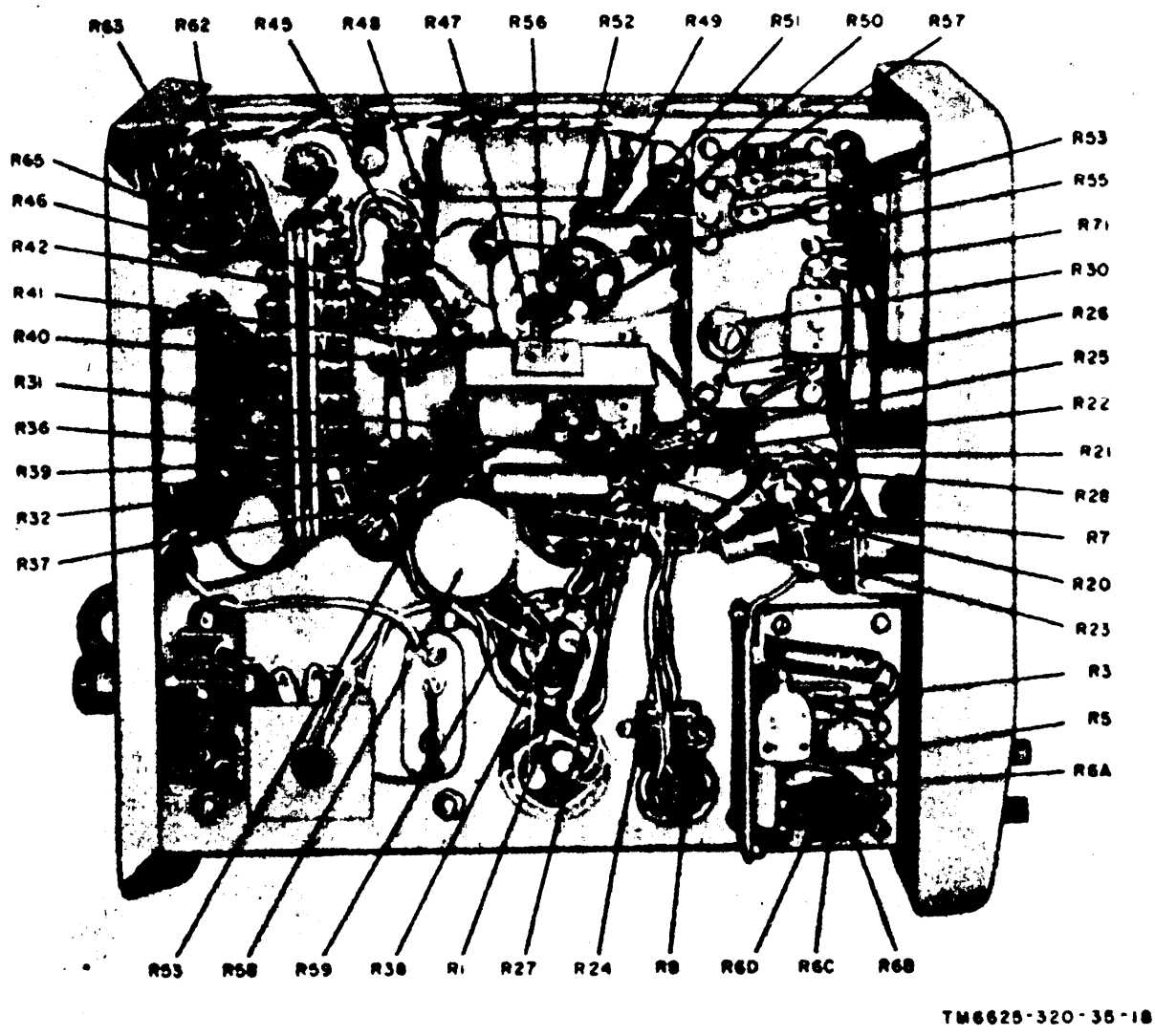


Figure 31. ME-30C/U, left side of chassis, case and input circuit shield removed, location of resistors.

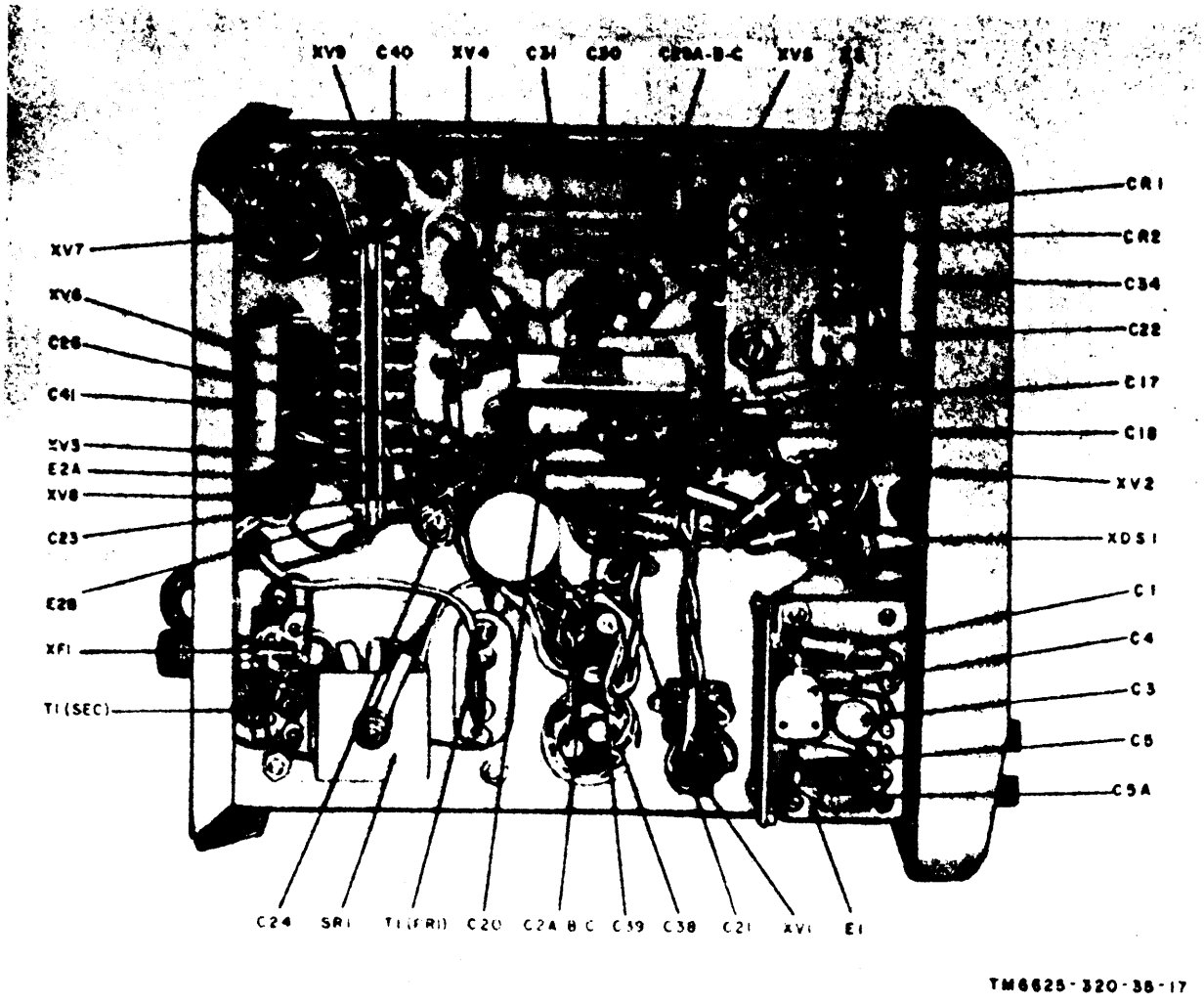
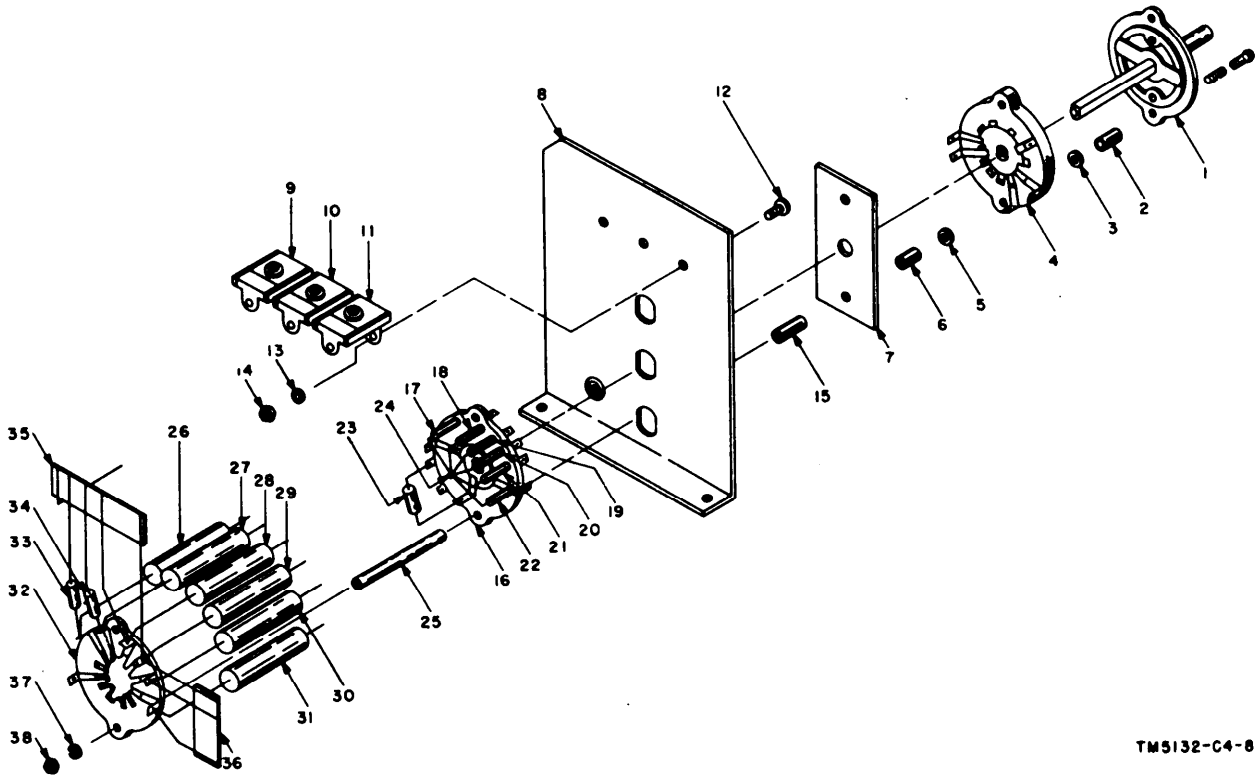


Figure 32. ME-30C/U, left side of chassis, case and input circuit shield removed, location of parts.



1 Rotary switch detent (part of switch S1)
2 Spacer, 3/16–in. by 1/4–in. lg
3 Washer, No. 4 flat, fiber
4 Switch section S1A
5 Washer, No. 4 flat, fiber
6 Spacer, 3/16–in. by 1/4–in. lg
7 Switch shield
8 Switch mounting bracket
9 Capacitor C16
10 Capacitor C14
11 Capacitor C6
12 Screw, No. 6–32 by 3/16–in. lg
13 Lockwasher, No. 6, internal tooth
14 Nut, No. 6–32 hexagonal
15 Spacer, 3/16–in. by 7/16–in. lg
16 Switch section S1B
17 Resistor R18
18 Resistor R19
19 Resistor R14
20 Resistor R15
21 Resistor R16
22 Resistor R17
23 Capacitor C15
24 Eyelet, 1/8–in. dia by .170–in. lg
25 Spacer, 3/16–in. by 1/12–in. lg
26 Capacitor C7
27 Capacitor C8
28 Capacitor C9
29 Capacitor C10
30 Capacitor C11
31 Capacitor C12
32 Switch mounting section
33 Resistor R12
34 Resistor R13
35 Resistor R9A thru R9D
36 Resistor R10A and R10B
37 Lockwasher, No. 4
38 Nut, No. 4–40

Figure 33. ME-30C/U, components mounted on switch S1, exploded view.

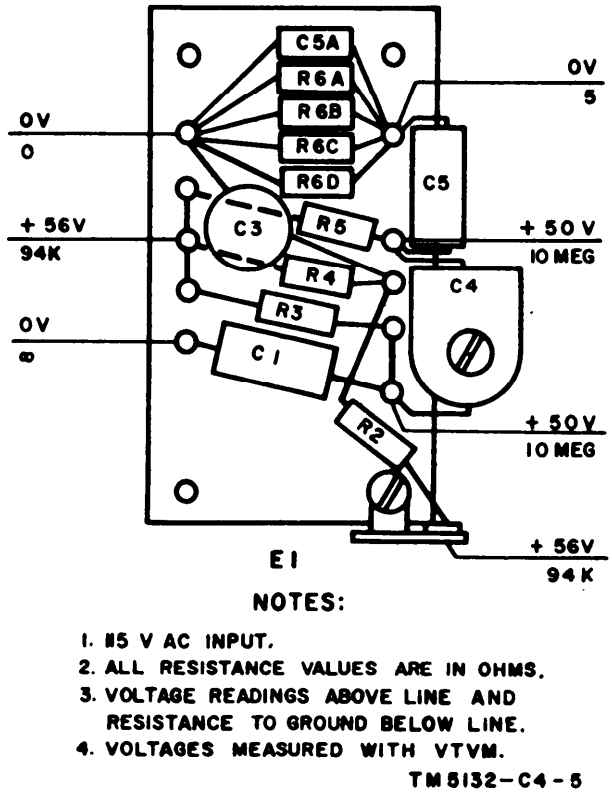


Figure 34. ME-30C/U, terminal board E1, parts location and voltage and resistance diagram.

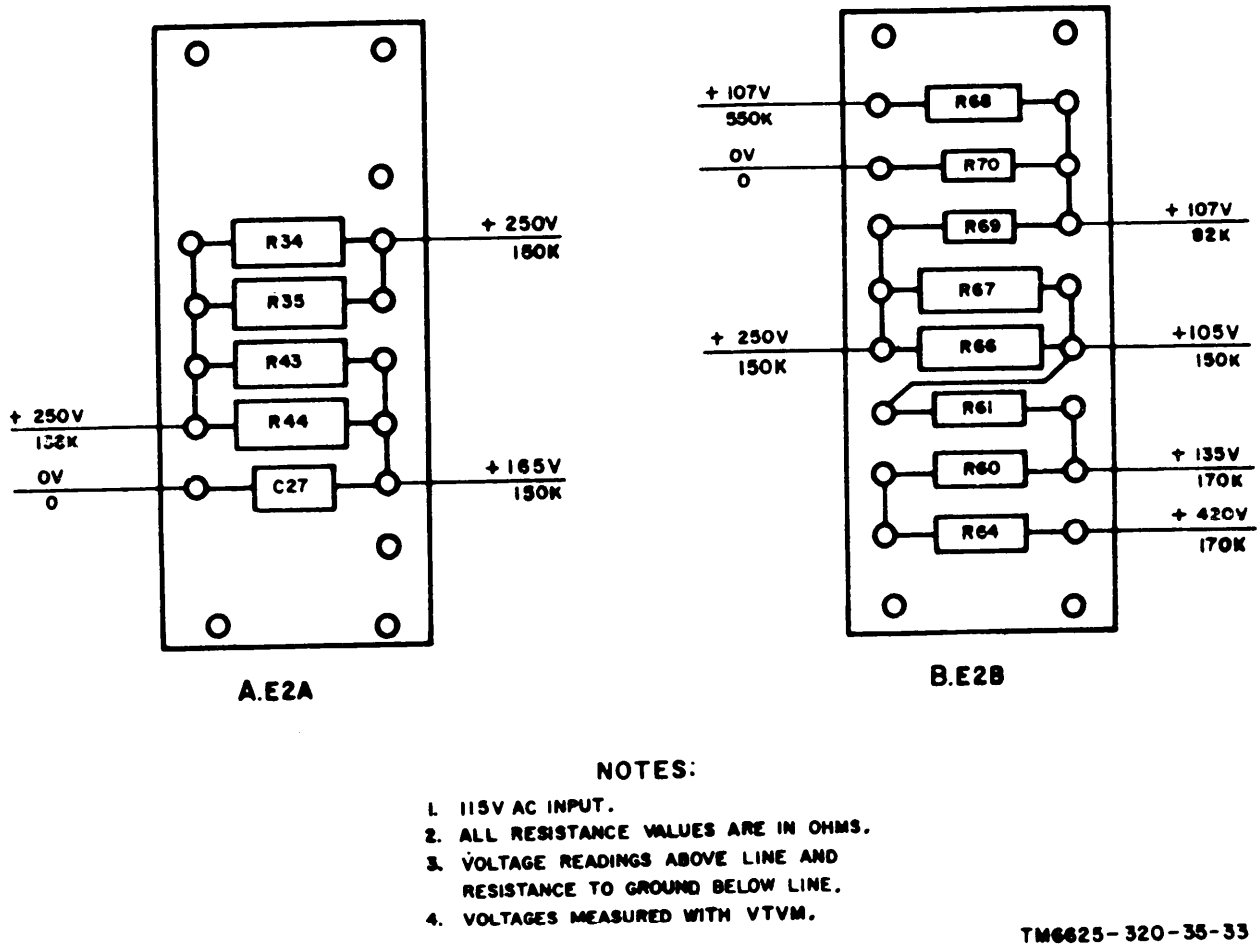


Figure 35. ME-30C/U, terminal boards E2A and E2B, parts location and voltage and resistance diagram.

