DEPARTMENT OF THE ARMY TECHNICAL MANUAL

DEPARTMENT OF THE AIR FORCE TECHNICAL ORDER

TM 11-2258

TO 31S2-2TXC1-1

FACSIMILE SETS AN/TXC-1, -1A -1B, -1C, AND -1D

This copy is a reprint which includes current pages from Changes IN FORCE 1.4.5.6.7

DEPARTMENTS OF THE ARMY AND THE AIR FORCE

MAY 1955

WARNING

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT

Be careful when working on the 450-volt plate and power supply circuits, or on the 115-volt ac line connections. Voltages as high as 1,250 volts ac are developed in the rectifier unit. Voltages up to 1,000 volts ac are developed in the transceiver.

DON'T TAKE CHANCES

CHANGE
No. 7

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC *19 February 1974*

FACSIMILE SETS AN/TXC-1, -1A, -1B, -1C, AND -1D

TM 11-2258, 3 May 1955, is changed as follows:

Page 3. Paragraph 2 is superseded as follows:

2. Forms and Records

a. Reports of Maintenance and Unsatisfactory Equipment. Maintenance forms, records, and reports which are to be used by maintenance personnel at all maintenance levels are listed in and prescribed by TM 38-750.

b. Report of Packaging and Handling Deficiencies. Fill out and forward DD Form 6 (Report of Packaging and Handling Deficiencies) as prescribed in AR 700-58 (Army)/NAVSUP PUB 378 (Navy)/AFR 71-4 (Air Force)/MCO P4030.29 (Marine Corps), DSAR 4145.8.

c. Discrepancy in Shipment Report (DISREP) (SF 361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38(Army)/NAVSUPINST 4610.33/AFM 75-18/MCO P4610.19A (Marine Corps), and DSAR 4500.15.

2.1. Reporting of Errors

The reporting of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publications) and forwarded direct to Commander, US Army Electronics Command, ATTN: AMSEL-MA-C Fort Monmouth, NJ 07703.

Page 6. Paragraph 6.1 is added after paragraph 6.

6.1. Items Comprising an Operable Equipment

FSN	*QTY*	*Nomenclature, part No., and Mfr code*	*Usable on code*
		NOTE The part number is followed by the applicable 5-digit Federal supply code for manufacturers (FSCM) identified in SB 708-42 and used to identify manufacturer, distributor, or Government agency, etc. **NOTE** Number 1 in the *Usable on code* column refers to AN/TXC-1; number 2 refers to AN/TXC-1A; number 3 refers to AN/TXC-1B; number 4 refers to AN/TXC-1C; and number 5 refers to AN/TXC-1D. ITEMS COMPRISING AN OPERABLE EQUIPMENT	
5995-161-8710	1	Cable Assembly, Power, Electrical 2 cond; 8 1/2 in. lg; one PL-55 on 1st end; 2 Mueller Electric alligator clips type "Pee-Wee" #45 on 2nd end #90-37-03; 97983	1,2,3,4,5
5995-164-6558	1	Cable Assembly, Power, Electrical: 1 cond; 5 ft 9 3/4 in. lg o/a incl terms; 1 GE Plug Part #1346 on 1st end 2 Muellar Electric alligator clips part #60S on 2nd end #90-37-02; 97983	1,2,3,4,5

FSN	QTY	Nomenclature, part No., and mfr code	Usable on code
5995-161-8708	1	Cable Assembly, Special Purpose, Electrical: CD-1019; 96 in. lg; 1 JAN Plug Type #PJ-068 on 1st & 2nd end; D-4822; 80063	1,2,3,4,5
5995-164-6594	1	Cable Assembly, Special Purpose, Electrical: CD-1018; 10 ft lg; PJ-055B on 1st end; PJ-055BL on 2nd end; SC-D-4821; 80063	1,2,3,4,5
5615-505-7183	1	Blower and Dust Filter Assembly: 115 v, 60 Hz, single Ph; 16 3/4 in. lg x 9 in. h x 10 in. d o/a; SM-D-201669; 80063	1,2,3,4,5
5815-164-7132	1	Facsimile Transceiver TT-1/TXC-1; TT-1A/TXC-1; TT-1C/TXC-1	1,2,3
5815-194-9523	1	Facsimile Transceiver: TT-1D/TXC-1; TT-1E/TXC-1	4
5815-396-3412	1	Facsimile Transceiver: TT-1F/TXC-1	5
5965-128-2991	1	Loudspeaker, Permanent Magnet: LS-11 (Not installed)	1,2,3,4,5
7530-282-8858	1	Paper, Recording Electrosensitive: For use when copies will be required; type "A" (Not mounted); 97983	1,2,3,4,5
7530-282-8860	1	Paper, Recording Electrosensitive: For use when no copies will be required; type "ND" (Not mounted; 97983	1,2,3,4,5
5815-255-0171	1	Power Supply:PP-86/TXC-1 (Not installed)	1,2
5815-243-0366	1	Power Supply:PP-86A/TXC-1; PP-86B/TXC-1 (Not installed)	3,4
5815-643-0257	1	Power Supply:PP-86E/TSC-1 (Not installed)	1,2,3,4,5
5815-244-4359	1	Table:MT-252/TXC-1; MT-252A/TXC-1; MT-252B/TSC-1	1,2,3,4,5
		EXHAUST BLOWER ASSEMBLY	
5815-505-7183	1	Exhaust Blower Assembly:(Basic Component)	
5340-392-8460	2	Clamp 1.660 in. dia x 3/4 in. w; 936C-69; 07344	
5815-392-9652	1	Hose, Flexible:f/collection of carbon dust emitted by stylus; 1 1/4 in. id x 42 in. lg; SM-B-201668; 80063	
		FACSIMILE TRANSCEIVER	
		NOTE Number 1 in *Usable on code* column refers to TT-1/TXC-1; number 2 refers to TT-1A/TXC-1; number 3 refers to TT-1B/TXC-1; number 4 refers to TT-1C/TXC-1; number 5 refers to TT-1D/TXC-1; number 6 refers to TT-1E/TXC-1; number 7 refers to TT-IF/TXC-1, procured on order #6437-PH-51; and number 8 refers to TT-1F/TXC-1 procured on order #21326-PH-56.	
	1	Facsimile Transceiver:TT-1/TXC-1 (Basic Component)	
	1	Facsimile Transceiver:TT-1A/TXC-1 (Basic Component)	
	1	Facsimile Transceiver:TT-1B/TXC-1 (Basic Component)	
	1	Facsimile Transceiver:TT-1C/TXC-1 (Basic Component)	
	1	Facsimile Transceiver:TT-1D/TXC-1 (Basic Component)	
	1	Facsimile Transceiver:TT-1E/TXC-1 (Basic Component)	
	1	Facsimile Transceiver:TT-1F/TXC-1 (Basic Component)	
	1	Facsimile Transceiver:TT-IF/TXC-1 (Basic Component)	
5815-392-8676	1	Exhaust Tube Assembly:L-shaped tube 3 1/8 in. w x 13 5/8 in. lg x 1 1/4 in. dia; SM-C-201305 (Mounted in equip); 80063	1,2,3,4,5 6,7,8
		RUNNING SPARES	
5960-261-9669	1	Photo-Electric Cell:Mil type 5652 (Not mounted)	1,2,3,4,5,6,7,8
5815-508-7819	50	Stylus NeedleAssembly:straight needle 0.125 in. lg, 0.625 in. lg o/a SC-B-37031 (Not mounted); 80063	1,2,3,4
5815-220-9946	50	Stylus, Recording, Sound: 68 deg angle; 0.004 in. rad; brass shank 3/4 in. lg x 0.062 in. dia o/a; 42-00-10-00 (Not mounted); 97983	5,6,7,8

Page 7, paragraph 7. Change "Table of Components" to read "Components and Dimensions."

Page 14. After paragraph 11 add:

11.1 Expendable Consumable Items

A list of expendable consumable items required for operation appear in table I.1.

Table 1.1. Expendable Consumable Supplies and Material

The supplies and material listed in this table are required for operation of this equipment and are authorized to be requisitioned by SB 700-50. The FSN or the applicable unit of issue required can be found in appropriate supply catalogs. The FSCM is used as an element in item identification to designate manufacturer or distributor or Government agency, etc., and is identified in SB 708-42.

Item	*Description*	*Ref. No. and FSCM*	*FSC*
1	*Carbon*, Granular:activated carbon 1/2 lb can	130-00-00-04	6810
2	Paper, Recording, Electrosensitive:for use when no copies will be required	ND 97983	7530
3	Paper, Recording, Electrosensitive:for use when copies will be required	A 97983	7530

Page 200. Appendix III is superseded as follows:

APPENDIX III
BASIC ISSUE ITEMS LIST (BIIL) AND ITEMS TROOP INSTALLED OR AUTHORIZED LIST (ITIAL)

Section I. INTRODUCTION

1. Scope

This appendix lists only basic issue items required by the crew/operator for installation, operation, and maintenance of Facsimile Sets AN/TXC-1, 1A, -1B, -1C, and -1D.

2. General

This Basic Issue Items and Items Troop Installed or Authorised List is divided into the following sections:

a. Basic Issue Items List-Section II. A list, in alphabetical sequence, of items which are furnished with and which must be turned in with the end item.

b. Items Troop Installed or Authorized List-Section III. Not applicable.

3. Explanation of Columns

The following provides an explanation of columns found in the tabular listings:

a. Illustration. This column is divided as follows:

(1) *Figure Number.* Indicates the figure number of the illustration in which the item is shown.

(2) *Item Number.* Not applicable

b. Federal Stock Number. Indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. Part Number. Indicates the primary number used by the manufacturer (individual, company, firm, corporation, or government activity), which controls the design and characteristics of the item by means of its engineering drawings, specifications standards, and inspection requirements, to identify an item or range of items.

d. Federal Supply Code for Manufacturer (FSCM). The FSCM is a 5-digit numeric code used to identify the manufacturer, distributor, or Government agency, etc., and is identified in SB 708-42.

e. Description. Indicates the Federal item name and a minimum description required to identify the item.

f. Unit of Measure (U/M). Indicates the standard of basic quantity of the listed item as used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in., pr, etc.) When the unit of measure differs from the unit of issue,

the lowest unit of issue that will satisfy the required units of measure will be requisitioned.

g. Quantity Furnished With Equipment (Basic Issue Items Only). Indicates the quantity of the basic issue item furnished with the equipment.

h. Quantity Authorized (Items Troop Installed or Authorized Olny). Indicatea the quantity of the item authorized to be used with the equipment.

Section II. BASIC ISSUE ITEMS LIST

(1) Illustration		(2) Federal stock number	(3) Part number	(4) FSCM	(5) Description Usable on code	(6) Unit of meas	(7) Qty furn with equip
(A) Fig. no.	(B) Item no.						
					FACSIMILE TRANSCEIVER		
		5815-652-8557	96-00-22	97983	COVER, DUST 34 1/2 in. lg x 18 1/2 in. w x 10 1/2 in. h (Mounted in equip)	EA	1
					RECTIFIER POWER UNIT		
		5815-406-0794	96-15-22	97983	COVER, POWER SUPPLY:12 1/2 in. lg x 10 1/2 in. w x 10 in. h (Mounted in equip)	EA	1
					EXHAUST BLOWER ASSEMBLY		
		6810-630-0355	MIL-AN#V-3	96906	BAG:Filter cloth construction; used as dust bag in exhaust system	EA	4

By Order of the Secretary of the Army:

CREIGHTON W. ABRAMS
General, ***United States Army***
Chief *of Staff*

Official:
VERNE L. BOWERS
Major General, United States Army
The Adjutant General

Distribution:
Active Army:
USASA (2)
CNGB (1)
ACSC-E (2)
Dir of Trans (1)
COE (1)
TSG (1)
USAARENBD (1)
USAMB (10)
AMC (1)
MICOM (2)
TECOM (2)
TRADOC (2)
ARADCOM (2)
ARADCOM Rgn (2)
Os Maj Comd (4)
LOGCOMD (3)
USACC (4)
USACC-Europe (5)
USACDCEC (10)
HISA (ECOM) (18)
MDW (1)
Armies (2)
Corps (2)
Instl (2) except
Ft Gordon (10)
Ft Huachuca (10)
Ft Carson (5)
Svc Colleges (1)
USASESS (20)
USASCS (10)
USAINTS (3)
USAADS (2)
USAFAS (2)
USAARMS (2)
USAIS (2)
USAES (2)
AD (2) except
SAAD (30)
LBAD (14)
TOAD (14)
ATAD (10)
Gen Dep (2)
Sig Sec, Gen Dep (2)
Sig Dep (2)
USASATC&S (2)
APG (2)
ATS (1)
MAAG (1)
WRAMC (1)
USARMIS (1)
USAERDAA (1)
USAERDAW (1)
Sig FLDMS (1)
Ft Richardson (ECOM Oft) (2)
Units org under fol TOE (1 ea.):
7
11-35
11-37
11-95
11-97
11-98
11-99
11-117
11-127
11-137
11-147
11-158
11-345
11-500(AA-AC)
17
29-134
29-136
37
54-12,
54-22
54-202

ARNG: State AG (3).
USAR: None.
For explanation of abbreviations used, see AR 310-50.

TM 11-2258
C 6

CHANGE
No. 6

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., *12 January 1968*

FACSIMILE SETS AN/TXC-1, -1A, -1B, -1C, AND -1D

TM 11-2258, 3 May 1955, is changed as follows:

Note. The parenthetical reference to previous changes (example: "page 5 of C2") indicates that pertinent material was published in that change.

Page 3, paragraph 1.1 (page 1 of C5). Delete paragraph 1.1 and substitute:

1.1. Index of Publications

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

b. DA Pam 310-7. Refer to DA Pam 310-7 to determine whether there are modification work orders (MWO's) pertaining to the equipment. DA Pam 310-7 lists all authorized Department of the Army modification work orders, identifying the type, model, series, and Federal stock number of the item to be modified; number, date, and classification of the MWO; category of maintenance authorized to perform the modification; and the man-hours required to apply the modification to each item.

Paragraph 2 (page 1 of C5). Delete paragraph 2 and substitute:

2. Forms and Records

a. Reports of Maintenance and Unsatisfactory Equipment. Use equipment forms and records in accordance with instructions given in TM 38-750.

b. Report of Packaging and Handling Deficiencies. Fill out and forward DD Form 6 (Report of Packaging and Handling Deficiencies) as prescribed in AR 700-58 (Army), NAVSUP Publication 378 (Navy), AFR 71-4 (Air Force), and MCO P4610-5 (Marine Corps).

c. Discrepancy in Shipment Report (DISREP) (SF361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF361) as prescribed in AR 55-38 (Army), NAVSUP Pub 459 (Navy), AFM 75-34 (Air Force), and MCO P4610.19 (Marine Corps).

d. Reporting of Equipment Manual Improvements. Report of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to DA Publications) and forwarded direct to Commanding General, U.S. Army Electronics Command, ATTN: AMSEL-ME-NMP-AD, Fort Monmouth, N.J. 07703.

Page 178. Delete section VI and substitute: (Figs. 128 through 156 are deleted).

140. Applicability of Depot Overhaul Standards

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

141. Applicable References

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

b. Technical Publications. The following technical publications are applicable to this equipment: TM 11-2258-ESC, TM 11-5815-246-20P, and TM 11-5815-246-35P.

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

142. Test Equipment and Materials Required

a. Test Equipment. The test equipment, or suitable equivalents, listed in the maintenance allocation chart (app II), will be used in determining complicance with the requirements of this specific standard.

b. Additional Equipment and Material.

Item	*Technical Manual*	*Quantity*	*Federal Stock No.*
Lamp, GE No. 1129		1	6240-155-8716
Transformer, Variable, Power CN-16/U		1	5950-235-2086
Radio Receiver R-390A/URR	TM 11-5820-358-10	1	5820-538-7555
Paper, Recording, Electrosensitive, Timesfax, Type A			7530-282-8860
Resistor, 24,000 ohms, ±5%		1	

Notes:

1. Voltmeter, Electronic ME-30 (*)/U represents Voltmeter, Meter ME-30A/U, and Voltmeters, Electronic ME-30B/U, ME-30C/U, and ME-30E/U.

2. Signal Generator SG-15(*)/PCM represents Signal Generators SG-15/PCM and SG-15A/PCM.

3. Decibel Meter ME-22(*)/PCM represents Decibel Meters ME-22/PCM and ME-22A/PCM.

4. Attenuatur TS-402(*)/U represents Attenuators TS-402/U and TS-402A/U.

5. Power Supply PP-86(*)/TXC-1 represents Power Supplies PP-86/TXC-1, PP-86A/TXC-1, PP-86B/TXC-1, and PP-86E/TXC-1.

142.1 Rectifier Power Unit PP-86(*)/TXC-1 and Power Supply PE-140(*)

All the test equipment will be given a 5-minute warmup before being used.

a. Insulation Resistance Test.

(1) Disconnect the ac plug and the Jones plug from all the power sources.

(2) Use a suitable test lead to connect terminal 11 on the Jones plug to a good chassis ground.

(3) Use Multimeter TS-352B/U to measure the insulation resistance between the points indicated in the chart below. The minimum insulation resistance must not be less than 8 megohms.

From Jones plug terminal No.	*To Jones plug terminal No.*
11	1
11	2
11	3
11	5

b. Output Voltage Test (fig. 196).

(1) Make the following Jones plug connections:

(a) Connect terminal 11 to chassis ground.

(b) Strap terminals 1 and 2 together.

(c) Connect Lamp, GE p/n 1129 (FSN 6240-155-8716) between terminals 5 and 6.

(2) Connect Signal Generator SG-15 (*)/PCM to terminals 9 and 11. Adjust the SG-15/PCM output to 1,000 cycles per second at 35 volts.

(3) Connect a regulated 250-volt direct current source to terminals 10 and 11, as shown in figure 196.

(4) The following listed output voltage requirements should be met with the specific input voltage supplied through Transformer, Variable, Power CN-16/U.

*Multimeter TS-352B*U connections to Jones plug terminals*	*AC input voltage 50/60 cycles per second*	*Output voltages*
5 and 6	100 to 130 volts[a]	6.3 volts±5%, 1,800 cps ac.
3 and 11	100 volts	Not less than 400 volts dc.
3 and 11	115 volts	Ac ripple voltage should not exceed 2 volts.
5 and 8	100 volts	Not less than 8 volts ac.
7 and 8	100 volts	5.3 to 6.1 volts ac.

[a] Vary the ac input voltage from 100 to 130 volts in 1-second cycles to test the regulated output voltage. The output voltage should not vary from that initially measured.

142.2. Facsimile Transceivers TT-1(*), TXC-1(*)

a. General Test Conditions. All tests should be conducted under the conditions given below:

(1) Facsimile Transceiver TT-1 (*)/TXC-1 should be connected to Rectifier Power Unit PP-86(*)/TXC-1, or Power Supply PE-140 (*).

(2) The rectifier power unit should be connected to a 110-volt, 50/60-cycle source of power through Transformer, Variable, Power CN-16/U.

(3) The tests will be made after a warmup period of at least 15 minutes.

(4) Each test applies to all models unless otherwise specifically noted.

(5) Disconnect all the test equipment from the TT-1(*) /TXC-1 when a test is completed.

b. Clutch Tension Tests.

(1) The primary clutch tension should be between 12 and 14 ounces when measured in accordance with instructions given in paragraph 106*a*.

(2) The secondary clutch tension should be between 4 and 7 ounces when measured in accordance with instructions given in paragraph 106*b*.

c. Electrical Tests.

(1) The red pilot lamp should illuminate when the Facsimile Transceiver TT-1(*)/TXC-1 power switch is set to ON.

(2) The regulated B+ voltage should stabilize between the limits of 240 and 255 volts dc when measured with Multimeter AN/URM-105 connected between pin 7 of tube V8 and chassis ground. The regulated B+ voltage of the TT-1 (*)/TXC-1 should be smoothly adjustable between the limits of 235 and 260 volts dc by adjustment of the regulated B+ control. The panel RB+ meter indication on the TT-1(*)/TXC-1 should be within ±3% of Multimeter AN/URM-105 indications.

(3) When the regulated B+ voltage is stabilized or adjusted, it should not vary more than ±3 volts when the ac input voltage to the power supply is slowly varied between the limits of 105 and 125 volts.

(4) After making the above tests, set the power supply input voltage to 115 volts ac, and the TT-1 (*)/TXC-1 regulated B+ voltage to 250 volts dc.

(5) With the exciter lamp in its socket, the selector switch set to TRANSMIT, and Voltmeter, Electronic ME-30(*)/U connected across the terminal lugs behind the exciter lamp socket, adjust the exciter lamp voltage to 6.5 volts ac on all models of Power Supply PP-86 (*)/TXC-1, except the B model which should be adjusted to 6.2 volts ac.

CAUTION: Too much force applied to the exciter lamp terminal lugs will affect the exciter lamp. Fingermarks on the exciter lamp will affect the amount of light transmitted from the exciter lamp.

(6) Place the selector switch at TRANSMIT, and connect Decibel Meter ME-22(*)/PCM across the line binding posts of the TT-1 (*)/TXC-1. Adjust the GAIN control until the panel db meter indicates +2 db. The ME-22(*)/PMC should indicate 0 dbm ±0.5 db.

(7) Turn the power ON-OFF switch to OFF. Connect the ohmmeter section of Multimeter TS-352B/U between the tip of the radio transmitter jack and the sleeve of CARBON MIKE jack J4. The TS-352B/U should indicate less than 2 ohms. Return the power ON-OFF switch to ON after making this test.

d. Receiving Test.

(1) Set the selector switch to RECORD PHOTO and turn the GAIN control fully counterclockwise. Connect Signal Generator SG-15(*)/PCM to TT-1(*)/TXC-1 line jacks and adjust its output frequency to 1,800 cycles per second (cps), and its output level to —45 dbm. Connect Voltmeter,

Electronic ME-30(*)/U between pins 3 and 7 of the recorder lamp socket. The ME-30(*)/U must indicate at least 90 volts ac for all models except the E model. The panel db meter must indicate between ±1 and ±4 db for all models except the E model. The E model must give an indication of al least 65 volts ac, and the E model panel db meter must indicate between —1 and —3 db.

(2) Connect one lead of the SG-15(*)/PCM to the center tap binding post of the TT-1(*)/TXC-1, and the other lead to each of the two line binding posts in turn. Note the panel db meter reading in each case. The difference between the two db meter readings should not exced 1 db.

(3) Connect the SG-15(*)/PCM to the R-390A/URR jacks and adjust the SG-15(*)/PCM output to 0.14 volt at 1,800 cycles per second. Connect the ME-30(*)/U between pins 3 and 7 of the recorder lamp socket; the ME-30(*)/U indication should not be less than 85 volts for all models except the E model, which must give an indication of at least 65 volts ac.

(4) Set the selector switch to RECORD DIRECT, and turn the GAIN control fully counterclockwise. Connect the SG-15(*)/PCM to the TT-1(*)/TXC-1 line binding posts and adjust its output to 1,800 cps at —45 dbm. Connect the ME-30(*)/U between terminals 1 and 2 of transformer T3; the ME-30(*)/U indication of the record amplifier output should not be less than 50 volts ac.

Note. The selector switch should not be set to RECORD DIRECT until the ME-30(*)/U reading is ready to be taken, since the voltage decreases with time when the stylus is shorted to the drum.

e. Noise Test. Set the selector switch to RECORD PHOTO, and turn the GAIN control fully counterclockwise. Connect the ME-30(*)/U between pins 3 and 7 of the recorder lamp socket; the ME-30(*)/U indication should not be more than 4 volts for the D model and later models, and not more than 10 volts for the plain, A, B, and C models. The panel db meter should give no signal indication. A 24,000-ohm resistor must be connected across the input of the ME-30(*)/U when testing the TT-1/TXC-1 and TT-1A/TXC-1.

f. Contrast Test.

(1) Set the selector switch to TRANSMIT.

(2) Connect Decibel Meter ME-22(*)/PCM to the TT-1-(*)/TXC-1 line binding posts.

(a) It should be possible to obtain a contrast range of at least 20 db (on the ME-22(*)/PCM) using either positive or negative transmission, as the light is focused from the white portion to the raised portion of the drum phasing ring.

(b) It should be possible to reduce the contrast range to at least 6 db (on the ME-22(*)/PCM), using either positive or negative transmission, as the light is focused from the white portion to the raised portion of the drum phasing ring.

Note. For positive transmission, the maximum output should be a 0-dbm indication on the ME-22(*)/PCM when the light is focused on the raised portion of the drum phasing ring. For negative transmission, the maximum output should be a 0-dbm indication on the ME-22(*)/PCM when the light is focused on the white portion of the drum phasing ring.

g. Fork Oscillator and Motor Test.

(1) Adjust the motor current to a

value between 60 and 75 milliamperes.

(2) The motor should be capable of accelerating the drum from standstill to a speed of more than 60 revolutions per minute (rpm) in not more than 5 seconds.

(3) The rotation of the drum must automatically stop when the drum reaches the end of the lead screw.

(4) The fork oscillator should be frequency tested by connecting the 600-ohm output terminals of Radio Receiver R-390A/URR to the TT-1(*)/TXC-1 line binding posts, and recording on Timesfax type *A* electrosensitive recording paper. The 1-second pulse transmitted by station WWV, Washington, D.C. will be used in this test.

(a) The 1,800-cycle-per-second oscillator (drum speed of 60 rpm) should cause the 1-second pulses of station WWV to form one straight line across the Timesfax recording paper, parallel to the clamping bar. The line formed should not have a uniform skew greater than 0.10 of an inch for a 12-inch recording.

(b) Facsimile Transceiver TT-1D/TXC-1 and all later models should be tested at drum speeds of 60 and 30 rpm, in turn. At 30 rpm, the 1-second pulses should form two straight lines, 180° apart. Both lines should be parallel to the clamping bar and neither should have a skew of more than 0.10 of an inch for a 12-inch recording.

Note. Station WWV transmits on the following carrier frequencies: 2.5, 5, 10, 15, 20, 25, 30, and 35 megacycles.

h. Operational Tests (fig. 197). Connect the two facsimile transceivers which have met all of the mechanical and electrical requirements above, back-to-back through Attenuator TS-402(*)/U which has been set for 45-db attenuation. The line binding posts will be used for connections.

(1) *Talk-back circuit test.* This test should be made on Facsimile Transceiver TT-1A/TXC-1 and all later models, with the selector switch set to STANDBY.

(a) Set the STANDBY-MON-TALK switch of one facsimile transceiver to TALK, and speak into the speaker. The speech should be heard clearly from the speaker of the other facsimile transceiver, with its STANDBY-MON-TALK switch set to STANDBY and MON, in turn. No scratchy noises should be heard from the speaker of the receiving facsimile transceiver as its GAIN control is slowly rotated from the maximum clockwise position to maximum counterclockwise position.

(b) Repeat the test given in *(a)* above, speaking into the speaker at the opposite facsimile transceiver.

(2) *Phasing operation.*

(a) Set the selector switch of one of the facsimile transceivers to RECORD PHOTO. Set the selector switch of the other facsimile transceiver to SET RANGE to transmit phasing signals of 3-db contrast. The receiving facsimile transceiver should be capable of phasing when the maximum level of the phasing signal is set at -1

db as read on the panel db meter of the receiving facsimile transceiver.

(b) Reverse the position of the selector switches and repeat the test given in *(a)* above, phasing the opposite facsimile transceiver.

(c) With the motor running, the phasing button placed in the nonoperated position, and the dog trip arm at a position so that it loses nearly 1 complete revolution before engaging the stop arm, the drum should decelerate and the dog trip arm should engage the stop arm. This secondary phasing operation should require at least 5 but not more than 7 revolutions of the lead screw and drum assembly. Test each facsimile transceiver in turn.

i. Transmitting and Receiving Tests.

(1) A direct recording and a positive photographic recording will be made on each facsimile transmitting any 12-inch by 18-1/2-inch copy from the other facsimile transceiver.

(2) The recordings should meet the following requirements:

(a) There should be no evidence of irregular skew in either recording.

(b) There should be no evidence of overlapping scanning lines.

(c) There should be no evidence of jitter in the photographic recording when viewed through a 10-power magnifying lens.

(d) Differences in the reproduced copy, because of photographic processing, should not be cause for rejection.

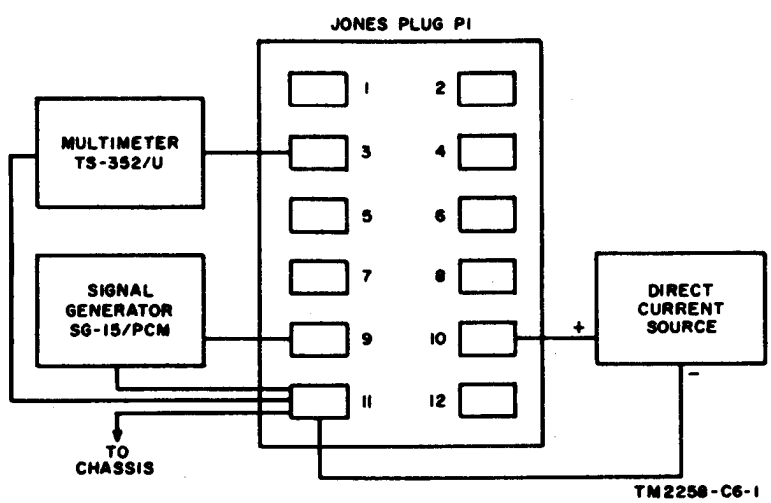

Figure 196. Test equipment setup for unregulated dc output voltage test.

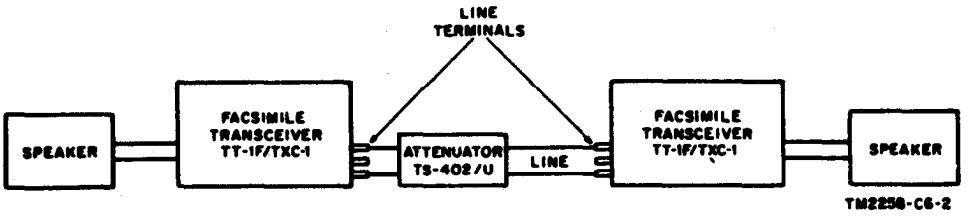

Figure 197. Back-to-back equipment setup for operational test.

Page 200, appendix I (page 7 of C4). Delete appendix I and substitute:

OF C4). Delete appendix I and substitute:

APPENDIX I

REFERENCES

Following is a list of applicable publications available to the operator, organizational, direct support, general support, and depot maintenance personnel of Facsimile Sets AN/TXC-1, -1A, -1B, -1C, and -1D.

DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (types 7, 8, and 9), Supply Bullentins, and Lubrication Orders.
DA Pam 310-7	Index of 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 355-1	Depot Inspection Standard for Repaired Signal Equipment.
TB SIG 355-2	Depot Inspection Standard for Refinishing Repaired Signal Equipment.
TB SIG 355-3	Depot Inspection Standard for Moisture and Fungus Resistant Treatment.
TB SIG 364	Field Instructions for Painting and Preserving Electronics Command Equipment.
TM 9-213	Painting Instructions for Field Use.
TM 11-2044	Attenuators TS-402/U and TS-402A/U.
TM 11-2258-ESC	Equipment Serviceability Criteria for Facsimile Sets AN/TXC-1, -1A, -1B, -1C, and -1D.
TM 11-5815-246-20P	Organizational Maintenance Repair Parts and Special Tool Lists; Facsimile Sets AN/TXC-1, AN/TXC-1A, AN/TXC-1B, AN/TXC-1C, and AN/TXC -1D.
TM 11-5815-246-35P	Field and Depot Maintenance Repair Parts and Special Tool Lists; Facsimile Sets AN/TXC-1, AN/TXC/1A, AN/TXC-1B, AN/TXC-1C, and AN/TXC-1D.
TM 11-5820-358-10	Operator's Manual: Radio Receiver R-390A/URR.
TM 11-6625-203-12	Operator and Organizational Maintenance: Multimeter AN/URM-105, Including Multimeter ME-77/U.

TM 11-6625-251-15	Organizational, DS, GS, and depot Maintenance Manual: Test Set TS-140/PCM, Signal Generator SG-15/PCM and SG-15A/PCM and Decibel Meter ME-22/PMC and ME-22A/PCM.
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 11-6625-316-12	Operator and Organizational Maintenance Manual: Test Sets, LElectron Tube TV-2/U, TV-2A/U, TV-2B/U, and TV-2C/U.
TM 11-6625-320-12	Operator and Organizational Maintenance Manual: Voltmeter, Meter ME-30A/U, and Voltmeters, Electronic ME-30B/U, ME-30C/U, and ME-30E/U.
TM 11-6625-366-15	Organizational, DS, GS, and Depot Maintenance Manual: Multimeter TS-352B /U.
TM 38-750	Army Equipment Record Procedures.

By Order of the Secretary of the Army:

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

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

Distribution:

Active Army:

USASA (2)
CNGB (1)
Dir of Trans (1)
ACSC-E (2)
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TSG (1)
CofSptS (1)
USAARENBD (2)
USACDCEC (10)
USACDC Agcy (1)
USAMC (5)
USCONARC (5)
ARADCOM (5)
ARADCOM Rgn (2)
OS Maj Comd (4)
LOGCOMD (2)
USAMICOM (4)
USASTRATCOM (4)
USASTRATCOM-EUR (10)
USAESC (70)
USARYIS (5)
MDW (1)
Armies (2)
Corps (2)
USAC (3)
Instl (2) except
  Ft Hancock (4)
  Ft Gordon (10)
  Ft Huachuca (10)
  WSMR (5)
  Ft Carson (25)
  Ft Knox (12)
Svc Colleges (2)
USASCS (40)
USASESS (60)
USAADS (2)
USAAMS (2)
USAARMS (2)
USAIS (2)
USAES (2)
USASA Tng Cen & Sch (5)
USATC Armor (2)
USATC Inf (2)
USASTC (2)
Gen Dep (2)
Sig Sec, Gen Dep (5)
Sig Dep (12)
Army Dep (2) except
  LBAD (14)
  SAAD(30)
  TOAD (14)
  LEAD (7)
  SHAD (3)
  NAAD (5)
  SVAD (5)
  CHAD (3)
  ATAD (10)
AMS (1)
APG (5)
MAAG (2)
WRAMC (1)
USARMA (2)
USARMIS (2)
USAERDAA(2)
USAERDAW (13)
USACRREL (2)
Sig FLDMS (2)
Army Pic Cen (2)
Units org under fol TOE: 2 ea.

7	11-592
11-5	11-597
11-7	17
11-35	37
11-57	54
11-95	54-2
11-97	54-102
11-98	54-202
11-99	67-2
11-117	
11-127	
11-137	
11-147	
11-155	
11-157	
11-327	
11-337	
11-500(AA-AC)	
11-587	

NG: State AG (3); Units — Same as Active Army except allowance is one (1) copy each.

USAR: None.

TM 11-2258
*C 5

FACSIMILE SETS AN/TXC 1, -1A, -1B, -1C, AND -1D

CHANGE
No. 5

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *4 June 1964*

TM 11-2258, 3 May 1955, is changed as follows:

Note. The parenthetical reference to previous changes (example: "page 1 of C 4") indicates that pertinent material was published in that change.

Page 3, paragraph 2 (page 1 of C 4). Delete subparagraph 2*c* and substitute:

c. 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.).

* This change supersedes C 2, 8 November 1961.

APPENDIX II

MAINTENANCE ALLOCATION

Section 1. INTRODUCTION

1. General

a. This section assigns maintenance functions to be performed on components, assemblies, and subassemblies by the lowest appropriate maintenance echelon.

b. Columns in the maintenance allocation chart are as follows:

(1) *Part or component.* This column shows only the nomenclature or standard item name. Additional descriptive data is included only where clarification is necessary to identify the components. Components, assemblies, and subassemblies are listed in top-down order. That is, the assemblies which are part of a component are listed immediately below that component, and the subassemblies which are part of an assembly are listed immediately below that assembly. Each generation breakdown (components, assemblies, or subasssemblies) is listed in disassembly order or alphabetical order.

(2) *Maintenance function.* This column indicates the various maintenance functions allocated to the echelons.

(*a*) *Service.* To clean, to preserve, and to replenish lubricants.

(*b*) *Adjust.* To regulate periodically to prevent malfunction.

(*c*) *Inspect.* To verify serviceability and to detect incipient electrical or mechanical failure by scrutiny.

(*d*) *Test.* To verify serviceability and to detect incipient electrical or mechanical failure by use of special equipment such as gages, meters, etc.

(*e*) *Replace.* To substitute serviceable components, assemblies, or subassemblies, for unserviceable components, assemblies, or subassemblies.

(*f*) *Repair.* To restore an item to serviceable condition through correction of a specific failure or unserviceable condition. This function includes but is not limited to welding, grinding, riveting, straightening, and replacement of parts other than the trial and error replacement of running spare type items such as fuses, lamps, or electron tubes.

(*g*) *Align.* To adjust two or more components of an electrical system so that their functions are properly synchronized.

(*h*) *Calibrate.* To determine, check, or rectify the graduation of an instrument, weapon, or weapons system, or components of a weapons system.

(*i*) *Overhaul.* To restore an item to *completely serviceable* condition as prescribed by serviceability standards. This is accomplished through employment of the technique of "Inspect and Repair Only as Necessary" (IROAN). Maximum utilization of diagnostic and test equipment is combined with minimum disassembly of the item during the overhaul process.

(*j*) *Rebuild.* To restore an item to a standard as near as possible to original or new condition in appearance, performance, and life expectancy. This is accomplished through the maintenance technique of complete disassembly of the item, inspection of all parts or components, repair or replacement of worn or unserviceable elements

using original manufacturing tolerances and/or specifications and subsequent reassembly of the item.

(3) *1st, 2d, 3d, 4th, 5th echelons.* The symbol X indicates the echelon responsible for performing that particular maintenance operation, but does not necessarily indicate that repair parts will be stocked at that level. Echelons higher than the echelon marked by X are authorized to perform the indicated operation.

(4) *Tools required.* This column indicates codes assigned to each individual tool equipment, test equipment, and maintenance equipment referenced. The grouping of codes in this column of the maintenance allocation chart indicates the tool, test, and maintenance equipment required to perform the maintenance function.

(5) *Remarks.* Entries in this column will be utilized when necessary to clarify any of the data cited in the preceding column.

c. Columns in the allocation of tools for maintenance functions are as follows:

(1) *Tools required for maintenance functions.* This column lists tools, test, and maintenance equipment required to perform the maintenance functions.

(2) *1st, 2d, 3d, 4th, 5th echelon.* The dagger (†) indicates the echelons normally allocated the facility.

(3) *Tool code.* This column lists the tool code assigned.

2. Maintenance by Using Organizations

When this equipment is used by Signal services organizations organic to theater headquarters or communications zones to provide theater communications, those maintenance functions allocated up to and including fourth echelon are authorized the organization operating this equipment.

SECTION II. MAINTENANCE ALLOCATION CHART

(1) PART OR COMPONENT	(2) MAINTENANCE FUNCTION	(3) 1ST ECH	(4) 2ND ECH	(5) 3RD ECH	(6) 4TH ECH	(7) 5TH ECH	(8) TOOLS REQUIRED	(9) REMARKS
FACSIMILE SET AN/TXC-1; AN/TXC-1A; AN/TXC-1B; AN/TXC-1C; AND AN/TXC-1D	service		X					
	inspect		X					
	repair		X				9,10	
CABLE ASSEMBLIES	replace	X						Except blower cable
			X				9,10	
	repair			X			9,10	
FACSIMILE TRANSCEIEVER TT-1/TXC-1; TT-1A,B,C,D,E,F/TXC-1	service	X						Exterior
			X					
	adjust		X				9,10,12	R25,R304, clutch tension
					X		6,9,10,11,12	All adjustments
			X				1,7	Operational test tubes, continuity
				X			2,3,4,5,6,7,9,10	AC-DC voltages, current, resistance-signal amplifier, signal voltage, phasing amplifier, photo cell ckts
					X		2,3,4,5,6,7,9,10, 11,12	Tool Code 8 replaces tool code 7 in 5th echelon
	replace			X			9,10	
	repair			X			9,10,11,12	Except for OSC GP
	overhaul				X		9,10,11,12	
FORK OSCILLATOR UNIT	replace		X				9	
	repair				X		9,10	
RECTIFIER POWER UNIT PP-86/TXC-1; PP-86A,B,E/TXC-1	service	X						Exterior
			X				10	
	adjust		X				9	Resister R15
	adjust			X			9	All adjustments
	inspect		X				10	
	test		X				1,7,10	Tubes continuity, resistance
				X			2 thru 7,9 thru 12	Tool code 8 replaces tool code 7 in 5th echelon
	replace		X				10	
	repair			X			9,10	
	overhaul				X		9,10	
TABLE: MT-252/TXC-1; MT-252A,B,/TXC-1	replace		X				9	
	repair			X			9,10	

SECTION III. ALLOCATION OF TOOLS FOR MAINTENANCE FUNCTIONS

(1) TOOLS REQUIRED FOR MAINTENANCE FUNCTIONS	(2) 1ST ECH	(3) 2ND ECH	(4) 3RD ECH	(5) 4TH ECH	(6) 5TH ECH	(7) TOOL CODE	(8) REMARKS
AN/TXC-1; AN/TXC-1A,1B,1C,1D							
MULTIMETER AN/URM 105		†				1	
MULTIMETER TS-352/U			†	†	†	2	
TEST SET, TS-140/PCM			†	†	†	3	
ATTENUATOR TS-402/U			†	†	†	4	
VOLTMETER, METER ME-30/U			†	†	†	5	
OSCILLOSCOPE OS-8B/U			†	†	†	6	
TEST SET, ELECTRON TUBE TV-7		†	†	†	†	7	
TEST SET, ELECTRON TUBE TV-2					†	8	
TOOL EQUIPMENT TK-87/U		†	†	†	†	9	
TOOL EQUIPMENT TE-123		†	†	†	†	10	
MAGNIFYING GLASS		†	†	†	†	11	FSN 5815-239-4734
SPRING SCALE		†	†	†	†	12	FSN 6670-222-1757

APPENDIX III

BASIC ISSUE ITEMS LIST

Section I. INTRODUCTION

1. General

This appendix lists items supplied for initial operation and for running spares. The list includes tools, parts, and material issued as part of the major end item. The list includes all items authorized for basic operator maintenance of the equipment. End items of equipment are issued on the basis of allowances prescribed in equipment authorization tables and other documents that are a basis for requisitioning. This equipment is combat essential.

2. Columns

Columns are as follows:

a. Federal Stock Number. This column lists the 11-digit Federal stock number.

b. Designation by Model. The dagger (†) indicates model and procurement.

c. 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.

d. 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.

e. Expendability. Nonexpendable items are indicated by NX. Expendable items are not annotated.

f. Quantity Authorized. Under "Item Comprising an Operable Equipment," the column lists the quantity of items supplied for the initial operation of the equipment. Under "Running Spare Items" the quantities listed are those issued initially with the equipment as spare parts. The quantities are authorized to be kept on hand by the operator for maintenance of the equipment.

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

SECTION II. FUNCTIONAL PARTS LIST

FEDERAL STOCK NUMBER	DESIGNATION BY MODEL 1 7	2 8	3	4	5	6	DESCRIPTION	UNIT OF ISSUE	EXP	QTY AUTH	ILLUSTRATION FIGURE NO.	ILLUSTRATION ITEM NO.
							FACSIMILE SET AN/TXC-1, AN/TXC-1A, AN/TXC-1B, AN/TXC-1C, AND AN/TXC-1D					
5815-164-7107							FACSIMILE SET AN/TXC-1, AN/TXC-1A AND AN/TXC-1B: Transmission and reception of Printed, Written, drawn or Photographic copy up to 12 in x 18 in size; for radio or wire transmission; in shades of black, white or gray; operates from 100 to 130 v, 50 to 70 cyc, ac input		NX			
5815-194-9522							FACSIMILE SET AN/TXC-1C: Fixed station; transmitting and receiving wire or radio message; sends written, typed, Photographic or drawn material; 12 in x 18 in copy; receives direct or photographic negative or positive; 100 to 130 v ac, 50/65 cps, single Ph; operates at 30 rPM and 60 rPM; interchangeable w/Previous Procurements of AN/TXC-1 but previous models cannot be used in place of this item due to additional speeds		NX			
5815-503-2711							FACSIMILE SET AN/TXC-1D: For transmitting and receiving; wire and radio transmission; light beam scanning and electric stylus or light beam recording dots of varying intensity; transmits and receives 12 in x 18 in page; positive or negative reproduction; 100 to 130 v, 50 to 65 cps, single Ph; ac; special features; operates at 30 or 60 rPM; includes exhaust system; includes end of travel switch; one-way interchangeability with all previous models except for maintenance parts		NX			
							NOTE: Model column 1 refers to AN/TXC-1, column 2 refers to AN/TXC-1A, column 3 refers to AN/TXC-1B, column 4 refers to AN/TXC-1C, column 5 refers to AN/TXC-1D,					
							ITEMS COMPRISING AN OPERABLE EQUIPMENT					
ORD THRU AGC	†	†	†	†	†		TECHNICAL MANUAL TM11-2258			2		
5995-161-8710	†	†	†	†	†		CABLE ASSEMBLY, POWER, ELECTRICAL: 2 cond; 8-1/2 in lg; one PL-55 on 1st end; 2 Mueller Electric alligator clips type "Pee-Wee" #45 on 2nd end; Timesfax dwg #90-37-03		NX	1		

FEDERAL STOCK NUMBER	DESIGNATION BY MODEL 1 2 3 4 5 6	DESCRIPTION	UNIT OF ISSUE	EXP	QTY AUTH	ILLUSTRATION	
	7 8					FIGURE NO.	ITEM NO.
		AN/TXC-1,1A,1B,1C,1D (continued)					
5995-164-6558	† † † † †	CABLE ASSEMBLY, POWER, ELECTRICAL: 1 cond; 5 ft 9-3/4 in lg o/a incl terms; 1 GE Plug Part #1346 on 1st end 2 Muellar Electric alligator clips part #60S on 2nd end Timesfax dwg #90-37-02		NX	1		
5995-161-8708	† † † † †	CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: CD-1019; 96 in lg; 1 JAN Plug Type #PJ-068 on 1st & 2nd end; Sig dwg #SC-D-4822		NX	1		
5995-164-6594	† † † † †	CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: CD-1018; 10 ft lg; PJ-055B on 1st end; PJ-055BL on 2nd end; Sig dwg #SC-D-4821		NX	1		
5815-505-7183	† † † † †	BLOWER AND DUST FILTER ASSEMBLY: 115 v, 60 cyc, single Ph; 16-3/4 in lg x 9 in h x 10 in d o/a; Sig dwg #SM-D-201669		NX	1		
5815-164-7132	† † †	FACSIMILE TRANSCEIVER: TT-1/TXC-1; TT-1A/TXC-1; TT-1B/TXC-1; TT-1C/TXC-1		NX	1		
5815-194-9523	†	FACSIMILE TRANSCEIVER: TT-1D/TXC-1; TT-1E/TXC-1		NX	1		
5815-396-3412	†	FACSIMILE TRANSCEIVER: TT-1F/TXC-1		NX	1		
5965-128-2991	† † † † †	LOUDSPEAKER, PERMANENT MAGNET: LS-11 (Not installed)		NX	1		
7530-282-8858	† † † † †	PAPER, RECORDING ELECTROSENSITIVE: For use when copies will be required; Timesfax type " A" (Not mounted)	Pkg		1		
7530-282-8860	† † † † †	PAPER, RECORDING ELECTROSENSITIVE: For use when no copies will be required; Timesfax type "ND" (Not mounted)	Pkg		1		
5815-255-0171	† †	POWER SUPPLY: PP-86/TXC-1 (Not installed)		NX	1		
5815-243-0366	† †	POWER SUPPLY: PP-86A/TXC-1; PP-86B/TXC-1 (Not installed)		NX	1		
5815-643-0257	† † † † †	POWER SUPPLY: PP-86E/TXC-1 (Not installed)		NX	1		
5815-244-4359	† † † † †	TABLE: MT-252/TXC-1; MT-252A/TXC-1; MT-252B/TXC-1		NX	1		
		EXHAUST BLOWER ASSEMBLY (FSN-5815-505-7183)					
		EXHAUST BLOWER ASSEMBLY: (BASIC COMPONENT)		NX	1		

FEDERAL STOCK NUMBER	DESIGNATION BY MODEL 1 2 3 4 5 6 7 8	DESCRIPTION	UNIT OF ISSUE	EXP	QTY AUTH	ILLUSTRATION FIGURE NO.	ILLUSTRATION ITEM NO.
		AN/TXC-1,1A,1B,1C,1D (continued)					
5340-392-8460		CLAMP: 1.660 in dia x 3/4 in w; Birtcher Corp part #936C-69			2		H-44 H-45
5815-392-9652		HOSE, FLEXIBLE: f/collection of carbon dust emitted by stylus; 1-1/4 in id x 42 in lg; Sig dwg #SM-B-201668			1		H-43
		FACSIMILE TRANSCEIVER TT-1/TXC-1 TT-1A/TXC-1 TT-1B/TXC-1 TT-1C/TXC-1 TT-1D/TXC-1 TT-1E/TXC-1 TT-1F/TXC-1					
		NOTE: Model column 1 refers to TT-1/TXC-1, Model " 2 refers to TT-1A/TXC-1, Model " 3 refers to TT-1B/TXC-1, Model " 4 refers to TT-1C/TXC-1, Model " 5 refers to TT-1D/TXC-1, Model " 6 refers to TT-1E/TXC-1, Model " 7 refers to TT-1F/TXC-1, procured on order #6437-PH-51 Model column 8 refers to TT-1F/TXC-1 procured on order #21326-PH-56					
		FACSIMILE TRANSCEIVER: TT-1/TXC-1 (BASIC COMPONENT)		NX	1		
		FACSIMILE TRANSCEIVER: TT-1A/TXC-1 (BASIC COMPONENT)		NX	1		
		FACSIMILE TRANSCEIVER: TT-1B/TXC-1 (BASIC COMPONENT)		NX	1		
		FACSIMILE TRANSCEIVER: TT-1C/TXC-1 (BASIC COMPONENT)		NX	1		
		FACSIMILE TRANSCEIVER: TT-1D/TXC-1 (BASIC COMPONENT)		NX	1		
		FACSIMILE TRANSCEIVER: TT-1E/TXC-1 (BASIC COMPONENT)		NX	1		
		FACSIMILE TRANSCEIVER: TT-1F/TXC-1 (BASIC COMPONENT)		NX	1		
		FACSIMILE TRANSCEIVER: TT-1F/TXC-1 (BASIC COMPONENT)		NX	1		

FEDERAL STOCK NUMBER	DESIGNATION BY MODEL 1 2 3 4 5 6 (17 28)	DESCRIPTION	UNIT OF ISSUE	EXP	QTY AUTH	ILLUSTRATION FIGURE NO.	ILLUSTRATION ITEM NO.
		AN/TXC-1,1A,1B,1C,1D (continued)					
5815-652-8557	† † † † † † † †	COVER, DUST: 34-1/2 in lg x 18-1/2 in w x 10-1/2 in h; Timesfax part #96-00-22 (Mounted in equip)			1		
5815-392-8676	† † † † † † † †	EXHAUST TUBE ASSEMBLY: L shaped tube 3-1/8 in w x 13-5/8 in lg x 1-1/4 in dia; Sig dwg #SM-C-201305 (Mounted in equip)			1		0-53
		RECTIFIER POWER UNIT PP-86/TXC-1 PP-86A,B,E/TXC-1					
		POWER SUPPLY: PP-86/TXC-1 (BASIC COMPONENT)		NX	1		
		POWER SUPPLY: PP-86A/TXC-1 (BASIC COMPONENT)		NX	1		
		POWER SUPPLY: PP-86B/TXC-1 (BASIC COMPONENT)		NX	1		
		POWER SUPPLY: PP-86E/TXC-1 (BASIC COMPONENT)		NX	1		
5815-406-0794		COVER, POWER SUPPLY: 12-1/2 in lg x 10-1/2 in w x 10 in h; Timesfax #96-15-22 (Mounted in equip)		NX	1		A1
		RUNNING SPARE ITEMS					
		EXHAUST BLOWER ASSEMBLY (FSN-5815-505-7183)					
5815-392-8387		BAG: filter cloth construction; used as dust bag in exhaust system; MIL-AN part #V-3 (Not mounted)			4		
6810-630-0355		CARBON, GRANULAR: activated carbon; 1/2 lb can; Westrex part #130-00-00-04 (Not mounted)	Cn		1		
		FACSIMILE TRANSCEIVER TT-1/TXC-1 TT-1A/TXC-1 TT-1B/TXC-1 TT-1C/TXC-1 TT-1D/TXC-1 TT-1E/TXC-1 TT-1F/TXC-1					
5240-188-3532	† † † † † † † †	ELECTRON TUBE: Mil type 1B59/R1130B (Not mounted)			1		

FEDERAL STOCK NUMBER	DESIGNATION BY MODEL 1 7	2 8	3	4	5	6	DESCRIPTION	UNIT OF ISSUE	EXP	QTY AUTH	ILLUSTRATION FIGURE NO.	ILLUSTRATION ITEM NO.
							AN/TXC-1,1A,1B,1C,1D (continued)					
5960-188-3557	† †	† †	†	†	†	†	ELECTRON TUBE: Mil type 7C5 (Not mounted)			2		
5960-188-3581	†	†	†	†	†		ELECTRON TUBE: Mil type 7C7 (Not mounted)			1		
5960-100-6017	† †	† †	†	†	†	†	ELECTRON TUBE: Jan type 7L7 (Not mounted)			2		
5960-235-9108	† †	† †	†	†	†	†	ELECTRON TUBE: Mil type 7N7 (Not mounted)			2		
5960-108-0257	† †	† †	†	†	†	†	ELECTRON TUBE: Mil type 884 (Not mounted)			1		
5960-188-3901	† †	† †	†	†	†	†	ELECTRON TUBE: Mil type 1635 (Not mounted)			1		
5960-262-0286	† †	† †	†	†	†	†	ELECTRON TUBE: Mil type 5651WA (Not mounted)			1		
5960-808-6490	†	†				†	ELECTRON TUBE: Mil type 5879 (Not mounted)			1		
5920-356-2188	† †	† †	†	†	†	†	FUSE, CARTRIDGE: 1/8 amp, 250 v; Mil type F02GR125A (Mounted in equip)			5		
5815-498-8391	† †	† †	†	†	†	†	HALF NUT SET: c/o 2 half nuts; 0.278 in dia x 47/64 in lg; Sig Dwg #SC-B-67409 (Not mounted)			1		
6240-155-8716	† †	† †	†	†	†	†	LAMP, INCANDESCENT: 6 to 8 v; S-8 clear bulb; GE part #1129 (Not mounted)			1		
6240-155-8706	†	† †	†	†	†	†	LAMP, INCANDESCENT: 6 to 8 v; T-3-1/4 bulb; Mil type TB-14 (Not mounted)			1		
7530-282-8860	† †	† †	†	†	†	†	PAPER, RECORDING, ELECTROSENSITIVE: for use when no copies will be required; Timesfax type "ND" (Not mounted)	Pkg		1		
7530-282-8858	† †	† †	†	†	†	†	PAPER, RECORDING, ELECTROSENSITIVE: for use when copies will be required; Timesfax type "A" (Not mounted)	Pkg		1		
5960-261-9669	† †	† †	†	†	†	†	PHOTO-ELECTRIC CELL: Mil type 5652 (Not mounted)			1		

FEDERAL STOCK NUMBER	DESIGNATION BY MODEL 1 7	2 8	3	4	5	6	DESCRIPTION	UNIT OF ISSUE	EXP	QTY AUTH	ILLUSTRATION FIGURE NO.	ITEM NO.
							AN/TXC-1,1A,1B,1C,1D (continued)					
5815-508-7819	†	†	†	†			STYLUS NEEDLE ASSEMBLY: straight needle 0.125 in lg; 0.625 in lg o/a; Sig dwg #SC-B-37031 (Not mounted)			50		
5815-220-9946	†	†			†	†	STYLUS, RECORDING, SOUND: 68 deg angle; 0.004 in rad; brass shank 3/4 in lg x 0.062 in dia o/a; Timesfax dwg #42-00-10-00 (Not mounted)			50		
							RECTIFIER POWER UNIT PP-86/TXC-1 PP-86A/TXC-1 PP-86B/TXC-1 PP-86E/TXC-1					
5960-188-8601							ELECTRON TUBE: Mil type 5Z3 (Not mounted)			1		
5960-188-3557							ELECTRON TUBE: Mil type 7C5 (Not mounted)			1		
5960-100-6017							ELECTRON TUBE: Jan type 7L7 (Not mounted)			1		
5960-235-9108							ELECTRON TUBE: Mil type 7N7 (Not mounted)			1		
5960-100-6019							ELECTRON TUBE: Jan type 7S7 (Not mounted)			1		
5960-262-0286							ELECTRON TUBE: Mil type 5651WA (Not mounted)			1		
5920-296-1519							FUSE, CARTRIDGE: 5 amp, 250 v; Mil type F02A250V5A (Not mounted)			5		
5920-010-6652							FUSE, CARTRIDGE: 3 amp, 250 v; Mil type F02G3R00A (Not mounted)			5		

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NG: State AG (3); units—same as active Army except allowance is one copy.

USAR: None.

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

FACSIMILE SETS AN/TXC1, -1A, -1B, -1C, AND -1D

TM 11-2258
TO 31S2-2TXC1-1
CHANGES No. 4

DEPARTMENTS OF THE ARMY
AND THE AIR FORCE
WASHINGTON 25, D.C., *20 March 1963*

TM 11-2258/TO 31S2-2TXC1-1, 3 May 1955, is changed as indicated to reflect new maintenance procedures in accordance with TM 38-750.

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

Page 3, paragraph 1. Delete subparagraph *c*. Add paragraph 1.1 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. Department of the Army Pamphlet No. 310-4 is an index of current technical manuals, technical bulletins, supply bulletins, lubrication orders, and modification work orders that are available through publication supply channels. The index lists the individual parts (-10, -20, -35P, etc.) and the latest changes to and revisions of each equipment publication.

Paragraph 2 (page 1 of C 2). Delete and substitute:

2. Forms and Records

a. Reports of Maintenance and Unsatisfactory Equipment. Use equipment forms and records in accordance with instructions in TM 38-750.

b. Report of Damaged or Improper Shipment. Fill out and forward DD Form 6 (Report of Damaged or Improper Shipment) as prescribed in AR 700-58 (Army), NAVSANDA Publication 378 (Navy), AFR 71-4 (Air Force).

c. Comments on Manual. Forward all comments on this publication direct to: Commanding Officer, U.S. Army Electronics Materiel Support Agency, ATTN: SELMS-MP, Fort Monmouth, N.J. (DA Form 1598 (Record of Comments on Publication), DA Form 2496 (Disposition Form), or letter may be used.)

Page 45, chapter 3. Change the title to: OPERATOR AND ORGANIZATIONAL MAINTENANCE.

Section I. Change the title to: OPERATOR MAINTENANCE.

Paragraph 38. Delete and substitute:

38. Scope of Operator's Maintenance

The maintenance duties assigned to the operator of Facsimile Set AN/TXC-1(*), are limited to the daily maintenance services and inspections outlined in paragraph 42.1. The duties assigned do not require tools or test equipment other than those listed in paragraph 39.

Paragraph 39, heading. After "for" add: Operator and.

In the list of materials, delete the following:

Burnisher, contact; pen type with pocket clip.
Carbon tetrachloride.
Cheesecloth, bleached; 36" w.
Solvent, Dry Cleaning (SD) (Fed Spec P-S-661a).

Paragraph 40. Delete and substitute:

40. Preventive Maintenance

Preventive maintenance is the systematic care, servicing, and inspection of equipment to prevent the occurrence of trouble, to reduce downtime, and to assure that the equipment is serviceable.

a. Systematic Care. The procedures given in paragraphs 41, 42, and 42.1 cover systematic care essential to proper upkeep and operation of the equipment. The cleaning operations (par. 41) should be performed once a day. If

the equipment is not used daily, however, the cleaning operations must be performed before operation after any extended shutdown, or once a week while the equipment is kept in standby condition. The other items must be checked before the equipment is placed in operation after a shutdown, during operation, or after it is turned off, as specified in the applicable paragraph.

b. Maintenance Service and Inspection. The maintenance service and inspection chart (par. 42.1) outlines inspections to be made at specific intervals. These inspections are made to determine combat serviceability; that is, to determine that the equipment is in good general (physical) condition, in good operating condition, and likely to remain combat serviceable. To assist operators in determining and maintaining combat serviceability, the charts indicate what to inspect, how to inspect, and what the normal conditions are; the *References* column lists the paragraph that contains additional information. If the defect cannot be remedied by the operator, higher echelon maintenance or repair is required. Records and reports of these inspections must be made in accordance with TM 38–750.

Paragraph 41*b*(1), lines 2 and 3. Delete "solvent (SD)" and substitute: Cleaning Compound (Federal stock No. 7930-395-9542).

Subparagraph *b*(2), line 2. Delete "carbon tetrachloride" and substitute: cleaning compound.

In the "Caution", lines 1 and 2. Delete "carbon tetrachloride" and substitute: cleaning compound.

Page 46, paragraph 41. Delete subparagraph *j*.

Paragraph 42. Delete and substitute:

42. Maintenance Services and Inspection Periods

Maintenance services and inspection of Facsimile Set AN/TXC–1(*) is required daily. Paragraph 42.1 specifies the items to be inspected and serviced. In addition to the routine daily services and inspection, the equipment should be reinspected and serviced immediately before going on a mission and as soon after completion of the mission as possible.

Add paragraph 42.1 after paragraph 42.

42.1. Daily Maintenance Service and Inspection Chart

Item No.	Procedure		References
	Item	Normal condition or result	
1	SET: Inspect the equipment for—		
	a. COMPLETENESS: Check for completeness and satisfactory condition of the equipment. Check the spare parts for quantities, general condition, and method of storage.	*a.* Equipment must be complete and in satisfactory condition. All spare parts must be in good condition and properly stored. There must be no evidence of overstock, and all shortages must be on valid requisitions.	Pars. 6 and 7 and app. III.
	b. INSTALLATION: Check the location and installation of the equipment for normal operation.	*b.* The location and installation of the equipment must be suitable for normal operation.	Pars. 12 and 14.
	c. CLEANLINESS:		
	(1) Remove dirt, dust, grease, corrosion, and moisture from carrying handles, motor housing, equipment cover, binding posts, base, stylus and assembly, drum, lead screw, clutch window, and DB meter window.	(1) Units must be free of dirt, dust, grease, corrosion, and moisture.	Par. 41.
	(2) Check exciter lamp envelope for burns and black spots.	(2) Exciter lamp envelope must be free of burns and black spots.	

Item No.	Procedure		References
	Item	Normal condition or result	
9	KNOBS, DIALS, AND SWITCHES: Check the following for positive mechanical action: *a.* Switches: (1) Selector. (2) Power ON-OFF. (3) START-PHASE. (4) STANDBY-MON-TALK. (5) 30RPM-60RPM. *b.* GAIN and CONTRAST controls. *c.* Engaging lever and clamping bar.	The mechanical action must be positive without backlash, binding, or scraping.	Par. 22*a* and figs. 13–16, and 117.
10	OPERATIONAL CHECK: Use the equipment performance checklist to test all operational aspects of the equipment for normal operation.	The equipment must function properly for all modes of operation.	Pars. 57 and 58.
11	SPEAKER:		
	a. Inspect the case for rust, scratches, dirt, and moisture.	*a.* The speaker case must be clean, dry, and free of rust and scratches.	Fig. 5.
	b. Inspect cord for breaks, frayed insulation, dirt, and moisture. Inspect plug and all connections.	*b.* The speaker cord must be clean, dry, and free of breaks and frayed insulation. The plug must be clean and dry and must fit properly into speaker jack. All connections must be properly made.	
21	LUBRICATION: Perform a complete lubrication of the equipment.	Mechanisms must be properly lubricated.	Pars. 44–47 and fig. 26.

Delete paragraph 43.

Paragraph 42.1. After paragrahp 42.1 add:

Section II.1. ORGANIZATIONAL MAINTENANCE

43. Scope of Organizational Maintenance

This section of the manual contains instructions covering second echelon maintenance of Facsimile Set AN/TXC–1(*). It includes instructions for performing preventive and periodic maintenance services and repair functions to be accomplished by the organizational repairman. Refer to appendix II for tools and test equipment, and to paragraph 39 for materials required for organizational maintenance.

Add paragraphs 43.1 through 43.5 after paragraph 43.

43.1. Preventive Maintenance

a. Preventive maintenance is the systematic care, inspection, and servicing of equipment to maintain it in serviceable condition, prevent breakdowns, and assure maximum operational capability. Preventive maintenance is the responsibility of all echelons concerned with the equipment and includes the inspection, testing, and repair or replacement of parts, subassemblies, or units that inspection and tests indicate would probably fail before the next scheduled periodic service. Preventive maintenance service and inspections of Facsimile Set AN/TXC–1(*) at the second echelon level are made at monthly and quarterly intervals unless otherwise directed by the commanding officer. The maintenance services should be scheduled concurrently with the periodic service schedule of the carrying vehicle for all vehicular installations.

b. Maintenance forms and records to be used and maintained on this equipment are specified in TM 38–750. Paragraph 2 contains additional information concerning submission of specific forms.

43.2. Monthly Maintenance

Perform the maintenance functions indicated in the monthly maintenance service and inspection chart (par. 43.3) once each month. A month is defined as approximately 30 calendar

days of 8-hour-per-day operation. If the equipment is operated 16 hours a day, the monthly maintenance should be performed at 15-day intervals. Adjustment of the maintenance interval must be made to compensate for any unusual operating conditions. Equipment maintained in a standby (ready for immediate operation) condition must have monthly maintenance performed on it. Equipment in limited storage (requires service before operation) does not require monthly maintenance.

43.3. Monthly Maintenance Service and Inspection Chart

Item No.	Procedure		References
	Item	Normal condition or result	
1	*c.* CLEANLINESS: Remove dirt, dust, and grease from the lead screw and meters.	*c.* Units must be free of dirt, dust, and grease.	Par. 41.
	d. PRESERVATION: Inspect the motor housing, equipment cover, and table for rust, indentures, scratches, and fit.	*d.* Painted surfaces must be free of bare spots, rust, and corrosion. Housing and covers must fit properly.	Par. 53.
13	ACCESSIBLE ITEMS: Inspect items such as switches, jacks, knobs, transformers, motor mount, and drum for looseness.	Items must be properly tightened.	Figs. 148–151.
14	ELECTRON TUBES: Inspect for loose envelopes and cracked sockets.	Envelopes must fit tight in tube base and sockets must be free of cracks.	Figs. 9 and 10.
18	CHASSIS: Clean and tighten all items and interiors of the chassis which are not readily accessible, and tighten all screws and bolts which are found to be loose.	All items and interiors of the chassis which are not readily accessible must be clean and tight.	Figs. 134–137.
21	LUBRICATION: Perform a complete lubrication of the equipment.	Mechanisms must be properly lubricated.	Pars. 44–47 and fig. 26.
26	OPTICAL SYSTEM: Inspect and clean the lenses and lamps and check the lens assembly for looseness.	Lenses and lamps must be clean and the lens assembly must be properly tightened.	Figs. 120–122.

43.4. Quarterly Maintenance

Quarterly maintenance on Facsimile Set AN/TXC–1(*) will be scheduled in accordance with the requirements of TM 38–750. If the equipment is part of a vehicular installation, the quarterly maintenance should be scheduled concurrently with the periodic service of the carrying vehicle to reduce out-of-service time to a minimum. All deficiencies or shortcomings will be recorded, and those not corrected during the inspection and service will be immediately reported to higher echelon by use of forms and procedures specified in TM 38–750. Equipment that has a deficiency that cannot be corrected by second echelon should be deadlined in accordance with TM 38–750. Perform all the services listed in the quarterly maintenance service and inspection chart (par. 43.5) in the sequence listed. Whenever a normal condition or result is not observed, take corrective action in accordance with the paragraph listed under references.

43.5. Quarterly Maintenance Service and Inspection Chart

Item No.	Procedure		References
	Item	Normal condition or result	
1	SET:		
	a. COMPLETENESS: Check the equipment for completeness and for satisfactory condition. Check all spare parts for quantities, general condition, and method of storage.	*a.* The equipment must be complete and in satisfactory condition. All spare parts must be in good condition and properly stored. There must be no evidence of overstock and all shortages must be on valid requisitions.	Pars. 6 and 7 and app. III.
	b. INSTALLATION: Check the location and installation of the equipment for normal operation.	*b.* The location and installation of the equipment must be suitable for normal operation.	Pars. 12 and 14.
	c. CLEANLINESS:		
	(1) Remove dirt, dust, grease, moisture, and corrosion from the carrying handles, motor housing, equipment cover, binding posts, base, lead screw, stylus, drum, clutch window, meters, and meter windows.	(1) Units must be clean, dry, and free of grease, dirt, dust, corrosion, and moisture.	Par. 41.
	(2) Check the exciter lamp envelope for burns and black spots.	(2) The exciter lamp envelope must be free of burns and black spots.	
	d. PRESERVATION: Inspect the motor housing, equipment cover and table for rust, indentures, scratches, and fit.	d. Painted surfaces must be free of bare spots, rust, and corrosion. Housing and covers must fit perfectly.	Par. 53.
2	PUBLICATIONS: See that pertinent publications are available.	The technical manual must be complete and in usable condition and all changes pertinent to the equipment must be on hand.	DA Pam 310–4.
3	MODIFICATION WORK ORDERS: Check DA Pam 310–4 to determine what new applicable MWO's have been published.	All URGENT MWO's must be applied to the equipment and all ROUTINE MWO's must be scheduled.	Par. 11.
4	MOUNTING: Inspect Table MT–252(*)/TXC–1 for completeness, proper assembly, rigidity, and for loose or missing hardware.	The table must be complete, properly assembled, and rigid with no indications of weakness or deformity. All bolts, nuts, and washers must be properly applied and tightened.	Par. 8*c* and fig. 2.
5	DUST AND ODOR FILTER: Check the condition of the canister, paper bag, exhaust tube and hose, carbon granules, blower unit, and mounting.	The exhaust, filter, and blower systems must be clean, completely assembled, correctly mounted, and functioning properly.	Par. 14*d* and fig. 2.
6	FUSES: Check the front panel and the rectifier power unit for the proper value and location of fuses.	The value and location of fuses must be as follows: *a.* Front panel: 1 ea ⅛ amp (motor). *b.* Rectifier power unit: 1 ea 5 amp (equipment). *c.* Rectifier power unit: 1 ea 3 amp (exhaust).	
7	PLUCKOUT ITEMS: Inspect the clamping devices and the seating of tubes, lamps, and fuses on the transceiver and the rectifier power unit base.	All items must be properly seated and the clamping devices properly positioned and tightened. The tube shields must be in place and locked.	Par. 14*a* and figs. 3 and 13–16.

Item No.	Procedure		References
	Item	Normal condition or result	
8	CONNECTIONS: Inspect the LINE binding posts, GROUND binding post, and jacks on the terminal panel for cleanliness, proper connections, and fitting.	Plugs, jacks, and binding posts must be clean, intact, and fit properly. Connections must be properly made.	Par. 14*c*.
9	KNOBS, DIALS, AND SWITCHES: Check the following for positive mechanical action: *a*. Switches: (1) Selector. (2) Power ON-OFF. (3) START-PHASE. (4) STANDBY-MON-TALK. (5) 30RPM-60RPM. *b*. GAIN and CONTRAST control. *c*. Engaging lever and clamping bar.	The mechanical action must be positive without backlash, binding, or scraping.	Par. 22*a* and figs. 13–16, and 117.
10	OPERATIONAL CHECK: Use the equipment performance checklist to test all operational aspects of the equipment for normal operation.	The equipment must function properly for all modes of operation.	Pars. 57 and 58.
11	SPEAKER: *a*. Inspect the case for dirt, rust, scratches, and moisture. *b*. Inspect the cord for dirt, breaks, frayed insulation, and moisture. Inspect the plug and all connections.	*a*. The speaker case must be clean, dry, and free of rust and scratches. *b*. The speaker cord must be clean, dry, and free of breaks and frayed insulation. The speaker cord plug must be clean, dry, and must fit properly into the speaker jack. All connections must be properly made.	Par. 10*b* and fig. 5.
12	CABLING: Inspect the cabling for mildew, breaks, and frayed insulation.	Cables must be dry and free of breaks and frayed insulation.	
13	ACCESSIBLE ITEMS: Inspect items such as switches, jacks, knobs, transformers, motor mount, and drum for looseness.	Items must be properly tightened_____	Figs. 148–151.
14	ELECTRON TUBES: Inspect for loose envelopes and cracked sockets.	Envelopes must fit tight in tube bases and sockets must be free of cracks.	Figs. 9 and 10.
15	FIXED CAPACITORS: Inspect for leaks, bulges, and discoloration.	Capacitors must be free of leaks, bulges, and evidences of discoloration.	Figs. 129 and 130.
16	RESISTORS: Inspect for cracks, chipping, blistering, discoloration, and moisture.	Resistors must be free of cracks, chipping, blistering, and evidences of discoloration.	Figs. 129 and 130.
17	TERMINALS: Inspect terminals on large capacitors and resistors for corrosion, dirt, and loose contacts.	Terminals must be clean and corrosion-free, and contacts must be tight.	
18	CHASSIS: Clean and tighten all items and interiors of the chassis. Tighten all screws and bolts which are found to be loose.	All items and interiors of the chassis must be clean and tight.	Figs. 134–137.
19	TERMINAL BLOCKS: Inspect for loose connections, breaks, and cracks.	Terminal blocks must be in good condition with no cracks or breaks, and all connections must be tight.	
20	MOTOR: Remove dirt and grease from motor and housing. Inspect mounting screws and wire connections.	Motor must be clean. Mounting screws must be tight and wire connections must be properly made.	Par. 104 and figs. 105–107.

Item No.	Procedure		References
	Item	Normal condition or result	
21	LUBRICATION: Perform a complete lubrication of the equipment.	Mechanisms must be properly lubricated.	Pars. 44–47, and fig. 26.
22	TRANSFORMERS: Inspect, clean, and tighten connections on transformers, chokes, potentiometers, and rheostats.	Connections must be clean, tight, and properly made.	
23	OVERHEATING: Inspect transformers, chokes, and all controls for evidences of overheating.	Components must show no evidences of overheating.	
24	CHASSIS WIRING: Inspect all wiring for breaks, tears, frayed insulation, lacing, and completeness, and all soldered connections for corrosion.	Wiring must be free of breaks, tears, frayed insulation, and must be complete and laced where feasible. All soldered connections must be free of corrosion.	
25	KEY TYPE SWITCHES: Inspect the switch contacts for burn spots and for proper electrical contact.	Switch contacts must be clean, free of burn spots, and must make proper electrical contact.	Par. 41.
26	OPTICAL SYSTEM: Inspect and clean the lenses and lamps and check the lens assembly for looseness.	Lenses and lamps must be clean and the lens assemblies must not be loose.	Figs. 120–122.

Page 47. Delete figure 24.

Page 48. Delete figure 25.

Page 52, paragraph 53*a*. Delete the second sentence and substitute: Remove rust and corrosion from metal surfaces by lightly sanding them with fine sandpaper. Brush two thin coats of paint on the bare metal to protect it from further corrosion. Refer to applicable cleaning and refinishing practices specified in TM 9–213.

Page 200. Add appendix I after chapter 7:

APPENDIX I
REFERENCES

DA Pam 310–4	Index of Technical Manuals, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders.
TM 9–213	Painting Instructions for Field Use.
TM 38–750	The Army Equipment Record System and Procedures.

Designate "APPENDIX I" (page 1 of C 2): APPENDIX II.

Designate "APPENDIX II" (page 5 of C 2): APPENDIX III.

By Order of the Secretaries of the Army and the Air Force:

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General, United States Army,
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Major General, United States Army,
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Armies (2)
Corps (2)
Div (2)
Instl (2) except
Ft Monmouth (63)
USATC AD (2)
USATC Armor (2)
USATC Engr (2)
USATC Inf (2)
USASTC (2)
Svc Colleges (2)
Br Svc Sch (2)
GENDEP (OS) (2)
Sig Dep (OS) (12)
Army Dep (2) except
Ft Worth (8)
Lexington (12)
Sacramento (17)
Tobyhanna (12)
Sig Sec, GENDEP (OS) (5)
USA Corps (3)
USA Elct RD Actv (Ft Huachuca) (2)
USA Elct RD Actv (White Sands) (13)
WRAMC (1)
Army Pic Cen (2)
USA Mbl Spt Cen (1)
USA Trans Tml Comd (1)
Army Tml (1)
POE (1)
USAOSA (1)
AFIP (1)
AMS (1)
USA Elct Mat Agcy (25)
Chicago Proc Dist (1)
USASSC (4)
USARCARIB Sig Agcy (1)
Sig Fld Maint Shops (3)
JBUSMC (2)
Units org under fol TOE:

7-52 (2)	11-117 (2)
11-5 (2)	11-137 (2)
11-7 (2)	11-155 (2)
11-15 (2)	11-157 (2)
11-16 (2)	11-500 (AA-AC) (4)
11-17 (2)	11-557 (2)
11-37 (2)	11-587 (2)
11-39 (2)	11-592 (2)
11-55 (2)	11-597 (2)
11-57 (2)	29-56 (2)
11-95 (2)	54-2 (2)
11-97 (2)	54-102 (2)
11-98 (2)	54-202 (2)
11-99 (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.

FACSIMILE SETS AN/TXC-1, -1A, -1B, -1C, AND -1D

TM 11-2258
TO 31S2-2TXC1-1
CHANGES No. 1

DEPARTMENTS OF THE ARMY
AND THE AIR FORCE
WASHINGTON 25, D. C., *25 April 1956*

TM 11-2258/TO 31S2-2TXC1-1, 3 May 1955, is changed as follows:

The following information changes TM 11-2258 so that the manual also applies to the following equipments:

Nomenclature	*Order No.*	*Serial No.*
Facsimile Transceiver TT-1F/TXC-1.	21326-Phila-56	1 through 159
Rectifier Power Unit PP-86E/TXC-1.	21326-Phila-56	1 through 159

Page 3, chapter 1. Add the following note at the beginning of chapter 1.

Note. Facsimile Sets AN/TXC-1D procured on Order No. 21326-Phila-56 are similar to Facsimile Sets AN/TXC-1D covered in the manual. Information in the technical manual applies to all Facsimile Sets AN/TXC-1D unless otherwise specified.

Page 12, paragraph 10*g*. Line 14. Add the following sentence after controls.: In Facsimile Transceivers TT-1F/TXC-1 (Order No. 21326-Phila-56) R70 is also a control.

h. (Added) *Equipments Bearing Order No. 21326-Phila-56.* The following changes have been made on Facsimile Transceivers TT-1F/TXC-1 and Rectifier Power Units PP-86E/TXC-1 bearing Order No. 21326-Phila-56:

(1) The value of resistor R14, in the power unit, has been changed from 240K ohms to 200K ohms.

(2) The value of variable resistor R42, in the transceiver, has been changed from 600 ohms to 1,000 ohms.

(3) Resistor R43, in the transceiver, has been replaced with a wire strap.

(4) The value of resistor R69, in the transceiver, has been changed from 100K ohms to 33K ohms.

(5) Fixed resistor R70, in the transceiver, has been replaced by a variable resistor. In addition, the value of resistor R70 has been changed from 56K ohms to 15K ohms.

(6) Fixed resistor R112 (1,500 ohms) has been added in the meter circuit of the transceiver.

(7) The worm that drives the reduction gear in the motor drive system of the transceiver has been changed from type 416, stainless steel, to type 440C, hardened stainless steel, and the reduction gear has been changed from bronze to nylon.

Page 87, figure 49. Make the following changes:

Change NOTE to read **NOTES:**.

Add number 1. before the existing note.

2. (Added) IN FACSIMILE TRANSCEIVERS TT-1F/TXC-1 BEARING ORDER NO. 21326-PHILA-56, RESISTOR R42 IS 1,000 OHMS AND RESISTOR R43 IS REPLACED WITH A WIRE STRAP.

Page 91, figure 54.

4. (Added) IN FACSIMILE TRANSCEIVERS TT-1F/TXC-1 BEARING ORDER NO. 21326-PHILA-56, THE LEAD FROM THE JUNCTION OF R61 AND R62 TO (4) OF V13 IS SHIELDED.

Page 92, figure 56. Make the following changes:

Delete the following notes: IN FACSIMILE TRANSCEIVER TT-1F/TXC-1, R64 IS 500K, R65 IS 510K, R68 IS 510K, R70 IS 56K, R71 IS 50K, R97 IS 2500.

Change the caption to read: **Figure 56. Record direct amplifier driver and meter amplifier, Facsimile Transceivers TT-1B/TXC-1 through TT-1E/TXC-1.**

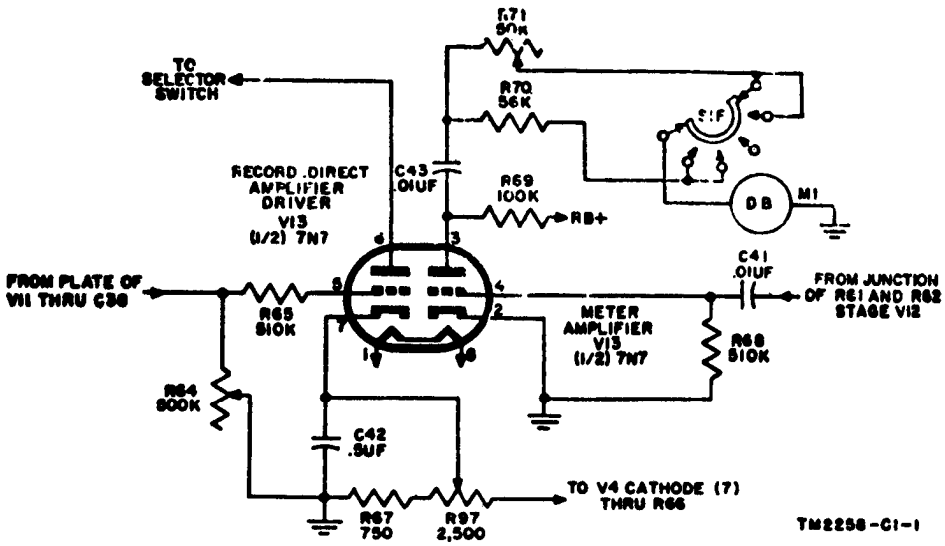

Figure 56.1. (Added) *Record direct amplifier driver and meter amplifier, Facsimile Transceivers TT-1F/TXC-1 bearing Order No. 6437-Phila-51.*

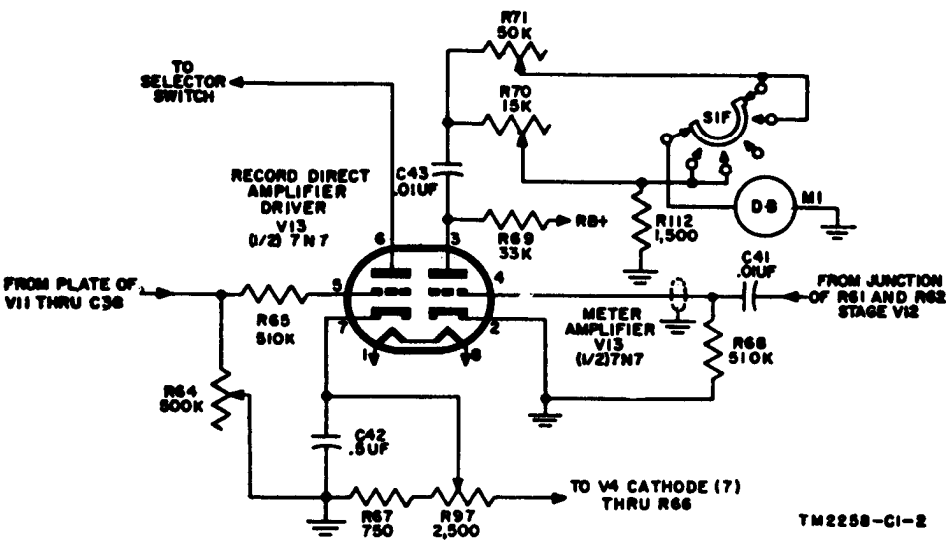

Figure 56.2. (Added) *Record direct amplifier driver and meter amplifier, Facsimile Transceivers TT-1F/TXC-1 bearing Order No. 21326-Phila-56.*

Page 93, paragraph 75*d* (2), line 7. Add the following sentence after V13: In Facsimile Transceivers TT-1F/TXC-1 bearing Order No. 21326-Phila-56, the leads from pin 4 of tube V13 to resistor R68 and from capacitor C41 to the junction of resistors R61 and R62 are shielded to reduce the error in the signal meter reading.

Page 107, figure 72.

NOTE. (Added) IN RECTIFIER POWER UNITS PP-86E/TXC-1 BEARING ORDER NO. 21326-PHILA-56, RESISTOR R14 IS 200K.

Page 119, figure 84.

D (Superseded)—TRANSMIT, SET RANGE 70 VDC IN FACSIMILE TRANS-

CEIVERS TT-1F/TXC-1 BEARING ORDER NO. 6437-PHILA-51 AND SET RANGE 90 VDC IN FACSIMILE TRANSCEIVERS TT-1F/TXC-1 BEARING ORDER NO. 21326-PHILA-56.

Page 122, figure 88. On the schematic diagram of tube socket V13, add an asterisk (*) after the dagger (†), which is located under the line leading from pin 3.

Add the following under the last note:

*IN FACSIMILE TRANSCEIVERS TT-1F/TXC-1 BEARING ORDER NO. 21326-PHILA-56, THE RESISTANCE MEASUREMENT IS 33K.

Page 135, figure 101. Make the following changes:

On the diagram of tube socket V21, add an asterisk (*) after 250K, which is located under the line leading from pin 6.

Add the following note under the last note:

*IN FACSIMILE TRANSCEIVERS TT-1F/TXC-1 BEARING ORDER NO. 21326-PHILA-56, THE RESISTANCE MEASUREMENT IS 200K.

Page 141, paragraph 94*b*.

b. (Superseded) *Correct Meter Reading.* In Facsimile Transceivers TT-1/TXC-1 through TT-1E/TXC-1, resistors R70 and R71 have tolerance values within 10 percent. In Facsimile Transceivers TT-1F/TXC-1 bearing Order No. 6437-Phila-51, R71 is an adjustable resistor. In Facsimile Transceivers TT-1F/TXC-1 bearing Order No. 21326-Phila-56 both R70 and R71 are adjustable resistors. If the meter does not indicate correctly, adjust or select resistors within this tolerance range to obtain a proper reading. To determine whether the reading is correct with the selector switch in the TRANSMIT position, measure the output signal across the LINE binding posts after connecting a 600-ohm resistor to these terminals. A reading of 0 dbm across the LINE binding posts should cause the transceiver DB METER to indicate +2 db. To determine whether the reading is correct with the selector switch in the RECORD PHOTO position, measure the current through the recorder lamp. The current should be 34 ma when a constant input signal is applied to the set and the GAIN control is adjusted for a reading of +2 db on the DB METER.

Page 144, paragraph 102*a*. Make the following changes:

Second sentence. **Change this sentence to read: It will usually be between 5 volts and a maximum of 6.3 volts at any line voltage between 100 and 130.**

Line 6. **Add the following sentences after supply: The proper voltage across the exciter lamp depends upon the sensitivity of the photo tube. The CONTRAST dial balance point on white (with maximum signal on black) will be at a low reading. For setting a lower contrast with maximum signal on black, use a lower CONTRAST dial reading than this. If the lamp voltage is too high, the contrast will still be greater than is desired when the CONTRAST dial is set at 0. If the exciter lamp voltage is too low, the necessary output signal level will be too low. The proper exciter lamp voltage will ordinarily be between 5 volts and 6 volts**

Page 149, paragraph 105. **Make the following changes:**

Line 2. **Add the following sentence after replaced: A worn worm and gear will be evidenced by the gear teeth or worm threads being worn narrow with much play between the worm and gear.**

Line 5. **Add the following sentences after new worm.: In Facsimile Transceivers TT-1F/TXC-1 bearing Order No. 21326-Phila-56, the worm is made of type 440C hardened stainless steel and the gear of natural color nylon to afford a longer life. In former transceivers, the worm was type 416 stainless steel and the gear was bronze. However, the two types are interchangeable.**

Page 154, paragraph 106*d*. **Change the table as follows:**

Add an asterisk (*) after the letters C, H, and L, in reference symbol column.

Add the following at the bottom of the table: *Rings C are pressed on both pressure plate L and retainer plate H at the factory and are removed as complete units.

119. DB METER Circuit

(Superseded)

a. If the DB METER readings are not correct, replace the tube V13 with a new tube. If the meter readings still are not correct, replace the new tube with the original tube and check the

resistance values of resistors R61, R62, R68, and R69.

b. If the resistance values of these resistors are found to be correct (within 10 percent), first adjust or select resistor R71 to get the required meter reading with the selector switch set on the TRANSMIT position ((1) below). Then adjust or select resistor R70 to get the required meter reading with the selector switch set on the RECORD PHOTO position ((2) below). In Facsimile Transceivers TT-1/TXC-1 through TT-1E/TXC-1, both resistors R70 and R71 are fixed resistors (fig. 56). In Facsimile Transceivers TT-1F/TXC-1 bearing Order No. 6437-Phila-51, resistor R70 is a fixed resistor and resistor R71 is a variable resistor (fig. 56.1). In Facsimile Transceivers TT-1F/TXC-1 bearing Order No. 21326-Phila-56, both resistors R70 and R71 are adjustable resistors (fig. 56.2).

(1) *Adjustment or selection of resistor R71.* Turn the selector switch to the RECORD PHOTO position, adjust the GAIN control to obtain a measurement between 14 volts and 18 volts at the grid of tube V14 (pin 4 or 5), adjust the recorder lamp current to 34 ma and then adjust or select resistor R71 so that a +2-db reading is obtained on the transceiver meter.

(2) *Adjustment or selection of resistor R70.* Connect a 600-ohm resistor to the LINE binding posts, turn the selector switch to the TRANSMIT position, adjust the GAIN and CONTRAST controls to obtain a 0-db reading on the transceiver meter and then adjust or select resistor R70 so that a +2-db reading is obtained on the meter.

c. The DB METER used with Facsimile Transceivers TT-1D/TXC-1 and TT-1E/TXC-1 is hermetically sealed. To zero-adjust the meter, use a 20-watt soldering iron having a small chisel-shaped tip. Insert the heated tinned iron into the slot of the zero corrector. When the solder softens, rotate the zero corrector as necessary for a correct zero setting. Remove the soldering iron and the seal will solidify. The instrument is then ready for use. This procedure will be used in an emergency *only*. In Facsimile Transceiver TT-1F/TXC-1, the zero adjustment of the DB METER is made with a screwdriver.

Page 173, paragraph 123*a*. Second column. Line 12. Insert the following after made: (The proper voltage across the exciter lamp depends upon the sensitivity of the photo tube. It must be low enough to permit setting the desired contrast wedge for maximum signal on black, and high enough to get the proper output signal voltage. The proper exciter lamp voltage will ordinarily be between 5 and 6 volts.)

Page 183, figure 133.

NOTE. (Added) IN FACSIMILE TRANSCEIVERS TT-1F/TXC-1 BEARING ORDER NO. 21326-PHILA-56, RESISTOR R70 IS A VARIABLE RESISTOR AND IS MOUNTED NEXT TO RESISTOR R71.

Page 186, figure 138.

NOTE. (Added) IN FACSIMILE TRANSCEIVERS TT-1F/TXC-1 BEARING ORDER NO. 21326-PHILA-56, A WIRE STRAP HAS BEEN SUBSTITUTED FOR RESISTOR R43.

Page 190, figure 144.

NOTE. (Added) IN FACSIMILE TRANSCEIVERS TT-1F/TXC-1 BEARING ORDER NO. 21326-PHILA-56, RESISTOR R43 HAS BEEN REMOVED FROM THE TERMINAL BOARD AND RESISTOR R112 HAS BEEN ADDED AT THE BOTTOM OF THE SELECTOR SWITCH S1.

Page 205, figure 161. Make the following changes:

Change NOTE to read **NOTES:**

Add number 1 before the existing note.

2. (Added) IN RECTIFIER POWER UNITS PP-86E/TXC-1 BEARING ORDER NO. 21326-PHILA-56, THE VALVE OF RESISTOR R14, IS 200K.

Figure 171 (fold-out). Add the following note:

7. IN FACSIMILE TRANSCEIVERS TT-1F/TXC-1 BEARING ORDER NO. 21326-PHILA-56, RESISTOR R42 IS A 1,000-OHM VARIABLE RESISTOR, RESISTOR R43 IS REMOVED, RESISTOR R69 IS 33K, RESISTOR R70 IS A 15K VARIABLE RESISTOR, AND RESISTOR R112 (1,500 OHMS) IS ADDED BETWEEN THE SWITCH END OF RESISTOR R70 AND GROUND.

Figure 192 (fold-out).

NOTE. (Added) IN FACSIMILE TRANSCEIVERS TT-1F/TXC-1 BEARING ORDER NO. 21326-PHILA-56,

SHIELDED WIRING IS USED BETWEEN PIN 4 OF TUBE V13 AND RESISTOR R68 AND BETWEEN CAPACITOR C41 AND THE JUNCTION OF RESISTORS R61 AND R62. RESISTOR R70 IS A VARIABLE RESISTOR LOCATED NEXT TO RESISTOR R71.

Figure 193 (fold-out). Change as follows:

Add the word NOTES: above the pictorial representation of the rear view of selector switch S1, which is located in the lower right hand corner of the wiring diagram.

Designate the pictorial representation of the rear view of selector switch S1 as note 1.

2. (Added) IN FACSIMILE TRANSCEIVERS TT-1F/TXC-1 BEARING ORDER NO. 21326-PHILA-56, RESISTOR R43 IS REPLACED WITH A WIRE STRAP AND FIXED RESISTOR R112 IS ADDED BETWEEN CONTACTS L1 AND RR ON SECTION 6 OF SELECTOR SWITCH S1.

[AG 413.44 (17 Apr 56)]

BY ORDER OF THE SECRETARIES OF THE ARMY AND THE AIR FORCE:

MAXWELL D. TAYLOR,
General, United States Army,
Chief of Staff.

OFFICIAL:
JOHN A. KLEIN,
Major General, United States Army,
The Adjutant General.

N. F. TWINING,
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Log Comd (5)
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Corps (2)
Div (2)
Ft & Cp (2)
Army Cml Cen (4)
Gen & Br Svc Sch (5) except Sig Sch (25)
Gen Depots (2) except Atlanta Gen Depot (None)
Sig Sec, Gen Depots (10)
Sig Depots (20)
SP WPN's Comd (2)
POE (OS) (2)
Trans Terminal Comd (2)
Army Terminals (2)
OS Sup Agencies (2)
Sig Fld Maint Shops (3)
Sig Lab (5)
Mil Dist (1)
Units organized under following TOE's:
11-7C, Sig Co, Inf Div (2)
11-15R, Sig Bn, Corps or Abn Corps (2)
11-16C, Hq & Hq Co, Sig Bn, Corps or Abn Corps (2)
11-17C, Rad and Msg Cen Opr Co (2)
11-57R, Armd Sig Co (2)
11-95R, Sig Opr Bn (2)
11-99R, Msg Cen Opr Co (2)
11-127R, Sig Rep Co (2)
11-128R, Sig Depot Co (2)
11-500R (AA-AE), Sig Svc Org (2)
11-557C, Abn Sig Co (2)
11-587R, Sig Base Maint Co (2)
11-592R, Hq & Hq Co, Sig Base Depot (2)
11-597R, Sig Base Depot Co (2)

NG: State AG (6); units—same as Active Army except allowance is one copy per unit.
USAR: None.
For explanation of abbreviations used, see SR 320-50-1.

TECHNICAL MANUAL
No. 11-2258
TECHNICAL ORDER
No. 31S2-2TXC1-1

DEPARTMENTS OF THE ARMY AND
THE AIR FORCE

WASHINGTON 25, D, C., *3 May 1955*

FACSIMILE SETS AN/TXC-1, -1A, -1B, -1C, and -1D

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*This manual supersedes TM 11-2258, 15 December 1947, including C 1, 29 June 1950.

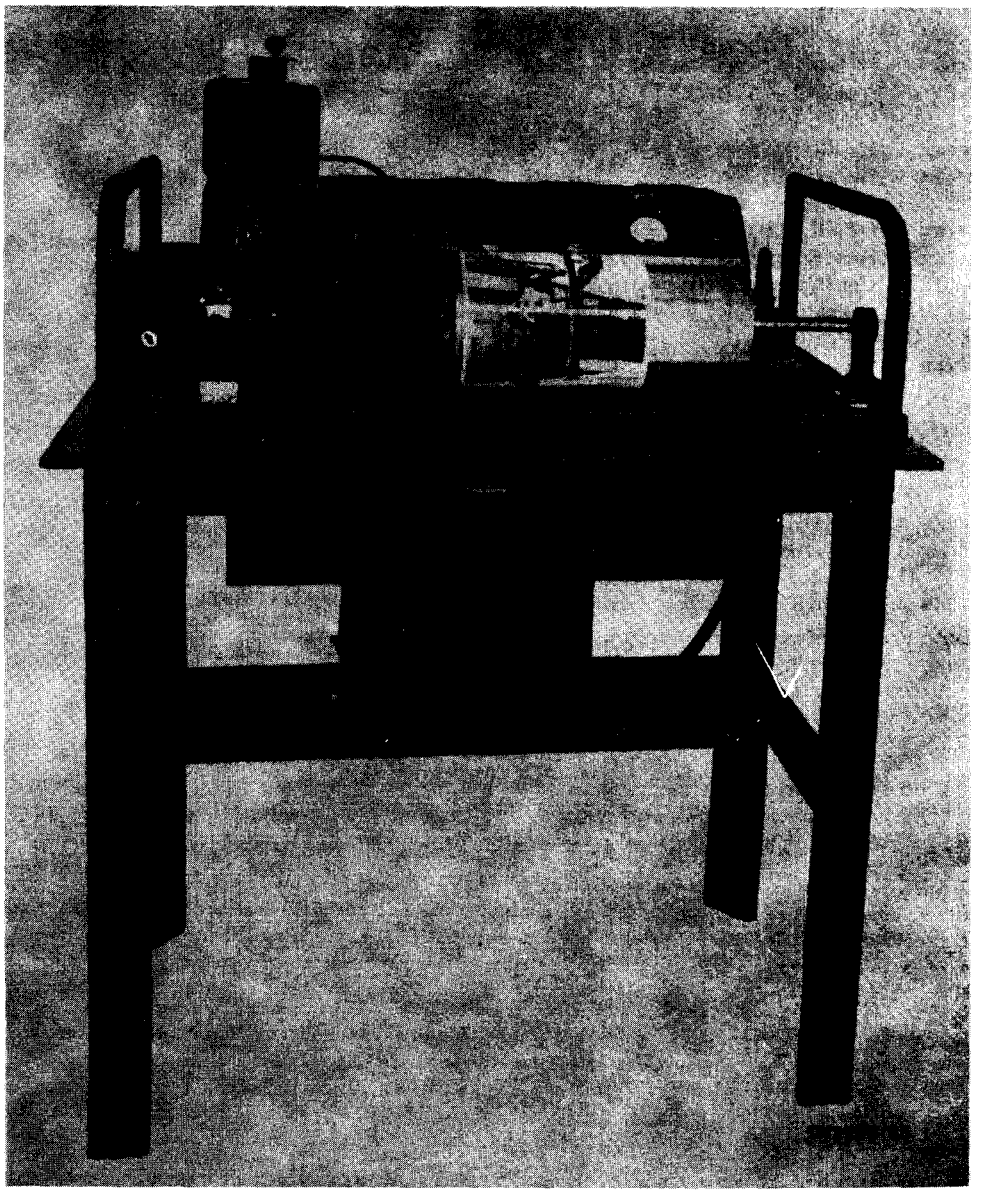


Figure 1. Facsimile sets AN/TXC-1, -1A, -1B, and -1C

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1. Scope

a. This manual contains instructions for the installation, operation, maintenance, and repair of Facsimile Set AN/TXC-1(*) (figs. 1 and 2). Descriptions of and data for Facsimile Set AN/TXC-1(*) and auxiliary equipment also are included.

b. Official nomenclature followed by the symbol (*) is used to indicate all models of the item of equipment included in this manual. Facsimile Set AN/TXC-1 (*) refers to Facsimile Sets AN/TXC-1, -1A, -1B, -1C, and -1D. Facsimile Transceiver TT-1(*)/TCX-1 refers to Facsimile Transceivers TT-1/TXC-1, TT-1A/TXC-1, TT-1B/TXC-1, TT-1C/TXC-1, TT-1D/TXC-1, TT-1E/TXC-1, and TT-1 F/TXC-1; Rectifier Power Unit PP-86(*)/TXC-1 refers to Rectifier Power Units PP-86/TXC-1, PP-86A/TXC-1, PP-86B/TXC-1, and PP-86E/TXC-1; Table MT-252 (*)/TXC-1 refers to Tables MT-252/TXC-1, MT-252A/TXC-1, and MT-252B/TXC-1.

c. Forward comments on this publication directly to: Commanding Officer, The Signal Corps Publications Agency, Fort Monmouth, New Jersey, ATTN: Standards Division.

2. Forms and Records

The following forms will be used for reporting unsatisfactory conditions of Army equipment and in performing preventive maintenance.

a. DD Form 6 (Report of Damaged or Improper Shipment) will be filled out and forwarded as prescribed in SR 745-45-5 (Army) and AFR-71-4 (Air Force).

b. DA Form 468 (Unsatisfactory Equipment Report) will be filled out and forwarded to the Office of the Chief Signal Officer as prescribed in SR 700-45-5.

c. DD Form 535 (Unsatisfactory Report) will be filled out and forwarded to Commanding General, Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio as prescribed in SR 700-45-5 and AF TO 00-35 -54.

d. DA Form 11-238 (Operator First Echelon Maintenance Check List for Signal Corps Equipment-Radio Communication, Direction Finding, Carrier, Radar) will be prepared in accordance with instructions on the back of the form (fig. 24).

e. DA Form 11-239 (Second and Third Echelon Maintenance Check List for Signal Corps Equipment-Radio Communication, Direction Finding, Carrier, Radar), will be prepared in accordance with instructions on the back of the form (fig. 25).

f. Use other forms and records as authorized.

Section II. DESCRIPTION AND DATA

3. Purpose and Use

Facsimile Set AN/TXC-1(*) is an electro-mechanical-optical facsimile set of the revolving drum type for the transmission and reception of page copy. It is used for transmission of maps, photographs, sketches, and printed or handwritten text over regular voice communication channels, either wire or radio, between fixed stations. Although colored copy may be transmitted, the reproduction is always in black, white, and intermediate shades of gray. Received copy is recorded either directly on chemically coated paper or photographically in either negative or positive form. The equipment will transmit or receive a page of copy 12 by 18 inches in 20 minutes; Facsimile Sets AN/TXC-1D, -1E, and -1F have provisions for transmitting or receiving copy at half speed. When set for half-speed operation, they will transmit or receive one page of copy in 40 minutes. Principal components of Facsimile Set AN/TXC-1(*) (figs. 1 and 2) are Facsimile Transceiver TT-1(*)/TXC-1 which serves either as transmitter or receiver (depending on the setting

of a front panel selector switch) and Rectifier Power Unit PP-86(*)/TXC-1 (fig. 3) which supplies operating power to the transceiver and dust removal blower and operates from an alternating-current (ac) source of 115 volts at 60 cycles per second (cps).

4. Application of Facsimile Set AN/TXC-1(*)

Facsimile Set AN/TXC-1(*) may be used with either wire or radio communication circuits.

a. Wire Circuits. When used with wire lines, the facsimile transceiver can be connected directly to the line by one of several input and output terminals of various impedances and levels. The transceiver also can be connected to the line through a coupling coil, which may be coupled magnetically to the receiver of a conventional telephone handset or which may be coupled inductively to certain types of lines that have no ringing or signaling circuits. An amplitude-modulated (am.) 1,800-cycle carrier is transmitted and received.

b. Radio Circuits. When used with radio communication circuits, the facsimile transceiver can be connected in several ways with auxiliary equipment to produce different types of radio signals.

(1) *Subcarrier amplitude modulation* (SCAM), When transmitting, the facsimile transceiver is connected to the microphone circuit of a conventional am radiotelephone transmitter to produce an am radio signal. When receiving, the output of a conventional am radio receiver

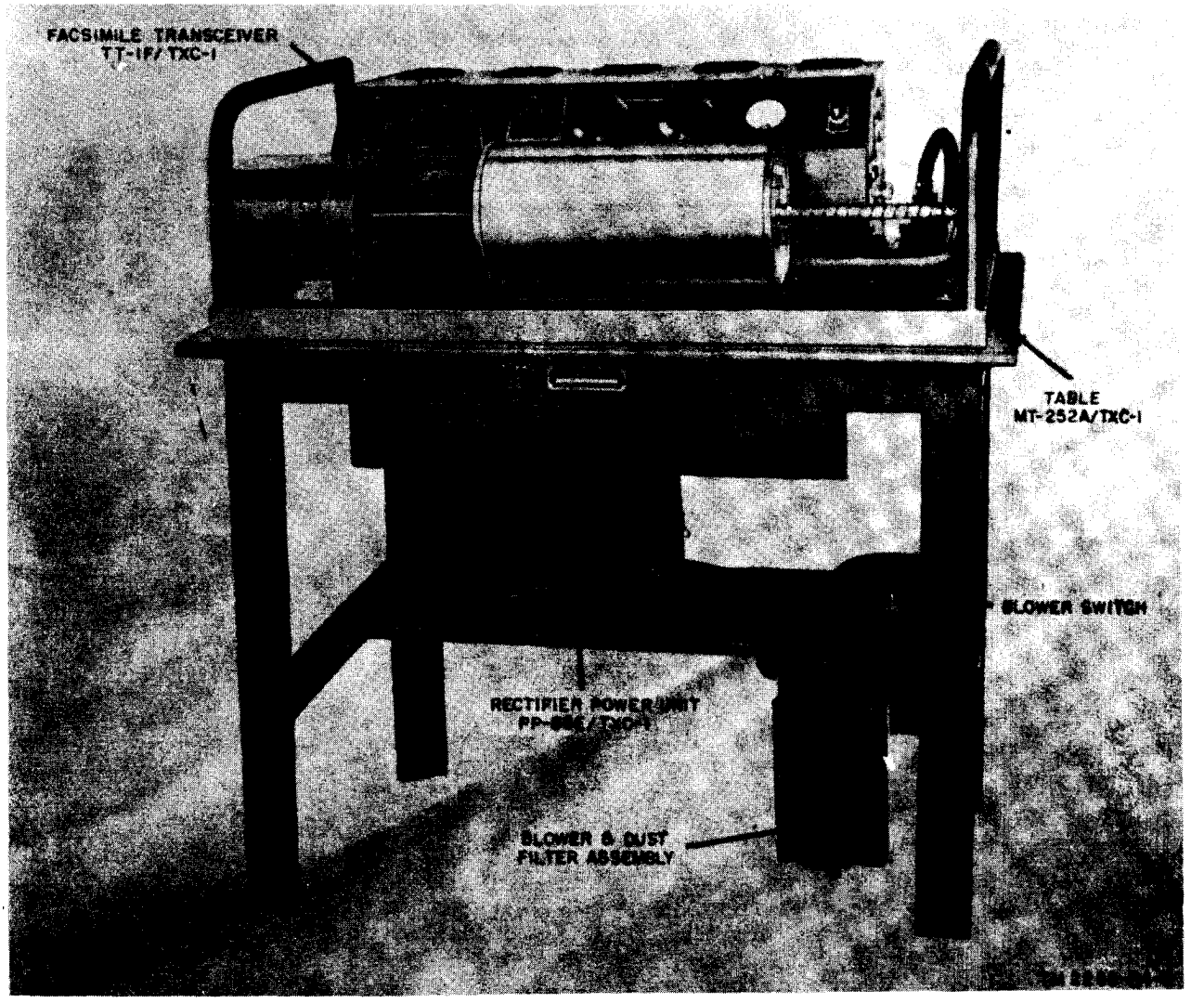


Figure 2. Facsimile set AN/TXC-1D.

is connected to the input of the facsimile transceiver.

(2) *Subcarrier frequency modulation* (SCFM). When the facsimile transceiver is connected to such auxiliary equipment as Converter CV-2(*)/TX, the converter output is fed into a conventional am radiotelephone transmitter and the radio signals are described as narrow band subcarrier frequency modulation. The radio signals consist of a radio-frequency (rf) carrier modulated by a constant-amplitude audio signal, the frequency of which is varied to carry facsimile intelligence. When this system is used for receiving, a conventional am radio receiver, the same converter, and the same facsimile transceiver are used. The converter changes the subcarrier fm signals back to am signals, which are required for operation of the transceiver.

(3) *Frequency-shijt modulation.* When Facsimile Transceiver TT-1(*)/TXC-1 is used with two auxiliary equipments, Converter CV-2C/TX and Exciter Unit O-5B/FR (earlier models must be modified) frequency-shift signals can be transmitted over a conventional continuous-wave (cw) radio transmitter. When transmitting, the am output of Facsimile Transceiver TT-1(*)/TXC-1 is fed into the converter. A varying direct-current (dc) output is taken from the converter and fed into frequency-shift Exciter Unit O-5B/FR. The output of the exciter unit excites the cw transmitter and a frequency-shift radio signal is transmitted. When receiving, a stable am communication receiver with a crystal-controlled, high-frequency (hf) oscillator and the converter are used to convert the frequency-shift signals to am signals. When using receivers that do not use crystal-controlled conversion, the stable output of additional auxiliary equipment Frequency Meter BC-221 is required and is used with Converter CV-2C/TX to receive frequency-shift signals.

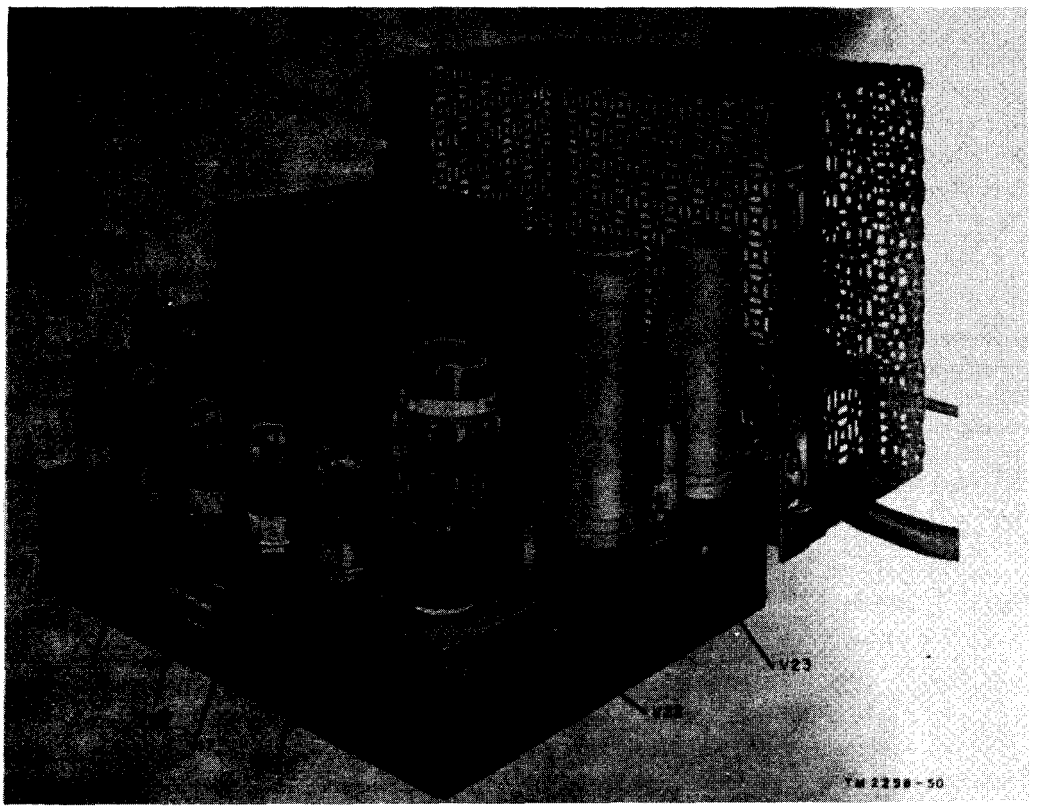


Figure 3. Rectifier power units PP-86/TXC-1, PP-86A/TXC-1, or PP-86B/TXC-1, cover removed.

5. Technical Characteristics

a. Facsimile Transceiver TT-1(*)/TXC-1.

Type of equipment. . . . . Rotating drum type.
Functions. . . . . Transmitting or receiving signals.
Type of copy . . . . . Page.
Maximum size of copy . . . 12 by 18 11/16 inches.
Size of scanning spot . . . . . 1/96 inch.
Type of recording. . . . . Direct, or photographic positive or negative.
Drum diameter . . . . . 6 inches.
Speed of drum:
- Rotation .. . . . 1 revolution per second in the -1, -1A, -1B, and -1C models; ½ or 1 revolution per second in the -1D, -1E, and -1F models.
- Lateral movement . . . . . 12 inches in 20 minutes in –1, -1A,-1B,and-1C models; 12 inches in 20 minutes or 40 minutes in -1D, -1E, and-1F models.
- Scanning lines per inch. 96.
- Index of cooperation.. . 576.
- Number of tubes . . . ... 18 in -1, -1A, -1B, and -1C models; 19 in -1D, -1E, and -1F models.
- Audio carrier frequency. 1,800 cps.

Type of modulation..... Am.
Frequency bandwidth ..... 1,800 cps maximum.
Frequency band limits .. .. 900 to 2,700 cps.
Drum speed control . . . . . Synchronous motor controlled by 1,800-cps fork oscillator, or 900-cps multivibrator (or external audio source).
Signals levels:
- Input, (for reception... -45 to 0 dbm.
- Output (for transmission). 0 to +26 dbm.

b. Rectifier Power unit PP-86(*)/TXC-1.

Number of tubes ..... 7.
Input requirements:
- Power source ..... 100 to 130 v, 50 to 65 cps; 250 w; at 115 v.
- Signal source ..... 1,800 cps from fork oscillator.

Output:
- Unregulated plate supply. 450 v at 270 ma.
- Filament supply ..... 6.5 v, ac at 6.25 amperes.
- Start motor supply . .. 115 v, ac at .5 ampere.
- Exciter lamp supply ... Regulated 6 v, 1,800 cps at 2.74 amperes, ±.1 v.
- Dust removal blower... 115 v, 60 cps, 3 amperes.

6. Packaging Data

When packaged for export shipment, the components of Facsimile Set AN/TXC-1(*) are placed in water-vaporproofed containers and are packed in four wooden crates. Typical packaging procedure of Facsimile Transceiver TT-1 (*)/TXC-1 is shown in figure 7. The size, weight, and volume of each crate are indicated in the following chart:

Note. Items may be packaged in a manner different from that shown, depending on the supply channel.

Box No.	Contents	Dimensions (in.)	Volume (cu ft)	Weight (lb)
1 of 4	Facsimile Transceiver TT-1(*)/TXC-1 and spare parts.	40½ x 15½ x 22½.	8.1	218
2 of 4	Rectifier Power Unit PP-86(*)/TXC-1 and spare parts.	17½ x 15 x 15¼.	2.3	89
3 of 4	Photographic Equipment PH-549/TXC-1.	40 x 26 x 26	15.6	339
4 of 4	Table MT-252(*)/TXC-1.	40 x 26 x 41	11.5	137

7. Table of Components

(figs 1-6)

Facsimile set					Component	Required No.	Height (in.)	Depth (in.)	Length (in.)	Volume (cu ft)	Unit weight (lb)
AN/TXC-1	AN/TXC-1A	AN/TXC-1B	AN/TXC-1C	AN/TXC-1E							
(*)					Facsimile Transceiver TT-1/TXC-1	1	10 ¼	17 5/8	34 5/8	3.5	85
	(*)				Facsimile Transceiver TT-1A/TXC-1	1	10 ¼	17 5/8	34 5/8	3.5	85
		(*)			Facsimile Transceiver TT-1B/TXC-1 or TT-1C/TCC-1.	1	10 ¼	17 5/8	34 5/8	3.5	85
			(*)		Facsimile Transceiver TT-1D/TXC-1 or TT-1E/TXC-1.	1	10 ¼	17 5/8	34 5/8	3.5	85
				(*)	Facsimile Transceiver TT-1F/TXC-1	1	10 ¾	17 5/8	34 5/8	3.5	85
(*)	(*)	(*)	(*)	(*)	Rectifier Power Unit PP-86(*)/TXC-1	1	9	10	12	62	48
(*)	(*)	(*)	(*)	(*)	Photographic Equipment PH-549/TXC-1	1					83
(*)	(*)	(*)	(*)	(*)	Table MT-252(*)/TXC-1	1	32	22	37	4.7	86
(*)	(*)	(*)	(*)	(*)	Paper, direct recording	1					
(*)	(*)	(*)	(*)	(*)	Paper, direct recording, hectograph process	1					
(*)	(*)	(*)	(*)	(*)	Cord CD-1018	1			120		
(*)	(*)	(*)	(*)	(*)	Cord CD-1019	1			96		
(*)	(*)	(*)	(*)	(*)	Cable assembly, special purpose	1			66		
(*)	(*)	(*)	(*)	(*)	Cable assembly, special purpose, electrical	1			6		
(*)	(*)	(*)	(*)	(*)	Clips, alligator	2					
(*)	(*)	(*)	(*)		Coupler, induction, UC	1	4 ¼	2	6		18
(*)	(*)	(*)	(*)	(*)	Cover, dust (transceiver)	1					
(*)	(*)	(*)	(*)	(*)	Cover, dust (power unit)	1					
	(*)	(*)	(*)	(*)	Loudspeaker LS-11	1	4	2	4		
			(*)	(*)	Lamp LM-52	1					
(*)	(*)	(*)	(*)	(*)	Weighing scale 2 to 24 ounces (avoirdupois)	1					
(*)	(*)	(*)	(*)	(*)	Screw driver	1			2½		
			(*)	(*)	Wrench, Allen #6	1					
(*)	(*)	(*)	(*)		Wrench, TL-507/U	1					
(*)	(*)	(*)	(*)	(*)	TM 11-2258	2					
(*)	(*)	(*)	(*)	(*)	Tube extractor	1					
				(*)	Fuse, 3 amperes	6					
					Blower and dust filter assembly including filter bag.	5					
					Can of activated carbon	2					
					Flexible hose	1					
					Hose clamps	2					

Note. This list is for information only. See appropriate supply publications for information pertaining to requisitioning of spare parts.

8. Description of Components

a. Facsimile *Transceiver TT-1(*)/TXP-1.* All models of Facsimile Transceiver TT-1(*)/TXC-1 are similar in size, weight, and appearance. They differ slightly in the number of operating controls and in certain circuit features. The transceiver is mounted on a steel chassis 34 5/8 inches long, 17 5/8 inches deep, and 10¾ inches high. Tubular guards, 1 inch in diameter, are welded to each end of the chassis to serve as carrying handles and to protect the equipment when it is turned on its side, back, or top for inspection and repair. Mounted to the chassis are the motor assembly, bearings that support the lead screw and drum, fork oscillator unit, regulator unit, signal and phasing circuit components, transmitting optical system, receiving optical system, indicating meters, and various other components. The power supply connection plug and the panel supporting the operating controls and terminal panel also are mounted on the chassis. Operating controls are located on a sloping portion of the front

panel, behind the drum. The terminal panel for input and output connections is on the right side of the panel assembly. An output jack for connecting an external speaker in the voice communication (talk-back) circuit is located on the left side of the panel assembly on all transceiver units except Facsimile Transceiver TT-1/TXC-1 (refer to note in *g* below). The transceiver is provided with a metal base cover, which is attached to the chassis with machine screws and which has four metal supporting feet. Metal covers that protect the motor and clutch assembly and the rear, side, and top of the transceiver are held in place with slide fasteners. A canvas cover is provided to protect the transceiver from dust when it is not in use. Facsimile Transceiver TT-1F/TXC-1 has an exhaust duct that runs from the vicinity of the stylus to the right rear of the chassis.

b. Rectifer Power Unit PP-86(*)/TXC-1. The rectifier power unit (fig. 3) is constructed on a metal chassis 12 inches long by 10 inches wide by 2½ inches high (some chassis are 3 inches high). All components are mounted on top of the chassis. The chassis is shielded and protected by a metal ventilated top cover and by a bottom cover plate with four metal feet. Two cables emerge from an opening in the top cover; one is a power cable for connecting to the ac line, and the other is a power cable that is terminated in a Jones plug attached to the transceiver. The rectifier power unit is provided with a canvas cover for protection during shipping. Rectifier Power Unit PP-86E/TXC-1 has a receptacle (J10) with a ground stud for the dust removal blower power cord. The fuse holder which housed the spare fuse in all former models of the rectifier power unit now is used for the 3 amp 3AG dust removal blower fuse (XF4, fig. 156).

Caution: Do not leave the cover on the power unit during operation or components will overheat.

c. Table MT-252(*)/TXC-1. The collapsible metal table (fig. 1) furnished with each facsimile set is 32 inches high, 22 inches deep, and 37 inches long. It can be disassembled by removing the metal screws in the legs and side braces. The table has a masonite top on which Facsimile Transceiver TT-1(*)/TXC-1 is mounted. A bottom shelf supports Rectifier Power Unit PP-86(*)/TXC-1 and auxiliary equipments Converter CV-2(*)/TX and Exciter Unit 0-5(*)/FR (when used). A hole in the top of the table permits easy connection of the power cable plug to the transceiver. It also permits passage of the flexible hose for the dust removal system from the duct on the transceiver to the blower and canister assembly which is clamped to the bottom shelf and right-hand leg brace of the table (fig. 2). A metal drawer is provided for storing a supply of recording paper.

d. Photographic Equipment (fig. 4). Photographic Equipment PH-549/TXC-1 is supplied with Facsimile Transceiver AN/TXC-1*. This equipment consists of one thermometer, four Bottles PH-22, and four trays.

e. Cords and Leads. The following cords and leads (fig. 5) are furnished with Facsimile Set AN/TXC-1(*):

(1) Cord CD-1018, a 10-foot, two-conductor, shielded, rubber-jacketed cord, terminated at each end with Plug PL-55. It is used in making input connections to the transceiver.

(2) Cord CD-1019 an 8-foot, three-conductor, shielded, rubber-jacketed cord, terminated at each end with Plug PL-68. It is used in making output connections from the transceiver.

(3) A 5½-foot test lead terminated on one end with a two-prong plug that fits the 1V and 6V jacks on the coupling coil (fig. 6), and on the other end with two alligator clips. It is used in making input and output connections to the transceiver when a high-level signal is required for certain types of wire lines.

(4) A 6-inch test lead a two-conductor cord terminated at one end with PL-55, and at the other end with two alligator clips. It is used in connecting a wire line into the RADIO RCVR jack during reception of high-level signals.

f. UC Coupling Unit. This coupling unit (fig. 6) is used to make input and output connections to the transceiver through a telephone receiver, and is supplied with a phosphor-bronze clamp for holding it in place on the telephone handset. The primary impedance is 600 ohms and matches the output of the transceiver. The full 10-ohm secondary provides an open-circuit output of 6 volts; the secondary also has a 2-ohm tap that provides an open-circuit voltage of 1 volt. The secondary terminates in two female type plugs for selection of the desired level. This unit is not used with Facsimile Transceiver TT-1F/TXC-1.

g. Loudspeaker LS-11 (fig. 5). This loudspeaker is used in the talk-back circuit of Facsimile

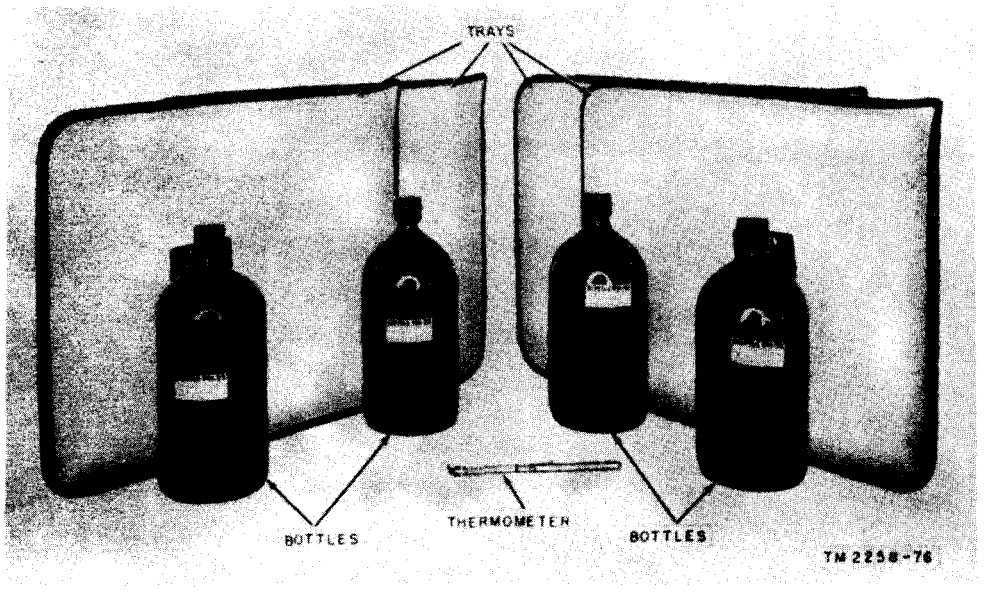


Figure 4. Photographic equipment PH-549/TXC-1.

Sets AN/TXC-1B, -1C, and -1D, and also in Facsimile Set AN/TXC-1A when modified according to MWO SIG 11-375B-(1), Modification of Facsimile Set AN/TXC-1A to Provide an External Loudspeaker (par. 11).

Note. Facsimile Set AN/TXC-1 contains no talk-back circuit. MWO SIG 11-2258-1, Modification of Facsimile Sets AN/TXC-1 to Provide an Audible Signaling Device, gives instructions for connecting a jack to add a loudspeaker to Facsimile Set AN/TXC-1. The tones that precede a facsimile transmission will then be audible to the receiving operator. This external speaker is of the permanent magnetic type, 4 inches in diameter, with a 250-ohm output transformer to match the impedance of the transceiver talk-back circuit. The speaker and transformer are contained within a steel box which is $4^{5}/_{8}$ inches high, $4^{5}/_{8}$ inches wide, and 2 inches deep. This box is fitted with a mounting clamp.

h. Recording Paper (fig. 5). Two special types of direct recording paper are furnished for use with Facsimile Transceiver TT-1(*)/TXC-1.

(1) Teledeltos paper or Timefax NDA is used in direct recording. They are dry papers with dark undercoating and light top coating. The coating is burned off by a spark from the transceiver stylus during the direct recording operation. The paper furnished is 12 inches by $18^{11}/_{16}$ inches in size. Four packages, each containing 250 sheets of Teledeltos grade H, or Timefax NDA, are furnished. This paper is nonduplicating.

(2) Timefax A paper is used in the direct recording process when multiple copies of the received pictures are to be made with a hectograph pad. This is a specially prepared paper containing a dye coating with a high-resistance outer coating that is burned by the spark from the transceiver stylus. The paper furnished is 12 inches by $18^{11}/_{16}$ inches in size. Two packages, each containing 250 sheets, are furnished.

9. Running Spares

Running spares are supplied with Facsimile Set AN/TXC-1(*) and are packed in the crate that contains the component in which they are used. Spares are supplied for all normally expendable items such as tubes, pilot lamps, and fuses. The following is a list of the items supplied:

1 tube, type 1B46
1 tube, type 1B47
1 tube, type 6AC5GT/G
3 tubes, type 7C5
1 tube, type 7C7
3 tubes, type 7L7
2 tubes, type 7N7
1 tube, type 7S7
1 tube, type 5Z3
1 tube, type 884
2 tubes, type RMA R1130B
2 tubes, type 1635
1 tube, type 1645
4 tubes, type 5651
1 tube, type 5652
1 tube, type 5879

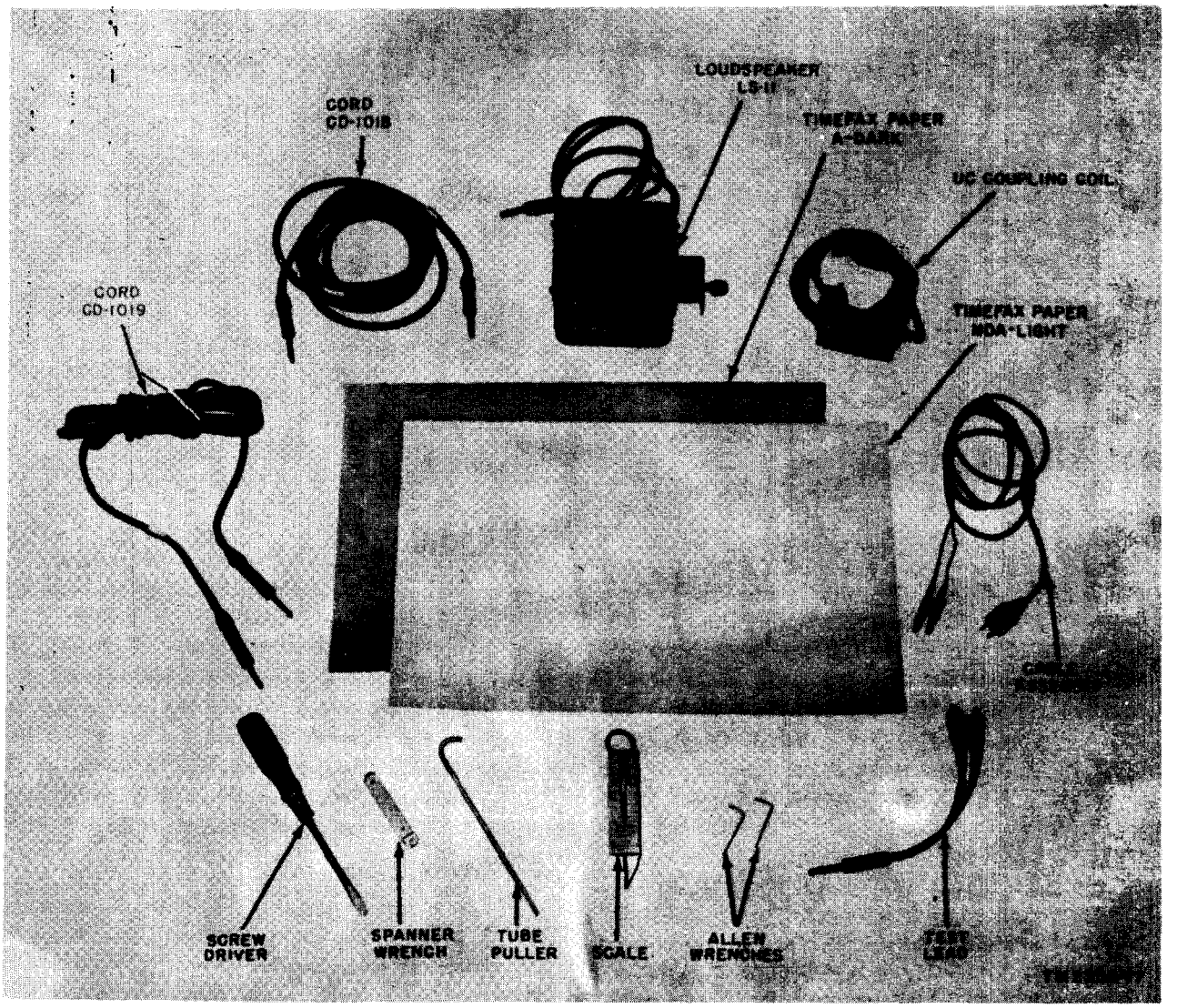


Figure 5. Facsimile set AN/TXC-1, accessories.*

100 styluses
12 fuses, $^1/_8$-ampere
5 fuses, 3-ampere
6 fuses, 5-ampere
6 lamps, 6 to 8 volts
2 sets split nuts
1 reduction worm gear*
1 motor shaft worm gear*
1 worm gear taper screw*
4 filter bags
1 can of activated carbon

10. Differences in Models

Facsimile Sets AN/TXC-1, -1A, -1B, -1C, and -1D are similar in purpose, operation, and appearance. The later models (1A, 1B, 1C, and 1D) include a number of improvements which are listed in a through g below and in table I.

a. Fork Oscillator Unit. This unit is unsealed in Facsimile Set AN/TXC-1, serial numbers up to 105, on Order No. 2695-MPD-45. Starting with serial number 105, a sealed fork oscillator unit is used in the transceiver of the remaining models of Facsimile Set AN/TXC-1 and in all models of Facsimile Sets AN/TXC-1A, -1B, -1C, and -1D. The sealed fork unit includes a revised tube line-up. The fork is sealed against changes in pressure and humidity. Details of both sealed and unsealed units are given in paragraphs 69 and 70. The two units are interchangeable electrically and mechanically.

*Gears not replaceable in Facsimile Sets AN/TXC-1, -1A, and -1B.

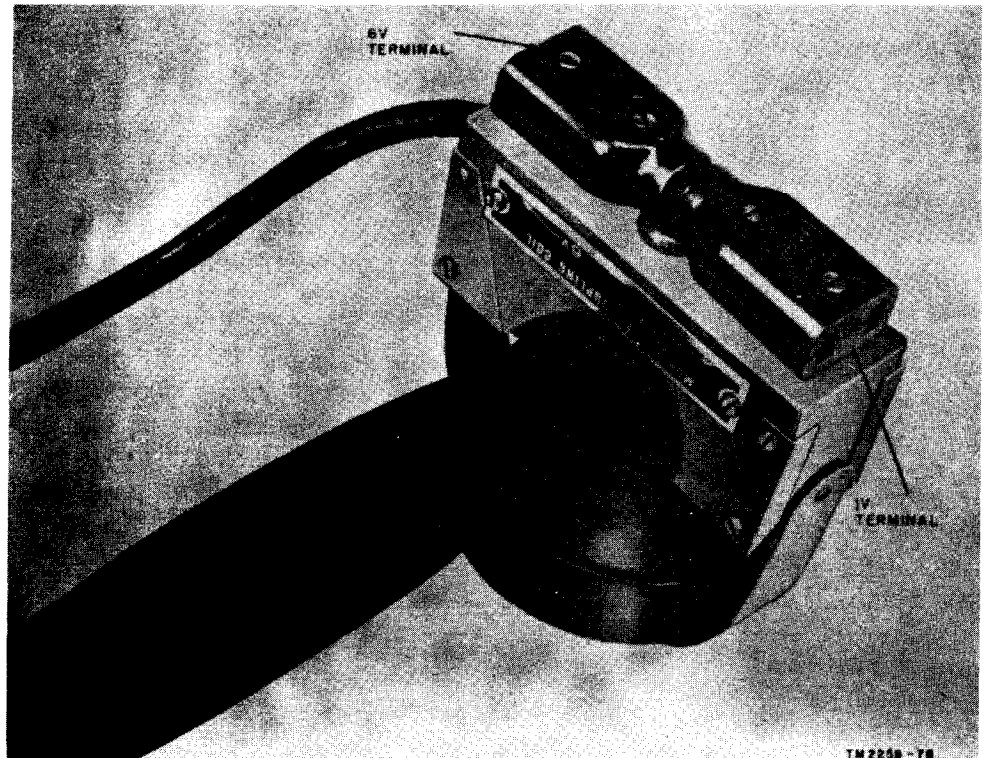


Figure 6. UC coupling coil.

b. Talk-Back Circuit. Facsimile Set AN/TXC-1 includes no talk-back circuit. Communication between transmitting and receiving operators is by means of external telephones, which may use the same wire or radio circuit as the facsimile equipment. All models of Facsimile Set AN/TXC-1A originally were produced with a built-in loudspeaker serving as both microphone and loudspeaker, the change-over of function being accomplished by a STANDBY-MON-TALK switch on the front panel. All models of Facsimile Set AN/TXC-1A modified by MWO SIG 11-375B-(1) contain a jack into which an external Loudspeaker LS-11 may be plugged to improve the quality of voice communication. Refer to figure 165 for details of this modification. All models of Facsimile Sets AN/TXC-1B, -1C, and -1D have only the external Loudspeaker LS-11. The built-in speaker and speaker transformer used in Facsimile Transceiver TT-1A/TXC-1 have been eliminated. The STANDBY-MON-TALK switch is used on Facsimile Sets AN/TXC-1A, -1B, -1C, and -1D.

c. Synchronous Motor. Motors on all four equipments are interchangeable mechanically, but motor parts are not interchangeable. All are synchronous motors, controlled by an 1,800-cps signal generated in the fork oscillator unit, and are increased in power by the motor amplifier tubes. Facsimile Transceivers TT-1B/TXC-1 through TT-1F/TXC-1 each use an induction-type start motor that operates from a 115-volt, 60-cps source supplied by Rectifier Power Unit, PP-86A/TXC-1, PP-86B/TXC-1, or PP-86E/TXC-1. Facsimile Transceivers TT-1/TXC-1 and TT-1A/TXC-1 originally used start motors that operated from a 9-volt, 60-cps supply, applied when the START button on the transceiver is pressed. Starting voltage for these motors was supplied by Rectifier Power Unit PP-86/TXC-1. All of the 9-volt KBA-1 motors in Facsimile Transceivers TT-1/TXC-1 and TT-1A/TXC-1 were replaced with 115-volt ac induction-type KBA-2 motors similar to those used in the later models, and Rectifier Power Unit PP-86/TXC-1 was modified to supply the 115-volt starting voltage. These modifications were accomplished by application of MWO SIG 11-2258-2, Modification of Facsimile Sets AN/TXC-1 and AN/TXC-1A to Eliminate Motor and Tube Failure and to Improve Voltage Regulation.

d. Resistance and Capacitance Values. Values of resistors and capacitors in Facsimile Set AN/TXC-1 were based on old standards. The

value of numerous individual components has changed slightly in Facsimile Sets AN/TXC-1A, -1B, -1C, and -1D to conform with American War Standards values. In most cases, the differences are less than the plus or minus 10 percent tolerances of the components, and are of no significance.

e. Rectifier Power Unit PP-86(*)/TXC-1. Rectifier Power Unit PP-86/TXC-1, a component of Facsimile Sets AN/TXC-1 and AN/TXC-1A, will operate Facsimile Transceiver TT-1/TXC-1 or TT-1A/TXC-1, but will not operate Facsimile Transceiver TT-1B/TXC-1, TT-1C/TXC-1, TT-1D/TXC-1, TT-1E/TXC-1, or TT-1F/TXC-1, unless modified. Rectifier Power Units PP-86A/TXC-1 and PP-86B/TXC-1 will operate Facsimile Sets AN/TXC-1 through AN/TXC-1C. Rectifier Power Unit PP-86E/TXC-1 will operate all models of the transceiver and has provision for supplying power for the dust removal blower supplied with Facsimile Set AN/TXC-1D.

f. Table MT-252A/TXC-1. Tables MT-252A/TXC-1 and MT-252B/TXC-1 are the same si e as Table MT-252/TXC-1. The construction and method of dismantling the three models differ slightly.

g. Transceiver Differences. Facsimile Transceiver TT-1F/TXC-1 is similar to Facsimile Transceiver TT-1E/TXC-1 as listed in table I, except in the following respects. In the -1F model, an automatic stop circuit is incorporated to de-energize the synchronous drive motor and ground the amplified facsimile signal at the end of drum travel. A duct has been placed to help remove dust from the vicinity of the stylus during the record direct operation. The paper clamp bar is plastic insulated to reduce spurious rf radiation generated as the stylus passes across the clamp bar. This model includes R64, R71, R107, and R318 controls. Differences in Facsimile Transceivers TT-1/TXC-1 through TT-1E/TXC-1 are listed in table I.

11. Modifications

Certain parts of Facsimile Set AN/TXC-1(*) and Rectifier Power Unit PP-86/TXC-1 have been modified as listed below. To determine whether or not the equipment in use has been modified, indications will be shown by markings on modified equipment or by the schematic diagrams found on the bottom plates of transceivers and rectifier power units.

a. MWO SIG 11-375B-(1) (fig. 165).
(1) The purpose of this modification is to provide an external loudspeaker for Facsimile Transceiver AN/TXC-1A.
(2) The talk-back circuit is the part modified.

b. MWO SIG 11-2258-1.
(1) The purpose of this modification is to make audible to the receiving operator the tones that precede a facsimile transmission. This is accomplished by rewiring the existing standby circuit to include a loudspeaker in Facsimile Set AN/TXC-1.
(2) The receiving and standby circuits are modified.

c. MWO SIG 11-2258-2 (fig. 163).
(1) The purposes of this modification are:
(a) To eliminate motor failure by providing a new and improved type motor.
(b) To install a meter and a control for proper motor current indication and adjustment.
(c) To prevent possible failure of amplifier tubes by installing a voltage dropping resistor and replacing tubes type 6AG5GT/G with tubes type 1635.
(d) To prevent fluctuation of the input signal to the motor power tubes by incorporating an adjustment control, indicating meter, and new regulating lamp in the regulated B+ voltage circuit.
(2) Facsimile Transceivers TT-1/TXC-1 and -1A and Rectifier Power Unit PP-86/TXC-1 are the major items affected.

d. MWO SIG 11-2258-3.
(1) The purpose of this modification is to provide a replaceable worm and gear, when the worm and worm gear become worn out, and when it is necessary to replace the decoupling springs between the synchronizing and start rotors with springs of improved design.
(2) Facsimile motor model KBA-1 is the major item affected.

e. MWO SIG 11-2258-5.
(1) The purpose of this modification is to provide an improved type motor and new mounting studs to be used on Facsimile Transceiver TT-1C/TXC-1 as made by Espey.
(2) Facsimile Transceiver TT-1C/TXC-1 is the major item affected.

Table I. Transceiver Differences

Item	acsim transcei					
	TT-1/TXC-1	TT-1A/TXC-1	TT-1B/TXC-1	TT-1C/TXC-1	TT-1D/TXC-1	TT-1E/TXC-1
Fork oscillator unit.	Unsealed fork on serial No. up to 105 on Order No. 2695-MPD-45; sealed on later models.	Sealed	Sealed.	Sealed.	Sealed.	Sealed.
Talk-back circuit.	None (external Loudspeaker LS-11 added by MWO SIG 11-2258-1 for monitoring tones preceding facsimile transmissions).	Internal speaker; external Loudspeaker LS-11 added by MWO SIG 11-375B-(1).	External Loudspeaker LS-11 only. R98 added as stabilizer.	External Loudspeaker LS-11 only. R98 added as stabilizer.	External Loud speaker LS-11 only. R98 added as stabilizer.	External Loudspeaker LS-11 only. R98 added as stabilizer.
Start motor.	3-volt ac brushes. (1 10-volt ac no brushes MWO SIG 11-2258-2).	9-volt ac brushes. (1 10-volt ac no brushes MWO SIG 11-258-2).	115-volt ac brushes 110-volt eliminated.	1 15-volt ac brushes eliminated.	11 5-volt ac brushes eliminated.	115-volt ac brushes eliminated.
	Type KB-1.	Type KB-1.	Type KBA-1.	Type KBA-1 or KBA-2.	Type K B A-1 or KBA-2.	Type KBA-1 or KBA-2.
Drum friction mechanism.	No (Yes, MWO SIG 11-2258-2).	No (Yes, MWO SIG 11-2258-2).	Yes.	Yes.	Yes.	Yes.
Motor fuse.	None (on front panel MWO SIG 11-2258-2).	On front panel.	On front panel.	On front panel.	On front panel.	On front panel.
Meters.	Single DB METER (MOTOR CURRENT (M2) and RB+ voltmeter (M3) added by MWO SIG 11-2258-2).	Single DB METER (MOTOR CURRENT (M2) and RB+ voltmeter. (M3) added by MWO SIG 11-2258-2).	1. DB METER M1 2. MOTOR CURRENT meter M2. 3. RB+ voltmeter M3.	1. DB METER M1 2. MOTOR CURRENT meter M2. 3. RB+ voltmeter M3.	1. DB METER M1 2. MOTOR CURRENT meter M2. 3. RB+ voltmeter M3.	1. DB METER M1. 2. MOTOR CURRENT meter M2. 3. RB + voltmeter M3.
Motor amplifier output tubes V5 and V6.	6AC5GT/G. (1635, MWO SIG 11-2258-2).	6AC5GT/G. (1635, MWO SIG 11-2258-2).	1635.	1635.	1635.	
Record output amplifier tube V14.	6AC5GT/G. (1635, MWO SIG 11-2258-2).	6AC5GT/G. (1635, MWO SIG 11-2258-2).	635.	1635.		
Reference voltage regulator V25.	R1160, or JAN-1B46 (5651, MWO SIG 11-2258-2).	R1160 or JAN-1B46 (5651, MWO SIG 11-2258-2).	5651.	5651.	5651.	5651.
Pilot lamp on front panel.	No.	Yes.	Yes.	Yes.	Yes.	Yes.
RB+ potentiometer.	None (R96 MWO SIG 11-2258-2).	None (R96 MWO SIG 11-2258-2).	R96.	R96.	R96.	R96.
Motor current potentiometer.	None (R93 MWO SIG 11-2258-2).	None (R93 MWO SIG 11-2258-2,.	R93.	R93.	R93.	R93.
Cathode potentiometer for tube V13	None.	None.	R97.	R97.	R97.	R97.
Condensing lens.	Yes.	Yes.	Yes.	No.	No.	No.
Photocell V24.	1645.	1645.	1645.	1645.	5652.	5652.
Selector switch for 30 or 60-rpm operation of drum.	None.	None.	None.	None.	34.	34.
Multivibrator V26.	None.	None.	None.	None.	7N7.	7N7.
First signal amplifier	None.	7C7.	7C7.	7C7.	7C7.	5879.
Rectifier power unit.	Any power units will function with any set providing Rectifier Power Unit PP-86/TXC-1 is modified in accordance with MWO SIG 11-2258-2.					

f. MWO SIG 11-2258-6 (fig. 162).

(1) The purpose of this modification is to provide an exhaust system for the removal of dust and odors when recording on Teledeltos or Timefax A paper.

(2) Facsimile Sets AN/TXC-1, -1A, -1B, and -1C are the major items affected.

g. MWO SIG 11-2258-7 (fig. 170).

(1) The purposes of this modification are:

(a) To eliminate excessive wear of the screw and damage to the drum by providing an automatic end of copy stop. The automatic stop actuates a relay that removes the power to the synchronous motor and grounds the input to the signal amplifier when the drum reaches the end of travel.

(b) To eliminate shock hazard by providing a protective guard and insulating sleeves for the synchronous motor terminals.

(2) Facsimile Sets AN/TXC-1, -1A, -1B, and -1C are the major items affected.

CHAPTER 2

OPERATION

Section I. SERVICE UPON RECEIPT OF FACSIMILE SET AN/TXC-1(*)

12. Siting

Facsimile Set AN/TXC-1(*) is intended for fixed station installation. Choose a location within the station so that connections can be made conveniently to the wire communication lines and a power source of 115 volts at 60 cps. If a radio circuit is to be used for facsimile transmission, the transceiver should be situated no less than 4 feet from the radio transmitter, auxiliary equipment, or power lines, to prevent extraneous noise or hum pick-up that may affect transmission or reception of satisfactory copy. If the equipment is to be used to transmit copy, place it so that the sun cannot shine directly on the drum. If the transceiver is to be used to receive copy by photographic processes, locate it in a darkroom.

13. Uncrating, Unpacking, and Checking New Equipment (fig. 7)

Note. For used or reconditioned equipment, refer to paragraph 20.

Be careful when unpacking or handling the equipment; it is damaged easily when it is not protected by the packing case. When unpacking, be careful to avoid damaging the packaging materials any more than is absolutely necessary. Store the inside packaging materials in the shipping container for future use. Unpack and check the equipment as follows:

a. Cut the steel straps.

b. Remove the nails with a nail puller. Remove the top of the shipping container. Avoid prying with a crowbar or other tool.

c. Lift the packaged equipment from the box and carefully remove the fiberboard box, the moisture-vaporproof barrier, and other packaging material. Figure 7 shows typical packing for export of the Facsimile Transceiver TT-1(*)/TXC-1.

Caution: Be careful not to damage the bottles and thermometers packed in the crate that contains Photographic Equipment PH-549/TXC-1.

d. If the equipment has been in storage for a long period, check lubrication of the motor before operating.

14. Installation of Facsimile Set AN/TXC-1(*)

a. Removal of Drum Chock. Before making connections to the facsimile set, remove the drum chock from its position under the lead screw directly beneath the engaging lever. Unfasten the two machine screws that hold the cap of the chock to the top of the lead screw (fig. 8). Unfasten the two machine screws that hold the chock to the transceiver chassis. Slide the chock toward the front of the transceiver at right angles to the lead screw.

Caution: Do not slide the drum chock along the length of the lead screw because aluminum chips from the chock may lodge in the threads.

b. Cord Connections oj Facsimile Set AN/TXC-1(*). Before making any connections, check to see that all tubes are in their proper locations in Facsimile Transceiver TT-1(*)/TXC-1 and Rectifier Power Unit PP-86(*)/TXC-1 (figs. 9 and 10).

Note. Make sure that the power ON-OFF switch on the front panel of the transceiver is set at OFF.

(1) Connect the multiconductor cord of the rectifier power unit to the transceiver by inserting the plug into the receptacle at the right-hand end of the transceiver chassis.

(2) Connect the ac plug on the two-conductor power cord of the rectifier power unit to a 115-volt, 60-cps outlet.

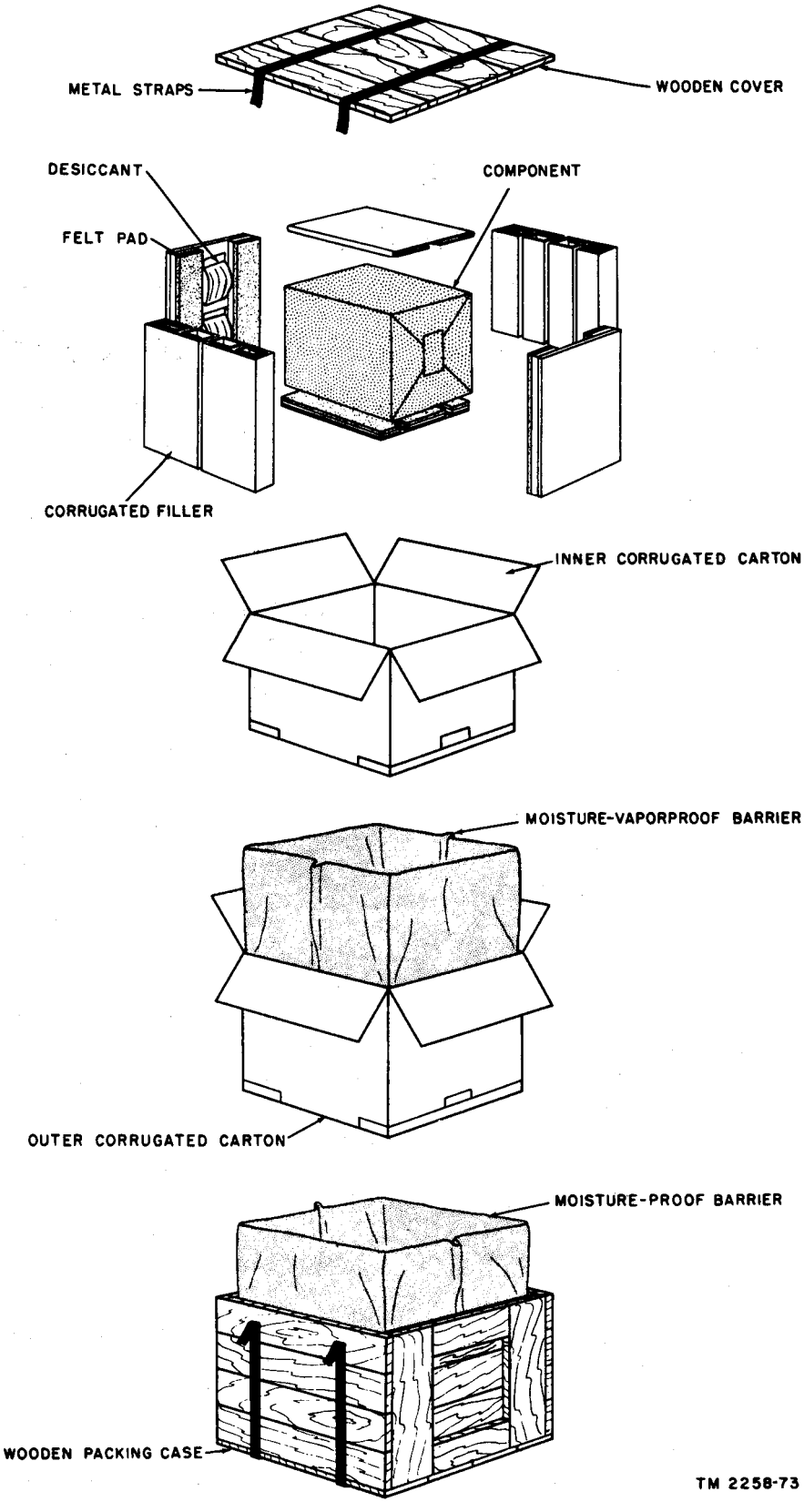


Figure 7. Typical export packaging of facsimile transceiver TT-T(*)/TXC-1.

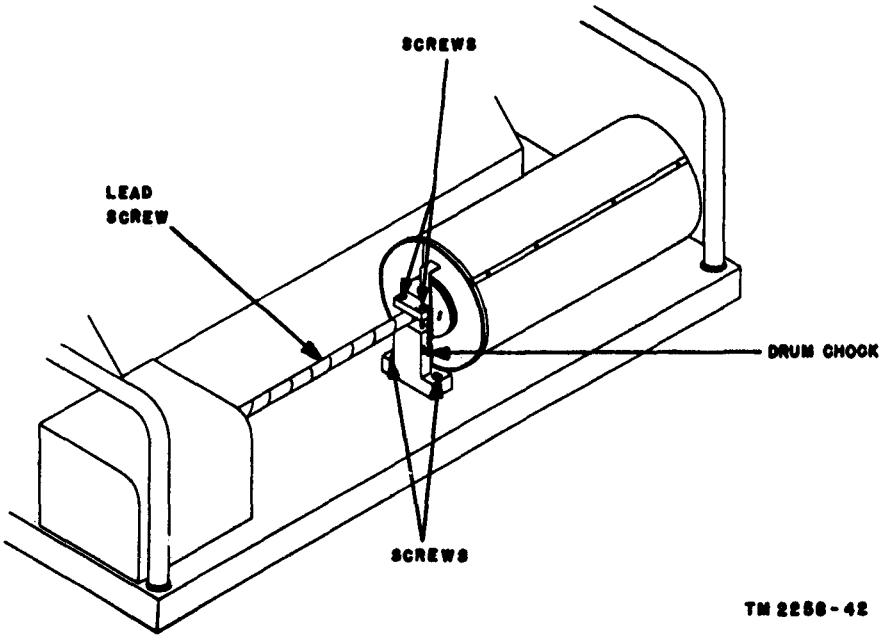
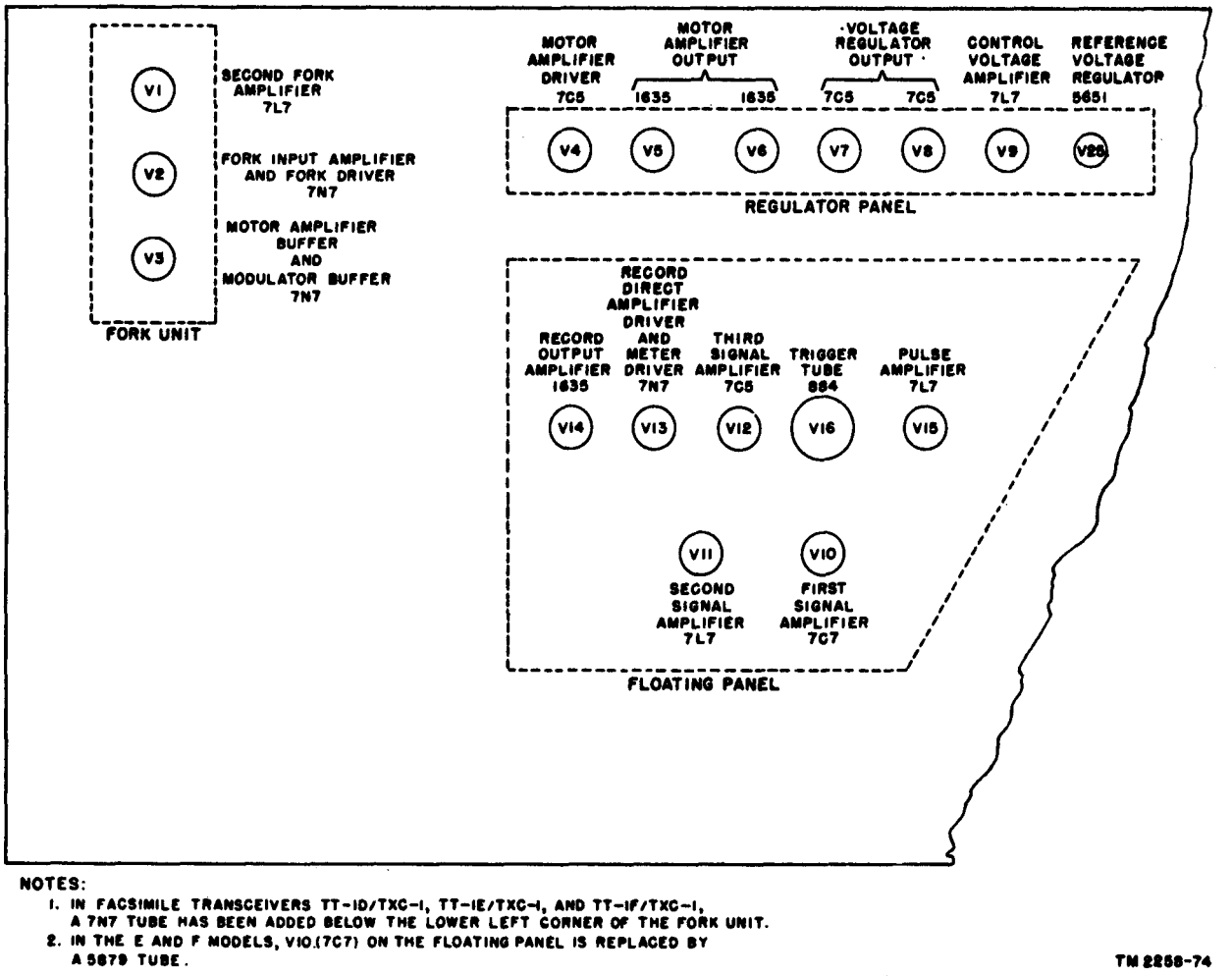


Figure 8. Drum chock in place on facsimile transceiver.



NOTES:
1. IN FACSIMILE TRANSCEIVERS TT-1D/TXC-1, TT-1E/TXC-1, AND TT-1F/TXC-1, A 7N7 TUBE HAS BEEN ADDED BELOW THE LOWER LEFT CORNER OF THE FORK UNIT.
2. IN THE E AND F MODELS, V10 (7C7) ON THE FLOATING PANEL IS REPLACED BY A 5879 TUBE.

TM 2258-74

Figure 9. Location of tubes, facsimile transceiver TT-1(*)/TXC-1.

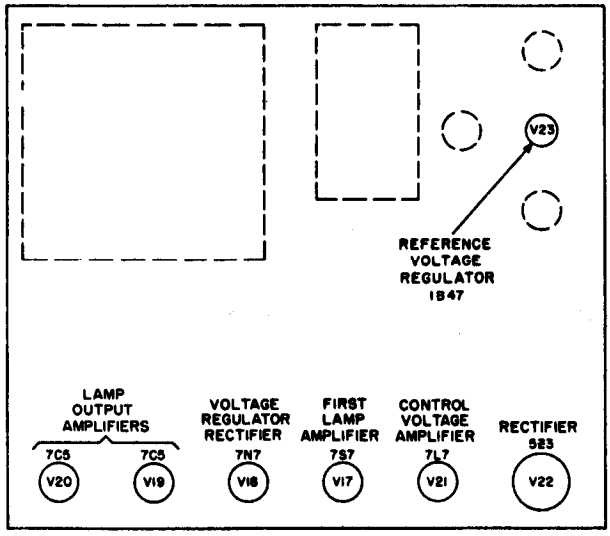


Figure 10. Location of tubes, rectifier power unit PP-86(*)/TXC-1.

(3) Connect the ac plug on the exhaust blower power cord to the 115-volt, 3-ampere outlet on the chassis of the rectifier power unit.

Caution: When replacing fuses, make sure not to use them in a circuit with a current rating above the specified value of the fuse.

c. *Terminal Panel* (fig. 144). The terminal panel located on the right end of the facsimile transceiver is used for connecting the facsimile equipment to the communication circuit.

(1) *PHONES jack (J1)* (figs. 141 and 168). This is a two-circuit jack that receives a type PJ-055B plug. It is connected through a resistor attenuation network to the primary of T7, the audio-frequency (af) input matching transformer (1:1 ratio) used for coupling between the line and the transceiver. It may be used for monitoring the line.

(2) *RADIO RCVR jack (J2).* This is a two-circuit jack wired in parallel with the PHONES jack, and may be used with a type PJ-055B plug as an input connection to the transceiver.

(3) *LINE binding posts.* These posts serve as input and output connections for the transceiver. When the selector switch is in either the RECORD PHOTO or RECORD DIRECT position, the LINE posts are connected to the primary of input transformer T7. The center binding post, marked REC C T (fig. 168), connects directly to the center tap of the primary of T7 at all times. When the selector switch is in TRANSMIT position, and the DB METER indication is +2 decibels (db), the two outside LINE binding posts are connected through 300-ohm resistors from secondary No. 2 of output transformer T2. They will furnish the standard 0 decibel referred to 1 milliwatt in 600 ohms (dbm) signal (.78 volt to a 600-ohm load) for connection to commercial wire lines.

(4) *CARBON MIKE jack (J4).* This is a three-circuit jack. It is an output connection that receives a type PJ-068 plug, commonly furnished with carbon microphones and is connected to one-half of secondary No. 2 of output transformer T2. When the selector switch is on TRANSMIT, secondary No. 2 of transformer T2 is connected to the LINE binding posts.

(5) *RADIO XMTR jack (J3).* This is a jack connected in parallel with the CARBON MIKE jack. It is used as a transceiver output, connection to the radio transmitting circuit. The output level is .4 volt into a 100-ohm load.

(6) *LINE JACK (J5).* This two-circuit polarized jack requires a special plug. It serves as the high-level input and output connector for the transceiver. The polarized plug of the UC coupling coil fits this jack. When the selector switch is set at TRANSMIT, the LINE JACK is connected across secondary No. 1 of output transformer T2, and provides an output of 15.15 volts into a 600-ohm line (+26 dbm). One side of the LINE JACK, labeled GND, is always at ground potential and is connected to the transceiver frame. When the selector switch is set at RECORD PHOTO or RECORD DIRECT, the LINE JACK is connected to the secondary of transceiver input transformer T7.

(7) *MOTOR JACK (J6).* This three-circuit jack receives a type plug that permits breaking into the 1,800-cycle signal circuit, between the motor amplifier buffer stage of the fork oscillator unit and the

motor amplifier driver stage of the transceiver for test purposes or for supplying an external signal to the motor amplifier. The drum of Facsimile Transceivers TT-1D/TXC-1, TT-1E/TXC-1, and TT-1F/TXC-1 can be operated at any speed from 30 revolutions per minute (rpm) to approximately 100 rpm by connecting an external signal of approximately 26 to 35 volts root mean square (rms), with a source impedance of 20,000 ohms or less, to the sleeve and ring of a plug and inserting it into MOTOR JACK J6. It may be necessary to ground the external generator to Facsimile Transceiver TT-1D/TXC-1, TT-1E/TXC-1, or TT-1F/TXC-1 for satisfactory operation of the motor circuit. The motor speed control switch, S4 (30 to 60 rpm), should be in the 60RPM position for external signal frequencies above 1,200 cps, and in the 30RPM position for frequencies below 1,200 cps.

(8) (*ND post.* Directly below the LINE binding posts is a GND post connected to the frame of the transceiver.

d. Mounting Dust Removal Blower Unit. Place the dust removal blower unit on the right-hand end of the shelf of Table MT-252(*)/TXC-1 as shown in figure 2. Be sure that the blower unit is resting firmly on the shelf and against the cross brace before tightening the thumbscrews located on the channels. Remove the canister by loosening. the swivel thumbscrew. Remove the paper bag from the canister and put activated carbon in the space between the inner and outer tubes. Shake the canister well to pack the carbon down and fill to within one-half inch of the top. Replace the paper bag in the canister, making sure that the flange projection lies uniformly along the top surface. Spread the paper bag so that it stays close to the inside of the inner tube. Replace the canister by sliding it into and around the three nuts used as guides. Tighten the swivel thumbscrew until the canister is held firmly in place. Do not overtighten the thumbscrew since it will tend to distort the assembly. Clamp the flexible hose to the exhaust tube with one of the hose clamps provided and secure tightly. Slide the free end of the flexible hose through the slot in the table and clamp it to the blower unit with the other hose clamp.

15. Connections to Wire Lines

Several distances can be obtained over voice wire line circuits for a given line loss. The maximum distance that can be covered for a given line loss generally depends on the type of wire line facility used. The wire circuits used to transmit facsimile signals must be of better quality than those suitable for voice transmission. The method of connection used depends on the. type of circuit, the loss and faults in the circuit, type of terminal equipment used, and the frequency characteristics of the line.

a. The facsimile signal delivered by Facsimile Transceiver TT-1(*)/TXC-1 is an am 1,800-cps carrier, and the circuit used is capable of passing both the upper and lower sideband frequencies, 900 to 2,700 cps, as flat as possible for satisfactory reproduction. The impedances of all the circuits along the line should be matched to avoid reflections. When the circuit distance is long, the received signal is reflected back to the sending station and is reflected again over the line to the receiving station. This causes two images to appear on the received copy. Echo suppressors, which allow transmission in only one direction, may be used in the circuit to overcome these effects. On short high-speed circuits, the echoes produce no undesirable effects.

b. It is important that the signal level at the receiving station be constant, especially when receiving photographic copy, since instantaneous changes as small as ¼ db in signal level will cause a noticeable change in the shading of the recorded picture. However, an increase or decrease of 1 to 2 db is permissible if the change occurs gradually during the transmission of an entire picture.

c. Delay in the line will cause different frequency components of the facsimile signal to be displaced. This results in a distorted picture. Delay correcting networks may be used to equalize frequency transmission rates. A high signal to noise ratio is desirable to eliminate dark streaks (noise) or spots on the recording.

d. Transmitting signal levels are explained in (1) through (4) below.

(1) A +26 dbm output signal (0 dbm=1 milliwatt (mw) in 600-ohms), approximately 15 volts, is available at LINE JACK J5 for transmission of facsimile signals over single field wire circuits made up of Wire W-110-B or WD-1/TT. The line must be long enough to attenuate the signal

down to -10 dbm or lower to prevent overloading the receiving transceiver. If more than one circuit is brought into the same terminal controlling the transmission of facsimile signals, cross talk tests should be made before operation of the facsimile circuit is begun with +26 dbm going into the line.

(2) Transmission over open-wire telegraph lines is sometimes practical, without danger of cross talk into dispatcher circuits, with a +26 dbm signal going into the line. As a further precaution against cross talk in this type circuit, transposition of the wires at ¼-, ½-, or $^{2}/_{3}$-mile intervals would be advantageous.