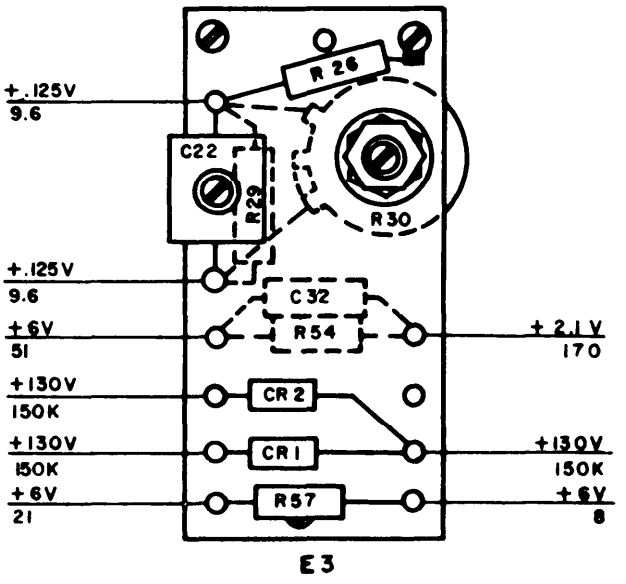


Figure 36. ME-30C/U, terminal board E3, parts location and voltage and resistance diagram.

d. Troubleshooting Chart.

Note. Perform the operations given in the equipment performance checklist (TM 11-6625-320-12) before using this chart, unless trouble has already been localized.

Item	Symptom	Probable trouble	Correction
1	Power indicator lamp does not light.	*a.* Fuse Fl burned out...	*a.* Replace fuse F1. If replaced fuse blows , check items 2 and 3 below.
		b. Power indicator lamp DSl (I1 in the ME-30A/U) defective.	*b.* Replace power indicator DS1 (I1 in the ME-30A/U).
		c. Defective ac power cable.	*c.* Check ac power cable: repair or replace, if necessary.
		d. Power switch S2 defective.	*d.* Check power switch S2, replace, if necessary.
		e. Transformer T1 primary winding terminals incorrectly connected.	*e.* Check connections of transformer T1 primary winding (TM 11-6625-320-12); restrap, if necessary.
		f. Transformer T1 defective.	*f.* Check transformer T1 (para 19); replace, if necessary.
2	Fuse F1 blows immediately when power switch S2 is operated to ON.	*a.* High voltage rectifier tube V6 shorted.	*a.* Check and replace rectifier tube V6 if necessary.
		b. Filament rectifier SR1 defective.	*b.* Check and replace filament rectifier SRI if necessary.

Item	Symptom	Probable trouble	Correction
		c. Short circuit in transformer T1 or in circuit Wiring.	*c.* Remove all tube, and check resistance of transformer windings (para 19). Replace transformer T1 if necessary. Check for short circuit (para 15).
3	Fuse F1 blows after power switch S2 has been operated to ON and tube filaments have warmed up.	Short in power supply or voltage regulator circuits.	Check for short circuit at cathode of rectifier tube V6 and at cathode of series regulator V7 (para 15). Replace defective filter capacitor or tube.
4	Power indicator lamp lights, voltmeter does not indicate on all ranges.	*a.* Power supply or voltage regulator circuits defective	*a.* Check, V6, V7, and V8 in turn (TM 11-6625-320-12 and para 25). Check high voltage secondary winding of transformer T1 (para 19). Replace defective component.
		b. Filament rectifier SR1 or circuit component defective.	*b. Check* for 12.6 volts dc across output of filament rectifier SRl (fig. 46, ME-30A/U; 48, ME-30B/U; or 50, ME-30C/U. Check resistors R58 and R59 in the ME-30A/U). If tubes Vl through V4 are not lighted, check for shorted capacitor C38 (C37 In the ME-30A/U). If tubes V1 and V2 are not lighted, check for shorted capacitor C39 (C38 in the ME-30A/U). Replace defective component.
		c. Crystal diode CRl or CR2 defective.	*c.* Check and replace crystal diode if necessary (para 20).
5	Meter indications normal on low voltage ranges (.001 to .3). Meter sensitivity distorted on high voltage ranges (1 to 300).	Capacitive voltage divider defective.	Check capacitors C4 and C5. Replace *defective* component.
6	Meter does not respond to highest or several of the highest voltage ranges in either group of VOLTS ranges (.001 to .3 or 1 to 300) but responds about uniformly to all other voltage ranges.	Open resistor R8A-R9D, R10, or R11 in the ME-30B/U; R10A , R10B, R11A-R11C, or R11D in the ME-30A/U; or R9A-R9D, R10A, or R10B in the ME-30C/U.	Check for defective resistor (fig. 16, ME-30A/U; 23, ME-30B/U; or 33, ME-30C/U), and replace if necessary.
7	Meter does not respond correctly on the two ranges located at opposite ends of switch S1 (para 5).	*a.* Faulty switch S1.	*a.* Check contacts of S1B (front) and replace switch S1 if necessary (para 21, ME-30A/U; 22, ME-30B/U; or 23, ME-30C/U). Check and recalibrate the voltmeter if switch S1 is replaced (para 26).
		b. Defective coupling circuit component.	*b.* Check components in coupling circuit corresponding to ranges that are not operating properly. Replace defective component (fig. 46, ME-30A/U; 48, ME-30B/U; or 50, ME-30C/U.
		(1) *ME-30A/U and ME-30C/U.* R12, C12, or R19; R13, C11, or R18; C10 or R17; C9, R16, or C16; C8, R15, C14, or C15; C7 or R14.	

Item	Symptom	Probable trouble	Correction
		(2) ME-30B/U.R12, C7, or R18; R13. C8, or R19; C9 or R14; C10, R15, or C14; C11, R16, C16, or C15; C12 or R17.	
8	Meter indicates nearly one-half of correct value on all ranges.	Crystal diode CR1 or CR2 defective.	Check crystal diodes CR1 and CR2 and replace if necessary (para 20).
9	Meter indication unstable or erratic.	*a.* Power supply, voltage regulator, or B+ voltage distribution circuit defective.	*a.* Check filaments and B+ voltage distribution circuit (fig. 12, ME-30A/U; 19, ME-30B/U; or 29, ME-30C/U; and para 25). Replace defective component.
		b. Amplifier tube V1, V2, V3, V4, or V5 defective.	*b.* Check tubes V1 through V5 for microphonics or noise. When it is necessary to replace a defective tube, check and recalibrate the voltmeter (para 26).
		c. Restistor or capacitor defective.	*c.* Determine which stage is responsible for noise by signal Substitution (para 17). Locate and replace defective component.

17. Signal Substitution

a. General. Signal substitution procedures help to localize troubles to a section or stage in the voltmeter. An externally generated signal is substituted for the signal normally present in each stage during measurements. The test equipment required for the tests in *b* and *c* below is listed in paragraph 14.

Caution: Do not push wiring or components out of place, because broken connections may result or the calibration of the voltmeter may be altered.

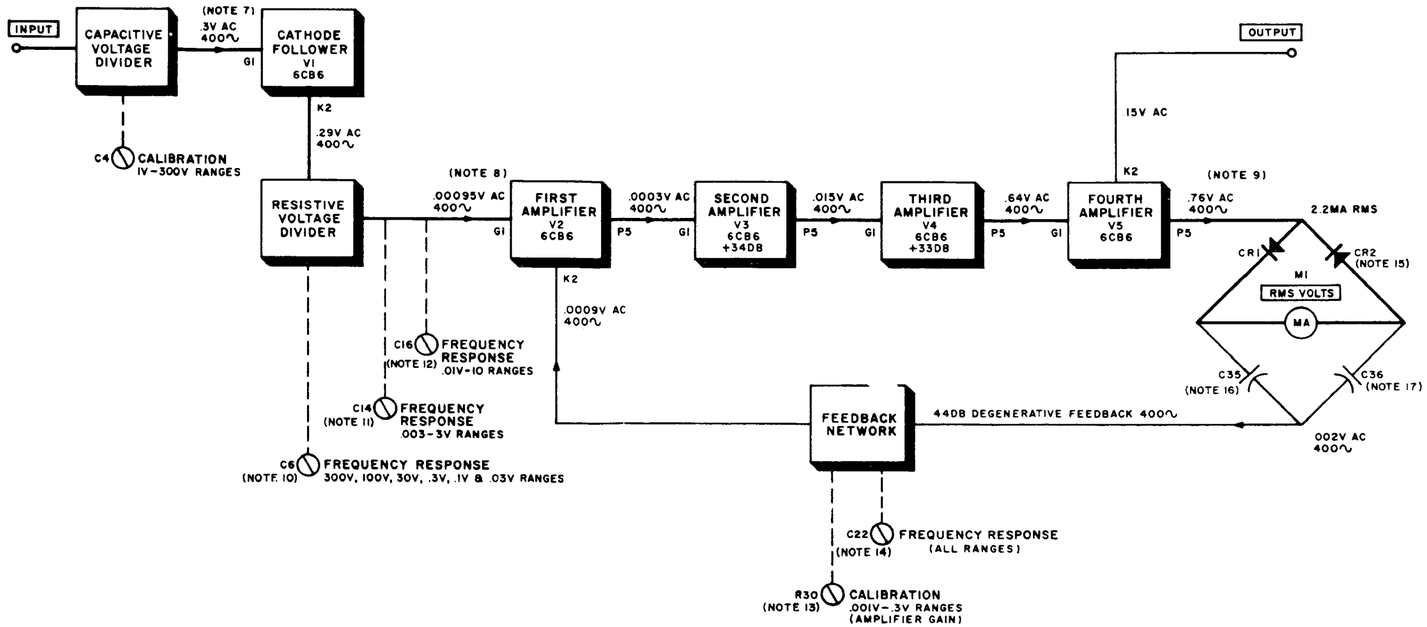
b. Hookup Procedure. When applying a signal to the grid of V1 or V5, be sure that the the audio oscillator does not present a dc path to ground. To prevent this, use a 0.05-microfarad or larger capacitor in series with the hot side of the audio oscillator output. To determine whether the stage under test and the succeeding stages are functioning correctly, the signa1s from preceding stages should be minimized by shorting the control grid of the stage preceding the stage under test to ground with a clip lead. Always make connections to control grids at the end of the parasitic oscillation suppressor resistor most distant from the grid. The parasitic oscillation suppressor resistors are R8, R21, R33, R42, and R51 in the ME-30B/U and ME-30C/U; and R9, R24, R31, R40, and R49 in the ME-30A/U. Be very careful to minimize stray pickup. The voltmeter is particularly sensitive to stray pickup because of its high sensitivity and wide bandpass.

c. Reference Information. Signal substitution can be easily performed using meter Ml of the voltmeter as an output indicator. Figure 37 indicates the approximate voltages at a frequency of 400 cps required at the input to each stage to obtain a full-scale deflection, the approximate gain of the second and third amplifier stages in db, and the relative location of the variable controls for calibration and adjustment of frequency response.

18. Isolating Trouble Within Stage

When the trouble has been localized to a stage, either through operational checks (TM 11-6625-320-12) or signal substitution (para 17), use the following techniques to isolate the defective part:

a. Test the tube involved, either in the tube tester or by substituting a similar type



NOTES:

1. HEAVY LINE INDICATES SIGNAL CIRCUIT.
2. LIGHT LINE INDICATES AUXILIARY CIRCUITS OR CONTROLS.
3. VARIABLE CONTROLS ARE INDICATED BY CIRCLE AND DOTTED LINE DROPPED FROM POINT IN CIRCUIT WHERE CONNECTED. LINE THRU CIRCLE INDICATES SCREWDRIVER CONTROL.
4. LETTERS AND NUMBERS OUTSIDE TUBE BLOCKS INDICATE TUBE ELEMENT AND SOCKET PIN
5. INDICATED GAINS AND VOLTAGES ARE NOMINAL VALUES.
6. CONDITIONS OF VOLTAGE MEASUREMENT:
   A. INPUT SIGNAL .3V RMS 400∿.
   B. RANGE SELECTOR SWITCH IN .3V POSITION.
   C. BETWEEN INDICATED POINT AND GROUND. RMS VALUE GIVEN.
7. VOLTAGE WILL VARY WITH LEVEL OF INPUT SIGNAL AND POSITION OF RANGE SELECTOR SWITCH, AND SHOULD NOT EXCEED .3V AT 400∿.
8. SIGNAL MEASUREMENTS IN FIRST STAGE NOT PRACTICABLE DUE TO EXTREMELY LOW SIGNAL LEVEL AND LARGE DEGENERATION APPLIED TO TUBE V2.
9. CAUTION: WHEN CHECKING TUBE V5 AVOID SHORTING CRYSTAL DIODES CR1 AND CR2 TO GROUND WITH POWER TURNED ON. THE DIODES WILL BURN OUT IF THEIR TERMINALS ARE SHORTED TO GROUND.
10. NO EQUIVALENT CAPACITOR IN THE ME-30A/U ONLY.
11. C16 IN THE ME-30A/U ONLY.
12. C14 IN THE ME-30A/U ONLY.
13. R29 IN THE ME-30A/U ONLY.
14. C21 IN THE ME-30A/U ONLY.
15. CR1 AND CR2 REFERENCE DESIGNATIONS ARE INTERCHANGED ON THE ME-30A/U ONLY.
16. C32 ON THE ME-30A/U ONLY.
17. C33 ON THE ME-30A/U ONLY.

TM6625-320-35-19

Figure 37. Signal substitution in voltmeter, block diagram.

CHAPTER 3
REPAIRS, CALIBRATION, AND ADJUSTMENT

Section I. REPAIRS

20. General Parts Replacement Techniques

Most of the parts of the voltmeter can be reached and replaced easily without special procedures. The following precautions apply specifically to this voltmeter.

a. Do not remove tubes V1 through V4 from their sockets with power applied. Do not attempt to operate the voltmeter unless these tubes are in their sockets. If one of the tubes is missing or has an open filament, an excessive voltage will appear across the filament that parallels the tube.

Note. Equipments were procured with some standard tubes. When replacement is required, replace standard tubes with preferred types.

b. When servicing the voltmeter, do not disturb the placement of parts, because the calibration will be affected.

c. Do not disturb any of the alignment adjustments, unless it has definitely been determined that the trouble is caused by an adjustment.

d. Several parts used in the voltmeter have smaller tolerances than those used in most test equipment. Resistors R9A through R9D, R10, and R11 in the ME-30B/U; resistors R9A through R9D, R10A, and R10B in the ME-30C/U; and resistors R11A through R11D, R10B, and R10A in the ME-30C/U are all precision components. If these resistors require replacement, replace with resistors of the *exact* value and type as those removed. If different values are used or components are moved, the calibration of the voltmeter will be inaccurate or the frequency response will be altered and adjustments will be required. Be careful to replace components as nearly as possible in the same positions occupied by the original components.

e. Some components are mounted on switch S1. The complete range selector switch assembly must be removed to reach these components for replacement (para 21, 22, and 23).

f. In some cases of repair, movement of a terminal board may be necessary. Do not disconnect components from terminal boards unless it is absolutely necessary. Tilting the board may be sufficient movement to perform the repair. Under these conditions, it is necessary to only disconnect those components which permit tilting of the terminal board.

g. The range selector switch knob is held by a setscrew through the center of the knob. When removing a knob, note the position of the pointer and shaft and replace the knob in the same position.

h. When replacing the crystal diodes, be careful in soldering, because the heat might damage the crystal diodes. Place copper alligator-type clips on each end of the diodes as close to the body of the crystal diode as possible. This will help conduct the heat away from the crystal diode.

i. In the ME-30A/U, the input circuit components near tube V 1 are mounted on terminal board RB3 (fig. 15) (terminal board E1 (fig. 31), ME-30C/U) and cannot be easily reached until the input circuit shield (fig. 14) is removed ((1) below). Difficulty may be encountered also, when replacing components on terminal board RB1 (fig. 15). Follow the procedure in (2) below to make the lower terminals more accessible.

(1) *Input circuit shield removal.*

(a) Remove the two securing nuts and lockwashers for the input circuit shield from the right side of the chassis (fig. 13).

(b) Lift the input circuit shield (fig. 14) away from the left side of the chassis.

(2) *Moving terminal board RB1* (station 15 and 16, fig. 47).

(a) Disconnect the connection between capacitor C36 and resistor R63 at the terminal board. Move capacitor C36 out of the way.

(b) Disconnect capacitor C22 at the terminal board. Move capacitor C22 out of the way.

(c) Remove the two terminal board securing screws from the top of the chassis (fig. 13).

(d) Tilt terminal board RB1 toward the front panel to make the lower terminals on the left side (with respect to the front panel) of terminal board RB1 more accessible.

Note. When it is desired to make the right side of terminal board RB1 more accessible, disconnect resistor R44 at the terminal board and tilt it away from the front panel.

21. Removal and Replacement of Switch S1, ME-30A/U

Range selector switch S1 (fig. 13) must be removed from the chassis of the voltmeter to reach the components mounted on it. Because of the critical construction and wiring of switch S1, it is not practical to repair the switch itself. When mechanical failure occurs in switch S1, replace it as a complete assembly.