(3) A line that has low-loss characteristics may furnish a received signal which is higher than the LINE binding post input of the transceiver can accept for satisfactory reproduction. This is indicated by the necessity of setting the GAIN control near zero to obtain the standard +2 db indication required for proper operation of the transceiver. When this condition is encountered, *for receiving only*, connect the line to a plug and insert the plug into the jack on the transceiver marked RADIO RCVR. To reduce hum, connect a wire from the GND terminal to the REC CT terminal. Leave the plug out of the RADIO RCVR jack except when receiving copy. When transmitting, the line must be reconnected to the LINE terminals.

(4) For transmission over a single commercial wire line, the standard 0 dbm (.78 volt) signal is available at the LINE terminals on Facsimile Transceiver TT-1(*)/TXC-1 when the GAIN control (figs. 13 through 16) on the front, panel is adjusted for a reading of +2 db on the DB METER.

Caution: When operating into AT&T (American Telephone and Telegraph Co.) lines (fig. 11), do not apply more than 0 dbm to the line since these circuits are adjusted for proper operation for inputs at this level. To limit the signal applied to their lines, AT&T requires that a 104A or 105A coupling coil be connected between the facsimile equipment and the line. These coils limit the amount of signal voltage that can be applied to the line and, in effect, place a heavy load across the line when the input signal goes above 0 dbm.

(a) If more than one commercial line is being supplied by Facsimile Transceiver TT-1(*)TXC-1, the output level at the LINE terminals will drop down below 0 dbm.

(b) If only two lines are being fed, the output at the LINE terminals can be brought up to 0 dbm by shunting resistors R84 and R85 (fig. 169) (in series with the LINE terminals) with 300-ohm resistors.

(c) If more than two lines are being fed, the output at the LINE terminals may be brought up to 0 dbm by shunting R84 and R85 with resistors that have a *lower* value than 300 ohms. In either case, the final adjustment should be reached with a DB METER reading of +2 db.

Note. If a DB METER is not available for measuring the input at the coupling coils, temporary connections can be made to the DB METER in Facsimile Transceiver TT-1(*)/TXC-1. The regular connections to the meter must be removed after setting the GAIN control for a normal output reading of +2 db on the DB METER. Eight db must he added to the meter reading when measuring the signal voltage present across the coupling coil because the DB METER in Facsimile Transceivcr TT-1(*)/TXC-1 is calibrated at the old reference level of 6 mw into a 600-ohm line. For 0 dbm at the coupling coil, the meter therefore will read -8 db. If measuring with a vacuum-tube voltmeter, the correct reading is .78 volt.

e. Use of UC *Coupling Coil* (fig. 6). When inductive coupling to a telephone line is required, use the UC coupling coil furnished with Facsimile Set AN/TXC-1(*) except with Facsimile Set AN/TXC-1D. This coupling (feed) coil is designed to fit over the receiver of the handset used on Telephone EE-8 and other telephone handsets (fig. 12). The coil is fitted into place and the plug at the end of the cord from the UC coupling coil is connected to the polarized LINE JACK (J5) on the transceiver terminal strip. Approximately 30 db is lost when using this method of connection. When using a line of Wire W-110-B or WD-1/TT between transceivers, if there signal voltage is required than that obtained by using

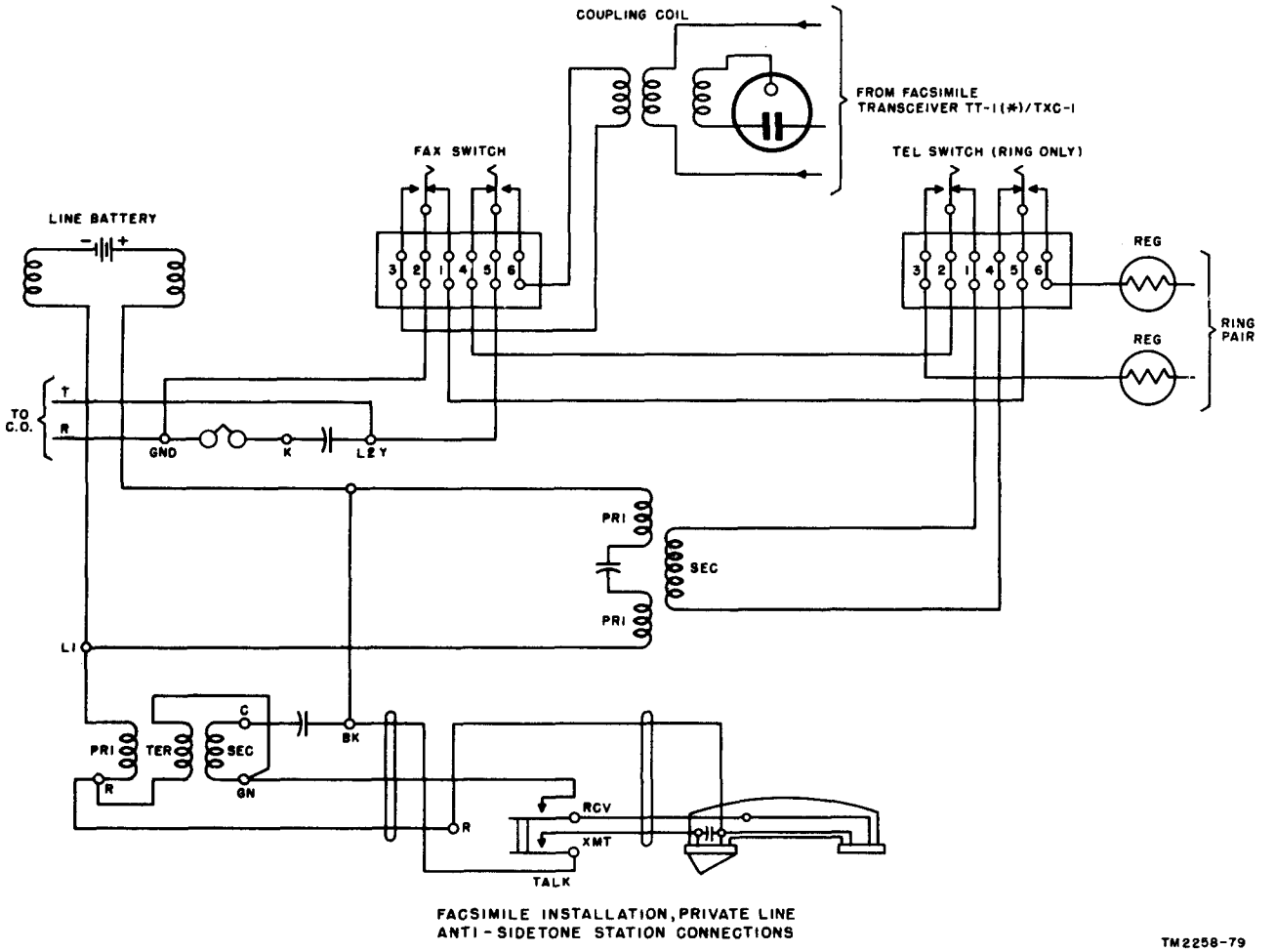


Figure 11. Facsimile installation, private line antisidetone station connectors.

the *magnetic* coupling connector on the UC coupling coil, connect the telephone line directly to the 1V connector on the coupling coil. If the circuit loss is exceptionally high, the connector marked 6V on the coupling coil may be used, provided, the line loss is at least 18 dbm before reaching the first telephone exchange or repeater.

Warning: Do not use the coupling coil outputs marked 1V or 6V with any commercial or common battery circuits, or any circuit that uses signaling or ringing.

16. Talking Circuits

Facsimile Transceivers TT-1A/TXC-1 through TT-1F/TXC-1 have built-in talk-back circuit facilities and permit communication between transmitting and receiving operators over the same circuit used for facsimile signals. This facility is controlled by the STANDBY-MON-TALK switch (S5) on the front panel. However, when using Facsimile Transceiver TT-1/TXC-1, external telephones must be used at each end of the circuit. Facsimile operation is also possible over blind circuits, on prearranged schedules, without voice communication.

17. Radio Circuit Considerations

a. Subcarrier Amplitude Modulation (SCAM). The average amplitude variations of the facsimile signal change in proportion to the average densities of the picture being scanned. Slight amplitude variations in the received signal, other than those caused by the components of the facsimile signal, also will cause objectionable distortion in the received copy. This is especially noticeable when receiving photographic material. When transmitting black and white copy only, considerable changes in amplitude can be tolerated, although distortion, caused by amplitude variations in the received signal, will appear in the

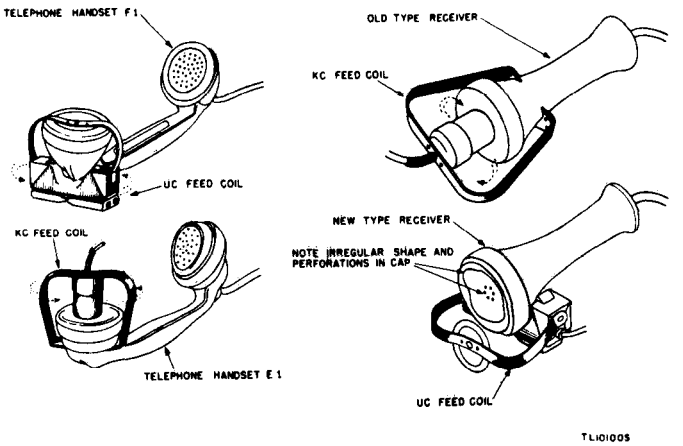


Figure 12. UC *coupling coil attached to telephone headsets.*

form of inconsistent lineweights throughout the Copy.

(1) For hf transmission (below 40 mc), the effects of fading must be taken into consideration. If transmission is by ground wave only, over short distances, circuits can be established for satisfactory reproduction of both photographic and black and white copy by utilization of suitable transmitting power levels. The channel bandwidth must be sufficient to pass the full frequency range (both upper and lower sidebands, 900 to 2,700 cps) produced by the facsimile transceiver.

(2) When transmission is by both ground and sky wave, the effects of fading must again be taken into consideration. Transmitted picture elements arriving at the receiving station, via the ground wave, may be out of phase with the same picture element arriving via the sky wave. This causes a change in the instantaneous signal level and consequent deterioration of the received copy.

(3) Compensation may be made to reduce the effects of fading by reducing the speed of transmission. Facilities for half-speed operation are provided on Facsimile Transceivers TT-1D/TXC-1, TT-1E/TXC-1, and TT-1F/TXC-1 by reducing the speed of rotation of the scanning drum from 60 rpm to 30 rpm.

b. Subcarrier Frequency Modulation (SCFM). Both photographic and black and white copy can be transmitted over regular very-high-frequency (vhf) or ultra-high-frequency (uhf) fm radio circuits by merely connecting Facsimile Transceiver TT-1(*)/TXC-1 to the input and output terminals of the radio equipment. The received signals must be of sufficient strength to keep the limiter circuits of the fm receiver saturated at all times. Details for this type connection using Converter CV-2C/TX are given in paragraph 60.

c. Frequency-Shift Transmission. To eliminate the effects of signal fading and to reduce the effects of interference and noise, a frequency-shift circuit using a regular cw transmitter is used. In this system, the amplitude variations of the facsimile signals are converted into frequency variations, and the facsimile signal components are transmitted over a regular cw radio channel as proportional shifts in frequency rather than changes in amplitude. At the receiver, a crystal-controlled oscillator is heterodyned with the incoming frequency-shift signals to produce corresponding af variations, and an af discriminator is used to convert the signal into the amplitude variations required for operation of Facsimile Transceiver TT-1(*)/TXC-1. Details for this type connection using Converter CV-2C/TX and Exciter Unit O-5B/FR are given in paragraph 61.

18. Connections to Radio Circuits

When Facsimile Transceiver TT-1(*)/TXC-1 is to operate in a conventional am radio transmitting and receiving circuit (SCAM), make connections as follows:

a. Plug one end of Cord CD-1018 into the transceiver RADIO RCVR jack (J2). Plug the

other end into the phones output jack of the radio receiver. This is the receiving connection.

b. Plug one end of Cord CD-1019 into the RADIO XMTR jack (J3) on the transceiver. Plug the other end into the microphone jack of the radio transmitter. This is the transmitting connection.

c. Plug the radio carbon microphone into the CARBON MIKE jack (J4) of the transceiver.

d. Plug the radio headset into the PHONES jack (J1) on the transceiver. The radio transmitter and receiver may be operated normally for radio voice communication while the transceiver selector switch is set at either the SET RANGE or STANDBY position.

e. If the radio receiver output is too low for the transceiver, check the label on the small circular tag screwed to the terminal board between the RADIO RCVR and PHONES jack. Ordinarily, the tag will read 2,500 ohms (this indicates the impedance at which the transceiver input circuit is set to match the phones circuit output of the conventional radio receiver). Some radio receiver circuits have a 250-ohm output. Connection of a 250-ohm receiver output to the 2,500-ohm transceiver input will be indicated by a failure to get a sufficiently high reading on the transceiver DB METER, even though the transceiver GAIN control (R59, R60) may be set at maximum and the monitored signal may sound loud in the headset plugged into the PHONES jack. To change the transceiver input to match a 250-ohm receiver output circuit, proceed as follows:

(1) Remove the back cover of the transceiver to gain access to the terminal board mounted inside the transceiver on the metal brace near the DB METER. Connect a wire between terminals 1 and 2 of the terminal board to short-circuit resistor R79 (fig. 168).

(2) Remove the wire which is soldered to terminal 3, and solder it to terminal 4. This places resistor R82 in the circuit.

(3) Replace the transceiver rear cover.

(4) Remove the two screws that hold the round tag in place on the outside terminal board. Turn the tag over so that the exposed side reads 250 ohms. Replace the screws.

Note. To avoid pick-up while receiving, it may be necessary to connect the GNI) binding post to one of the LINE binding posts or to the REC C T binding post. Remove this connection when transmitting.

f. If the facsimile transceiver output is too high for the radio transmitter input circuit, reduce the gain of the radio transmitter preamplifier. A temporary alternative, for example, is to set up the facsimile transceiver in the normal manner, then reduce its maximum output by turning the GAIN control until the maximum meter reading is -4 db.

19. Darkroom Installation

When Facsimile Set AN/TXC-1(*) is used for photographic reception of copy, install the equipment in a large, well-ventilated darkroom from which all light is excluded. A large sink and running water are necessary.

a. Safelight. Install a safelight equipped with a Wratten series OA filter, or its equivalent. This gives a yellowish green light. Locate the light approximately 5 feet from both the transceiver and the sink.

b. Additional Equipment. In addition to Photographic Equipment PH-549/TXC-1 which is supplied with Facsimile Set AN/TXC-1(*), the following equipment is desirable:

1 electric print dryer.
1 gross each of contact printing paper, single weight, 12 inches by 18¾ inches, contrast F1, F2, F3, and F4, Eastman Kodak or equal.
2 dozen each, contact printing paper, contrast F0 and F5.
1 contact printer, 18 inches by 22 inches.
1 darkroom clock with sweep second hand.
1 squeegee, 10 inches long.
2 or more ferrotype plates, chrome, to fit electric dryer.
2 print tongs.

20. Service upon Receipt of Used or Reconditioned Equipment

a. Follow the instructions in paragraph 13 for uncrating, unpacking, and checking the equipment.

b. Check equipment for tags or other indications pertaining to modifications (par. 11) or other changes. If any changes in the wiring (other than the modifications listed in paragraph 11) have been made, note the change on the schematic diagram in this manual.

c. Check and lubricate the equipment as instructed in paragraphs 44 through 47.

d. Perform the installation and connection procedures outlined in this section.

Section II. CONTROLS AND INSTRUMENTS

21. General

All electrical operating controls of Facsimile Set AN/TXC-1(*) are located on the sloping front panel of Facsimile Transceiver TT-1(*)/TXC-1 (figs, 13, 14 and 16). Two mechanical controls, the drum-engaging lever, and the clamp-bar control knob are located on the drum and its control mechanism. Controls are the same for all facsimile transceivers, except for minor differences required by changes in the talk-back circuit, the drum speed circuit, and the starting and phasing circuits on certain models. Input and output connections are located on the right-hand end of the transceiver.

22. Controls and Their Uses

The following chart lists the controls of Facsimile Transceiver AN/TXC-1(*) and indicates their functions.

a. Panel Controls.

Control	Function
Power ON-OFF switch (S2) ----------	Makes and breaks one side of the 110-volt, 60-cycle ac line circuit which feeds the primary of transformer T11, located in Rectifier Power Unit PP-86(*)/TXC-1. In the ON position, plate, filament, and screen voltages are applied to all tubes in the facsimile set. Power is made available for starting and operating the synchronous motor, subject to changes made by the selector switch (S1) and STANDBY-MON-TALK switch (S5).
STANDBY-MON-TALK switch (S5) (Not included in Facsimile Transceiver TT-1/TXC-1).	In the STANDBY (upper) position, it connects the loudspeaker in the circuit and permits the operator to monitor the communication channel. If both the STANDBY-MON-TALK switch (S5) and the selector switch (S1) are in the STANDBY positions, the synchronous motor will not operate. This position is used to receive voice communications when it is not necessary to have the motor running. ***Warning:*** When using Facsimile Transceivers TT-1B/TXC-1 through TT-1F/TXC-1, the motor may run at a nonsynchronous speed in any switch position. When the motor is running at synchronous speed, the drum will revolve ½ or 1 revolution each second, and the respective 900- or 1,800-cycle audible tones will be heard coming from the motor laminations. In the MON (middle) position, it connects the loudspeaker and permits the operator to monitor the communication channel. The motor is supplied power and may be started and run at synchronous speed. This is the normal position for receiving voice communications when phasing the transmitting and receiving equipments preparatory to sending and receiving facsimile copy. In the TALK (lower) position, the loudspeaker becomes the microphone of a voice intercommunication system. The switch must be held in the TALK position; if pressure is released, it will snap back to the MON position. The TALK position is used when talking to the facsimile operator on the other end of the circuit. *Note.* The talk-back circuit operates only when the selector switch (S1) is at STANDBY. ***Caution:*** The talk-back circuit will not function over a radio circuit that uses Converter CV-2C/TX, TM 11-2252A, unless the converter is bypassed for voice communication.
Selector switch (S1)----------	This control determines the function of the transceiver. Positions and functions are as follows: *Position* — *Function* T R A N S M I T - - - - - The facsimile transmitting circuit is established. Impulses representing elements of the facsimile copy are sent out over the facsimile circuit to the receiver. This is the normal operating position when the transceiver is actually transmitting copy. In this position, the switch also closes the radio transmitter relay circuit associated with CARBON MIKE jack J4.

Control	Function
Selector switch (S1)-Continued	SET RANGE. . . . . The transmitting circuit is established but impulses are not sent over the line. This position is used when the operator is engaged in setting the contrast range (wedge) for transmitting a specific piece of copy. *Note.* Since the transceiver is disconnected from the line when the selector switch is at SET RANGE, some method must be used to avoids disconnect when operating with a commercial line. A telephone set across the line or a special telephone key will hold the line (fig. 11). A dry line, one not normally used with signaling, will not be rung off. STANDAY. . . . . The tubes are kept ready for operation of the transceiver. This is the normal setting during the periods when copy is not actually being transmitted or received. RECORD PHOTO... .. The receiving circuit is established to use the recorder lamp, which causes recording of received copy on photographic paper. This switch position is, used to set the gain and phase the receiving transceiver. A raised portion of the selector switch name plate enables the operator to set the switch at RECORD PHOTO in the darkroom. RECORD DIRECT. . The receiving circuit is established to use the stylus instead of the recording lamp. The stylus causes recording of received copy on direct recording paper or other electro-sensitive paper. Moving the selector switch to RECORD DIRECT position mechanitally moves the stylus into contact with the paper on the drum. *Note.* In the TRANSMIT, RECORD PHOTO, and RECORD DIRECT positions, automatic end-of-copy stop relay K1 remains energized if limit switch S8 has been thrown. It is necessary to switch to STANDBY or SET RANGE to reenergize relay K1 in Facsimile Transceiver TT-1F/TXC-1.
START button (S4) (Facsimile Transceivers TT-1/TXC-1, TT-1A/TXC-1, TT-1B/TXC-1, TT-1C/TXC-1 and TT-1D/TXC-1 only).	This is a nonlocking, multipole, push-button switch. When pressed, this button momentarily applies power to the start winding of the motor and the motor is operated above its normal operating speed. When the START button is released, the motor slows down to its normal operating speed and continues to operate at that speed. ***Caution:*** The motor of Facsimile Transceiver TT-1B/TXC-1 or TT-1C/TCX-1 is at synchronous speed only when the 1,800-cycle tone can be heard from the motor laminations.
PHASE button (S3) (Facsimile Transceivers TT-1/TXC-1, TT-1A/TXC-1, TT-1B/TXC-1, TT-1C/TXC-1 and TT-1D/TXC-1 only).	This is a nonlocking, multipole, push-button switch. The receiving operator presses this button to energize the phasing circuit of the receiving transceiver, while the transmitting operator is sending phasing pulses. The operation assures that both transmitting and receiving drums are in the same position at the same instant. Once the relatively short phasing operation is completed, the machines will remain synchronized because both drums are driven by motors running at the same speed.
START-PHASE switch (S3) (Facsimile Transceivers TT-1D/TXC-1, TT-1E/TXC-1, and TT-1F/TXC-1 only).	In Facsimile Transceivers TT-1D/TXC-1, TT-1E/TXC-1, and TT-1F/TXC-1, the functions of the START switch (S4 in previous models) and the PHASE switch (S3 in previous models) have beeh combined into one, which is START-PHASE switch S3 (fig. 15). It is a three-position, nonlocking, lever-type switch which is spring-loaded to return to neutral when released from the START or PHASE position. The operator throws the START-PHASE switch to the START position momentarily to apply power to the start winding to bring the motor above the normal operating speed. When switch S3 is released, the 1,800 cps is

Control	Function
START-PHASE, switch (S3) (Facsimile Transceivers TT-1D/TXC-1, TT-1E/TXC-1, and TT-1F.TXC-1 Only)-Continued	applied to the synchronous winding of the motor causing the motor to lock in at its normal operating speed. The receiving operator throws the START-PHASE switch to the PHASE position to energize the phasing circuit of the receiving transceiver while the transmitting operator is sending phase pulses. When the relatively short phasing operation is completed, the machines remain Synchronized because both drums are driven by motors running at the same speed. ***Caution:*** The motor of Facsimile Transceiver TT-1D/TXC-1, TT-1E/TXC-1, or TT-1F/TXC-1 is at synchronous speed only when the 1,800-cycle tone can be heard from the motor laminations.
30RPM-60RPM (motor speed control) switch (S4) (fig. 138) (Facsimile Transceivers TT-1D/TXC-1, TT-1E/TXC-1, and TT-1F/TXC-1 only).	Used in the 30RPM position to provide half-speed operation of the recording drum when transmitting over long radio circuits under adverse receiving conditions, and in the 60RPM position for normal operation.
CONTRAST control (R45) - - - - - - - - - - - -	A calibrated potentiometer which adjusts the contrast range (difference between minimum and maximum signal level of the transmitted signal) by adjusting the magnitude of currents in the photocell bridge circuit. This control is operated only by the transmitting operator, although the setting he makes is determined partially by the request of the receiving operator. The dial on this control is numbered from 1 to 100, and the ranges for transmitting positive and negative are indicated.
GAIN control (R59 and R60).. .	A dual potentiometer which serves to control the level of the signal handled by the transceiver. It does not change the contrast range.
DB METER (M1)	The front panel DB METER serves as a guide in setting GAIN and CONTRAST controls. It is calibrated in db with reference to 0 power level of 6 mw in 600 ohms. Line power levels are commonly expressed in terms of dbm, decibels with reference to 0 power level of 1 mw in 600 ohms. The DB METER on this equipment does not register the true line signal level in either db or dbm. When the facsimile transceiver selector switch is at TRANSMIT and the DB METER indicates plus 2 db, the resultant power dissipated in a 600-ohm resistive load connected across the LINE binding posts is 1 mw (.78 volt), representing the standard 0 dbm reference. When the facsimile transceiver is receiving, there is no fixed relationship between line power and db power and DB METER reading, because meter readings depend on the setting of the GAIN control. In paragraph 5, input and output signal levels for the transceiver are expressed in true line dbm. Elsewhere in this manual, however, the term db is used merely to express the relative level readings of the DB METER, not to indicate line levels in dbm. Used for setting the transmitting contrast (wedge) range. This meter may be temporarily disconnected from the circuit, and may be used to measure dbm (at 0 dbm =1 mw into 600 ohms) directly, providing 8 db is added to the meter reading when so used.
MOTOR ON-MOTOR OFF switch. (Added on Facsimile Transceiver TT-1/TXC-1 only by MWO SIG 11-2258-1).	Provides a means for turning off the motor when the selector switch is in the STANDBY position.
SPEAKER jack. (Added on Facsimile Transceiver TT-1/TXC-1 by MWO SIG 11–2258–1).	Permits connecting an xternal loudspeak to the transceiver so that the maximum and minimum signals for setting contrast will be audible to the receiving operator.
RB + meter (M3) (fig. 138).	Provides continuous check on regulated + 250-volt supply.
MOTOR CURRENT meter (M2) -- ----	Connected in series with motor voltage supply for setting proper motor current. *Note.* Meters M2 and M3 were added to Facsimile Transceivers TT-1/TXC-1 and TT-1A/TXC-1 by MWO SIG 11-2258-2.

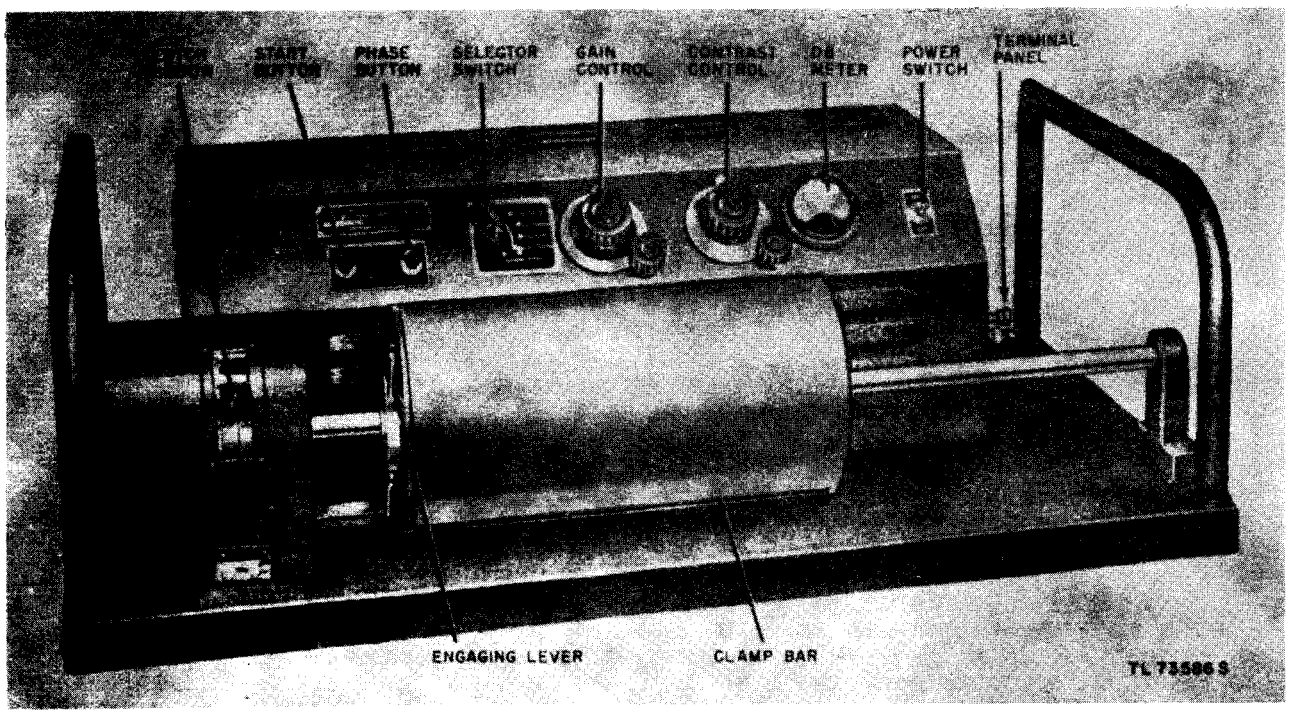


Figure 13. Controls, facsimile transceiver TT-1/TXC-1.

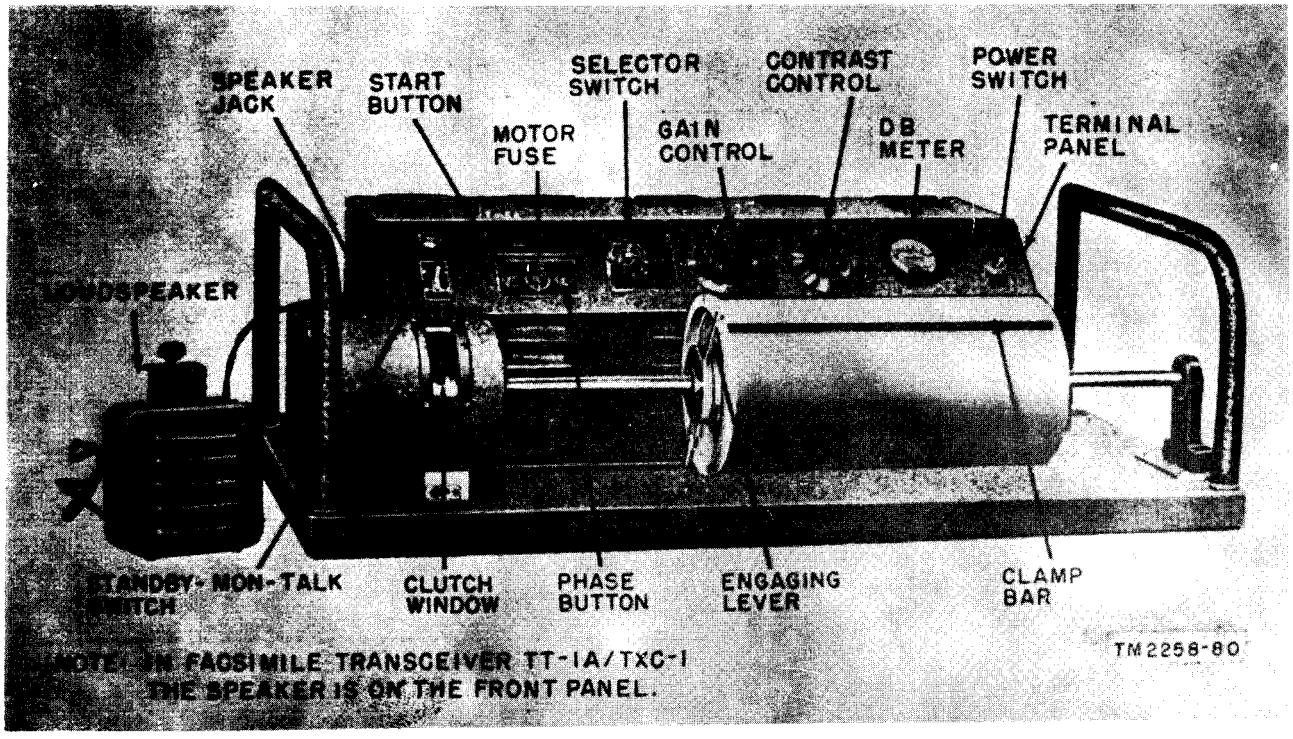


Figure 14. Controls, facsimile transceiver TT-1A/TXC-1 through TT-1C/TXC-1.

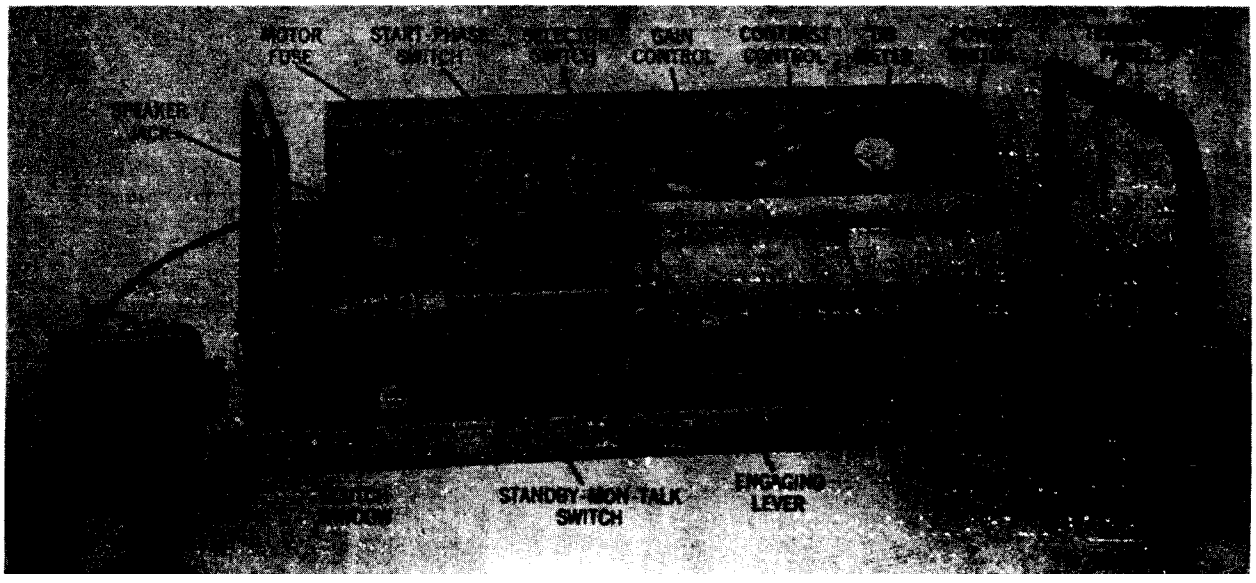


Figure 15. Controls, facsimile transceiver *TT-1D/TXC-1 and TT-1E/TXC-1.*

b. Drum Controls. Two mechanical controls are located on the drum mechanism.

(1) The clamp bar control knob (fig. 17) is located on the right side of the rotating drum. It is used to open and shut the clamps that hold copy to the drum and can be operated only when the motor is not running and the drum is not rotating. This knob has three positions:

(a) Center position (both sides of the clamps are fastened). This is the normal operating position when copy or recording paper is securely fastened to the drum during either transmitting or receiving.

(b) Counterclockwise position (clamp is open on the side toward the operator). The clamping bar is at the top of the drum. This position is used only momentarily, while inserting copy and preparing to fasten it to the drum.

(c) Clockwise position (clamp is open on the side away from the operator). The clamping bar is at the top of the drum. This position also is used only momentarily, while fastening copy to the drum.

(2) The drum engaging lever (fig. 16) is located on the left side of the drum. It is used to engage the half nuts on the rotating drum with the lead screw, causing the drum to travel from right to left during the scanning process. This position is used during the actual transmitting or receiving of copy. When the lever is pushed away from the operator, it disengages the drum from the lead screw so that the drum rotates but does not travel from right to left. The disengaged position is used at all times when copy is not actually being transmitted or received.

Warning: On Facsimile Transceivers TT-1/TXC-1 and TT-1A/TXC-1, the guide arm of the engaging mechanism may leave its track on the chassis of the transceiver if the drum is pushed to the far left with the protective housing removed from the motor and clutch. If this occurs, the drum will not feed properly on the lead screw. In Facsimile Transceivers TT-1B/TXC-1 and TT-1C/TXC-1, a machine screw provides a stop to prevent the guide arm from leaving the track.

c. End-of-copy Limit Switch (S8). A pressure-sensitive switch is mounted on the left-hand bearing block of Facsimile Transceiver TT-1F/TXC-1 (fig. 16). The drum, in its extreme left-hand excursion, will actuate this switch. This causes power to be removed from the synchronous drive motor and the amplified facsimile signal will

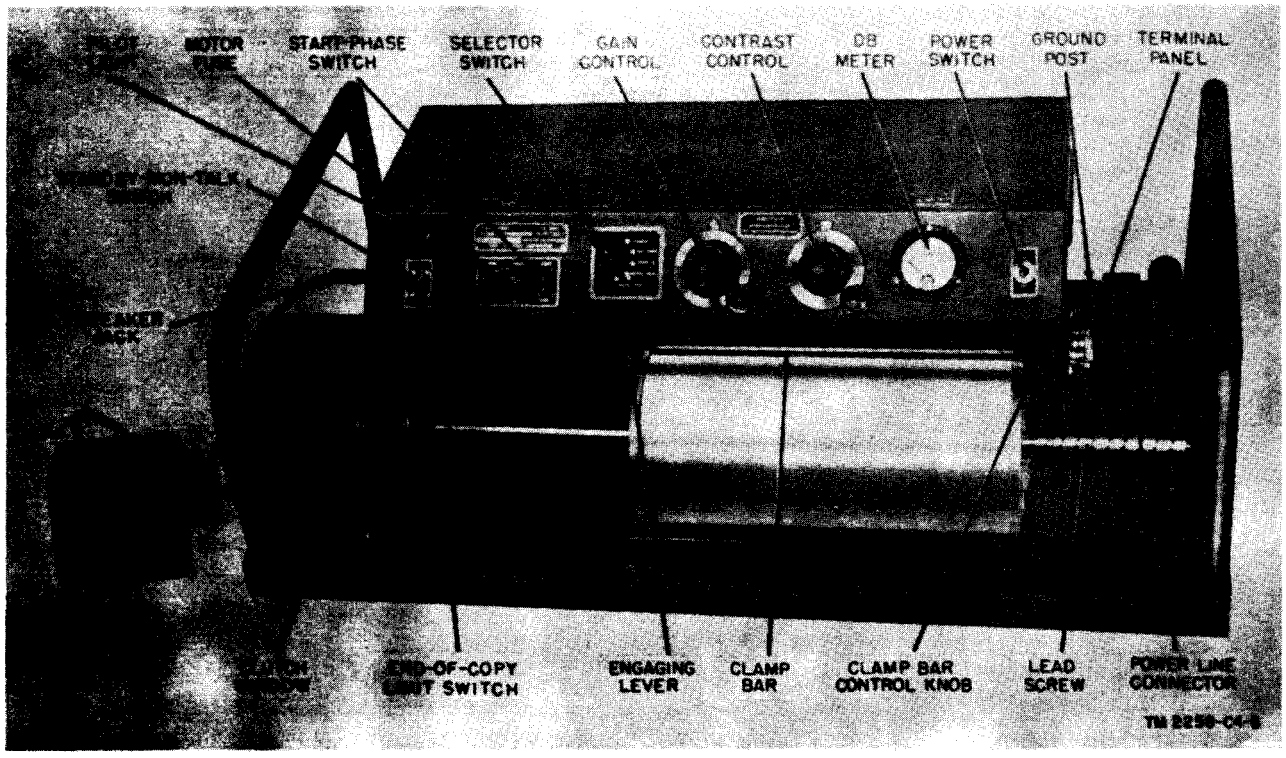


Figure 16. Controls, facsimile transceiver TT-1F/TXC-1.

be diverted to ground. It is therefore not necessary for the operator to be with the equipment at the end of a transmission.

d. Blower Switch (S9). A toggle ON-OFF switch is provided for the dust removal blower supplied with Facsimile Set AN/TXC-1D. This switch is located on the blower and canister supporting bracket (fig. 2) and should be thrown to the ON position only when the equipment is used for direct recording.

Section III. OPERATION UNDER USUAL CONDITIONS

Note. The operating instructions in this section are based on the use of a voice communication circuit between transmitting and receiving operators. Blind circuits, however, in which transmission and reception of facsimile copy are completed on prearranged schedules, are feasible without voice communication. Experienced operators will find numerous satisfactory ways of saving time by varying the operating procedures described in this section.

23. Preparations

Before operating Facsimile Set AN/TXC-1(*), determine the type of circuit being used, wire or radio, and all types of transmission and reception desired; this will affect the operating procedure.

a. Index of Cooperation. Transmitting and receiving equipments at each end of the circuit should have the same index of cooperation, the same speed, and a recording system responsive to the modulated signal of the transmitter. The index of cooperation is equal to the scanning drum diameter times the pitch (lines per inch scanned); thus, the index of cooperation of Facsimile Transceiver TT-1(*)/TXC-1 is equal to 6 (drum diameter in inches) $\times$96 (lines per inch) = 576. Satisfactory operation may be obtained even though the indexes of cooperation are not exactly the same. Differences of as much as 5 or 10 percent are generally not noticeable in photographic or message copy. The indexes of cooperation may differ by as much as 50 percent for weather map work or other line illustrations without affecting the usability of the received copy. The maximum speed tolerance between the transmitting and receiving scanning drums of Facsimile Transceivers TT-1(*)/TXC-1 is .00033 percent. The table below lists the standards applicable in present day military and commercial wire and radiophoto facsimile circuits.

Standard	Index	Speed (rpm)
Facsimile Transceiver TT-1(*)/TXC-1 . ..	576	60
Facsimile Transceiver FX-1-( )	264	90
Acme	290	100
Associated Press	380	100
CCIT and CCIR (Consultive Committee on International Telegraph and Consultive Committee on International Radio).	264	90
CCIT and CCIR	352	60
International News Service	264	90
Western Union	254	180

b. Circuits.

(1) If a wire circuit is used between a transmitting transceiver and a receiving transceiver, be certain that connections are correct for the quality of line (par. 15).

(2) If a radio circuit is used, and Converter CV-2C/TX is in the circuit between facsimile transceiver and radio transmitter, the transceiver talk-back circuit will not function.

c. Type of Transmission. Adjustment of the transmitting transceiver will depend on the type of transmission being made and the type of receiving process in use. Coordination is necessary between transmitting and receiving operators. Transmission can be either positive or negative. In positive transmission, black portions of the copy are transmitted as high-level signals which print at the receiving end as black (fig. 21). In negative transmissions, white portions of the copy are transmitted as high-level signals which print on the negative (fig. 21). The relative signal levels are indicated by the DB METER on the transceiver. The kind of copy being sent and the use to be made of the copy at the receiving end determine whether transmissions should be negative or positive.

d. Type of Reception.

(1) *Direct recording.* When the time element is important, use the direct recording method. Slight loss of detail and fidelity of half tones (shades of gray between white and black) must be tolerated. Copy received on Teledeltos or Timefax NDA paper is ready for immediate use; copy received on Time fax A paper permits making duplicates by the gelatin pad method (par. 29) in a very short time.

(2) *Positive photographic recording.* When only one copy is needed and when finer detail and better half-tone reproduction than that obtained by direct recording are necessary, use the positive photographic recording method. Copy received by this method requires photographic processing before it can be used.

(3) *Negative photographic recording.* When maximum quality of a photograph is required, use the negative photographic recording method. Copy received by this method requires photographic processing and positive prints can be made from the negative.

24. Preliminary Transmitting Operations

a. Initial Operation.

(1) Cut the copy to be transmitted to a size no larger than 12 by 18 5/8 inches. Keep the actual message for transmission to 12 x 17½ inches for both photographic and direct recording.

(2) Fasten captions on the copy to be transmitted with scotch tape or write them on the copy with either ink or pencil.

(3) Throw the power ON-OFF switch of the transceiver to the ON position. Turn the selector switch to the SET RANGE position. Wait for the high-pitched 1,800-cycle tone. (There is no audible tone when the selector switch is in STANDBY position and the STAND-BY-MON-TALK switch is in the STANDBY position.) Normally, a 10-minute warm-up period should be allowed before transmitting. The dust removal blower ON-OFF switch should be in OFF position when the equipment is in use as a transmitter.

(4) Press backward on the engaging lever, on the left end of the drum mechanism, to disengage the drum from the lead screw. Push the drum to the right-hand end of the lead screw. Turn the drum so the clamping bar is on top.

b. Placing Copy on Drum (fig. 17).

(1) Raise one edge of the clamp bar by turning the knob on the right end of the drum to its clockwise position. Place the lower edge of the copy, face up, under the rear edge of the clamp bar. Turn the knob to its counterclockwise position to set the clamp and open its other edge. Revolve the drum, wrapping the copy

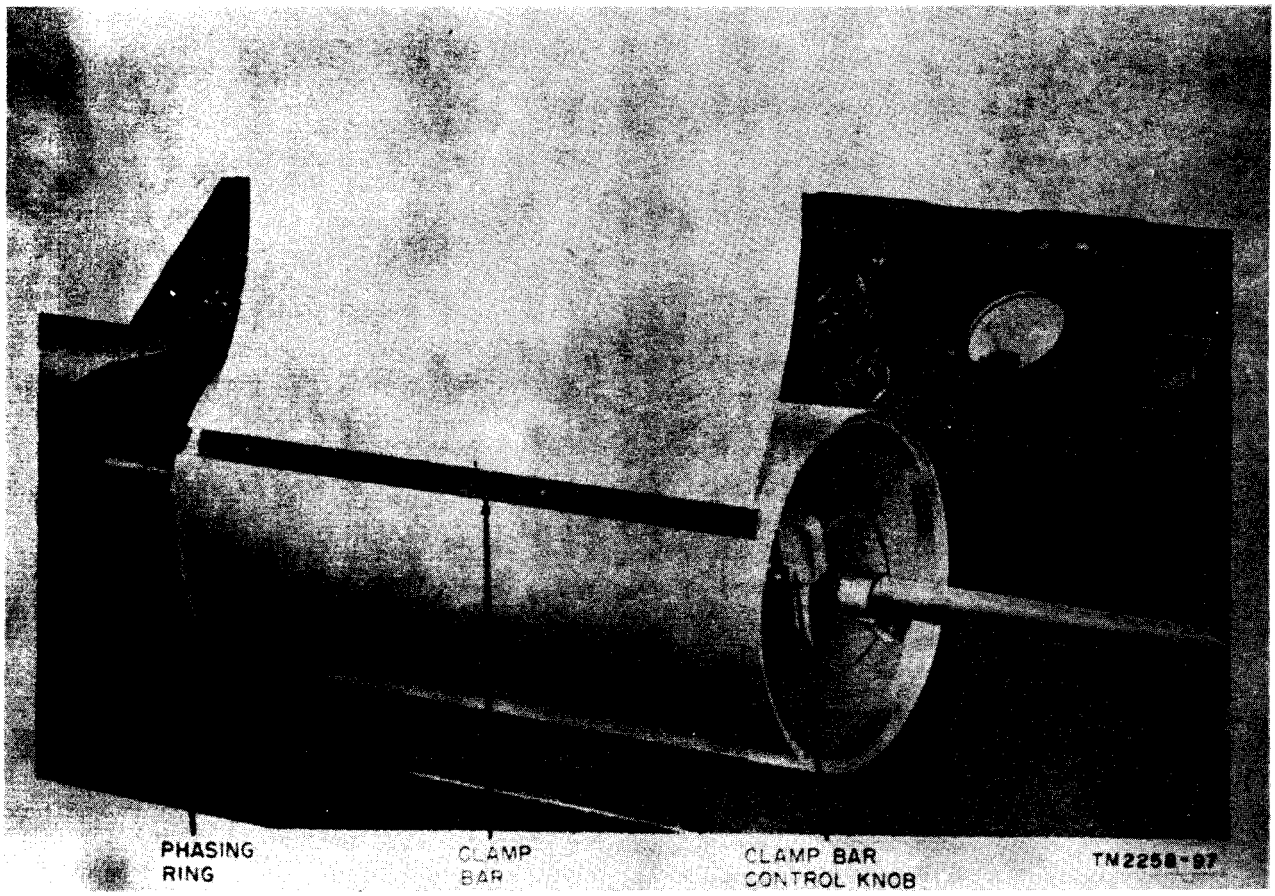


Figure 17. Loading drum *with direct recording* paper.

around it. Insert the loose edge of the copy under the clamp. Pull the copy tightly around the drum with a wiping motion of the hand. Set the clamp by turning the clamping bar knob back to its center position.

(2) Make certain that there are no bulges in the copy. If the copy is too small to fit around the drum and into the clamping bar, fasten it to the drum with scotch tape.

25. Transmitting Positive for Direct Recording

In transmitting positive for reception on Teledeltos, Timefax NDA, or Timefax A paper, proceed as follows:

a. Preparations.

(1) Allow the transceiver to warm up. Load the drum as outlined in paragraph 24.

(2) Be sure the selector switch is on the SET RANGE position. Place the dust removal blower switch in the OFF position on equipment modified by MWO 11-2258-6 and on Facsimile Transceiver TT-1F/TXC-1.

b. Setting GAIN and CONTRAST controls.

(1) Place the whitest portion of the copy in line with the scanning beam. Set the GAIN control at 65. Adjust the CONTRAST control until the meter indicates a minimum. Check the meter reading and move the drum slightly backward and forward while examining a different white portion of the copy to be sure the whitest spot is used.

(2) Move the drum so that the blackest portion of the copy is illuminated by the spot of light. Be sure the blackest portion actually is used by again rotating the drum slightly backward and forward while checking the meter.

(3) Adjust the GAIN control so that the meter indicates +2 db.

(4) Return to the whitest portion of the copy and readjust the CONTRAST control for a minimum reading on the meter.

(5) Repeat the procedures in (2), (3), and (4) above until the final adjustments of GAIN and CONTRAST controls give meter readings differing by at least 15 db between the blackest and whitest portions of the copy. The maximum reading (on black copy) should not exceed +2 db.

(6) If the UC coupling coil is used to couple the transceiver output to a telephone circuit, an additional adjustment must be made at this point. With a +2 db meter reading, indicating maximum transmitted signal, turn the selector switch to the TRANSMIT position. Listen closely in the telephone earpiece, and slowly rotate the coupling coil on the telephone headset until the loudest tone is heard. Be sure that the coupling coil is at least 2 feet from the transceiver, power supply, and other electrical equipment to prevent magnetic pick-up of interference.

(7) When using any model of the transceiver except TT-1/TXC-1, set the selector switch at STANDBY. Operate the STANDBY-MON-TALK switch momentarily to TALK and inform the receiving operator that maximum and minimum signals will be sent. This will permit the receiving operator to make proper adjustments on the transceiver being used for reception. Release the STANDBY-MON-TALK switch and it will snap back to MON position. This enables the transmitting operator to hear the re-receiving operator's acknowledgment. When using Facsimile Transceiver TT-1/TXC-1, external telephones must be used for voice communications between operators. However, if no external voice communication circuit is available, with Facsimile Transceiver TT-1/TXC-1 modified by MWO SIG 11-2258-1 being used at the receiving end, the maximum and minimum signals can be heard by the receiving operator when the selector. switch on the receiving transceiver is set to STANDBY. When operating blind, this would be a signal for the receiving operator to turn the selector switch to one of the record positions for setting the contrast of his machine.

(8) Turn the selector switch to the TRANSMIT position and, with the spot of light on the blackest portion of the copy, transmit a maximum signal for approximately 15 seconds. This should be enough time for the receiving operator to adjust the controls on his set; then alternately send maximum and minimum signals (with the spot of light alternately on the blackest and whitest portions of the copy) for about 5 seconds each, so that the receiving operator can check the contrast set up by the transmitting operator. After some experience, this procedure can be shortened on subsequent transmissions over the same circuit by sending only minimum signals for receiver adjustment.

c. Transmitting Phasing Pulses.

(1) Move the drum so that the spot of light shines directly on the raised phasing ring at the left end of the drum (fig. 17). The STANDBY-MON-TALK switch may be in the MON or STANDBY position, and the selector switch is at SET RANGE. Operate the START switch and hold it engaged until the motor starts and the drum picks up speed to slightly more than 60 rpm, which is the normal operating speed. (Do not race the motor; 2 to 4 revolutions of the drum should be sufficient.) Release the START switch. The drum will slow down to a synchronous speed of 60 rpm as indicated by the 1,800-cycle audible tone from the motor laminations.

Warning: The motors of Facsimile Transceivers TT-1B/TXC-1 through TT-1F/TXC-1 may run at nonsynchronous speed. It is at synchronous speed only when the 1,800-cycle tone can be heard from the motor laminations.

(2) If the drum stops, repeat the starting operation. When the light shines on the white phasing spot of the phasing ring, phasing pulses are transmitted. This is indicated by a flicking of the DB METER each time the light shines on the phasing spot. Look through the clutch window and make sure the drum is driven by the stop arm driving the dog trip arm (fig. 20). This condition should take place automatically after 5 to 10 revolutions of the drum. If the stop arm is not driving

the dog trip arm, false phasing may result. To correct this condition, exert a gentle friction, with the fingers against the phasing ring on the drum, until the stop arm catches up with the dog trip arm. (Facsimile Transceivers TT-1B/TXC-1, TT-1C/TXC-1, TT-1D/TXC-1, TT-1E/TXC-1, and TT1F/TXC-1 have a drum friction mechanism which makes this step unnecessary.) Switch to the TRANSMIT position and send about 25 phasing pulses.

d. Transmitting Copy. If the receiving operator does not request more phasing pulses, proceed to transmit copy as follows:

(1) Turn the selector switch to the TRANSMIT position. Pull forward the knurled engaging lever on the left end of the drum mechanism to engage the half nuts of the drum feed mechanism with the lead screw. This will cause the drum to move slowly from right to left on the shaft.

Note. If the transmitter picture is smaller than 12 inches in width, the drum may be moved to the left by grasping the housing (do not touch the drum) and sliding the drum so that the light falls on the left edge of the copy. The phasing will not be upset as long as the drum is not touched.

(2) When all copy has moved past the scanning beam, turn the selector switch to STANDBY. This will stop the motor in the unmodified Facsimile Transceiver TT-1/TXC-1. In Facsimile Transceiver TT-1/TXC-1, modified by MWO SIG 11-2258-1, the MOTOR OFF-MOTOR ON switch must also be operated to the MOTOR OFF position. If Facsimile Transceiver TT-1A/TXC-1, TT-1B/TXC-1, TT-1C/TXC-1, TT-1D/TXC-1, TT-1E/TXC-1, or TT-1F/TXC-1 is being used, the motor will continue to run until the STANDBY-MON-TALK switch also is operated to the STANDBY position. Remove the completed copy from the drum. If more pictures are to be transmitted, proceed from the start. Set up a new contrast and gain setting for the new copy, and repeat the phasing procedure. If no more copy is to be transmitted immediately, leave the selector switch at STANDBY. When closing down, throw the power ON-OFF switch to the OFF position.

Caution: The phasing procedure must always be repeated after the transmitting or receiving drum is stopped before transmitting another picture.

26. Transmitting Positive for Positive, Photographic Recording

When transmitting positive for positive photographic reception, follow the procedure outlined in the preceding paragraph for transmitting positive for direct recording.

a. With the CONTRAST control set to approximately 30 (never over 45 on the dial for positive transmissions), set the GAIN control (on the blackest portion) for the +2 db reading. However, when setting the CONTRAST control for the whitest portion of the copy, slowly turn the control *only* until the DB METER indicates -13 db. *Do not set it for a minimum reading.* Do not turn the CONTRAST control so far that the meter indication passes -13 db and dips to a lower reading, then rises again to -13 db. This type of adjustment will cause reversal of tones on the received copy.

Note. When setting the CONTRAST control of Facsimile Transceiver TT-1/TXC-1, -1A/TXC-1, and -1B/TXC-1 for receiving, adjust it to read only -8 db instead of -13 db on the DB METER.

b. If it is not possible to obtain the -13 db reading, recheck the setting of the GAIN control and readjust the CONTRAST control as in *a* above.

c. The minimum reading on the whitest portion should be -13 db; the maximum reading on the blackest portion should not exceed +2 db. Check the final GAIN and CONTRAST control adjustments by slowly cutting off the light from the exciter lamp. When this is done, the DB METER indication should rise from -13 db to +2 db without going to a value of less than -13 db. If the 15 db wedge setting cannot be obtained, check the exciter lamp adjustment.

27. Transmitting Negative

When transmitting negative for reception on film, proceed as follows:

a. Preparations. Make the same initial preparations as in transmitting positive. Be sure the selector switch is on SET RANGE.

b. Setting GAIN and CONTRAST Controls.

(1) Set the GAIN control to 65. (Never set below 50 when transmitting negative.) Set the CONTRAST control to 100.

(2) Turn the drum so that the blackest portion of the copy is illuminated by the spot of light. Carefully turn the CONTRAST control to a lower setting until the meter indicates -6 db. Check the meter reading. Move the drum backward and forward slightly while examining a different black portion of the copy to be sure the blackest spot is used.

Caution: Do not turn the CONTRAST control so far that the meter passes -6 db, and dips to a lower reading before rising again to -6 db.

(3) Move the drum so that the whitest portion of the copy is illuminated by the spot of light. Adjust the GAIN control until the meter indicates +2 db. Be sure the whitest portion of the copy actually is being used by again rotating the drum backward and forward slightly while checking the meter.

(4) Return to the blackest portion of the copy and readjust the CONTRAST control for a -6 db reading on the meter.

(5) Repeat the procedure in (2), (3), and (4) above until the final adjustment of the GAIN and CONTRAST controls give meter readings differing by 8 db between the whitest and blackest portions of the copy. The maximum reading (on white copy) must not exceed +2 db. As a final check, slowly cut off the light from the exciter lamp; the DB METER indication should go from +2 db to -6 db without going to a value of less than -6 db.

c. Other Steps. Other steps in the procedure for transmitting negative are the same as for transmitting positive.

28. Receiving on Teledeltos or Timefax NDA Paper (Direct Process)

Direct process recording on Teledeltoe or Timefax NDA paper does not require reception in a darkroom and provides a single received copy which can be used immediately without processing.

a. Preparation.

(1) Wrap the direct process paper around the drum with the white side of Timefax NDA or the metallic side of Teledeltos toward the drum. The drum loading operation is essentially the same as for transmitting (par. 24).

Caution: Hands should be clean and dry. Do not get finger marks on the glazed surface of the paper.

(2) Warm up the transceiver as outlined in paragraph 24a(3).

Warning: It is possible to overheat or bum out recorder lamp E2 (fig. 168) when setting the GAIN control. Temporarily remove it from the circuit by disconnecting the plug at the rear of the housing in which the recorder lamp is mounted.

(3) Operate the dust removal blower switch to ON in equipment modified by MWO 11-2258-6 and in Facsimile Transceiver TT-1F/TXC-1.

b. Adjustment of GAIN Control.

(1)Turn the selector switch to the RECORD PHOTO position. This makes the facsimile transceiver capable of receiving signals without operating the stylus.

(2) If the UC coupling coil is being used (coupled to a telephone receiver), direct the transmitting operator to send a maximum signal. When the maximum signal is received, adjust the GAIN control until the DB METER indicates near zero; then rotate the coupling coil on the earpiece to the position that gives the maximum DB METER reading. Be sure the coupling coil is at least 2 feet from the transceiver, power supply, and other electrical equipment.

(3) While the transmitting operator is alternately sending maximum and minimum signals, adjust the GAIN control on the receiving transceiver so that the DB METER indicates from +2 to +4 db on the steady maximum tone. (The test setting can be learned by experience.) Note the difference on the receiving transceiver DB METER between maximum and minimum signal levels. If the circuit is functioning properly, this difference will be the same as the difference established at the transmitting transceiver within 2 db.

Note. The CONTRAST control is not part of the receiving circuit and does not have to be adjusted when operating the receiver.

c. *Phasing Receiver.*

(1) Be sure the STANDBY-MON-TALK switch is at MON. Operate the START

switch and hold it engaged until the motor starts and the drum picks up speed to slightly more than 60 rpm. Release the switch. The drum will slow down to its synchronous speed at 60 rpm.

Warning: The motors of Facsimile Transceivers TT-1B/TXC-1, TT-1C/TXC-1, TT-1D/TXC-1, TT-1E/TXC-1, and TT-1F/TXC-1 may run at a non-synchronous speed. It is at synchronous speed only when the 1,800-cycle tone can be heard from the motor laminations. If the drum stops, repeat the starting operation.

The transmitting operator will send approximately 25 phasing pulses. These are indicated at the receiver by a momentary dip on the DB METER which occurs once for each revolution of the drum. Be sure to wait for 10 to 15 pulses during which the transmitting machine comes into proper phase; then operate the PHASE switch and hold it engaged for about 6 to 10 pulses. The phasing pulses actually bring the stop arm on the clutch mechanism into phase, and from 5 to 10 more revolutions of the stop arm may be required before the drum falls into phase. The drum is not phased until the stop arm is driving the dog trip arm (figs. 18, 19, and 20). When using Facsimile Transceivers TT-1/TXC-1 and TT-1A/TXC-1, which have not been modified according to MWO SIG 11-2258-2, check for this condition by looking at the clutch mechanism through the window on the clutch housing. If the drum is not being driven by the stop arm driving the dog trip arm after 10 revolutions following the release of the PHASE switch, exert a gentle friction with the fingers against the phasing ring on the drum until the stop arm catches up with the dog trip arm. Modified Facsimile Transceivers TT-1/TXC-l and TT-1A/TXC-1 and Facsimile Transceivers TT-1B/TXC-1, TT-1C/TXC-1, TT-1D/TXC-1, TT-1E/TXC-1, and TT-1F/TXC-1 have a drum friction mechanism which automatically phases the drum.

Note. If the receiving operator misses the phasing pulses and is on a circuit where he cannot break in to ask the transmitting operator for more phasing pulses, it may be possible to phase the receiving machine as follows. Watch the DB METER for the periodic pips that occur once each second, representing the pulses sent when the transmitting machine scans the clamp bar. Gradually stop the drum so that the clamp bar is facing the stylus or recorder lamp barrel by applying pressure with the fingers. Release the drum in synchronization with the pips observed on the DB METER. There is a good chance that the drum will be phased properly and a suitable picture will be recorded.

d. Receiving Copy.

(1) If the receiving transceiver is phased properly, wait for transmission of the picture signals to start. When these signals start, as indicated by irregular fluctuations of the DB METER, engage the drum to the feed mechanism by pulling the feed engaging lever forward, turn the selector switch to RECORD

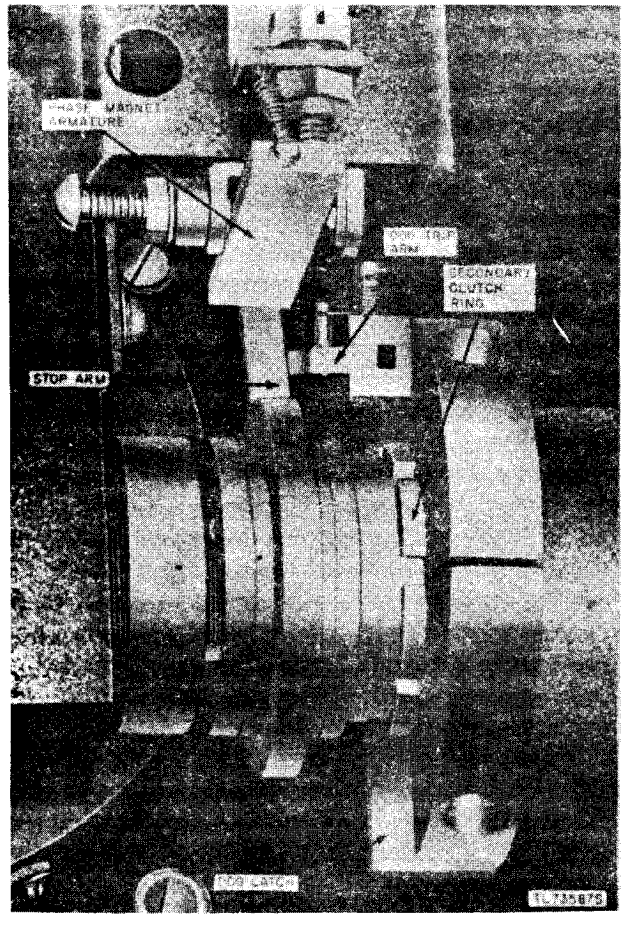


Figure 18. Clutch assembly, start of phasing.

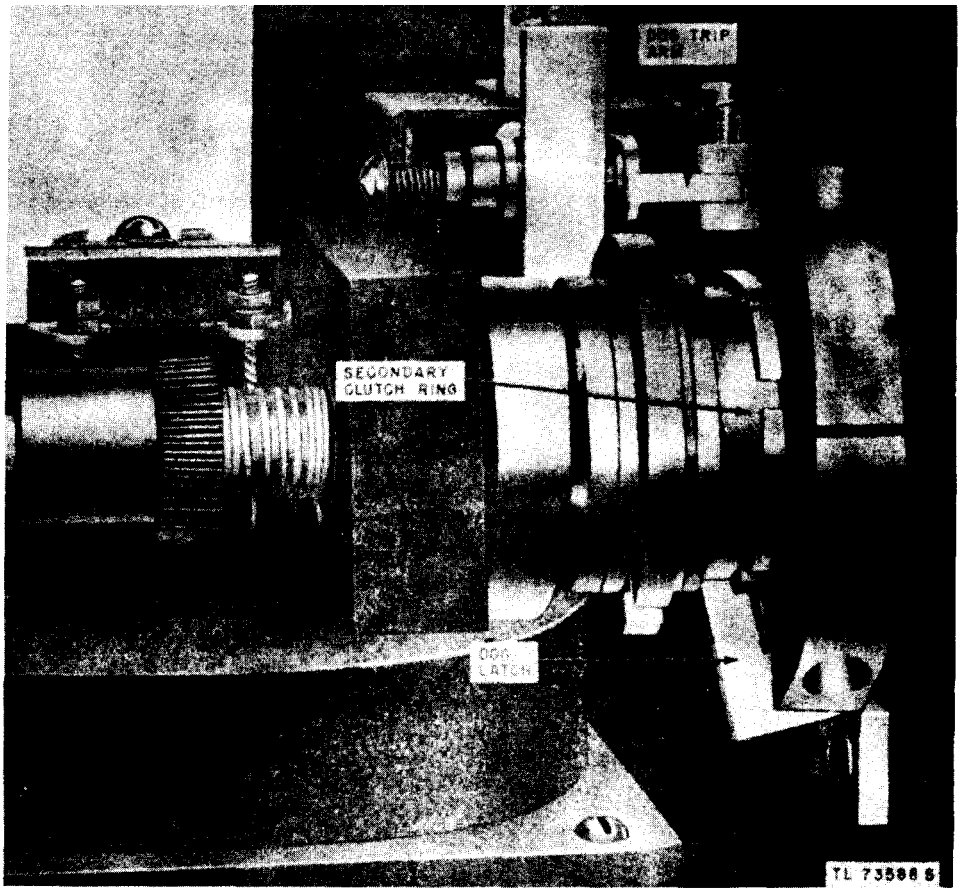


Figure 19. Clutch assembly, during phasing.

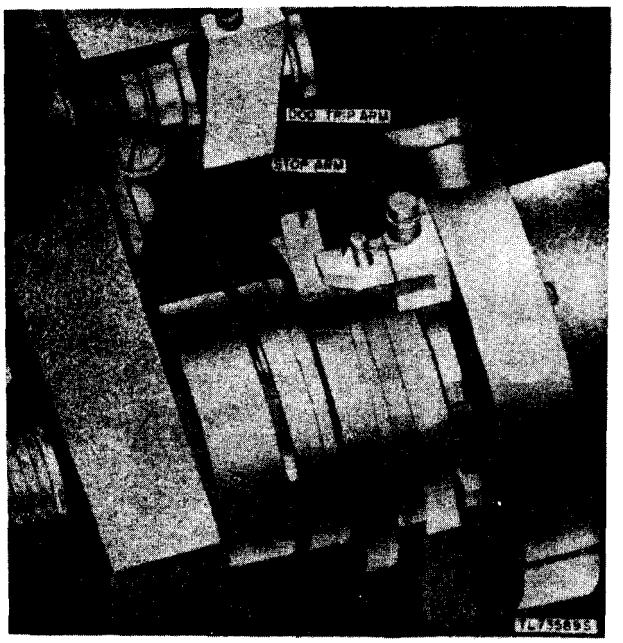


Figure 20. Clutch assembly, phasing completed.

DIRECT to engage the stylus and receive the copy.

Caution: Be careful when breaking into the circuit to talk to the transmitting operator. On some circuits with several stations on a network, an attempt to talk will spoil reception at the other stations.

(2) When the complete picture has been received, turn the selector switch to the STANDBY position. Stop the motor, using the procedure outlined in paragraph 25d(2), and remove the copy. If more traffic is on hand, attach a new sheet of direct recording paper to the drum. Proceed from the start, set the wedge with the new transmitting levels, and repeat the phasing procedure. If all traffic has been cleared, throw the power ON-OFF switch to the OFF position.

29. Duplicating Process Using Timefax A Paper.

Timefax A paper is a specially prepared recording paper which is used when multiple copies of a facsimile recording are required. The received copy acts as the master copy and is applied to a hectograph or gelatin pad from which additional copies are made. Timefax A paper has a high-resistance, light-colored, bluish top coating, which is burned away by the current from the stylus to expose the dye in the undercoating, just as the carbon undercoating of Teledeltos paper is exposed. The master copy as obtained is impressed on the gelatin pad for a sufficient time to transfer the exposed dye to the gelatin. Duplicate copies are then made by transferring the dye in the gelatin to a suitable coated hectograph paper. For short runs (10 to 15 copies), Times Dyeprint paper or Ditto HiSpeed paper should be used. When more copies are required, a long run paper should be used which does not pickup the dye so rapidly. Recording on Timefax paper is quicker than photographic paper methods, but the definition is not as sharp. The quality of the multiple copies depends on the condition of the gelatin pad, the amount of time the master copy is impressed on the gelatin pad, the amount of time duplicating copy paper is left on the pad, and the recording level used in making the master copy.

a. *Recording.* Recording on Timefax A paper is similar to recording by the direct process method on Teledeltos or Timefax NDA paper. Place the paper on the recording drum with the coated side out and follow the procedure outlined in paragraph 28. Do not judge the master copy by its appearance, but rather by is performance on the gelatin pad. The master copy need not be black and distinct. Set the transceiver GAIN control so that the meter indicates approximately +2 db on the black (maximum) signal for the original trial. Increase the setting if necessary, but avoid too high a setting. For beat results, the printing level should be maintained as high as possible without causing destruction or thinning out of the dye. Usually the level is +3 db or +4 db. Excessive gain will cause excessive smoking at the stylus and will destroy the transfer dye in the undercoating. Do not change the setting of the GAIN control during the recording period.

b. Use of Gelatin Pad for Duplicating. For satisfactory results, the gelatin pad must be sufficiently conditioned by moistening so that the surface of the pad presents a slimy, slightly slippery, but not sticky or excessively wet appearance. If the gelatin is too dry, there will be insufficient transfer of dye from the master and the copy may stick to the pad. If the surface is too wet, the dye in the master will run and blur the recording. After the master copy has been received on Time fax A paper, proceed as follows for making duplicate copies:

(1) Prepare the gelatin pad for use by moistening, with a damp sponge and allow the gelatin to absorb the water for about 1 minute. Avoid puddles. Wipe off the excess water with a piece of absorbent paper, or a sponge that has been squeezed thoroughly. Repeat the moistening procedure until the surface of the pad appears in the condition outlined in subparagraph *b* above. Apply a little water at a time until the surface stays moist.

Caution: *Ordinary* tap water may be used unless it is bacteria-infested, in which case the gelatin will deteriorate slowly. To prevent this, add a specially-prepared germicide solution to the water.

(2) Fold back one comer of the master copy to facilitate its subsequent removal with. out scratching or scoring the pad. Place the master copy face down on the pad with a wiping action (do not slide) so that it makes perfect contact over its entire area. Leave the master copy on the pad or roll approximately 1 minute. Experience will prove whether more or less time is required. If the master copy is not left in contact with the gelatin pad long enough, there will be insufficient transfer of dye from the master, and copies will be faint and poorly defined. An the time of impression is increased, more dye will be transferred but it will penetrate farther into the gelatin, resulting in very little improvement in the brightness of duplicate copies. An excessive transfer of dye will result in a reduction of the total number of impressions that can be made with the master copy. After 1 minute has elapsed, check the impression made on the pad by carefully lifting one corner of the master off the gelatin. If more time is required, replace the master for a few more seconds.

(3) When a satisfactory impression is obtained, peel the master from the pad. Make duplicate copies by following ordinary hectograph procedure. Press the copy paper down firmly and evenly on the impression in the gelatin, then peel it off. Fifteen or 20 brilliant copies can be made on short-run high-speed paper from a good impression. If more copies are desired, make another impression from the master, and use a long-run paper which does not pick up the dye, so rapidly. If the copy is not pressed on the gelatin impression long enough, there will be insufficient transfer of dye on the paper, and the copies will be faint. Increasing the duplicating time improves the brillance of the multiple copies by drawing more dye from the gelatin, but limits the total number of copies to be made from that impression. Ordinarily, 2 or 3 seconds should be sufficient for the first multiple copy. Increase the time by 1 or 2 seconds with each succeeding multiple copy.

(4) After running copy, and before using another section of the pad, wipe the section used during the previous run with a damp sponge to hasten fading of the impression and to replenish the moisture absorbed during the run. This section will ordinarily be ready for re-use after a period of 24 hours. Lift the master copy from the gelatin without allowing it to slide. File the master copy, without folding; in a cool, dry place; it may. be used for another impression.

30. Receiving Photographic Recording

Receiving technique for photographic recording is similar to that for direct recording, except that operations must be performed in a darkroom.

a. Loading Drum. Use photographic paper, Royal Bromide F-1, for normal positive recording. Use 1020 paper (or Aero enlarging paper), contrast No. 1, for positive recording when no shrinkage of the print can be tolerated. Use Eastman transmission photographic film, type A, for negative recording.

(1) Turn the selector switch on the facsimile transceiver to the STANDBY position and make initial preparations.

(2) Turn off all lights in the darkroom except the safelight.

(3) Open the box of photographic paper, remove a single sheet, and close the box.

(4) Load the drum in the same manner as for loading with direct recording paper, but be sure to leave approximately one-fourth inch of space between the phasing ring and the paper.

Note. If film is used, place a sheet of black paper between the drum and the dull tide of the film to prevent reflections.

b. Receiving Copy. Adjust the GAIN control and phase the transceiver as outlined in paragraph 28 for direct recording. In this. position, the selector switch is on RECORD PHOTO, and the photographic paper or film may be ruined if the light of the recorder lamp falls on the paper. Care must be taken to perform these operations with the drum at the far right side of the lead screw, so that the light from the recorder lamp falls only on the aluminum drum (fig. 17). When the signal starts, leave the selector switch in the RECORD PHOTO position. Move the drum to the left approximately ¼ inch until the beam from the recorder lamp shines on the extreme left-hand edge of the photographic paper. Engage the drum feed mechanism. Turn off the safelight. Turn it on occasionally to permit checking of the transceiver operation.

Warning: Light through the type OA filter will fog type A transmission film under prolonged exposure. Therefore, whenever possible, set up the receiving transceiver before putting on the film. Phase the machine quickly, and turn off the safesight as quickly as possible.

Note. If the recorder lamp socket has been disconnected When setting the GAIN control, reconnect it before recording.

31. Piece-by-Piece Transmission

When the entire picture to be transmitted cannot be handled in a single transmission, it must be sent piece-by-piece. A copy as large as 12 by 18 inches can be received either on direct recording or photographic recording. For piece-by-piece transmission, cut the original copy into sections so that the entire picture can be recorded in the minimum number of transmissions. Procedure for piece-by-piece transmission is the same as for transmitting several successive pictures, with the following exceptions:

a. During the first contact, the transmitting operator informs the receiving operator that the

transmission will be piece-by-piece, and states the number of pieces.

b. In establishing desired contrast range and gain setting for the transmissions, the transmitting operator uses the phasing ring and the phasing spot to send maximum and minimum signal levels. The transmitting operator does not use the darkest and lightest portions of the picture. This would cause each piece of the complete picture to be recorded with different over-all densities.

c. Once the transmitting GAIN and CONTRAST controls and the receiving GAIN control are set correctly, they are not changed until the last of the piece-by-piece copy has been received. The receiving drum must be rephased to the transmitting drum before the start of each picture.

32. Photographic Processing

a. Developer and Hypo Solutions. Mix developer and hypo solutions according to instructions on the containers of powder. Mix developer DK-60A for film or developer D-72 for photographic paper. The same type of hypo is used for fixing both film and paper.

b. Darkroom Operations. Keep all lights except the safelight turned off until the photographic copy has been fixed in hypo. Arrange three trays beside the sink so that they are lighted by the safelight. Put developer in the left-hand tray, clean water in the middle tray, and hypo in the right-hand tray. Be sure that there is enough solution (at least ½ inch) in each tray to cover the copy being processed.

(1) *Negative (film).* Use DK-60A solution, full strength, for developer. Check the temperature of the developer with the thermometer. It must be between 60° F. and 80° F. for satisfactory results.

Caution: Development will be slowed by temperatures below 70° F. and accelerated by temperatures above 70° F. For consistent results, temperature of developers should be maintained at 68° F. by use of heat or ice. Immersing developer tray in another large tray of water at proper temperature will hold for a sufficient time to permit development of several negatives.

(a) Immerse the exposed film in the developer tray. Agitate the solution. Watch the film as the picture begins to form. After detail is noticed in the light portions of the lighter side of the film, continue developing for 3 or 4 minutes. Total development time is about 5 minutes at 70° F. Place the film in the middle tray for 5 seconds; then place it in the hypo tray.

(b) After all cloudy white portions of the film have cleared, lights may be turned on for a few minutes. Leave the film in the hypo for at least 15 minutes, then wash it for at least 15 minutes in running water. After the film has been washed, hang it up to dry; use wooden clips.

Caution: When handling film, be careful to avoid getting finger marks, scratches, or dust on the emulsion. Keep wash water and tray solutions as near the same temperature as possible. Never use warm water to wash film; it removes the emulsion from the film base.

Note. For black and white copy such as maps or messages, use developer D-72 mixed 1 to 1 instead of DK-60A. This will reduce the developing time. If rushed, fixing and washing time can be reduced if it is not necessary to preserve the film. The film must be clear before it is removed from the hypo. Use of D-72 solution is not recommended for photographic work requiring detail in highlights and shadows.

(2) *Positive (paper).* Use one part of D-72 solution mixed with two parts of water for developer. Be sure the temperature of the developer is between 60° and 80° F.

(a) Place the paper in the developing tray and watch the picture begin, to form. When the desired density has been obtained (after 1½ minutes), remove the picture from the developer and place it in the wash water in the middle tray.

(b) After about 5 seconds, remove the picture from the washing tray and immerse it in the hypo. The lights may be turned on after the paper has been in the hypo for about a minute. Leave the paper in the hypo for at least 10 minutes, then wash it in running water for 15 minutes.

(c) If Royal Bromide paper is used, place the paper face down on a ferrotype plate and force out the excess water

with a squeegee. Put the ferrotype plate on a dryer until the copy is dry.

(d) If Aero enlarging paper or 1020 is used, dry the paper between two blotters, not on the ferrotype plate.

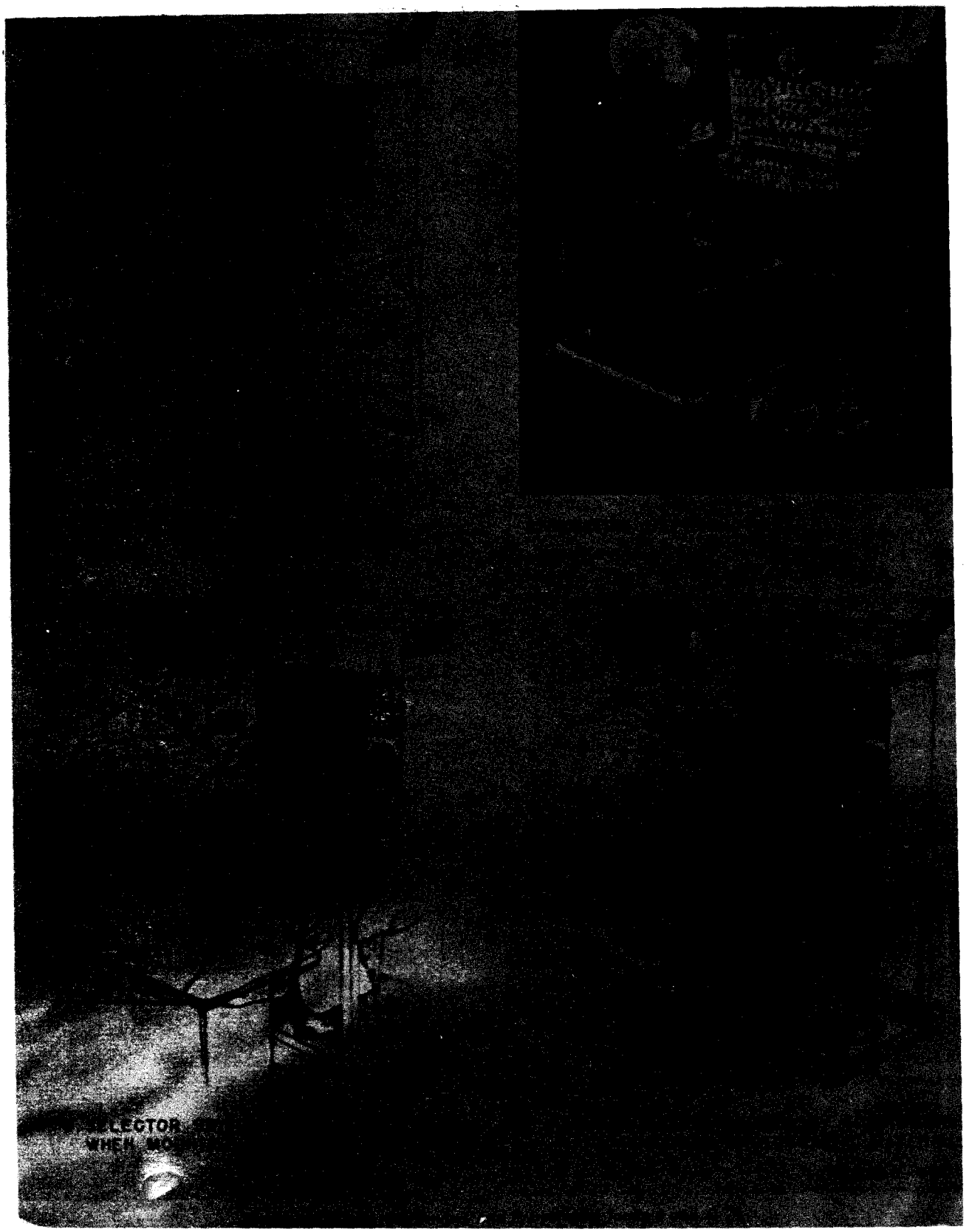
c. Common Photographic Faults (figs. 21, 22, and 23). The following table lists common photographic faults and their causes:

Fault	Cause
1. Print too dark	Overdevelopment; developer too warm. Contact print-exposure too great; negative too weak or too thin.
2. Print too light	Underdevelopment; developer exhausted, developer too cold. Contact print-exposure not sufficient; negative too dense.
3. Gray whites throughout picture.	Developer too cold; long development; paper fogged.
4. Gray granular appearance.	Underexposed contact print and long development; old paper; paper kept in damp place.
5. Brown or green tones	Developer solution too cold, badly discolored, exhausted, or contaminated.
6. Brown and red stains	Developer exhausted; prints not moved about enough during fixing.
7. Round white spots	Air bubbles on the surface of the paper. Prints not moved about enough during development and fixing.
8. White deposits on surface of prints.	Milky fixer solutions; incorrect mixing or impure chemicals.
9. Blisters on surface	Print creased or broken while washing; temperature difference between solutions and wash water too great.
10. Yellow stains	Insufficient washing between developing and fixing; long development; print not kept moving when first immereed in fixer; iron in wash water, probably from rusty pipes; print exposed to air too much while developing, especially in warm weather. To remedy, try using fresh developer solution.

33. Operator Coordination

The following is a summary of the joint and individual operations required of both transmitting and receiving operators for the satisfactory transmission and reception of facsimile copy.

Item No.	Both operators	
1	Check equipment connections.	
2	Turn transceiver power ON-OFF switches to the ON position.	
3	Establish voice communication (radio or wire).	
4	Decide what method of transmission and reception is required.	
	Transmitting Operator	Receiving operator
5	Places copy on transmitter drum.	Places recording paper on receiver drum.
6	Sate wedge at 8 db for negative reception, 15 db for positive photographic reception, or maximum usable contrast for direct recording paper.	
7	Sends maximum signal, then maximum and minimum signals.	Adjusts GAIN control for proper receiving level and checks contrast.
8	Sends phasing signals	Operates PHASE switch to phase receiver.
9	Sends copy	Receives copy.