Caution: No detail on any section of switch S1 should be changed, Contacts and terminals which appear disconnected introduce very small amounts of capacitance necessary for the proper functioning of the circuit.

a. Removal.

(1) Remove the input circuit shield (para 20i) from the left side of the chassis (fig. 15) to expose the two switch shield securing nuts.

(2) Loosen the wiring clamp (fig. 13) on the switch shield enough for the wiring to be moved free of the lamp; it is not necessary to remove the wiring clamp.

(3) Remove the two switch shield securing nuts and lockwashers on the left side of the chassis and remove the stitch shield (fig. 13).

(4) Remove the two setscrews in the range selector switch knob and remove the knob.

(5) Remove the nut and the washer that secure the shaft of switch S1 to the front panel.

(6) Disconnect the black wires from contacts 3 and 5, and 9 on switch S1A (rear) (fig. 47) at terminal board RB3 and terminal board E22, respectively. Note the wires for exact replacement.

(7) Disconnect the yellow wire from terminal 4 on switch S1D (front) at terminal 2 of tube socket XV1.

(8) Disconnect the green wire from contact 7 on switch S1B (front) at terminal board E20.

(9) Disconnect the black wire from terminal 8 on switch S1C (rear) at terminal board E20.

(l0) Remove the two machine screws that secure the isolating shield (fig. 13) to the chassis.

(11) Remove the assembly.

Note. If there is not enough clearance between the isolating shield and switch SIB to permit access to the terminals on that section, remove the support rod that is secured by nuts and washers (fig. 16). This permits moving the switch section along the shaft away from the isolating shield.

b. Replacement.

(1) Position the assembly in place.

(2) Replace the two machine screws to secure the isolating shield (fig. 13) to the chassis.

(3) Connect the black wire from terminal 8 on switch SIC (rear) at terminal board E20 (fig. 47).

(4) Connect the green wire from contact 7 on switch SIB (front) at terminal board E20.

(5) Connect the yellow wire from terminal 4 on switch S1D) (front) at terminal 2 of tube socket XV1.

(6) Connect the black wires connected to contacts 3 and 5, and 9 on switch SIA (rear) at terminal board RB3 and terminal board E22, respectively. Replacement routing of wires should be the same as noted during removal.

(7) Replace the nut and the washer that secure the shaft of switch S1 to the front panel.
(8) Replace the two setscrews in the range selector switch knob, replace the knob on the shaft and tighten the two setscrews.
(9) Replace the switch shield (fig. 13) and the two switch shield securing nuts and lockwashers on the left side of the chassis. Tighten. the nuts.
(10) Replace the wires and tighten the wiring clamp.
(11) Replace the input circuit shield on the left side of the chassis.

Note. After replacing switch S1, check the calibration (para 26) voltmeter and make any necessary adjustments.

22. Removal and Replacement of Switch S1, ME-30B/U

Range selector switch S1 must be removed from the chassis of the voltmeter to reach the components mounted on it. Because of the critical construction and wiring of switch S1, it is not practical to repair the switch itself. When mechanical failure occurs in the switch replace it as a complete assembly.

Caution: No detail on any section of switch S1 should be changed. Contacts and terminals that appear disconnected introduce very small amounts of capacitance necessary for the proper functioning of the circuit.

a. Removal.

(1) Remove the setscrew in the range selector switch knob and remove the knob.
(2) Remove the switch shield (fig. 20) by removing the two screws at the base of the stitch shield.
(3) Disconnect the black wire from contact 1 of S1A (rear) at R8 (fig. 49).
(4) Disconnect the black wire from the junction of R11 and C12 at terminal 2 of tube socket XV1.
(5) Disconnect the red wire from contact 1 of switch S1B (front) at R21.
Contact 2 of switch SIA (rear) at the junction of C1 and R3.
(6) Connect the black wire from contact 2 of switch S1A (rear) at the junction of Cl and R3.
(7) Disconnect the orange wire from contact 3 of switch S1A (rear) at the junction of C5 and R5.
(8) Disconnect the black wire from the junction of R17, R16, R15, R14, R19, R18, and R9A (station 25, fig. 49) at C2.
(9) Remove the nut holding the switch bushing to the front panel.
(l0) Remove the two screws holding the switch mounting bracket (8,- fig. 23) to the chassis.
(11) Remove the switch assembly.

b. Replacement.

(1) Position the switch assembly in place.
(2) Replace the two screws to hold the switch mounting bracket (8, fig. 23) to the chassis.
(3) Replace the nut to hold the switch bushing to the front panel.
(4) Connect the black wire from the junction of R17, R16, R15, R14, R19, R18, and R9A at C2 (fig. 49).
(5) Connect the orange wire from contact 3 of switch SIA (rear) at the junction of C5 and R5.
(6) Connect the black wire from contact 2 of switch S1A (rear) at the junction of C1 and R3.
(7) Connect the red wire from contact 1 of switch S1B (front) at R21.
(8) Connect the black wire from the junction of R11 and C 12 at terminal 2 of the tube socket XV1.
(9) Connect the black wire from contact 1 of S1A (rear) at RS.
(10) Replace the switch shield (fig. 20) and replace and fasten the two screws at the base of the switch shield.
(11) Replace the range selector switch knob with its setscrew and tighten the setscrew.

Note. After replacing switch S1, check the calibration (para 26) voltmeter and make any necessary adjustments.

23. Removal and Replacement of Switch S1, ME-30C/U

Range selector switch S1 (fig. 30) must be removed from the chassis of the voltmeter to reach the components mounted on it. Because of the critical construction and wiring of switch S1, it is not practical to repair the switch itself. When mechanical failure occurs in switch S1, replace it as a complete assembly.

Caution: No detail on any section of switch S1 should be changed. Contacts and terminals which appear disconnected introduce very small amounts *of* capacitance necessary for proper functioning of the circuit.

a. Removal.

(1) Remove the input circuit shield (para 20i) from the left side of the chassis (fig. 31) to expose the two switch shield securing nuts.
(2) Loosen the wiring clamp (fig. 30) on the switch shield enough for the wiring to be moved free of the clamp. It is not necessary to remove the clamp.
(3) Remove the two switch shield securing nuts and lockwashers on the left side of the chassis and remove the switch shield (fig. 30).
(4) Remove the two setscrews in the range selector switch knob and remove the knob.
(5) Remove the nut and the washer that secure the shaft of switch S1 to the front panel.
(6) Disconnect the black, blue and orange wires connected to contacts 1, 2, and 3 on switch S1A rear (fig. 51) at terminal board E23 (blue wire) and terminal board El (orange and black wires). Note the routing of wires for exact replacement.
(7) Disconnect the black wire from terminal 9 on switch S1C at terminal 2 on tube socket XV1.
(8) Disconnect the red wire from contact 1 on SIB front at terminal board E20.
(9) Disconnect the black wire from terminal board E18 (station 29, fig. 51) at terminal board E20.
(10) Remove the two machine screws securing the shield (fig. 30) to the chassis.
(11) Remove the assembly.

b. Replacement.

(1) Position the assembly in place.
(2) Replace the two machine screws and secure the shield (fig. 30) to the chassis.
(3) Connect the black wire from terminal board E18 (station 29, fig. 51) at terminal board E20.
(4) Connect the red wire from contact 1 on SIB front at terminal board E20.
(5) Connect the black wire from terminal 9 on switch S1C at terminal 2 on tube socket XV1.
(6) Connect the black, blue, and orange wires connected to contacts 1, 2, and 3 on switch S1A rear at termi - nal board E23 (blue wire) and terminal board E1 (orange and black wires). Replacement routing of wires should be the same as noted during the removal.
(7) Replace the nut and the washer that secure the shaft of switch S1 to the front panel.
(8) Replace the two setscrews in the range selector switch knob, replace the knob on the shaft, and tighten the two setscrews.
(9) Replace the switch shield (fig. 30) and the two switch shield securing nuts and lockwashers on the left side of the chassis. Tighten the nuts.
(10) Replace the wires and fasten the wiring clamp (fig. 30).
(11) Replace the input circuit shield on the left side of the chassis.

Note. After replacing switch S1, check the calibration (para 26) of the voltmeter and make any necessary adjustments.

Section II. CALIBRATION AND ADJUSTMENT

24. Test Equipment Required for Calibration and Adjustment

In addition to the test equipment required for troubleshooting (para 14), the test equipment listed in *a* below is required for calibration and adjustment. Since the calibration and adjustment procedures for the voltmeter are accomplished with the case removed, special shields are also required (b below).

a. Test Equipment. Unless otherwise indicated in the chart below, one of each test equipment is required.

Test equipment	Technical manual
Meter Test Set TS-682/GSM-l or equal.	TM 11-2535
R. F. Signal Generator Set AN/URM-25B.	TM 11-5551B
Decade Resistor TS-679/U (2 ea).	TM 11-5520
Oscilloscope AN/USM-50 or equal.	TM 11-5129

b. Shields. Two aluminum shields (base and calibration) are required for calibration and adjustment of the ME -30 B/U to minimize stray field pickup. The shield should meet the following requirements:

(1) The base shield should be large enough to be placed beneath the entire test setup (excluding the TS-682A/GSM-1 (para 26a)). Normally, a base shield should messure 24 inches by 36 inches.

(2) The calibration shield which is to be placed against the bottom of the chassis should be 8 inches by 8 inches. A 1/2-inch diameter hole should be centered 2 inches from one edge of the calibration shield and 2-1/4 inches from the adjacent edge.

Note. In the ME-30A/U and the ME-30C/U, the case is used as a shield to minimize stray field pickup:

25. Regulated B+ and Filament Voltage Checks and Adjustments

In each of the test setups given below, connect the voltmeter and the TS-505A/U to a 115-volt ac source. Allow the equipment to reach operating temperature (approximately one-half hour) before proceeding with the check and/or adjustment. Remove the case from the voltmeter (TM 11-6625-320-12).

a. Regulated B+ Check and Adjustment. Check the voltage at the output of the regulated power supply after replacement of tube V6, V7, V8, or V9.

(1) Adjust the TS-505A/U to indicate dc voltage on a range to include 225 volts.

(2) Connect the test leads of the TS-505A/U across terminal 3 of XV7 and ground (fig. 15, ME-30A/U; 21, ME-30B/U; or 32, ME-30C/U.

(3) The TS-505A/U should indicate between 245 and 255 volts. If the indication is not within the specified limits, replace tube V9 and remeasure the output voltage.

Note. 0ther troubles in the regulated power supply are indicated if it is impossible to bring the output voltage within the specified limits by replacing tube V9.

b. Filament Voltage Check and Adjustment. Check the dc filament voltage after replacement of components in that circuit.

(1) Adjust the TS-505A/U to indicate dc voltage on a range to include 12.6 volts.

(2) Connect the test leads of the TS-505A/U across C38 (fig. 21, ME-30B/U; or 32, ME-30C/U) or C37 (fig. 15, ME-30A/U).

(3) The TS-505A/U should indicate 12.6 volts dc. If it does not, adjust R58 in the ME-30 B/U (fig. 21) and ME -30 C/U (fig. 30) or R66 in the ME-30A/U (fig. 14) until 12.6 volts dc is indicated on the TS-505A/U.

Note. Use an insulated screwdriver with a l/8-inch flat blade.

26. Calibration

Calibration of the voltmeter is required when calibration control R29 (ME-30A/U), R30 (ME-30B/U and ME-30C/U) or C4 is replaced. Components other than those in the power supply circuit may also affect

calibration of the voltmeter when replaced; therefore, after replacement of any of these components, check the calibration of the voltmeter (para 26) before making any calibration adjustments (c below). Check the meter zero adjustment (TM 11-6625-320-12) and the regulated B+ and filament voltages (para 25) and adjust if necessary before calibrating the voltmeter.

a. Preparation, ME-30B/U.

(1) Remove the case from the chassis of the voltmeter (TM 11-6625-320-12) l

(2) Place the chassis of the ME-30 B/U with the side nearest the INPUT binding posts, on the base of the shield (para 24).

(3) Place the calibration shield (para 24b(2)) almost flat against the bottom of the chassis (fig. 22) with the hole over C4.

(4) Place the TS-679/U's on the base shield.

(5) Allow the voltmeter and TS-682A/GSM-1 to reach operating temperature (approximately one-half hour) before proceeding with the adjustments (c below).

b. Preparation, ME-30A/U and ME-30C/U.

(1) Draw the chassis from the case of the voltmeter until R29 (ME-30A/U) or R30 (ME-30C/U) and C4 are exposed.

(2) Allow the voltmeter and TS-682A/GSM-1 to reach operating temperature (approximately one-half hour) before proceeding with the adjustments (c below).

c. Adjustments. Low frequency accuracy adjustments are made on the .3 VOLTS range for the low ranges of the voltmeter ((1) below) and on the 1 VOLTS range for the high ranges of the voltmeter ((2) below), Make the adjustments as indicated.

(1) *Low ranges.*

(a) Connect the output of the TS-682A/GSM-l to the voltage divider consisting of the TS-679/U's (fig. 38).

(b) Connect TS-679/U No. 2 across the INPUT binding posts of the voltmeter under test.

(c) Adjust the output of the TS-682A/GSM-1 to exactly 1 volt.

(d) Operate the range selector switch of the voltmeter under test to .3 VOLTS.

(e) Adjust the TS-679/U No. 1 to 70,000 ohms.

(f) Adjust TS-679/U No. 2 to 30,000 ohms .

(g) Adjust R30 (fig. 14, ME-30A/U; 22, ME-30B/U; or 31, ME-30C/U) until the voltmeter under test indicates 0.3 volt.

(2) *High ranges.* This adjustment should be checked when R30 (ME-30 B/U and ME-30C/U) or R29 (ME-30A/U) is readjusted and should not be made unless the resistor has been checked and readjusted.

(a) Connect the output of the TS-682A/GSM-l direct to the INPUT binding posts of the voltmeter under test.

(b) Adjust the output of the TS-682A/GSM-1 to exactly 1 volt.

(c) Operate the range selector switch of the voltmeter under test to 1 VOLTS.

(d) Adjust C4 through the hole in the calibration shield, using an insulated screwdriver. Remove the screwdriver after a slight adjustment so that the meter indication will not be affected. The adjustment is properly made when the voltmeter under test indicates 1 volt after the screwdriver is removed.

Note. In the ME-30A/U and ME-30C/U, C4 is adjusted through the hole in the input circuit shield (fig. 14) over the edge of the case.

27. Frequency Response Adjustments

All frequency response adjustments in the voltmeter are used to modify the high frequency response of the unit to obtain a flat frequency response of the meter indication for a constant input voltage. Follow the procedures in the sequence given below to obtain optimum results. Follow

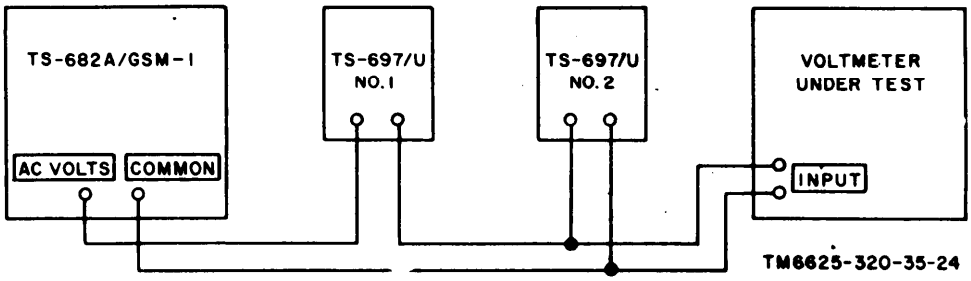


Figure 38. Setup for testing and calibrating low ranges of voltmeter.

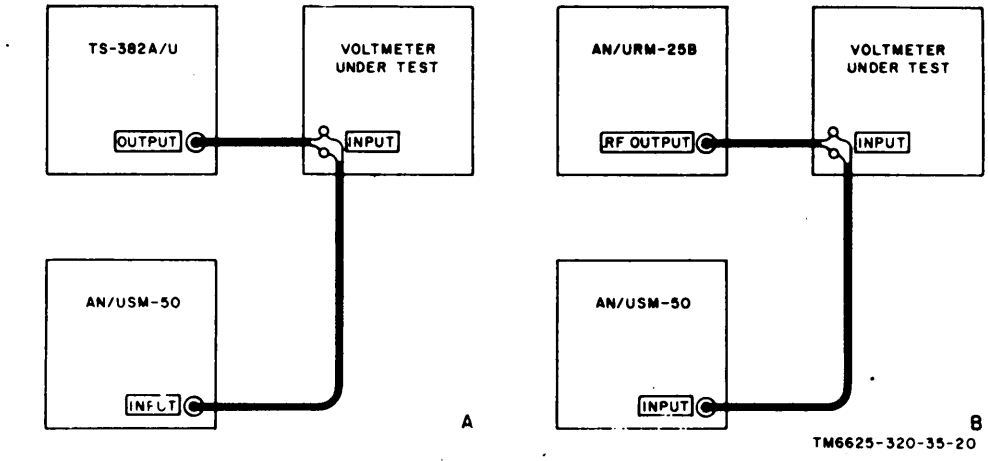


Figure 39. Setup for frequency response test.

the procedures in paragraph 26 *a* or *b* to prepare the voltmeter for frequency response adjustments. Allow the voltmeter under test and the test equipment to reach operating temperature (approximately one-half hour) before proceeding.

a. Connect the TS-382A/U and the AN/USM-50 across the input binding posts of the voltmeter under test (A, fig. 39).

b. Set the output frequency of the TS-38 A/U to 400 cps. Set the range selector switch of the voltmeter under test to .1 VOLTS position. Adjust the output level of the TS-382A/U until the voltmeter indicates 0.90 (the long line halfway between .8 and 1.0) on the 0- to l-volt scale. Note the reference level on the AN/USM-50.

c. Disconnect the TS382A/U and connect the AN/URM-25B in its place (B, fig. 39). Set the output frequency of the AN/URM-25B to 4 mc and adjust the output level to the oscilloscope reference level established in *b* above.

d. Adjust C21 (fig. 15, ME-30A/U) or C22 (fig. 22, ME-30B/U; 32, ME-30C/U) until the voltmeter pointer indicates 0.90 on the 0- to 1.0-volt scale.

e. Change the output frequency of the AN/URM-25B to 6.4 mc and adjust the output level to the AN/USM-50 reference level established in *b* above.

f. The reading on the voltmeter under test should not have increased by more than 2 percent of full scale. A decrease is acceptable.