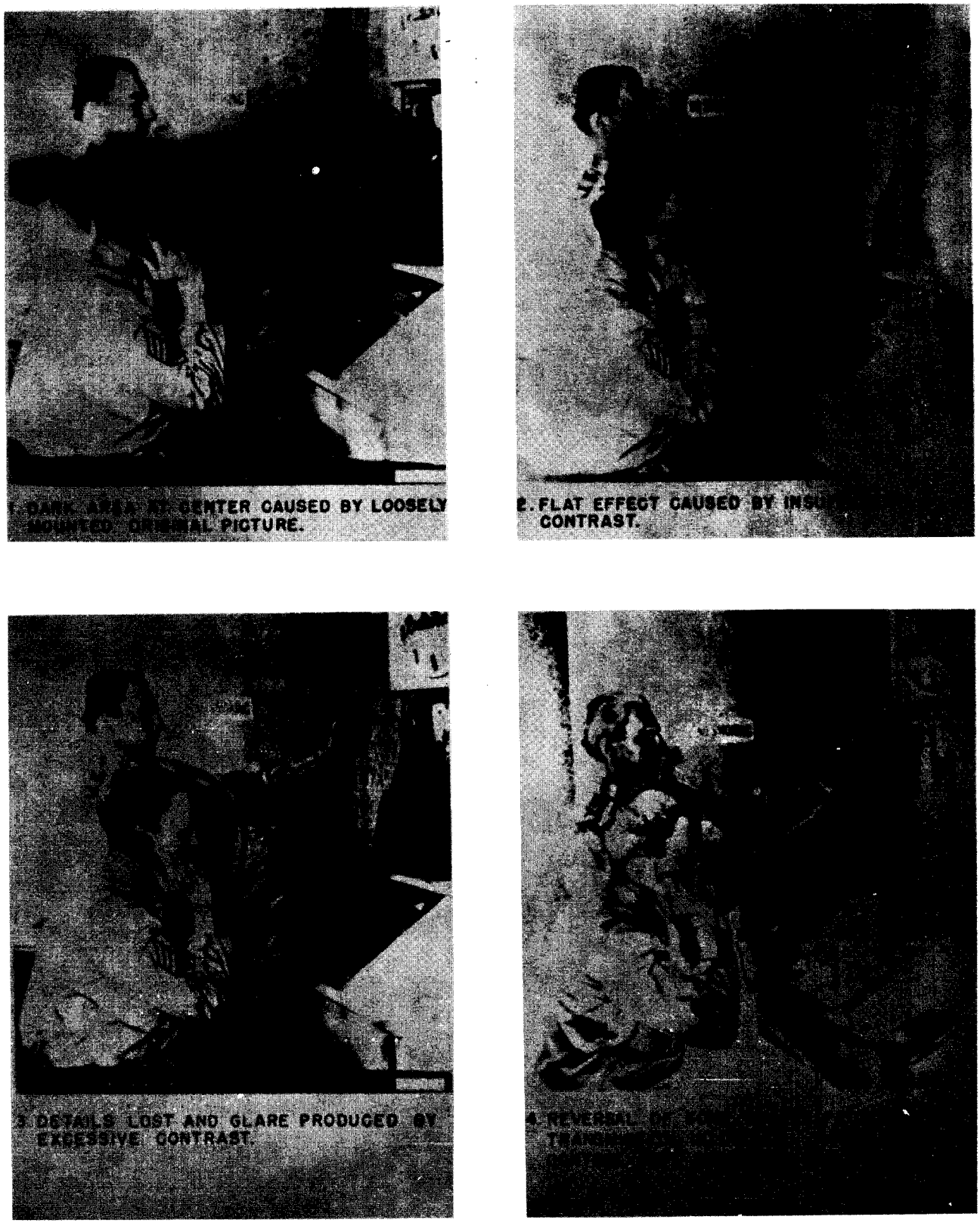
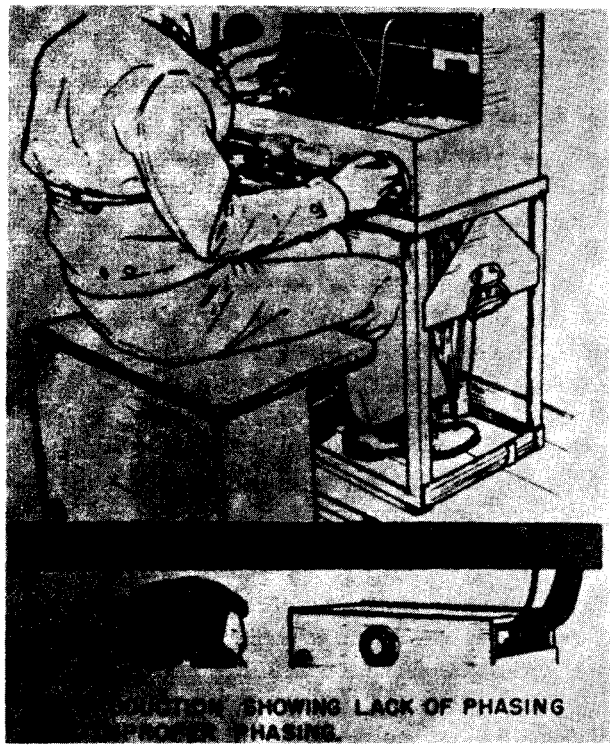
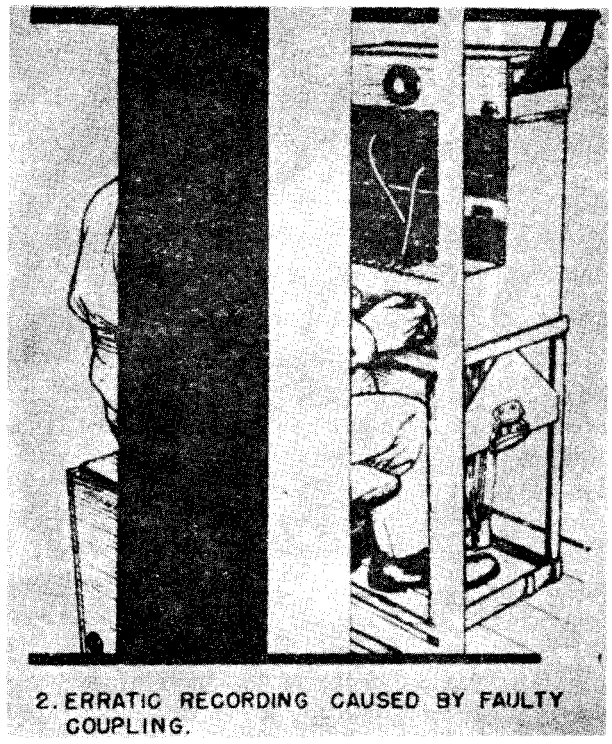


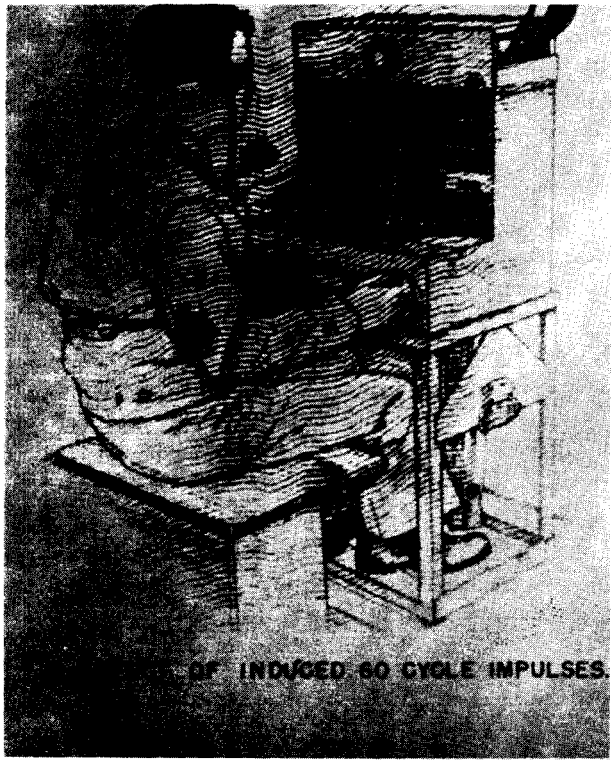
Figure 22.Operating faults.



...SHOWING LACK OF PHASING
...PHASING.



2. ERRATIC RECORDING CAUSED BY FAULTY COUPLING.



...OF INDUCED 60 CYCLE IMPULSES.

4. DARK STRIPES CAUSED BY INDUCED 1,800 CYCLE IMPULSES AT RECEIVER.

TM 2258-45

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

34. General

The operation of Facsimile Set AN/TXC-1(*) may be difficult in regions where extreme cold, heat, humidity and moisture, sand conditions, etc., prevail. In the following paragraphs, instructions are given on procedures for minimizing the effect of these unusual operating conditions.

35. Operation in Arctic Climates

Subzero temperatures and climatic conditions associated with cold weather affect the efficient operation of equipment. Instructions and precautions for operation under such adverse conditions follow:

a. Handle the equipment carefully.

b. Keep the equipment warm and dry. Do not allow the temperature of the fork oscillator unit to go below +32° F. Although the fork oscillator is a sealed unit, extreme changes in temperature will cause the 1,800-cps output of the fork oscillator to change, resulting in objectionable skew on the received copy. Changes in the RB + voltage also will affect the output frequency of the fork oscillator. If the set is not in a heated inclosure, construct an insulated box for the set. Keep resistor heaters (if available) turned on, provided this does not overtax the power supply. If this method is impracticable, keep the filament of vacuum tubes lighted constantly, unless this also overtaxes the power supply. Maintain the temperature of the developer solutions as close as possible to +68° F.

c. Locate the equipment inside a heated inclosure where there is no danger of a cold draft striking the glass tubes when a door is opened. A sudden draft of cold air often is sufficient to shatter the glass envelope of a heated tube. If the inclosure is so constructed that this precaution is impossible, place a blanket or some barrier between the source of the draft and the equipment.

d. When equipment which has been exposed to the cold is brought into a warm room, the equipment will sweat and the lenses will become fogged with moisture condensation. This will continue until the equipment reaches room temperature. When the equipment has reached room temperature, dry it thoroughly. This condition also arises when equipment warms up during the day after exposure during a cold night.

36. Operation in Tropical Climates

For operation in tropical climates, the equipment may be installed in tents, huts or, when necessary, in underground dugouts. When equipment is installed below ground or when it is set up in swampy areas, moisture conditions are more acute. Ventilation is usually very poor, and the high relative humidity causes condensation of moisture on the equipment whenever the temperature of the equipment becomes lower than the surrounding air. To minimize this condition, place lighted electric bulbs under the equipment.

37. Operation in Desert Climates

a. Conditions similar to those encountered in tropical climates often prevail in desert areas. Use the same measures to insure proper operation of the equipment.

b. The main problem arising with equipment operation in desert areas is the large amount of sand, dust, or dirt which enters the moving parts of the equipment such as motor and drum, lead screw, etc. The ideal preventive precaution is to house the equipment in a dustproof shelter. Since such a building seldom is available and would require air conditioning, the next best precaution is to make the building in which the equipment is located as dustproof as possible with available materials. Hang wet sacking over the windows and doom; cover the inside walls with heavy paper. Secure the side walls of tents with sand to prevent their flapping in the wind.

c. Never tie power cords, signal cords, or other wiring connections to either the inside or the outside of tents. Desert areas are subject to sudden wind squalls which may jerk the connections loose or break the lines.

d. Keep the equipment as free of dust as possible. Make frequent preventive maintenance checks (pars. 40-43). Pay particular attention to the condition of the lubrication of the equipment. Excessive amounts of dust, sand, or dirt that come into contact with oil and grease result in grit, which will damage the equipment.

CHAPTER 3

ORGANIZATIONAL MAINTENANCE

Section I. ORGANIZATIONAL TOOLS AND EQUIPMENT

38. Tools Used With Facsimile Set AN/TXC-1(*)

The following organizational maintenance tools are used with Facsimile Set AN/TXC-1(*):

1 Tube Puller TL-201 (fig. 73).
1 Screwdriver TL-467/U: 2½" blade, $^{5}/_{32}$" tip, 5" lg o/a; w/2 blades.
1 Screwdriver, 4-inch blade; $^{3}/_{16}$ inch wide by .032 inch thick bit.
1 Screwdriver TL-359/U; 6" lg blade; 11¾" lg o/a.
1 Weighing Scale (for checking clutch tension) 8-24 ounce.
1 Wrench TL-567/U, Allen type, hexagonal key for No. 5 set screws.
1 Allen wrench, for No. 6 Allen set screws.

39. Materials Required for Organizational Maintenance of Facsimile Set AN/TXC-1(*)

The tools and materials listed below are not supplied with Facsimile Set AN/TXC-1(*) but are required for maintaining the equipment and may be secured through regular supply channels.

Abrasive, crocus cloth; 9" x 11" sheet
Brush, cleaning; ½" w x $5^{27}/_{32}$ lg
Brush, oval; sash; 1" x 9¾" lg
Brush TL-72: camel's hair; ½" w; flat
Burnisher, contact; pen type with pocket clip
Carbon tetrachloride
Cheesecloth, bleached; 36" w
Cleaner, lens; Kodak 1-oz bottle
Cleaning paste
Lens tissue, 3" x 5"
Orangewood stick
Paper, sand; #0000
Polish, metal; paste
Solvent, Dry Cleaning (SD) (Fed spec P-S-661a)

Section II. PREVENTIVE MAINTENANCE SERVICES

40. Definition of Preventive Maintenance

Preventive maintenance is work performed on equipment (usually when the equipment is not in use) to keep it in good working order so that breakdowns and needless interruptions in service will be kept to a minimum. Preventive maintenance differs from trouble shooting and repair since its object is to prevent certain types of trouble from occurring.

41. General Preventive Maintenance Techniques

00 sandpaper to remove corrosion except on or near mechanical parts, such as plugs.

b. Use a clean, dry, lint-free cloth or a dry brush for cleaning.

(1) If necessary, except for electrical contacts, moisten the cloth or brush with solvent (SD); then wipe the parts dry with a cloth.

(2) Clean electrical contacts with a cloth moistened with carbon tetrachloride; then wipe them dry with a dry cloth.

Caution: Repeated contact of carbon tetrachloride with the skin or prolonged breathing of the fumes is dangerous. Make sure adequate ventilation is provided.

c. Clean carbon deposits from the face of the drum with a clean cloth dampened with water. Use only enough water to moisten the cloth. Do not wet the lead screw or the adjacent surfaces.

After cleaning, dry the drum thoroughly and polish it with a clean, dry cloth.

d. Clean the stylus assembly with a soft bristle brush. Do not disturb the adjustment. Use a soft brush to clean the transmitter lens adjacent to the stylus assembly. Avoid touching the lamps with the bare fingers.

e. Clean the drum shaft, and keyway, and the guide rail with a cloth dampened in solvent (SD). Wipe them dry with a clean lint-free cloth. Use a small, stiff brush dipped in solvent (SD) to clean the lead-screw threads while the motor is running. Wipe it dry with a clean, lint-free cloth. Apply a small amount of oil to the lead screw.

f. Clean rust and corrosion from photographic trays with fine sandpaper or emery cloth. If the protective coating has worn off and the trays are corroded, replace the trays if possible. In an emergency, corroded trays may be coated with paraffin or wax. Warm the tray so that the paraffin or the wax will flow.

g. To clean the drum feed mechanism, remove the four screws in the retaining ring (figs. 117 and 118) and slide the cam plate and retaining ring free of the feed mechanism. Do not drag the ring over the threads of the lead screw. Remove the half nut retainer plug and slide the half nut and spring from the holder. Remove and clean only one half nut at a time so there will be no mistake in restoring it to the proper holder. Clean the holder, half nut, and spring with a small brush dipped in solvent (SD). Dry thoroughly with a clean, lint-free cloth. Clean the cam plate with a cloth dampened with solvent (SD), and dry thoroughly with a clean, lint-free cloth. Reassemble in the reverse procedure of disassembly; see that the half nut retaining plugs are flush with the outer edge of the holder. This provides proper tension for the spring, and allows clearance for the drum cam plate.

h. If available, a vacuum cleaner may be used to remove dust from inaccessible places. Be careful or mechanical damage from the air blast may result.

i. Check the motor current daily. It should be between 60 and 70 on the motor current meter.

j. For further information on preventive maintenance techniques, refer to TB SIG 178, Preventive Maintenance Guide for Radio Communication Equipment.

42. Use of Preventive Maintenance Forms
(figs. 24 and 25)

a. The decision as to which items on DA Forms 11-238 and 11-239 are applicable to this equipment is a tactical decision to be made in the case of first echelon maintenance by the communication officer/chief or his designated repreaentative, and in the case of second and third echelon maintenance, by the individual making the inspection. Instructions for the use of each form appear on the reverse side of the form.

b. Circled items in figures 24 and 25 are partially or totally applicable to Facsimile Set AN/TXC-1(*) and Rectifier Power Unit PP-86(*)/TXC-1. References in the ITEM block are to paragraphs in the text which contain additional maintenance information.

43. Performing Preventive Maintenance

Perform the following preventive maintenance operations at the intervals indicated, unless these intervals are reduced by the local commander.

Caution: Tighten screws, bolts, and nuts carefully. Fittings tightened beyond the pressure for which they are designed will be broken on damaged.

a. External Preventive Maintenance.

(1) Check for completeness and satisfactory condition of the equipment and the spare parts (pars. 6 and 7).

(2) Check the site for the location and installation of the equipment for normal operation (par. 12).

(3) Remove dirt, dust, moisture, and corrosion from the carrying handles, motor cover, equipment cover, binding posts, base, and drum.

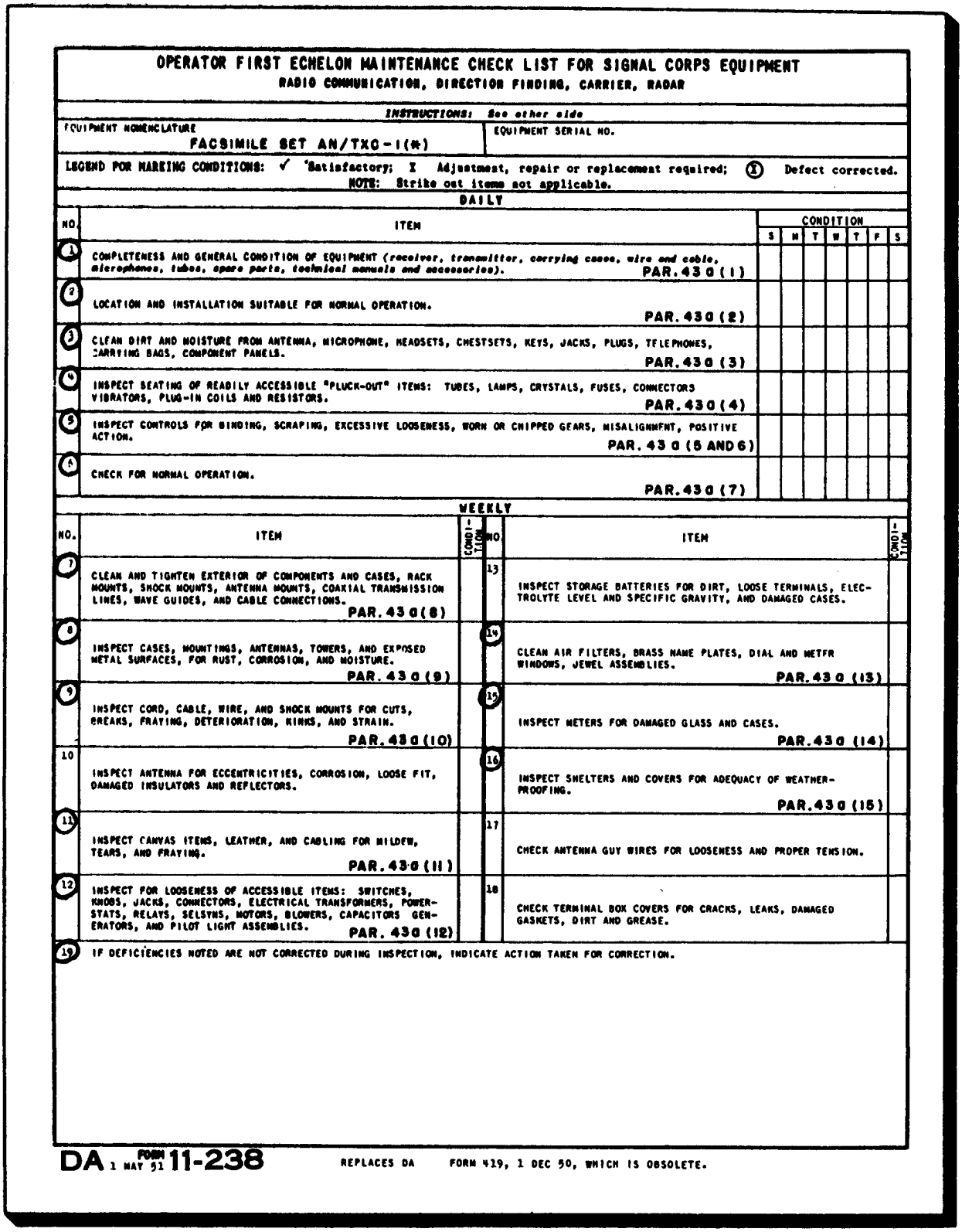
(4) Inspect the motor housing and equipment cover for rust, indentures, scratches, and perfect fit. Inspect the fuses for suitability and seating.

(5) Check the engaging lever and clamp bar on the drum for positive action (fig. 117).

(6) Inspect the START PHASE, ON-OFF, 30RPM-60RPM, and the STANDBY-MON-TALK switches for positive action (figs. 13 through 16).

(7) Check for normal operation.

(8) Inspect, clean, and tighten the GAIN and CONTRAST controls, and the cable connections (figs. 148, 149, and 150).



OPERATOR FIRST ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT

RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE: FACSIMILE SET AN/TXC-1(*)

EQUIPMENT SERIAL NO.

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; (X) Defect corrected.
NOTE: Strike out items not applicable.

DAILY

NO.	ITEM	CONDITION S	M	T	W	T	F	S
1	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT *(receiver, transmitter, carrying cases, wire and cable, microphones, tubes, spare parts, technical manuals and accessories).* PAR. 43 a (1)							
2	LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION. PAR. 43a (2)							
3	CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, HEADSETS, CHESTSETS, KEYS, JACKS, PLUGS, TELEPHONES, CARRYING BAGS, COMPONENT PANELS. PAR. 43a (3)							
4	INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: TUBES, LAMPS, CRYSTALS, FUSES, CONNECTORS VIBRATORS, PLUG-IN COILS AND RESISTORS. PAR. 43a (4)							
5	INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION. PAR. 43 a (5 AND 6)							
6	CHECK FOR NORMAL OPERATION. PAR. 43a (7)							

WEEKLY

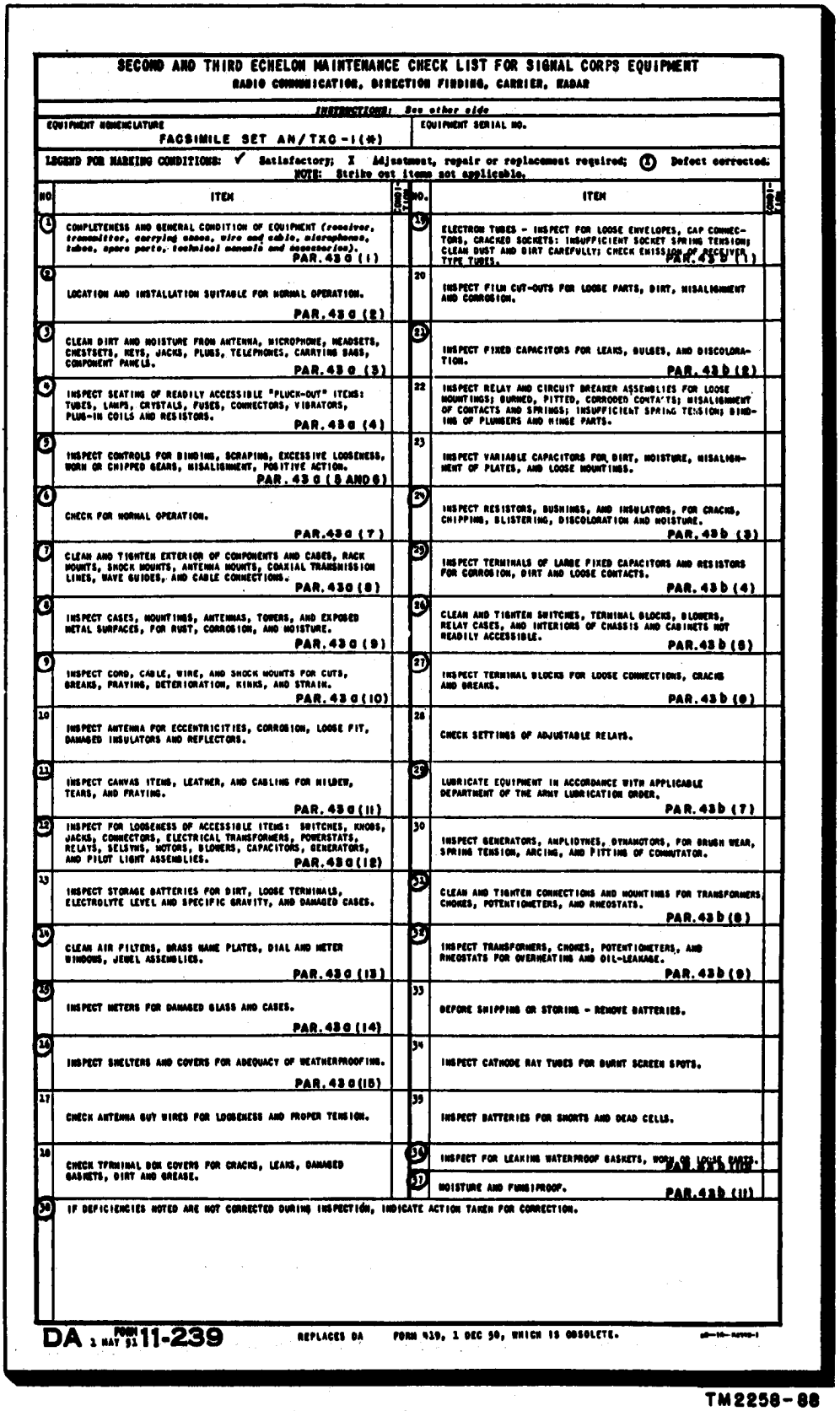
NO.	ITEM	CONDITION	NO.	ITEM	CONDITION
7	CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, WAVE GUIDES, AND CABLE CONNECTIONS. PAR. 43a (8)		13	INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES.	
8	INSPECT CASES, MOUNTINGS, ANTENNAS, TOWERS, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE. PAR. 43a (9)		14	CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES. PAR. 43a (13)	
9	INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN. PAR. 43a (10)		15	INSPECT METERS FOR DAMAGED GLASS AND CASES. PAR. 43a (14)	
10	INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS.		16	INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING. PAR. 43a (15)	
11	INSPECT CANVAS ITEMS, LEATHER, AND CABLING FOR MILDEW, TEARS, AND FRAYING. PAR. 43a (11)		17	CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION.	
12	INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, POWERSTATS, RELAYS, SELSYNS, MOTORS, BLOWERS, CAPACITORS GENERATORS, AND PILOT LIGHT ASSEMBLIES. PAR. 43a (12)		18	CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE.	

19 IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.

DA FORM 1 MAY 51 11-238 REPLACES DA FORM 419, 1 DEC 50, WHICH IS OBSOLETE.

TM2258-87

Figure 24. DA Form 11-238.



SECOND AND THIRD ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT
RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE: FACSIMILE SET AN/TXC-1(*)
EQUIPMENT SERIAL NO.

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; ⓒ Defect corrected.
NOTE: Strike out items not applicable.

NO.	ITEM	CORRECTED
1	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT (receiver, transmitter, carrying cases, wire and cable, microphones, tubes, spare parts, technical manuals and accessories). PAR. 43 c (1)	
2	LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION. PAR. 43 c (2)	
3	CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, HEADSETS, CHESTSETS, KEYS, JACKS, PLUGS, TELEPHONES, CARRYING BAGS, COMPONENT PANELS. PAR. 43 c (3)	
4	INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: TUBES, LAMPS, CRYSTALS, FUSES, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS. PAR. 43 c (4)	
5	INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION. PAR. 43 c (5 AND 6)	
6	CHECK FOR NORMAL OPERATION. PAR. 43 c (7)	
7	CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, WAVE GUIDES, AND CABLE CONNECTIONS. PAR. 43 c (8)	
8	INSPECT CASES, MOUNTINGS, ANTENNAS, TOWERS, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE. PAR. 43 c (9)	
9	INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN. PAR. 43 c (10)	
10	INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS.	
11	INSPECT CANVAS ITEMS, LEATHER, AND CABLING FOR MILDEW, TEARS, AND FRAYING. PAR. 43 c (11)	
12	INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, POWERSTATS, RELAYS, SELSYNS, MOTORS, BLOWERS, CAPACITORS, GENERATORS, AND PILOT LIGHT ASSEMBLIES. PAR. 43 c (12)	
13	INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES.	
14	CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES. PAR. 43 c (13)	
15	INSPECT METERS FOR DAMAGED GLASS AND CASES. PAR. 43 c (14)	
16	INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING. PAR. 43 c (15)	
17	CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION.	
18	CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE.	
19	ELECTRON TUBES - INSPECT FOR LOOSE ENVELOPES, CAP CONNECTORS, CRACKED SOCKETS; INSUFFICIENT SOCKET SPRING TENSION; CLEAN DUST AND DIRT CAREFULLY; CHECK EMISSION OF RECEIVER TYPE TUBES. PAR. 43 c (1)	
20	INSPECT FILM CUT-OUTS FOR LOOSE PARTS, DIRT, MISALIGNMENT AND CORROSION.	
21	INSPECT FIXED CAPACITORS FOR LEAKS, BULGES, AND DISCOLORATION. PAR. 43 b (2)	
22	INSPECT RELAY AND CIRCUIT BREAKER ASSEMBLIES FOR LOOSE MOUNTINGS; BURNED, PITTED, CORRODED CONTACTS; MISALIGNMENT OF CONTACTS AND SPRINGS; INSUFFICIENT SPRING TENSION; BINDING OF PLUNGERS AND HINGE PARTS.	
23	INSPECT VARIABLE CAPACITORS FOR DIRT, MOISTURE, MISALIGNMENT OF PLATES, AND LOOSE MOUNTINGS.	
24	INSPECT RESISTORS, BUSHINGS, AND INSULATORS, FOR CRACKS, CHIPPING, BLISTERING, DISCOLORATION AND MOISTURE. PAR. 43 b (3)	
25	INSPECT TERMINALS OF LARGE FIXED CAPACITORS AND RESISTORS FOR CORROSION, DIRT AND LOOSE CONTACTS. PAR. 43 b (4)	
26	CLEAN AND TIGHTEN SWITCHES, TERMINAL BLOCKS, BLOWERS, RELAY CASES, AND INTERIORS OF CHASSIS AND CABINETS NOT READILY ACCESSIBLE. PAR. 43 b (5)	
27	INSPECT TERMINAL BLOCKS FOR LOOSE CONNECTIONS, CRACKS AND BREAKS. PAR. 43 b (6)	
28	CHECK SETTINGS OF ADJUSTABLE RELAYS.	
29	LUBRICATE EQUIPMENT IN ACCORDANCE WITH APPLICABLE DEPARTMENT OF THE ARMY LUBRICATION ORDER. PAR. 43 b (7)	
30	INSPECT GENERATORS, AMPLIDYNES, DYNAMOTORS, FOR BRUSH WEAR, SPRING TENSION, ARCING, AND PITTING OF COMMUTATOR.	
31	CLEAN AND TIGHTEN CONNECTIONS AND MOUNTINGS FOR TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS. PAR. 43 b (8)	
32	INSPECT TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS FOR OVERHEATING AND OIL-LEAKAGE. PAR. 43 b (9)	
33	BEFORE SHIPPING OR STORING - REMOVE BATTERIES.	
34	INSPECT CATHODE RAY TUBES FOR BURNT SCREEN SPOTS.	
35	INSPECT BATTERIES FOR SHORTS AND DEAD CELLS.	
36	INSPECT FOR LEAKING WATERPROOF GASKETS, WORN OR LOOSE PARTS. PAR. 43 b (10)	
37	MOISTURE AND FUNGIPROOF. PAR. 43 b (11)	
38	IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.	

DA 1 MAY 51 FORM 11-239 REPLACES DA FORM 439, 1 DEC 50, WHICH IS OBSOLETE.

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Figure 25. DA Form 11-239.

(9) Inspect the speaker case for rust, scratcher dirt, and moisture. Tighten all screws (fig. 5).

(10) Inspect the speaker cord for breaks, frayed insulation, dirt, and moisture. Inspect the plug and all connections (fig. 5).

(11) Inspect cabling for mildew, tears, and fraying.

(12) Inspect for looseness of accessible items such as switches, jacks, knobs, transformers, motor mount, and drum (figs. 127 through 137).

(13) Inspect and clean the DB METER window and the clutch window.

(14) Remove dirt, dust, and grease from the lead screw and meters (fig. 119).

(15) Lubricate the equipment in accordance with instructions contained in the lubrication order (par. 44). Inspect the weatherproofing (pars. 48-53).

b. Internal Preventive Maintenance.

Caution: Disconnect all power before performing the following operations. Upon completion, reconnect power and check for satisfactory operation.

(1) Inspect electron tubes for loose envelopes and cracked sockets (figs. 9 and 10): clean them carefully.

(2) Inspect fixed capacitors for leaks, bulges, and discoloration (figs. 129 and 130).

(3) Inspect resistors for cracks, chipping, blistering, discoloration, and moisture (figs. 129 and 130).

(4) Inspect terminals of large fixed capacitors and resistors for corrosion, dirt, and loose contacts.

(5) Clean and tighten switches and interiors of chassis not readily accessible (figs. 134-137).

(6) Inspect terminal blocks for loose connections, cracks, and breaks.

(7) Remove dirt and grease from the motor. Inspect the mounting screws and wire connections. Lubricate the equipment in accordance with applicable Department of the Army Lubrication Order (par. 44).

(8) Clean and tighten connections for transformers, chokes, potentiometers, and rheostats (figs. 134-137).

(9) Inspect transformers, chokes, and all controls for overheating.

(10) Inspect for worn or loose parts.

(11) Check the moistureproofing and fungiproofing (par. 48).

(12) Check for corrosion at all soldered connections. Inspect all wiring.

(13) Clean all key type switches. Inspect the contacts for proper contact and burn spots.

(14) Inspect and clean the lenses and lamps in the optical systems. Check the lens assemblies for looseness (figs. 120, 121, and 122).

Section III. LUBRICATION

44. Department of the Army Lubrication Orders

Department of the Army lubrication orders are illustrated, numbered, and dated cards or decalcomania labels that prescribe approved organizational lubrication instructions for mechanical equipment which requires lubrication by using organizations. Current available lubrication orders are listed in the latest issue of DA Pamphlet 310-4, Index of Technical Manuals, Technical Regulations, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders. Lubrication orders should be requisitioned in conformance with instructions and lists in DA Pamphlet 310-4.

a. Compliance with Department of the Army Lubrication Orders. Instructions contained in lubrication orders are mandatory and supersede all conflicting lubrication instructions of an earlier date. Applicable lubrication orders which are available must be obtained and carried with the equipment at all times, and fully complied with. Difficulties experienced in obtaining and complying with such orders will be reported through technical channels.

b. Location of Department of the Army Lubrication Order. Lubrication Order 11-2258, Facsimile Sets AN/TXC-1, AN/TXC-1A, AN/TXC-1B, AN/TXC-1C, and AN/TXC-1D, is located on the top right side of the chassis base of Facsimile

Transceiver TT-1(*)/TXC-1 under the lead screw shaft.

45. Approved Lubricants for Facsimile Set AN/TXC-1(*)

The following chart lists the lubricating materials necessary when servicing Facsimile Set AN/TXC-1(*).

Symbol	Standard nomenclature
PL Special	Oil, Lubricating, Preservative, Special.
GL	Grease, Aircraft and Instruments.
OCW	Oil, Clock and Watch.

46. Lubrication Techniques

Clean the parts thoroughly before applying lubricant. Be sure that the parts are free of dirt, dust, corrosion, and old lubricants. The following paragraph outline the methods, procedure, and materials to be used when cleaning equipment preparatory to lubrication. The instructions are applicable in common to Facsimile Sets AN/TXC-1, -1A, -1B, -1C, and -1D unless otherwise noted. For additional information on cleaning, refer to paragraphs 40 through 43 for preventive maintenance.

a. Lead Screw, Guide Rail, Drum Shaft, and Keyway (fig. 26). Disassembly is not required for cleaning and lubricating these items. Thoroughly clean the parts as outlined in paragraph 41e. Lubricate as outlined in LO 11-2258 (fig. 26).

b. Secondary Clutch (fig. 26). No parts need be removed or any adjustments disturbed to clean the dog latch cam plate. Clean the cam plate with a lint-free cloth dampened with solvent (SD). Any portion which cannot be reached easily can be cleaned by covering an orangewood stick with the dampened cloth. Dry thoroughly with a lint-free cloth. Lubricate according to LO 11-2258 (fig. 26).

c. *Motor* Worm *and Gear* (fig. 26). Clean the motor worm and gear with a lint-free cloth dampened with solvent (SD). Clean in between the teeth by covering an orangewood stick with the dampened cloth and running it between the teeth. Dry with a lint-free cloth. Lubricate according to LO 11-2258 (fig. 26). To perform this operation on Facsimile Sets AN/TXC-1B and -1C, first remove the gear case cover.

47. Lubrication under Unusual Conditions

The lubricants listed in paragraph 45 may be used in all temperature. The intervals listed in the lubrication order (fig. 26) are based on 8-hour normal daily use. When the equipment is used more than 8 hours daily, or is used in tropical climates, lubricate it more often. For example, if the equipment is in use 16 to 20 hours daily, lubricate after each 3 hours of operation. The lubrication periods can be determined by frequent inspection of all lubrication points.

Section IV. WEATHERPROOFING

48. Weatherproofing Procedures

a. Genaral. When electronic equipment is operated under the severe climatic conditions which prevail in the tropical, arctic, or desert regions, it requires special treatment and maintenance. Fungus growths, insects, dust, corrosion, salt spray, excessive moisture, and extreme temperatures are harmful to most materials.

b. Tropical Maintenance. Because fungus growth, insects, corrosion, salt spray, and excessive moisture affect most materials in a harmful manner, a special moistureproofing and fungiproofing treatment is used and, if properly applied, it provides a reasonable degree of protection. Refer to TB SIG 13 (Moistureproofing and Fungiproofing Signal Corps Equipment), and TB SIG 72 (Tropical Maintenance of Ground Signal Equipment) for detailed descriptions of the varnish-spray method of applying moistureproofing and fungiproofing and the supplies and equipment required for this treatment. The following problems may be encountered:

(1) Resistors, capacitors, coils, chokes, transformer windings, etc., fail because of the effects of fungus growth and excessive moisture.

(2) Electrolytic action often visible in the form of corrosion takes place in resistors, coils, chokes, transformer windings, etc., and eventually causes breakdown.

(3) Hook-up wire insulation and cable insulation break down. Fungus growth accelerates deterioration.

(4) Moisture forms electrical paths on terminal boards and insulating strips, and causes flashovers and cross talk.

LUBRICATION ORDER

LO 11-2258

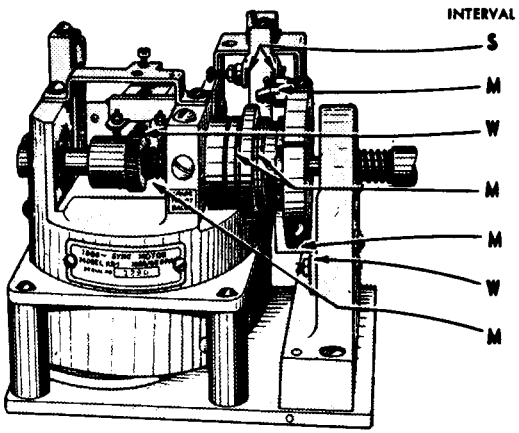
31 March 1955 (Supersedes LO 11-2258, 3 June 48)

FACSIMILE SETS AN/TXC-1, AN/TXC-1A, AN/TXC-1B, AN/TXC-1C, AND AN/TXC-1D

Reference: TM 11-2258

Intervals given are maximum for normal 8-hour day operation. For abnormal conditions or activities, intervals should be shortened to compensate. Clean parts with SOLVENT, dry cleaning. Dry before lubricating.

CAUTION. This equipment employs high voltages that may be fatal if contacted by operating personnel. Use necessary precautions before servicing.



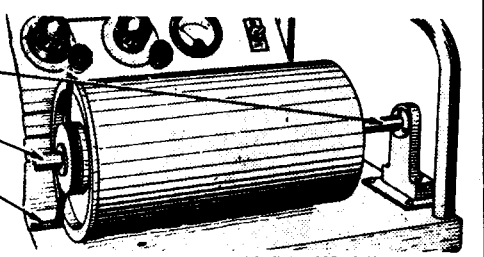
MOTOR AND CLUTCH ASSEMBLY
(Cover Removed)

INTERVAL — LUBRICANT

S	OCW	Phase Magnet Armature Pivots (Apply sparingly)
M	PL	Dog Trip Arm (One drop)
W	GL	Motor drive, Worm and Gear (Apply to gear teeth, run motor, and remove excess grease. To lubricate gears on AN/TXC-1B, -1C, and -1D, remove gear case cover)
M	OCW	Clutch Rings (One or two drops. See note 2)
M	PL	Secondary Clutch Dog Latch Pivot (One drop)
W	GL	Secondary Clutch Dog Latch Cam Plate (Thin film on the cam surface)
M	PL	Top Bearing on Motor (AN/TXC-1 and AN/TXC-1A only) (One or two drops)

LUBRICANT — INTERVAL

Drum Shaft and Keyway (Thin film)	PL	D
Lead Screw (Thin film. See note 1)	PL	D
Guide Rail (Thin film)	PL	D



DRUM AND LEAD SCREW ASSEMBLY

—KEY—

LUBRICANTS, ALL TEMPERATURES	INTERVALS
GL – GREASE, Aircraft and Instruments	D – Daily
PL – OIL, Lubricating, Preservative, Special	W – Weekly
OCW – OIL, Clock and Watch	M – Monthly
	S – Semiannually

NOTES:

1. LEAD SCREW – Clean monthly. With drum rotating, disengage the clutch. Slide drum to extreme right of lead screw. Cover screw with PL, then remove lubricant by holding lintless cloth against rotating lead screw. Again coat lead screw with PL, and allow drum to travel length of screw. Repeat this operation until wiping action of drum accumulates only clean oil at left end of lead screw.
2. CLUTCH RINGS – After lubrication, run the motor at least 15 minutes with the clutch in a locked position. Measure the clutch tension and if it has not stabilized, repeat the running in process.
3. DRIVE SHAFT BEARINGS, LEAD SCREW BEARINGS, AND MOTOR BEARINGS – To be lubricated with GL, after disassembly, by Field or Base Maintenance.
4. FAN BLOWER – Units equipped with blower, lubricate blower bearings monthly with PL.

A copy of this Lubrication Order will remain with the equipment at all times; instructions contained herein are mandatory and supersede all conflicting lubrication instructions dated prior to the date of this Lubrication Order.

BY ORDER OF THE SECRETARY OF THE ARMY:

M. B. RIDGWAY,
General, United States Army,
Chief of Staff.

OFFICIAL:

JOHN A. KLEIN
Major General, United States Army,
The Adjutant General.

Figure 26. Facsimile Transceiver TT-1(*)/TXC-1, lubrication order.

49. Moistureproofing and Fungiproofing After Repairs

If the coating of protective varnish is punctured or broken during repair, and if a complete treatment is not needed to reseal the equipment, apply a brush coat to the affected part. Be sure the break is sealed completely.

50. Winterization

Special precautions are necessary to prevent poor performance or total operational failure of equipment in subzero temperatures. Most signal equipment can be used in winter if difficulties common in low temperatures are anticipated and precautions are taken to prevent them. For operational purposes, place the equipment in heated rooms whenever possible. Take measures to keep the temperature of the fork oscillator unit above *+32°* F. Refer to TB SIG 66 (Winter Maintenance of Signal Equipment), and TB SIG 219 (Operation of Signal Equipment at Low Temperatures) for complete information. The following problems may be encountered:

a. Steel shrinks and becomes brittle in subzero temperatures.

b. Glass is especially susceptible to sudden temperature changes. The difference between a low air temperature and the warmth of a man's breath may be sufficient to shatter a lens.

c. Pure rubber resists cold weather well, but certain types of synthetic rubber are unreliable and become brittle.

d. Canvas freezes and loses its pliability in cold weather.

e. Lubricants become stiff, causing the moving parts to stick and dry.

51. Rustproofing

Signal Corps equipment operated in desert localities is affected by the extremely high temperatures and the amount of dirt, dust, sand, and other foreign matter in the air. Keep such elements from filtering into lubricated parts. Cover the equipment when it is not in use. Thorough cleanliness is imperative. Instead of merely adding new lubricants at regular intervals, whenever practicable clean and lubricate all moving parts. If it is possible, inspect and clean the equipment daily. In any case, inspect the air filters and similar protective devices every day and clean them whenever necessary. Refer to TB SIG 75 (Desert Maintenance of Ground Signal Equipment). Some of the problems encountered are the following:

a. Lubricants become thin and drain rapidly from moving metal and fiber parts.

b. Foreign matter, such as dirt, dust, and sand, acts as an abrasive. This causes excessive wear, clogging of air cleaners, and impeding of the flow of air.

52. Lubrication

The effects of extreme cold and heat on materials and lubricants are explained in TB SIG 69 (Lubrication of Ground Signal Equipment). Observe all precautions outlined in TB SIG 69 and pay strict attention to all lubrication orders when operating the equipment under conditions of extreme cold or heat.

53. Rustproofing and Painting

a. When the finish on the transceiver and power unit chassis or the table has been badly scarred or damaged, rust and corrosion can be prevented by touching up bared surfaces. Use No. 00 or No. 000 sandpaper to clean the surface to the bare metal until a bright smooth finish is obtained.

Caution: Do not use steel wool. Minute particles frequently enter the equipment and cause harmful internal shorting or grounding of circuits.

b. When a touch-up job is necessary, apply paint with a small brush. Remove rust from the case by cleaning corroded metal with solvent (SD). In severe cases, it may be necessary to use solvent (SD) to soften the rust and to use sandpaper to complete the preparation for painting. Paint used will be authorized and consistent with existing regulations.

Section V. TROUBLESHOOTING AT ORGANIZATIONAL MAINTENANCE LEVEL

54. General

a. The troubleshooting and repairs that can be performed at the organizational maintenance level (operators and repairmen) are necessarily limited in scope by the tools, test equipment, replaceable parts issued, and by the existing tactical situation. Accordingly, troubleshooting is based on the performance of the equipment and the use of the senses in determining such troubles as burned-out tubes, cracked insulators, etc.

b. Paragraphs 55 through 58 help in determining which component is at fault and in localizing the fault in that component to the defective stage or items such as a tube or fuse.

55. Visual Inspection

a. Before making operational tests, examine the equipment for one or more of the following defects:

(1) Tubes out of sockets.
(2) Tubes 1oose in sockets.
(3) Broken exciter lamp.
(4) Damage to lead screw.
(5) Blown rectifier power supply fuse.
(6) Blown motor fuse.
(7) Worn, broken, or disconnected cords or plugs.
(8) Wires broken because of excessive vibration.

b. When failure is encountered and the cause in not immediately apparent, check as many of the above items as is practicable before starting a detailed examination of the component parts of the system. If possible, obtain information from the operator of the equipment regarding performance at the time trouble occurred.

56. Sectionalization of Trouble to Component

Sectionalization consists of determining whether the trouble is in the transceiver or the power supply.

a. Operate the set and observe its performance. Refer to the equipment performance check list (par. 58) for normal operating indications.

b. If the entire equipment is dead, the trouble is undoubtedly in Rectifier Power Unit PP-86(*)/ TXC-1. Check the fuse (figs. 158 through 161) and interconnecting cable.

c. If a tone is not heard in the motor laminations, and the exciter lamp does not light, the trouble is probably in the fork oscillator unit, or the trouble may be in the lamp amplifier section of Rectifier Power Unit PP-86(*)/TXG1. Check tubes V17 through V21 and V23.

d. Use procedure similar to the simple checks given in a through *c* above to isolate trouble to a particular init.

57. Troubleshooting by Using Equipment Performance Check List

a. General. The equipment performance check list (par. 58) will help the operator to determine whether Facsimile Set AN/TXC-1(*) is functioning properly. The check list gives the item to be checked, the conditions under which the item is checked, the normal indications and tolerances of correct operation, and the corrective measures the repairman can take. To use this list, follow the items in numerical sequence.

b. Action or Condition. For some items, the information given in the action or condition column consists of the settings of various switches and controls under which the item is to be checked. For other items, it represents an action that must be taken to check the normal indication given in the normal indications column.

c. Normal Indications. The normal indications listed include the visible and audible signs that the operator will perceive when the items are checked. If the indications are not normal, the repairman should apply the recommended corrective measures.

d. Correction Measures. The corrective measures listed are those the operator can make without turning in the equipment for repairs. Reference in the table to a paragraph in chapter 6 indicates that the trouble cannot be corrected during operation and that troubleshooting by an experienced repairman is required. If the set is completely inoperative or if the recommended corrective measures do not yield results, troubleshooting is necessary. If the situation requires that communication be maintained, and if the set is not completely inoperative, the operator must maintain the set in operation as long as it is possible to do so.

58. Equipment Performance Checklist

	Item No.	Item	Action or condition	Normal indications	Corrective measures
PREPARATORY	1	Power ON-OFF switch..	Turn to OFF position.		
	2	Selector switch----------	Set to SET RANGE position.		
	8	Drum----------	Disengage; move drum to extreme right.		
	4	Connections to line-----	Make connections for wire or radio circuit as described in paragraphs 15 and 18.		
	5	Connection to power source.	Jones plug connected to transceiver recptacle.		
	6	Communication----------	Establish communication with other station.		
	7	Method of recording-----	Arrange method of recording with operator at other station.		
	8	Copy----------	Place copy on scanning drum.		
*START	9	Power ON-OFF switch --	Turn to ON position -----	Allow to warm up at least 10 minutes. An 1,800 ops tone is heard in the motor laminations. Pilot light and exciter lamp light.	Check fuse in Rectfier Power Unit PP-86(*)/ TXC-1. Check V21 through V23. Check V1 through V6.

a. Facsimile Transceicer TT-1/TXC-1 (Transmitting).*

EQUIPMENT PERFORMANCE

Item No.	Item	Action or condition	Normal indications	Corrective measures
10	CONTRAST and GAIN controls.	Adjust for proper contrast and correct output.	DB METER indicates correct contrast (pars. 25 and 26).	Check adjustment of exciter lamp. Readjust CONTRAST control and reset GAIN. Check balance (R42). Check V10, V11, V12, and V13.
11	Selector switch	Turn to TRANSMIT position.		
12	Maximum and minimum signals.	Send maximum signal for 15 seconds, then send maximum and minimum signals for 5 seconds each.	DB METER indicates correct contrast. Receiving operator checks contrast and sets GAIN control.	Same as item 10. Send signals until receiving operator is ready.
13	Motor	Operate START switch	Motor starts and drives drum. MOTOR CURRENT meter (M2) indicates between 70 to 75 milliamperes.	Check motor fuse. Readjust motor current potentiometer R93 (fig. 169 and par. 71). Check V4, V5, and V6.
14	Phasing pulses	Move drum so light shines on phasing ring. Transmit about 25 phasing pulses.	Pointer of DB METER will flick once for each revolution of drum. Stop arm driving dog trip arm (fig. 14).	Check tubes V15 and V16. Check tube V25 for glow. Check RB+ meter M3 for correct voltage, and adjust RB+ potentiometer for reading of 250 volts.
15	Phasing check	Receiving operator may ask for phasing check.		Send more phasing pulses.
16	Transmitting copy	Engage drum feed mechanism.	Scanning drum moves to left along lead screw.	Check if selector switch is at TRANSMIT. Check for dirt on lead screw threads. Check condition of half nuts.
17	Stopping transceiver	Operate selector switch to STANDBY. Also operate MOTOR ON-MOTOR OFF switch on Facsimile Transceiver TT-1/TXC-1 to MOTOR OFF. Disengage drum feed mechanism.	Drum stops	Check position of STANDBY-MON-TALK switch; must also be at STANDBY.

*b. Facsimile Transceiver TT-1*TXC-1 (Receiving, Direct Recording).*

	Item No.	Item	Action or condition	Normal indications	Corrective measures
IT PERFORMANCE	18	Direct recording paper..	Fasten to scanning drum	Metallic or backside toward drum. No wrinkles in paper.	Release recording paper and refasten to drum.
	19	Selector switch.....	Turn to RECORD DIRECT.		
	20	Blower switch.....	Turn to ON.....	Blower motor operates.	
	21	GAIN control.....	Contact transmitting operator to check signal levels. When transmitting operator sends maximum signal, adjust GAIN control for proper reading on DB METER. Check contrast on maximum and minimum signals.	Difference in maximum and minimum should be same as at transmitting station within 2 db.	Check tubes V10, V11, V12, and V14. Check line if possible. (If radio circuit is being used, check for proper receiver output impedance match (par. 18e).)
	22	Phasing.....	Start motor and phase transceiver.	Drum rotates, 900 cps or 1,800 cps tone heard from motor laminations.	Check motor fuse. Check for locked-up clutch. Check tubes in fork-oscillator unit. Check tubes V4, V5, and V6, loose Jones plug, and V26.
	23	Receiving copy.....	Turn selector switch to RECORD DIRECT; engage drum feed mechanism.	Drum moves to the left along lead screws. Stylus records; slight tinge of smoke emitted at stylus.	Check copy, replace stylus if necessary (par. 118). Remove foreign matter from lead screw. Examine half-nuts.
	24	Stopping transceiver....	Same as step 17.....	Same as step 17.....	Same as step 17.

c. Facsimile Transceiver TT-1/TXC-1 (Receiving, Photographic Recording).*

	Item No.	Item	Action or condition	Normal indications	Corrective measures
EQUIPMENT PERFORMANCE	25	Darkroom and photographic solutions.	Prepare for photographic processing (par. 29).	No light present. Solutions and pans clean and proper temperature.	Make up new solutions if required.
	26	Selector switch	Turn to STANDBY position.		
	27	Recording	Move drum to extreme right. Place paper on scanning drum. If film is used, place sheet of black paper between film and drum.	Glossy side of film or paper is out, and no wrinkles are present.	Place film on scanning drum correctly.
	28	Selector switch	Turn to RECORD PHOTO position.		
	29	GAIN control	When transmitting operator sends maximum signal, adjust GAIN control for +2 db reading on DB METER. Check contrast on maximum and minimum signals.	Maximum reading should be +2 db. Difference in maximum and minimum signals should be the same as transmitting station within 2 db.	Contact transmitting operator to check the signal levels. Check line if possible.
	30	Phasing	Start motor and phase transceiver.	Same as item 22	Same as item 22.
	31	Receiving copy	Turn selector switch to RECORD PHOTO position. Move drum to left so beam from recording lamp shines on left-hand edge of recording paper or film. Engage drum feed mechanism.	Drum moves to the left. Meter reading varies.	Check receiving transceiver.
	32	Stopping transceiver	Same as item 17	Same as item 17	Same as item 17.
	33	Photographic processing	Process received copy	Good print or negative	Refer to paragraph 29.

d. Facsimile Transceiver TT-1/TXC-1 (Shut Down).*

	Item No.	Item	Action or condition	Normal indications	Corrective measures
STOP	34	Power switch	Turn power ON-OFF switch to OFF position.		
	35	Scanning drum	Disengage drum feed mechanism. Move drum to left to protect lead screw threads from dirt.		

CHAPTER 4

AUXILIARY EQUIPMENT

Section I. CONVERTER CV-2C/TX

59. Block Diagram

(fig. 27)

Converter CV-2C/TX is an electronic device which is used between the facsimile transceiver and the radio circuit in transmission and reception of facsimile signals by the subcarrier frequency modulation (SCFM) method. Figure 27 is a block diagram that shows Converter CV-2C/TX connected in an am SCFM application. When transmitting, the converter changes 1,800-cps am signals from the facsimile transceiver into frequency-modulated voice-frequency signals which modulate a conventional radiotelephone transmitter. The transmitted signal consists of a rf carrier on which is superimposed a constant level af modulation. The frequency of the af modulation is varied in accordance with the facsimile signals. When receiving, the radio signal is picked Up by a conventional am communication receiver. The receiver output, which is fed into the converter, consists of voice-frequency signals. The converter changes these signals into am signals, which are fed to the receiving facsimile transceiver. This type of circuit is less affected by fading and interference than transmissions using conventional am. Complete information on Converter CV-2C/TX is contained in TM 11-2252A.

60. Application

a. Connections. Locate Facsimile Transceiver TT-1(*)/TXC-1 and Converter CV-2C/TX so that the front panel controls of both units can be operated easily. The tuning eye on the front panel of the converter must be in view.

(1) *Normal operation.*

(a) Insert the input cord of Converter CV-2C/TX into the LINE jack on the right-hand end of Facsimile Transceiver TT-1(*)/TXC-1.

(b) Insert the connector plug of the ac power cord into the socket (PS1) on the rear panel of the converter.

(c) Insert the plug on the other end of the ac cord into a 115-volt, 60-cps, ac source.

(d) Insert one end of Cord CD1019 into the RADIO XMTR jack on the front panel of the converter and the other end to the carbon microphone input of the radio transmitter.

(e) Strap the GND and adjacent LINE terminal on the terminal board at the rear of the converter.

(f) Plug one end of Cord CD-1018 into the RADIO REC. jack (J5) on the front

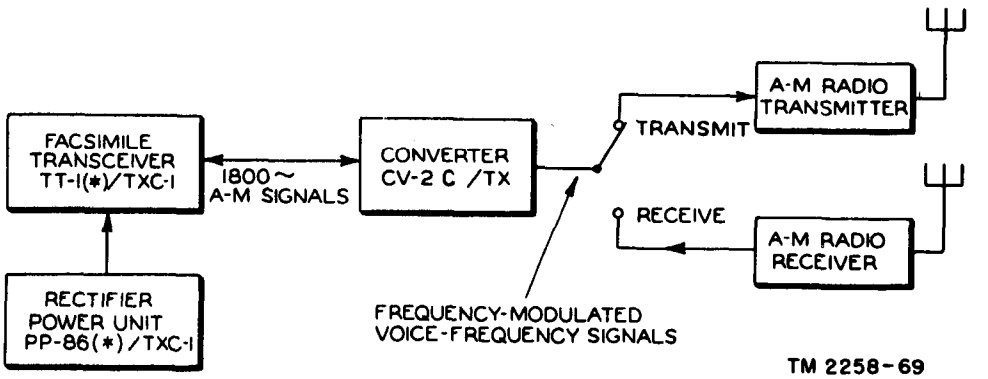


Figure 27. Am-SCFM transmission and reception of facsimile signals, block diagram.

panel of the converter. Plug the other end of this cord into the high-level audio output termination on the radio receiver.

Note. When Converter CV-2C/TX is used in a radio facsimile circuit, the talk-back circuit of Facsimile Transceiver TT-1(*)/TXC-1 is inoperative. However, carbon Microphone T-17 (or equivalent) and Headset HS-30 (or equivalent) are plugged into the converter CARBON MIC. and MONITOR jacks, respectively, for voice communication and transmitter control.

(2) *Remote operation of radio transmitter.* If the radio transmitter is remotely located, use shielded two-conductor cable in place of Cord CD-1019 to connect it to the radio transmitter.

(a) If the distance is great, connection to the radio transmitter must be made from the LINE terminals at the rear of the converter. Remove the strap that connects the GND terminal and the adjacent LINE terminal, and use a telephone line or field wire to connect the output of the converter to the radio transmitter.

(b) In either case, the line must be limited to a length which will provide equal modulation of the radio transmitter at the 1,500- or 3,000-cps shift limits.

Note. The microphone plugged into the converter cannot be used when connection is made from the LINE terminals. A separate line to the transmitter must be used under these conditions.

b. Transmitting. Adjust Facsimile Transceiver TT-1(*)/TXC-1 in accordance with the type transmission to be made. Refer to paragraph 17.

(1) Operate power ON-OFF switch S4 to the ON position, REC.-SEND switch S1 to the SEND position, SET MIN.-SET MAX. switch S5 to SET MAX., SEND-STANDBY switch S6 to STAND-BY, and 1500 2300-1800 3000 switch S2 to 1500 2300 position.

(2) With maximum signal being delivered by Facsimile Transceiver TT-1(*)/TXC-1, adjust FREQ. ADJ. control R2 for maximum closure of the tuning eye on Converter CV-2C/TX (+2 db reading on the DB METER).

(3) Operate the SET MIN.-SET MAX. switch to the SET MIN. position.

(4) Set Facsimile Transceiver TT-1(*)/TXC-1 to deliver minimum signal. The tuning eye on the converter should be at maximum closure. If not, adjust the transceiver CONTRAST control for maximum closure.

(5) Return the SET MIN.-SET MAX. switch to the SET MAX. position. The tuning eye should be maximum closure with a +2 db reading on the DB METER. If not, readjust the FREQ. ADJ. control.

(6) Operate the SEND-STANDBY switch to the SEND position.

(7) Adjust SEND GAIN control R21 on Converter CV-2C/TX far proper modulation of the transmitter.

(8) The transceiver and converter now are adjusted properly. Proceed as outlined in paragraph 23c and *d*.

c. Receiving.

(1) Operate REC.-SEND switch S1 to the REC. position.

(2) Tune in the carrier signal (maximum indication on receiver). Adjust the rf and audio controls for a clear signal with minimum background noise.

(3) When the transmission begins (maximum and minimum signals), adjust Facsimile Transceiver TT-1(*)/TXC-1 for normal operation as outlined in paragraph 28.

(4) If correct contrast cannot be obtained, increase the radio receiver audio output by advancing the audio gain control.

Section II. EXCITER UNIT O-5B/FR

61. General

Exciter Unit O-5B/FR is an electronic device which is used in place of the oscillator section of a cw transmitter to excite the transmitter with frequency-shift signals according to a varying dc or audio voltage which is fed into the exciter unit, The exciter unit is used with Converter CV-2C/TX to permit transmission of frequency-shift facsimile signals over a cw radiotelegraph transmitter when using Facsimile Set AN/TXC-1(*). Complete information on Exciter Unit O-5B/FR is contained in TM 11-2205A.

Note. Exciter Unit O-5/FR or O-5A/FR can be used with Converter CV-2/TX or CV-2A/TX after minor changes have been made in the circuit. Complete information on Exciter Units O-5/FR and O-5A/FR is contained in TM 11-2205.

62. RF Oscillator O-86/FRT

RF Oscillator O-86/FRT is similar to Exciter Unit O-5/FR or O-5A/FR that already has been modified for use with Converter CV-2/TX or CV-2A/TX. It can be used in place of Exciter Unit O-5/FR or O-5A/FR without modification. Refer to TM 11-2205 for complete information on RF Oscillator O-86/FRT.

63. Application

Figure 28 is a block diagram which shows how Converter CV-2C/TX and Exciter Unit O-5B/FR are used in frequency-shift transmission and reception of facsimile signals.

a. Transmitting. When transmitting, the 1,800-cycle am signals from Facsimile Transceiver TT-1(*)/TXC-1 are fed into Converter CV-2C/TX, where they are rectified. The output from the converter is in the form of a varying dc signal that represents the envelope of the modulated, 1,800-cycle carrier. This varying dc signal is applied to the oscillator control tube in Exciter

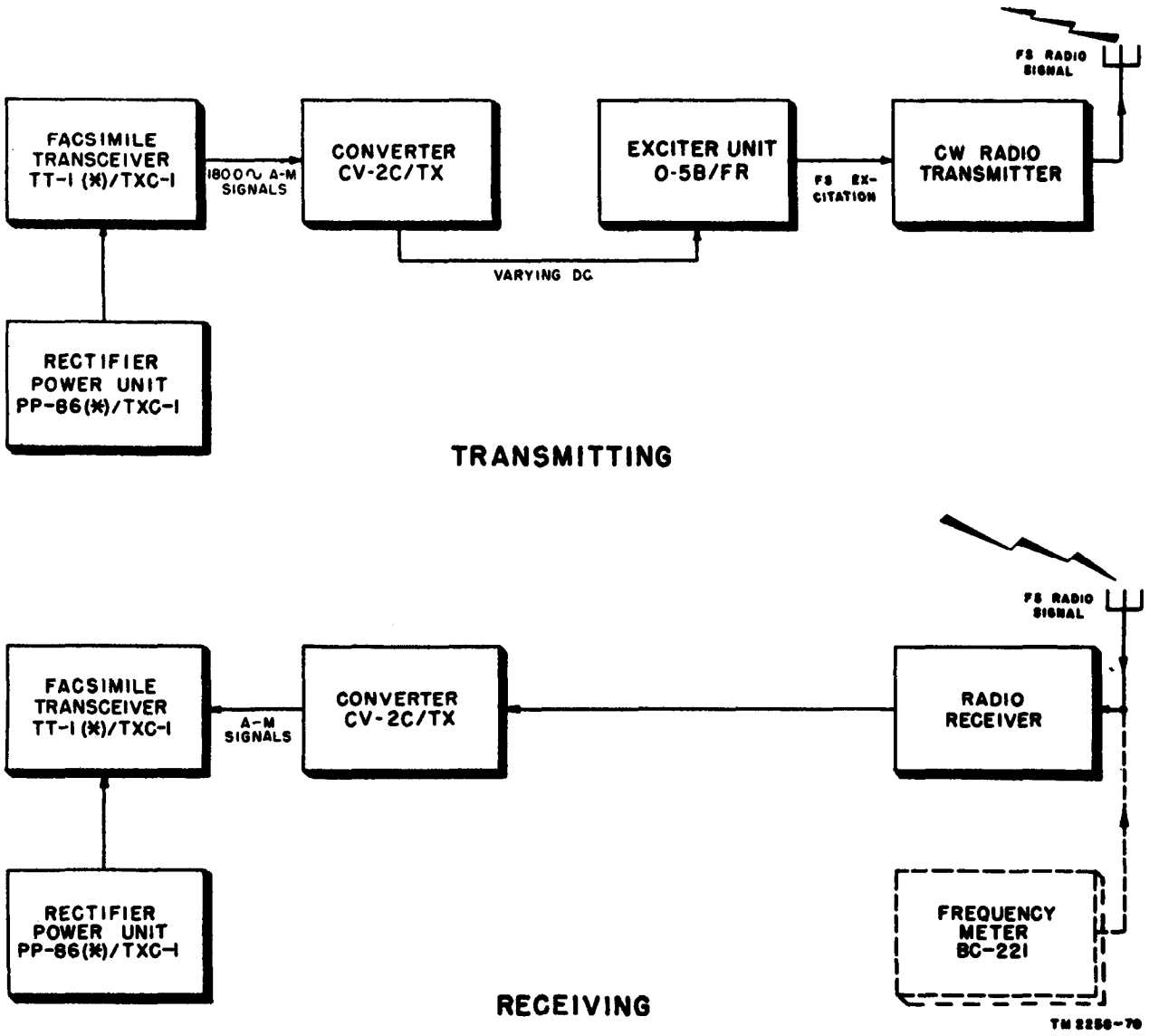


Figure 28. Frequency-shift transmission and reception of facsimile signals, block diagram.

Unit O-5B/FR. The output of the exciter unit is a frequency-shift rf signal which shifts above and below a center frequency by an amount proportional to the varying dc signal produced by rectification of the 1,800-cps signal. This serves as the rf excitation for the cw transmitter. The transmitter output is a frequency-shift signal, shifting a total of 800 cycles between picture white and picture black; 400 cycles above and 400 cycles below the assigned carrier frequency (a total of 1,200 cps, ±600 cycles under the old shift limits) (fig. 29). Frequency-shift transmissions are advantageous because they are affected less by fading and interference than transmissions using conventional am and, in addition, the rf channel width required is less than when using am SCFM.

b. Receiving. When receiving frequency-shift facsimile signals, a conventional communication receiver that has a crystal-controlled temperature compensated hf oscillator and a stabilized beat-frequency oscillator should be used. Radio Receiver R-390/URR or Radio Receivers BC-779, BC-794, and BC-1004 modified in accordance with MWO SIG 11-866-4, Modification of Radio Receivers BC-779-(*), BC-794-(*) and BC-1004-(*) to provide for improved stability of the high frequency oscillator circuit, are suitable in this application. However, a conventional receiver may be used to pick up the frequency-shift radio signal with a stable rf signal applied to its input from Frequency Meter BC-221. Therefore, the beat-frequency oscillator will not be required. In both methods, the incoming signal is heterodyned with the local oscillator signal to produce an output in the af range swinging from 1,500 to 2,300 cps or from 1,800 to 3,000 cps, depending on which shift limit is used (fig. 29). These fm voice-frequency signals are applied to the input of Converter CV-2C/TX which converts them into am af signals which are fed into the input of the receiving facsimile transceiver.

64. Operation

After the equipments have been connected as shown in figure 28, apply the following operating instructions when using an 800-cps shift (1,500 to 2,300 cps). Detailed instructions for connecting and adjusting Exciter Unit O-5B/FR are given in TM 11-2205A. Audio Oscillator TS-382A/U and Electronic Multimeter TS-505/U may be used to assist in properly setting up the equipment for operation.

a. Setting Controls. The following procedure sets the controls of the facsimile transceiver, the the converter, and the exciter unit to produce the required carrier shift:

(1) With maximum signal of +2 db from the facsimile transceiver, adjust the exciter unit and the FREQ. ADJ. (R2) control of the converter so that the transmitter output frequency is 400 cps above the assigned carrier frequency. Check by using Audio oscillator TS-382A/U and tuning for zero beat.

(2) With minimum signal from the facsimile transceiver, adjust the facsimile transceiver until the transmitter output is 400 cps below the assigned carrier frequency. This will require adjustment of the CONTRAST and GAIN controls of the facsimile transceiver. While adjusting transceiver controls, check again to be sure that the maximum transceiver signal is maintained at +2 db. Do not make any further frequency control adjustments on the exciter unit or the converter. Use Audio Oscillator TS-382A/U to see that the change from minimum facsimile signal to maximum facsimile signal increases the transmitter output frequency by 800 cps. To do this, leave the oscillator tuned as described in (1) above, and measure the frequency of the beat note produced by the beating of the oscillator signal with the transmitter output signal. Use the beat note method to measure the frequency of this 800-cycle note either on a direct reading af meter or by comparison with an 800-cycle signal from an audio oscillator.

(3) To check the accuracy of the adjustments and to assist the receiving operator in adjusting the station, send a series of maximum and minimum level signals (high- and low-frequency signals), followed by a series of phasing pulses. Repeat this sequence two or three times before actually transmitting the copy.

Note. Allow at least ½-hour warm-up period before making operating adjustments.

b. Transmitting. Negative transmission of facsimile copy is preferable, although copy may be transmitted either negative or positive. The

controls of the facsimile transceiver are used in their normal manner to select either positive or negative transmission as required. In either case, adjust the system so that a minimum amplitude signal · output from the facsimile transceiver produces the lowest output frequency from exciter Unit O-5B/FR and a maximum amplitude signal output from the facsimile transceiver produces the highest output frequency from Exciter Unit O-5B/FR. The frequency and frequency deviation at the output of Exciter Unit O–5B/FR will be multiplied by the radio transmitter frequency multipliers, but the transmitter output frequency must be kept to a maximum frequency swing of 800 cps. This requires that the transmitter output frequency be 400 cps below the assigned carrier frequency when a minimum facsimile signal is sent, and 400 cps above the assigned carrier frequency when a maximum facsimile signal is sent. The actual output frequency of the transmitter will vary between these two extremes from instant to instant in accordance with the brightness or darkness of the transmitted copy being scanned on the facsimile transceiver drum. The following chart shows the actual transmitter output frequencies for minmum and maximum facsimile signals (when the assigned rf carrier is 7,500 kilocycles (kc)), when either positive or negative facsimile transmissions are being made:

Assigned carrier frequency	Amplitude of facsimile signal	Tranmitter output
7,500 kc	Minimum	7,499.6 kc.
7,500 kc	Maximum	7,500.4 kc.

c. Receiving (fig. 29). The receiving station must be adjusted so that the highest received frequency is interpreted as a maximum amplitude signal at the receiving facsimile transceiver, and the lowest received frequency is interpreted as a minimum amplitude signal at the receiving facsimile transceiver. To obtain this desired relationship, the output of the receiver hf oscillator must be on the hf side of the received rf signal. This will produce an af beat note (2,300 cps) at the receiver output when the received rf signal is at its lowest frequency, and a low-frequency beat note (1,500 cps) at the output of the receiver when the received rf signal is at its highest frequency. The received carrier frequencies are the same as those assumed for the transmitting station, and they produce the desired facsimile signals at the input of the facsimile transceiver. The received carrier swings over a total of 800 cycles and normal heterodyning action of the beat-frequency oscillator in the receiver produces a receiver output which varies from 2,300 to 1,500 cps. The low-pass filter in Converter CV-2C/TX changes the 2,300-cps signal into a minimum amplitude output signal and the 1,500-cps signal into a maximum amplitude signal. Received carrier frequencies between the low extremity (7,499.6 kc) and the high extremity (7,500.4 kc) produce amplitudes in between minimum and maximum, which the receiving facsimile transceiver prints as intermediate shades of gray between black and white. If the receiver hf oscillator output is set to the low side of the received carrier, the received picture tones will be reversed. A positive transmission will be received as a negative, and vice versa.

Frequency of receiver carrier	Frequency of receiver hf oscillator	Frequency of receiver output	Amplitude of recovered facsmile signal
7,499.6 kc	7,501.9 kc	2,300 cps	Minimum.
7,500.4 kc	7,501.9 kc	1,500 cps	Maximum.

(1) When using receivers that do not use crystal-controlled conversion, front-end insertion of a highly stable heterodyning signal is a necessity for satisfactory results. The constant frequency output of Frequency Meter BC-221 is ideal as a substitute for crystal-controlled hf oscillator injection. The following procedure sets Frequency Meter BC-221 to the high side of the received carrier:

(a) Tune in the facsimile signal and zero beat the frequency meter to this signal.

(b) Reduce the receiver rf gain control for a reading of approximately 1 on the receiver S-meter.

(c) Couple the output of Frequency Meter BC-221 to the receiver at the receiver antenna terminal.

(d) Without disturbing the receiver rf gain control, adjust the injection level by adjusting the coupling to the receiver for a full-scale reading on the receiver S-meter (direct coupling, although not recommended, may be necessary).

Note. The exact level will vary slightly for different receivers and can be determined best by the overall performance of the system.

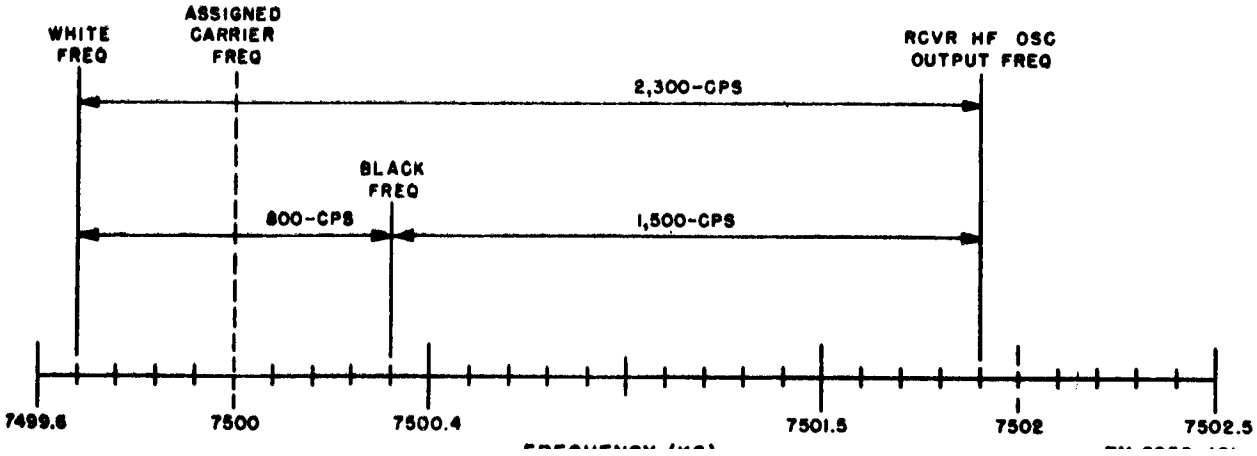


Figure 29. Receiver rf relationships during reception of frequency-shift facsimile transmissions.

(e) With the transmitting operator sending a steady minimum signal (7,499.6 kc in this example), adjust Frequency Meter BC-221 until the af output signal from the radio receiver is exactly 2,300 cps. Check to see that the frequency meter is tuned 2,300 cps (2.3 kc) above the incoming signal (to 7,501.9 kc in this example). Check this by varying the frequency meter dial through zero beat and by turning it to the highest frequency setting of the two settings that will produce a 2,300-cps receiver output signal. Check the accuracy of the 2,300-cps signal either on a direct reading af meter or by comparing it with the signal from an audio oscillator.

(f) With the transmitting operator sending a steady maximum signal (7,500.4 kc in this example), and without changing the setting of the frequency meter, the receiver output signal should be exactly 1,500 cps. This can be checked with the direct reading af meter or by comparison with the signal from an audio oscillator.

Note. The facsimile transceiver produces an audible oscillation which is highly accurate. This can be used for checking the 1,800-cycle signal from the receiver when the 1,800- to 3000-cps shift limit is used.

(g) Check the accuracy of the adjustments by listening to the series of maximum signals, minimum signals, and phasing pulses which the transmitter operator will repeat two or three times.

(h) When phasing pulses are being received on positive transmissions (maximum signal on black), the radio receiver output will be a steady 1,500-cps tone, interrupted onoe each second by a 2,300-cps pulse. On negative transmissions, during phasing, the radio receiver output will be a steady 2,300-cps tone, interrupted once each second by a 1,500-cps pulse.

(2) Set up Facsimile Transceiver TT-1(*)/ TXC-1 as outlined in paragraph 28.

CHAPTER 5

THEORY

Section I. GENERAL

65. Fundamentals of Facsimile Equipment

Facsimile equipment is used to transmit images over an electrical communication system, These images, called pictures or copy in facsimile terminology, may be maps, photographs, sketches, typewritten or printed text, or handwriting.

a. Operation Performed. The image that serves as facsimile copy or picture cannot be transmitted instantly in its entirety. The three operations necessary to transmit and record the picture are as follows:

(1) The breaking up of the picture in an orderly manner into a large number of elemental areas of varying shades. This process is called *scanning* and is accomplished by the facsimile transmitter.

(2) Transmission of electrical signals, representing these individual elemental areas, to the facsimile receiver. Facsimile signals are transmitted over wire and radio circuits.

(3) The interpreting of these electrical signals and the rebuilding and recording of the original picture from them. This reversal of the transmitter scanning process is accomplished by the facsimile receiver. The receiving transceiver must be accurately synchronized with the transmitting transceiver to assure satisfactory reproduction.

b. Facsmimile Set AN/TXC-1(*). Facsimile Set AN/TXC-1(*) performs the basic operations outlined in a above in the following manner:

(1) The picture to be transmitted is mounted on a cylindrical drum, which revolves at the rate of 1 revolution per second, in Facsimile Transceivers TT-1/TXC-1, TT-1A/TXC-1, TT-1B/TXC-1 and TT-1C/TXC-1. In Facsimile Sets AN/TXC-1C and -1D (Facsimile Transceiver TT-1D/TXC-1, TT-1E/TXC-1, or TT-1/XC-1), the drum rotates at the rate of ½ revolution per second or 1 revolution per second, depending on the setting of motor speed control switch (30RPM-60RPM) S4. The drum travels from right to left along a lead screw at the rate of 12½ inches in 20 minutes when revolving at 1 revolution per second, and at the rate of 12½ inches in 40 minutes when revolving at ½ revolution per second. Light from an exciter lamp illuminates a small area of the picture being scanned and is reflected back through an aperture to a photocell. During the transmission of a complete picture, this light traverses every portion of the picture as the drum slowly spirals past the fixed lighted area.

(2) At any instant, the amount of light reflected back to the photocell is a measure of the lightness or darkness of the tiny spot of picture which is being scanned. A photocell transforms varying amounts of light into corresponding electrical signals, which are amplified and transmitted over the facsimile circuit.

(3) Electrical signals received by the facsimile receiver are amplified and serve to actuate a recording mechanism which makes a permanent record, spot by spot, on the recording paper on the synchronized receiver drum until the complete original picture is reproduced. Facsimile Set AN/TXC-1(*) reproduces either photographically, with a controlled light source shining on photographic paper film, or directly, with a stylus that burns a white protective coating from specially prepared recording paper. Synchronization is obtained by constantly driving both receiving and transmitting

drums with synchronous motors operating at identical speeds. Phasing is accomplished by transmitting a series of phasing pulses just prior to each facsimile transmission. These pulses operate a clutch mechanism which phases the receiving drum to the transmitting drum.

66. Block Diagrams

Figures 30, 31 and 32 show the various stages of Facsimile Set AN/TXC-1(*).

a. Electrical Circuits. The complete electrical circuit of Facsimile Set AN/TXC-1(*), including Facsimile Transceiver TT-1(*)/TXC-1 and Rectifier Power Unit PP-86(*)/TXC-1, may be broken down by functions into the following eight principal circuits:

(1) Signal source at 1,800 cycles. The fork oscillator unit (V1, V2, and V3) generates a steady 1,800-cycle audio signal for use in several other circuits (figs. 30 and 34).

(2) *Photocell bridge modulator.* The photocell bridge modulator circuit (V24), built around a type 1645 photocell tube (type 5652 in Facsimile Transceivers TT-1D/TXC-1, TT-1E/TXC-1, and TT-1F/TXC-1), is used on transmission only. It amplitude modulates the 1,800-cycle signal in accordance with variations in light intensity of the small portion of the transmitted copy being scanned at any instant.

(3) *Signal amplifier circuit.* The signal amplifier circuit (V10, V11, V12, V13, and V14) amplifies the 1,800-cycle am signal (figs. 51 through 54). One-half of V13 is used to drive V14 on direct recordings only. The other half of V13 is connected as a meter amplifier for operation of the DB METER. On transmission, the photocell bridge modulator feeds the signal amplifier circuit, which feeds the line. On reception, the signal on the line is fed to the signal amplifier circuit which drives either the stylus for direct recording or the recorder lamp for photo recording. Tubes V10, V11, and V12 also are used in the talk-back circuit.

(4) *Phasing circuit.* The phasing circuit (V15 and V16) is used only for phasing the facsimile receiver. A series of phasing pulses from the transmitter actuate a clutch mechanism and phase the receiving drum to the transmitting drum (par. 77).

(5) *Motor circuit.* The motor circuit (V4, V5, and V6) amplifies the 1,800-cycle signal from the fork oscillator unit and drives the synchronous motor at a constant speed. A multivibrator stage, V26, has been incorporated into Facsimile Transceivers TT-1D/TXC-1, TT-1E/TXC-1, and TT-1F/TXC-1 to provide for half-speed operation of the synchronous motor (par. 71).

(6) *B+ regulator circuit.* The B+ regulator circuit (V7, V8, V9, and V25) provides a closely regulated voltage of 260 volts from the rectifier power supply of 450 volts. Regulated B+ voltage is used on critical transceiver circuits.