(1) If the reading increased more than 2 percent but less than 4 percent, adjust C21 (ME-30A/U) or C22 (ME-30B/U, ME-30C/U) to give a reading of +2 percent. The reading at 4 mc should be not more than 2 percent of full-scale below 0.90; that is, 0.90-.002.

(2) If the reading increased more than 4 percent, follow the procedures given in *(a)* or *(b)* below.

(a) Shunt R26 (fig. 14, ME-30A/U) or R31 (station 17, fig. 49, ME-30B/U; fig. 31, ME-30C/U) with a resistor and a capacitor connected in series. The value of the resistor and the capacitor should be approximately 270 ohms and 180 micromicrofarads (uuf), respectively.

(b) Change the value of C26 (B, fig. 18, ME-30A/U) or C27 (B, fig. 27, ME-30B/U; A, fig. 35, ME-30 C/U). These capacitors maybe changed within the limits of 15 uuf and 82 uuf to control high frequency response.

(3) After the shunt resistor and capacitor have been added or C26 or C27 changed, repeat the procedures given in *a* through *f* above.

g. Disconnect the AN/URM-25B and connect the TS-382A/U in its place (A, fig. 39). Set the output frequency of the TS-382A/U to 20 cps and adjust the output level to the AN/USM-50 reference level established in *b* above. The reading on the voltmeter under test should be not more than ±2 percent of full-scale from 0.90.

h. Set the range selector switch of the voltmeter under test to .01 VOLTS position. Establish a new 400-cycle reference level for this voltage range as follows:

(1) Set the output frequency of the TS-382A/U to 400 cps.

(2) Adjust the output level of the TS-382A/U until the voltmeter indicates 0.90 on the 0- to 1.0-volt scale of the voltmeter.

i. Disconnect the TS-382A/U and connect the AN/URM-25B in its place (B, fig. 39).

j. Set the output frequency of the AN/URM-25B to 4 mc and adjust the output level to the reference level established in (2) above. Adjust C14 (fig. 20, ME-30B/U; 30, ME-30C/U) or C16 (fig. 13, ME-30A/U) until the voltmeter pointer indicates 0.90 on the 0- to 1.0-volt scale.

k. Set the range selector switch of the voltmeter under test to 1 VOLTS position. Disconnect the AN/URM-25B, and connect the TS-382A/U in its place, and establish a new 400-cycle reference level (h(l) and (2) above).

l. Disconnect the TS-382A/U and connect the AN/URM-25B in its place. Set the output frequent y of the AN/URM-25B to 4 mc and adjust the output level to the reference level established in ***k*** above.

m. Change R6 or R6A (fig. 25, ME-30B/U); R6A, R6B, or R6C (D, fig. 18, ME-30A/U); or R6A-R6D (fig. 34, ME-30C/U) to bring the 4-mc frequency response within 2± percent of full-scale from 0.90.

Note. Resistor R6 is normally a combination of two or three resistors. Occasionally, it may be necessary to connect a capacitor or a resistor parallel to resistor R6. A response that is high at 4 mc and low at 2 mc and 1 mc indicates that a capacitor is required. A response that is high at all check frequencies indicates that a resistor is required. Resistance values may range from 10 ohms to 33 ohms. Capacitors which may be required are 0.005 microfarad (uf) and 0.01 uf. The combination is chosen by trial and error.

n. Set the range selector switch of the voltmeter under test to 3 VOLTS. Disconnect the AN/URM-25B, connect the TS-382A/U in its place, and establish a new 400-cycle reference level (h(l) and (2) above).

o. Disconnect the TS-382A/U and connect the AN/URM-25B in its place (B, fig. 39). Set the output frequency of the AN/URM-25B to 4 mc and adjust the output level to the reference level established in *n* above. Adjust capacitor C14 (fig. 13, ME-30A/U) or C16 (fig. 20, ME-30B/U; 30, ME-30C/U) until the voltmeter pointer indicates 0.90 on the 0- to 1.0-volt scale.

p. Use the procedure in *n* and *o* to check the output level of the voltmeter with the range selector switch alternately set on the .3 and .03 VOLTS ranges. Slightly adjust C6 (fig. 20, ME-30B/U: 30, ME-30C/U) on the 3, .3, and .03 VOLTS ranges until the output levels on the three ranges are within 2 percent of full-scale from 0.90.

Note. The ME-30A/U has no capacitor equivalent to C6 in the ME-30B/U and ME–30C/U.

CHAPTER 4

FOURTH ECHELON TESTING PROCEDURES AND FINAL TESTING

Section I. FOURTH ECHELON TESTING PROCEDURES

28. 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 to test equipment repaired at third echelon if the proper tools and test equipment are available. A summary of the performance standards is given in paragraph 35.

b. Comply with the instructions preceding the body of each chart b e f o r e proceeding to the chart. Perform each test in 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* col - umns; then perform each specific test procedure and verify it against its performance standard.

29. Test Equipment

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

Nomenclature	Federal stock No.	Technical manual
R. F. Signal Generator Set AN/URM-25F	6625-570-5719	TM 11-5551E
or		
R. F. Signal Generator Set AN/URM-25D	6625-309-5381	TM 11-5551D
Audio Oscillator TS-382(*)/U[a]	6625-192-5094	TM 11-2684A
Meter Test Equipment AN/GSM-1(*)[b]	6625-224-7700	TM 11-2535 TM 11-2535B[c]
Analyzer, Spectrum TS-723(*)/U[d]	6625-668-9418	TM 11-5097
Transformer, Variable CN-16(*)/U[e]	5950-235-2086	None
Multimeter TS-352(*)/U[fg]	6625-242-5023	TM 11-5527

[a] Indicates Audio Oscillators TS-382A/U, TS-382B/U, TS-382D/U, TS-382E/U, and TS-382F/U.

[b] Indicates Meter Test Equipments AN/GSM-1B and AN/GSM-1C.

[c] Applies to Meter Test Set TS-682A/GSM-1 (P/O AN/GSM-1C) only.

[d] Indicates Spectrum Analyzers TS-723A/U and TS-723B/U.

[e] Indicates Transformers CN-16/U and Transformer, Variable CN-16B/U.

[f] Indicates Multimeters TS-352/U, TS-352A/U, and TS-352B/U.

[g] Multimeter AN/URM-105, authorized under TA 11- 17 was purposely omitted in favor of Multimeter TS-352 (*)/U which is more likely to be available. Multimeter AN/URM-105 may be used if available.

30. Special Requirements

a. The location and labeling of certain controls and test jacks differ on Meter Test Set TS-682/GSM-l (p/o AN/GSM-lB) and Meter Test Set TS-682A/GSM-l (p/o AN/GSM-lC). Reference to controls, control settings, and test jacks in the charts (para 31-34) apply to Meter Test Set TS-682/GSM-1. If Meter Test Set TS-682A/GSM-l is used, set corresponding controls to achieve equivalent results. Meter Test Set TS-682/GSM-l is shown in the illustrations. If Meter Test Set TS-682A/GSM-l is used, make connections to corresponding test jacks where physical location is different and to the jack of nearest voltage

value where a test jack of the specified voltage does not exist.

b. The labeling of certain controls differs between models of the signal generator set and audio oscillator listed in paragraph 29. Reference to controls and control settings in the charts apply to R.F. Signal Generator Set AN/URM-25F and Audio Oscillator TS-382D/U. If other models of these equipments are used, set corresponding controls to positions that will achieve the specified conditions of operation, voltage output, and frequency.

31. Physical Tests and Inspection

a. Test Equipment and Materials.

b. Test Connections and Conditions. Do not connect the voltmeter to a power source until instructed to do so in the test procedure.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	N/A	Controls may be in any position.	*a.* Inspect the voltmeter case and panel for loose or missing parts, damage, and condition of finish.	*a.* No damage or loose or missing parts are evident. External surfaces intended to be painted do not show bare metal. Panel lettering is legible.
			b. Inspect the power cable and plug for damage and signs of deteriorated insulation.	*b.* The power cord and plug are in good condition, free from damage and deteriorated insulation. *Note.* Minor cracks in the power cord insulation are not cause for rejection.
			c. Note the position and condition of the meter movement pointer.	*c.* The meter pointer is not bent and lies directly over the zero mark at the left edge of the meter scale.
			d. Turn the range selector switch to each of the indicated positions.	*d.* The range selector switch operates freely without binding or excessive looseness. The switch detents are positive. The knob is tight on its shaft and properly indexed.
			e. Remove the fuseholder and inspect it for damage and the fuse for proper size and rating. *Note.* Replace the fuse and fuseholder cap before proceeding.	*e.* The fuseholder is in serviceable condition. The fuse is MIL type F02GIR00A (normal blow). Fuse rating is as follows: 115-volt operation: 1 amp. 230-volt operation: 0.5 amp.

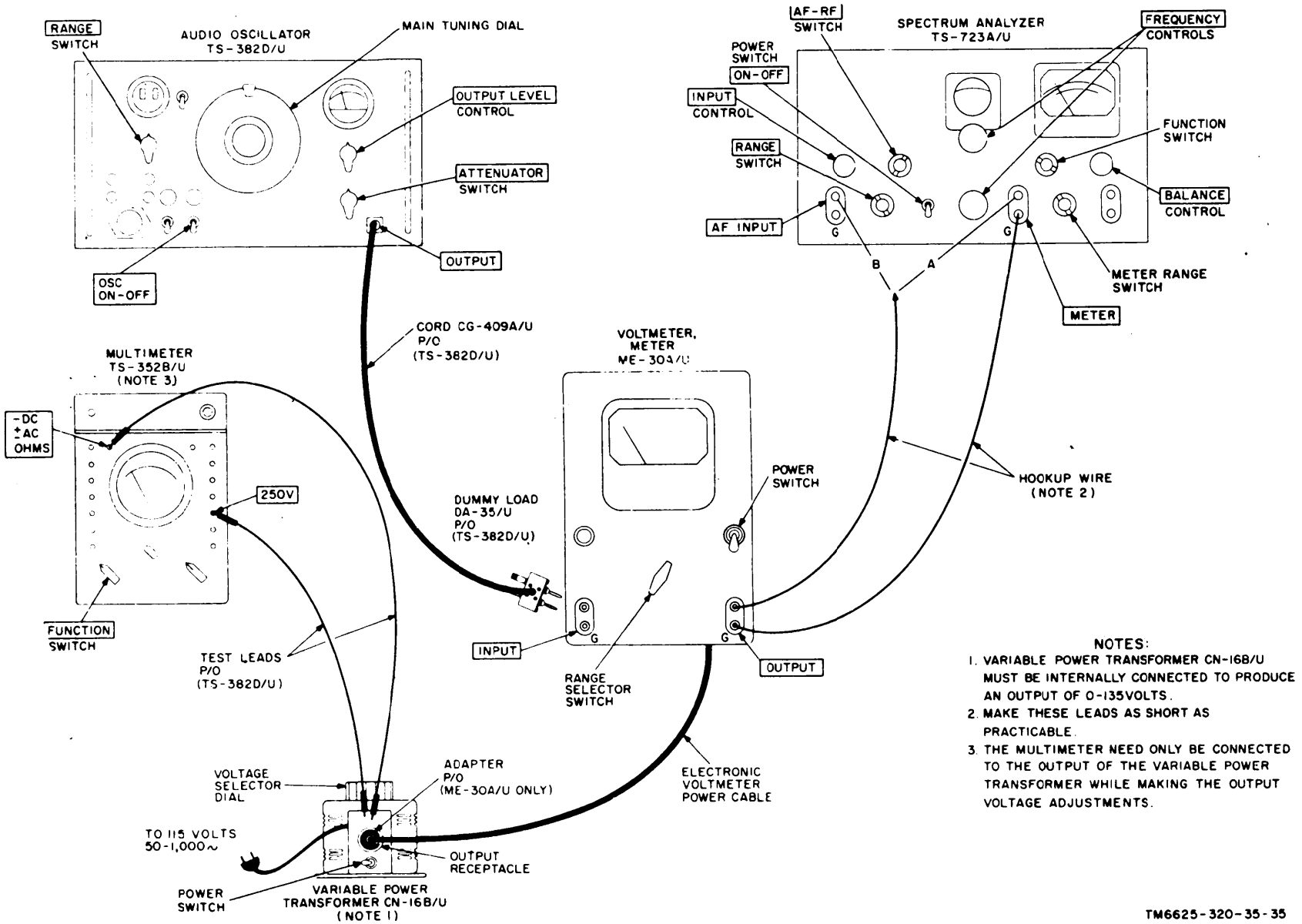


Figure 40. Amplifier gain and distortion test.

32. Amplifier Gain and Distortion Test

a. Test Equipment and Materials.
Audio Oscillator TS-382(*)/U
Spectrum Analyzer TS-723(*)/U
Multimeter TS-352(*)/U (p/o AN/GSM-1(*))
Variable Power Transformer CN-16(*)/U
Hookup wire

b. Test Connections and/or Conditions. Connect the equipment to the ME-30A/U as shown in figure 40, with the output of the electronic voltmeter connected to the meter input of the spectrum analyzer (connection A).

c. Procedure. The procedure is also applicable to the ME-30B/U and the ME-30C/U.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	*TS-382D/U* Main tuning dial: 100. RANGE switch: X1. OUTPUT LEVEL control: fully counterclockwise. ATTENUATOR switch: X1000. OSC. ON-OFF switch: ON. *TS-723A/U* Function switch: METER. Meter range switch: .30 R.M.S. VOLTS. Power switch: ON. *TS-352B/U* Function switch: AC VOLTS. *TS-16B/U* Voltage selector dial: 115. Power switch: ON.	Range selector switch: .001 VOLTS. Power switch: ON . .	a. Adjust the voltage selector dial of the CN-16B/U for an indication of 115 volts on the TS-352B/U. *Note.* The TS-352B/U can be temporarily connected to the output of the CN-16B/U by pulling the plug from the receptacle far enough to expose the plug pins. b. Note the indication of the ME-30A/U and the power indicator lamp. c. Adjust the OUTPUT LEVEL control of the TS-382D/U for a full-scale indication on the ME-30A/U (0-1.0 scale). Note the indication on the TS-723A/U and the TS-382D/U panel meter.	a. None. b. The power indicator lamp lights and the meter indicates not more than .1 (0-1.0 scale). c. The TS-723A/U indicates not less than 0.15 volt (1.5 on the 0-3 scale). The TS-382D/U panel meter indicates not more than 1.05.
2			a. Adjust the TS-382D/U OUTPUT LEVEL control for an indication of 1.5 on the TS-723A/U (0-3 scale). b. Adjust the voltage selector dial on the CN-16B/U for a 105-volt indication on the TS-352B/U. Note the indication on the TS-723A/U. c. Adjust the voltage selector dial on the CN-16B/U for a 125-volt indication on the TS-352B/U. Note the indication on the TS-723A/U. d. Adjust the voltage selector dial on the CN-16B/U for a 115-volt indication on the TS-352B/U and proceed to the next step.	a. None. b. The indication on the TS-723A/U meter is within the following limits: 1.47-1.53 (0-3 scale). c. Same as *b* above. d. None.
3	*TS-723A/U* Function switch: SET LEVEL. Meter range switch: 10%. RANGE switch: X1. AF-RF switch: AF. INPUT control: MIN. Power switch: ON.		a. Reconnect the output of the ME-30A/U to the TS-723A/U as shown in B, figure 40. b. Adjust the OUTPUT LEVEL control on the TS-382D/U for a full-scale indication on the ME-30A/U (0-1.0 scale). c. Adjust the TS-723A/U INPUT control for a full-scale indication on the panel meter (0-1.0 scale), then set the function switch to DISTORTION. d. Adjust the TS-723A/U FREQUENCY controls for a minimum indication on the panel meter. e. Adjust the TS-723A/U BALANCE control for a minimum indication on the panel meter. f. Repeat *c* and *d* until a minimum meter indication has been achieved.	a. None. b. None. c. None. d. None. e. None. f. The TS-723A/U panel meter indicates not more than 5% (.05 on the 0-1.0 scale). *Note.* The performance figure of 5% includes the maximum allowable distortion of the TS-382D/U. The maximum allowable distortion of the ME-30A/U amplifier is 2%.
4	*TS-382D/U* Function switch: SET LEVEL. Meter range switch: 10%. RANGE switch: X100. AF-RF switch: AF. INPUT control: MIN. Power switch: ON. *TS-382D/U* Main tuning dial: 150. RANGE switch: X100. OUTPUT LEVEL control: fully counterclockwise. ATTENUATOR switch: X1000. OSC. ON-OFF: ON.		Repeat *b* through *e*, step No. 3 test procedure.	Same as step No. 3.

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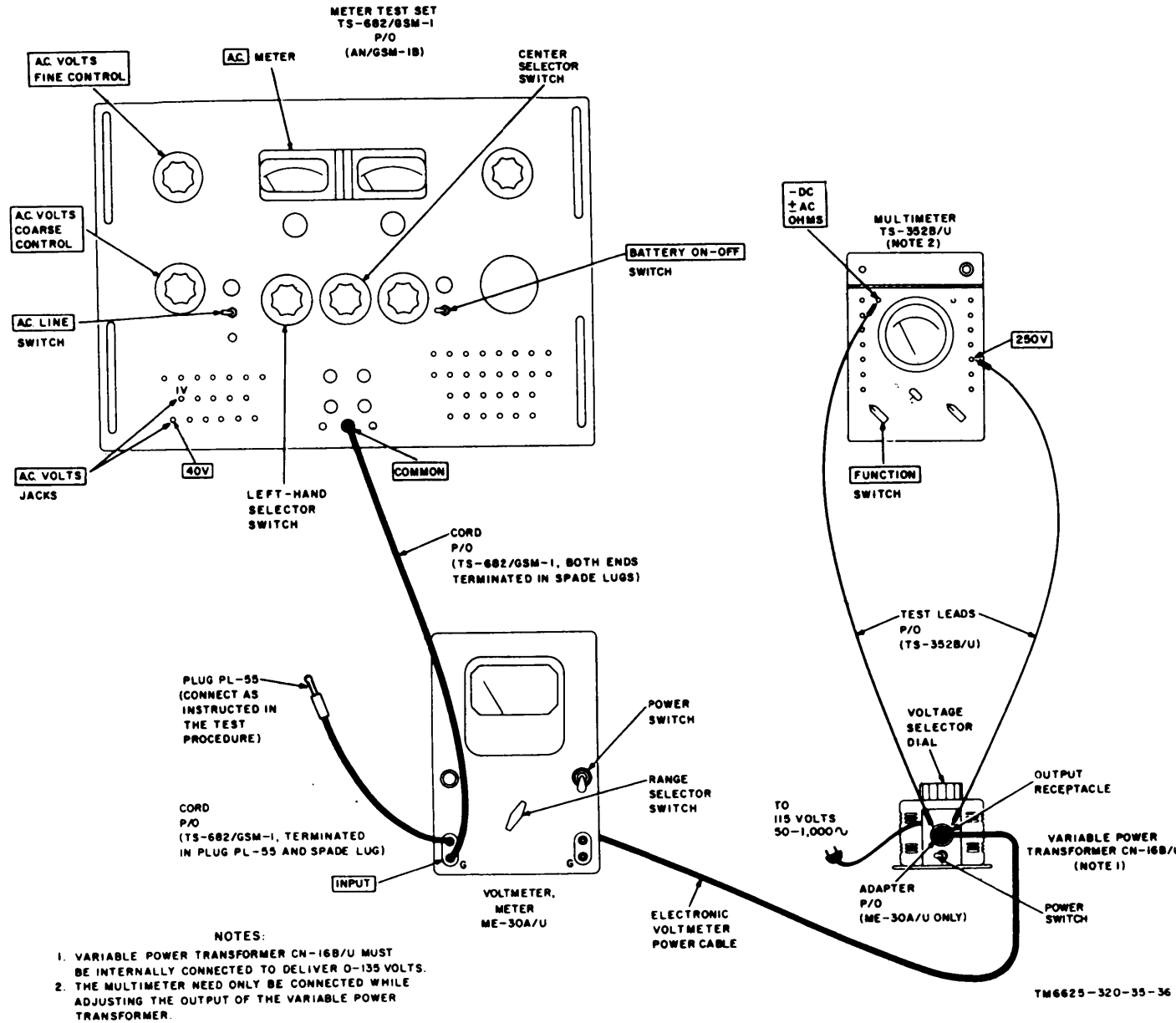

Figure 41. Calibration test.

33. Calibration Test

a. *Test Equipment and Materials.*
Meter Test Equipment TS-682/GSM-1 (p/o AN/GSM-1B)
Multimeter TS-352(*)/U (p/o AN/GSM-1(*))
Variable Power Transformer CN-16(*)/U

b. *Test Connections and/or Conditions.* Do not connect the equipment until instructed to do so in the test procedure.

c. *Procedure.* The procedure is also applicable to the ME-30B/U and the ME-30C/U.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	*TS-682/GSM-1* Left-hand selector switch: A.C.V. Center selector switch: A.C.V.-D.C.V. A.C. VOLTS FINE CONTROL: mid-position. A.C. VOLTS COARSE CONTROL: fully counterclockwise. BATTERY ON-OFF switch: OFF. A.C. LINE switch: ON. *TS-352(*)/U* FUNCTION switch: AC VOLTS. *CN-16(*)/U* Voltage selector dial: 115. Power switch: ON....	Range selector switch: .3 VOLTS. Power switch: ON	a. Connect the equipment to the ME-30A/U as shown in figure 40 and insert plug PL-55 in the 1V jack on the TS-682/GSM-1. *Note.* The TS-352B/U need only be connected when adjusting the output of the CN-16B/U. b. Adjust the CN-16B/U voltage selector dial for an indication of 115 volts on the TS-352B/U. c. Adjust the A.C. VOLTS COARSE and A.C. VOLTS FINE controls on the TS-682/GSM-1 for a full-scale indication on the ME-30A/U (0-3 scale). Note the indication on the A.C. meter of the TS-682/GSM-1.	a. None. b. None. c. The indication on the TS-682/GSM-1 is within the following limits: 29.4-30.6 (0-100 scale).
2	*TS-682/GSM-1* A. C. VOLTS FINE CONTROL: mid-position. A. C. VOLTS COARSE CONTROL: fully counterclockwise.	Range selector switch: 1 VOLTS.	a. Remove the plug from the 1V jack of the TS-682/GSM-1 and connect it to the 2V jack. b. Adjust the A. C. VOLTS COARSE and A. C. VOLTS FINE controls on the TS-682/GSM-1 for a full-scale indication on the ME-30A/U (0-1.0 scale). Note the indication on the A. C. meter of the TS-682/GSM-1.	a. None. b. The indication on the TS-682/GSM-1 meter is within the following limits: 49-51 (0-100 scale).
3	*TS-682/GSM-1* A. C. VOLTS FINE CONTROL: mid-position. A. C. VOLTS COARSE CONTROL: fully counterclockwise.	Range selector switch: 3 VOLTS.	a. Remove the plug from the 2V jack of the TS-682/GSM-1 and insert it in the 4V jack. b. Adjust the A. C. VOLTS COARSE and A. C. VOLTS FINE controls on the TS-682/GSM-1 for a full-scale indication on the ME-30A/U (0-3 scale). Note the indication on the A. C. meter of the TS-682/GSM-1.	a. None. b. The indication on the TS-682/GSM-1 is within the following limits: 73.5-76.5 (0-100 scale).
4	*TS-682/GSM-1* A. C. VOLTS FINE CONTROL: mid-position. A. C. VOLTS COARSE CONTROL: fully counterclockwise.	Range selector switch: 10 VOLTS.	a. Remove the plug from the 4V jack of the TS-682/GSM-1 and insert it in the 20V jack. b. Adjust the A. C. VOLTS COARSE and A. C. VOLTS FINE controls on the TS-682/GSM-1 for a full-scale indication on the ME-30A/U (0-1.0 scale). Note the indication on the A. C. meter of the TS-682/GSM-1.	a. None. b. The indication on the TS-682/GSM-1 is within the following limits: 48-52 (0-100 scale).
5	*TS-682/GSM-1* A. C. VOLTS FINE CONTROL: mid-position. A. C. VOLTS COARSE CONTROL: fully counterclockwise.	Range selector switch: 30 VOLTS.	a. Remove the plug from the 20V jack of the TS-682/GSM-1 and insert it in the 40V jack. b. Adjust the A. C. VOLTS COARSE and A. C. VOLTS FINE controls on the TS-682/GSM-1 for a full-scale indication on the ME-30A/U (0-3 scale). Note the indication on the A. C. meter of the TS-682/GSM-1.	a. None. b. The indication on the TS-682/GSM-1 is within the following limits: 73.5-76.5 (0-100 scale).
6	*TS-682/GSM-1* A. C. VOLTS FINE CONTROL: mid-position. A. C. VOLTS COARSE CONTROL: fully counterclockwise.	Range selector switch: 100 VOLTS.	a. Remove the plug from 40V jack of the TS-682/GSM-1 and insert it in the 200V jack. b. Adjust the A. C. VOLTS COARSE and A. C. VOLTS FINE controls on the TS 682/GSM-1 for a full-scale indication on the ME-30A/U (0-1.0 scale). Note the indication on the A. C. meter of the TS-682/GSM-1.	a. None. b. The indication on the TS-682/GSM-1 is within the following limits: 48-52 (0-100 scale).
7	*TS-682/GSM-1* A. C. VOLTS FINE CONTROL: mid-position. A. C. VOLTS COARSE CONTROL: fully counterclockwise.	Range selector switch: 300 VOLTS.	a. Remove the plug from the 200V jack of the TS-682/GSM-1 and insert it in the 400V jack. b. Adjust the A. C. VOLTS COARSE and A. C. VOLTS FINE controls on the TS-682/GSM-1 for a full-scale indication on the ME-30A/U (0-3 scale). Note the indication on the A. C. meter of the TS-682/GSM-1. c. Adjust the A. C. VOLTS COARSE and A. C. VOLTS FINE controls on the TS-682/GSM-1 for an indication of 2 on the ME-30A/U (0-3 scale). Note the indication on the A. C. meter of the TS-682/GSM-1. d. Adjust the A. C. VOLTS COARSE and A. C. VOLTS FINE controls on the TS-682/GSM-1 for an indication of 1 on the ME-30A/U (0-3 scale). Note the indication on the A. C. meter of the TS-682/GSM-1.	a. None. b. The indication on the TS-682/GSM-1 is within the following limits: 73.5-76.5 (0-100 scale). c. The indication on the TS-682/GSM-1 is within the following limits: 48-52 (0-100 scale). d. The indication on the TS-682/GSM-1 is within the following limits: 23-27 (0-100 scale).

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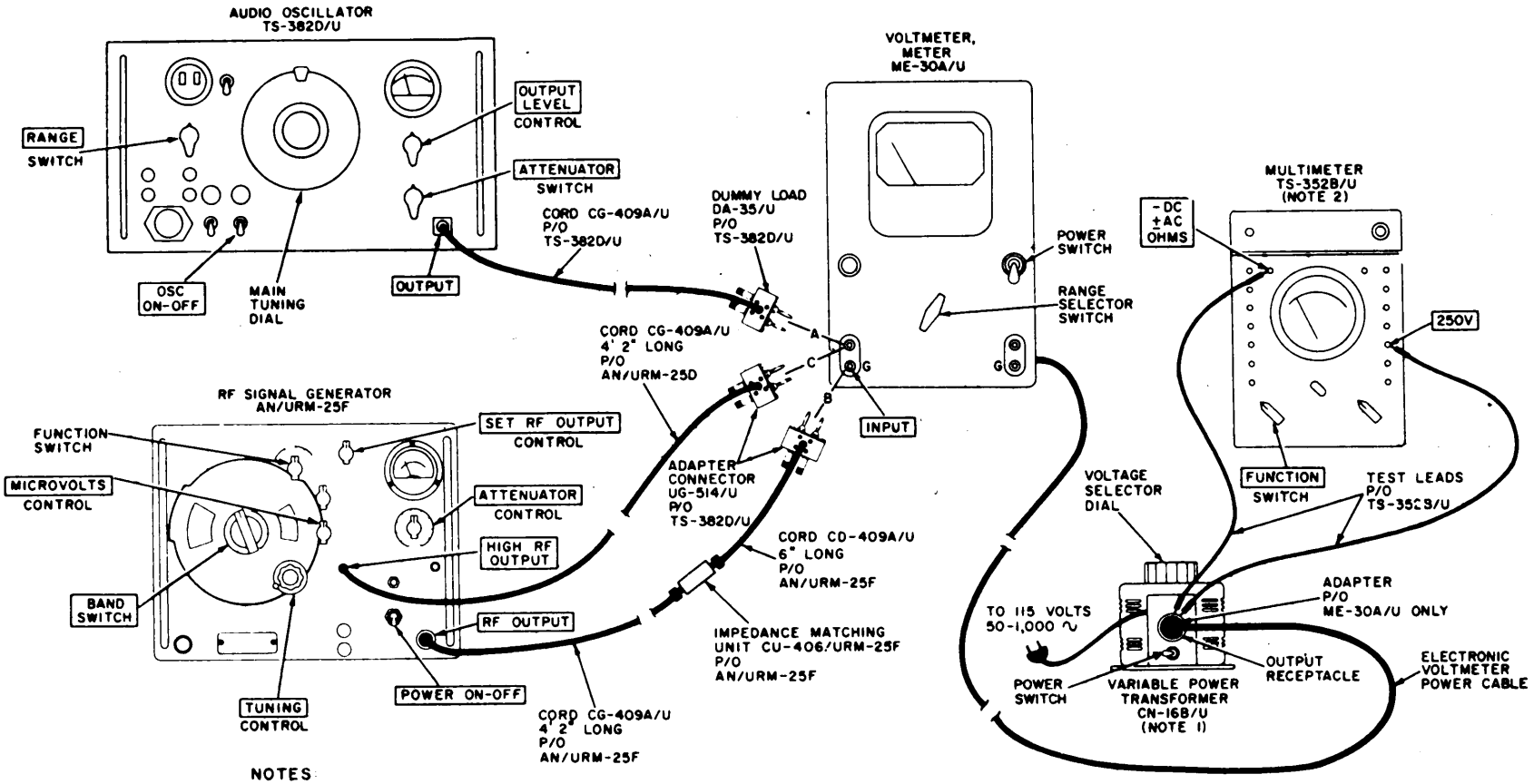


NOTES

1 VARIABLE POWER TRANSFORMER CN-16B/U MUST BE INTERNALLY CONNECTED TO DELIVER 0-135 VOLTS.
2 THE MULTIMETER NEED ONLY BE CONNECTED WHILE ADJUSTING THE OUTPUT OF THE VARIABLE POWER TRANSFORMER.

TM6625-320-35-37

Figure 42. Frequency response test.

34. Frequency Response Test

a. Test Equipment and Materials.
Audio Oscillator TS-382(*)/U
R. F. Signal Generator AN/URM-25(*)
Variable Power Transformer CN-16(*)/U

b. Test Connections and/or Conditions. Connect the equipment to the ME-30A/U as shown in A, figure 42 (TS-382D/U connected).

c. Procedure. The procedure is also applicable to the ME-30B/U and ME-30C/U.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	*TS-382D/U* Main tuning dial: 100. RANGE switch: X10. ATTENUATOR switch: X1000 OUTPUT LEVEL control: fully counterclockwise. OSC. ON-OFF switch: ON. *CN-16B/U* Voltage selector dial: 115. Power switch: ON.	Range selector switch: .001 VOLTS Power switch: ON	*Note.* It will not be necessary to perform a below if the voltage selector dial of the CN-16B/U has not been disturbed since the preceding test. *a.* Adjust the voltage selector dial of the CN-16B/U for a 115-volt indication on the TS-352B/U. *b.* Adjust the OUTPUT LEVEL control of the TS-382D/U for an indication of .9 on the ME-30A/U (0-1.0 scale). Note and record the indication on the TS-382D/U panel meter. *c.* Set the TS-382D/U RANGE switch to X100 and adjust the OUTPUT LEVEL control for the same indication on the panel meter as was recorded in *b* above. Note the indication on the ME-30A/U. *d.* Set the TS-382D/U RANGE switch to X1000 and adjust the OUTPUT LEVEL control for the same indication on the panel meter as was recorded in *b* above. Note the indication on the ME-30A/U. *e.* Set the TS-382D/U RANGE switch to X1 and the main tuning dial to 20, then adjust the OUTPUT LEVEL control for the same indication on the panel meter as was recorded in *b* above. Note the indication on the ME-30A/U.	 *a.* None. *b.* None. *c.* The indication on the ME-30A/U is within the following limits: .88-.92 (0-1.0 scale). *d.* Same as *c*, step No. 1 above. *e.* Same as *c*, step No. 1 above.
2	*AN/URM-25F* BAND SWITCH: 10-26. TUNING control: 10 KILOCYCLES. Function switch: CW. ATTENUATOR control: 1K. MICROVOLTS control: MAX. SET RF OUTPUT control: fully counterclockwise. POWER ON-OFF switch: ON.		*a.* Reconnect the equipment as shown in B, figure 42 (AN/URM-25F connected). *b.* Adjust the AN/URM-25F SET RF OUTPUT control for a full-scale (10) indication on the panel meter. *c.* Adjust the AN/URM-25F MICROVOLTS control for an indication of .9 on the ME-30A/U (0-1.0 scale). Note and record the indication on the AN/URM-25F panel meter (0-10 scale).	*a.* None. *b.* None. *c* None.
3	*AN/URM-25F* BAND SWITCH: 75-220. TUNING control: 100 KILOCYCLES. MICROVOLTS control: MAX.		*a.* Adjust the AN/URM-25F SET RF OUTPUT control for a full-scale (10) indication on the panel meter. *b.* Adjust the AN/URM-25F MICROVOLTS control for the same indication on the panel meter as was recorded in *c* step No. 2 (0-10 scale). Note the indication on the ME-30A/U meter.	*a.* None. *b.* The indication on the ME-30A/U is within the following limits: .88-.92 (0-1.0 scale).
4	*AN/URM-25F* BAND SWITCH: 0.6-1.5. TUNING control: 1.0 MEGACYCLES. MICROVOLTS control: MAX.		Repeat *a* and *b*, step No. 3 above.	Same as step No. 3.
5	*AN/URM-25F* BAND SWITCH: 1.5-3.8. TUNING control: 2.0 MEGACYCLES. MICROVOLTS control: MAX.		Repeat *a* and *b*, step No. 3 above.	Same as step No. 3.
6	*AN/URM-25F* BAND SWITCH: 3.8-10. TUNING control: 4.0 MEGACYCLES. MICROVOLTS control: MAX.		Repeat *a* and *b*, step No. 3 above.	Same as step No. 3.
7	*AN/URM-25F* BAND SWITCH: 3.8-10. TUNING control: 6.4 MEGACYCLES. MICROVOLTS control: MAX.		*Note.* This step applies to the ME-30C/U only. Repeat *a* and *b*, step No. 3 above.	Same as step No. 3.
8	*AN/URM-25F* BAND SWITCH: 220-600. TUNING control: 600 KILOCYCLES. MICROVOLTS control: MAX. SET RF OUTPUT control: fully counterclockwise.	Range selector switch: .3 VOLTS.	*a.* Reconnect the equipment as shown in C, figure 42. *b.* Adjust the AN/URM-25F SET RF OUTPUT control for a full-scale indication on the ME-30A/U (0-3 scale). *c.* Set the ME-30A/U range selector switch to 1 VOLTS and note the indication on the panel meter (0-1.0 scale).	*a.* None. *b.* None. *c.* The indication on the ME-30A/U is within the following limits: .29-.31 (0-1.0 scale).