(7) *Rectifier power supply.* The high-voltage power supply rectifier (V22 in Rectifier Power Unit PP-86(*)/TXC-1) provides unregulated +450 volts. Power transformer T11 supplies 6.3-volt ac for the transceiver and power unit tube filaments. Starting voltage for the synchronous motor and the blower in modified sets and Facsimile Transceiver TT-1F/TXC-1, is obtained directly from the ac line. Rectifier Power Unit PP-86E/TXC-1 also supplies 115-volts ac for the dust filter blower operation.

(8) *Exciter lamp supply.* The exciter lamp supply (V17, V18, V19, V20, V21, and V23) in Rectifier Power Unit PP-86(*)/TXC-1 amplifies and regulates the 1,800-cycle signal voltage from the fork oscillator unit to provide a steady potential for the transceiver exciter lamp, which illuminates the transmitted copy with a constant brilliancy.

b. Mechanical System. The mechanical system of the facsimile transceiver (figs. 31 and 32) consists of a synchronous motor which drives the rotating drum through a clutch arrangement. Operation of the clutch during phasing is described in paragraph 77.

c. Transmitting. Figure 31 shows the functions of the various stages of the facsimile set when transmitting. The picture being transmitted is attached to the rotating drum, on which the condenser lens system focuses light originating at the exciter lamp. Varying amounts of light are reflected back through the objective lens and

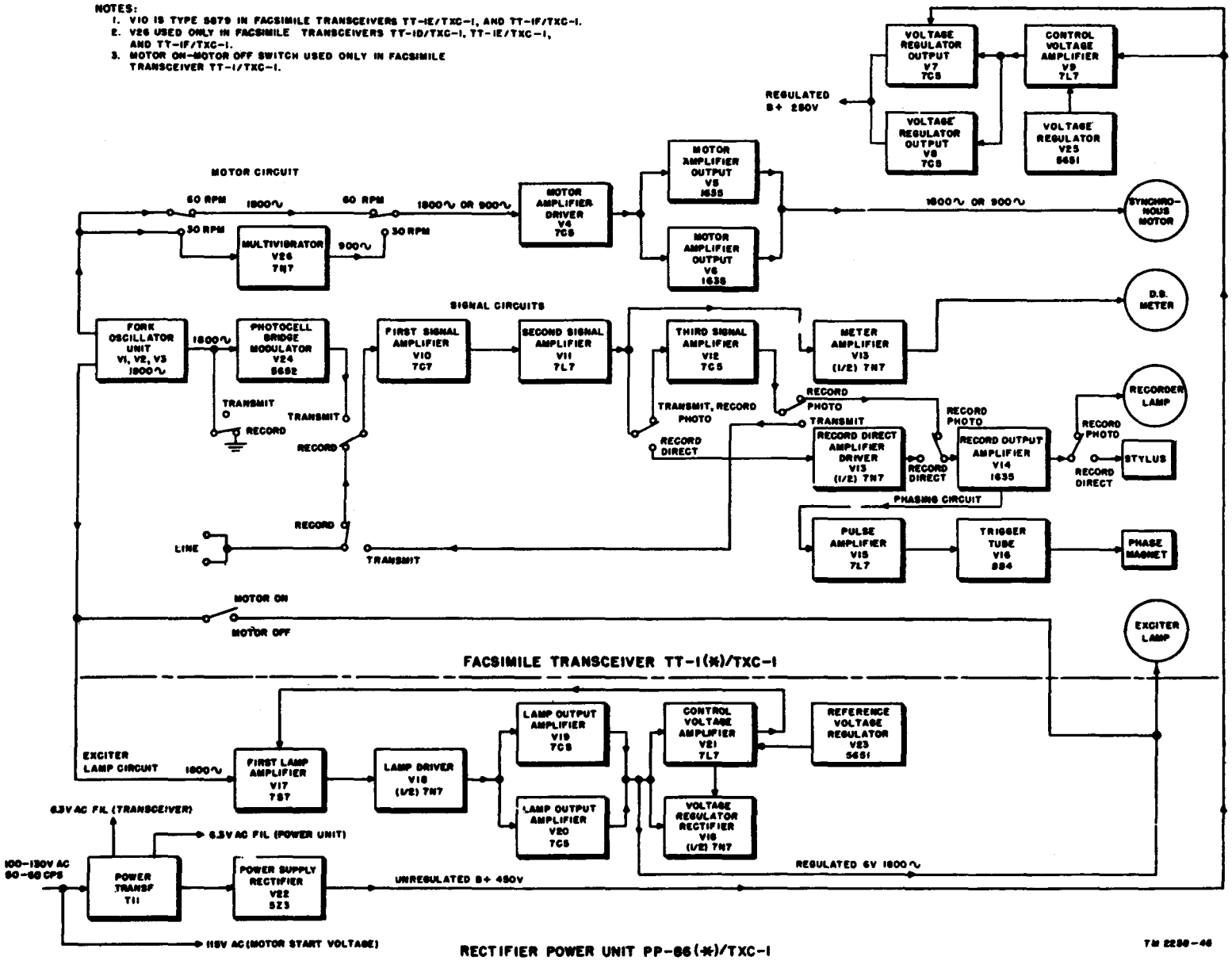
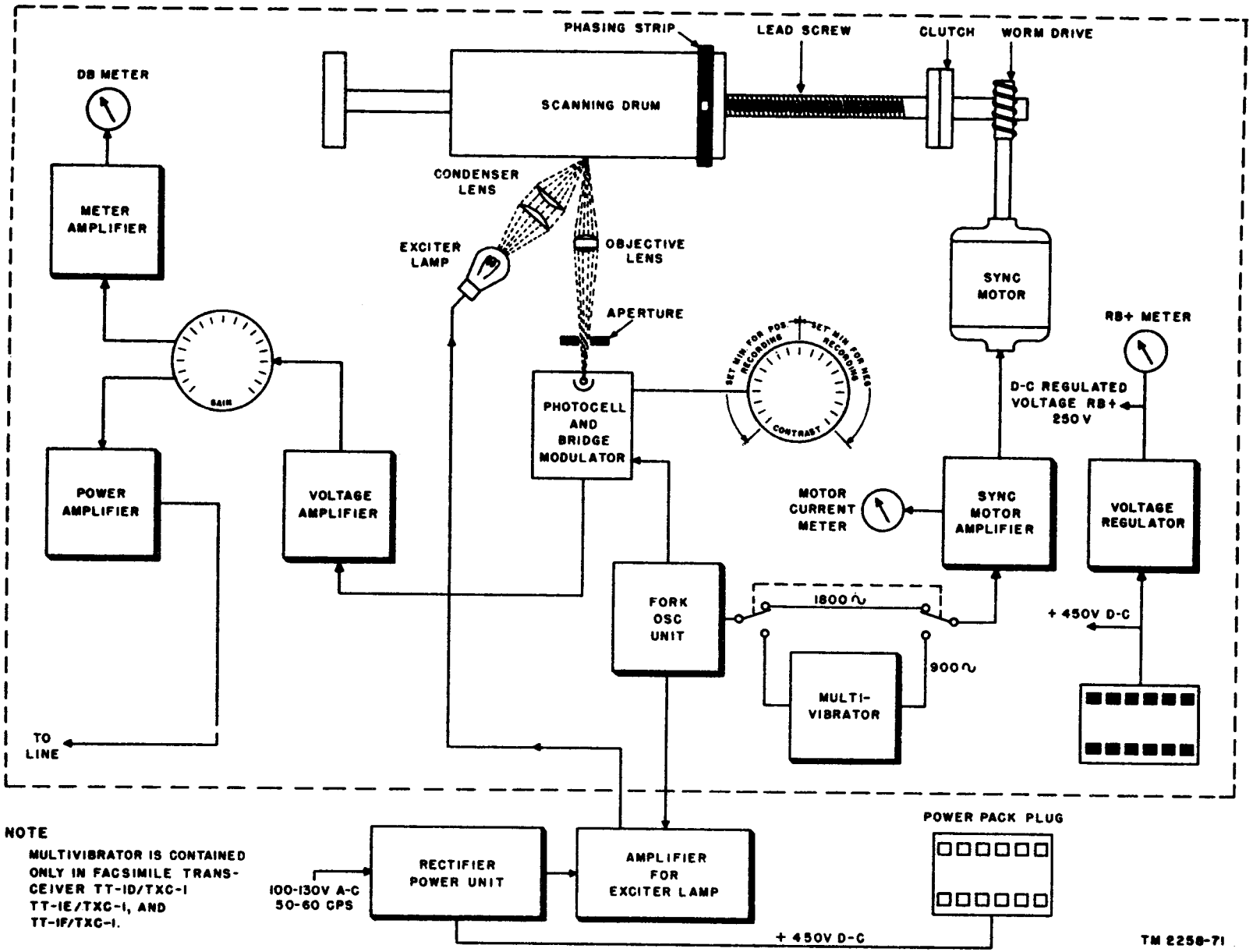


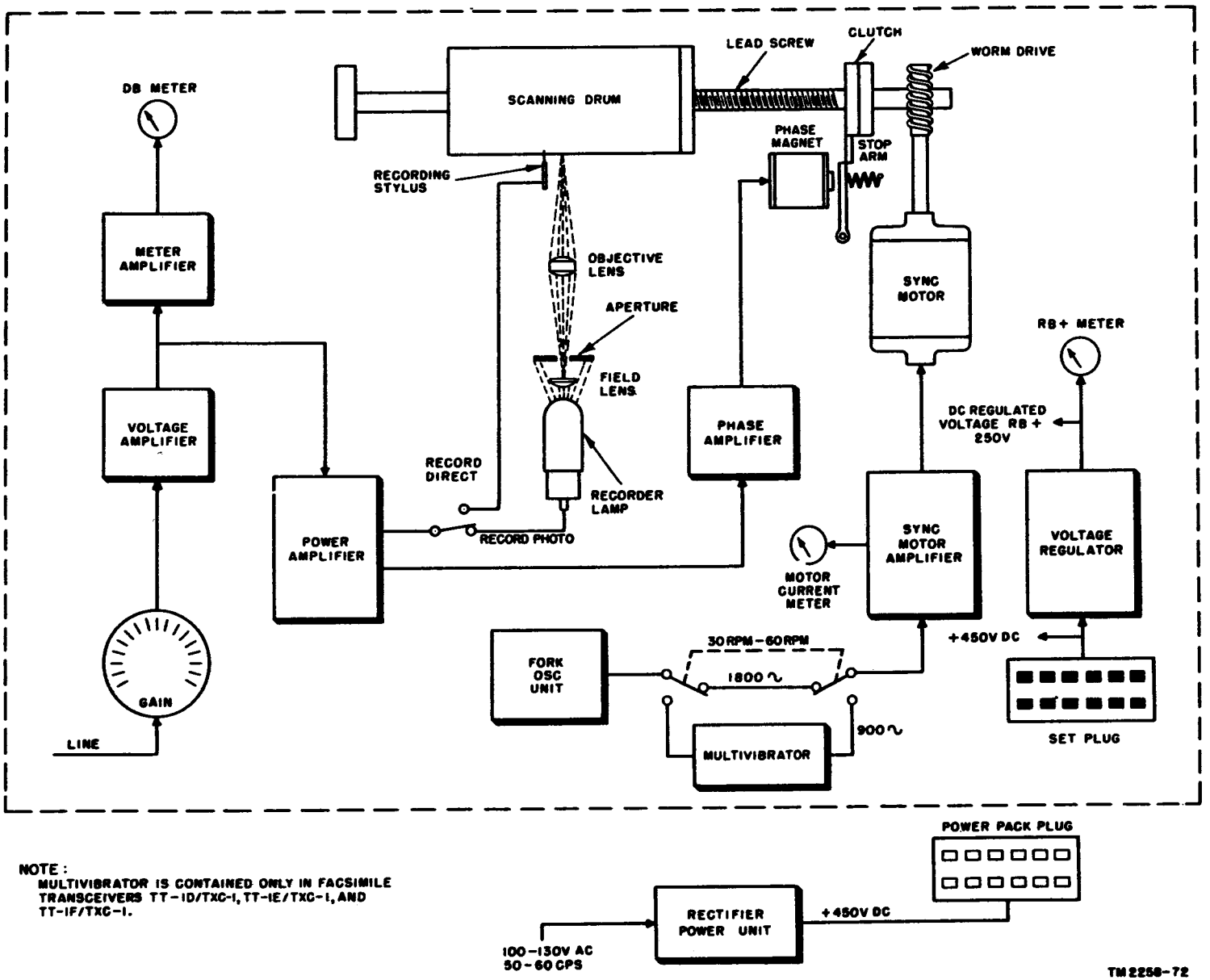
Figure 30. Facsimile Set AN/TXC-1(*), block diagram.



NOTE

MULTIVIBRATOR IS CONTAINED ONLY IN FACSIMILE TRANSCEIVER TT-ID/TXC-1 TT-IE/TXC-1, AND TT-IF/TXC-1.

Figure 31. Facsimile Transceiver TT-1(*)/TXC-1, transmitting block diagram.



NOTE:
MULTIVIBRATOR IS CONTAINED ONLY IN FACSIMILE TRANSCEIVERS TT-1D/TXC-1, TT-1E/TXC-1, AND TT-1F/TXC-1.

Figure 38. Facsimile Transceiver TT-1(*)/TXC-1, receiving block diagram.

aperture to the photocell and bridge modulator where varying light intensities are converted into varying electrical signals. These signals amplitude modulate the 1,800-cycle carrier signal supplied from the fork oscillator unit. This modulated signal is amplified in the voltage amplifier. The level is established at this point by the GAIN control and is indicated on the DB METER. The signal is boosted further by the power amplifier before going out on the line. The fork oscillator unit, in addition to furnishing the carrier signal to the photocell bridge modulator, supplies an 1,800-cycle voltage which is amplified in the exciter lamp amplifier circuit of Rectifier Power Unit PP-86(*)/TXC-1. The output of this circuit supplies 6 volts at 1,800 cycles to the exciter lamp to maintain it at a constant brilliancy. Another portion of the 1,800-cycle fork oscillator output is amplified in the motor amplifier circuit for operation of the synchronous motor which drives the drum at a constant speed. The voltage regulator supplies a regulated +250 volts to the critical transceiver circuits.

d. Receiving. Functions of the various stages in the receiving transceiver are shown in figure 32. The signal from the line is set to the proper operating level by the GAIN control, then amplified in the voltage amplifier and the power amplifier. The DB METER, driven by the meter amplifier, indicates the relative level of the signal being used for recording. The power amplifier drives either the recorder lamp for photographic recording, or the recording stylus for direct recording. Another connection from the power amplifier sends phasing pulses to the phase amplifier circuit, which operates the phase magnet and clutch during the phasing process just before each picture transmission. The fork oscillator unit serves a single purpose on receiving. It generates an 1,800-cycle signal which is amplified to operate the synchronous motor at the same speed as the motor in the transmitting transceiver.

e. Multivibrator. Facsimile Transceivers TT-1D/TXC-1, TT-1E/TXC-1, and TT-1F/TXC-1 contain a multivibrator circuit which is used only when operation at half-normal speed (30 drum rpm) is desired. The multivibrator is switched into the motor circuit by operation of motor speed control switch (30RPM-60RPM) S4. For half-speed operation the 1,800-cycle signal voltage from the fork oscillator unit locks in the 900-cycle multivibrator, the output of which is applied to the synchronous winding of the motor through the synchronous motor amplifier. Motor current is indicated on the MOTOR CURRENT meter. Application of an external signal voltage in the MOTOR JACK permits operation of the recording drum at any speed between 30 and 100 rpm.

j. Talk-Back Circuit (fig. 33). The talk-back circuit is included in all models of the transceiver except Facsimile Transceiver TT-1/TXC-1, and is energized when the selector switch is at STANDBY, For normal reception of voice over this circuit, the STANDBY-MON-TALK switch is at MON (if the motor is to be in operation) or at STANDBY (if the motor is not to be in operation). In either of these positions, the signal from the

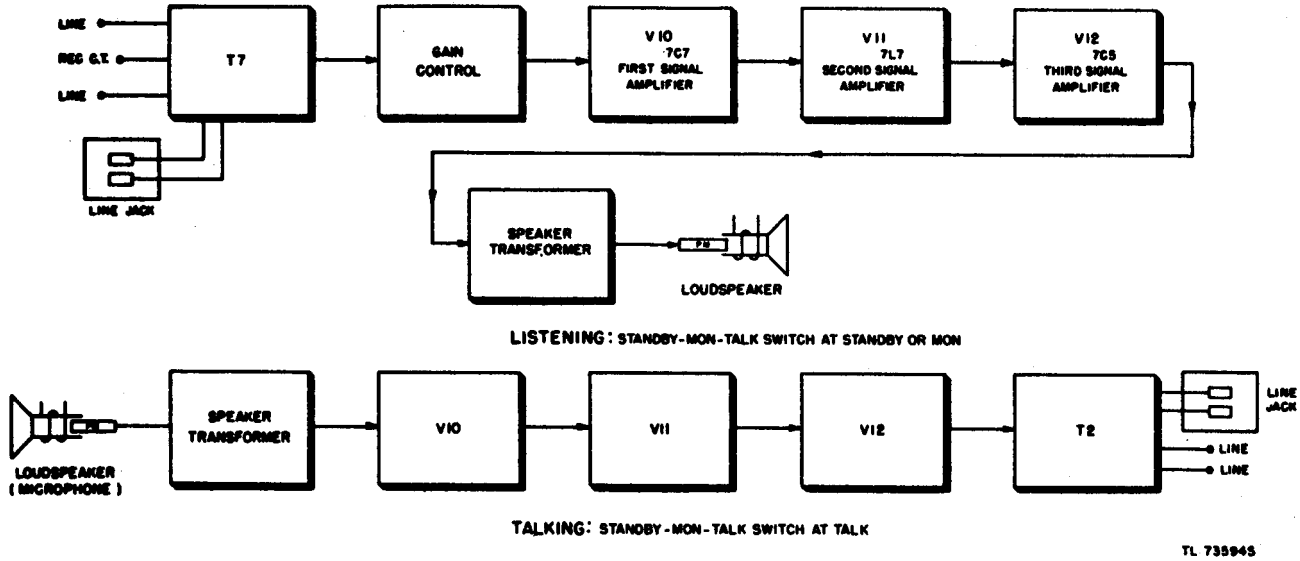


Figure 33. Talk-back circuit, block diagram.

line is amplified by three audio stages, V10, V11, and V12, before it reaches the loudspeaker. The GAIN control is in the voice circuit. When the STANDBY-MON-TALK switch is at TALK, the loudspeaker becomes a microphone, and the signal is amplified by V10, V11, and V12 before it is fed to the line.

67. Stage Names

Facsimile Sets AN/TXC-1, -1A, and -1B use 25 electron tubes, 18 of which are located in the facsimile transceiver and 7 of which are located in the rectifier power unit. Facsimile Sets AN/TXC-1C and -1D use 26 tubes, 19 of which are located in the facsimile transceiver and 7 of which are located in the rectifier power unit. The following chart shows the stage number, type tube used, and the functional name of the stage.

a. Facsimile Transceiver TT-1(*)/TXC-1.

(1) *Fork oscillator unit (unsealed).*

Note. Unsealed fork oscillator units are used only in Facsimile Transceivers TT-1/TXC-1 and TT-1A/TXC-1, up to serial number 105.

Ref symbol	Stage name	Facsimile transceiver					
		TT-1/TXC-1	TT-1A/TXC-1	TT-1B/TXC-1	TT-1C/TXC-1	TT-1D/TXC-1	TT-1E/TXC-1 and TT-1F/TXC-1
V1	Fork input a	7L7	7L7	----------	----------	----------	----------
V2	Fork driver	7C5	7C5	----------	----------	----------	----------
V3	Motor amplifier buffer Modulator buffer	7N7	7N7	----------	----------	----------	----------

(2) *Fork oscillator unit (sealed).*

Ref symbol	Stage name	Facsimile transceiver					
		TT-1/TXC-1	TT-1A/TXC-1	TT-1B/TXC-1	TT-1C/TXC-1	TT-1D/TXC-1	TT-1E/TXC-1 and TT-1F/TXC-1
V1	Second fork amplifier	7L7	7L7	7L7	7L7	7L7	7L7
V2	Fork input amplifier Fork driver	7N7	7N7	7N7	7N7	7N7	7N7
V3	Motor amplifier buffer Modulator buffer	7N7	7N7	7N7	7N7	7N7	7N7

(3) *Motor circuit.*

Ref symbol	Stage name	Facsimile transceiver					
		TT-1/TXC-1	TT-1A/TXC-1	TT-1B/TXC-1	TT-1C/TXC-1	TT-1D/TXC-1	TT-1E/TXC-1 and TT-1F/TXC-1
V4	Motor amplifier driver	7C5	7C5	7C5	7C5	7C5	7C5
V5, V6	Motor amplifier output	6AC5GT/G	6AC5GT/G	1635	1635	1635	1635
V26	Multivibrator	----------	----------	----------	----------	7N7	7N7

(4) *B+ voltage regulator.*

Ref symbol	Stage name	Facsimile transceiver					
		TT-1/TXC-1	TT-1A/TXC-1	TT-1B/TXC-1	TT-1C/TXC-1	TT-1D/TXC-1	TT-1E/TXC-1 and TT-1F/TXC-1
V7, V8	Voltage regulator output	7C5	7C5	7C5	7C5	7C5	7C5
V9	Control voltage amplifier	7L7	7L7	7L7	7L7	7L7	7L7
V25	Reference voltage regulator	1B46	1B46	5651	5651	5651	5651

(5) *Signal circuit.*

Ref symbol	Stage name	Facsimile transceiver					
		TT-1/TXC-1	TT-1A/TXC-1	TT-1B/TXC-1	TT-1C/TXC-1	TT-1D/TXC-1	TT-1E/TXC-1 and TT-1F/TXC-1
V24	Photocell	1645	1645	1645	1645	5652	5652
V10	First signal amplifier	7C7	7C7	7C7	7C7	7C7	5879
V11	Second signal amplifier	7L7	7L7	7L7	7L7	7L7	7L7
V12	Third signal amplifier	7C5	7C5	7C5	7C5	7C5	7C5
V13	Record direct amplifier driver / Meter amplifier	7N7	7N7	7N7	7N7	7N7	7N7
V14	Record output amplifier	6AC5GT/G	6AC5GT/G	1635	1635	1635	1635

(6) *Phasing circuit.*

Ref symbol	Stage name	Facsimile transceiver					
		TT-1/TXC-1	TT-1A/TXC-1	TT-1B/TXC-1	TT-1C/TXC-	TT-1D/TXC-1	TT-1E/TXC-1 and TT-1F/TXC-1
V15	Pulse amplifier	7L7	7L7	7L7	7L7	7L7	7L7
V16	Trigger tube	884	884	884	884	884	884

b. Rectifier Power Unit PP-86/TXC-1.*

(1) Exciter lamp supply.

Ref symbol	Stage name	Rectifier power unit			
		PP-86/TXC-1	PP-86A/TXC-1	PP-86B/TXC-1	PP-86E/TXC-1
V17	First lamp amplifier	7S7	7S7	7S7	7S7
V18	Lamp driver / Voltage regulator rectifier	7N7	7N7	7N7	7N7
V19, V20	Lamp output amplifier	7C5	7C5	7C5	7C5
V21	Control voltage amplifier	7L7	7L7	7L7	7L7
V23	Reference voltage regulator	1B47	5651	5651	5651

(2) *High-voltage power supply.*

Ref symbol	Stage name	Rectifier power unit			
		PP-86/TXC-1	PP-86A/TXC-1	PP-86B/TXC-1	PP-86E/TXC-1
V22	Power supply rectifier	5Z3	5Z3	5Z3	5Z3

68. Partial Schematic Diagrams

The partial schematic diagrams that show components of individual stages of the facsimile transceiver and rectifier power unit are applicable to all models of equipment unless otherwise noted. Slight changes in resistor and capacitor values were made in later models of equipment to conform with American War Standards values. These slight differences in values are not significant, however, because the changes in most cases are within the tolerance of the components. For exact component values, refer to the complete schematic diagrams (figs. 163 through 169).

Section II. FACSIMILE TRANSCEIVER TT-1(*)/TXC-1

69. Block Diagram of Unsealed Fork Oscillator Unit

(fig. 34)

The fork oscillator unit generates a highly stable 1,800-cycle audio signal to supply the photocell bridge modulator circuit, the motor amplifier circuit, and the exciter lamp circuit. The unsealed unit, used in Facsimile Transceiver TT-1/TXC-1 only (serial numbers up to 105 on order No. 2695-MPD-45), consists of three stages: a fork input amplifier (V1), a fork driver (V2), and a dual tube (V3) whose sections serve as output buffers (figs. 35 through 37). All three stages are supplied regulated B+ voltage. The sealed unit is described in paragraph 70.

a. Tuning Fork. The frequency-determining device is a bimetallic tuning fork with a natural period of vibration of 1,800 cps. The fork is kept in vibration by a drive coil which is fed an 1,800-cycle signal of constant amplitude from the fork driver stage. A second coil, a pick-up coil, is coupled to the vibrating fork so that the fork vibrations generate an 1,800-cycle ac in the coil. This coil feeds the grid of the fork input amplifier stage through a transformer. The fork thus becomes a feedback unit that controls the frequency in the oscillator circuit composed of the fork, V1, and V2.

b. Fork Input Amplifier (fig. 35). This stage, V1 using a type 7L7 tube, amplifies the small oscillations from the tuning fork and drives tube V2, the fork driver, and also the two output buffer sections of V3. Energy from the fork pick-up coil is coupled through transformer T4 directly to the grid of V1 (pin 6). Transformer T4 steps up the voltage from approximately .4 volt to 1.0 volt. The tube is biased by the flow of plate current through cathode resistor R18 which is bypassed by C15. Screen and plate voltage is applied through screen dropping resistor R19 and plate load resistor R20 from the regulated +250-volt supply. The screen is bypassed to cathode by C16 to improve the stability of amplification in this stage. Sine-wave voltage developed across R20 is coupled from the plate through capacitor C18 to the grid of V2 (pin 6) and through C17 to the output buffers. C20, a bypass capacitor across the fork drive coil, suppresses harmonica of the 1,800-cycle signal.

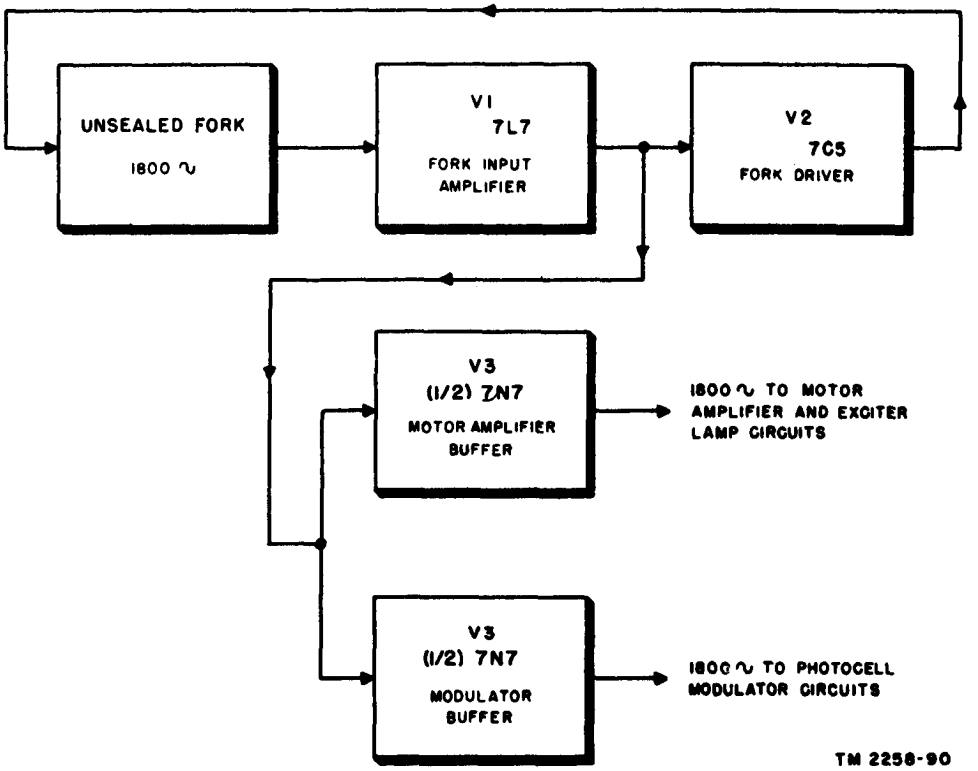


Figure 34. Unsealed fork oscillator unit, block diagram.

c. Fork Driver (fig 36). This stage (V2), using a type 7C5 tube, amplifies the output of V1 and supplies feedback energy to the drive coil which keeps the fork vibrating. One of the requirements for frequency stability is 8 constant output from this stage to the fork drive coil. The grid is driven so hard that variations in amplitude at the input have practically no effect on the output. The output from the plate of V1 is coupled to the grid of V2 (pin 6) through C18, with R23 serving as the grid return. Cathode resistor R24 and variable resistor R25 are left unbypaseed to provide degenerative feedback in this stage, giving a stabilizing effect on the output. Resistor R25 is variable to permit minor adjustments in frequency of the fork oscillator to compensate for extreme variations in temperature, or changes in value of circuit components. The plate and screen are connected together for triode operation. Plate voltage is applied through plate load resistor R26 from the regulated +250-volt supply. The output voltage developed across R26 is coupled back to the fork drive coil through capacitor C19.

d. Fork Output Buffer (fig. 37). This stage (V3), using a type 7N7 dual triode, consists of two buffer amplifiers fed by the fork input amplifier V1, and supplies an 1,800-cycle signal to the motor amplifier stage V4, the exciter lamp amplifier circuit in Power Supply PP-86(*)/TXC-1, and the photocell bridge modulator circuit (fig. 48). The buffer action prevents load variations from affecting the fork oscillator.

(1) *Motor amplifier buffer.* Pins 2, 3, and 4 of tube V3 comprise the motor amplifier buffer. The grid receives 1,800-cycle energy from the plate of V1 through coupling capacitor C17 and limiting resistor R21. Resistor R27 serves as the grid return and the grid is bypassed for high frequencies by C21. Cathode resistor R28 is left unbypassed to provide degeneration. Plate voltage is applied to pin 3 from the regulated +250-volt supply through plate load resistor R23. Output from the plate is coupled through C23 to the motor amplifier driver stage (V4) via the MOTOR JACK. Capacitor C23 also couples 1,800-cycle energy to the exciter lamp amplifier circuit in Rectifier Power Unit PP-86(*)/TXC-1 through pin 9 of plug P1 . A connection from C23 to section 3 of selector switch S1 short-circuits the 1,800-cycle supply to the motor circuit and the exciter lamp circuit when the switch is in the STAND-BY position.

(2) *Modulutor buffer.* Pins 5, 6, and 7 of tube V3 comprise the modulator buffer. The grid also receives 1,800-cycle energy

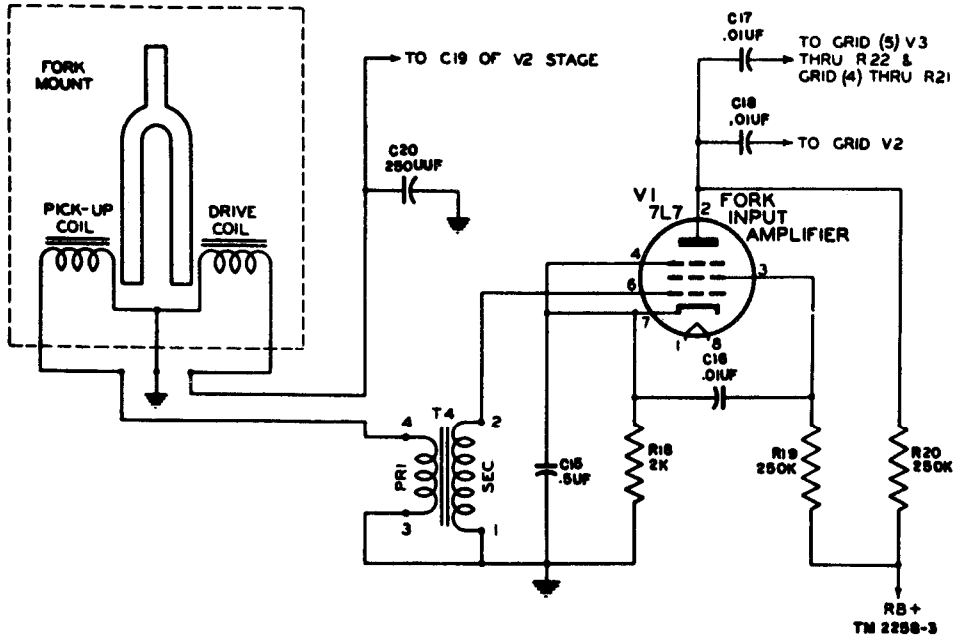


Figure 35. Fork input amplifier, unsealed fork oscillator unit.

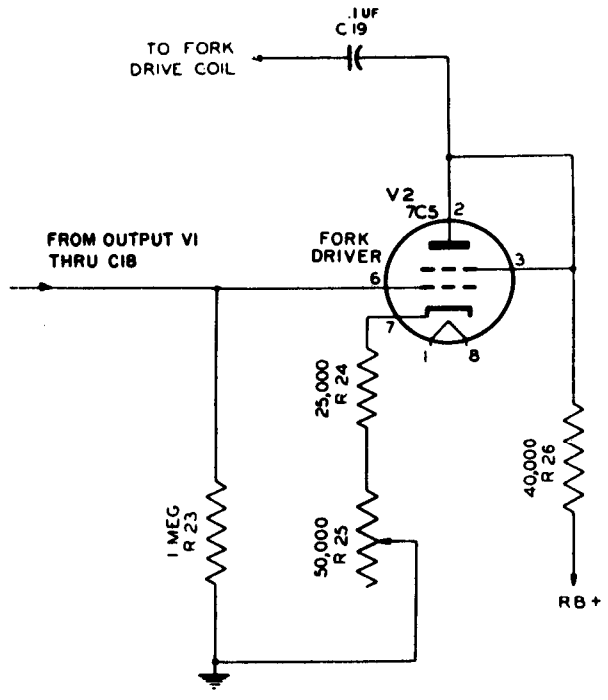


Figure 36. Fork driver, unsealed fork oscillator unit.

from the plate of V1 through coupling capacitor C17 and limiting resistor R22. Resistor R30 is the grid resistor, and the grid is bypassed for high frequencies by C22. Plate voltage is applied to pin 6 from the regulated +250-volt supply through plate load resistor R31. Output from the plate is applied to the photocell bridge modulator circuit through blocking capacitor C24 and output coupling transformer T5. The output coupling circuit includes a low-pass filter which eliminates harmonics of the 1,800-cycle frequency and delivers a sine-wave output to the modulator. Components of this low-pass filter include hf shunt capacitors C25 and C26, an audio choke, a capacitor, and an output transformer. A connection to section 2 of selector switch S1 short-circuits the input of T5, removing 1,800-cycle energy from the photocell circuit when the selector switch is in the STANDBY, RECORD PHOTO, or RECORD DIRECT position.

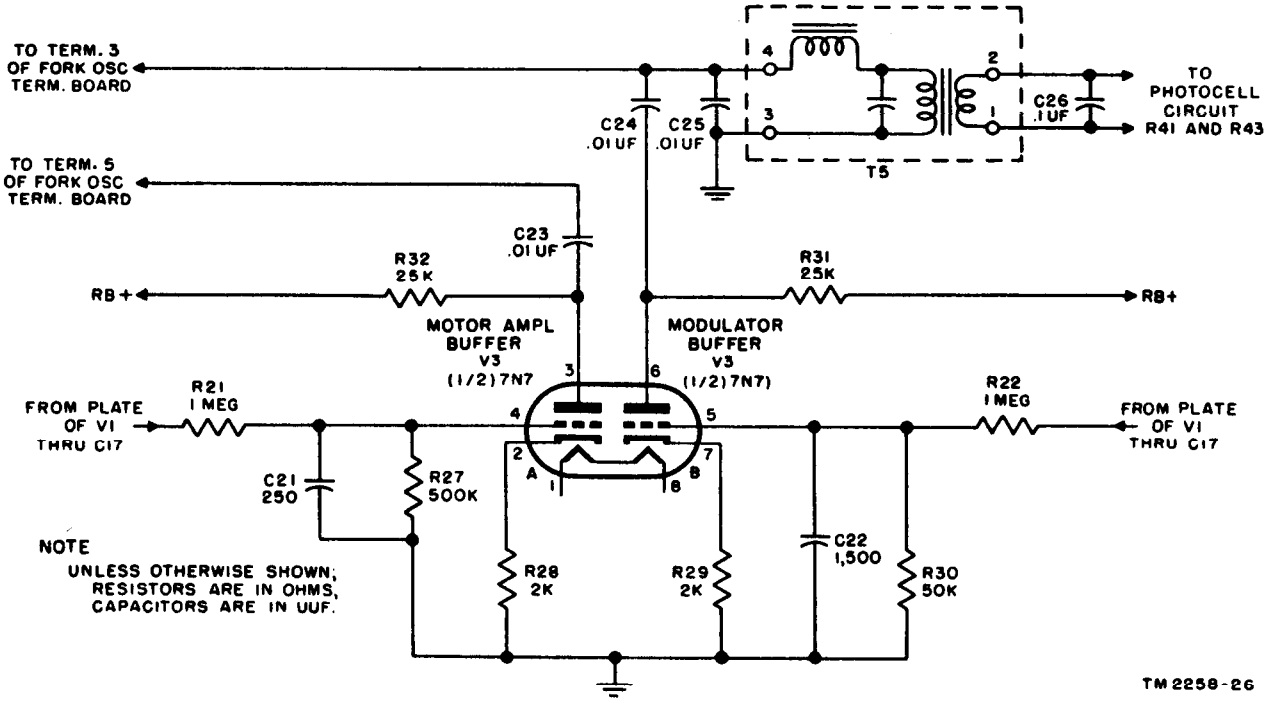


Figure 37. Output buffers, unsealed fork oscillator unit.

70. Scaled Fork Oscillator Unit

The sealed fork oscillator unit, used in Facsimile Sets AN/TXC-1 above serial number 105 on Order No. 2695-MPD-45 and in all Facsimile Sets AN/TXC-1A, -1B, -1C, and -1D, is similar in purpose and performance to the unsealed unit described in paragraph 69. However, the stability of this tuning fork is improved by using a temperature-compensated, bimetallic fork which is vacuum sealed to minimize the effects of atmospheric and barometric changes. The frequency must be maintained with extreme accuracy; a slight variation will cause a change in motor speed and a loss of synchronization between transmitting and receiving machines. A deviation in frequency of 1 cycle in 10 seconds will cause a skew of more than 1 inch in the received copy. The sealed fork oscillator unit consists of three stages: a fork input amplifier and driver, another fork amplifier, and a dual output buffer. All stages are supplied from the regulated +250-volt source.

a. Block Diagram. Figure 38 shows, in block diagram form, the signal paths in the sealed fork oscillator unit. One-half of V2 picks up the weak signal from the fork and amplifies it enough to drive V1 so that the output of V1 is constant despite minor variations in input. The constant level output of V1 is amplified in the other half of V2, the output of which feeds the drive coils of the tuning fork. Part of the output of V1 is impressed on V3, one section of which feeds the motor amplifier and exciter lamp amplifier circuit, and the other section of which feeds the photocell bridge modulator circuit. A complete schematic diagram of the sealed fork oscillator unit is shown in figure 39.

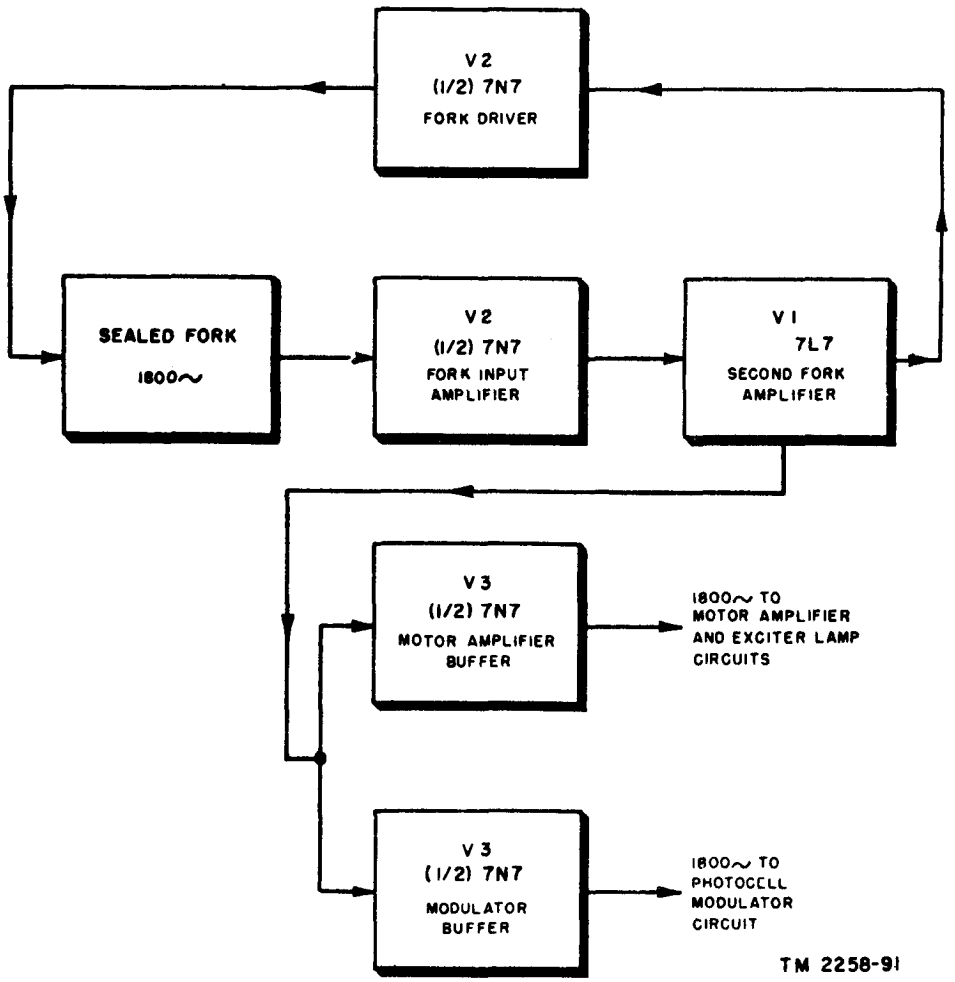


Figure 38. Sealed fork oscillator unit, block diagram.

b. Fork Input Amplifier Fork Driver (fig. 39). Dual triode tube V2 (7N7) serves as the fork input amplifier and fork driver.

(1) *Fork input amplifier.* Pins 2, 3, and 4 comprise the fork input amplifier which is fed 1,800-cycle energy generated in the pick-up coil by the vibrating fork. Resistor R302 is the unbypassed cathode resistor. Plate voltage is applied to pin 3 from the regulated +250-volt supply through plate load resistor R301. The output developed across the resistor is coupled to the grid (pin 6) of the second fork amplifier V1 (7L7) through coupling capacitor C304.

(2) *Fork driver.* Pins 5, 6, and 7 comprise the fork driver. Input to the grid (pin 5) is received from the plate of V1 through coupling capacitor C303 and series resistor R305. Limiting resistor R305 and grid resistor R306 serve, as a voltage divider for the input to this section of V2, Regulated +250 volts is supplied through plate load resistor R307. Output from the plate is coupled through C301 to the drive coil which keeps the fork oscillating. The cathode circuit consists of two unbypassed resistors: fixed resistor R303 and variable resistor R304. Adjust R304 to compensate for minor changes in the frequency of the fork.

c. Second Fork Amplifier (fig. 39). Second fork amplifier V1 (7L7) is an amplifying link in the oscillator circuit composed of the fork, the input amplifier, the second fork amplifier, and the fork driver. The grid (pin 6) is fed from the plate (pin 3) of V2 through coupling capacitor C304. The grid voltage is developed across resistor R313. Cathode resistor R310 is bypassed by C306. Screen voltage is supplied through dropping resistor R311 and the screen is bypassed to cathode by C305. The plate load resistor is R312 and the 1,800-cycle output from the plate (pin 2) is coupled to the fork driver through C303 and limiting resistor R305, Part of the output of V1 is applied to the dual buffer output stage V3 through limiting resistor R314.

d. Fork Ooutput Amplifier (fig. 39). The fork output stage V3 is a 7N7 dual triode tube. It consists of two buffer amplifiers, fed by second fork amplifier V1. This tube supplies an 1,800-cycle signal to motor amplifier stage V4, the exciter lamp amplifier circuit, and the photoed bridge modulator circuit.

(1) *Motor amplifier buffer.* Triode section 5, 6, and 7 of V3 is the motor amplifier buffer. Its grid receives 1,800-cycle energy from the plate circuit of V1 through coupling capacitor C303 and limiting resistor R314. The grid resistor is a combination of R315 and R318, with the grid of the second section of V3 fed from a tap between these resistors. Capacitor C310 is an hf bypass for the grid. Resistor R316 is the unbypassed cathode resistor. The signal at the plate developed across load resistor R308 is coupled through C302 to motor amplifier stage V4 via the MOTOR JACK and control switch S4, and also to the exciter lamp amplifier circuit of Rectifier Power Unit PP-86(*)/TXC-1.

Note. In Facsimile Transceivers TT-1D/TXC-1, TT-1E/TXC-1, and TT-1F/TXC-1, the motor amplifier buffer output is coupled to motor amplifier stage V4 through the motor speed control switch S4 permitting selection of either the 900-cycle output of the multivibrator (half-speed operation), or the 1,800-cycle fork unit output. The selected output is applied to the grid of V4 through MOTOR JACK J6. In Facsimile Tranceiver TT-1B/TXC-1, a connection to IIIR of selector switch S1C short-circuits the 1,800-cycle motor circuit and exciter lamp supply when the selector switch and the STANDBY-MON-TALK switch are both at STANDBY. In Facsimile Transceiver TT-1C/TXC-1, a connection to the front of IIIR of selector switch S1C opens the B+ circuit in the motor lead, and the connection to the back of contact IIIR of the selector switch short-circuits the 1,800-cycle exciter lamp circuit supply when the selector and STANDBY-MON-TALK switches are at STANDBY. (Refer to figure 167.) In Facsimile Transceivers TT-1D/TXC-1, TT-1E/TXC, and TT-1F/TXC-1 the motor is stopped by short-circuiting to ground the grid of motor amplifier tube V4 through the contacts of the STANDBY-MON-TALK switch and section 6 of the selector switch when both switches are operated at the STANDBY position. The exciter lamp supply is short-circuited to ground through section 2 with the selector switch at STANDBY.

(2) *Modulator buffer.* Triode section 2, 3, and 4 of V3 is the modulator buffer. Its grid (pin 4) receives the 1,800-cycle energy developed across R318, as explained in (1) above. Resistor R317 is the unbypassed cathode resistor. The plate

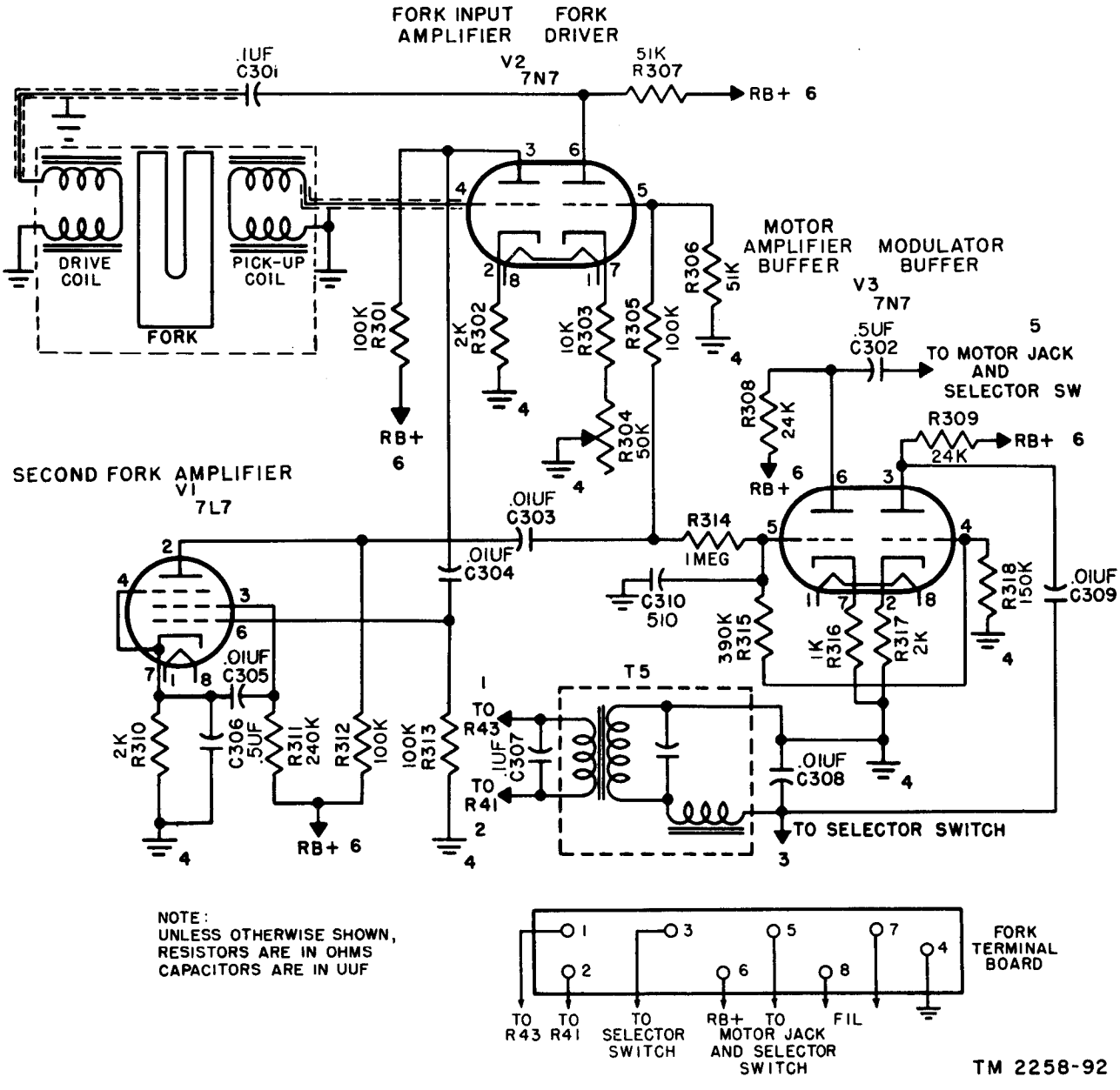


Figure 39. Sealed fork oscillator unit, schematic diagram.

circuit energy developed across load resistor R309 is coupled through C309 to the low-pass filter and output transformer T5. Capacitor C308 across the input and C307 across the output and T5 form part of a filter network which reduces the hf components of the signal. A connection to section IIR of the selector switch short-circuits the input and output to T5. This connection removes the 1,800-cycle energy from the photocell circuit when the selector switch is in the RECORD PHOTO or the RECORD DIRECT position in Facsimile Transceiver TT-1/TXC-1 (also in the STAND-BY position in Facsimile Transceivers TT-1A/TXC-1 through TT-F/TXC-1).

71. Motor Amplifier Driver and Output Stages (V4, V5, and V6)

(figs. 40-46)

Stages V4, V5, and V6 amplify the 1,800-cycle signal supplied by the fork oscillator unit, and furnish ac power to operate the synchronous

motor. Input to the motor amplifier stage V4 is approximately 25 volts. The voltage across the motor, however, may be as high as 1,000 volts.

a. Motor Amplifier Driver.

(1) *Facsimile Transceivers TT-1/TXC-1 and TT-1A/TXC-1* (fig. 40). The 1,800-cycle signal of the fork oscillator unit is applied to the grid of the motor amplifier driver stage V4 (7C5). This signal is applied through terminal 5 of the fork oscillator terminal board through MOTOR JACK J6 and is applied to a voltage divider consisting of R34, R35, and R36. Normally, the junction between resistors R35 and R36 is shorted to ground so that R36 is out of the circuit. The voltage across R35 is applied to the tube control grid (pin 6). During the phasing operation, however, R36 becomes part of the voltage divider, and the voltage to the grid of tube V4 is increased. Increasing the input to V4 results in increasing the drive on parallel motor amplifier tubes V5 and V6, furnishing additional power to the synchronous motor. During the phasing operation, the motor requires additional power because of the additional load created by friction in the clutch mechanism. During normal operation, with the PHASE switch released, cathode current of V4 flows through the phasing magnet coil associated with trigger tube V16 and also through the series resistor combination, R66 and R67 (stage V13), which is in parallel with this coil. (Refer to figures 48 and 49 and the over-all schematic diagrams of Facsimile Transceivers TT-1/TXC-1 and TT-1A/TXC-1 (figs. 163 and 164).) The flow of current through the coil holds the armature against the phasing magnet so that it does not actuate the clutch mechanism used in the phasing operation. The flow of current through R67 adds to the bias of tube V13, which requires bias beyond the cut-off value. During the phasing operation, the phasing magnet is disconnected from the cathode circuit of V4, and the armature is released. To compensate for the removal of the phasing magnet coil from the cathode circuit, resistor R40 is connected in parallel with the series combination, R66 and R67, during the phasing operation. Capacitor C27 is the cathode bypass capacitor for tube V4. Screen and plate voltage is applied from the +450-volt supply through screen

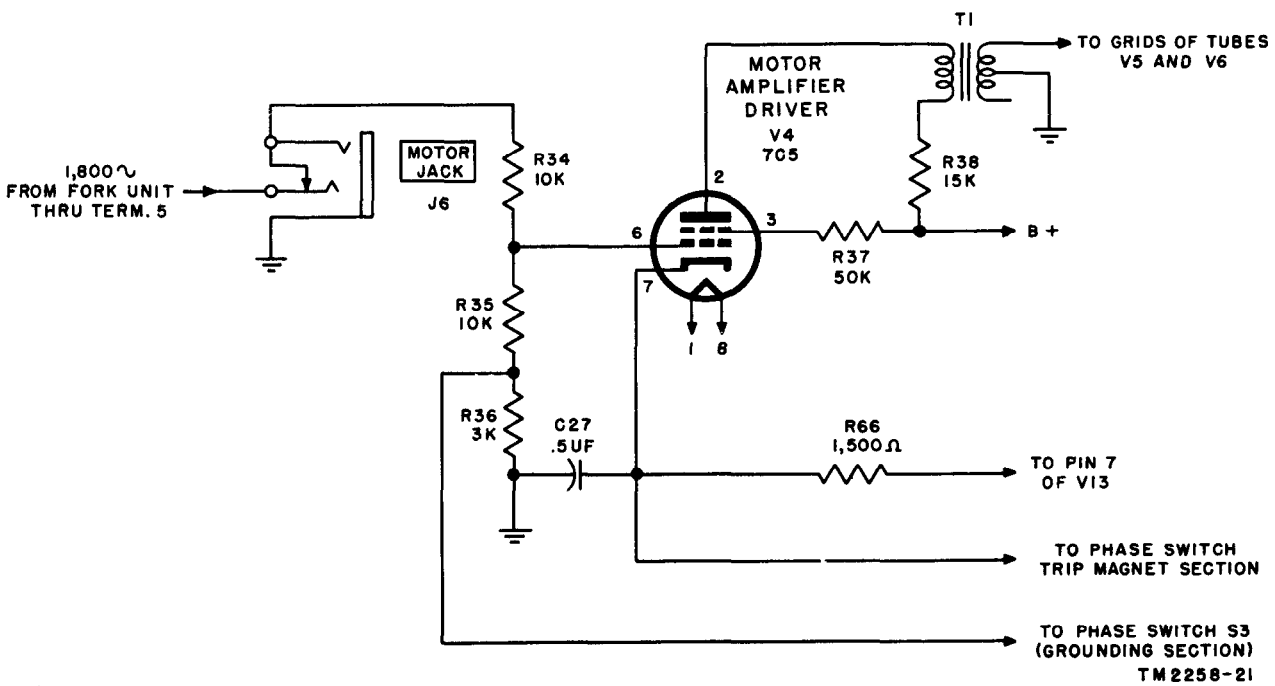


Figure 40. Motor amplifier driver, facsimile transceivers, TT-1/TXC-1 and TT-1A/TXC-1.

dropping resistor R37 and through dropping resistor R38 and the primary winding of class B driver transformer T1. The screen is not bypassed to ground.

(2) *Facsimile Transceivers TT-1B/TXC-1 and TT-1C/TXC-1* (fig. 41). The motor amplifier driver circuit of Facsimile Transceiver TT-1B/TXC-1 or TT-1C/TXC-1 is similar to that described in (1) above for earlier models of the equipment, except that the grid and cathode circuits of tubes V4 have been redesigned. Potentiometer R93 has been added to the grid circuit of V4 so that proper adjustment may be made of the input to V4 which, in turn, affects the drive of stages V5 and V6. Resistor R93, located on MOTOR CURRENT meter M2, is adjusted for proper motor current reading on this meter. Cathode current of V4 in Facsimile Transceiver TT-1B/TXC-1 or TT-1C/TXC-1 flows through the series combination of R66, control R97, and R67 of V13 in parallel with the phasing magnet coil. Refer to paragraph 75 for details of V13 cathode circuit.

Note. The value of R66 is changed from 1,500 ohms to 750 ohms in the motor amplifier driver stage of Facsimile Transceivers TT-1B/TXC-1 and TT-1C/TXC-1 to compensate for the addition of R97 to the cathode circuit of V13.

(3) *Facsimile Transceivers TT-1D/TXC-1, TT-1E/TXC-1 and TT-1F/TXC-1* (fig. 42). The motor amplifier driver circuit of Facsimile Transceivers TT-1D/TXC-1, TT-1E/TXC-1, and TT-1F/TXC-1 (fig. 42) is the same as that of the 1B and 1C model transceivers, except for the following changes which allow for a 900-cps signal at half-speed operation:

(a) Speed control switch (30RPM-60RPM), S4, in series with the 1,800-cps fork output to V4, and a multivibrator-t ype oscillator have been added. In the 60RPM position, the 1,800-cps fork output is coupled directly to the grid of V4 through MOTOR JACK J6. For half-speed operation of the scanning drum (30RPM), the 1,800-cps fork signal locks in the 900-cps multivibrator (V26, 7N7), the output of which is applied to the grid of V4 through MOTOR JACK J6.

(b) Capacitor C62 has been added to the plate circuit of V4 as an ac bypass.

(c) Capacitor C61 has been added between R34 and R93 to ground to improve the 900-cps waveshape. To stop the motor during standby periods, the grid of V4 (pin 6) is short-circuited to ground

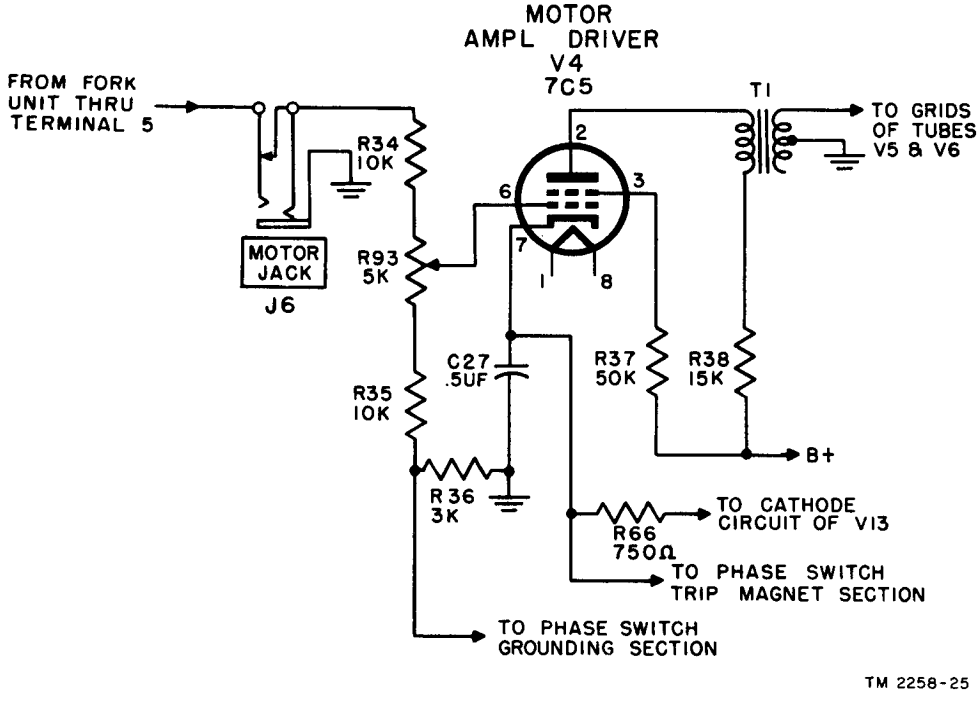


Figure 41. Motor amplifier driver, Facsimile Transceivers TT-1B/TXC-1 and TT-1C/TXC-1.

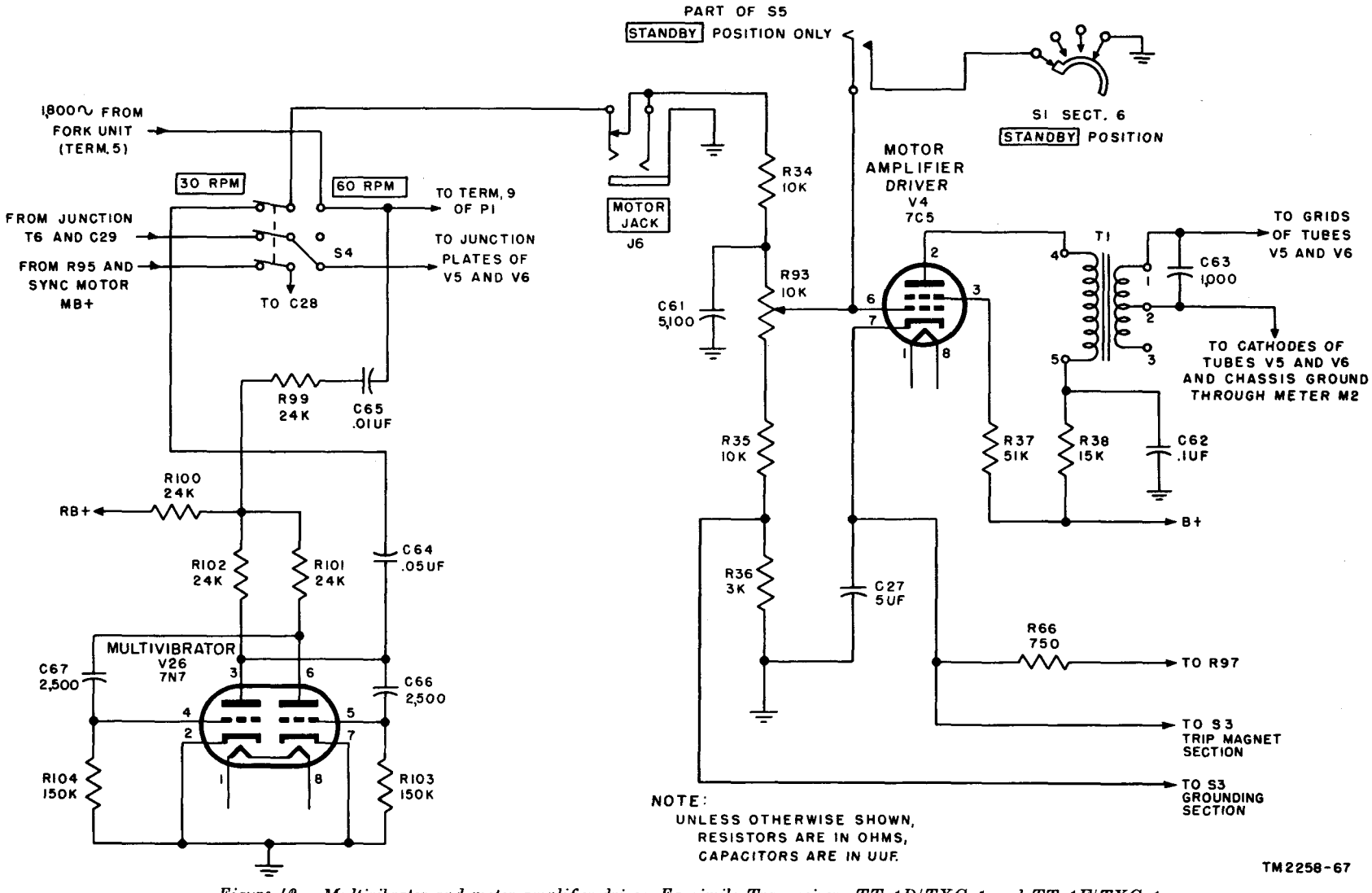


Figure 42. Multivibrator and motor amplifier driver, Facsimile Transceivers TT–1D/TXC–1 and TT–1E/TXC–1.

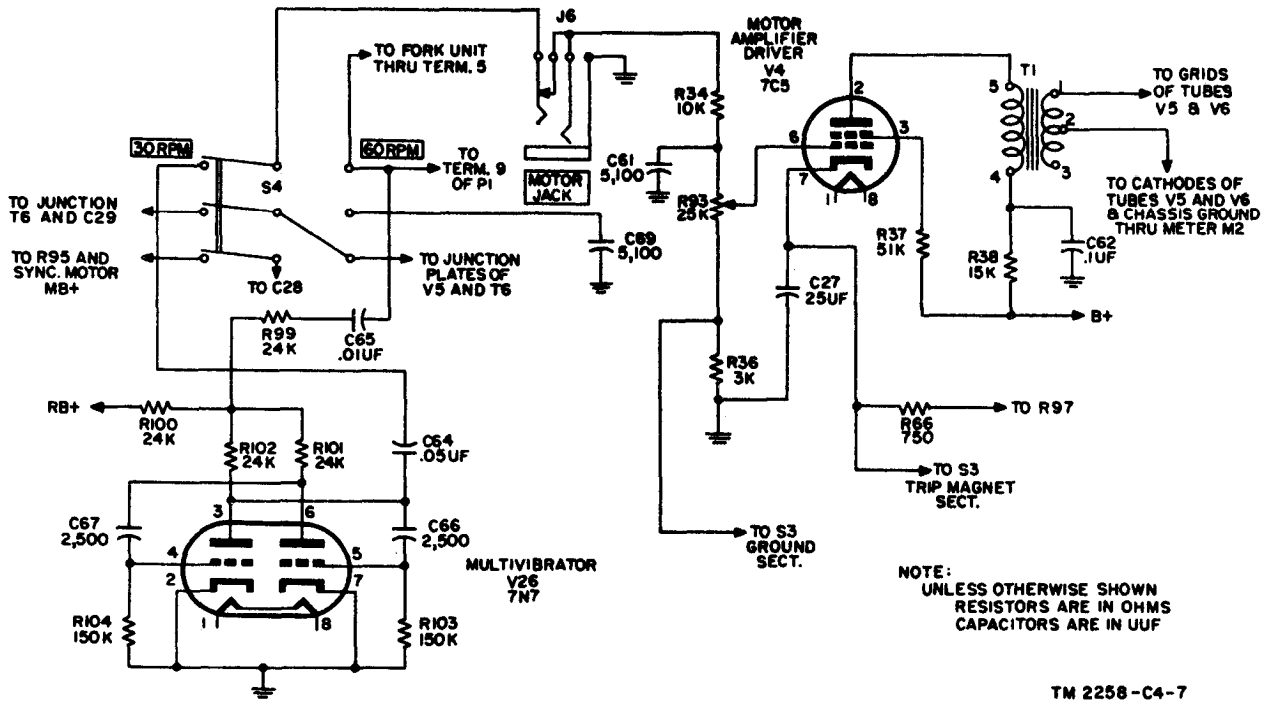


Figure 43. Multivibrator and motor amplifier driver Facsimile Transceiver TT-1F/TXC-1.

through the contacts of STANDBY-MON-TALK switch S5 and selector switch S1 when both are operated to the STANDBY positions.

b. Motor Amplifier Output Stage (figs. 44 through 46). In unmodified Facsimile Transceivers TT-1/TXC-1 and TT-1A/TXC-1 (fig. 44), V5 and V6 are type 6AC5GT/G tubes (type 1635 tubes when these units are modified in accordance with MWO SIG 11-2258-2). Refer to a(2) above and figure 38. Tubes V5 and V6 are connected in parallel in all models of the equipment and serve as single-ended, zero-bias, Class B, power amplifier tubes whose output drives the synchronous motor.

(1) *Facsimile Transceivers TT-1/TXC-1 and TT-1A/TXC-1* (fig. 44). Input to the grids (pin 5) of V5 and V6 is applied from V4 through transformer T1. The plate circuit of V5 and V6 consists of two parts; a dc circuit to supply plate current to the tubes and a series-resonant circuit at 1,800 cycles to power the motor. The dc circuit consists of the synchronous motor winding and choke T6. The series-resonant circuit consists of two series capacitors, C28 and C29, and the synchronous motor winding, which is shunted by capacitor C30 to limit transients. The synchronous motor winding is common to both circuits. The motor current is a series of dc pulses that reoccur 1,800 times per second, since tubes V5 and V6 conduct only on the positive half-cycles of the 1,800-cycle input wave. Choke T6 is not a part of the series-resonant circuit; its ac impedance is high and it may be considered a device for shunt-feeding stages V5 and V6. Voltage across the synchronous motor winding and across T6 is approximately equal and may rise as high as 1,000 volts. Capacitor C30, by limiting transients, prevents high peak voltages that might break down insulation if the motor winding. In Facsimile Transceiver TT-1A/TXC-1, MOTOR FUSE F1 has been added in the plate circuit of tubes V5 and V6. Capacitor C31 prevents arcing at the START switch contacts. Normally, the +450-volt circuit to the plates of V5 and V6 is completed through the START switch contacts, but when the START switch is operated to energize the separate start windings, the synchronous winding of the motor is disconnected and the plates of V5 and V6 are not energized.

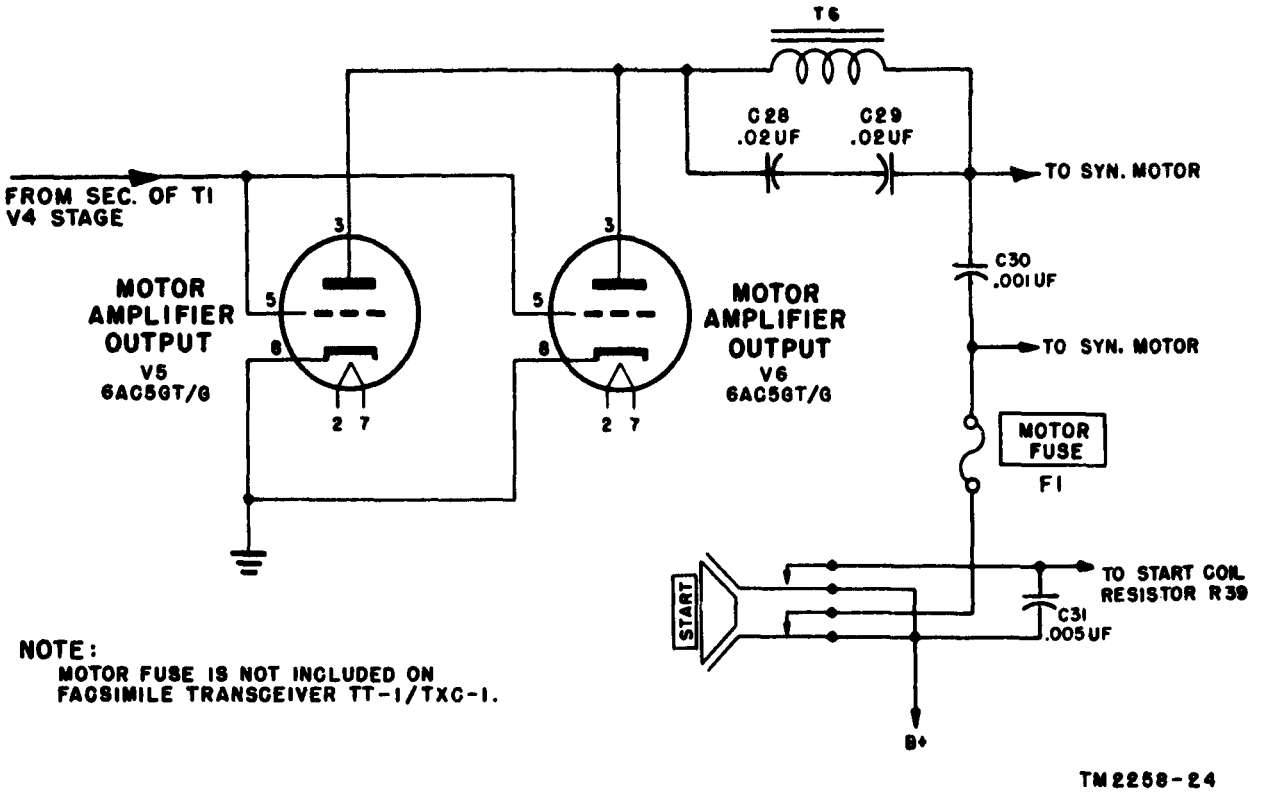


Figure 44. Motor amplifier output stage, facsimile Transceivers TT-1/TXC-1 and TT-1A/TXC-1.

(2) *Facsimile Transceivers TT-1B/TXC-1 and TT-1C/TXC-1* (fig. 45). These models operate the same as Facsimile Transceivers TT-1/TXC-1 and TT-1A/TXC-1 except for the following changes:

(a) Bypass capacitor C31 in parallel with resistor R95 is placed across MOTOR FUSE F1. MOTOR CURRENT meter M2 indicates necessary adjustments of the motor current.

(b) Series resistor R39 limits the motor current, and bypass capacitor C60 keeps this part of the circuit at ac ground potential. A connection from R39 to START switch S4 stops the motor in Facsimile Transceiver TT-1C/TXC-1 when selector switch (S1) is operated to the STANDBY position. This connection is made through the front section of S1, disconnecting the +450-volt supply from the motor circuit when the selector switch is operated to the STANDBY position.

(3) *Facsimile Transceivers TT-1D/TXC-1. TT-1E/TXC-1, and TT-1F/TXC-1 (fig.* 46). In Facsimile Transceivers TT-1D/TXC-1, TT-1E/TXC-1, and TT-1F/TXC-1, MOTOR CURRENT meter M2 is in the cathode circuit instead of the plate circuit of the motor amplifier output stage. The plate circuit is modified so that when the 30RPM-60RPM speed change switch, S4, is in the 60RPM position, C28 and C29 in series are across T6 for 1,800-cycle operation of the synchronous motor. When S4 is in the 30RPM position, C28 and C29 in series are across the synchronous motor and T6 is shorted for 900-cps operation of the motor.

(4) *Facsimile Ttransceiver TT-1F/TXC-1* (fig. 46). In this model of the transceiver, capacitor C69 has been added to prevent interned arcing in motor amplifier tubes V5 and V6 by reducing peak voltages in the 60RPM position.

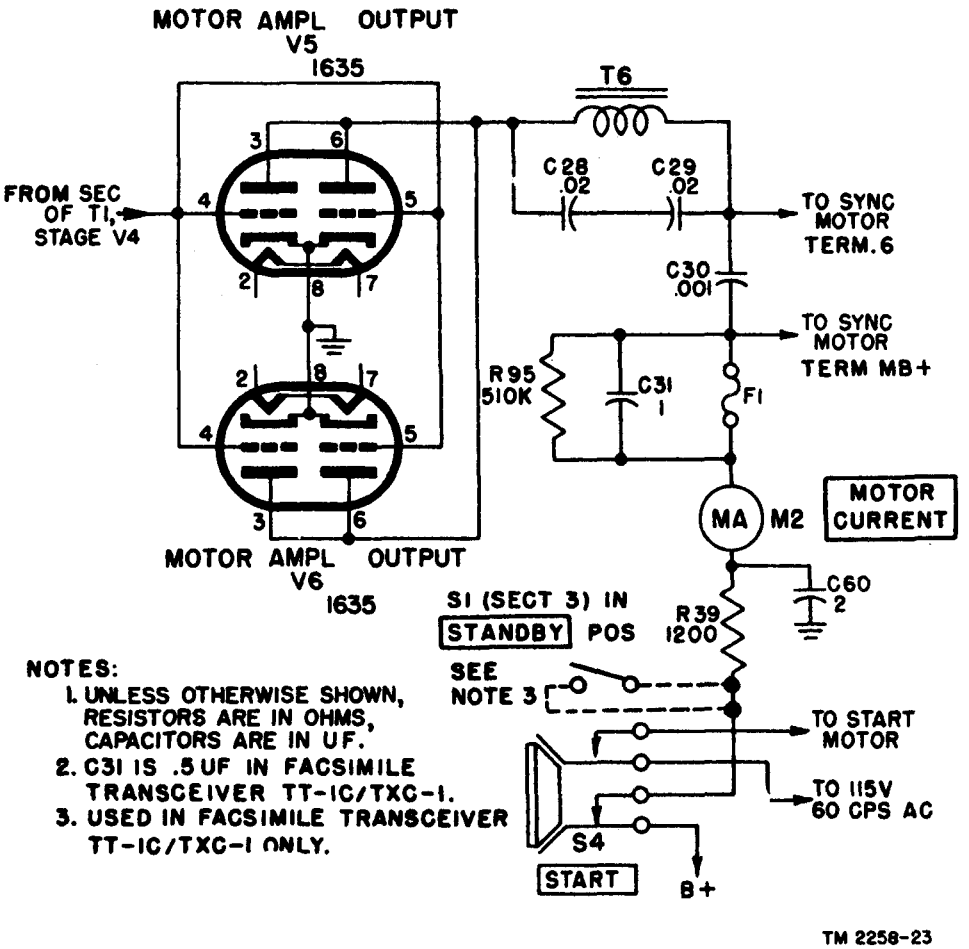


Figure 45. Motor amplifier output stage, Facsimile Transceivers TT-1B/TXC-1 and TT-1C/TXC-1.

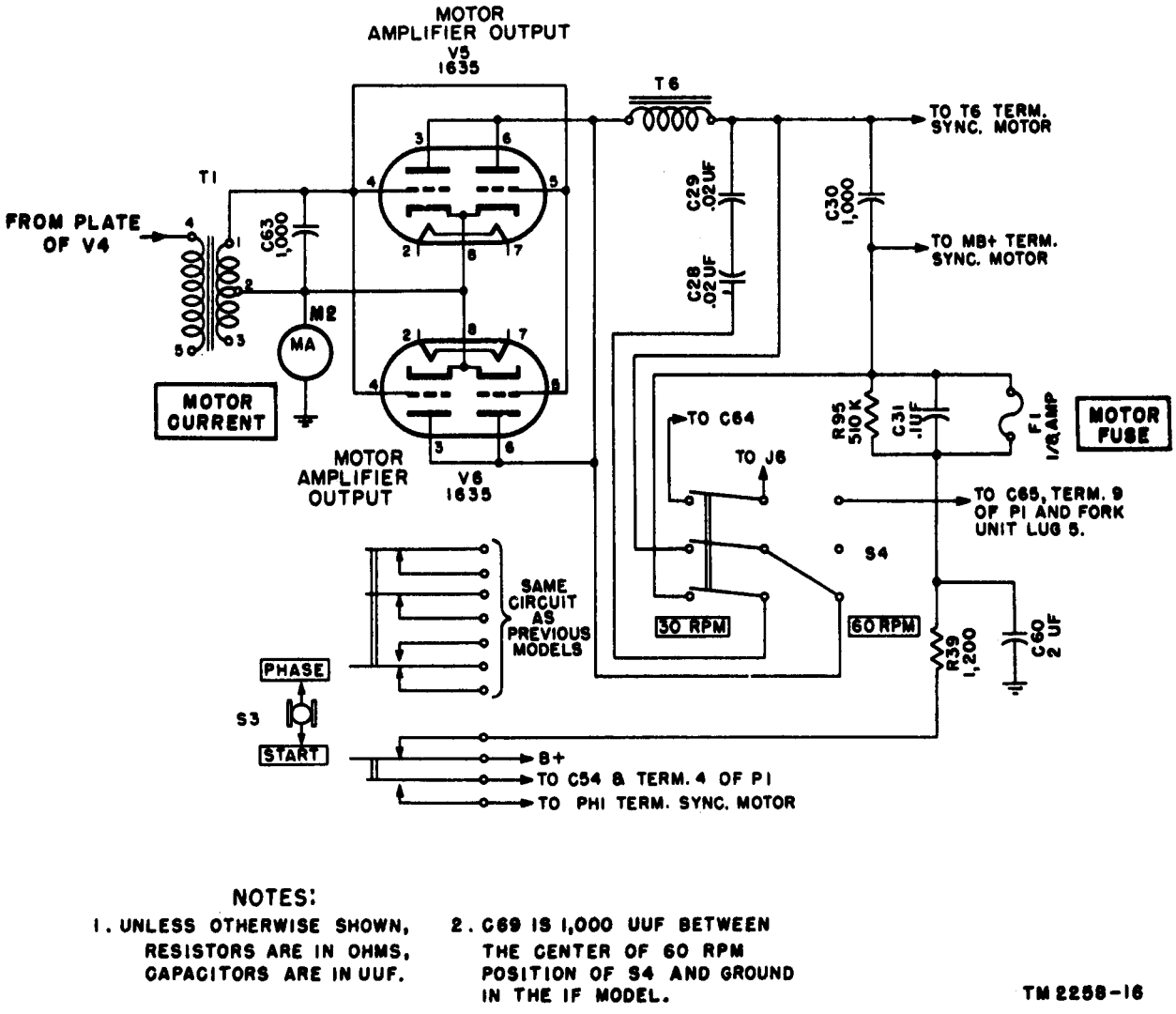
72. Multivibrator(V26 in Facsimile Transceivers TT-1D/TXC-1, TT-1E/TXC-1, and TT-1F/TXC-1 only)

(figs. 42 and 43)

Tube V26 operates as a multivibrator. In this circuit, a portion of the output of one section of the 7N7 tube is fed into the input circuit of the other section. While one section conducts, the other section is cut off. The fork unit 1,800-cps output is fed to the plates of the 7N7 through C65 and R99. The values of C66, C67, R103, and R104, together with the internal capacitances of the tube, determine the frequency and rate at which each section conducts. The output is taken from the plate (pin 3) through C64. The multivibrator natural output (output without synchronization signal) is slightly less than 900 cps; the 1,800-cps signal locks it at exactly 900 cps. Switch S4 selects either the multivibrator output or the fork unit output directly and applies it through MOTOR JACK J6 to the grid of motor amplifier driver tube V4.

73. Synchronous Motor

a. General. The synchronous motor in Facsimile Transceiver TT-1(*)/TXC-1 is held at a constant speed of 60 rpm by the 1,800-cycle power supplied by the plate circuit of motor amplifier output tubes V5 and V6. A worm gear on the motor shaft is meshed with a gear which drives the lead screw at 60 rpm through the clutch mechanism. The motors originally used in Facsimile Transceivers TT-1/TXC-1 and TT-1A/TXC-1 operated on 9-volt, 60-cps, ac, which was supplied by Rectifier Power Unit PP-86/TXC-1. These motors have been replaced with 115-volt ac operated motors, and the circuitry of the transceiver and rectifier unit has been modified according to MWO SIG 11-2258-2. Facsimile Transceivers TT-1B/TXC-1 through TT-1F/TXC-1 contain motors that operate on 115-volt, 60-cps.



NOTES:

1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
2. C69 IS 1,000 UUF BETWEEN THE CENTER OF 60 RPM POSITION OF S4 AND GROUND IN THE IF MODEL.