35. Performance Standards Summary

Function	*Performance standard*
a. Amplifier gain (maximum output voltage at full-scale meter deflection).	0. 15 volt minimum
b. Amplifier distortion.	2% maximum
c. Voltage regulation (for ±10% line voltage fluctuation).	±2%
d. Calibration accuracy.	±2%
e. Frequency response.	±2%

Section II. FINAL TESTING

36. Purpose of Final Testing

a. The tests outlined in this section are designed to measure the performance capability of a repaired voltmeter. Equipment that meets the minimum standards stated in the tests (para 38-40) will furnish satisfactory operation equivalent to that of new equipment.

b. Final tests are performed with the voltmeter fully assembled and inclosed in its case. Connect the voltmeter and test equipment (where required) to a 115-volt ac source, and allow them to reach operating temperature (one-half hour) before proceeding with the tests (para 38-40).

37. Test Equipment Required for Final Testing

The test equipment required for trouble-shooting (para 14) and calibration and adjustment (para 24) are also used for final testing except that Electron Tube Test Set TV-2/U replaces Electron Tube Test Set TV-7/U.

38. Calibration Final Test

This test is made at 60 cps for full-scale value of each range of the voltmeter under test, using the TS-682A/GSM-l as a standard. For the six low ranges from .001 to .3 VOLTS ranges, a voltage divider consisting of two TS-679/U's is used with the TS-682A/GSM-l. For the six high ranges from 1 to 300 VOLTS ranges, the comparison is made directly with the TS-682A/GSM-1.

a. Low Ranges Test (fig. 38).

(1) Connect the output of the TS-682/GSM-1 to the voltage divider consisting of the two TS-679/U's.

(2) Connect TS-679/U No. 2 across the INPUT binding posts of the voltmeter under test.

(3) Adjust the output of the TS-682A/GSM-1 to exactly 1 volt.

(4) Adjust the range selector switch of the voltmeter under test and TS-679/U No. 1 and No. 2 as indicated in the chart below.

Voltmeter range selector switch position (volts)	TS–679/U No. 1 (ohms)	TS–679/U No. 2 (ohms)
.001	99,900	100
.003	99,700	300
.01	99,000	1,000
.03	97,000	3,000
.1	90,000	10,000
.3	70,000	30,000

(5) Note the indication on the voltmeter under test. The indication should be full-scale value ±2 percent for each range.

b. High Ranges Test.

(1) Connect the output of the TS-682A/GSM-1 directly to the INPUT binding posts of the voltmeter under test.

(2) Adjust the range selector switch on the voltmeter under test and the TS-682A/GSM-1 as indicated in the chart below.

(3) Note the indication on the voltmeter under test. The indication should be full-scale value ±2 percent for each range.

Voltmeter range selector switch position (volts)	TS–682A/GSM–1 range (volts)	TS–682A/GSM–1 output (volts)
1	1	1
3	5	3
10	10	10
30	50	30
100	100	100
300	500	300

39. Frequency Response Find Test

The AN/URM-25B provides a signal voltage to the voltmeter under test at 100 kilocycles (kc) 1 mc, 2 mc, and 4 mc. The TS-382A/U provides a signal voltage at 20 cps and at 400 cps. The AN/USM-50 is used only as a monitor to maintain a constant input level regardless of the frequency.

a. Connect the TS-382A/U (A, fig. 39) and the AN/USM-50 across the INPUT binding posts of the voltmeter under test.

b. Operate the range selector switch on the voltmeter under test to the position indicated in *h* below.

c. Adjust the output frequency of the TS-382A/U to 400 cps.

d. Adjust the output voltage of the TS-382A/U for a full-scale deflection on the voltmeter under test.

e. Note the input level on the oscilloscope.

f. Disconnect the TS-382A/U and connect the AN/URM-25B in its place (B, fig. 39) .

g. Adjust the output frequency of the AN/URM-25B to 4 mc.

h. Adjust the output voltage of the AN/URM-25B to obtain the input level indication on the AN/USM-50 as noted in e above, The indication on the voltmeter under test should be within the minimum and maximum limits specified in the chart below.

Voltmeter range selector switch position (volts)	400 cps	Frequency and voltmeter indication									
		4 mc		2 mc		1 mc		100 kc		20 cps	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
1	1	.0.97	1.03	0.98	1.02	0.98	1.02	0.98	1.02	0.98	1.02
.3	0.3	0.291	0.309	0.294	0.306	0.294	0.306	0.294	0.306	0.294	0.306
.1	0.1	0.097	0.103	0.098	0.102	0.098	0.102	0.098	0.102	0.098	0.102
.03	0.03	0.0291	0.0309	0.0294	0.0306	0.0294	0.0306	0.0294	0.0306	0.0294	0.0306
.01	0.01	0.0097	0.0103	0.0098	0.0102	0.0098	0.0102	0.0098	0.0102	0.0098	0.0102
.003	0.003	0.00291	0.00309	0.00294	0.00306	0.00294	0.00306	0.00294	0.00306	0.00294	0.00306

i. Repeat the procedures in *g* and *h* above for all frequencies for each voltage range listed in the chart.

40. Amplifier Gain Final Test (fig. 43)

In the following test, use the AN/USM-50 to measure the output voltage of the voltmeter under test.

a. Connect the AN/URM-25B to the INPUT binding posts of the voltmeter under test.

b. Connect the TS-697/U across the OUTPUT binding posts of the voltmeter under test.

c. Adjust the TS-697/U to provide aresistance of 50 ohms.

d. Operate the range selector switch on the voltmeter under test to .001 VOLTS,

e. Adjust the output frequency of the AN/URM-25B to 10 kc.

f. Adjust the output voltage of the AN/URM-25B to 0.001 volt.

g. Connect the AWUSM-50 across the TS-697/U.

h. Adjust the AN/USM-50 to measure the voltage output of the voltmeter under test. The measured voltage should be not less than 0.075 volt.

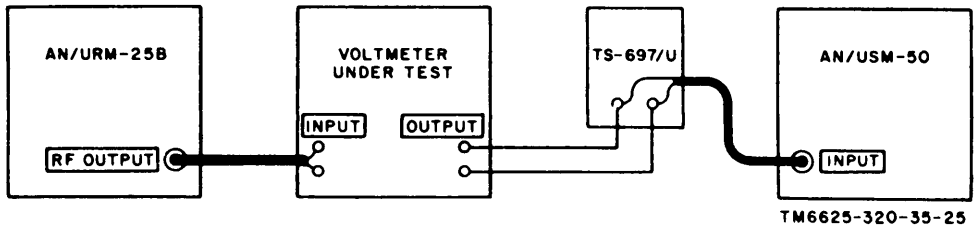


Figure 43. Setup for testing amplifier gain of voltmeter.

APPENDIX

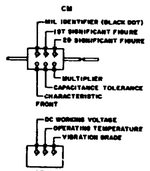
REFERENCES

Following is a list of applicable references available to the field and depot maintenance repairmen of Voltmeter, Meter ME-30A/U, and Voltmeters, Electronic ME-30B/U and ME-30C/U.

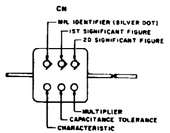
TA 11-17	Signal Field Maintenance Shops.
TA 11-100(11-17)	Allowances of Signal Corps Expendable Supplies for Signal Field Maintenance Shops.
TB SIG 225	Radioactive Electron Tube Handling.
TM 11-2535	Meter Test Equipment AN/GSM-1.
TM 11-2535B	Meter Test Set TS-682A/GSM-l.
TM 11-2684A	Audio Oscillators TS-382A/U, TS-382B/U, TS-382D/U, and TS-382E/U.
TM 11-5097	Spectrum Analyzers TS-723A/U and TS-723/U.
TM 11-5129	Oscilloscope AN/USM-50A, B, and C.
TM 11-5520	Decade Resistors TS-679/U and TS-679A/U.
TM 11-5527	Multimeters TS-352/U, TS-352A/U, and TS-352B/U.
TM 11-5551B	R. F. Signal Generator Set AN/URM-25B.
TM 11-5551D	R. F. Signal Generator Set AN/URM-25D.
TM 11-5551E	R. F. Signal Generator AN/URM-25F.
TM 11-6625-203-12	Operation and Organizational Maintenance: Multimeter AN/URM-105, Including Multimeter ME-77/U.
TM 11-6625-274-12	operator's and Organizational Maintenance Manual: Test Sets, Electron Tube TV-7/U, TV-7A/U, TV-7B/U, and TV-7D/U.
TM 11-6625-320-12	Operator's and Organizational Maintenance Manual: Voltmeter, Meter ME-30A/U and Voltmeters, Electronic ME-30B/U and ME-30C/U.
TM 11-6625-320-12P	Operator's and Organizational Maintenance Repair Parts and Special Tools Lists and Maintenance Allocation Chart: Voltmeter, Meter ME-30A/U, Voltmeter, Electronic ME-30B/U and ME-30C/U.
TM 11-6625-320-35P	Field and Depot Maintenance Repair Parts and Special Tools List: Voltmeter, Meter ME-30A/U, Voltmeter, Electronic ME-30B/U and ME-30C\U.

COLOR CODE MARKING FOR MILITARY STANDARD CAPACITORS

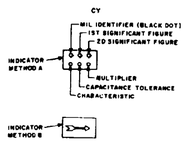
GROUP I Capacitors, Fixed, Various-Dielectrics, Styles CM, CN, CY, and CB



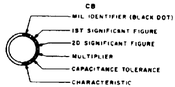
MICA-DIELECTRIC



PAPER-DIELECTRIC

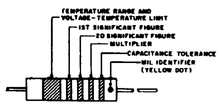


GLASS-DIELECTRIC, GLASS CASE

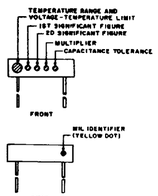


MICA, BUTTON TYPE

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



AXIAL LEAD



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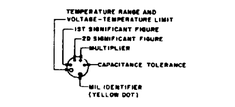
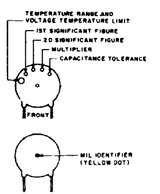


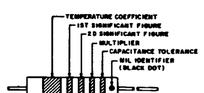
FEED-THROUGH

STAND-OFF

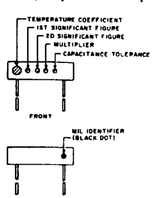


DISK-TYPE

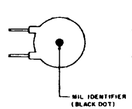
GROUP III Capacitors, Fixed, Ceramic-Dielectric (Temperature Compensating) Style CC

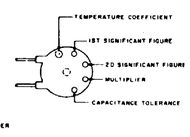


AXIAL LEAD



RADIAL LEAD





DISK-TYPE

Figure 44. MIL-STD resistor color code markings.

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

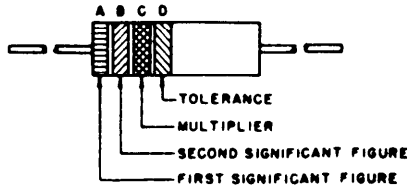
COLOR	TEMPERATURE COEFFICIENT[4]	1st SIG FIG	2nd SIG FIG	MULTIPLIER[1]	CAPACITANCE TOLERANCE		MIL ID
					Capacitances over 10uuf	Capacitances 10uuf or less	
BLACK	0	0	0	1		± 2.0uuf	CC
BROWN	−30	1	1	10	± 1%		
RED	−80	2	2	100	± 2%	± 0.25uuf	
ORANGE	−150	3	3	1,000			
YELLOW	−220	4	4				
GREEN	−330	5	5		± 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 temperarure range and voltage-temperature limits designated in MIL-C-11015.
4. Temperature coefficient in parts per million per degree centigrade.

STD-CR

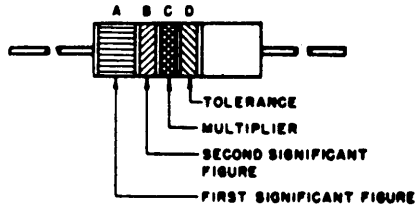
COLOR CODE MARKING FOR MILITARY STANDARD RESISTORS

COMPOSITION-TYPE RESISTORS



BAND A— Equal Width Band Signifies Composition-Type

WIREWOUND-TYPE RESISTORS

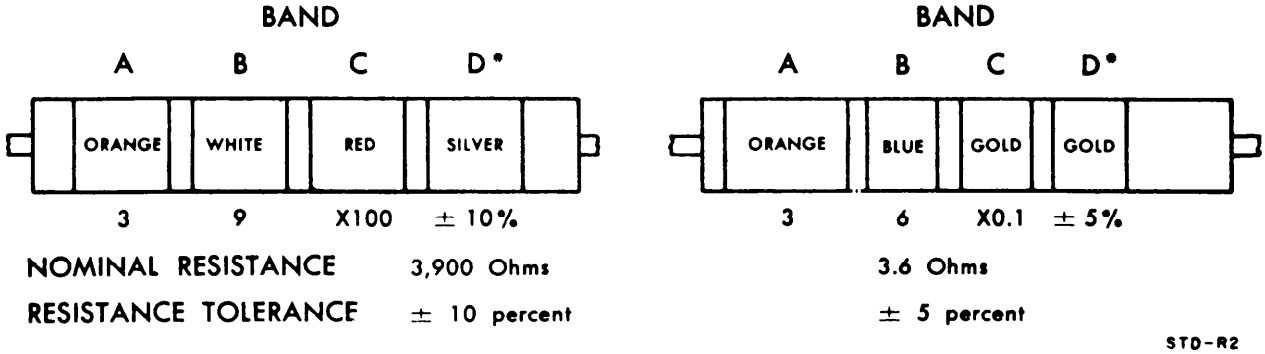


BAND A— Double Width Signifies Wire-wound Resistor

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



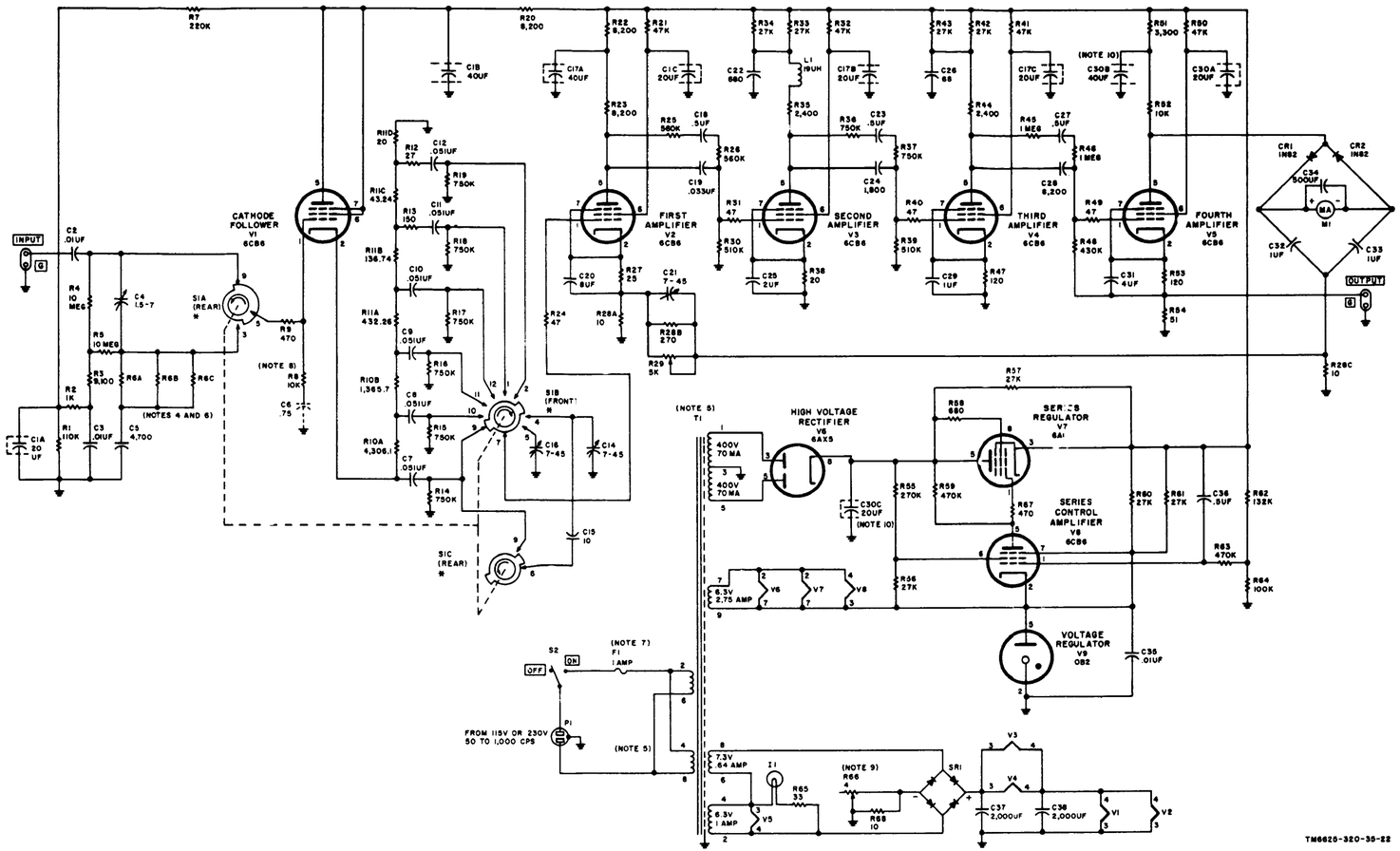
*If Band D is omitted, the resistor tolerance is ±20%, and the resistor is not Mil-Std.

Figure 45. MIL-STD capacitor color code markings.

NOTES:

1. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UUF.
2. WAFER SWITCHES ARE IN EXTREME COUNTERCLOCKWISE POSITION AND ARE VIEWED FROM FRONT, EXCEPT AS OTHERWISE INDICATED. FRONT OF WAFER IS SIDE TOWARD CONTROL KNOB. WAFER NEAREST CONTROL KNOB IS SECTION A.
3. ▭ INDICATES EQUIPMENT MARKING.
4. R6A, R6B AND R6C CONSIST OF A PARALLEL COMBINATION OF THREE RESISTORS WHOSE VALUES ARE NORMALLY 10 OHMS.
5. TRANSFORMER T1 SHOWN CONNECTED FOR 115V INPUT. FOR 230V OPERATION, THE JUMPERS BETWEEN TERMINALS 2 AND 4, AND 6 AND 8 ARE REMOVED AND A SINGLE JUMPER IS CONNECTED BETWEEN TERMINALS 6 AND 4.
6. FACTORY SELECTION.
7. FOR 230V OPERATION, FUSE F1 IS .5 AMP.
8. C6 IS STRAY CAPACITY BETWEEN RESISTOR R8 TERMINAL LUG AND ADJACENT CHASSIS CONNECTED LUG.
9. ON EQUIPMENT WITH SERIAL NUMBERS BELOW 4145, RESISTOR R6B IS 3 OHMS. ON EQUIPMENT WITH SERIAL NUMBERS BELOW 4345, RESISTOR R6B (10 OHMS), IS NOT USED.
10. ON EQUIPMENT WITH SERIAL NUMBERS 4472, 4473, 4784, 5048, 5068, 5069, 5071, 5072, 5073, 5074, 5131, AND ABOVE THE VALUES OF CAPACITORS C30B AND C30C ARE AS INDICATED. ON ALL OTHER EQUIPMENT THESE VALUES ARE TRANSPOSED.

RANGE SELECTOR SWITCH POSITION		CONTACTS		
DB	VOLTS	S1A (REAR)	S1B (FRONT)	S1C (REAR)
-60	.001	5-9	7-9	—
-50	.003	5-9	7-10-4	6-9
-40	.01	5-9	7-11-5	—
-30	.03	5-9	7-12	—
-20	.1	5-9	7-1	—
-10	.3	5-9	7-2	—
0	1	5-3	7-9	—
+10	3	5-3	7-10-4	6-9
+20	10	5-3	7-11-5	—
+30	30	5-3	7-12	—
+40	100	5-3	7-1	—
+50	300	5-3	7-2	—



TM6626-320-35-22

Figure 46. ME-30A/U, schematic diagram.

NOTES:

1. THE ENCIRCLED NUMBER ADJACENT TO THE STATION NUMBER ON SOME WIRES CORresponds TO THE TERMINATING POINT AT THAT STATION.
2. WIRING AND GROUND LOCATIONS ARE CRITICAL FOR THE INTRODUCTION OF APPROPRIATE DISTRIBUTED CAPACITIES.
3. P DENOTES PAIR.
4. BS DENOTES BARE STRAPPING.
5. ALL LEADS FROM CAPACITY AND RESISTORS NOT IDENTIFIED BY A COLOR OR BS ARE PIGTAILS.
6. ALL TERMINAL BOARD NUMBERS ABOVE EB AND TERMINAL NUMBERS ARE ARBITRARILY ASSIGNED.
7. WAFER SWITCHES ARE IN EXTREME COUNTERCLOCKWISE POSITION AND ARE VIEWED FROM FRONT, EXCEPT AS OTHERWISE INDICATED. FRONT OF WAFER IS SIDE TOWARD CONTROL KNOB. WAFER NEAREST CONTROL KNOB IS SECTION A. SECTION D IS USED ONLY FOR TIE POINTS.
8. WIRING OF PRIMARY WINDING OF TRANSFORMER T1 SHOWN FOR 115-VOLT AC INPUT. FOR 230-VOLT AC INPUT STRAPS FROM TERMINALS 2 TO 4 AND 6 TO 8 ARE NOT USED, AND TERMINAL 4 IS STRAPPED TO TERMINAL 6.
9. ON EQUIPMENT WITH SERIAL NUMBERS BELOW 4165, RESISTOR R66 (5.5 OHMS) ON EQUIPMENT WITH SERIAL NUMBERS BELOW 4345, RESISTOR R68 (10 OHMS), IS NOT USED.
10. ON EQUIPMENT WITH SERIAL NUMBERS 4472, 4473, 4784, 5048, 5068, 5069, 5071, 5072, 5073, 5074, 5127, 5131, AND ABOVE, THE CONNECTIONS AT TERMINALS 5 AND 6 OF CAPACITOR C30 ARE AS INDICATED ON ALL OTHER EQUIPMENT THESE TERMINALS ARE TRANSPOSED.

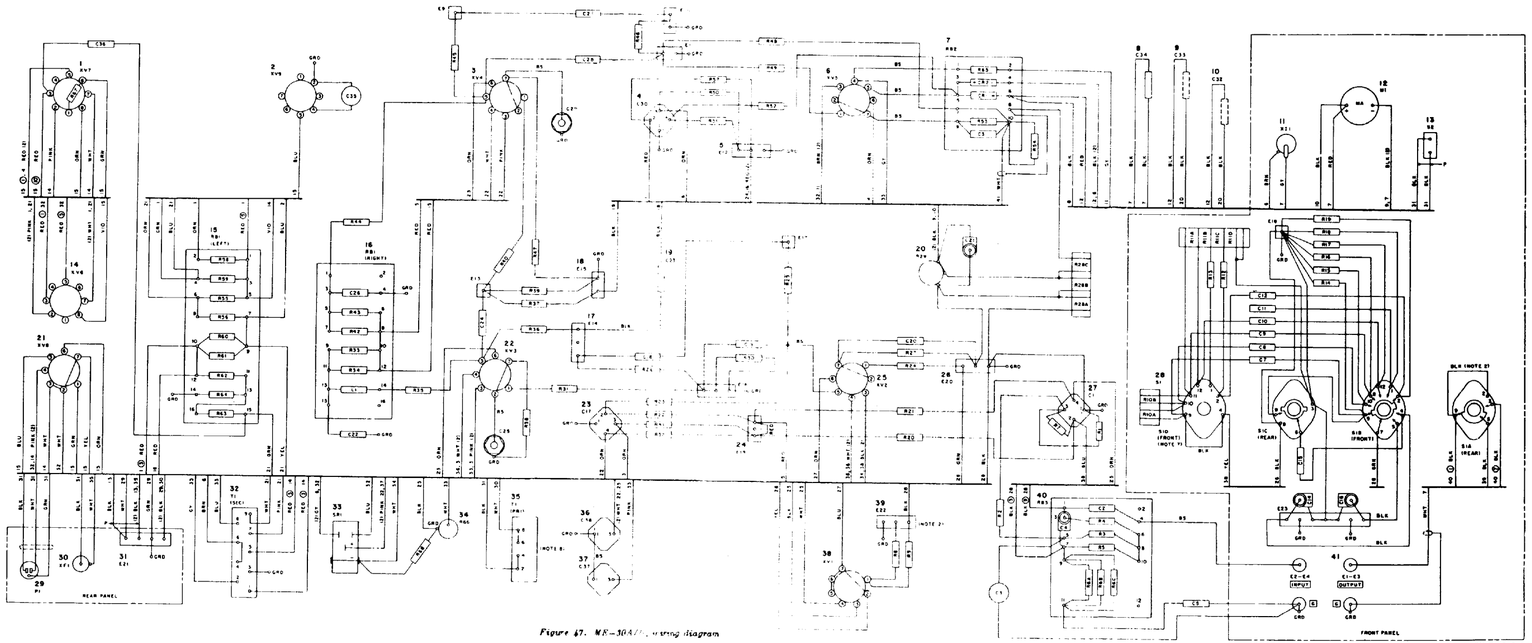


Figure 67. MK-30A/[illegible] wiring diagram

NOTES:

1. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, CAPACITANCES IN UUF
2. WAFER SWITCHES ARE IN EXTREME COUNTERCLOCKWISE POSITION AND ARE VIEWED FROM FRONT, EXCEPT A" OTHERWISE INDICATED. FRONT OF WAFER IS SIDE TOWARD CONTROL KNOB. WAFER NEAREST CONTROL KNOB IS SECTION A.
3. ▭ INDICATES EQUIPMENT MARKING
4. R16 AND R64 CONSIST OF A PARALLEL COMBINATION OF TWO OR MORE RESISTORS WHOSE VALUES RANGE FROM 10 TO 33 OHMS IN SOME EQUIPMENTS A CAPACITOR OF .005 OR OF MICROFARAD IS ALSO CONNECTED IN PARALLEL
5. TRANSFORMER T1 SHOWN CONNECTED FOR 115V INPUT FOR 230V OPERATION. THE JUMPERS BETWEEN TERMINALS 10 AND 12, AND 11 AND 13 ARE REMOVED AND A SINGLE JUMPER IS CONNECTED BETWEEN TERMINALS 11 AND 12
6. FACTORY SELECTION.
7. THE VALUE MAY VARY FROM 330K TO 680K.
8. FOR 230V OPERATION, FUSE F1 IS 3 AMP.
9. THE VALUE OF R12 MAY VARY FROM 10 TO 330. REPLACE R12 WITH A 100 OHM RESISTOR WHEN IT IS NOT POSSIBLE TO DETERMINE THE COLOR-CODED VALUE OF THE DEFECTIVE R12.
10. ON ME-30B/U (ORDER NO. 39132-PP-58-A3-A3), THERE IS NO CONNECTION BETWEEN PIN 3 OF TUBE V8 HEATER (CONNECTED ACROSS TERMINALS 4 AND 5 OF TRANSFORMER T1) AND RESISTOR R81.
11. ON ME-30B/U (ORDER NO. 39132-PP-58-A3-A3) A WIRE CONNECTS PIN 2 OF TUBE V7 AND PIN 4 OF TUBE V8 HEATER.
12. ON ME-30B/U (ORDER NO. 39132-PP-58-A3-A3), CAPACITORS C21, C31, C33, AND C34 ARE .05UUF, 9,100UUF, 510UUF, AND 1,000UF, RESPECTIVELY.

*

RANGE SELECTOR SWITCH POSITION		CONTACTS			
DB	VOLTS	S1A (REAR)	S1B (FRONT)	S1B (REAR)
-60	.001	1-2	1-2	1-2
-50	.003	1-2	1-3-8	
-40	.01	1-2	1-4-9	
-30	.03	1-2	1-5	
-20	.1	1-2	1-6	
-10	.3	1-2	1-7	
0	1	1-3	1-2	
+10	3	1-3	1-3-8	1-3
+20	10	1-3	1-4-9	
+30	30	1-3	1-5	
+40	100	1-3	1-6	
+50	300	1-3	1-7	

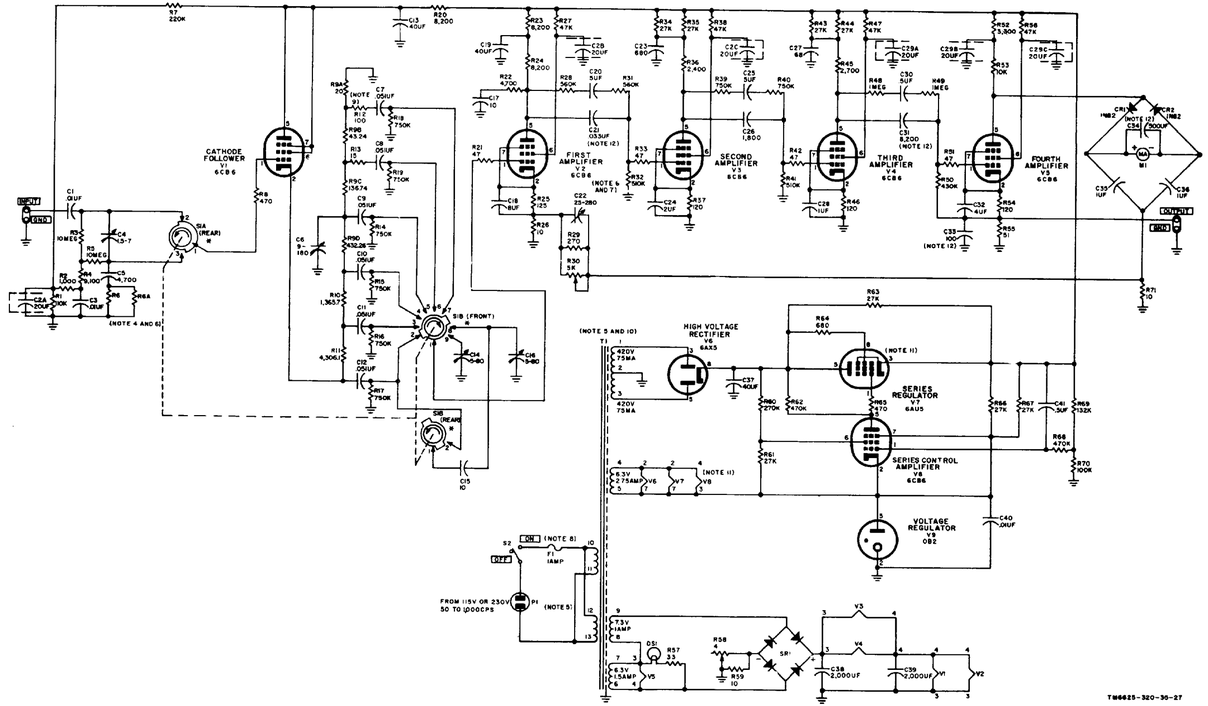


Figure 48. ME-30B/U, schematic diagram.