TM 2258-16

Figure 46. Motor amplifier outstage, Facsimile Transceivers TT-1D/TXC-1, TT-1E/TXC-1, and TT-1F/TXC-1.

ac. Operation of the motors is similar in all models of the equipment.

b. Stating Circuit. The motor contains a separate starting coil in Facsimile Transceivers TT-1/TXC-1 through TT-1C/TXC-1 and a synchronous coil. The start section of the motor is a capacitor-start induction type which operates on 115-volt, 60-cps, ac. Pressing the START button (START-PHASE switch S3 on Facsimile Transceivers TT-1D/TXC-1, TT-1E/TXC-1, and TT-1F/TXC-1) disconnects the synchronous motor winding and applies 115-volt ac to the start winding. This voltage is brought up from the primary terminals of power transformer T11 in the power unit through terminals 2 and 4 of the Jones plug and the contacts of the, starting switch. The switch is held in the START position until the drum speed rises above 60 rpm (3 to 5 revolutions of the drum should be sufficient); then the switch is released. Note that the capacitor winding of the start motor is in the circuit at all times. This winding also furnishes part of the power for the motor while it is running at synchronous speed, but the major part of the power is developed by the synchronous motor, which also controls the speed. Because this capacitor winding is in the circuit at all times, it is possible for this motor to run at a nonsynchronous speed. The operator must guard against operating the transceiver with the motor running at a nonsynchronous speed. An 1,800- or 900-cycle tone from the motor laminations is the best assurance that the motor is running at synchronous speed.

74. Photocell Circuit

(figs. 47,48, and 49)

Photocell tube V24 is the heart of the photocell bridge modulator circuit, which is used only on transmitting. Tube 1645 is used as the photocell in Facsimile Transceivers TT-1/TXC-1 through TT-1C/TXC-1. Tube 5652 is used as the photocell in Facsimile Transceivers TT-1D/TXC-1, TT-1E/TXC-1, and TT-1F/TXC-1. The photocell and its associated circuit (fig. 47,48, and 49) cause amplitude modulation of the 1,800-cycle signal supplied from the fork oscillator unit. Amplitude modulation follows the lights and shadows on that portion of the transmitted copy being scanned. After modulation of the 1,800-cycle signal is accomplished in the photocell bridge modulator circuit, the modulated signal is fed to the grid (pin 6) of V10, the first signal amplifier. Tube V10 and the following signal amplifiers not only amplify the modulated signal, but use a series of differentiating circuits (small coupling capacitors and large grid resistors) to remove undesirable low-frequency signal components generated in the modulator circuit. Photocell tube 5652 in Facsimile Transceivers TT-1D/TXC-1, TT-1E/TXC-1, and TT-1F/TXC-1 permits the use of larger values of coupling capacitors than photocell tube 1645, which was used in previous models. The circuit that uses tube 5652 is inherently balanced for the modulating frequency, and therefore requires no discrimination against low frequencies in its amplifier strip as required in previous models.

a. Simplified Bridge Modulator Circuit. A simplified equivalent of the photocell bridge modulator circuit is shown in figure 47. In the simplified circuit, the 1,800-cycle carrier signal from the fork oscillator unit is fed to points A and C of the resistance-capacitance bridge. Output from the bridge is the voltage developed across R50, between points D and B. This voltage is the grid to cathode or input voltage of V10. A small capacitance (C_c) exists between the cathode and active anode of V24, and this is effectively balanced out by the neutralizing, capacitance (C_n), which is the capacitance existing between the cathode and the second or neutralizing anode within the photocell. When the bridge is perfectly balanced, there is no output of 1,800-cycle signal to be applied to V10; but when increased light shines on the photocell, it causes increased electron emission from the cathode, producing a resistive unbalance of the bridge and a greater 1,800-cycle signal.

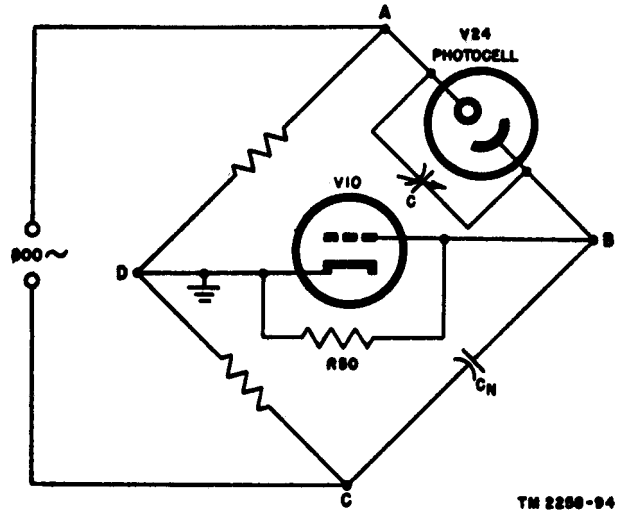


Figure 47. Simplified bridge modulator circuit.

b. Optical System. The light that reaches the photocell can be determined at any instant by the shade (from white to black) of the small area of transmitting copy being scanned. Light from the constant source of illumination (the exciter lamp shown in the transmitting block diagram (fig. 31)) is concentrated onto a small portion of the copy by the condenser lens system. The illuminated area is approximately the size of the filament in the exciter lamp. The objective lens focuses an image of the illuminated area of copy onto a screen having a small hole or aperture that permits only the light from an area approximately one ninety-sixth of an inch square to pass onto the photocell in back of the aperture. As the drum and copy move during transmission of a picture, each scanned element of the picture reflects a different amount of light back to the photocell. The photocell and bridge modulator circuit change each level of light into its equivalent electrical signal.

c. Schematic Diagram:

(1) *Facsimile Transceivers TT-1/TXC-1 through TT-1C/TXC-1* (fig. 48). The output of the bridge (the voltage across, R60) is a varying dc signal that consists of the keying or modulating frequency which is superimposed on the 1,800-cycle carrier frequency. This varying dc signal is always of such polarity that the grid end of R50 is positive with respect to the other end. This is caused by the increased emission from the photocell when increased light strikes it. The conven-

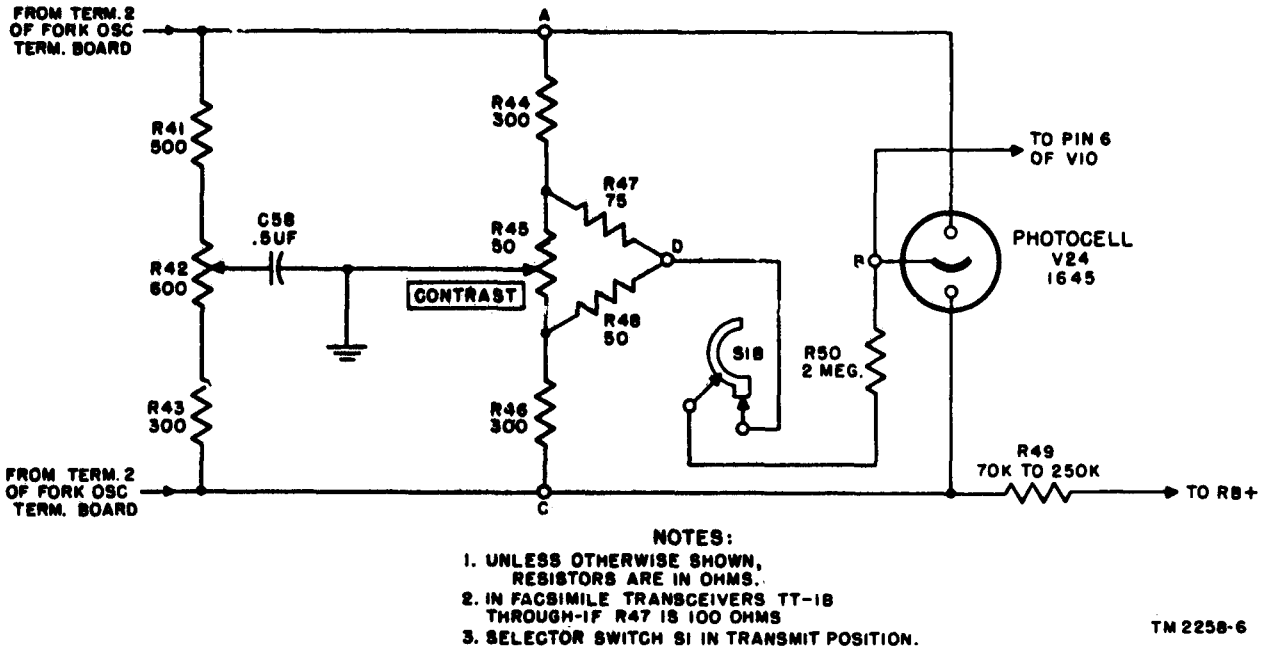


Figure 48. Photocell bridge modulator circuit of Facsimile Transcievers TT-1/TXC-1 through TT-1C/TXC-1.

tional modulation envelope, consisting of the 1,800-cycle signal varied in amplitude both above and below the zero axis, first appears in a distorted form at the grid of stage V10.

(a) Resistor networks. Between points A and C, figure 48, where the unmodulated 1,800-cycle carrier signal is applied, are two resistor networks; one consists of R41, R42, and R43 in series and the other consists of R44, R45, and R46 in series. Resistors R47 and R48 are in series across R45. The first of these networks includes variable resistor R42, which serves as a neutralizing control and is used in balancing out the capacitive effect of the photocell. Its effect on the circuit is the same as making C_n (fig. 47) variable. Resistor R42 is an alignment control and is located beneath the chassis of Facsimile Transceivers TT-1/TXC-1 through TT-1B/TXC-1 (figs. 128 and 129). In Facsimile Transceiver TT-1C/TXC-1, R42 is located on the floating panel behind the DB METER. This control is used to set the proper value to balance out the capacitive effect of the photocell when the photocell is changed; it is not used as an operating control. Capacitor C58 provides capacitive reactance to ground for the slide arm of R42, thereby permitting close adjustment of the null point. Variable resistor R45 (in the second network across the input of the bridge) is the CONTRAST control, a front panel operating control used in setting the original contrast range at the facsimile transmitter. This control may be adjusted to balance the bridge on either maximum light (positive transmission; minimum signal on white, maximum on black) or on minimum light (negative transmission; minimum signal on black, maximum on white).

(b) Other components. Resistors R47 and R48 are used in place of the proper tap on CONTRAST control R45; they serve merely to keep point D electrically at a predetermined relationship with respect to R45. Resistor R49, which may be shunted by R49A, R49B, or R49C, or combinations thereof, is a portion of a voltage divider between the regulated B+ voltage and ground. This divider keeps both anodes of the photocell at a slight positive potential (.3 to .6 volt) with respect to the photocell cathode. This bias extends the linear portion of the photocell curve

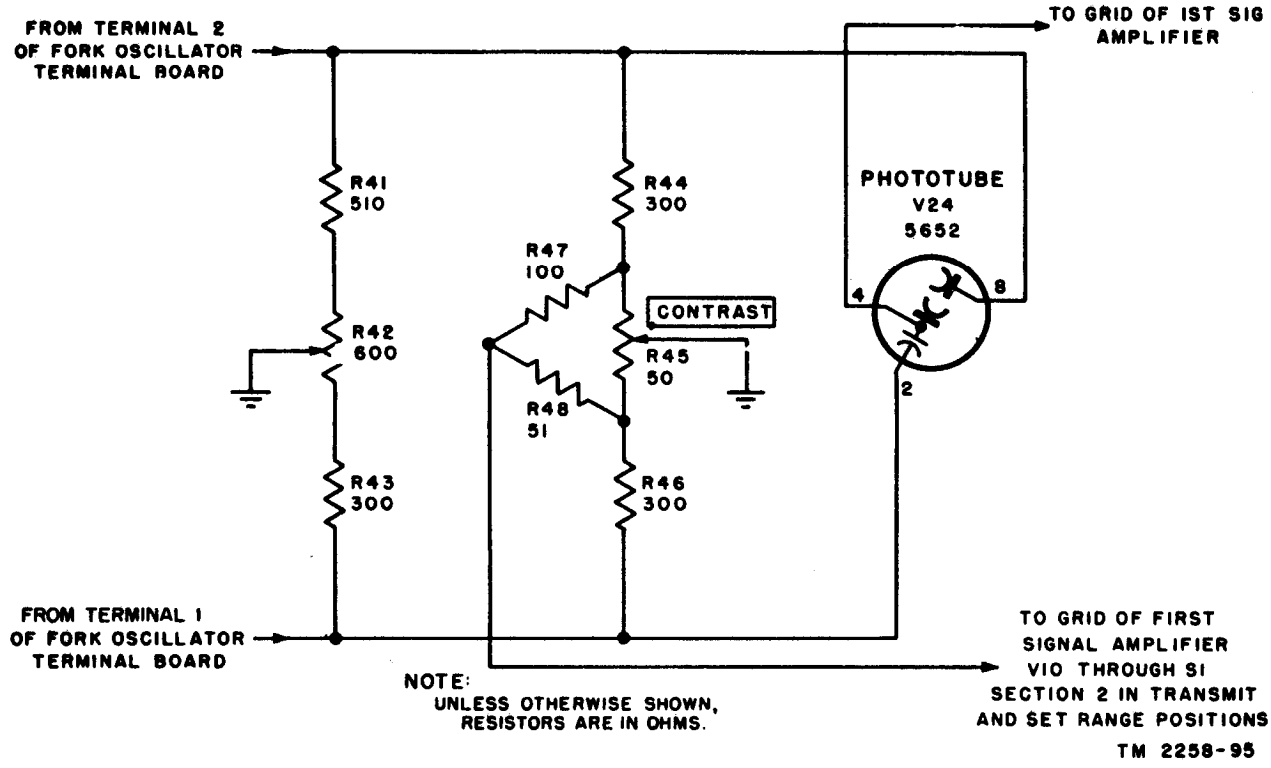


Figure 49. Photocell bridge modulator, Facsimile TranseiversTT-1D/TXC-1, TT-1E/TXC-1, and TT-1F/TXC-1.

and makes possible the use of an increased 1,800-cycle input into the bridge.

(2) *Facsimile Transceivers TT-1D/TXC-1, TT-1E/TXC-1, and TT-1F/TXC-1* (fig. 49). A type 5652 tube is used as the photocell in these units. Resistor R49 is not used and the regulated +250 volts is not needed since this tube operates linearly without the injection of fixed bias. Capacitor C58 is not used since the null point can be closely adjusted in these models (because of the operating characteristic of photocell tube 5652) with the slide arm of R42 connected directly to ground. Resistor R50 (fig. 52) is the grid resistor of V10, the high side connecting both to the cathode of the photocell and to the grid of V10. Its low potential side is returned to ground through R47, R48, and R45, when selector switch S1 (section 3) is in the TRANSMIT or SET RANGE position. On other settings of the selector switch, the bridge circuit continuity is interrupted.

75. Signal Amplifiers (V10 through V14)

(figs. 50 through 54)

Facsimile Transceiver TT-1(*)/TXC-1 has five stages of signal amplification. Various stages are used for various functions, as determined by the setting of the selector switch and as illustrated in figure 76. Tubes V10, V11, and V12 are Class A signal amplifiers. The first half of V13 is operated as a Class C threshold limiter and serves as a driver for V14, a Class B output amplifier. Tubes V10 and V11 are used for all functions, V12 on TRANSMIT and RECORD PHOTO, V13 on RECORD DIRECT, and V14 on RECORD DIRECT and RECORD PHOTO positions. The use of V10, V11, and V12 in the talkback circuit is explained in paragraph 78.

a. First Signal Amplifier (V10) (figs. 51 and 52). This stage is a high-gain pentode voltage amplifier, tube 7C7 (tube 5879 in Facsimile Transceiver TT-1E/TXC-1 and TT-1F/TXC-1), biased for Class A operation and used for both transmitting and receiving.

(1) *Transmitting.* With the selector switch at TRANSMIT or SET RANGE, the grid of V10 is fed by the photocell bridge

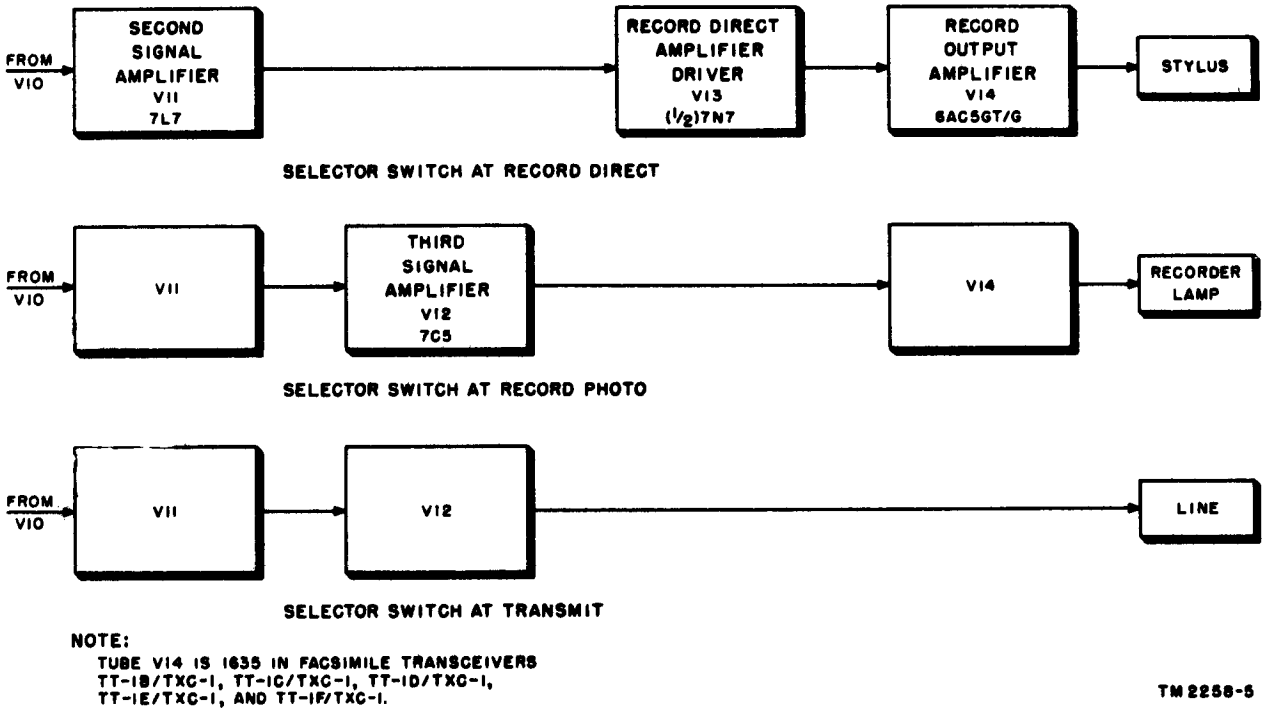


Figure 50. Signal amplifiers used in various positions of selector switch, block diagram.

modulator circuit as explained in paragraph 74. Resistor R50 serves as the grid resistor, across which the modulated 1,800-cycle signal is developed and applied to the grid. Cathode bias is developed across R51 and filtered by C32. The screen is fed through R52 and bypassed directly to the cathode by C33. Resistor R53 is the plate load resistor. An amplified modulated 1,800-cycle signal is developed across this resistor and applied to the grid of tube V11 through output coupling capacitor C35. Resistor R54 and capacitor C34 form a resistance-capacitance decoupling network between the stage and the source of regulated B+ plate and screen voltages.

(2) *Receiving.* With the selector switch in the recording positions, the bridge modulator is inactive. The control grid of V10 is connected through R50 as a series resistor and S1 is connected to the arm on control R60, that half of the dual GAIN control which serves as an input gain control across the secondary of input transformer T7 (figs. 163 through 169). Input to the transceiver is either through this line-matching transformer (T7) from the LINE binding posts through section 1 of the selector switch, or to the high end of R60 from the LINE JACK through section 3 of the switch, depending on the input connections in use (par. 15d). The rest of the circuit of V10 is the same for receiving as for transmitting.

b. Second Signal Amplifier (V11) (fig. 53). The second signal amplifier is a pentode voltage amplifier tube 7L7, biased for Class A operation and used without circuit changes for both transmitting and receiving. The input is from stage V10 and its output feeds V12 through the transmitting portion of the dual GAIN control (R59) and also both triode sections of the signal meter amplifier (V13). The input signal (the modulated 1,800 cycles from V10) is applied through C35 and across grid resistor R55 to the control grid of V11. Capacitor C35 is a low value capacitor used to attenuate unwanted low-frequency signals from the previous stage. In Facsimile Transceivers TT-1/TXC-1 through TT-1C/TXC-1, C35 is 100 micromicrofarad (μμf). Cathode bias for Class A operation is developed by current flow through cathode resistor R56, which is bypassed at audio frequencies by C36. In Facsimile Transceiver TT-1D/TXC-1, coupling capacitor C35 is increased to 5,100 μμf (the same as C38) and grid resistor R55 to 470,000

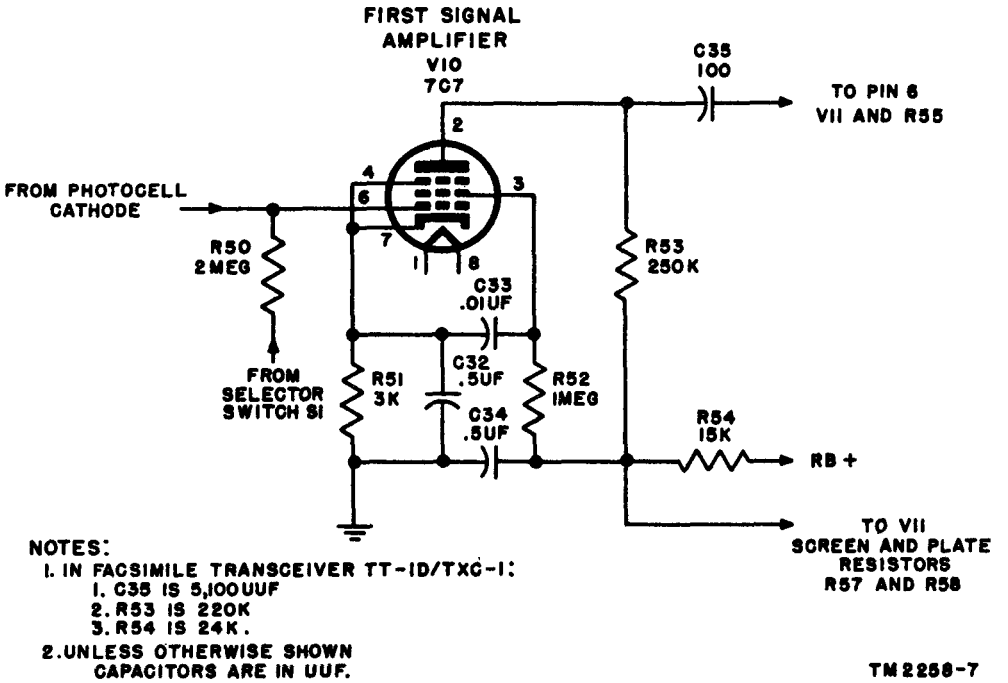


Figure 51. First ssignal amplifier, Facsimile Transceivers TT-1/TXC-1 through TT-1D/TXC-1, schematic diagram.

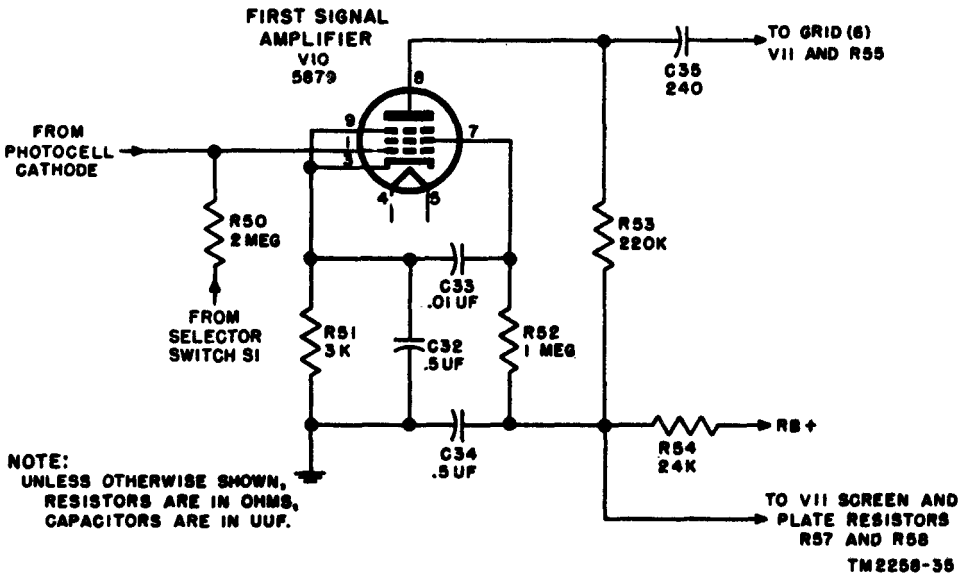


Figure 52. First signal amplifier, Facsimile Transceivers TT-1E/TXC-1 and TT-1F/TXC-1, schematic diagram.

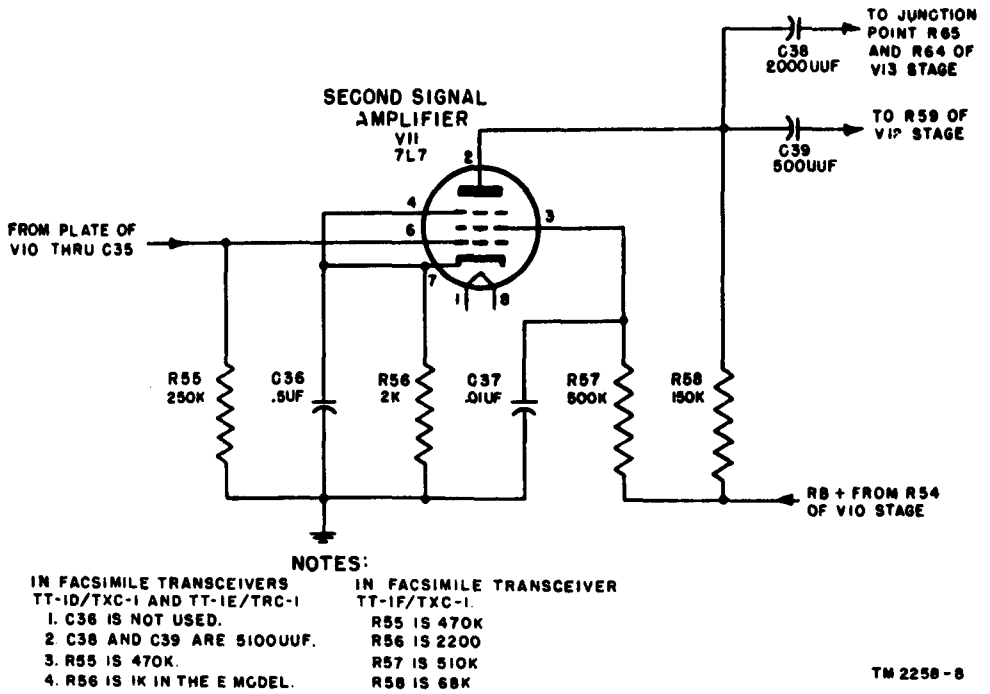


Figure 53. Second signal amplifier.

ohms, since the use of tube 5652 as a photocell in these models precludes the passage of undesired low frequencies through the amplifier strip. In Facsimile Transceiver TT-1E/TXC-1 and TT-1F/TXC-1, capacitor C35 is 240 μμf. The cathode of V11 is not bypassed; sufficient signal is impressed on the grid of this tube because of the increased values of coupling capacitor C35 and grid resistor R55 to make it unnecessary to have additional gain by means of cathode bypassing. Screen current is supplied through screen resistor R57, and the screen is bypassed to ground by C37. Regulated plate voltage is applied through R58, the plate load resistor. The amplified 1,800-cycle signal developed across R58 is applied through C39 to output GAIN control R59, and through C38 to the grid circuit of the signal amplifier half of dual triode tube V13.

c. *Third Signal Amplifier (V12)* (fig. 54). The third signal amplifier is a triode-connected, Class A signal amplifier, using a 7C5 tube, which serves as the transceiver output amplifier on transmitting and as a driver stage for V14 (Class B stage) on photo recording. Tube V12 is in the facsimile signal circuit only when the selector switch is in the TRANSMIT, SET RANGE, or RECORD PHOTO position. The stage amplifies modulated 1,800-cycle signals in both transmitting and receiving functions. The stage is also used in the talk-back circuit of Facsimile Transceivers TT-1A/TXC-1 through TT-1F/TXC-1.

(1) Transmitting. With the selector switch set in the TRANSMIT or SET RANGE position, the control grid of V12 receives the signal coupled from the plate of tube V11 through C39 and developed across R59, the transmitting half of the dual GAIN control. The slider on R59 selects the portion of voltage across the resistor which is to be applied to the grid of V12. Resistors R61 and R62 in series constitute a voltage divider across the input circuit of V12. Half of the V12 grid voltage is applied from the junction of R61 and R62 through capacitor C41 to the grid of the meter amplifier half of V13 (figs. 55 and 56). Tube V12 is biased by cathode current flowing through cathode resistor R63, which is bypassed at audio frequencies by C40. Transformer T2 is the output transformer for stage V12. Plate current flows through the primary from the regulated +250-volt supply. Signal variations at the plate of V12 cause signal voltages to be induced in the two secondaries of T2. In the TRANSMIT position of the selector switch only, secondary No. 1 is connected to the LINE JACK, one side of which is grounded through section IVL of the selector switch, and secondary No. 2 is

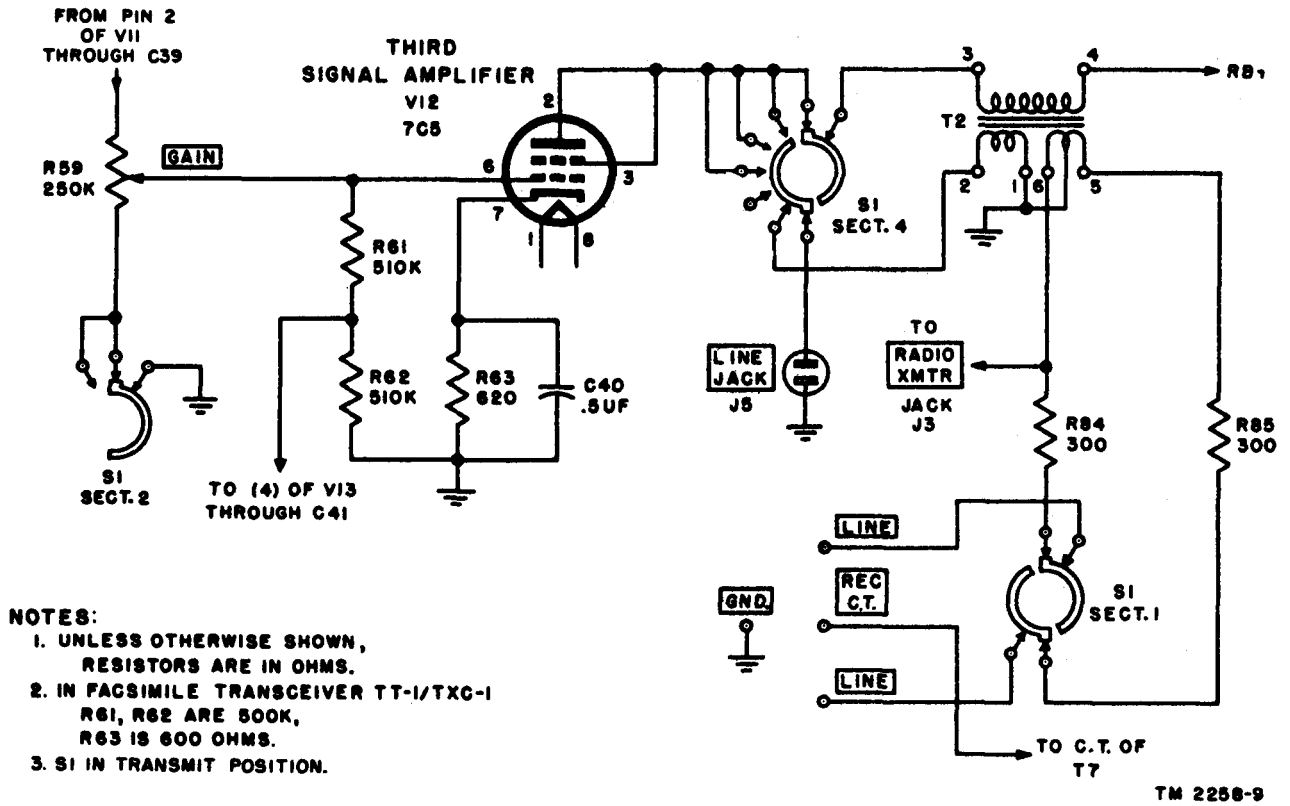


Figure 54. Third signal amplifier.

connected to the LINE binding posts through sections IR and IL and attenuator resistors R84 and R85. In the set RANGE position of the selector switch, the LINE binding posts and the LINE JACK are disconnected, and secondary No. 1 is short-circuited and grounded.

(2) *Receiving.* When the selector switch is at any other position than TRANSMIT or SET RANGE, the low side of R59 (the output GAIN control) is ungrounded, removing its effectiveness as a gain control but still permitting V12 to be fed by V11. Tube V12 serves as a received signal amplifier only for photographic recording. With the selector switch in RECORD PHOTO position, the plate circuit of V12 is established through the primary of transformer T2 and through section IVR of the selector switch. Secondary No. 2 of T2 is open-circuited, but secondary No. 1 of T2 is in the grid circuit of V14, the output amplifier for recording. With the selector switch in the RECORD DIRECT position, the plate circuit of the record direct amplifier (V13, section 5-6-7) is completed through the primary of transformer T2 and section IVR of the selector switch, with secondary No. 1 of T2 connected to the grid circuit of V14.

d. Signal Meter Amplifier (V13) (figs. 55 and 56). This stage uses dual-triode tube 7N7. Section 5-6-7 serves as the Class C RECORD DIRECT amplifier-driver stage which drives stage V14. Pins 2, 3, and 4 serve as the meter amplifier, providing a vacuum-tube voltmeter circuit for measuring input and output signal levels in decibels.

(1) *Record direct amplifier driver.* Although the grid (pin 5) of the first section of tube V13 is fed a modulated 1,800-cycle signal at all times, the stage is operative only when the selector switch is in the RECORD DIRECT position. The stage is operated as a threshold limiter; that is, it is biased considerably beyond cutoff and prevents an output signal until the input signal reaches a predetermined level. This is advantageous in controlling the signal used on direct recording. The grid (pin 5) is fed from the plate of

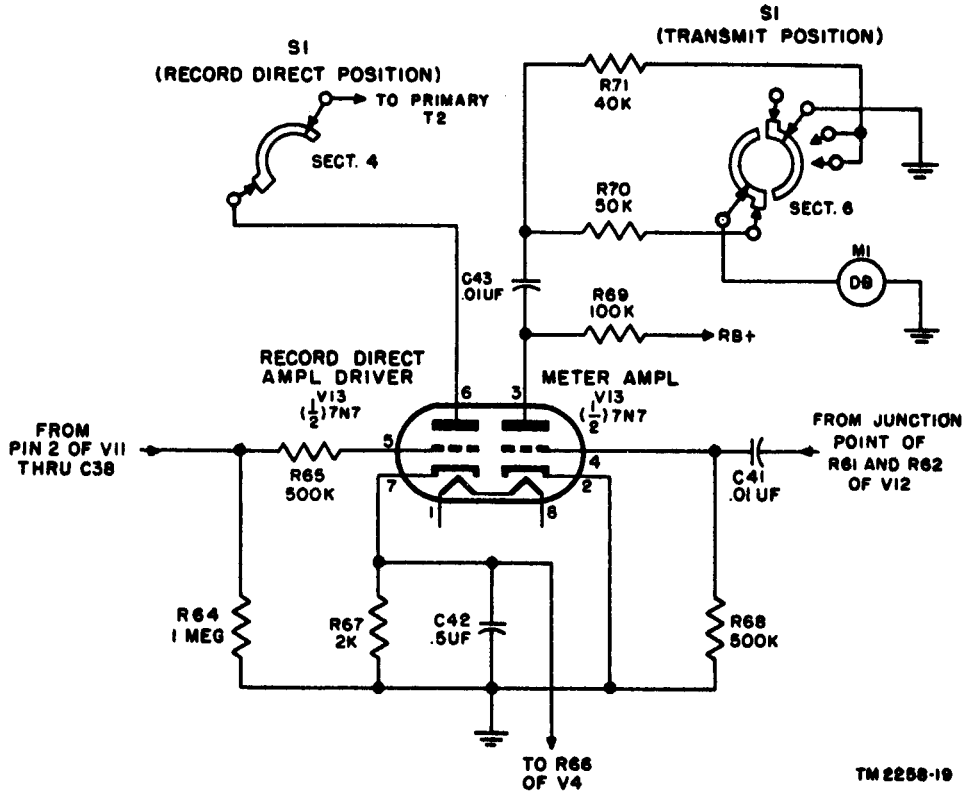


Figure 55. Record direct amplifier driver and meter amplifier, Facsmimile Transceivers TT-1/TXC-1 and TT-1A/TXC-1.

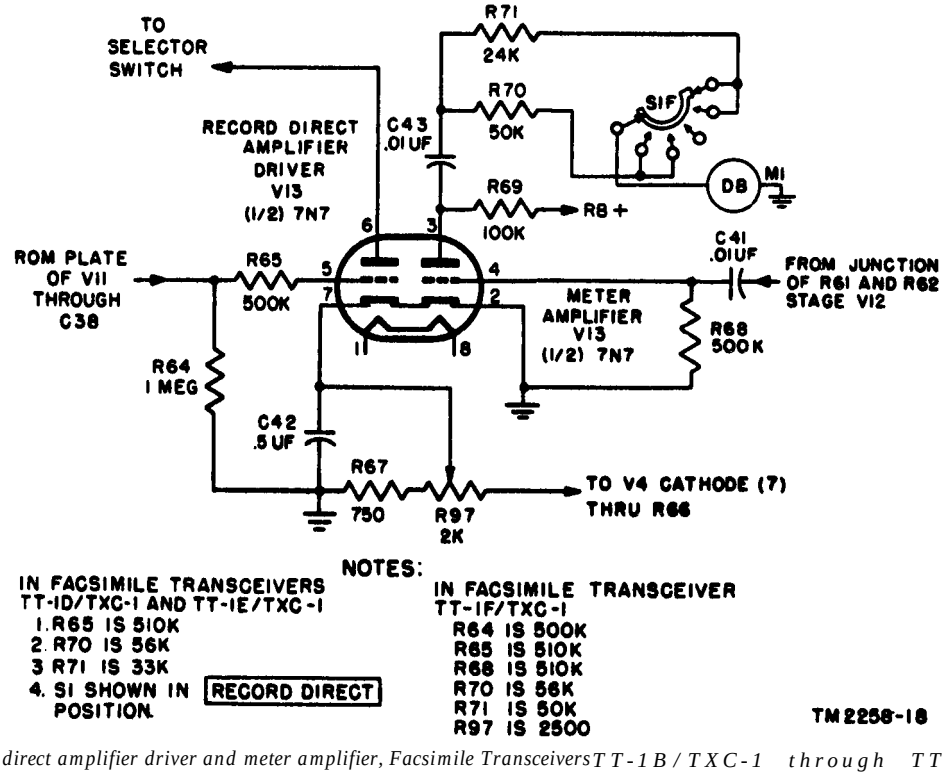


Figure 56. Record direct amplifier driver and meter amplifier, Facsimile Transceivers TT-1B/TXC-1 through TT-1F/TXC-1.

V11 through coupling capacitor C38 and limiting resistor R65. Resistor R65 is in the circuit to prevent the grid from drawing current when the plate circuit is not energized; that is, when the selector switch is in some position other than in the RECORD DIRECT position. During operation of the stage, the grid is not fed sufficient signal to drive it positive and cause grid current to flow through grid resistor R64. Bias for the stage (approx. 18 volts) is developed by the flow of cathode current in stage V13 and motor amplifier stage V4. In Facsimile Transceivers TT-1/TXC-1 and TT-1A/TXC-1, V4 cathode current flows through resistors R66 and R67. The bias on V13 is the voltage developed across R67. In Facsimile Transceivers TT-1B/TXC-1 through TT-1F/TXC-1, V4 cathode current flows through resistors R66, R67, and R97 (fig. 56). The bias on V13 is the voltage developed across R67 and that portion of potentiometer R97 which is in the V13 cathode circuit. Control R97 can be adjusted for best operation of the stage. The cathode resistor is bypassed by capacitor C42. Only when the selector switch is in the RECORD DIRECT position is plate current supplied to this section of V13 through section S1D of the selector switch and the primary of transformer T2, which now becomes the Class B driver transformer for stage V14.

(2) *Meter amplifier.* The grid (pin 4) of the meter amplifier tube, triode section 2, 3, and 4 of V13, is fed at all times by the voltage across R62 in the grid circuit of stage V12. Capacitor C41 is the input coupling capacitor and R68 is the grid resistor for this section of V13. The DB METER, an ac meter with a self-contained copper-oxide rectifier, receives its signal from the shunt-fed plate circuit of the stage. The plate is supplied from the regulated +250-volt supply through plate load resistor R69. Capacitor C43 couples the modulated 1,800-cycle signal from the plate to the meter through R70 for the TRANSMIT and SET RANGE positions of the selector switch and through R71 for the RECORD PHOTO and RECORD DIRECT settings of the selector switch. This meter is disconnected in the STANDBY position of the selector switch.

e. Record Output Amplifier (V14) (fig. 57). The record output amplifier, V14 (type 1635), a Class B power stage, drives the recorder lamp on the RECORD PHOTO setting of the selector switch, and drives the stylus on the RECORD DIRECT setting of the selector switch. These two outputs are plate circuit outputs A separate, cathode circuit output is taken during the phasing operation (when the PHASE switch is operated) and is applied to cathode-driven pulse amplifier stage V15 (par. 74 and fig. 59). Stage V14 is driven through secondary No. 1 of transformer T2 by stage V12 when the selector switch is in the RECORD PHOTO position and by stage V13 in the RECORD DIRECT position. A type 6AC5GT/G tube was originally used in Facsimile Transceivers TT-1/TXC-1 and TT-1A/TXC-1, but was replaced in these equipments with a type 1635 tube (MWO SIG 11-2258-2) because of frequent failure.

(1) *Record photo* (fig. 57). Input to V14 from secondary No. 1 of T2 is applied to grids No. 4 and 5 in parallel. Plate voltage is applied from the regulated +250-volt supply through the recorder lamp (E2) and resistor R94 in parallel (modified Facsimile Transceivers TT-1/TXC-1 and TT-1A/TXC-1 have resistor R94). The stage is biased Class B, so that with no signal input, the recorder lamp produces only a slight glow. The recorder optical system uses recorder lamp E2, tube R1130B, which is a neon-filled lamp, capable of converting varying signal intensities into varying amounts of light. The lamp is mounted in a housing (A, fig. 121) which opens into an aperture plate and field lens at one end of a lens barrel. On the other end of the barrel is an objective lens which focuses the light passing through the aperture to a small spot on the film or photographic paper. The recording beam produces exposures in accordance with its intensity.

(2) *Record direct* (fig. 57). Input to V14 in this position is applied from record direct amplifier driver V13 through the selector switch. Plate voltage is supplied from the unregulated +450-volt supply

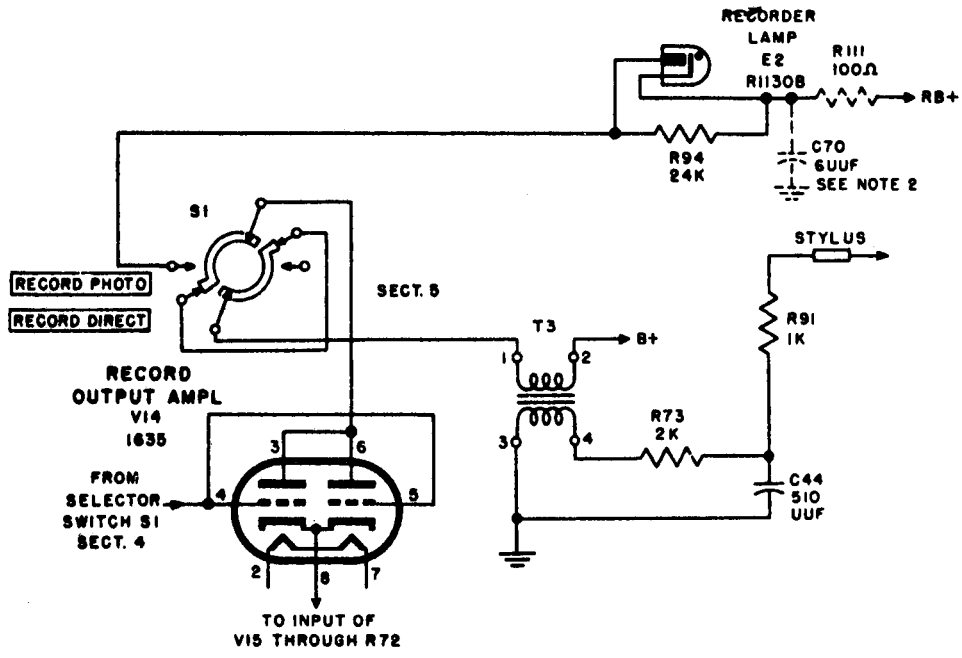


Figure 57. Record output amplifier, Facsimile Transceiver TT-1(*)/TXC-1.

through the primary of the stylus transformer T3 and the selector switch. In Facsimile Transceiver TT-1E/TXC-1, resistor R106, and capacitor C68 are added in series across the selector switch. One aide of the secondary is grounded and the stylus is connected to the high side through an rf suppressor composed of R73, R91, and C44. This suppressor reduces electrical interference from the spark. The audio output voltage causes a spark between the stylus and the grounded metal drum of the transceiver, burning the white covering from the black recording paper.

(3) *Cathode circuit.* In normal operation of stage V14, the cathode is connected directly to ground through contacts of the phasing switch. This permits normal zero-bias operation of the Class B stage. During phasing operations, however, resistor R72 is connected into the cathode circuit of V14 and becomes a coupling resistor between stages V14 and V15. Phasing pulses from the transmitter are transferred from the output of V14 to the input of V15.

76. Automatic Stop Circuit (End-of-Copy Limit Switch)

(fig. 58)

An automatic stop circuit is incorporated in Facsimile Transceiver TT-1F/TXC-1 to switch the amplified facsimile signal to ground and to stop the synchronous motor when the drum reaches the end of its travel. The circuit operates in all positions of the selector switch and has a locking feature when in the TRANSMIT, RECORD DIRECT, or RECORD PHOTO position. The stop is intended to prevent unnecessary wear of the half nut threads if the machine is left unattended at the end of a transmission. It prevents marring of the recorded copy by the stylus should the operator move the drum to the right at the completion of a transmission while the selector switch is in the RECORD DIRECT position and the incoming signal is still on. The circuit consists of limit switch S8 which is operated by the drum when it reaches the end of its travel. It also consists of relay K1 which is energized by 115 volts dc obtained by passing regulated dc voltage (RB+) through dropping resistors R109 and R110.

a. When the transceiver ia operated in the TRANSMIT position and the drum reaches the

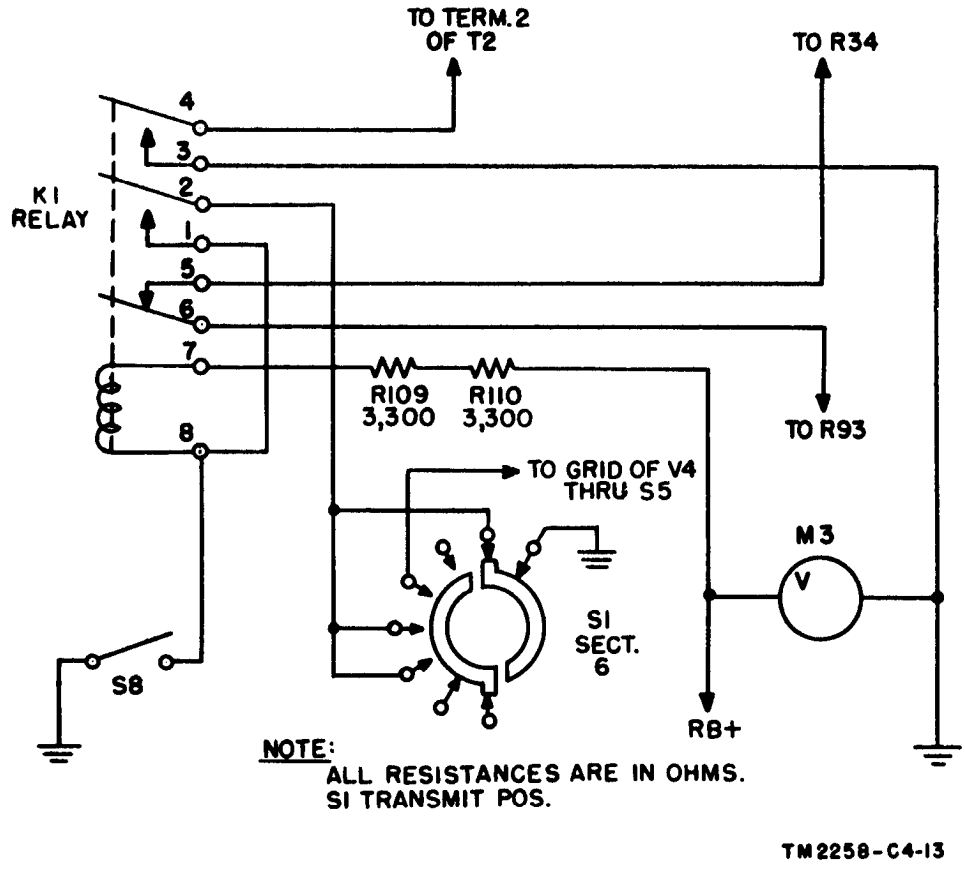


Figure 58. Automatic stop circuit, Facsimile Transceiver TT-1F/TXC-1.

end of its travel, limit switch S8 closes. This energizes relay K1. Contacts 5 and 6 open and break the tuning fork signal to the grid of the motor amplifier tube (V4). Contacts 3 and 4 close and short the output signal to ground. Contacts 1 and 2 close to keep the relay energized if the drum is moved away from the limit switch.

b. To de-energize relay K1 before the next transmission, the selector switch must be turned to SET RANGE or STANDBY and the drum moved to the right away from limit switch S8. The relay coil is de-energized in these positions since the path to ground from pin 2 of the relay is opened.

c. When the transceiver is operated in the RECORD PHOTO or RECORD DIRECT position, the automatic stop circuit functions in the same manner. The synchronous drive motor is stopped and the signal to record output amplifier V14 is shorted to ground. To de-energize the relay for the next recording, the selector switch is turned to STANDBY and the drum is moved to the right to disengage it from limit switch S8.

77. Phasing Circuit (V15 and V16)

The phasing operation is performed jointly by the transmitting and receiving operator. The transmitting operator turns the selector switch of the transmitting transceiver to TRANSMIT and causes the scanning system to scan the phasing ring on the scanning drum. A pulse, in the form of an abrupt increase or an abrupt decrease in the amplitude of the 1,800-cycle carrier signal, is generated by the transmitter each time it scans the white spot on the dark phasing ring (once each second). The transmitting operator does not operate the phasing switch on his machine. The receiving operator phases his machine to the transmitting machine by turning the selector switch to RECORD PHOTO and by pressing the PHASE button. (In Facsimile Transceivers TT-1D/TXC-1, TT-1E/TXC-1, and TT-1F/TXC-1, the operator phases his machine to the transmitting machine by pressing the START PHASE switch toward PHASE.)

a. PHASE Switch. The receiver phasing circuit (fig. 59) is operative only when the PHASE

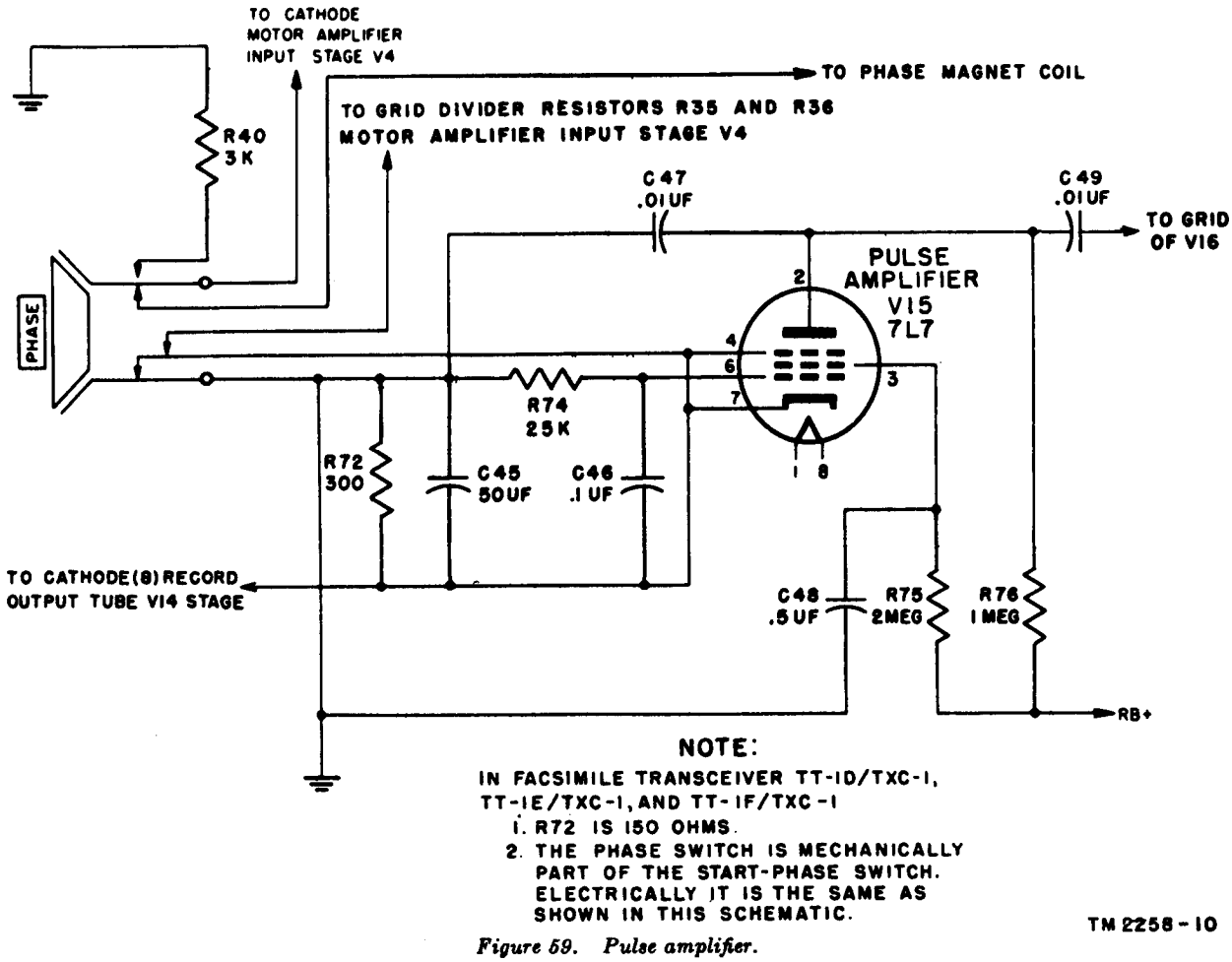


Figure 59. Pulse amplifier.

switch is pressed. Pressing this switch makes the following circuit changes:

(1) Removes the phasing magnet from the cathode circuit of V4, stopping the flow of holding current through the magnet. The magnet armature then engages the stop arm on the clutch, causing the receiving drum to rotate slower than the transmitting drum.

(2) Substitutes R40 in the cathode circuit of V4 to compensate for the removal of the phasing magnet (par. 71).

(3) Disconnects the short circuit across R36 in the grid circuit of V4, providing increased drive to V4 (par. 71).

(4) Disconnects the short circuit across R72, coupling stage V14 into stage V15.

b. Electrical Circuit. The phasing pulse received over the facsimile circuit is amplified by stages V10, V11, V12, and V14 of the receiving transceiver, and is rectified by the combination of tube V14 and the recorder lamp. The 1,800-cycle component is removed by a filter (C45, C46, C47, and R74) in the input circuit of V15. This tube amplifies the pulse, which is applied to the input of thyratron trigger tube V16. Each pulse causes V16 to arc, pulling the armature to the phasing magnet and releasing the primary clutch stop arm. The transmitter sends the phasing pulse just as the stop arm on the transmitting machine is passing the phasing magnet. Since the receiving stop arm is released by the phasing pulse at this same instant, the transmitting and receiving transceivers are phased.

c. Pulse Amplifier (V16) (fig. 59). Stage V15 uses a type 7L7 tube as a pulse voltage amplifier in an inverted circuit. When the PHASE switch is operated, the pulse voltage developed across R72 (cathode resistor of V14) is applied between the cathode and the grid of V15. The cathode of V15 is at signal input potential, and the grid is at ground potential for signal input. The

phasing pulse (a sudden decrease or increase in the 1,800-cycle signal) is smoothed into a dc pulse by the filter action of 50-microfarad capacitor C45 across R72, C46 between cathode and grid, and C47 between plate and ground. Resistor R74 serves as the grid resistor. Screen current is fed through screen dropping resistor R75, which is bypassed by C48. The dc pulse developed across plate load resistor R76 is coupled to the grid of trigger tube V16 through coupling capacitor C49. Both plate and screen are supplied from the regulated +250-volt supply. Refer to figures 74 and 75 for waveforms.

d. Trigger Tube (V16) (fig. 60). The trigger tube is a gas-filled thyratron, type 884 connected so that each phasing pulse applied to ita grid causes the tube to arc and energize the phasing magnet. When the PHASE switch on the transceiver is operated, the normal holding current from the cathode circuit of tube V14 is removed, permitting the magnet armature to engage the stop arm on the primary clutch. Tube V16 has a positive potential of 250 volts applied directly to ita plate from the regulated +250-volt supply. In the absence of a phasing pulse, the cathode is approximately 57 volts positive with respect to ground, being tapped onto the voltage divider composed of R17 and R78 across the regulated +250-volt supply. Since the tube grid is at ground potential, there being no voltage drop across grid resistor R77, the grid is effectively negative with respect to the positive cathode, and the tube is nonconductive. Capacitor C50 is charged 57 volts positive because, in series with the phasing magnet coil, it is across cathode resistor R78. When a phasing pulse on the grid of V16 causes the tube to arc, the voltage drop across the tube and across R17 is suddenly reduced to 16 volts, the characteristic voltage drop across this tube when it arcs; then the cathode potential suddenly becomes 234 volts, increasing approximately 177 volts in a positive direction. This sudden change in potential across C50 causes sufficient electron flow through the phasing magnet to attract the armature and release the stop arm on the clutch; but as soon as the charge on capacitor C50 is equalized by the current flow through the phasing magnet, the impedance of the cathode circuit again becomes very high (with R78 serving as a current-limiting resistor) and the tube arc is extinguished. The negative grid of the tube then resumes control, keeping the tube nonconductive and the phasing magnet de-energized until the next phasing pulse arrives. Capacitor C49 and resistor R77 constitute a differentiating circuit, serving to sharpen the peak of the useful positive pulse.

(1) *Phasing error.* The phasing pulses are transmitted at slightly different times when transmitting for negative and positive reception. When transmitting for positive reception (maximum signal on black), a positive voltage large enough to make V16 arc is developed immediately after scanning of the phasing spot. This is at the instant when the scanning changes from the white of the phasing spot (minimum signal) to the black of the phasing ring (maximum signal). However, when transmitting for negative reception (maximum signal on white), the necessary positive voltage pulse is developed at the very beginning of the scanning of the phasing spot. This is at the instant when the scanning changes from the black of the phasing ring (minimum signal) to the white of the phasing spot (maximum signal). Therefore, the exact phasing point of positive recording is displaced from the exact phasing point for negative recording by the length of the phasing pulse (length of the phasing spot on the phasing ring).

(2) *Correction of error.* To divide this error evenly, the dog trip arm is so positioned that it splits the two pulses (positive and negative) evenly on each side of the center. The error is then so small on both positive and negative transmissions that no appreciable portion of the picture is obscured by the image of the clamp bar.

e. Clutch Operation (figs. 18, 19, and 20). When the PHASE switch is operated, and before a phasing pulse arrives, the holding current normally applied to the phasing magnet from the cathode circuit of V4 is removed. The phasing magnet armature is released and stops the travel of the stop arm (fig. 18), which is friction driven by the motor through the primary clutch. The stop arm, on which the phasing operation actually is performed, normally drives the dog trip arm which causes the drum to rotate. However, once the PHASE switch is operated and the stop arm is held stationary by the phasing magnet armature, the drum is driven at a slower rate by action of the

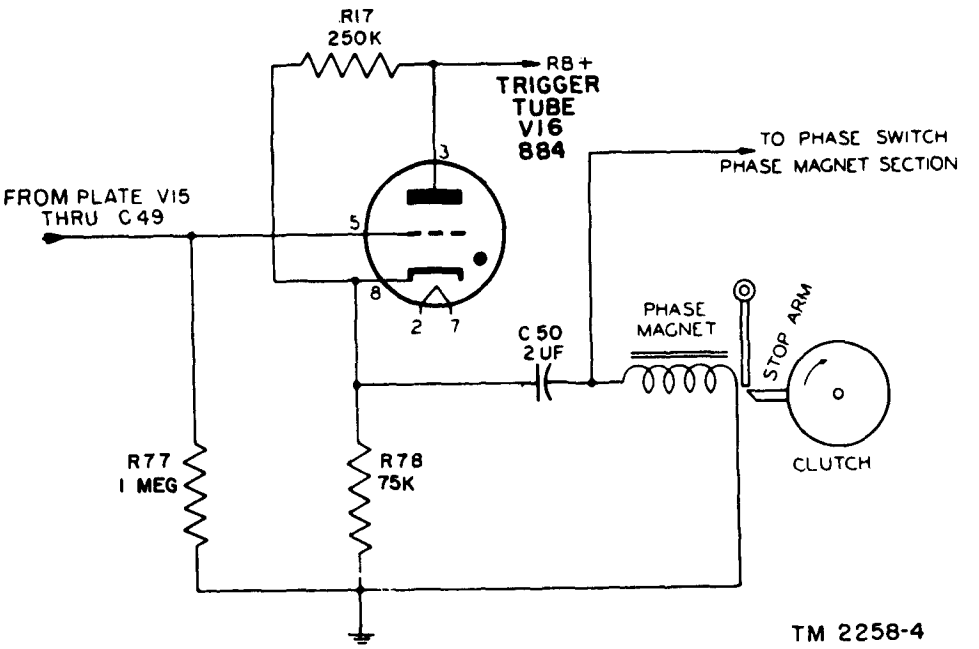


Figure 60. Trigger tube.

secondary clutch, which permits intermittent slippage. During a part of each revolution, the drum is driven by the secondary clutch, the drive being active only when the dog latch is engaged in the secondary clutch ring. During the rest of each revolution, a cam operating on the dog latch disengages the dog latch from the secondary clutch ring, permitting the slippage (fig. 19). When a phasing pulse from the transmitting station energizes the phasing magnet, the phasing magnet armature is drawn to the magnet, the travel of the stop arm is no longer impeded, and the primary clutch resumes rotation. The first phasing pulse may serve to phase the stop arm to the transmitting drum correctly, although several are allowed. Once the correct phasing is established, additional phasing pulses pull the phasing magnet armature out of the way just as the stop arm approaches it on each revolution. The PHASE switch then can be released. However, the entire phasing operation is not complete until the stop arm actually engages the dog trip arm (fig. 20). Only then is the receiving drum, as well as the stop arm, phased to the transmitting drum. For this reason, the operator must allow a few extra revolutions for the stop arm to catch up with the dog trip arm and transfer the drum drive from the secondary clutch to the primary clutch before assuming that phasing is complete.

78. Talk-Back Circuit

(figs. 61 and 62)

The talk-back circuit, only on Facsimile Transceivers TT-1A/TXC-1 through TT-1F/TXC-1, is controlled by the STANDBY-MON-TALK switch S5) on the front panel. The circuit is operative only when the selector switch (S1) is in the STANDBY position. When the STANDBY-MON-TALK switch is in the TALK position, the loudspeaker plugged into SPEAKER JACK J7 becomes a magnetic microphone and transforms speech sound waves into electrical currents, which are transferred to the line through the speaker transformer, amplifier stages V10, V11, and V12, and output transformer T2 (figs. 51, 53, and 54). For reception of voice signals with the switch in either the STANDBY or MON position, the signal from the line is fed through input transformer T7, the GAIN control, amplifier stages V10, V11, and V12, and through the speaker transformer to the speaker. The STANDBY-MON-TALK switch makes the following circuit connections:

a. Standby.

(1) The LINE binding posts are connected to the primary of input transformer T7 through S1, section 1, and S5.

(2) The LINE JACK is connected to the secondary of input transformer T7 through S1, section 3, and S5.

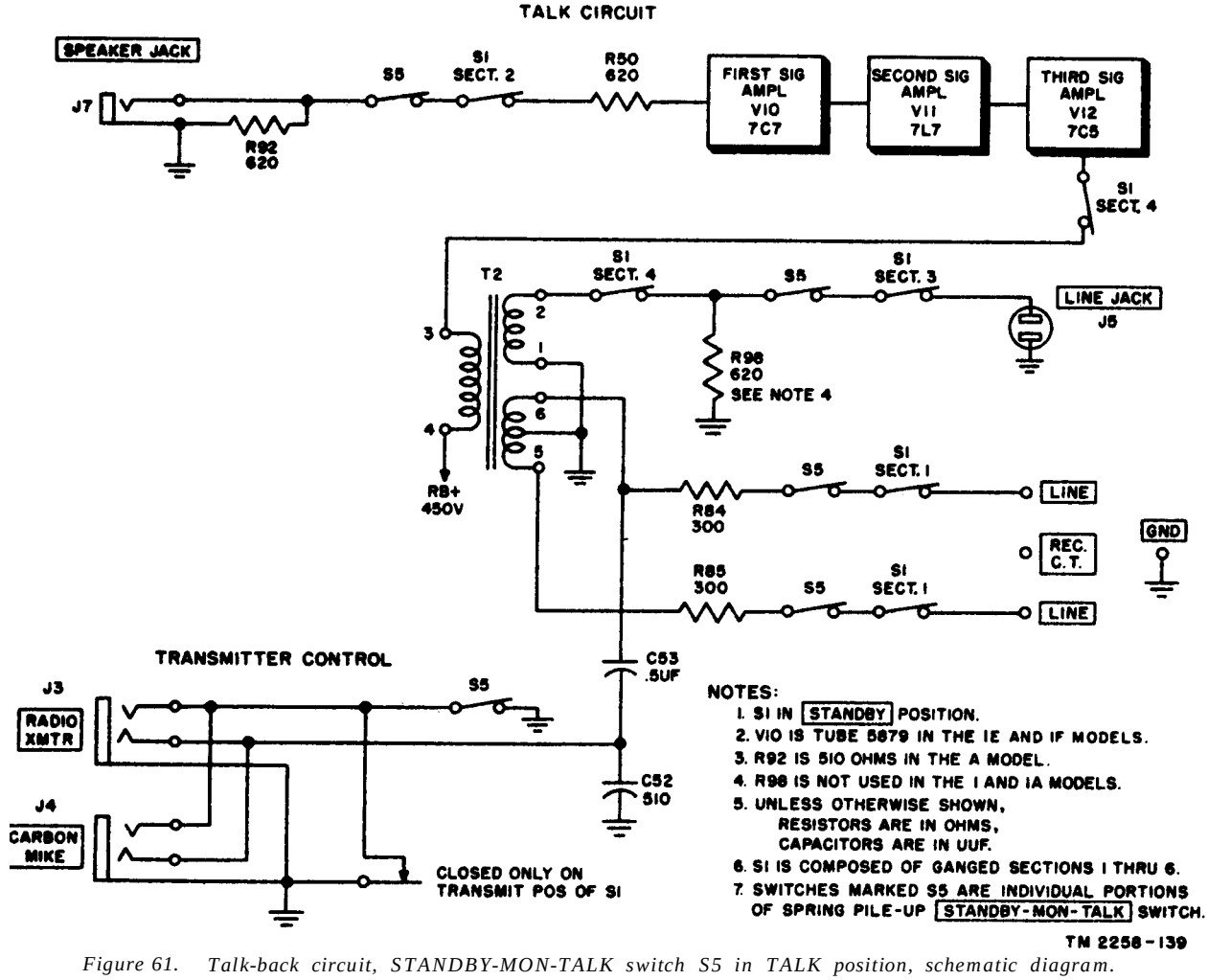


Figure 61. Talk-back circuit, STANDBY-MON-TALK switch S5 in TALK position, schematic diagram.

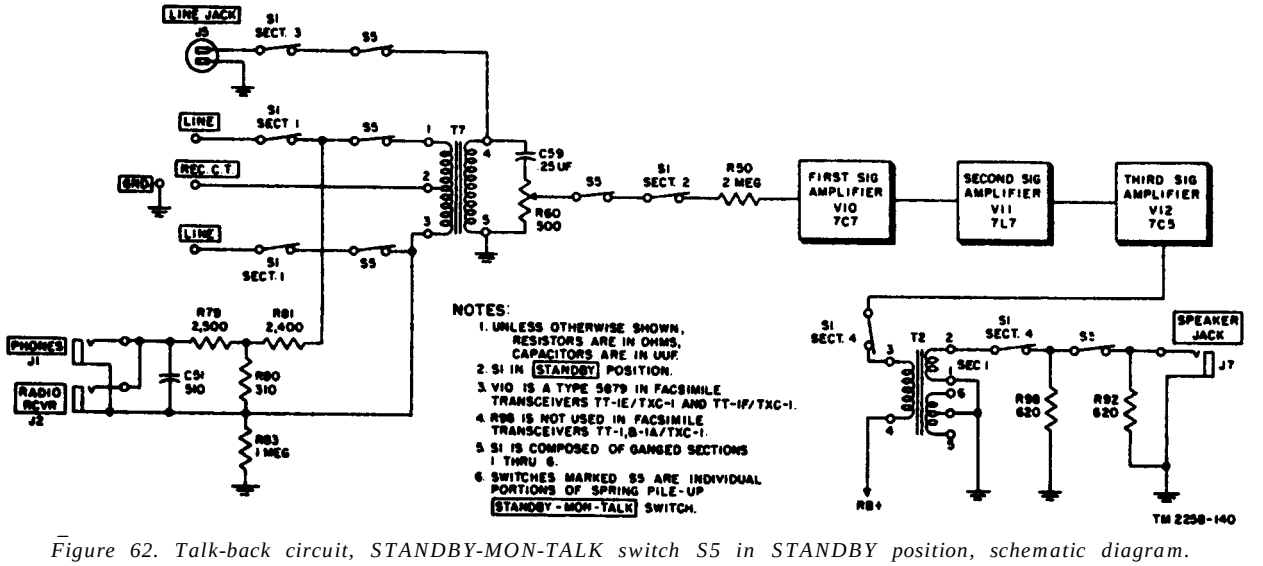


Figure 62. Talk-back circuit, STANDBY-MON-TALK switch S5 in STANDBY position, schematic diagram.

(3) The slider on receiving GAIN control R60 connects through S1, section 2, S5, and R50 to the grid of first signal amplifier V10.

(4) Tubes V10, V11, and V12 amplify the signal and apply it through switch S1, section 4, to the primary of T2. Secondary No. 1 of T2 is connected through switch S1, section 4, and switch S5 to SPEAKER JACK J7.

(5) The 1,800-cycle signal from the fork oscillator unit to the motor amplifier circuit is grounded through the exciter lamp and filament transformers, and the synchronous motor does not operate.

(6) Subparagraph (5) above does not apply to Facsimile Transceivers TT-1D/TXC-1, TT-1E/TXC-1, and TT-1F/TXC-1. In these models, the grid of V4 is grounded through S1, section 6, and the synchronous motor does not operate.

(7) The PHONES and RADIO RCVR jacks (J1 and J2), permanently connected in parallel across the primary of T7, provide for voice reception when a radio circuit is used.

b. MON (Monitor position). In this position of the STANDBY-MON-TALK switch, the same connections are completed as in the STANDBY position, except that the 1,800-cycle supply to the motor amplifier circuit is not grounded, and the motor can operate.

c. TALK.

(1) The LINE binding posts are disconnected from input transformer T7 and connected to output transformer T2 (secondary No. 2), through S1, section 1, S5, and 300-ohm dropping resistors R84 and R85,

(2) The LINE jack is disconnected from input transformer T7 and is connected to output transformer T2 (secondary No. 1) through S1, sections 3 and 4, and S5.

(3) The receiving GAIN control R60 is disconnected from the first signal amplifier V10. No GAIN control is used in the talking end of the talk-back circuit.

(4) The loudspeaker serves as a microphone and is connected through SPEAKER JACK J7, switch S5, switch S1, section 2, and resistor R50 to the grid of the first signal amplifier V10.

(5) Tubes V10, V11, and V12 amplify the signal and apply it to the primary of transformer T2 through switch S1, section 4. Secondary No. 1 is connected through S1 section 4, S5, and S1 section 3 to LINE JACK J5. Secondary No. 2 is connected through S5 and S1 section 1 to the LINE binding posts.

(6) The 1,800-cycle signal from the fork unit is supplied to the motor amplifier circuit, and the motor can operate.

(7) The push-to-talk relay control circuit on the CARBON MIKE jack is closed to put the transmitter on the air when a radio circuit is used.

(8) Resistor R98 (in Facsimile Transceivers TT-1B/TXC-1 through TT-1F/TXC-1 only) is disconnected as a shunt across R92 and is shunted across the LINE JACK terminals.

79. B+ Voltage Regulators (V7, V8, V9, and V25)

(figs, 63, 64, and 65).

The B+ voltage regulator, located in Facsimile Transceiver TT-1(*)/TXC-1 (figs. 63-65), drops the 450-volt dc input from the rectifier power unit to regulated +250 volts for critical transceiver circuits.

a. Two triode-connectad voltage regulator output tubes (V7 and V8, type 7C5) (fig. 63) are connected in parallel with their plates at +450-volt potential and their cathodes at +250-volt potential. In this way, their plate cathode impedance forms a variable series dropping resistor to drop the +450 volts to +250 volts. The value of this dropping resistor is automatically varied by varying grid bias of the tubes to provide a constant output voltage. Tube V9, type 7L7, a pentode, control voltage amplifier tube amplifies voltage changes in the +250-volt supply and controls the grids of regulator tubes V7 and V8. The gaseous voltage regulator tube (V25) in the cathode circuit of V9 provides a constant voltage drop (approx. 70 volts), serving as a reference level for stabilizing the +250-volt output. This tube is type R1160A or R1160B in Facsimile Transceivers TT-1/TXC-1 and TT-1A/TXC-1 and type 5651 in Facsimile Transceivers TT-1B/TXC-1 through TT-1F/TXC-1. The output voltage may be stabilized anywhere between +240 and +255 volts, but once established, it will not vary more than 2 volts under normal operating conditions.

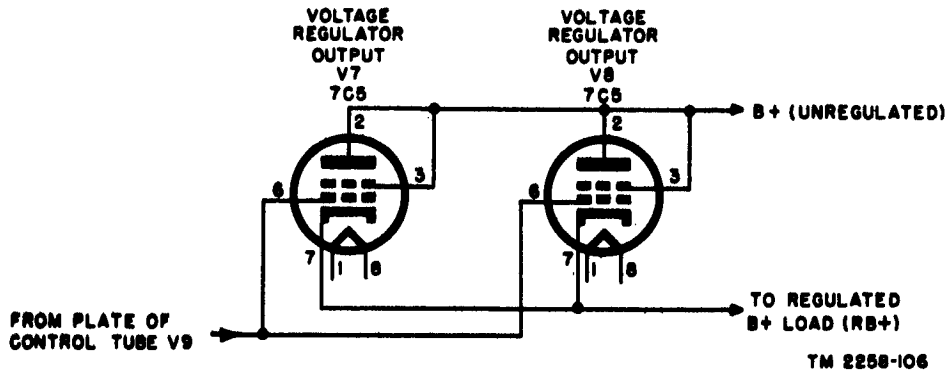


Figure 63. Voltage regulator output stage, RB+ circuit

b. To understand the functioning of the circuit in Facsimile Transceivers TT-1/TXC-1 and TT-*1A/TXC-1, assume* that the +250-volt output of the regulator suddenly changes to some higher voltage because of line or load changes. The grid bias on tube V9 (fig. 64) is the difference in potential between the cathode and the grid of the tube. In thie circuit, that potential difference consists of the difference between the voltage drop across V25 and the voltage drop across the parallel combination, R90 and R90A. This combination is part of the voltage divider circuit which also includes R89, and is across the regulated +250-volt output. However, the voltage drop across R90 and R90A is opposite in polarity to that across V25 when the cathode grid circuit is considered. The voltage drop across R90 and R90A changes approximately one-third as much as the voltage of the +250-volt supply. The drop across V25 is constant. Normally, the bias on V9 is about -3 volts. When the output voltage rises slightly above 250 volts, the bias on tube V9 increases in a positive direction. More positive grid voltage causes V9 to conduct more current, producing a greater voltage drop across plate load resistor R87. The voltage change at the plate of V9 is in a negative direction, and is greater in magnitude than the voltage change in a positive direction on the grid. This increased negative voltage at the plate of V9 is directly applied to the grids of V7 and V8, causing their plate cathode impedance to increase. This increase in impedance drops the regulated output voltage back to a normal 250 volts.

c. Resistor R86 is the V9 screen resistor and is bypassed to ground by C56 to prevent oscillation. Resistor R90A is in parallel with R90, and its value may be changed to adjust the value of the regulated output voltage. Capacitor C57 bypasses R89 as a smoothing filter capacitor. Capacitor C55 serves as a smoothing filter capacitor across the 450-volt input to the voltage regulator. Resistor R88 serves as a current limiting resistor in series with V25 to keep it operating in its normal range.

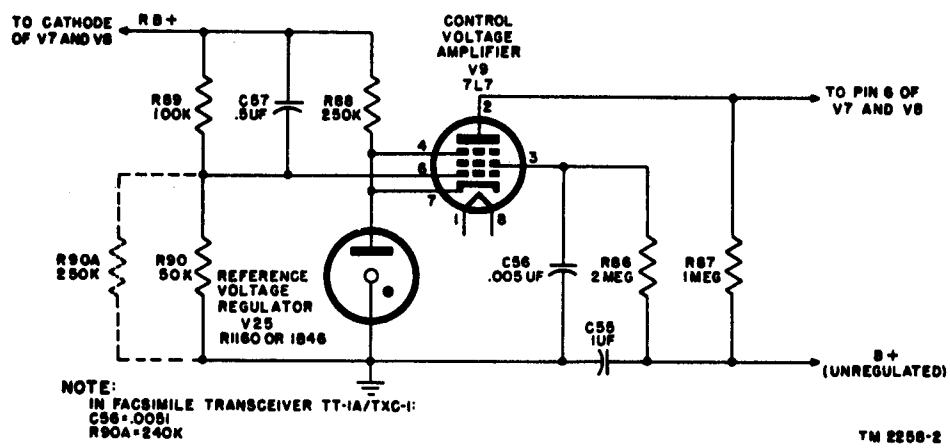


Figure 64. Control voltage amplifier, RB+ circuit, Facsimile Transceivers *TT-1/TXC-1 and TT-1A/TXC-1.*

d. The B+ voltage regulator circuit in Facsimile Transceivers TT-1B/TXC-1 through TT-1F/TXC-1 (fig. 65) operates in the same manner as that described above. However, potentiometer R96 has been inserted into the grid circuit of stage V9 to permit easy control of the output voltage and to eliminate the necessity of shunting R90 with R90A to obtain the correct voltage. Potentiometer R96 is located on the regulated B+ voltmeter M3 (fig. 65), which is also a component only of Facsimile Transceivers TT-1B/TXC-1, through TT-1F/TXC-1. The value of R88 has been modified so that it still provides minimum stabilization current for the reference voltage regulator tube V25.

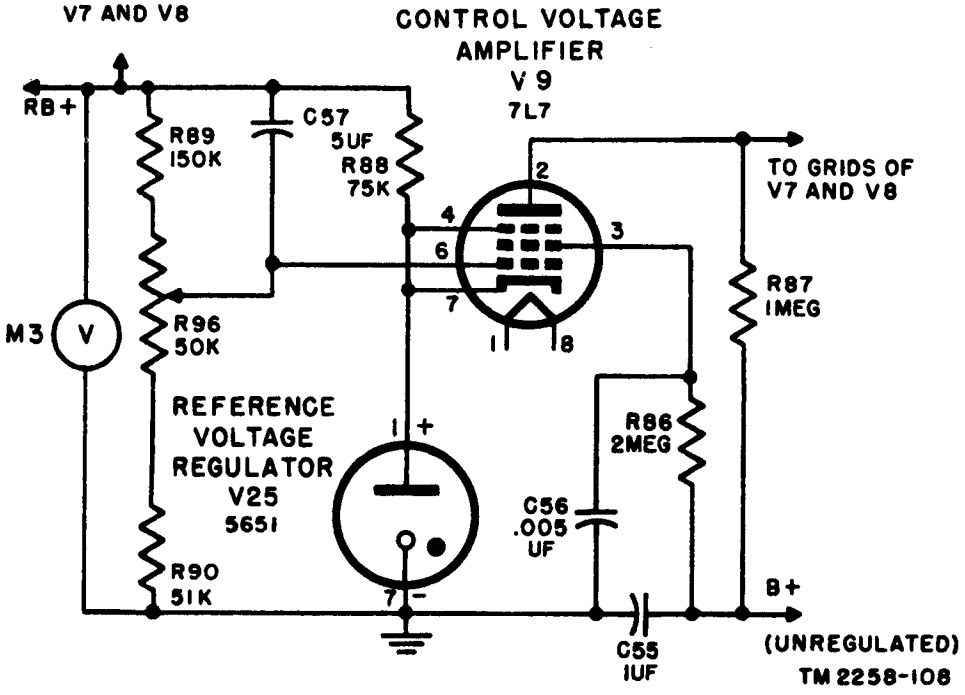


Figure 65. Control voltage amplifier, RB+ circuit, Facsimile Traneceivers TT-1B/TXC-1, TT-1C/TXC-1, TT-1D/TXC-1. TT-1E/TXC-1, and TT-1F/TXC-1.

Section III. RECTIFIER POWER UNIT PP-86(*)/TXC-1

80. Block Diagram

(fig. 66)

The rectifier power unit serves four purposes:

a. Provides unregulated B+ at 450 volts dc and filament voltage at 6.5 v ac for operation of the transceiver for a normal source of 115-volt 60-cycle ac.

b. Provides 115-volt 60-cycle ac for starting the synchronous motor in Facsimile Transceiver TT-1(*)/TXC-1.

c. Provides closely regulated voltage for the exciter lamp (6 volts at 1,800 cycles) from a 1,800-cycle signal supplied by the fork oscillator unit.

d. Rectifier Power Unit PP-86E/TXC-1 also provides 115 volts at 60 cps for the dust removal blower motor.

81. Power Supply Rectifier (V22)

(fig. 67)

The high-voltage power supply rectifier (V22), located within Rectifier Power Unit PP-86(*)/TXC-1, furnishes +450-volt unregulated dc for transceiver plate and screen circuits. The +450-volt, unregulated dc also is the source of voltage for the voltage regulator (V7, V8, V9, and V25) located on the transceiver chassis (par. 80), which furnishes regulated +250 volts for critical transceiver circuits. Rectifier V22, type 5Z2, is connected in a conventional full-wave rectifier circuit. Transformer T11 changes the 115-volt ac input on the primary side to high voltage for the plates of V22, 5 volts for the filament of V22, 6.5 volts for filaments of other tubes in the power

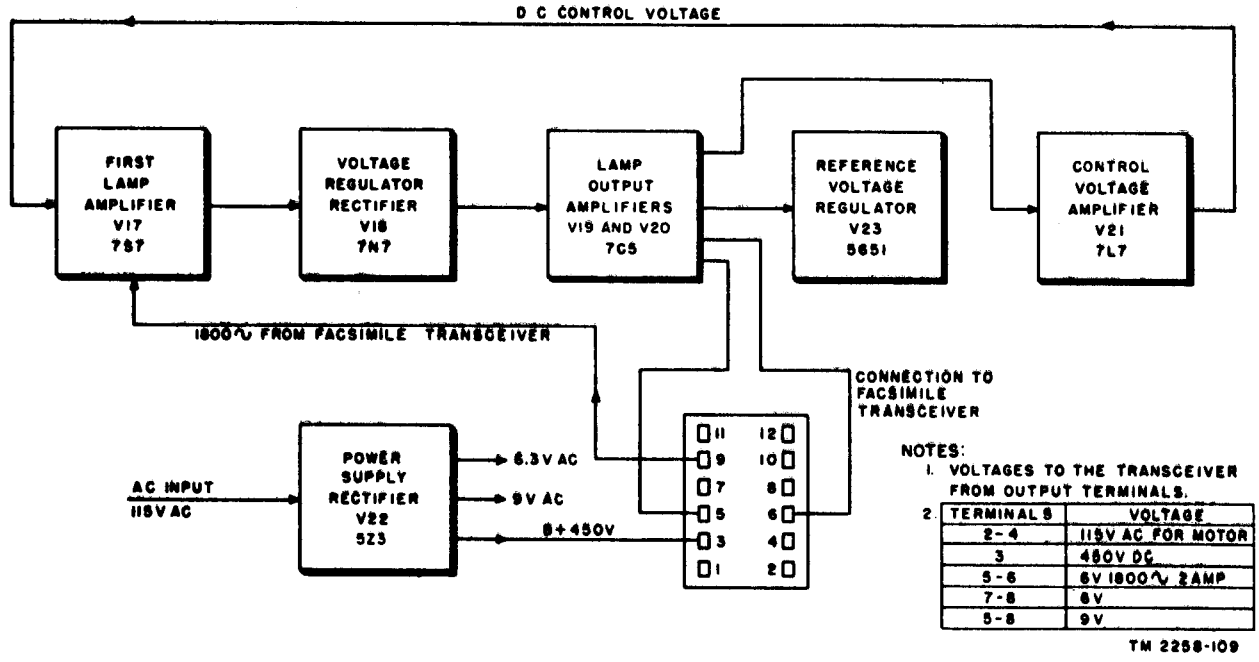


Figure 66. Rectifier power unit PP-86(*)/TXC-1, block diagram.

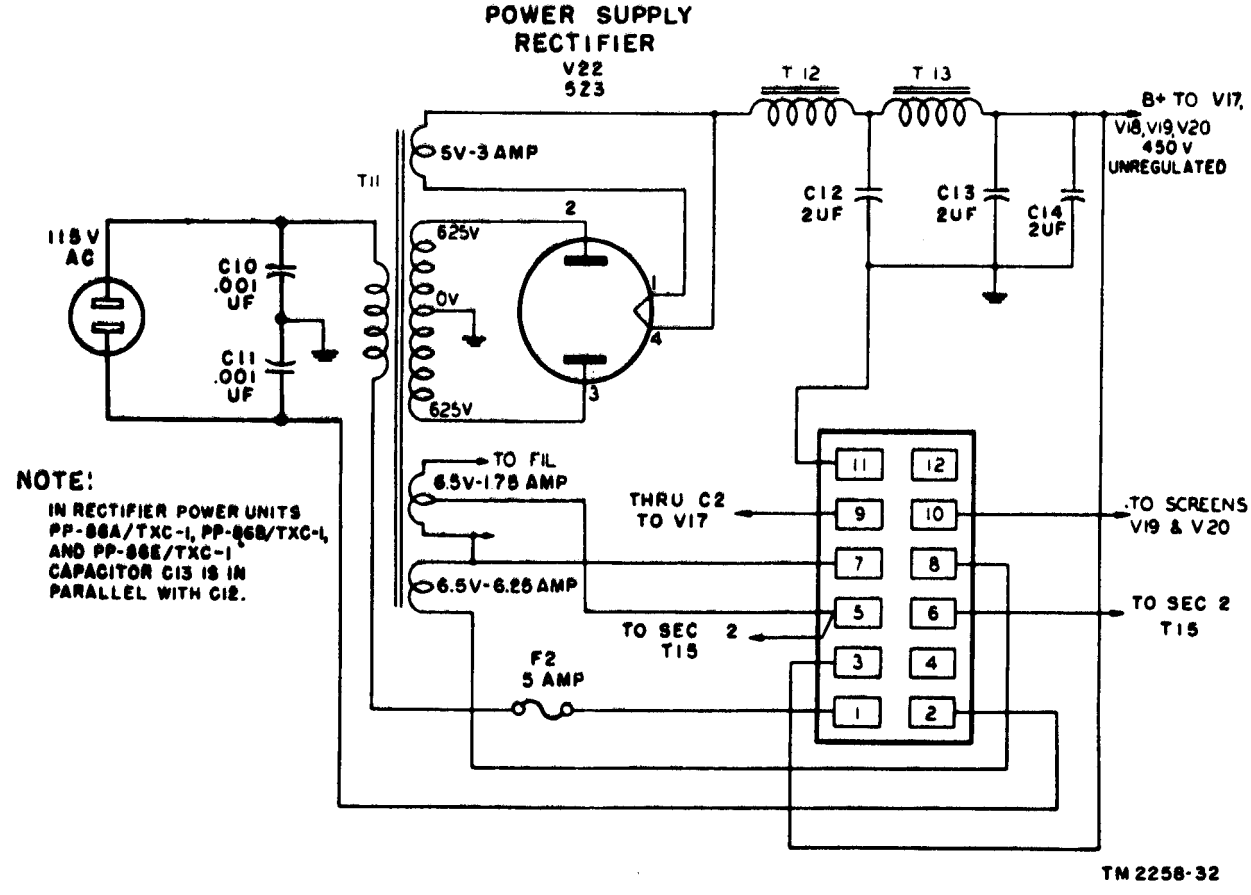


Figure 67. Rectifier power power supply, part of Rectifier power unit PP-86(*)/TXC-1.

supply, and 6.5 volts for the transceiver filaments. The primary of T11 is fused by F2, and the circuit is completed through ON-OFF switch S2 on the transceiver operating panel. In Rectifier Power Unit PP-86(*)/TXC-1, the starting voltage for the transceiver motor is supplied from the line through terminals 2 and 4 of the Jones plug when the START switch is operated. Two capacitors, C10 and C11, form a high-frequency suppressor at the transformer input. The rectified ac delivered by V22 is filtered by swinging input choke T12, choke T13, and filter capacitors C12, C13, and C14. In Rectifier Power Unit PP-86/TXC-1, filter capacitor C13 is in parallel with output filter capacitor C14 (fig. 66). In Rectifier Power Units PP-86A/TXC-1, PP-86B/TXC-1, and PP-86E/TXC-1, C13 is in parallel with first filter capacitor C12.

82. Exciter Lamp Supply (V17, V18, V19, V20, V21, V23)

(figs. 68-72)

The exciter lamp supply, located in Rectifier Power Unit PP-86(*)/TXC-1, receives a constant-frequency input signal of 1,800 cycles from the fork oscillator unit, amplifies and regulates it, and supplies the exciter lamp with an 1,800-cycle signal which remains steady at 6-volt amplitude. The voltage must be well regulated because the exciter lamp must maintain constant brilliancy, since it serves as the source of light which is reflected from the facsimile copy to the photocell during transmission of a picture. The exciter lamp is illuminated only when selector switch S1 is in the TRANSMIT or SET RANGE position. Input voltage is applied to V17, which amplifies the signal and applies it to one section of V18. This section of V18 serves as the driver for push-pull class AB_1 tubes V19 and V20. The output of these tubes is applied to the lamp through one secondary on T15, and to control voltage amplifier circuit V21 and V23, through the other secondary. Tube V21 varies the amplification of tube V17 in an automatic voltage-control circuit.

a. First Lamp Amplifier (V17) (fig. 68). The 1,800-cycle signal from the motor amplifier buffer (V3, sections 2, 3, and 4) in the fork oscillator unit is applied to the injection grid (pin 4) of V17, type 7S7. This signal is applied through pin 9 of the power supply plug, coupling capacitor C2, and the voltage-divider circuit composed of resistors R1 and R2. The grid is bypassed to ground by C1 to suppress high frequencies. Resistor R6 is the unbypassed cathode resistor. The control voltage to regulate the amplification of V17 is coupled from control voltage amplifier V21 directly to the control grid of tube V17 (pin 6). Capacitor C7 is a smoothing capacitor for the

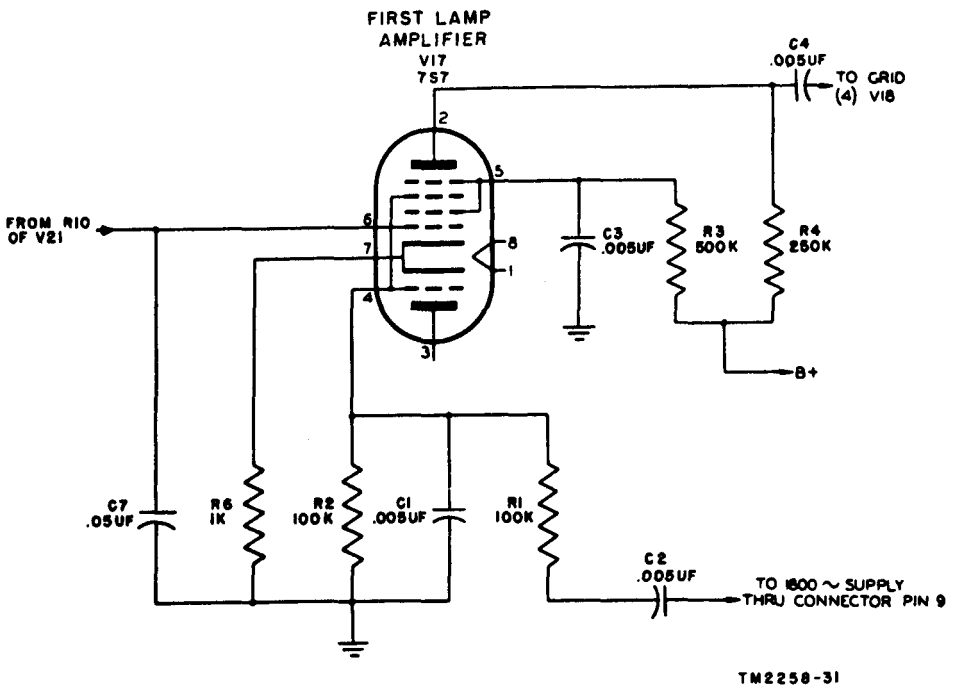


Figure 68. First lamp amplifier, exciter lamp supply.

control voltage. Unregulated B+ voltage is supplied to the screen (pin 5) of V17 through resistor R3, which is bypassed to ground by C3, and to the plate through plate load resistor R4. The amplified 1,800-cycle voltage developed across R4 is applied through coupling capacitor C4 to the grid (pin 4) of the lamp driver triode section (pins 2, 3, and 4) of V18.

b. Lamp Driver (V18) (fig. 69). The grid (pin 4) of the lamp driver section (pins 2, 3, and 4) of V18, type 7N7, is driven by the voltage from V17, which is applied across grid resistor R5. Capacitor C5 serves as a high-frequency suppressor. This section of V18 is biased by the flow of plate current through cathode resistor R7, which is bypassed by C6. The primary of transformer T14 is the plate load.

c. Voltage Regulator Rectifier (V18) (fig. 69). Secondary No. 1 of transformer T15 and pins 5, 6, and 7 of V18, form a dc rectifier for control voltage amplifier V21. Plate and grid of this section of V18 are tied together and form a diode used as a half-wave rectifier on the 1,800-cycle signal. The grounded cathode is the positive terminal of this power supply. Capacitor C9 is across secondary No. 1 of T15 (fig. 70) to suppress high peak voltages.

d. Lamp Output Amplifiers (V19 and V20) (fig. 70). The voltage developed across the secondary of driver transformer T14 drives the grids of push-pull class AB_1 tubes V19 and V20, which are C57 tubes. This is a power output stage biased by cathode resistor R16. Screen voltage is applied directly from the regulated +250-volt supply through pin 10 of the power plug when the selector is in the TRANSMIT or the SET, RANGE position. On other settings of the selector switch the screens are not energized, and there is no output. Output transformer T15 has two secondaries: one feeding the exciter lamp, and the other driving control voltage amplifier stage V21.

e. Exciter Lamp. The exciter lamp is a 6-volt lamp, which draws approximately 2.75 amperes of current. It has an incandescent filament which emits steady light because of its well-regulated supply voltage. While 1,800-cycle voltage is applied, thermal inertia of the heavy filament is high and a 3,600-cycle light ripple is present but does not affect operation in any way.

f. Control Voltage Amplifier (V21 and V23) (figs. 71 and 72). Negative voltage for the operation of V21, 7L7 (the control voltage amplifier) is applied to the cathode through filter dropping resistor R8 and gaseous voltage regulator tube V23 (type R1160A or 1B47 in unlettered models, type 5651 in later models). The plate of V21 is positive with respect to the cathode because it is connected to ground, the positive side of the voltage source, through plate resistor R11. Resistor R12 is the screen resistor. A voltage-dividing network in the grid circuit is composed of resistors R9, R15, and R14. Resistor R15 is variable to provide adjustment of the regulated output voltage. Any variations in the voltage are

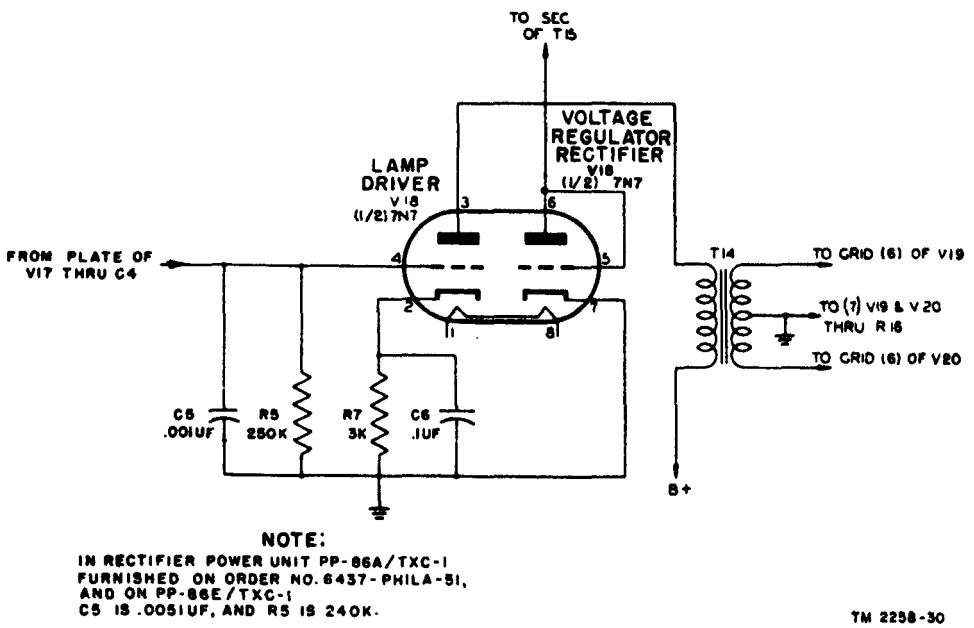


Figure 69. Lamp driver and voltage regulator rectifier, exciter lamp supply.

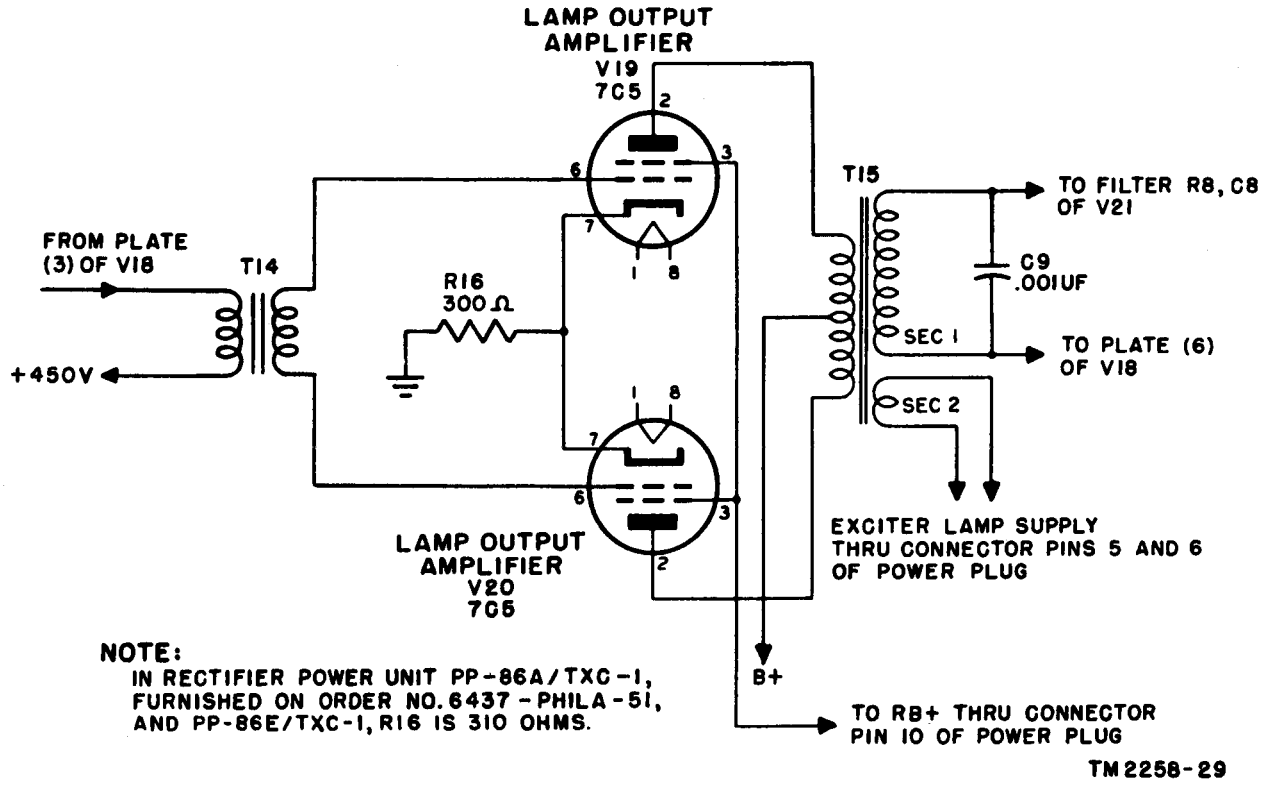


Figure 70. Lamp output amplifiers, exciter Lamp supply.

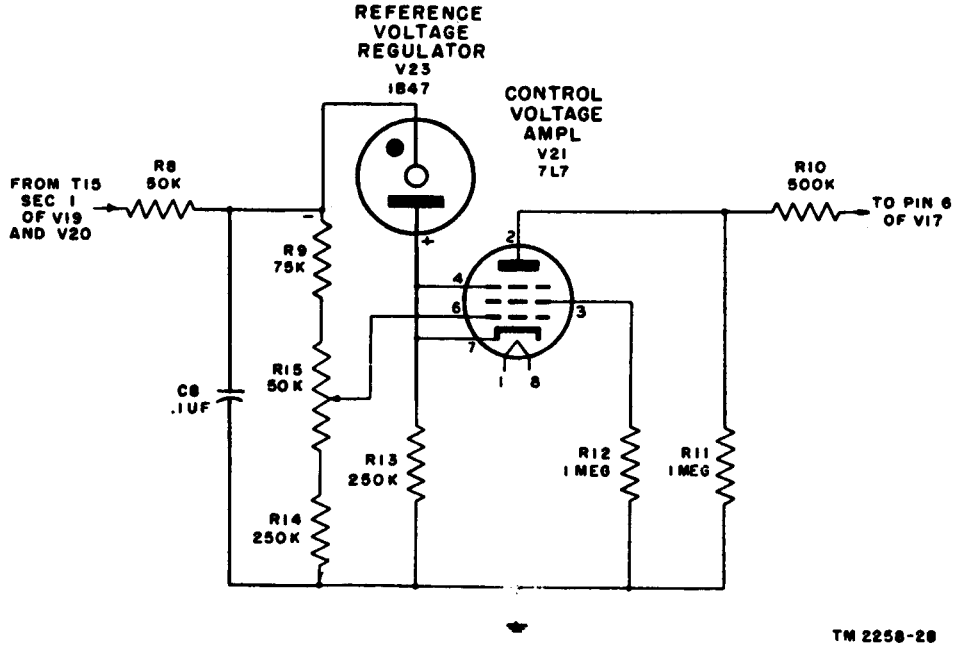


Figure 71. Control voltage amplifier, exciter lamp power supply, rectifier power unit PP-86/TXC-1.

amplified by tube V21, and applied through resistor R10 directly to the grid of first lamp amplifier V17. If the lamp output voltage becomes higher than normal, the output at secondary No. 1 of T15 will increase, and the rectified supply voltage for stage V21 will increase. The bias on V21 is the voltage developed between cathode and grid, across V23, resistor R9, and that portion of R15 between R9 and the slider on R15. However, the voltage across V23 (about 70 volts) is opposite to that across the resistors. Consequently, the true bias on V21 is the difference between the voltage developed across V23 and that developed across R9 and a portion of R15. When the supply voltage increases, approximately 70 percent of the increase is developed across R9 and the portion of R15 and is applied as positive bias to the grid of V21. The reference voltage across V23 remains constant. Tube V21 becomes more conductive, the drop across plate load resistor R11 increases, and the bias applied to the control grid of V17 becomes more negative. This reduces amplification of stage V17 and brings the output voltage down to normal. In Rectifier Power Unit PP-86/TXC-1, tube V23, type R1160 or 1B47, now is obsolete and is replaced by type 5651 (fig. 72). In Rectifier Power Units PP-86A/TXC-1, PP-86B/TXC-1, and PP-86E/TXC-1 tube V23 is type 5651, which requires a different value of R13 to provide minimum stabilization current for the tube and a different value of R9 (fig. 72).

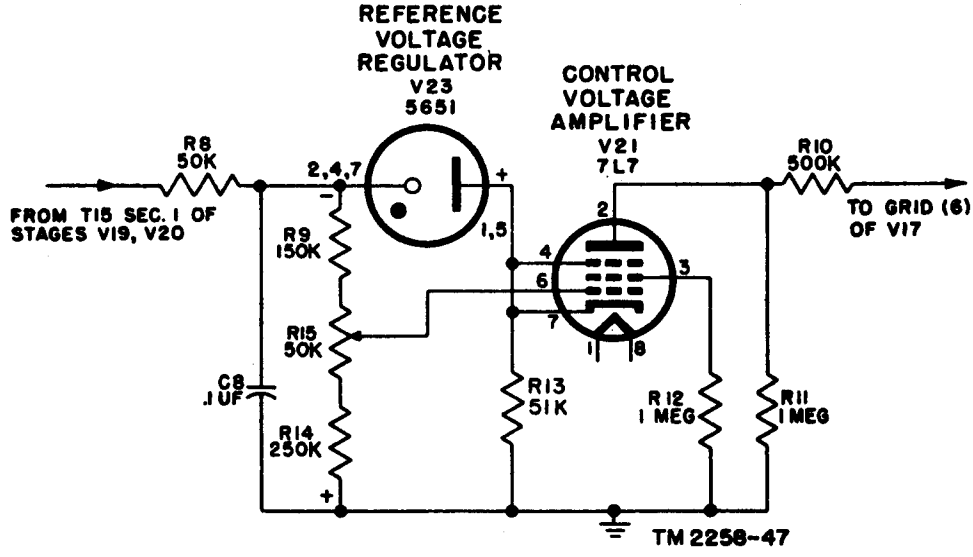


Figure 72. Control voltage amplifier, exciter lamp power supply, rectifier power units PP-86A/TXC-1, PP-86B/TXC-1, and PP-86E/TXC-1.

CHAPTER 6
FIELD MAINTENANCE

Note. This chapter contains information for field maintenance. The amount of repair that can be performed by units having field maintenance responsibility is limited only by the tools and test equipment available and by the skill of the repairman.

Section I. TROUBLESHOOTING AT FIELD MAINTENANCE LEVEL

Warning: When servicing Facsimile Set AN/TXC-1(*), use extreme care because of the high voltages exposed. Potentials as high as 1,000 volts at 1,800 cycles ac may be developed in the [illegible] amplifier circuit. Potentials as high as 1,250 volts at 60 cycles ac and 450 volts dc are developed in Rectifier Power Unit PP-86(*)/TXC-1. When measuring high voltages with a probe, try to keep one hand in the pocket. Before touching any part after the voltage has been turned off, short-circuit the part to ground.

83. Troubleshooting Procedures

a. General. The first step in servicing a defective facsimile transceiver is to sectionalize the fault. Sectionalization means tracing the fault to a major component or circuit responsible for abnormal operation. The second step is to localize the fault. Localization means tracing the fault to the defective part responsible for the abnormal condition. Some faults, such as burned-out resistors, arcing, and shorted transformers, often can be located by sight, smell, and hearing. The majority of faults, however, must be localized by checking voltages and resistances.

b. Component Sectionalization and Localization. Listed below is a group of tests arranged to simplify and reduce unnecessary work, and aid in tracing a trouble to a specific component. The simple tests are used first. Those that follow are more complicated. Follow the procedure in the sequence given. A serviceman must be careful not to cause further damage to the transceiver while it is being serviced. In general, the trouble is traced to a section of the transceiver, and the faulty component in that section is located; then the trouble is remedied. The service procedure is summarized as follows:

(1) *Visual inspection.* The purpose of visual inspection (par. 54) is to locate any visible trouble. Through inspection alone, the repairman frequently may discover the trouble or determine the circuit in which the trouble exists. This inspection is valuable in avoiding additional damage which might occur through needless and improper serficing methods and in forestalling future failures. Figures 129 through 151 will aid in identification of parts in the facsimile transceivers. Figures 152 through 156 refer to the rectifier power units.

(2) Resistance *measurements.* These measurements (par. 88) prevent further damage to the transceiver from possible short circuits. Resistor and capacitor color codes (figs. 194 and 195) help in determining values of components.

(3) *Operational test.* The operational test is important as it may indicate the location of trouble. In many instances, the information gained may determine the exact nature of the fault. To utilize this information fully, all symptoms must be interpreted in relation to one another.

(4) *Troubleshooting chart.* The trouble symptoms listed in this chart (par. 89) will aid greatly in localizing trouble.

(5) *Signal tracing.* Signal tracing (par. 100) is helpful in troubleshooting as it will isolate the specific circuit at fault.

(6) *Wiring diagrams* (figs. 178 through 193). These diagrams are included as an aid in locating faulty parts.

(7) *Schematic diagrams* (figs. 163 through 171). These schematic diagrams will aid in tracing troubles to individual components or circuits.

(8) *Intermittents.* In all these tests, the possibility of intermittent conditions should not be overlooked. If present, this type of trouble often may be made to appear by tapping or jarring the equipment. It is possible that some external source may cause the trouble. Test wiring for loose connections and move wires and compo-

nents with an insulated tool, such as a fiber rod or a pencil. This may show where a faulty connection or component is located.

84. Troubleshooting Data

Fig. No	Title
128	Facsimile Transceivers TT–1/TXC–1 and TT–1A/TXC–1, bottom view, parts identification.
129	Facsimile Transceiver TT–1B/TXC–1, bottom view.
130	Facsimile Transceiver TT–1C/TXC–1, bottom view, parts identification.
131	Facsimile Transceiver TT–1D/TXC–1, bottom view, parts identification.
132	Facsimile Transceiver TT–1E/TXC–1, bottom view, parts identification.
133	Facsimile Transceiver TT–1F/TXC–1, bottom view, parts identification.
134	Facsimile Transceiver TT–1/TXC–1, rear view, parts identification.
135	Facsimile Transceiver TT–1B/TXC–1, rear view, parts identification.
136	Facsimile Transceiver TT–1C/TXC–1, rear view, parts identification.
137	Facsimile Transceivers TT–1D/TXC–1 and TT–1E/TXC–1, rear view, parts identification.
138	Facsimile Transceiver TT–1F/TXC–1, rear view, parts identification.
139	Facsimile Transceivers TT–1/TXC–1 and TT–1A/TXC–1, regulator panel, bottom view, parts identification.
140	Facsimile Transceivers TT–1D/TXC–1, TT–1E/TXC–1, and TT–1F/TXC–1, regulator panel, bottom view, parts identification.
141	Facsimile Transceiver TT–1/TXC–1, rear of front panel, parts identification.
142	Facsimile Transceiver TT–1A/TXC–1, rear of front panel, parts identification.
143	Facsimile Transceivers TT–1B/TXC–1 and TT–1C/TXC–1, rear of front panel, parts identification.
144	Facsimile Transceivers TT–1D/TXC–1, TT–1E/TXC–1, and TT–1F/TXC–1, rear of front panel, parts identification.
145	Unsealed fork oscillator unit, parts identification
146	Sealed fork oscillator unit, Facsimile Sets AN/TXC–1, AN/TXC–1A, and AN/TXC–1B, parts identification.
147	Sealed fork oscillator unit, Facsimile Sets AN/TXC–1C and AN/TXC–1D, parts identification.
148	Facsimile Transceiver TT–1B/TXC–1, top view, parts identification.
149	Facsimile Transceiver TT–1C/TXC–1, top view, parts identification.
150	Facsimile Transceivers TT–1D/TXC–1 and TT–1E/TXC–1, top view, parts identification.
151	Facsimile Transceiver TT–1F/TXC–1, top view, parts identification.
152	Rectifier Power Unit PP–86/TXC–1, bottom view, parts identification.
153	Rectifier Power Units PP–86/TXC–1 and PP–86E/TXC–1 as furnished on Order No. 21751–P–50, top view, parts identification.
154	Rectifier Power Unit PP–86A/TXC–1 as furnished on Order No. 21751–P–50, bottom view, parts identification.
155	Rectifier Power Unit PP–86B/TXC–1, bottom view, parts identification.

85. Tools and Test Equipment Required for Troubleshooting

Note. Final test must be made with photographic transmissions and receptions. This necessitates the use of a darkroom.

a. The test equipment required for troubleshooting Facsimile Set AN/TXC-1(*) is listed below. The manuals associated with the test equipment also are listed.

Test equipment	Technical manual
Test Set TS–140/PCM, Signal Generator SG–15/PCM and Decibel Meter ME–22/PCM.	TM 11–2096
Multimeter TS–352/U	TM 11–5527
Oscilloscope OS–8A/U	TM 11–1214
Electronic Multimeter ME–6A/U	TM 11–5549
Tube Tester TV–2/U	TM 11–2661
Headset HS–30( )	
Radio Receiver R–388/URR	TM 11–854
Photographic equipment	

b. The tools and equipment required for alignment and adjustment are listed below.

Item	Description
Spring scale	Measure up to 32 ounces.
Screwdriver TL–359/U	6 inches long, ¼-inch blade.
Tube puller	For tube replacement (fig. 73).
Pliers TL–103	Diagonal pliers, 6 inches long.
Pliers TL–126	Long-nosed pliers, 6 inches long.
Hammer	10 ounces.
Punch set	
Eraser	Rubber.
Cloth	Lint-free.
Glyptal cement	
Magnifying glass	4- to 10-power.
Solvent, Dry Cleaning (SD).	Federal Specification P–S–661–a, QM issue.

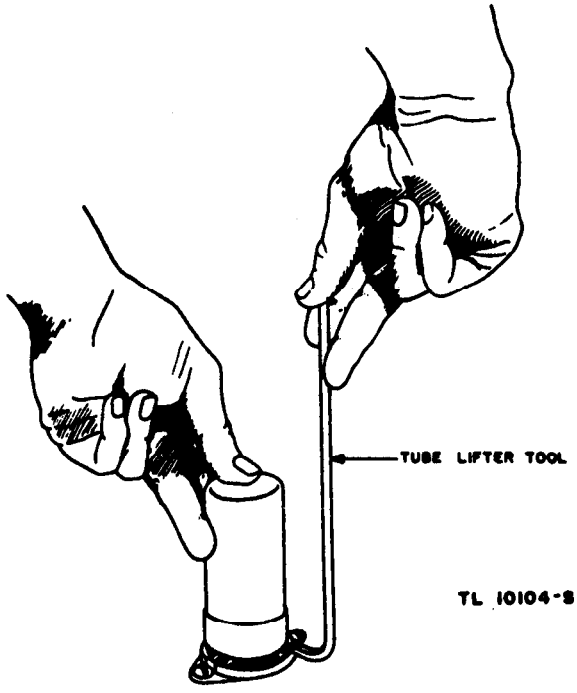


Figure 73. Use of tube puller.

c. Whenever the equipment is serviced, observe the following precautions very carefully:

(1) Be careful when the transceiver cover is removed; dangerous voltages are exposed.

(2) Careless replacement of parts often makes new faults inevitable. Note the following points:

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

(b) Be careful not to damage or disturb other leads by pulling or pushing them out of the way.

(c) Do not allow drops of solder to fail into the set; they may cause short circuits.

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

(e) When a part is replaced, it must be placed exactly as the original. Give particular attention to proper grounding when replacing a part. Use the same grounds in the original wiring. Failure to observe these precautions may result in decreased gain or oscillation of the circuit.

86. Checking Filament and B+ Circuits for Shorts

a. Filament and B+ voltages are supplied to the transceiver by Rectifier Power Unit PP-86(*)/TXC-1 through a 12-connector Jones plug. If there is no B+ or filament voltage in the transceiver, it is likely that the trouble lies in the rectifier power unit. This may be due to a faulty rectifier tube, an open filter choke, or a shorted filter capacitor. Operating selector switch S1 will aid in determining the circuit at fault. The schematics, the parts identification figures, and the wiring diagrams of Rectifier Power Unit PP-86(*)/TXC-1 and the transceiver will help to trace the trouble.

b. A trouble in any circuit will be noticed when following the operating procedures. These troubles will be indicated in the equipment performance check list (par. 58). Normally, use of this procedure will narrow down the trouble to a section of the transceiver or power supply. Most of the checking can be accomplished from the bottom of the chassis. Paragraphs 101 and 121 describe the power supply.

Section II. TROUBLE ANALYSIS

87. Use of Signal-Tracing Charts

To determine whether a circuit is performing in accordance with the requirements, it is necessary to measure the signal voltages and, in some cases, to observe the waveforms at various points, using an oscilloscope and a vacuum-tube voltmeter. Use of signal-tracing charts (figs. 74 through 81) is described where applicable. General conditions for signal tracing, unless otherwise directed, are:

a. Set turned on.

b. Motor running.

c. Input signal sufficient to cause a +2-db reading on DB METER.

d. Selector switch on one of the recording positions.

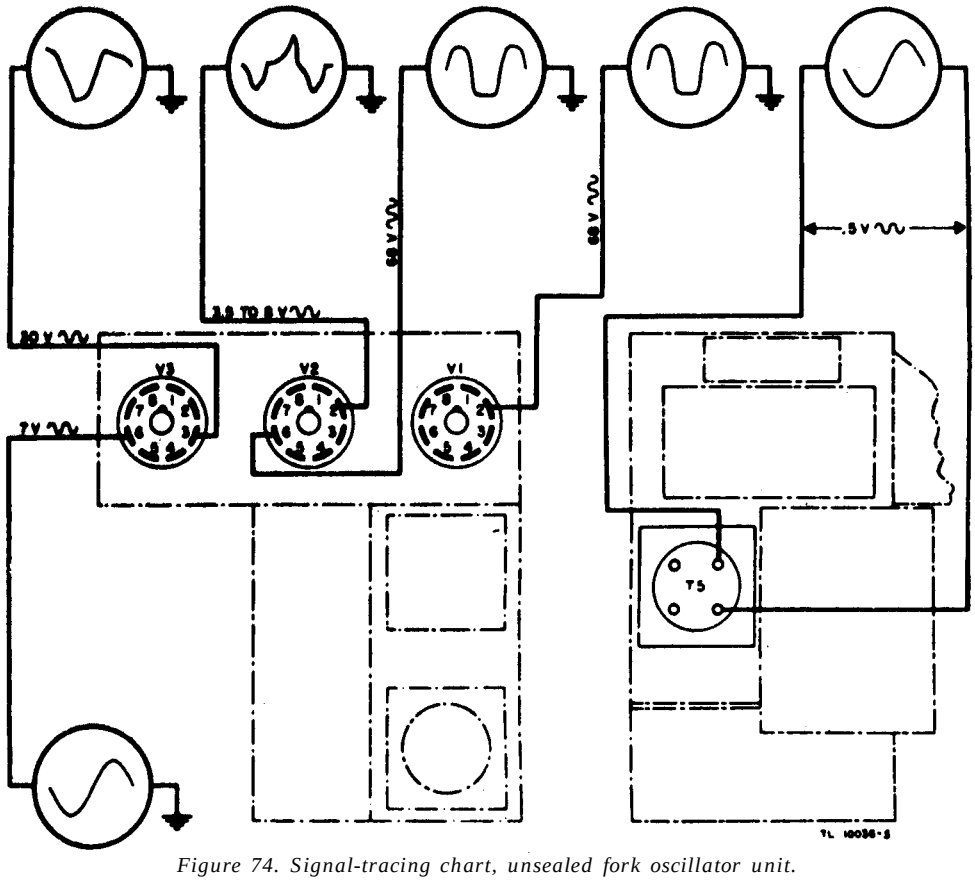


Figure 74. Signal-tracing chart, unsealed fork oscillator unit.

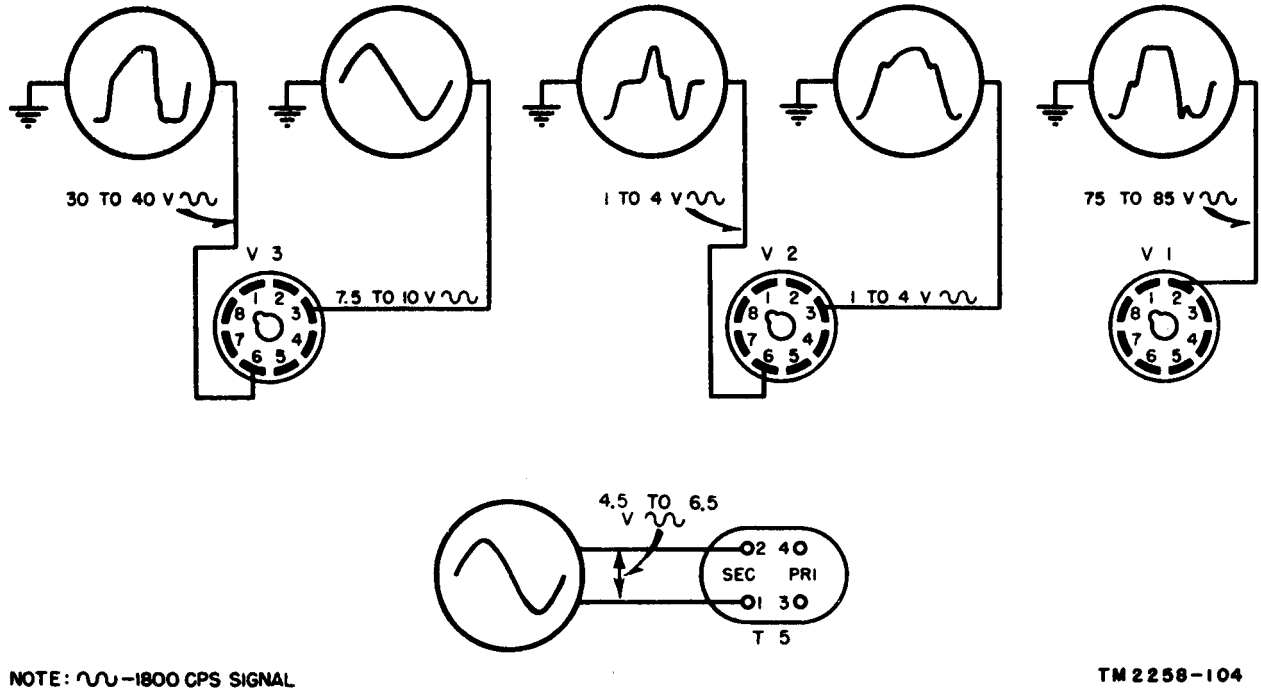


Figure 75. Signal-tracing chart, sealed fork oscillator unit.

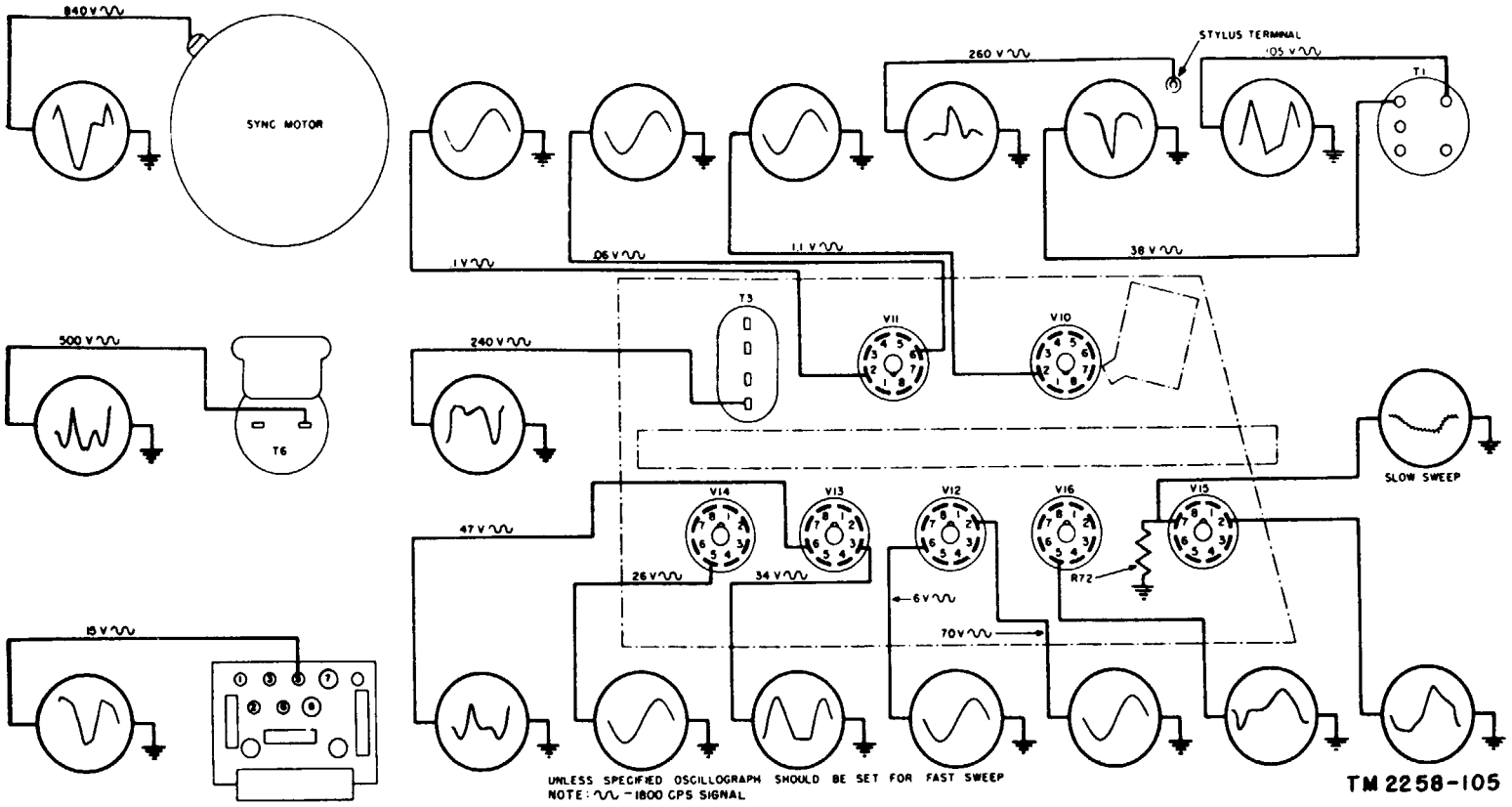


Figure 76. Signal-tracing chart, Facsimile Transceiver TT-1/TXC-1.

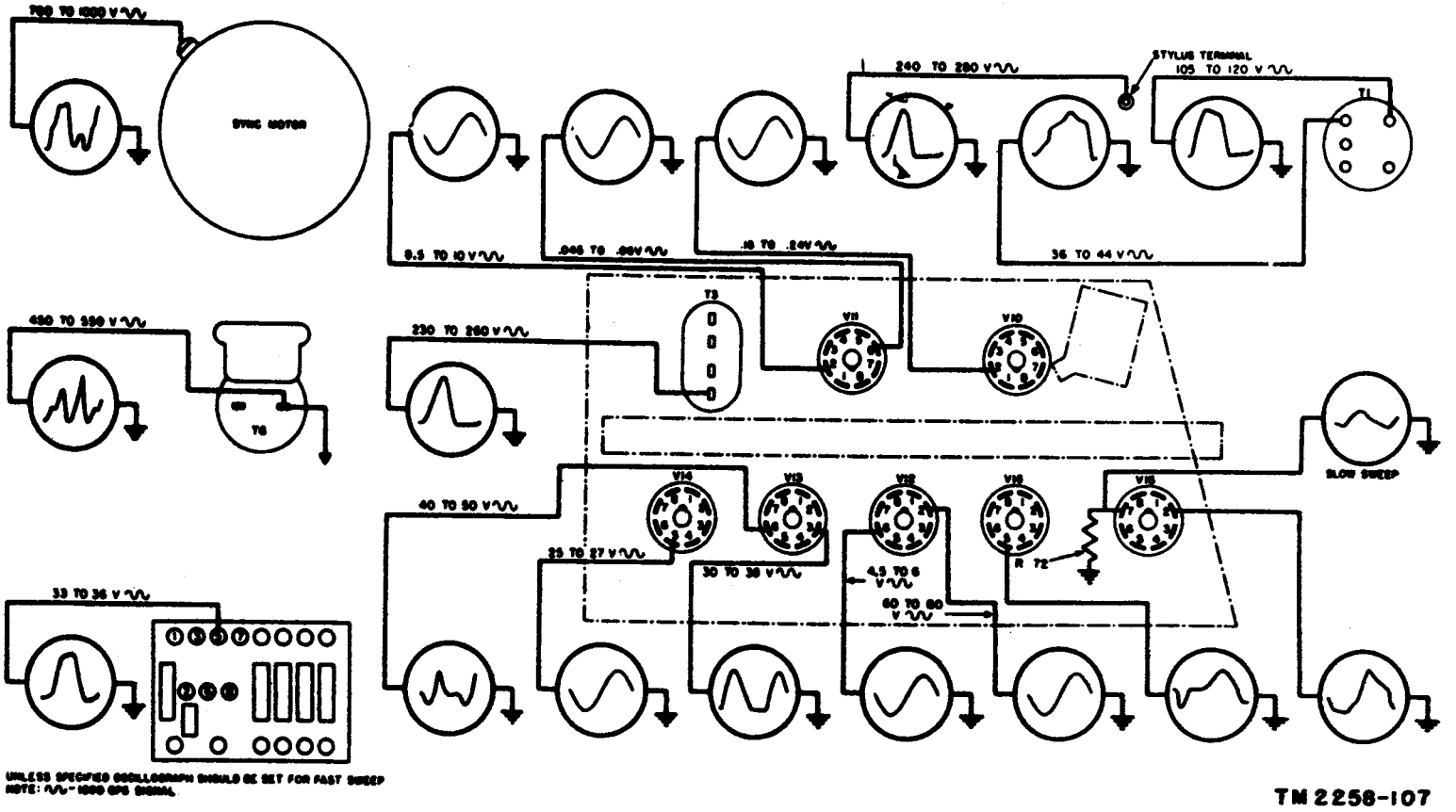
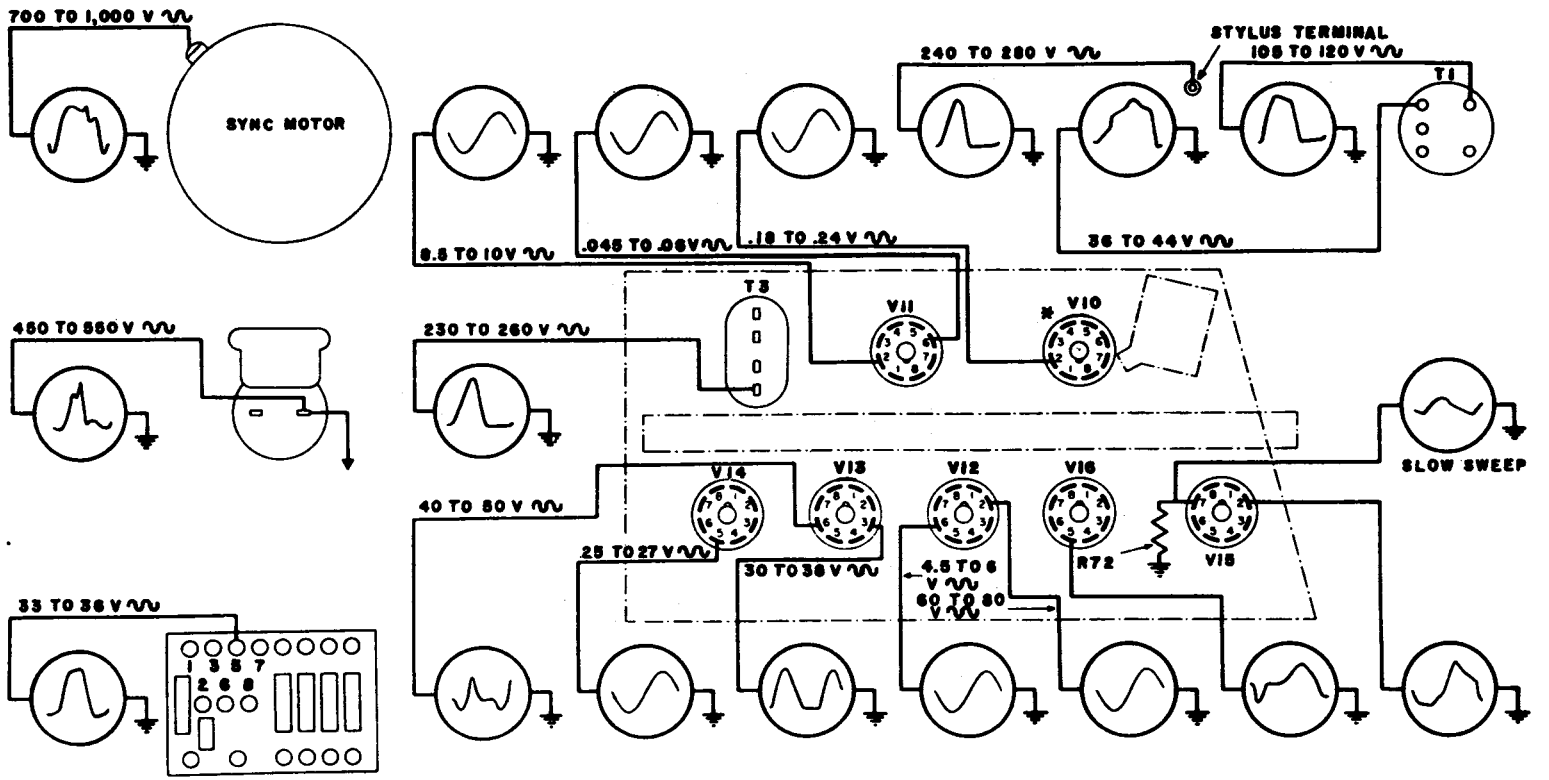


Figure 77. Signal-tracing chart, Facsimile Transceiver TT-1A/TXC-1.



NOTES:

1. UNLESS SPECIFIED OSCILLOGRAPH SHOULD BE SET FOR FAST SWEEP.
2. ∿∿ = 1,800 CPS SIGNAL.

TM 2258-15

Figure 78. Signal-tracing chart, Facsimile Transceivers TT-1B/TXC-1, TT-1C/TXC-1, TT-1D/TXC-1, TT-1E/TXC-1 and TT-1F/TXC-1.

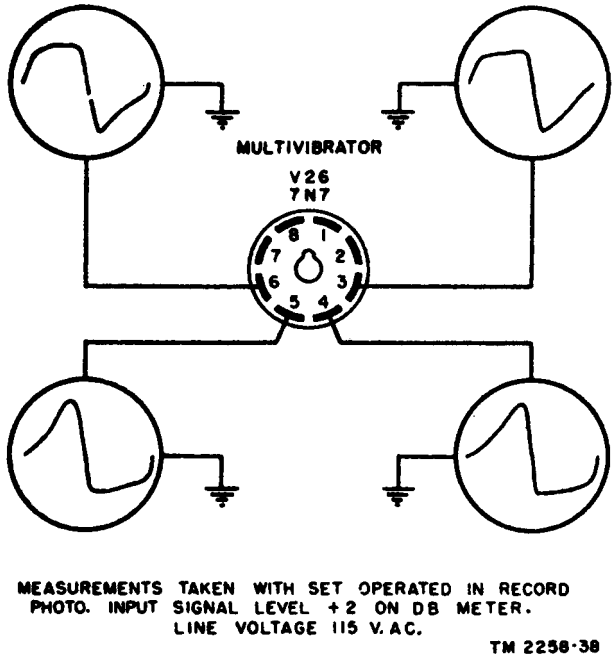


Figure 79. Signal-tracing chart, multivibrator stage, Facsimile Transceivers TT-1D/TXC-1, TT-1E/TXC-1 and TT-1/TXC-1.

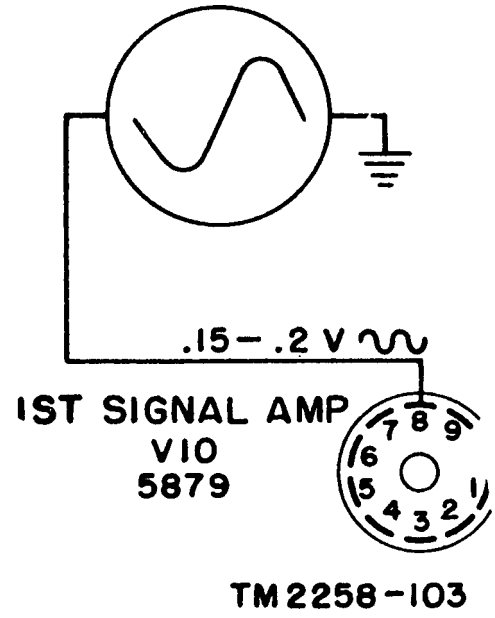


Figure 80. Signal-tracing chart, first signal amplifier, Facsimile Transceivers TT-1E/TXC-1 and TT-1F/TXC-1.

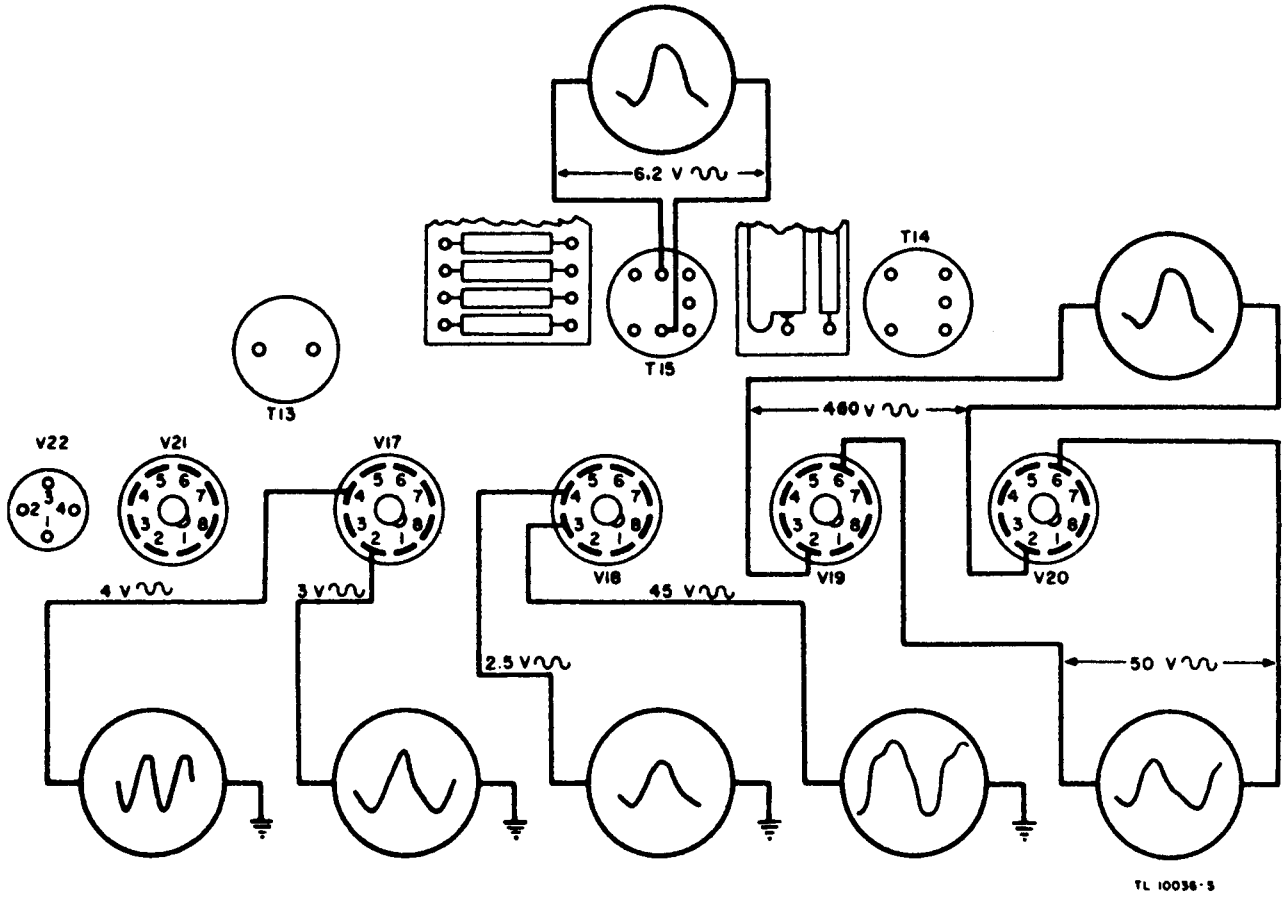


Figure 81. Signal-tracing chart, Recfifier Power Unit PP-86(*)/TXC-1.

88. Voltage and Resistance Measurements

Follow the voltage and resistance charts (figs. 82 through 101) when localizing trouble. Make readings with the meter connected between the chassis and the indicated socket lug or the component lug. Make all voltage tests with the tubes in place, the power switch at the ON position and, unless otherwise noted on the chart, with an input signal sufficient to cause a reading of +2 on the DB METER. For dc voltage measurements, use a voltmeter with a sensitivity of 1,000 ohms per volt, and for ac signal measurements, use a vacuum-tube voltmeter, unless otherwise specified. Line voltage should be 115 volts ac; if it is higher or lower, make allowances in measuring voltages affected by line voltage. For resistance tests, disconnect the power cord from the ac line and remove the tubes, Make all tests from the bottom of the chassis.

a. The following circuits are affected by higher or lower line voltages within normal limits: filaments; unregulated B+; V14 stage when selector switch S1 is at RECORD DIRECT: regulator stages V7, V8, V9, and V21; start motor; start coil; and motor amplifier stages V4, V5, and V6.

b. The motor amplifier is self-regulating, so that the motor current varies very little over a wide range of line voltages. The effect of the line voltage on this circuit is complex; in some cases, the motor current or voltage increases as the line voltage decreases.

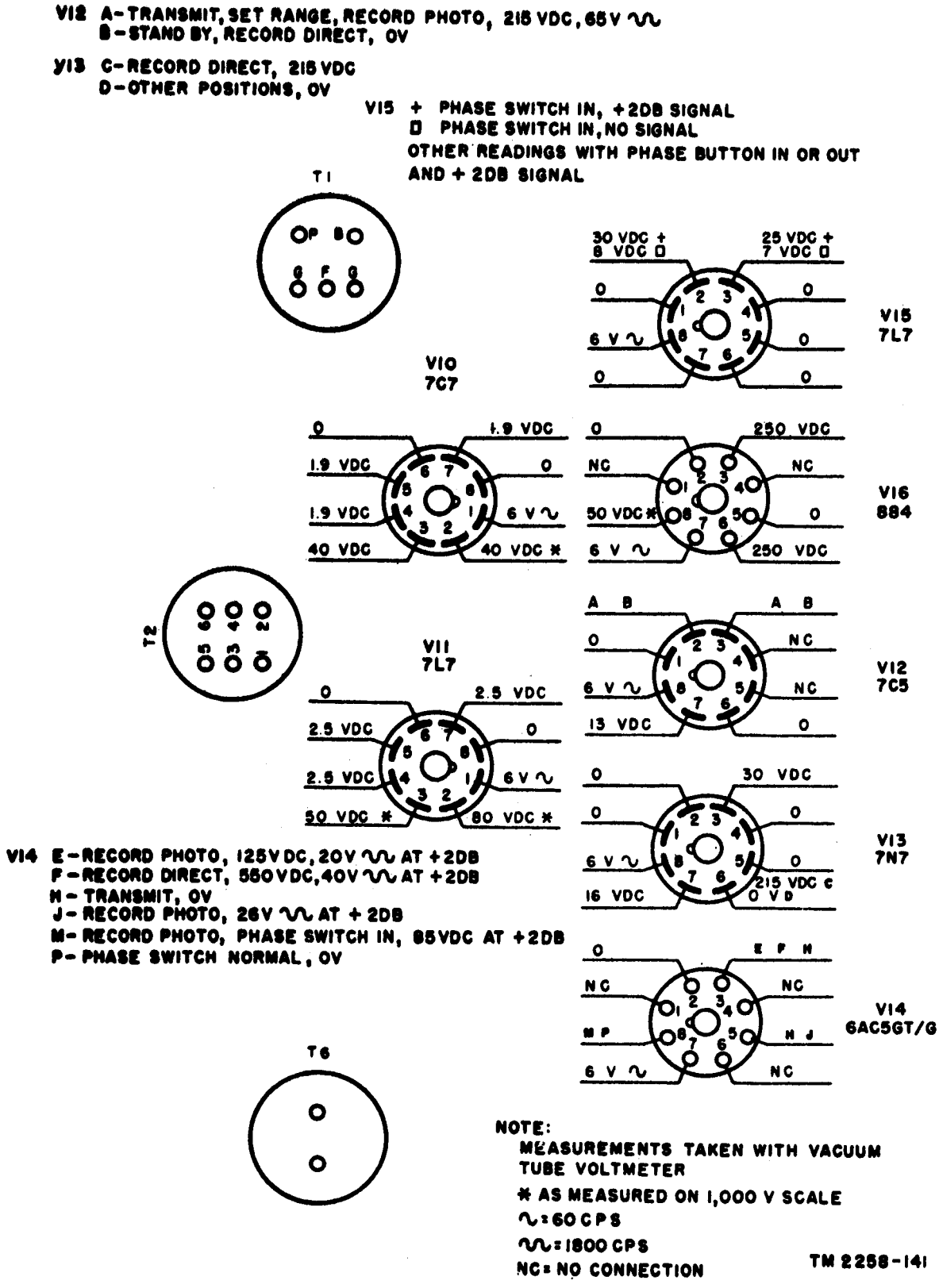
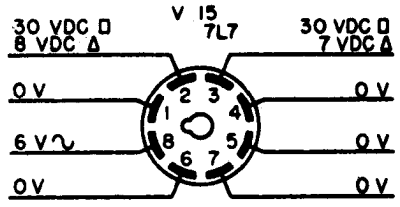


Figure 82. Voltage measurement chart, stagesV10 through V16, Facsimile Transcievers TT-1/TXC-1 and TT-1A/TXC-1.

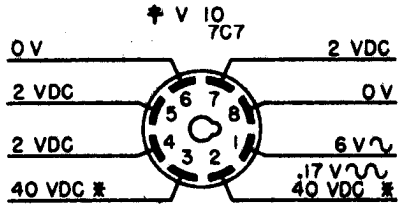
NOTES:
INPUT .003 V ∿∿
GAIN DIAL AT 100, +2 DB ON SET METER

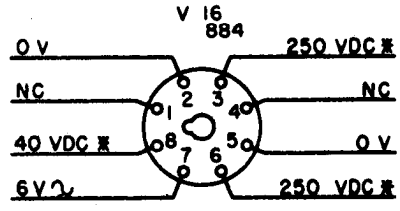
ALL READINGS TAKEN AT 115 V LINE

ALL READINGS TAKEN FROM TUBE SOCKET PINS TO CHASSIS GROUND



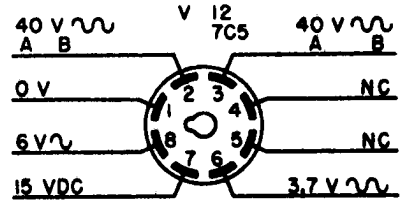
V 15
□ PHASE BUTTON IN +2 DB SIGNAL
Δ PHASE BUTTON IN NO SIGNAL
OTHER READINGS WITH PHASE BUTTON IN OR OUT

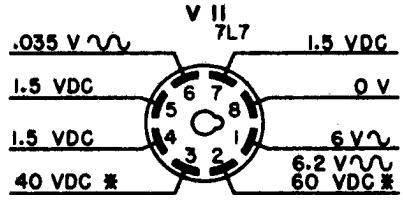




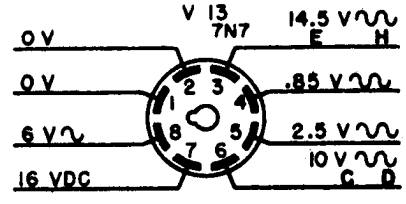
V 12
A - RECORD DIRECT 0 VDC
B - ALL OTHER POSITIONS 235 VDC *

*V 10
VOLTAGES DO NOT APPLY TO FACSIMILE TRANSCEIVER TT-1F/TXC-1





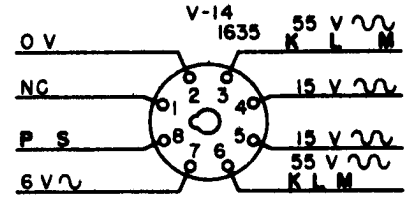
V 13
C - RECORD DIRECT 240 VDC *
D - ALL OTHER POSITIONS 0 VDC
E - RECORD PHOTO, STANDBY, REC. DIRECT 40 VDC *
H - TRANSMIT, SET RANGE 50 VDC *



V 14
K - RECORD PHOTO 175 VDC *
L - TRANSMIT, SET RANGE, STANDBY 0 VDC
M - RECORD DIRECT 510 VDC *
P - RECORD PHOTO PHASE BUTTON IN 5 VDC
S - PHASE BUTTON OUT 0 VDC

∿∿ READINGS TAKEN ON RECORD PHOTO
* AS MEASURED ON 1,000 V SCALE USING 1,000 OHMS PER VOLT METER
AC AND SIGNAL VOLTAGES MEASURED WITH BALLANTINE VACUUM TUBE VOLTMETER

∿ = 60 ∿
∿∿ = 1800 ∿ SIGNAL VOLTS



IN TT-1C/TXC-1, REVERSE PINS 1 AND 8 OF V10, V11
IN TT-1D/TXC-1 AND TT-1E/TXC-1, REVERSE PINS 1 AND 8 OF V12, V13, V14; REVERSE PINS 7 AND 2 OF V14, V16

NC = NO CONNECTION

TM 2280-40

Figure 83. Voltage measurement chart, stages V10 through V16, Facsimile Transceivers TT-1B/TXC-1, TT-1C/TXC-1, TT-1D/TXC-1, and TT-1E/TXC-1.

NOTES:

INPUT .003 V ∿∿

GAIN DIAL AT 100, +2 DB ON SET METER.

ALL READINGS TAKEN AT 115 V LINE.

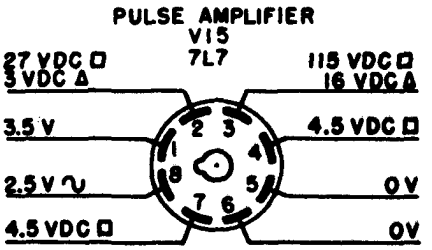
ALL READINGS TAKEN FROM TUBE SOCKET PINS TO CHASSIS GROUND.

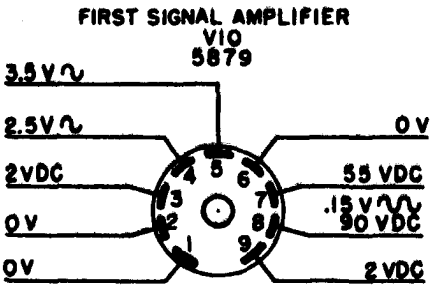
V15

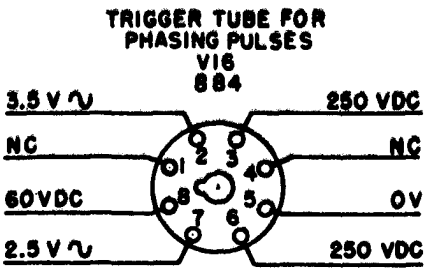
□ PHASE BUTTON IN +2 DB SIGNAL.

Δ PHASE BUTTON IN NO SIGNAL.

OTHER READINGS WITH PHASE BUTTON IN OR OUT.





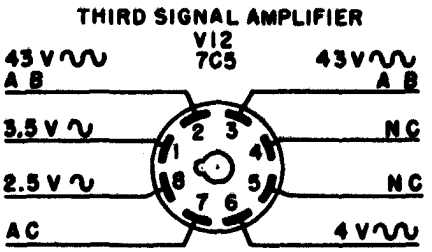


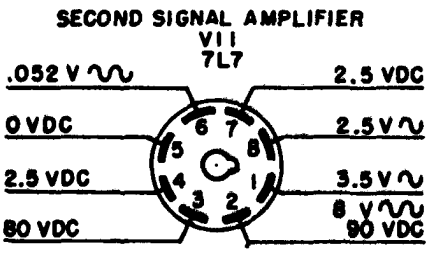
V12

A-RECORD DIRECT 0 VDC.

B-ALL OTHER POSITIONS 250 VDC.

C-ALL OTHER POSITIONS 15 VDC.





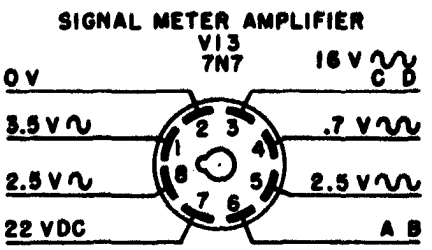
V13

A-RECORD DIRECT 250 VDC.

B-ALL OTHER POSITIONS 0 VDC.

C-RECORD PHOTO, STANDBY, REC. DIRECT 55 VDC.

D-TRANSMIT, SET RANGE 70 VDC.



V14

A-RECORD PHOTO 185 VDC.

B-TRANSMIT, SET RANGE, STANDBY 0 VDC.

C-RECORD DIRECT 320 VDC.

E-RECORD PHOTO PHASE BUTTON IN 5 VDC.

F-PHASE BUTTON OUT 0 VDC.

∿∿ = READINGS TAKEN ON RECORD PHOTO

D.C. VOLTAGES MEASURED WITH 20,000 OHMS PER VOLT METER.

AC AND SIGNAL VOLTAGES MEASURED WITH BALLANTINE VACUUM TUBE VOLTMETER.

∿ = 60 ∿

∿∿ = 1800 ∿ SIGNAL VOLTS

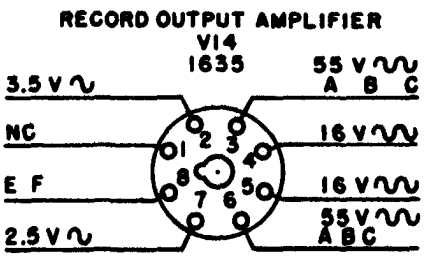


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Figure 84. Voltage measurement chart, V10 through V16, Facsimile Transceiver TT-1F/TXC-1.

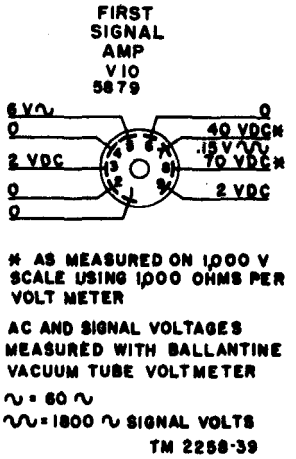


Figure 85. Voltage measurement chart, first signal amplifier (V10), Facsimile Transceiver TT-1E/TXC-1.

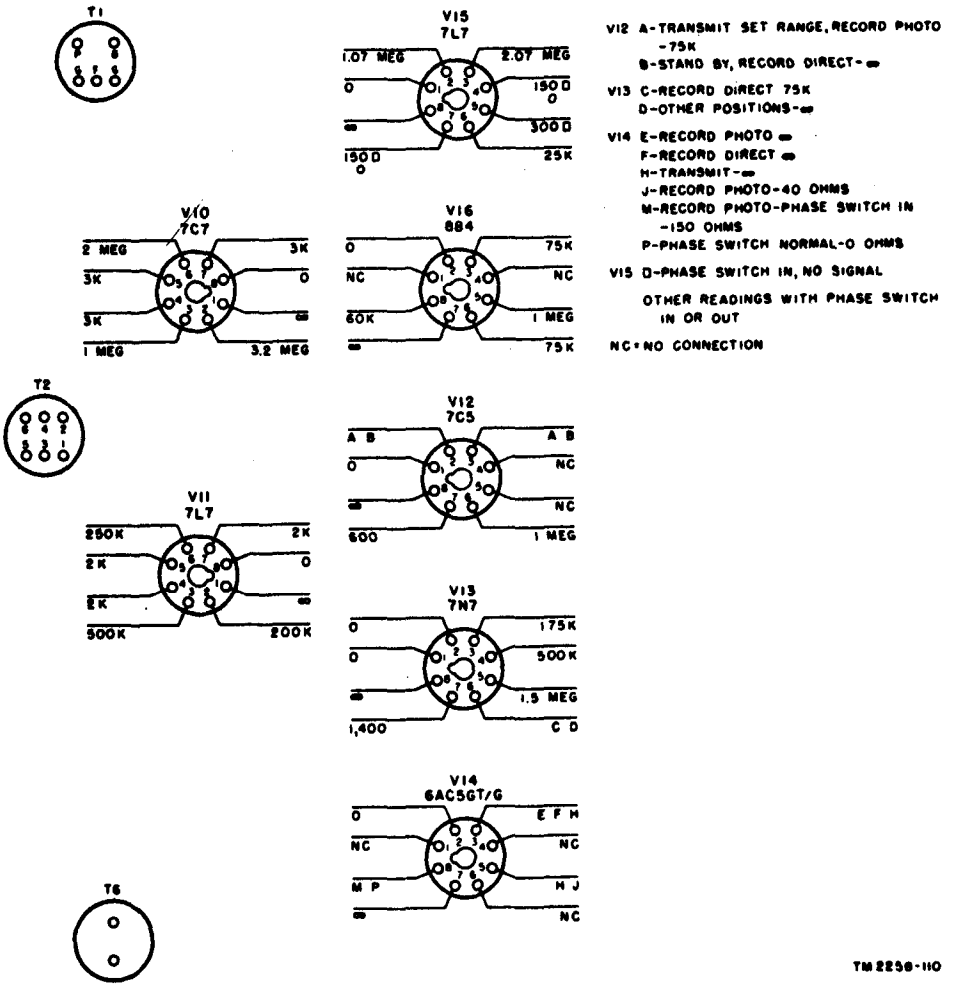


Figure 86. Resistance measurement chart, stages V10 through V16, Facsimile Transceivers TT-1/TXC-1 and TT-1A/TXC-1.

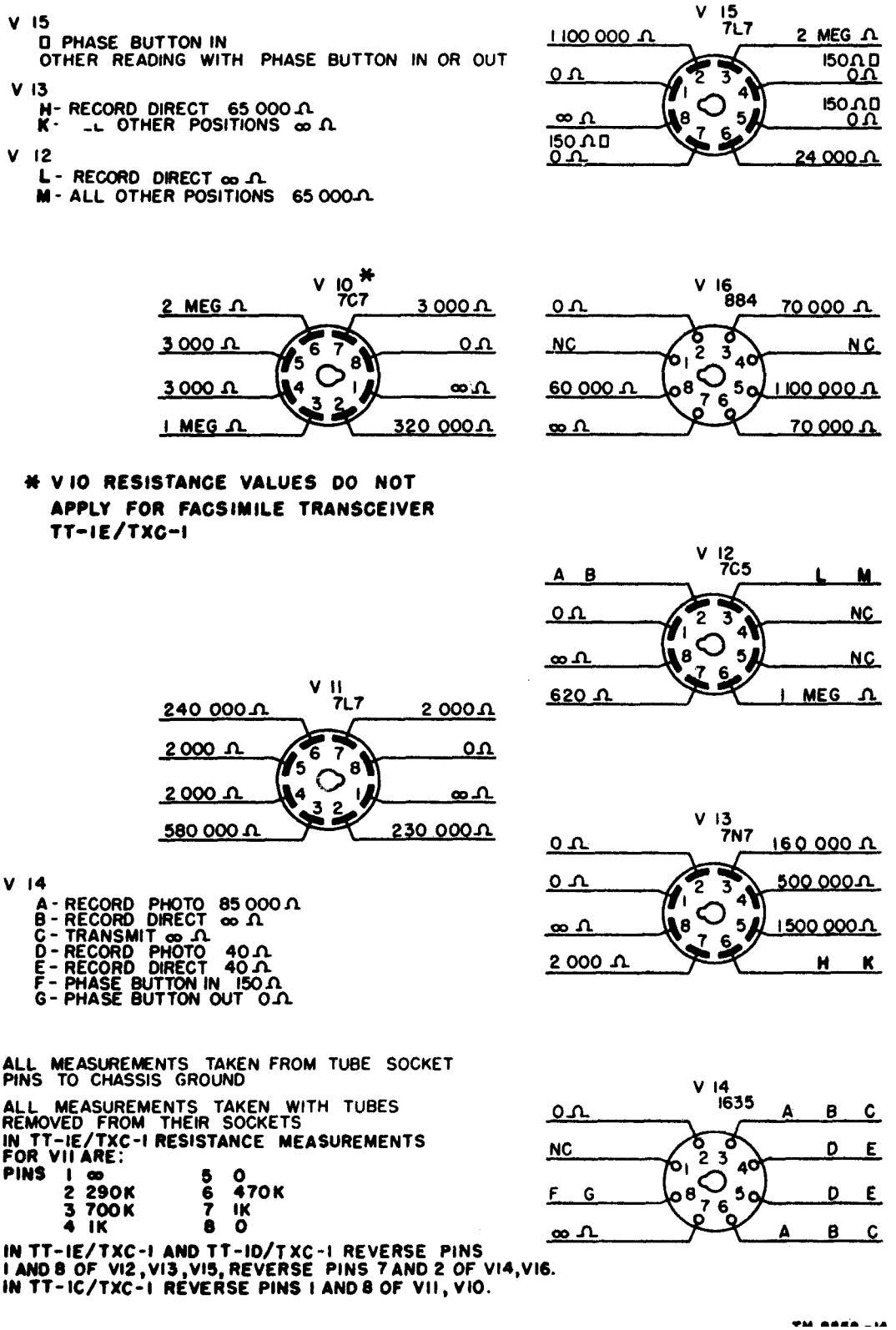


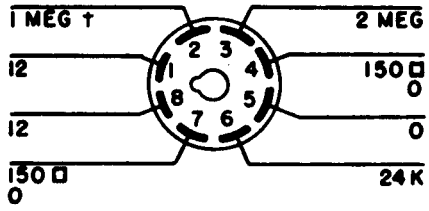
Figure 27. Resistance measurement chart, stages V10 through V16, Facsimile Transceivers TT-1B/TXC-1, TT-1C/TXC-1, TT-1D/TXC-1, and TT-1E/TXC-1.

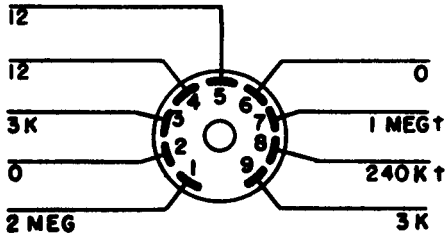
V15
□ PHASE BUTTON IN
OTHER READING WITH PHASE BUTTON IN OR OUT.

V13
E-RECORD DIRECT 120 †
F-ALL OTHER POSITIONS ∞

V12
A-RECORD DIRECT ∞
B-ALL OTHER POSITIONS 120 †
C-SET RANGE AND TRANSMIT POSITION
GAIN DIAL AT 100, 180 K
D-ALL OTHER POSITIONS 1 MEG.

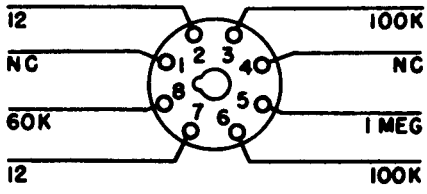
PULSE AMPLIFIER
V15
7L7



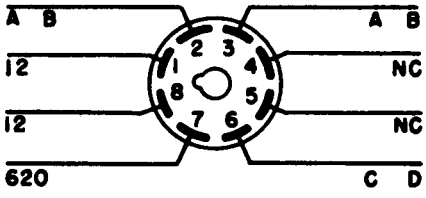


FIRST SIGNAL AMPLIFIER
V10
5879

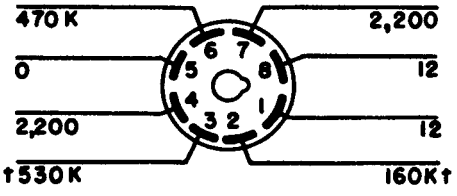
TRIGGER TUBE FOR
PHASING PULSES
V16
884



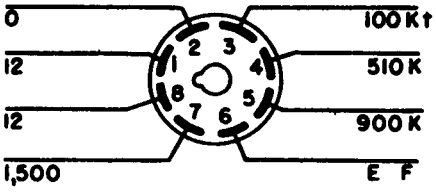
THIRD SIGNAL AMPLIFIER
V12
7C5



SECOND SIGNAL AMPLIFIER
V11
7L7



SIGNAL METER AMPLIFIER
V13
7N7



V14
G-RECORD PHOTO 24 K †
H-RECORD DIRECT 100 ♦
I-TRANSMIT ∞
J-RECORD PHOTO 40
K-RECORD DIRECT 40
L-PHASE SWITCH IN 150
M-PHASE SWITCH OUT 0

UNLESS SPECIFIED ALL MEASUREMENTS TAKEN FROM TUBE SOCKET PINS TO CHASSIS GROUND.

† MEASURED FROM RB+

♦ MEASURED FROM B+

UNLESS OTHERWISE SPECIFIED RESISTANCES ARE IN OHMS.

RECORD OUTPUT AMPLIFIER
V14
1635

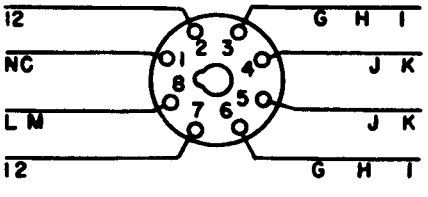


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Figure 88. Resistance measurement chart V10 through V16, Facsimile Transceiver TT-1F/TXC-1.

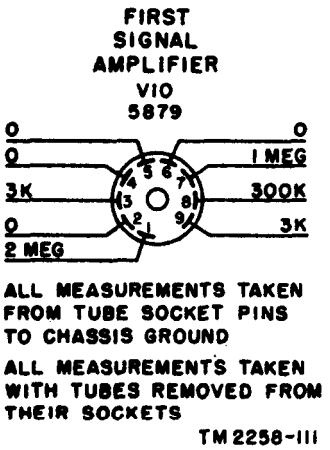


Figure 89. Resistance measurement chart, first signal amplifier (V10), Facsimile Transceiver TT-1E/TXC-1.