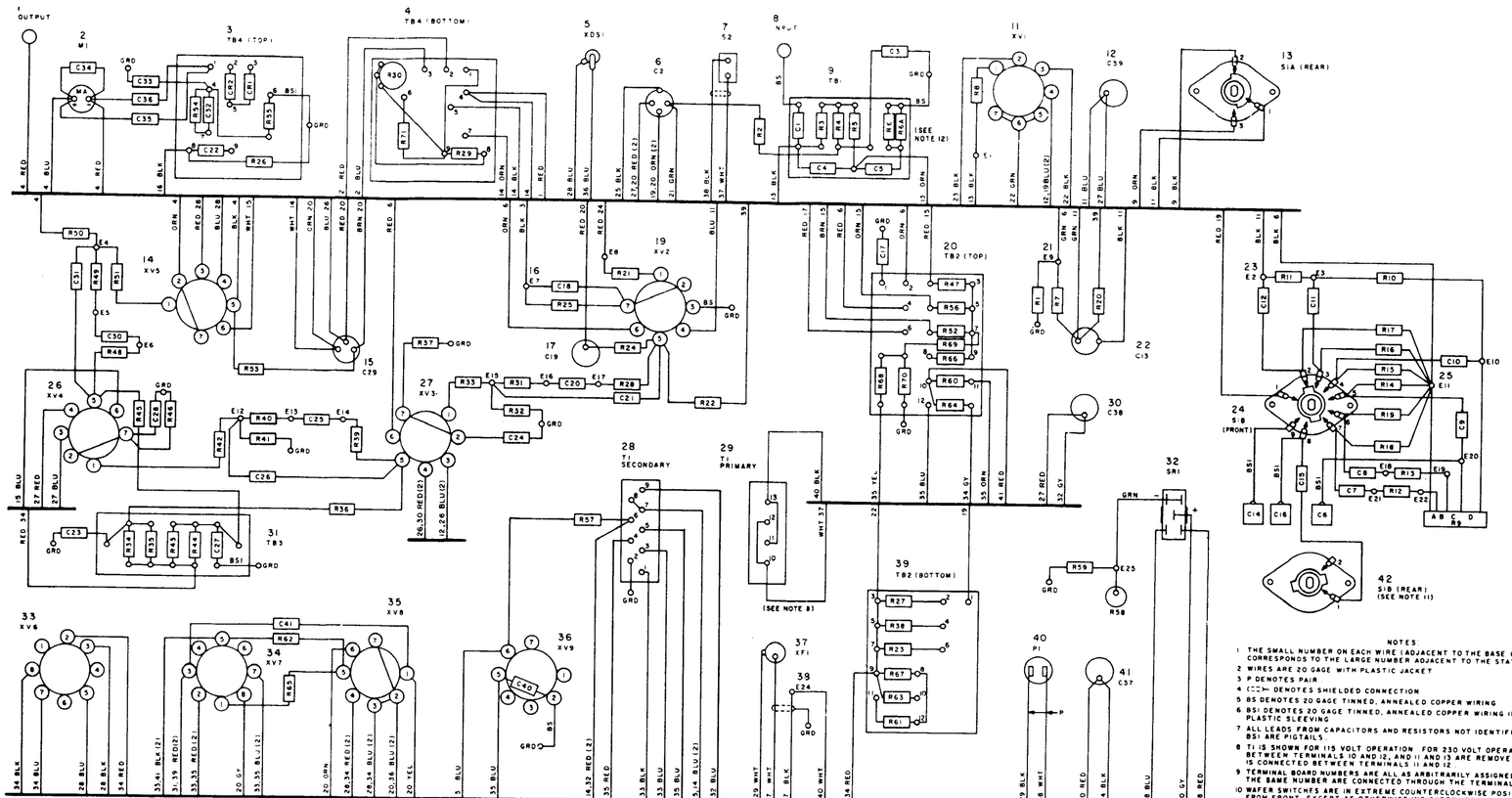
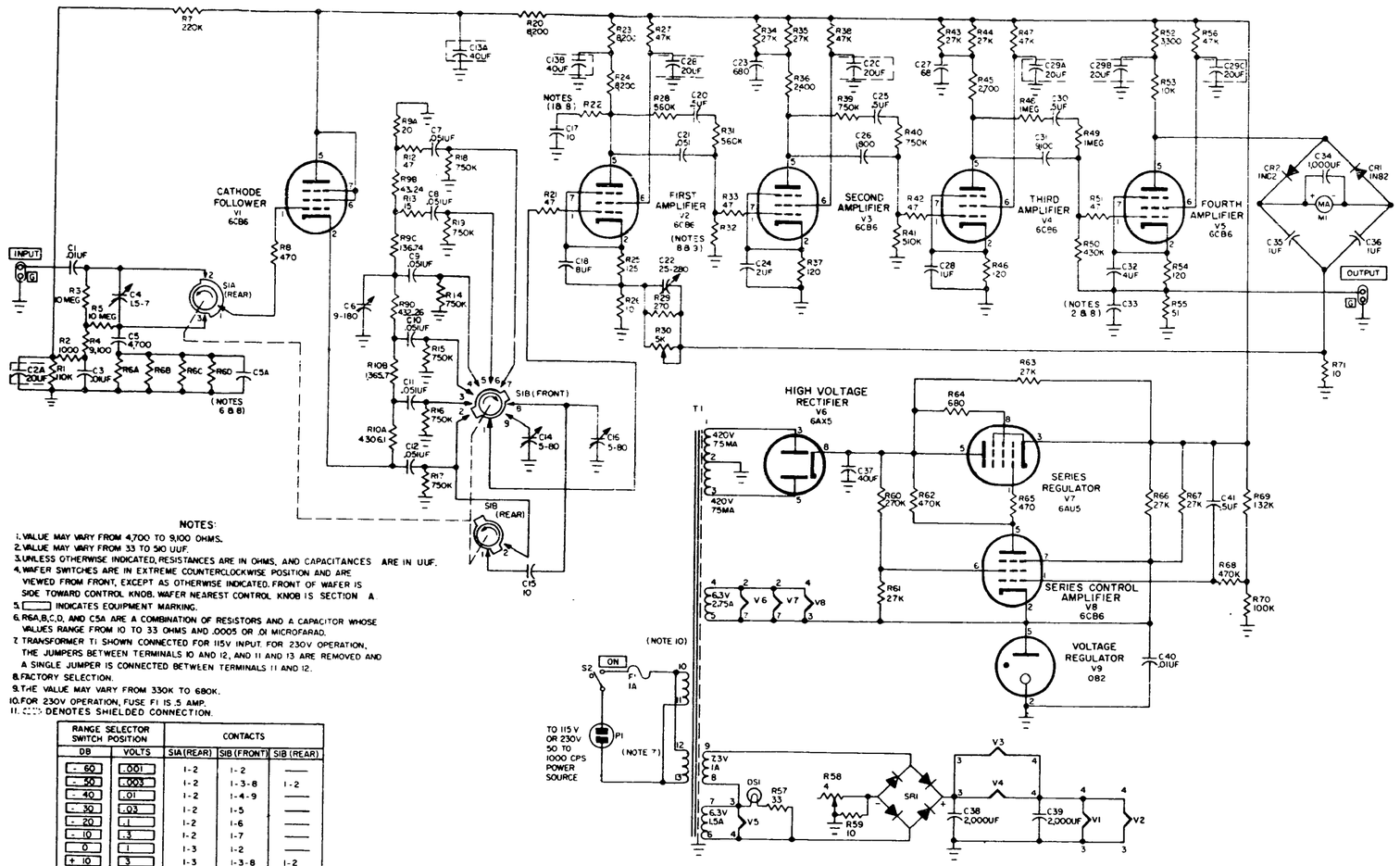


Figure 49. ME–30B/U, wiring diagram.

NOTES

1. THE SMALL NUMBER ON EACH WIRE (ADJACENT TO THE BASE OR COMMON LINE) CORRESPONDS TO THE LARGE NUMBER ADJACENT TO THE STATION TO WHICH IT RUNS
2. WIRES ARE 20 GAGE WITH PLASTIC JACKET
3. P DENOTES PAIR
4. ⊂⊃⊢ DENOTES SHIELDED CONNECTION
5. BS DENOTES 20 GAGE TINNED, ANNEALED COPPER WIRING
6. BSI DENOTES 20 GAGE TINNED, ANNEALED COPPER WIRING INSULATED WITH PLASTIC SLEEVING
7. ALL LEADS FROM CAPACITORS AND RESISTORS NOT IDENTIFIED BY A COLOR, BS OR BSI ARE PIGTAILS.
8. T1 IS SHOWN FOR 115 VOLT OPERATION. FOR 230 VOLT OPERATION, THE JUMPERS BETWEEN TERMINALS 10 AND 12, AND 11 AND 13 ARE REMOVED AND A SINGLE JUMPER IS CONNECTED BETWEEN TERMINALS 11 AND 12.
9. TERMINAL BOARD NUMBERS ARE ALL AS ARBITRARILY ASSIGNED. TERMINALS ASSIGNED THE SAME NUMBER ARE CONNECTED THROUGH THE TERMINAL BOARD.
10. WAFER SWITCHES ARE IN EXTREME COUNTERCLOCKWISE POSITION AND ARE VIEWED FROM FRONT, EXCEPT AS OTHERWISE INDICATED. FRONT OF WAFER IS SIDE TOWARD CONTROL KNOB. WAFER NEAREST CONTROL KNOB IS SECTION A.
11. TERMINAL 2 ON S1B (REAR) IS CONNECTED TO TERMINAL NUMBER 2 ON SWITCH S1B (FRONT) THROUGH THE SWITCH WAFER.
12. R6 AND R64 CONSIST OF A PARALLEL COMBINATION OF TWO OR MORE RESISTORS. IN SOME EQUIPMENTS, A CAPACITOR IS ALSO CONNECTED IN PARALLEL.
13. ON ME-30B/U (ORDER NO 39132-PP-58-A3-A3), THERE IS A JUMPER LEAD BETWEEN PINS 2 AND 3 AT STATION 34.
14. ON ME-30B/U (ORDER NO 39132-PP-58-A3-A3), THERE IS NO JUMPER LEAD BETWEEN PINS 2 AND 3 AT STATION 35.

TM6625-320-35-26



NOTES:

1. VALUE MAY VARY FROM 4,700 TO 9,100 OHMS.
2. VALUE MAY VARY FROM 33 TO 510 UUF.
3. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, AND CAPACITANCES ARE IN UUF.
4. WAFER SWITCHES ARE IN EXTREME COUNTERCLOCKWISE POSITION AND ARE VIEWED FROM FRONT, EXCEPT AS OTHERWISE INDICATED. FRONT OF WAFER IS SIDE TOWARD CONTROL KNOB. WAFER NEAREST CONTROL KNOB IS SECTION A.
5. [ ] INDICATES EQUIPMENT MARKING.
6. R6A,B,C,D, AND C5A ARE A COMBINATION OF RESISTORS AND A CAPACITOR WHOSE VALUES RANGE FROM 10 TO 33 OHMS AND .0005 OR .01 MICROFARAD.
7. TRANSFORMER T1 SHOWN CONNECTED FOR 115V INPUT. FOR 230V OPERATION, THE JUMPERS BETWEEN TERMINALS 10 AND 12, AND 11 AND 13 ARE REMOVED AND A SINGLE JUMPER IS CONNECTED BETWEEN TERMINALS 11 AND 12.
8. FACTORY SELECTION.
9. THE VALUE MAY VARY FROM 330K TO 680K.
10. FOR 230V OPERATION, FUSE F1 IS .5 AMP.
11. ⊂⊃ DENOTES SHIELDED CONNECTION.

RANGE SELECTOR SWITCH POSITION		CONTACTS		
DB	VOLTS	S1A (REAR)	S1B (FRONT)	S1B (REAR)
- 60	.001	1-2	1-2	——
- 50	.003	1-2	1-3-8	1-2
- 40	.01	1-2	1-4-9	——
- 30	.03	1-2	1-5	——
- 20	.1	1-2	1-6	——
- 10	.3	1-2	1-7	——
0	1	1-3	1-2	——
+ 10	3	1-3	1-3-8	1-2
+ 20	10	1-3	1-4-9	——
+ 30	30	1-3	1-5	——
+ 40	100	1-3	1-6	——
50	300	1-3	1-7	——

Figure 50. ME-30C/U, schematic diagram.

TM6625-320-35-31

NOTES:

1. THE ENCIRCLED NUMBER ADJACENT TO THE STATION NUMBER ON BOARD EDGE CORRESPONDS TO THE TERMINATING POINT OF THAT STATION.
2. THE SMALL NUMBER ON EACH WIRE (ADJACENT TO THE BASE OR COMMON LINE) CORRESPONDS TO THE LARGE NUMBER ADJACENT TO THE STATION TO WHICH IT RUNS.
3. WAFER SWITCHES ARE IN EXTREME COUNTERCLOCKWISE POSITION AND ARE VIEWED FROM FRONT, EXCEPT AS OTHER-WISE INDICATED. FRONT OF WAFER IS SIDE TOWARD CONTROL KNOB. WAFER NEAREST CONTROL KNOB IS SECTION A, SECTION C IS USED ONLY FOR TIE POINTS.
4. P DENOTES PWB.
5. SB DENOTES BARE STRAPPING.
6. ALL LEADS FROM CAPACITORS AND RESISTORS NOT IDENTIFIED BY A COLOR OR SB ARE PART LEADS.
7. ALL TERMINAL BOARD NUMBERS ABOVE E9 AND TERMINAL NUMBERS ARE ARBITRARILY ASSIGNED.
8. WIRING OF PRIMARY WINDING OF TRANSFORMER T1 SHOWN FOR 115-VOLT AC INPUT. FOR 230-VOLT AC INPUT STRAP'S FROM TERMINALS 10 TO 12 AND 11 TO 13 ARE NOT USED, AND TERMINAL 9 IS STRAPPED TO TERMINAL 12.
9. WIRING AND GROUND LOCATIONS ARE CRITICAL FOR THE INTRODUCTION OF APPROPRIATE DISTRIBUTED CAPACITIES.
10. ⊏⊐⊏⊐ DENOTES SHIELDED CONNECTION.
11. CAPACITORS C25 AND C36 ARE ABOVE CHASSIS.

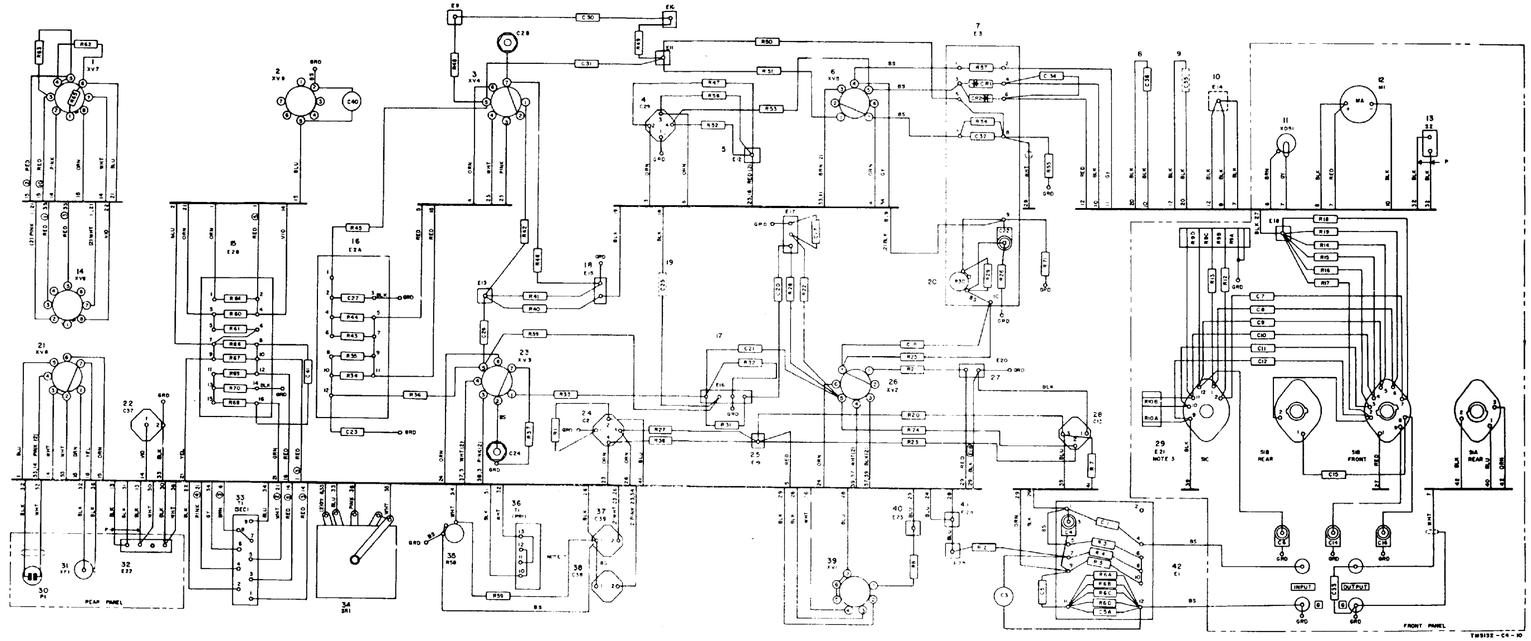


Figure 3-1. Wiring diagram.

By Order of Secretary of the Army:

G. H. DECKER,
General, United States Army,
Chief of Staff.

Official:

R. V. LEE,
Major General, United States Army,
The Adjutant General

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USAAVNBD (1)
USAATBD (1)
ARADCOM (2)
ARADCOM Rgn (2)
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MDW (1)
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Div (2)
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USATC AD (2)
USATC Armor (2)
USATC Engr (2)
USATC FA (2)
USATC Inf (2)
Svc Colleges (2)
Br Svc Sch (2)
GENDEP (2) except
Atlanta GENDEP (None)
Sig Sec, GENDEP (5)
Sig Dep (12)
AFIP (1)
WRAMC (1)
AFSSC (1)
USAEPG (2)
APG (5)
EMC (1)
USACA (2)
USASEA (1)
USA Caribbean Sig Agcy (1)
USA Sig Msl Spt Agcy (12)
USASSA (20)
USASSAMRO (1)
Army Pictorial Cen (2)
USAOMC (3)
USA Trans Tml Comd (1)
Army Tml (1)
POE (1)
OSA (1)
AMS (1)
Sig Fld Maint Shops (2)
JBUSMC (2)
Units org under fol TOE:
11-7 (2)
11-16 (2)
11-57 (2)
11-97 (2)
11-98 (2)
11-117 (2)
11-155 (2)
11-500 (AA-AE,RA-RT) (4)
11-555 (2)
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.

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The Metric System and Equivalents

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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

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