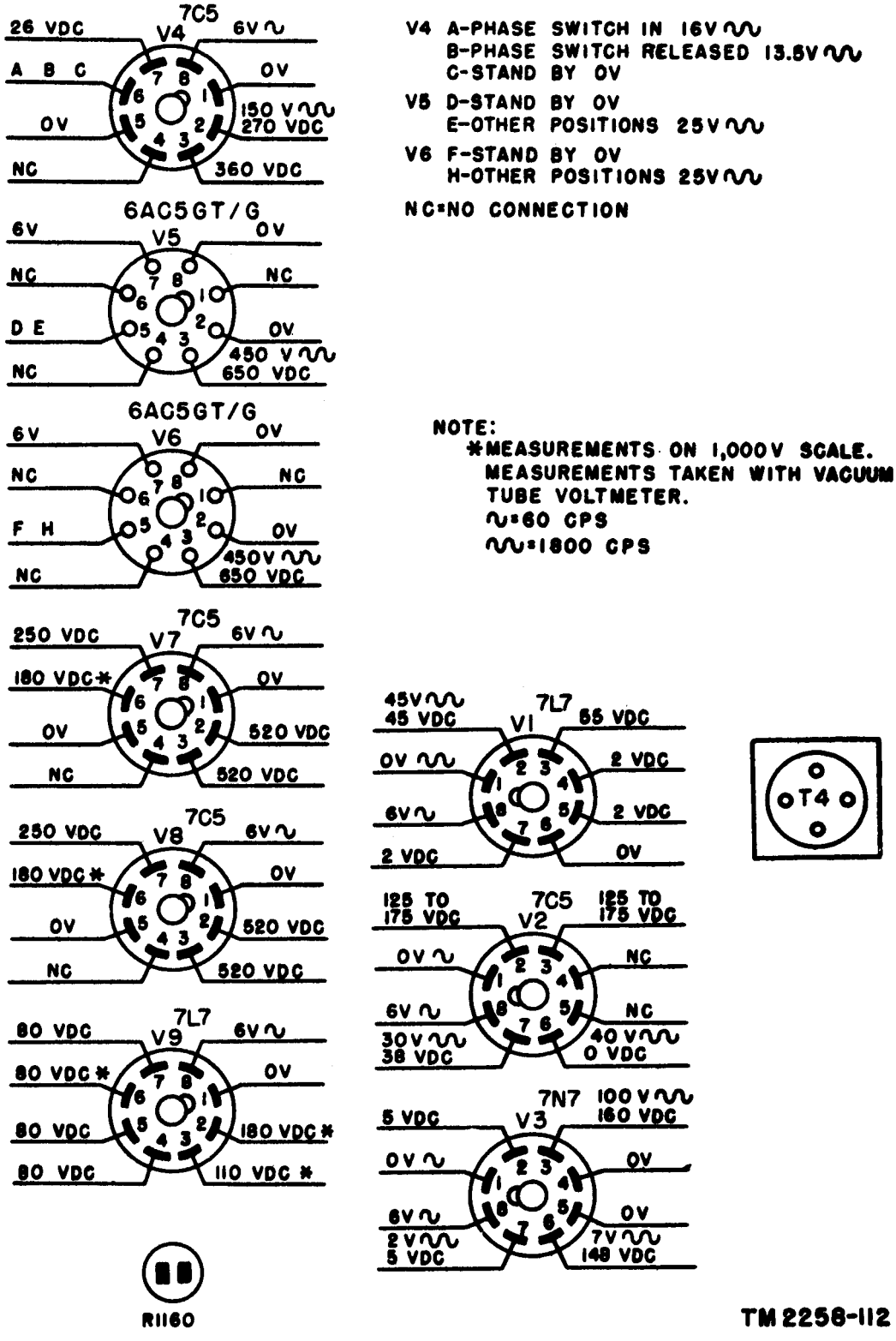


Figure 90. Voltage measurement chart, stages V1 through V9, Facsimile Transceiver TT-1/TXC-1 with unsealed for oscillator unit; data for stages V4 through V9 also applicable to Facsimile Transceiver TT-1A/TXC-1.

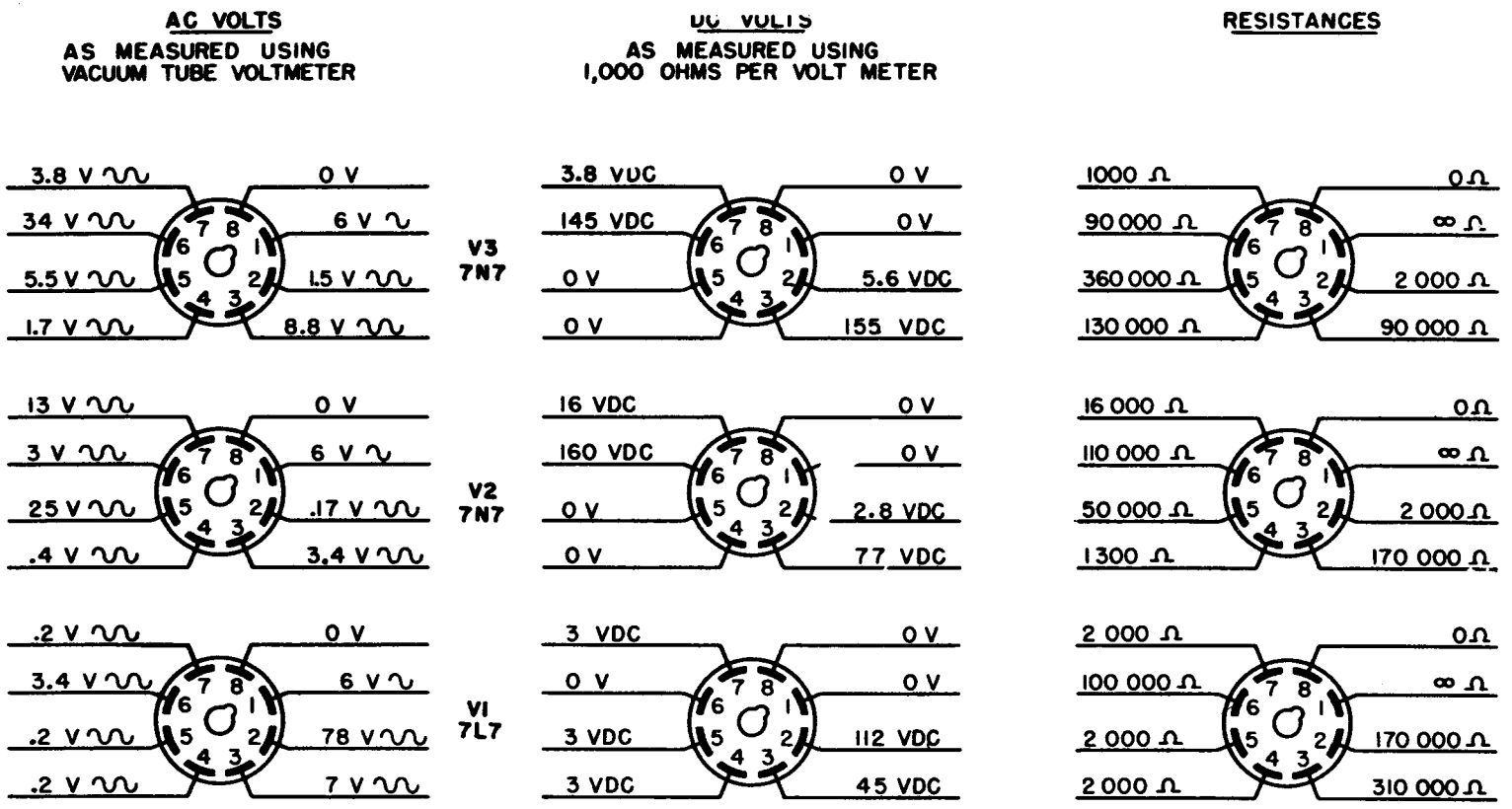


Figure 91. Voltage and resistance measurement chart, stages V1 through V3, sealed for oscillator unit, Facsimile Transceivers TT-1/TXC-1 through TT-1E/TXC-1.

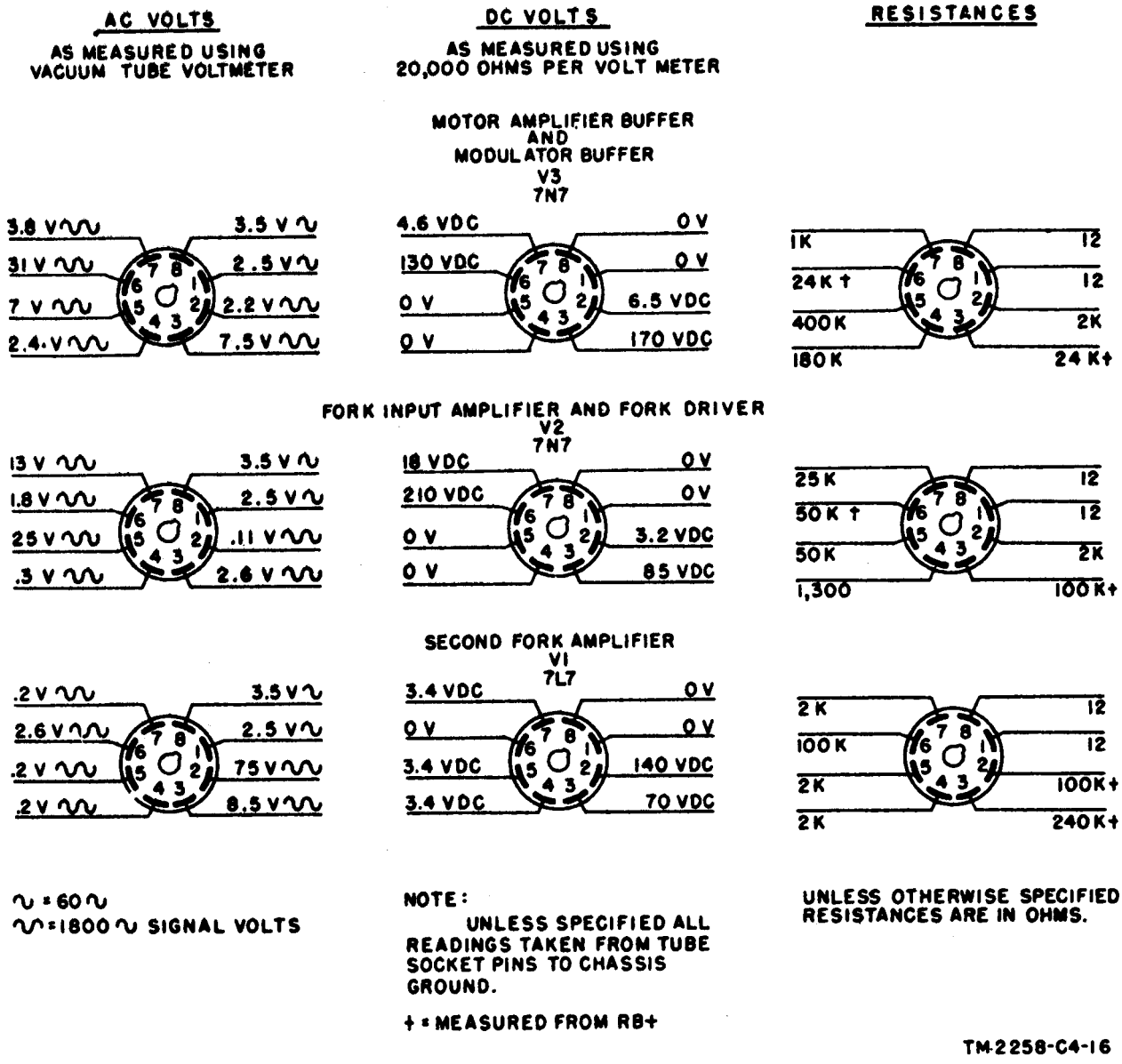
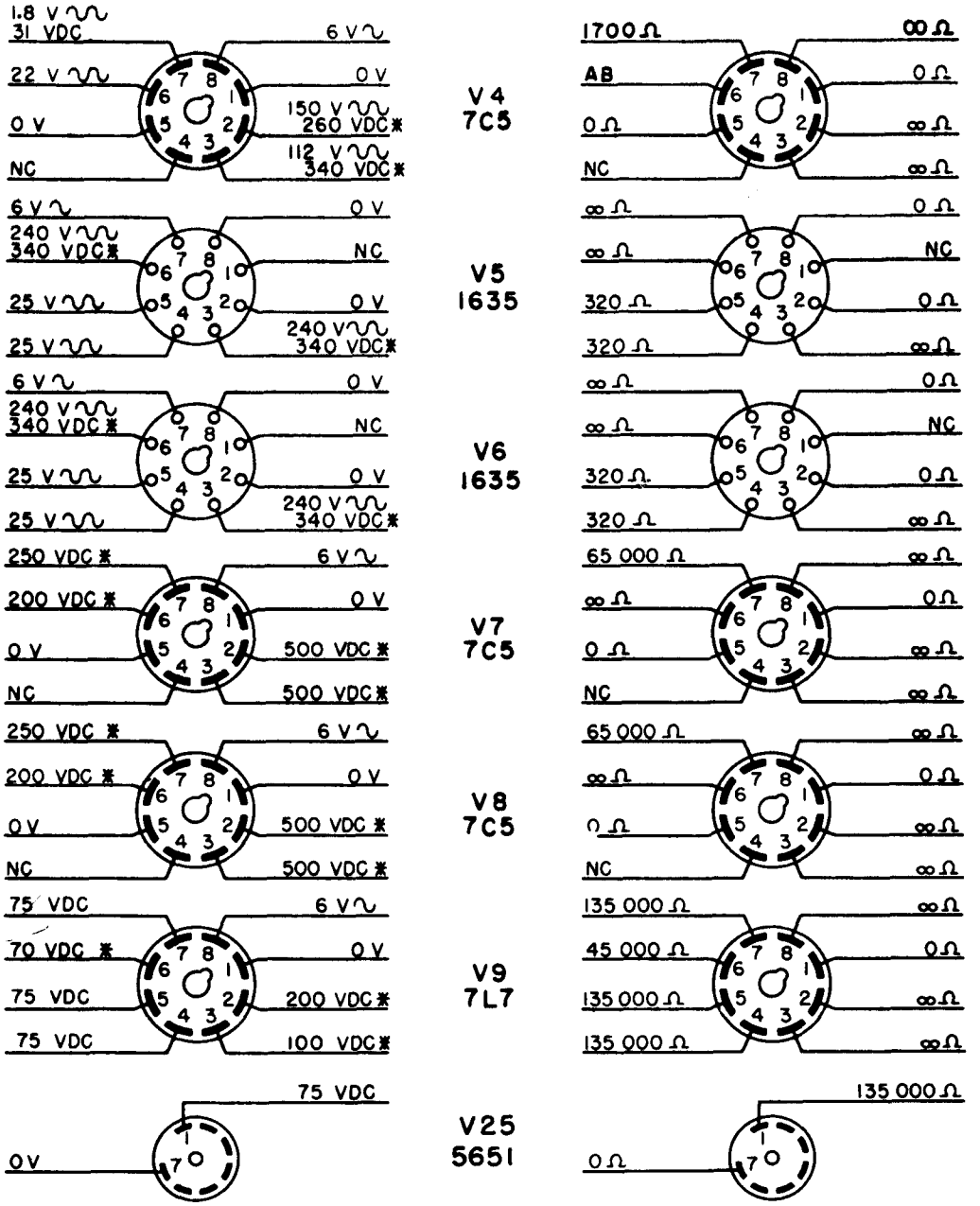


Figure 92. Voltage and resistance measurement chart, stages V1 through V3, sealed fork oscillator unit, Facsimile Transceiver TT-1F/TXC-1.



ALL MEASUREMENTS TAKEN FROM TUBE SOCKET PINS TO CHASSIS GROUND
V4, V5, AND V6 VOLTAGE READINGS TAKEN WITH 80 MA MOTOR CURRENT
* AS MEASURED ON 1,000 V SCALE
RESISTANCE MEASUREMENTS TAKEN WITH TUBES REMOVED FROM THEIR SOCKETS
ALL VOLTAGE MEASUREMENTS TAKEN AT 115V LINE
∿=60∿ ∿∿=1,800∿ SIGNAL VOLTS
AC AND SIGNAL VOLTAGES MEASURED WITH BALLANTINE VACUUM TUBE VOLTMETER
V4
A-PHASE BUTTON IN 13,500 Ω
B-PHASE BUTTON OUT 10,000 Ω

TM 2258-113

Figure 93. Voltage and resistance measurement chart, stages V4 through V9 and V25, Facsimile Transceivers TT-1B/TXC-1, TT-1C/TXC-1, TT-1D/TXC-1, and TT-1E/TXC-1.

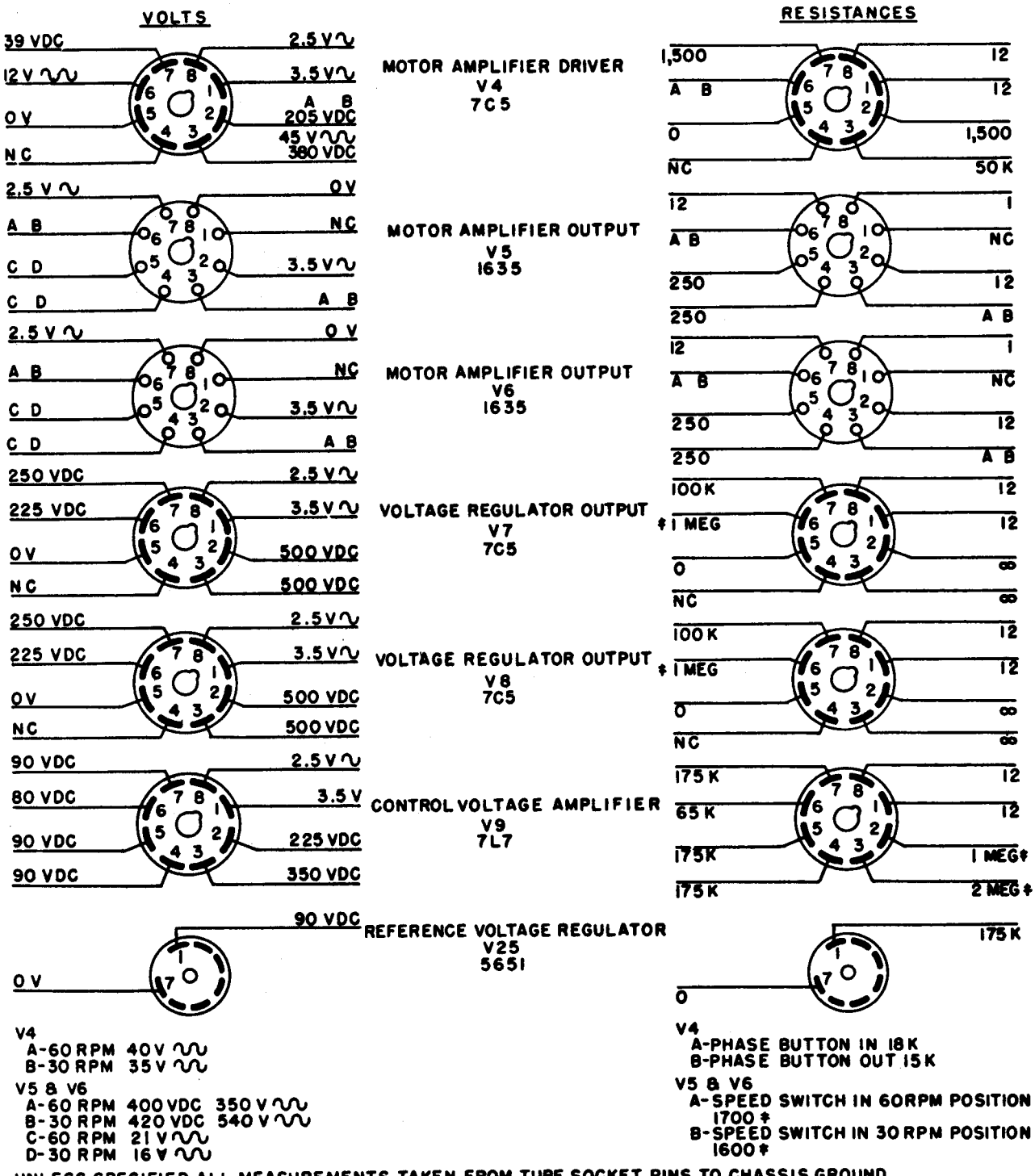


Figure 94. Voltage resistance chart, V4 through V9 and V25, Facsimile Transceiver TT-1F/TXC-1.

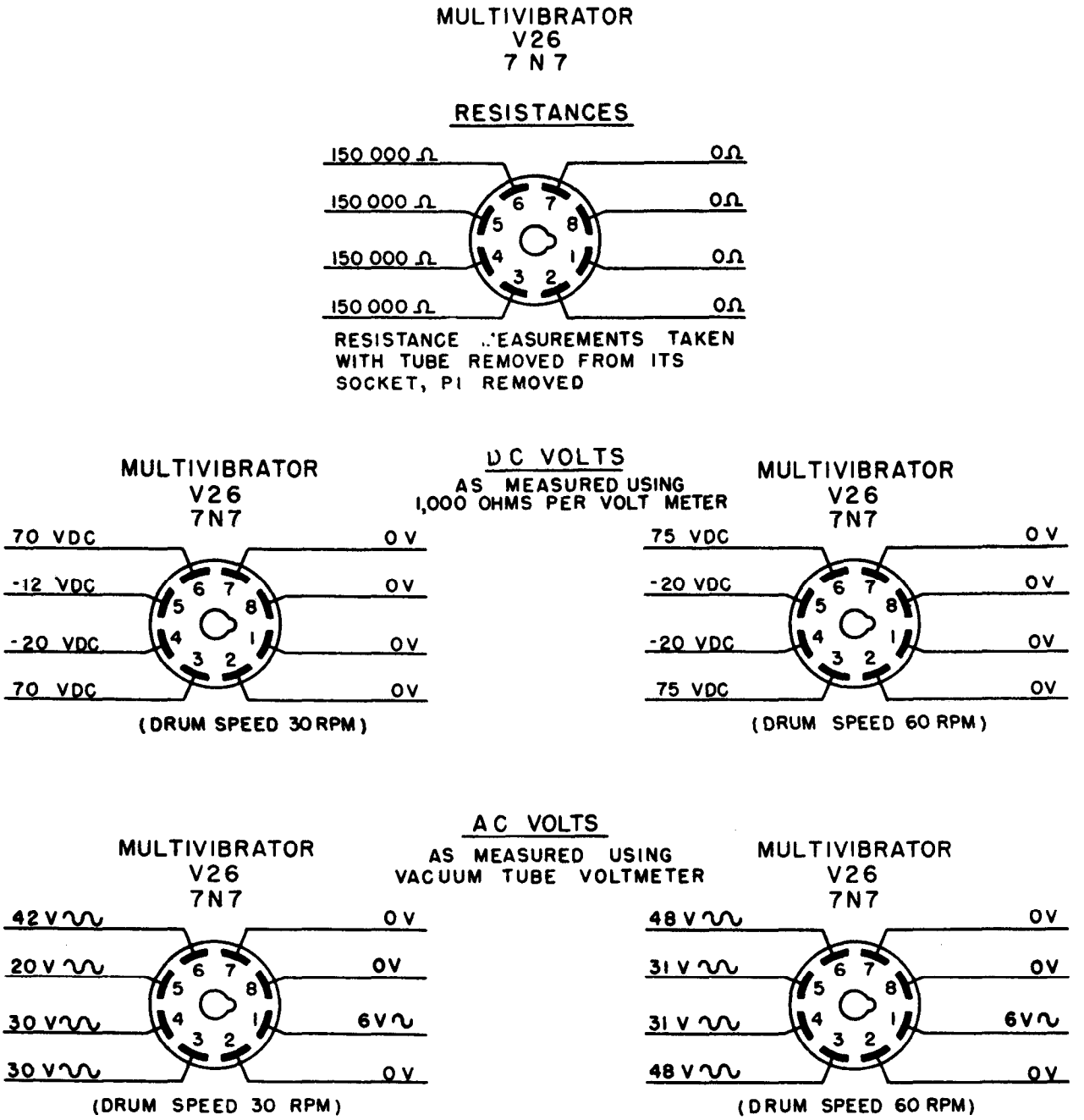


Figure 95. Voltage and resistance measurement chart, multivibrator stage (V26), Facsimile Transceivers TT-1D/TXC-1 and TT-1E/TXC-1.

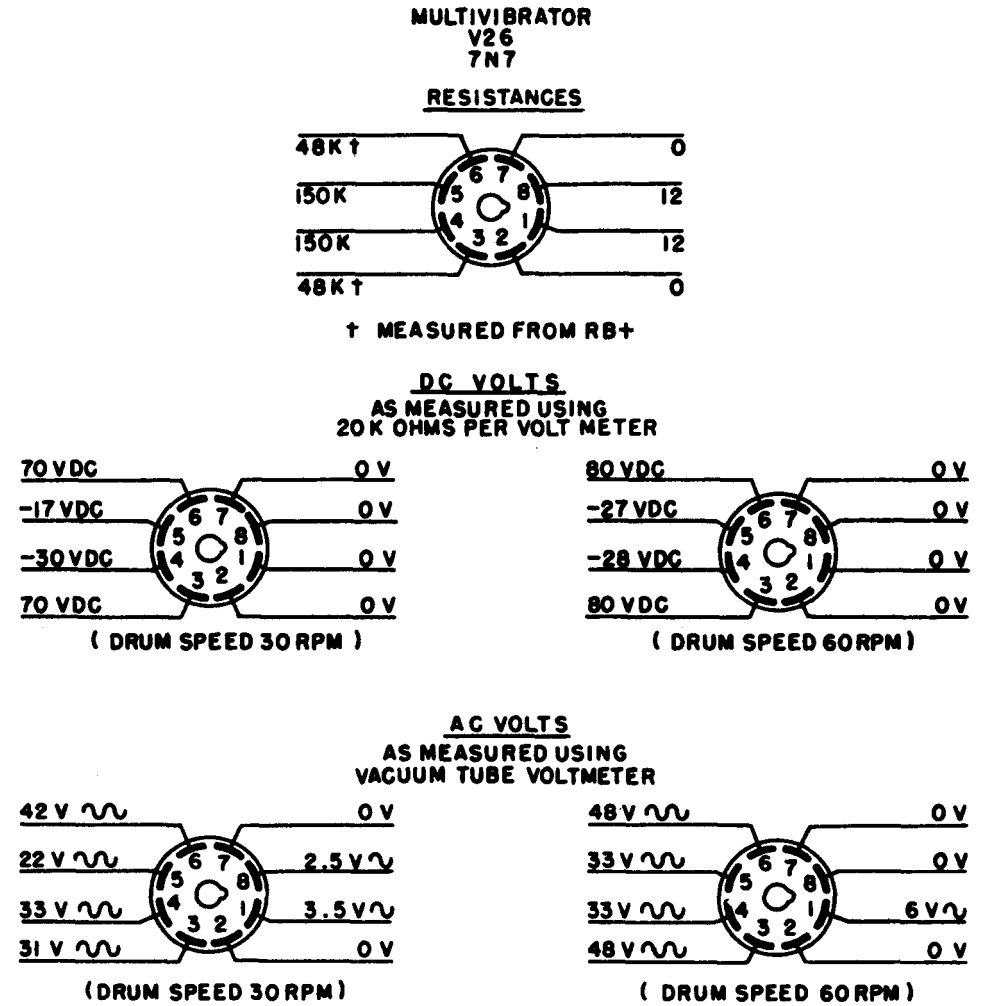


Figure 96. Voltage and resistance measurement chart, multivibrator stage (V26), Facsimile Transceiver TT-1F/TXC-1.

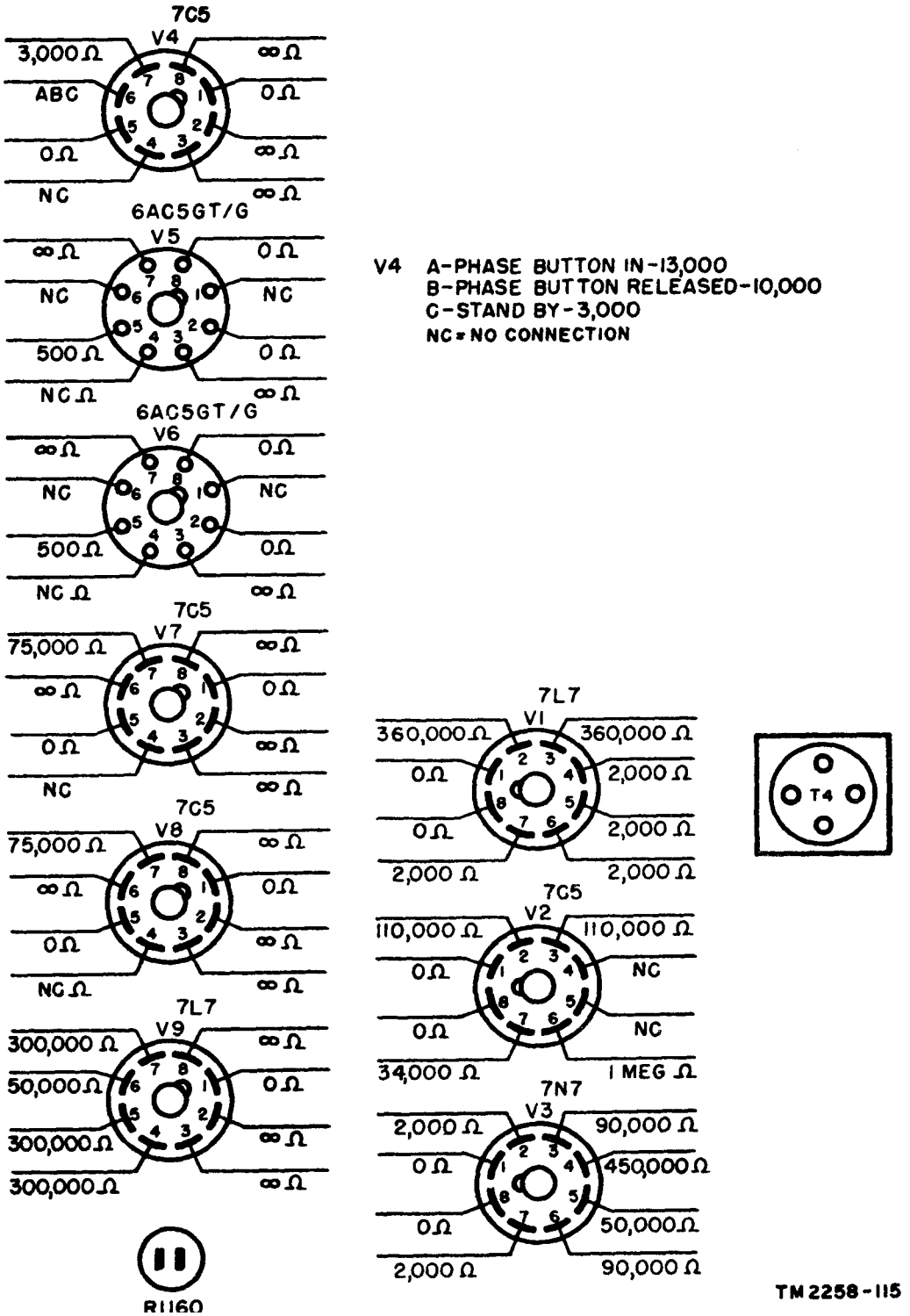


Figure 97. Resistance measurement chart, stages V1 to V9, Facsimile Transceiver TT-1/TXC-1 with unsealed fork oscillator unit; data for stages V4 to V9 also applicable too Facsimile Transceiver TT-1A/TXC-1.

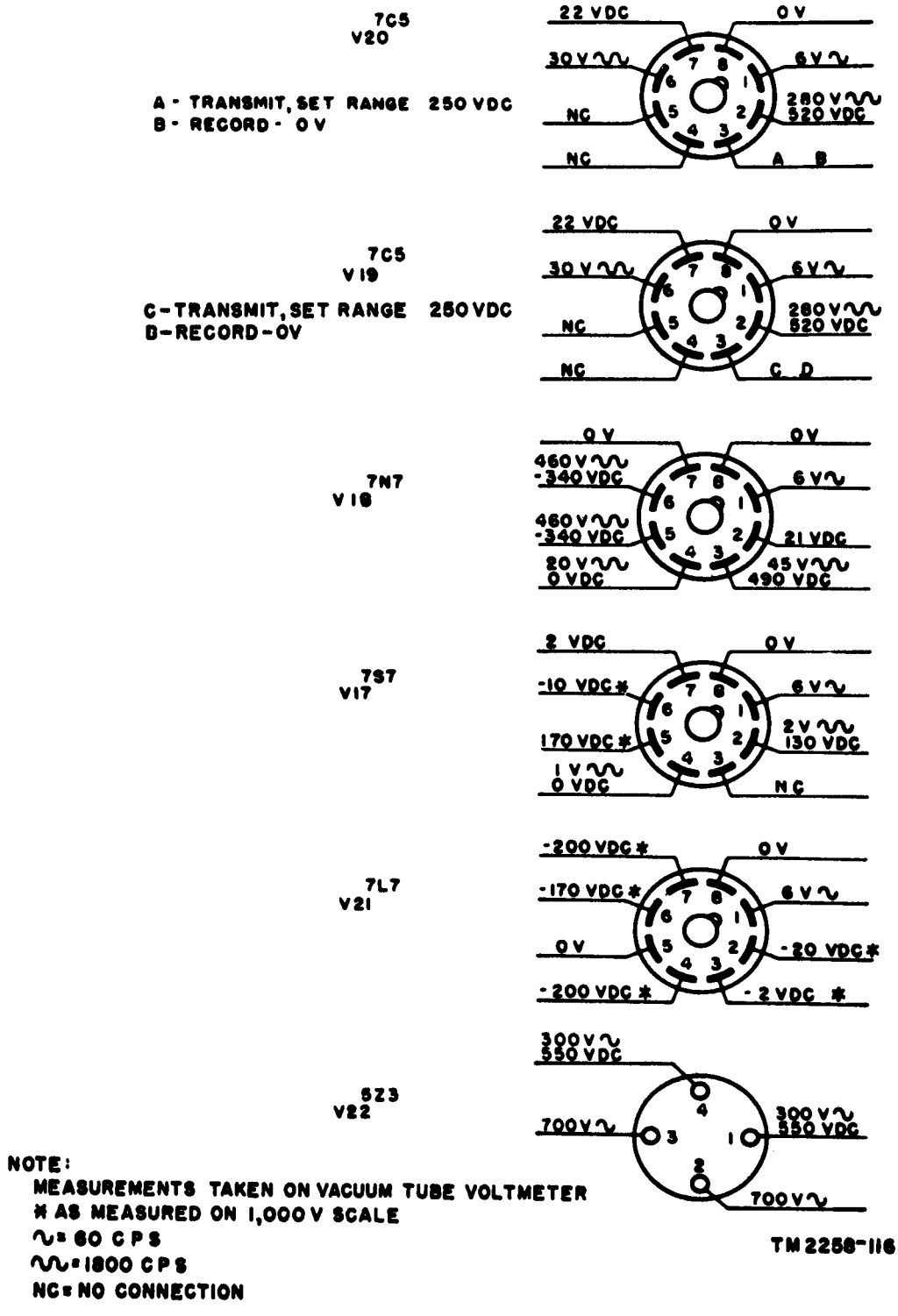


Figure 98. Voltage measurement chart, Rectifier Power Unit PP-86/TXC-1.

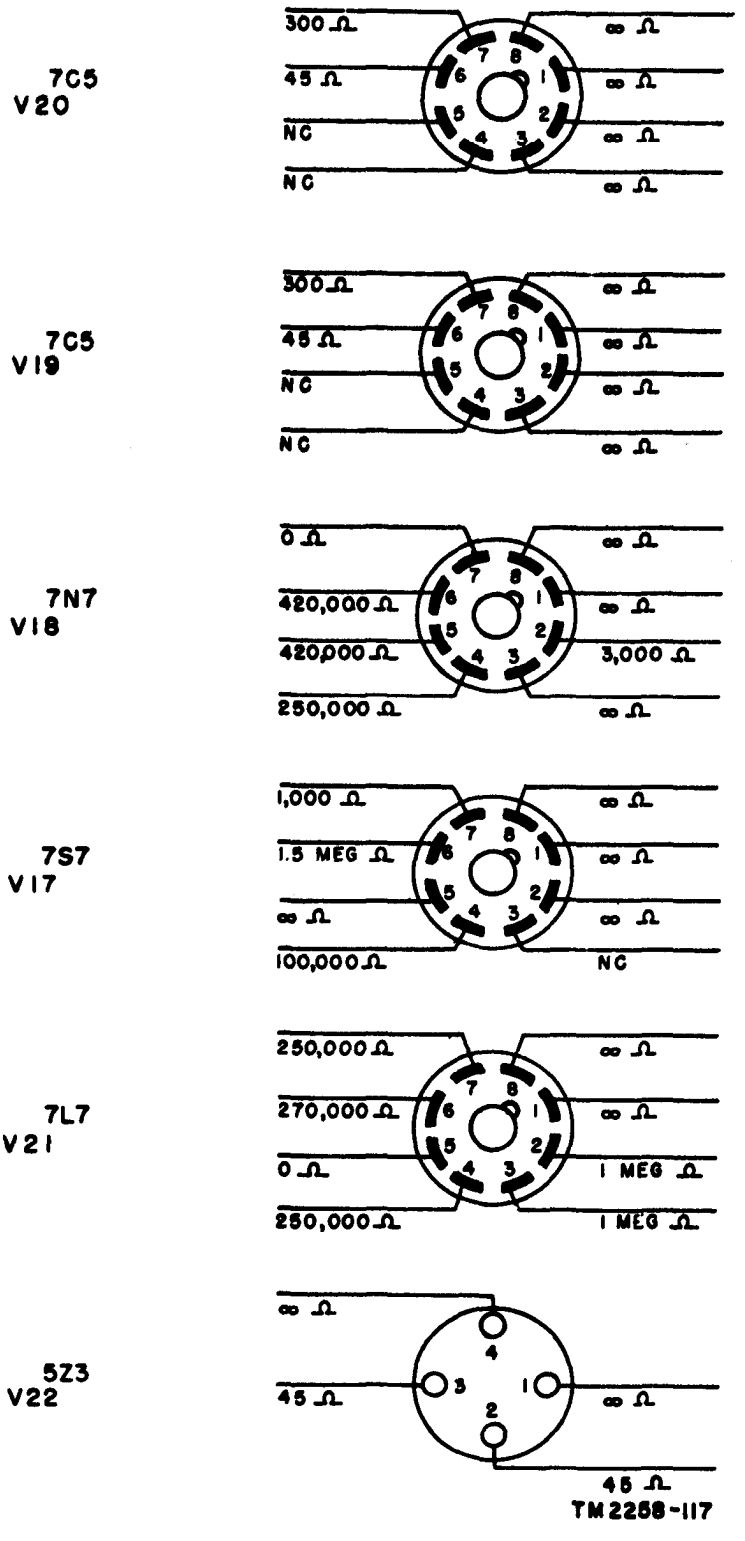


Figure 99. Resistance measurement chart, Rectifier Power Unit PP-86/TXC-1.

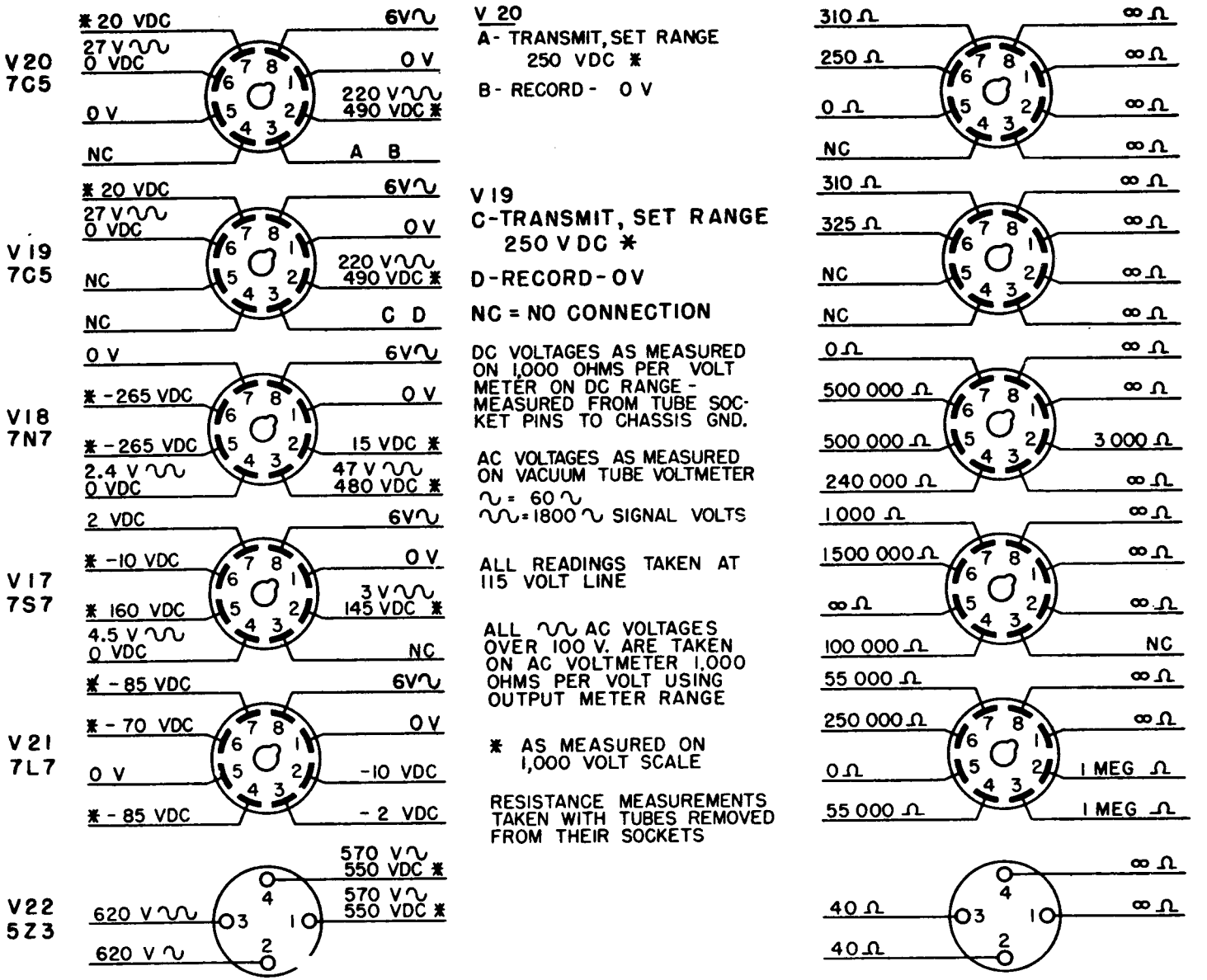


Figure 100. Voltage and resistance measurement chart, Rectifier Power Unit PP-86A/TXC-1 or PP-86B/TXC-1.

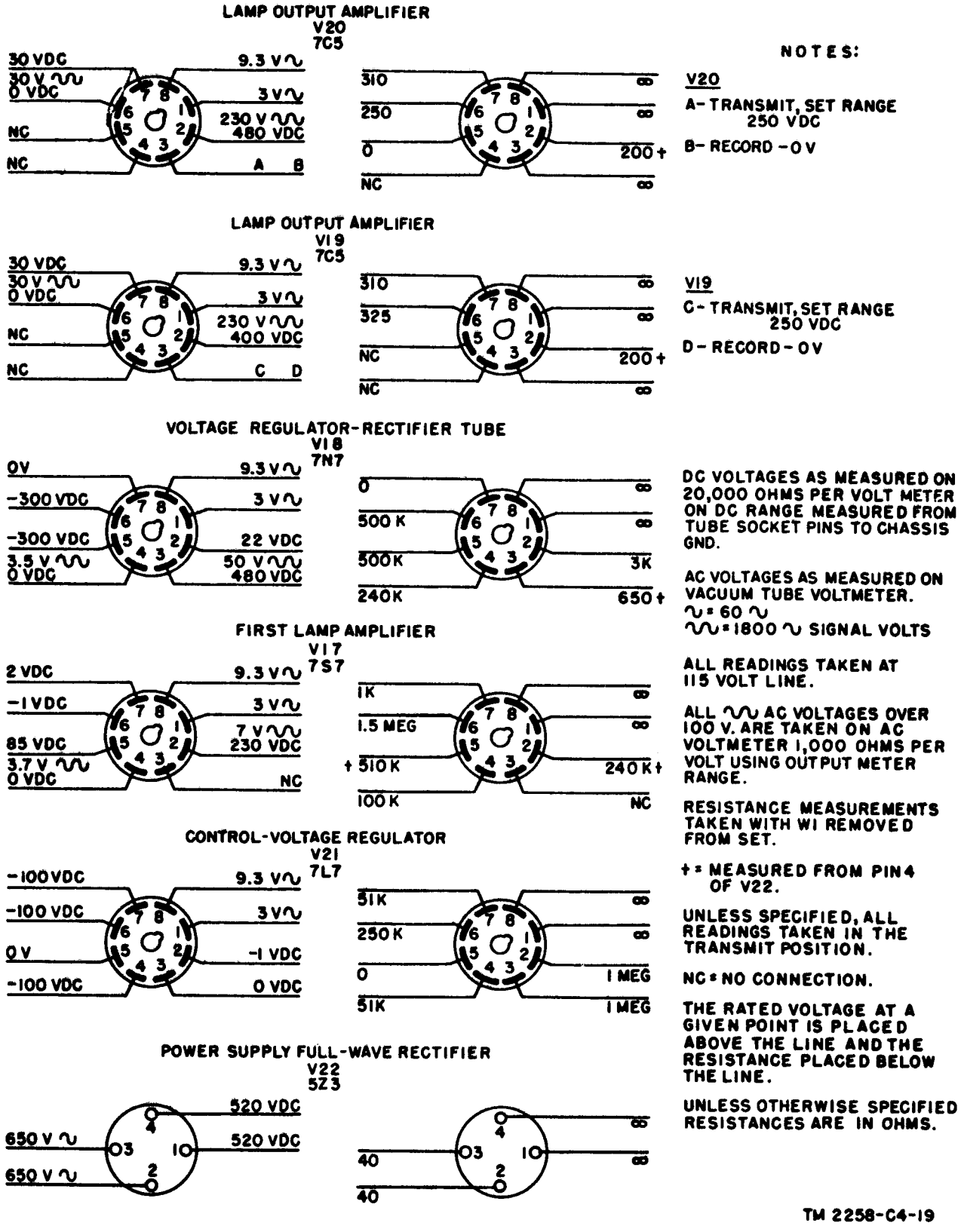


Figure 101. Voltage and resistance measurement chart, Rectifier Power Unit PP-86E/TXC-1.

89. Troubleshooting Chart

The following chart is supplied as an aid in locating trouble in the transceiver and power supply. This chart lists the symptoms which the repairman observes, either visually or audibly, while making a few simple tests. This chart also indicates how to localize trouble to the motor circuit, voltage regulator circuit, signal circuits, and optical or mechanical abnormalities. The signal-tracing charts then can be used to supplement this procedure and to determine the defective stage. Once the trouble hae been localized to a stage or circuit, a tube check and voltage and resistance measurement of this stage or circuit should be enough to isolate the defective part. Normal voltage and resistance measurements are given in figures 82 through 101. Repair and adjustment of the optical and mechanical components of the transceiver are discussed in paragraphs 103 through 123.

Symptom	Probable trouble	Correction
1. Drum does not accelerate past synchronous speed on START.	Lack of proper input voltage to start motor.	Check switch and input voltage circuit.
	Defective start motor	Check motor for mechanical binding. Check for open winding.
2. Synchronous motor does not hold synchronism when phasing.	Lack of motor power	Check clutch adjustment. Check lubrication of worm gear and motor bearings. Motor current may be too low (par. 91). Check motor and drum for mechanical binding. Check action of synchronous rotor (par. 104c).
3. Phase magnet armature does not release the stop arm of the clutch when a phasing pulse is received on PHASE.	Defective phase magnet	Check adjustment of armature backstop screw and armature spring. Check electrical contacts.
	Not enough electrical power applied to phase magnet.	Check phasing circuit. See paragraph 96.
	Improper clutch adjustment	See paragraph 106.
4. With the START-PHASE switch released, phase magnet armature does not lock to allow the stop arm to pass it freely.	Lack of voltage across cathode resistors of tubes V4 and V13.	Check tube circuits of V4 and V13.
	Open coil in phase magnet.	Check winding.
5. Armature does not release to engage stop arm on PHASE.	Defective phase magnet	Check for a weak armature return spring, improper adjustments of PHASE portion of switch contacts, or a bind in the armature pivots.
6. Pattern or jagged lines in received pictures (fig. 102).	Improper action of motor thrust bearing.	Check motor thrust bearing for signs of wear (par. 104).
	Defect in lead screw or drum	See paragraph 90.
7. Line feed pattern (fig. 104)	Irregular longitudinal travel of drum.	See paragraph 90.
8. Irregular skew in received copy (fig. 103).	Clutch of transmitter or receiver may be slipping.	Examine photographic recording with a magnifying glass. If the individual recorded elemental areas are in approximate alignment, the defect is in the transmitter system. If the individual recorded elemental areas follow the contour of the skew, the trouble is in the recorder system. When receiving on direct recording paper, observe direction of skew before removing paper from drum. If right hand side of copy is skewed to the rear of the machine, the clutch is slipping in transmitter. Check clutch tension (par. 106). If tension is correct, the drum or lead screw may be binding. See paragraphs 90 and 107.

Symptom	Probable trouble	Correction
9. Drum wobble which throws optical system out of focus during a portion of the revolution.	Bent lead screw or worn bearing in drum.	Place a white sheet of paper on drum, adjust for a negative transmission having a 15-db contrast range, and scan the white sheet. Note variation in output level as measured by the DB METER. The level should not vary more than ½ db in a complete revolution. Corrective measures are given in paragraph 99. Partial compensation for drum wobble can be made by centering the exciter lamp (par. 109).
10. Drum fails to feed or remains in one spot for more than 1 revolution.	Damaged half nuts	Check for binding between drum and lead screw. Examine lead screw with a magnifying glass before replacing half nuts.
11. Excessively high motor current, as read on MOTOR CURRENT meter M2, or blown fuse F1.	Motor may be short-circuited	Check motor for a short circuit. See paragraph 91.
12. Low motor current. See 11 (above) for method of indication.	Defective component in motor amplifier circuit. If exciter lamp does not light to its normal brilliancy, a low fork amplifier output is indicated.	See paragraph 91. If trouble persists, refer to the signal tracing charts. Do not change tubes in the fork amplifier unit unless absolutely necessary. If a tube is removed and found to be good, replace it in its original position. New tubes in the unsealed fork oscillator unit require about 30 hours of aging to stabilize; new tubes in the sealed unit require about 3 hours. Readjustment of R25 (unsealed unit) or R304 (sealed unit) may be necessary when tubes are replaced. Measure voltage between terminal 5 of the fork terminal board and ground. This should be between 30 and 40 volts. If it is not, test for continuity of fork coils. If voltage is correct, trace signal, using figure 74 or 75. If mechanical trouble exists in the fork or its mount, replace the entire fork oscillator unit with a new sealed unit.
13. Received copy shows straight uniform skew or drift.	Frequency of either transmitter or receiver fork is off standard.	See paragraph 92.
14. No output from signal amplifier	No input from photocell circuit in TRANSMIT position. No input from line in RECORD position. Tubes defective. Transmitter optical system grounded to case, short-circuiting R51. Gain control defective. No plate voltage.	See paragraph 93.
15. Low signal amplifier output in TRANSMIT position.	Output load excessive	See paragraph 95.
16. Not enough contrast in TRANSMIT position.	Exciter lamp improperly alined. Dirty lens in optical system. Low voltage across exciter lamp. Defective photocell. Resistor R42 improperly adjusted.	See paragraph 97.

Symptom	Probable trouble	Correction
17. Low signal amplifier output in RECORD position.	Low input. Tubes defective	See paragraph 93.
18. Exciter lamp does not light, or light is insufficient or flickering.	Defective lamp. Socket corroded. Not enough input Voltage. Transformer T15 defective. No input signal to V17.	See paragraph 109.
19. Elemental area rectangles (fig. 123) overlapping one another.	Objective lens of recording optical system is misalined.	Align in accordance with instructions in paragraph 110.
20. Background and fuzziness on direct recordings; poor contrast.	Bias too low on V13	Increase size of cathode resistance R97 in 500-ohm steps.
21. Final photographic copy too light	Recorder lamp defective	Replace recorder lamp.
22. Mottled or intermittent reception on direct recording.	Stylus needle pressure too low	Adjust or replace as required.

90. Lead Screw and Drum

a. Line Feed Pattern. Line feed pattern (fig. 104) may develop as a result of irregular longitudinal travel of the drum. If the drum does not advance uniformly at the rate of 1/96 inch per revolution, some of the photographically recorded scanning lines will overlay and others will underlap, thereby creating a blank space between the two lines. If the effect is great enough to cause noticeable deterioration in the received copy, corrective measures must be taken. The most common cause of trouble is the drum and lead-screw system. First check the arm of the drum-feed engaging mechanism to be sure it is riding on the guide rail. Install new half nuts as a corrective measure. Be sure that the snubber (N, fig. 122) is set firmly against the lens barrel. If this does not correct the trouble, make a test recording by substituting the drum of another machine. Be sure that the test recording is of the same type and is made by the same method as the one on which the line feed pattern proved troublesome. A final test should be made by using both the drum and the lead screw of another machine. If the line feed trouble remains, the trouble is probably in the motor or the optical system.

b. Jag or Jitters. These are the terms used to describe irregular or saw-tooth recording of lines that should be straight (fig. 102). The trouble is generally in the motor or the clutch. It can, however, originate in the drum or the lead screw. To determine whether it is in the drum or the lead screw, first replace the motor with one from another machine which is operating satisfactorily, and make a test run. Use a transmission test copy having straight lines running parallel to the axis of the drum. The recording of the straight line should not deviate from its correct position by more than the width of one recording dot or elemental area. This is approximately one one-hundredth inch. A bind in the drum and the lead-screw system causes jitters which will be aggravated considerably if the synthetic rubber plate is too soft.

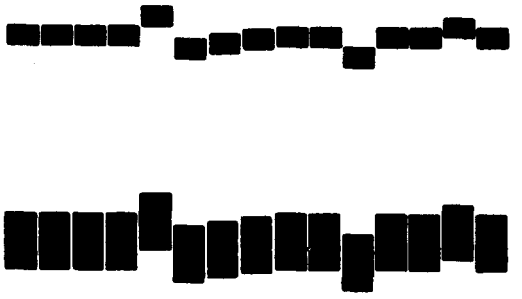


Figure 102. Enlarged examples of jitters.

c. Irregular Skew. If the receivced copy shows an irregular skew (fig. 103), it is probable that the clutch of the transmitter or receiver motor is slipping. This slippage often can be traced to a bind in the drum system. To determine whether the defect is in the transmitter or receiver, examine the recorded copy with a magnifying glass. If the individually recorded elemental areas are in approximate straight alinement, the defect is in the transmitter system. If they follow the contour of the skew, the trouble is in the recorded system. When receiving on direct recording paper, observe the direction of the skew before removing the paper from the drum. If the right-hand side of the copy is skewed toward the rear of the machine, the clutch is slipping in the

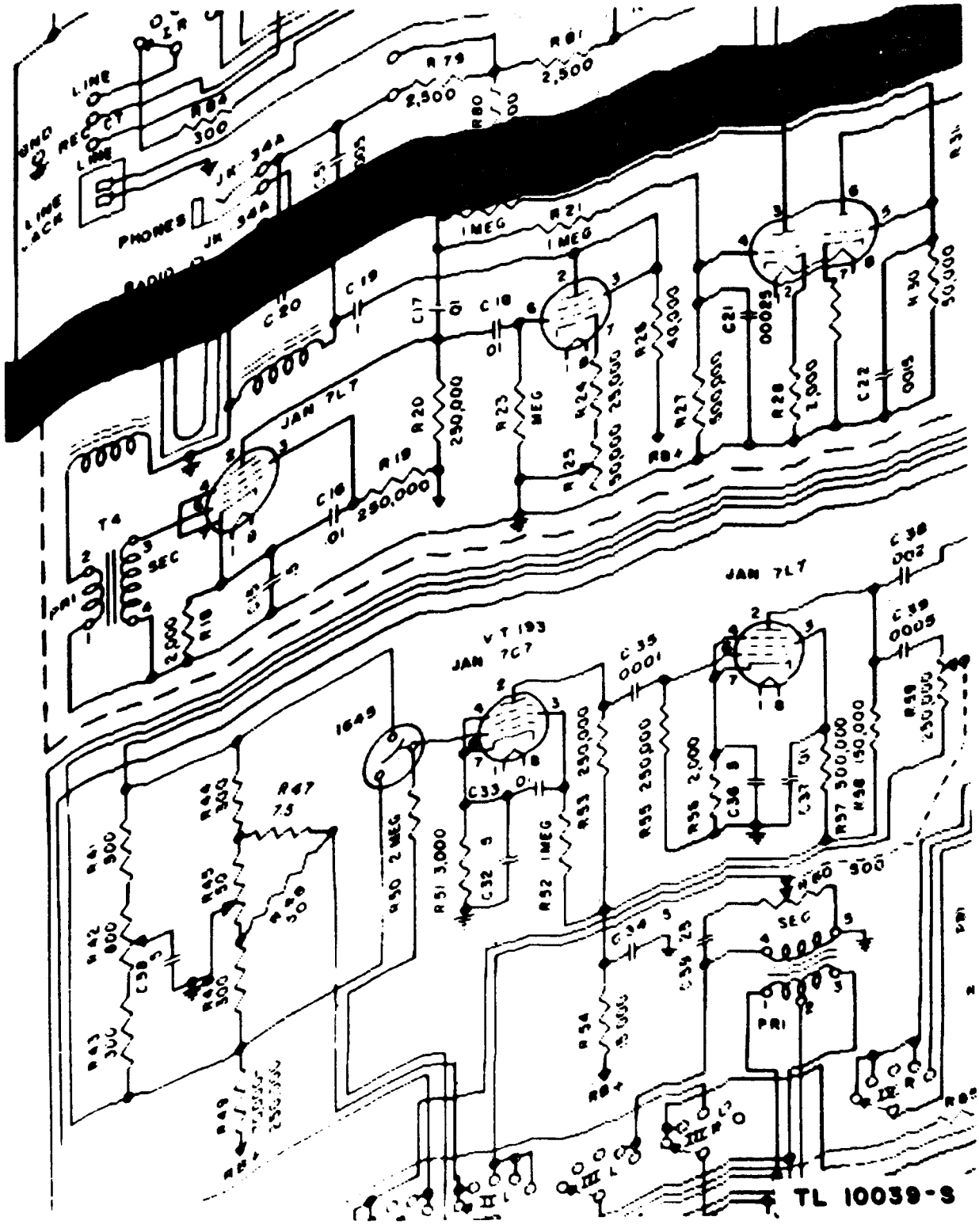


Figure 103. Example of irregular skew.

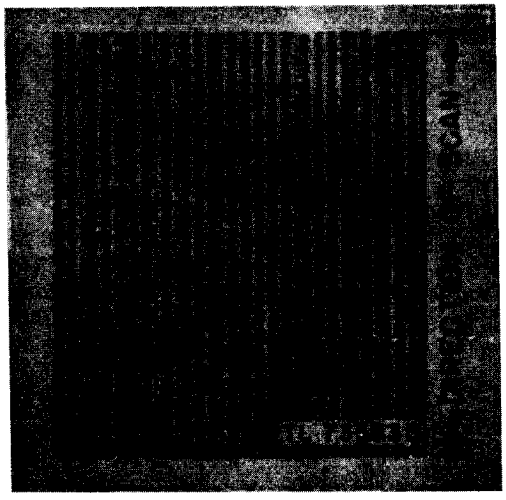


Figure 104. Enlarged example of line feed overlay and underlap.

transmitter. Check the clutch tension as outlined in paragraph 106. If the tension is correct, take the necessary measures to eliminate the bind in the defective drum or lead screw (pars. 107 and 108).

91. Motor Amplifier (figs. 40-46)

a. General. The output circuit of the motor amplifier includes choke T6, capacitors C28, C29, and C30, as well as the synchronous motor winding.

Caution: The high voltage at the terminals of the synchronous motor, choke T6, and capacitors C28, C29, and C30 may be dangerous to life. Shut off the power when connecting a meter or an oscilloscope to these components. Do not touch the meter or the oscilloscope when the power is on. In Facsimile Transceiver TT-1A/TXC-1, do not replace the motor fuse without discharging capacitor C31, or the fuse may blow. In Facsimile Transceivers TT-1B/TXC-1 through TT-1F/TXC-1, wait (a few seconds) for capacitor C31 to discharge through resistor R95 before attempting to replace the motor fuse.

b. Low Output. In Facsimile Transceivers TT-1B/TXC-1 through TT-1E/TXC-1, motor current is read directly on MOTOR CURRENT meter M2. In Facsimile Transceivers TT-1D/TXC-1, TT-1E/TXC-1, and TT-1F/TXC-1, M2 should indicate 40 to 60 ma for 30-rpm operation, and 55 to 80 ma for 60-rpm operation.

(1) If the input to the motor amplifier is low, the exciter lamp will not light to full brilliancy.

(2) If the motor current is between 40 and 70 ma for 60-rpm operation, any one or all of tubes V4, V5, and V6 may be, weak.

(3) If the current is less than 40 ma, the trouble is probably a defective component.

(4) If motor current is excessively high, the motor may be short-circuited.

(5) If the troubles are not located by the above checks, follow the signal-tracing charts.

92. Fork Oscillator Unit

a. Off Frequency. If the received copy shows a straight uniform skew or a drift, the frequency of either the transmitter or the receiver fork is off standard.

(1) The set under question can be tested by using it to record radio signals from station WWV, Washington, D. C. The signals include 1 pulse each second. If the fork is adjusted properly, a straight-line pattern parallel to the drum clamp will he recorded.

(2) If a signal is available from a facsimile transceiver having a fork known to be in perfect adjustment, a comparison can be made with the set under test, and adjustments can be made. Feed the accurate signal into the transceiver under test through the 6-volt connection of the UC feed coil. Set the selector switch at RECORD PHOTO. Adjust the GAIN control for a meter reading of –2 db. Move the feed coil close to the synchronous motor. The indention on the DB METER will rise and fall. The amount to rise and fall will depend on the position of the feed coil with respect to the motor. The rate of rise and fall will indicate the off-frequency condition of the fork. Adjust control R25 in unsealed units, or R304 in sealed units until the rate of rise and fall drops to less than one full swing in 2 minutes.

b. Caues of Frequency Drift.

(1) Condensation of moisture on the unsealed tuning fork will cause a frequency drift until the moisture evaporates.

(2) Rusting of the unsealed tuning fork will affect the frequency.

(3) Slight changes in component values will affect the frequency.
(4) Deviations from the values shown in the signal-tracing chart may point to the cause of off-frequency operation.
(5) Low or high RB+ voltage may affect the frequency.

93. Signal Amplifier (RECORD PHOTO)

(figs. 50 through 54)

a. Signal Tracing. Apply an input signal of .0015 volt at 1,800 cps to LINE JACK connector J5. Connect a voltmeter between the grid and ground of V14 with the selector switch at RECORD PHOTO and the GAIN control set at 100. Set Signal Generator SG-15/PCM to produce an output of 1 volt. Place a 100,000-ohm resistor in series with a 200-ohm resistor across this output. The output across the 200-ohm resistor will be approximately .002 volt. This is enough to insure an input voltage that will give a test of the amplifier gain. The voltage on the grid of V14 should be approximately 16 volts. In some sets, it may be necessary to raise the input voltage to obtain the proper reading on the grid of V14. An oscilloscope (placed in the grid circuit of V14) should show the proper waveforms (figs. 76, 77, and 78). If the voltage and waveforms are not correct, trace the signal in accordance with the signal-tracing chart to localize the trouble. The performance of stage V14 can be checked by measuring the current in the recorder lamp circuit. The current should be approximately 35 ma with proper input voltage on the grid of V14. This current will vary somewhat with different recording lamps and different tubes.

b. Level Changes. Occasionally, recordings will show undesirable changes in density. To localize the trouble, apply a steady tone, free from level changes, to the input of the facsimile transceiver, If necessary, connect the test meter across the input and watch it for several minutes; be sure that there is no change in level more than .2 db; watch the DB METER in the facsimile transceiver for 6 to 10 minutes. Bounce or jar the set in an effort to aggravate the troubles caused by poor contacts. If the indication on the meter remains steady, it is possible that the level changes are the result of a defective recorder lamp. Replace the lamp with a new one. Line it up and adjust it in accordance with the instructions in paragraph 110. Take a photographic test on a steady input signal. As a final check, a test should be taken at several levels; for example, -4 db, -1 db, +4 db, and +2 db. Plus 4 db is not an operating level, but it is possible that defects will show up quicker when this overload signal is used.

94. DB METER Circuit

a. General. The DB METER circuit is of the vacuum-tube voltmeter type which measures the output of the second signal amplifier, V11 (7L7). The circuit of the meter includes resistor R70 or R71, depending on whether the selector switch is in the sending or receiving position.

b. Correct Meter Reading. Resistors R70 and R71 have tolerance values within ±10 percent. If the meter does not indicate correctly, select resistore within this tolerance range to obtain a reasonably exact reading. To determine whether the reading is correct with the selector switch in the TRANSMIT position, measure the output signal across the LINE binding posts after connecting a 600-ohm resistor to these terminals. A reading of 0 dbm across the LINE binding posts should cause the DB METER in the transceiver to indicate ±2 db. If the reading is correct in the TRANSMIT position, it will also be correct in the RECEIVE position unless the value of R71 has changed. This may be checked by making a simple resistance measurement.

95. Signal Amplifier (RECORD DIRECT)

a. General. When the selector switch is set to RECORD DIRECT, the signal amplifier circuit is changed in the following manner:

(1) Tube V12 (7C5) is cut off by opening the plate supply circuit. One section (5, 6, and 7) of V13 (7N7) is switched in and takes the place of V12. This is done for the purpose of increasing the contrast on the RECORD DIRECT position. The cut-off bias of V13 is supplied in part by bias from the cathode circuit of motor amplifier driver tube V4 (7C5).
(2) The output of V14 (1635) is switched to transformer T3. The output of T3 delivers the power to the recording stylus. The switching connections include two sets of contacts to reduce the danger of a high-voltage flashover. When operating through transformer T3, the plate voltage of tube V14 is +450 volts.

b. Low Output. Recordings which are not up to full density may be traced to:

(1) Excessive bias on the cathode, pin 7, of V13.
(2) Defective transformer T2.
(3) Low cathode emission in V14.
(4) Flat-faced stylus or accumulation of carbon on the stylus. Clean the stylus and rotate it 90°.

c. *Blurred Recording.* When the tungsten wire point which is set in the brass body of the stylus becomes so worn that a reproduction is blurred during the RECORD DIRECT process, change the stylus needle. Loosen the spring latch (or screw) that holds the needle; remove the old needle, and replace it with a new one. Locate the needle so that the point is in contact with the surface of the direct recording paper mounted on the drum when the selector switch is in the RECORD DIRECT position.

d. Poor Contrast. If the recorded copy lacks contrast, and if the transmitted signal has a range of 15 db, the trouble may be traced to low bias voltage on cathode pin 7 of stage V13. This voltage may be increased by raising the value of R67 in Facsimile Transceivers TT-1/TXC-1 and TT-1A/TXC-1, or by readjusting control R97 in Facsimile Transceivers TT-1B/TXC-1 through TT-1F/TXC-1. A defective V4 tube also may be the cause of low bias voltage. When tubes are changed, the bias on the cathode of V13 should be checked.

96. Phasing Amplifier

a. No Output. To determine whether V16 (884) delivers power to the phase magnet, watch the tube when receiving phasing pulses. There should be a flash within the tube at each pulse while phasing, providing a good phasing signal is being received. On Facsimile Transceivers TT-1/TXC-1 and TT-1A/TXC-1, a quick test with no received signal can be made by depressing the PHASE button and giving the START button a short, quick push. A flash within the thyratron should occur each time the START button is depressed.

b. Signal Tracing. Connect the transceiver under test to a second transceiver for the purpose of obtaining a phasing signal. Set the CONTRAST control of the sending transceiver to produce a 6- to 8-db phasing pulse with the CONTRAST control in the range for negative transmissions.

(1) Connect the oscilloscope between ground and the cathode of V15 (pin 7). With the PHASE switch operated, the signal should appear as indicated on the signal-tracing chart. If it does not, trace trouble in stage V14.
(2) Check the signal at the other points indicated in the signal-tracing chart.

c. *Phase Magnet.* The phase magnet is part of the cathode circuit of stage V4 when the PHASE button is not depressed. Failure of the phase magnet to lock when the PHASE button is not depressed may be traced to stage V4. Resistor R40 is in the cathode circuit of V4 only when the button is depressed.

97. Photocell Circuit

a. Signal Tracing. Because of the sensitiveness of the output of the photocell circuit, it is not practical to make direct measurements with a meter or an oscilloscope. It is convenient to use the signal amplifier to feed the oscilloscope, which can be connected across the LINE terminals. The signal amplifier and meter circuit first must be checked for satisfactory operation. If the required measurements on the DB METER and oscilloscope are not obtained, the circuit should be traced on a stage-to-stage basis as indicated in the signal-tracing chart. If the photocell has been subjected to high humidity, it may require replacement. Its dc resistance, measured on an ohmmeter when no light is shining on the cell, should exceed 10 megohms. Be sure to readjust R42 after replacing the photocell with a new one.

b. Output Requirement. Set the GAIN control at 100 and adjust the CONTRAST control for a minimum meter reading when the scanning beam is on the phasing spot. This is the condition for positive transmission. The DB METER should indicate +2 or +3 db when the scanning beam is on the raised portion of the phasing ring. The equipment will operate satisfactorily even though the reading is not above 0 db. It is desirable, but not necessary, to have the 2- or 3-db margin. If the output level is not proper, check the alignment of the optical system; check amplifier stages V10, V11, and V12; then check the voltage across resistors R41, R42, and R43. This should be between .4 and .6 volt.

c. Low Contrast. Insufficient contrast when balanced on black or white generally can be corrected by the adjustment of resistor R42. Excessive voltage from the fork unit reduces the contrast

range. The voltage can be reduced by shunting the output of the fork unit with a 2,000-ohm resistor. Sometimes, the correction can be made by increasing the value of R49 (except in Facsimile Transceivers TT-1D/TXC-1, TT-1E/TXC-1, and TT-1F/TXC-1). The exact amount of this increase can be determined by experiment. Low contrast also may be caused by lack of light from the exciter lamp (par. 102).

98. Signal Amplifier (TRANSMIT)

a. Low Output. The signal amplifier circuit, with the selector switch in the TRANSMIT position, is a modification of the signal amplifier circuit with the selector switch in the RECORD PHOTO position. In practice, it is generally found that if the signal amplifier operates correctly in the RECORD PHOTO position, it performs properly with the switch in the TRANSMIT position. A quick check to determine whether the input circuit has been properly switched to the photocell circuit is to place a screw driver under the extension of the photocell shield pan. Do not let the blade touch the grid connection or the pan. If the amplifier is performing properly, it breaks into oscillation. In most cases, if the input circuit is open, oscillations will be present and will be indicated by continuous flickering of the DB METER.

b. Signal Compression. Connect the oscilloscope and DB METER across the LINE terminals. The waveform should be sinusoidal between the balance point and +2 db. If the waveform tends to compress before reaching +2 db, trace through the circuit to localize the trouble. The flattening or compression of the signal maybe caused by low plate voltage, low cathode bias voltage, low screen voltage, or defective tubes.

99. Signal Amplifier (STANDBY)

With the selector switch of Facsimile Transceiver TT-1/TXC-1 in the STANDBY position, the fork oscillator signal to the motor amplifier is effectively short-circuited to ground through pin 9 of the Jones plug and the exciter lamp and its circuit. (In all other facsimile transceivers, the STANDBY-MON-TALK switch (S5) also must be at STANDBY.) In Facsimile Transceiver TT-1C/TXC-1, the B+ circuit to the motor is opened when selector switch S1 and STANDBY-MON-TALK switch S5 are both at STANDBY. By short-circuiting the 1,800-cycle signal to the motor amplifier, the power to the synchronous motor is practically cut off. There is only a small residual dc flowing in the synchronous motor coils. Failure of the signal amplifier circuit to operate properly may be caused by a burned-out exciter lamp or a poor switch contact. The disappearance of the characteristic 1,800-cycle tone in the synchronous motor indicates proper operation of the grounding circuit.

100. B+ Voltage Regulator

a. Requirements. The B+ voltage regulator must deliver voltage that does not vary more than 2 volts when operating conditions change. The voltage may be anywhere between 240 and 255 volts dc. The measurements may be made at the bottom end of resistor R88 or R89 on the regulator panel terminal strip, or on pins 3 and 6 of stage V16 in Facsimile Transceivers TT-1/TXC-1 and TT-1A/TXC-1. This voltage is measured by RB+ meter M3 in Facsimile Transceivers TT-1B/TXC-1 through TT-1F/TXC-1.

b. Effects of Poor Operation. If the regulated voltage is too high, the fork frequency deviates from 1,800 cycles and causes a noticeable drift in the recorded copy. A low voltage also will result in a drift and permit the amplifiers to overload on a high signal level. The overloading shows up as flattened high lights when transmitting for negative reception, or flattened shadows when transmitting for positive reception. A flickering voltage regulator may produce level changes and may oscillate when the line voltage is low. The oscillations will show up in the recorded copy.

c. Tracing trouble. When trouble is suspected in the regulator unit, check the output voltage with the line voltage varying between 100 and 130 volts. The ac input frequency may be between 50 and 65 cycles. Watch the test voltmeter for several minutes when level change trouble is being traced. If the voltage takes a jump when the line voltage is within a few volts of 110, there is danger of the regulator breaking into oscillation at low line voltages. If it is important to operate at an exact line voltage, it will be necessary to use an accurately calibrated voltmeter to measure the line voltage. Most rectifier-type voltmeters can be depended on for an accuracy of 5 percent at temperatures between 65° and 100° F. Above and below these temperatures, the accurary is generally poor. If it is found that the regulated B+ voltage is not within the correct range, check the voltage across regulator lamp V25 (5651). This can be done by measuring the voltage between cathode pin 7 of tube V9 (7L7) and

ground. Use the 250-volt scale of a voltmeter having a resistance of 1,000 ohms per volt or higher. The voltage across the regulator lamp should be between 82 and 92 volts. If the voltage is found to be correct, test V9 or try a new tube. Weak tubes in stages V7 and V8 maybe responsible for a low RB+ voltage. There is a possibility that an excessive load is responsible for the low output voltage. If there is reason to suspect this, disconnect the load from the regulator panel and measure the open-circuit voltage. If it is necessary to trace further, test the components for the correct value. Capacitors, especially C57, must be tested for leakage.

101. Rectifier Power Supply

a. General. The term *rectifier power unit* is used to describe the complete unit, which includes the conventional rectifier power supply and the exciter lamp power supply system. In this paragraph, the term *rectifier power supply* does not include the exciter lamp supply system.

b. Tube replacement. Rectifier tube V22 (5Z3) may require replacement after a few hundred hours of operation, especially if the equipment is to operate on low line voltages; that is, 100 to 110 volts. A tube selected for hugh emission permits operation on voltages between 90 and 100. If the unregulated B+ voltage falls below 400 when the line voltage is 100, the tube emission is too low for satisfactory operation. Tube V22 should be replaced after each 500 transmissions.

102. Exciter Lamp Supply

a. Signal Tracing. For a quick check of satisfactory operation, measure the voltage across the exciter lamp. It should be between 6.1 and 6.3 volts at any line voltage between 100 and 130. The measurement is made at the terminal strip in the power supply. The voltage drop to the lamp socket is approximately .2 volt. If the voltage is not correct, measure the voltage on grid 4 of stage V17 (7S7). This should be about 4 volts ac, as measured with a vacuum-tube voltmeter. If further signal tracing is necessary, follow the steps shown in the signal-tracing chart. The exciter lamp should be replaced after each 500 transmissions.

b. 0utput Transformer T15. When the exciter lamp burns out, the load on transformer T15 becomes practically zero, resulting in a very high voltage across secondary No. 1. There have been transformer failures as a result of the high voltage. In tracing trouble, consideration must be given to the probability of failure of this transformer.

Section III. REPAIRS AND ADJUSTMENTS

103. General

Except in cases of simple trouble, do not attempt to repair mechanical parts such as the motor, the lead screw, the drum, and the tuning fork unless new parts are not available. Put replacements and lead wires in the same physical location as the original. When replacing components in the amplifier system, take into account protection necessary because of high voltages.

104. Synchronous Motor Unit

(figs. 105, 106, and 107)

Caution: Work on the synchronous motor should be done in a clean, dry place. Disassemble and assemble motor parts with care, avoiding risks of scratching and damaging any of the machined surfaces. Be careful not to lose the lower thrust bearing ball (R, fig. 105) when disassembling the motor.

a. Top Bearing (B, fig. 105). It is not practical to replace this bearing in the field. Use solvent (SD) to remove gummed-up oil and grease. After the bearing has been thoroughly cleaned, dry out all traces of the solvent before re-oiling.

b. Lower Bearing (fig. 105). In motors with serial numbers below 1157, do not attempt to replace the side-wall bearing in the field. Clean and re-oil. In motors with serial numbers above 1157, side-wall bearings (C, fig. 105) are of the ball-bearing type. These bearings may be replaced when defective. If tests indicate that synthetic rubber pad P is too soft, replace it. If the pad is too hard, a portion of the center can be cut away. If bearing ball R is replaced, select one that will not bind on the side wall of the bearing.

c. *Synchronous Rotor Bearing* (D, fig. 105). This bearing cannot be replaced in the field. If the rotor turns too freely on the shaft and does not fall into synchronism as it should, the free oscillating action must be reduced by adding some end thrust. Insert a thin washer (U) between the felt washer (V) and collar (S) Remove the collar after driving out the taper pin (T) with a

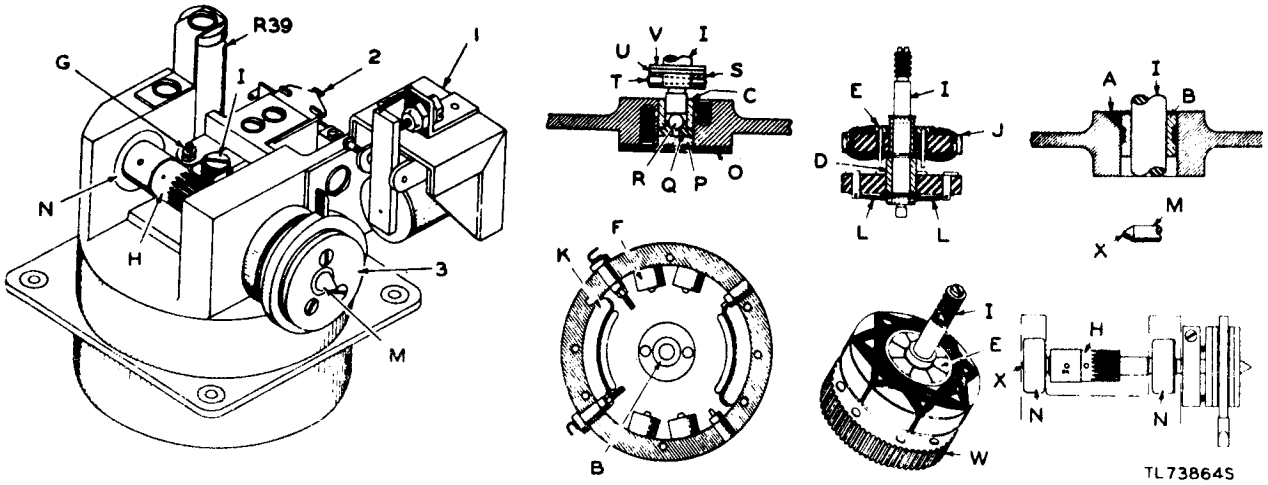


Figure 105. Synchronous motor, early models.

pin punch having a tip approximately .05 inch in diameter.

d. Commutator (E, fig. 195). Clean the commutator with a rubber eraser, preferably one containing grit, such as an ink eraser. Do not use emery or sandpaper.

e. Synchronous Motor Field Coils (F, fig. 105). In emergencies, a defective coil can be disconnected and the motor operated on three of its four coils. The power will be reduced, making it difficult to phase. Motors with serial numbers above 1000 have six poles; those below this serial number have four poles. The removal of one coil does not materially reduce the motor power. When ordering replacement parts, be sure to select the proper replacement coil. For replacement of synchronous motor coils and bushings on synchronous motors KBA-1 and KBA-2, use the appropriate Signal Corps Motor Coil Replacement Kit.

f. Lead-In Bushings. Defective lead-in bushings are the most common causes of motor coils burning out. Keep them clean at all times and, when possible, replace then with nylon bushings. Nylon bushings are supplied on KBA-1 motors. Ceramic bushings are supplied on motor KBA-2. Refer to *e* above for information on replacement bushings.

g. Brushes (C, fig. 109). To replace the brushes in motors supplied with Facsimile Transceivers TT-1/TXC-1 and TT-1A/TXC-1, remove the armature extension (A) of the start magnet and disconnect the brush leads from the terminal (H). If the bakelite sleeve (B) is in good condition, replace only the carbon brush (C) and its flexible lead. The brush can be pulled loose from the bakelite sleeve. In some cases, it may be necessary to warm the brush with a soldering iron or soak the brush and tip of the bakelite sleeve in glyptal solvent.

h. Synchronous Motor, Parts Description (fig. 105).

Ref symbol	Name of part and description	Function
	MOTOR, ac: 1,800-cycle, synchronous.	Driver for drum.
A	WICK, felt	Oil reservoir.
B	BEARING, composition: 5/16".	Top bearing.
C	BEARING, composition: 5/16".	Lower bearing on motors below serial No. 1157.
C	BEARING, ball: 1/2" od by 5/16" id by 5/32" w.	Lower bearing on motors above serial No. 1157.
D	BEARING, composition: 5/16".	Synchronous rotor bearing.
E	COMMUTATOR	Reverses current.
F	COIL, field: 125 ohms	Synchronous motor field coils.
G	BRUSH ASSEMBLY, electrical contact.	Supports motor brushes.
H	GEAR: 30 teeth, 40 pitch.	Reduction gear.
I	SHAFT, synchronous motor: start motor, worm.	Motor shaft and worm.
J	ARMATURE, series type	Start armature.
K	COIL, series field: 2 ohms.	Start motor field coil.
L	SPRING, synchronous rotor coupling.	Couple rotor to shaft.
M	SHAFT, drive	Drives clutch assembly.
N	BEARING, ball	Drive shaft bearings.
O	PLATE, bottom	Thrust bearing retainer.
P	RUBBER, synthetic	Enf-thrust decoupling.

Ref symbol	Name of part and description	Function
Q	PLATE, thrust	Thrust ball retainer.
R	BEARING, ball : steel ; ⅛″ dia.	Thrust bearing.
R39	RESISTOR, fixed : ww ; 7,500 ohms, ± 10%; 20 w.	Voltage dropping resistor.
S	COLLAR, thrust: also spring anchor.	Thrust collar and spring anchor.
T	PIN, taper: 7/0.	Secure spring anchor to shaft.
U	WASHER, bakelite: thrust.	Thrust bearing for synchronous rotor.
V	WASHER, felt: thrust.	Thrust bearings for synchronous rotor.
W	ROTOR, synchronous.	Synchronous rotor.
X	BEARING, ball; steel; ⅛″ dia.	Thrust bearing for shaft assembly.

i. Gear (H) (fig. 105). The gear on the drive shaft can be replaced if suitable shop facilities are available. Pin the new gear to the shaft with a taper pin. Sometimes, a damaged gear can be moved along the shaft and pinned in a new place so that 23 good portion of the gear will mesh with the worm.

j. Phase Magnet (fig. 108). The armature return spring (H) must produce a strong spring action. Replace the spring if the tension is too weak. Pivots (F) and (G) must not cause binds or side play. To adjust the armature backstop (B), set up the transceiver for a receiving test on a phasing signal. Proceed as follows: With the PHASE button depressed, back off the adjusting screw until the armature fails to operate. Screw in the armature back screw until the armature fails to catch the top arm. Return the screw

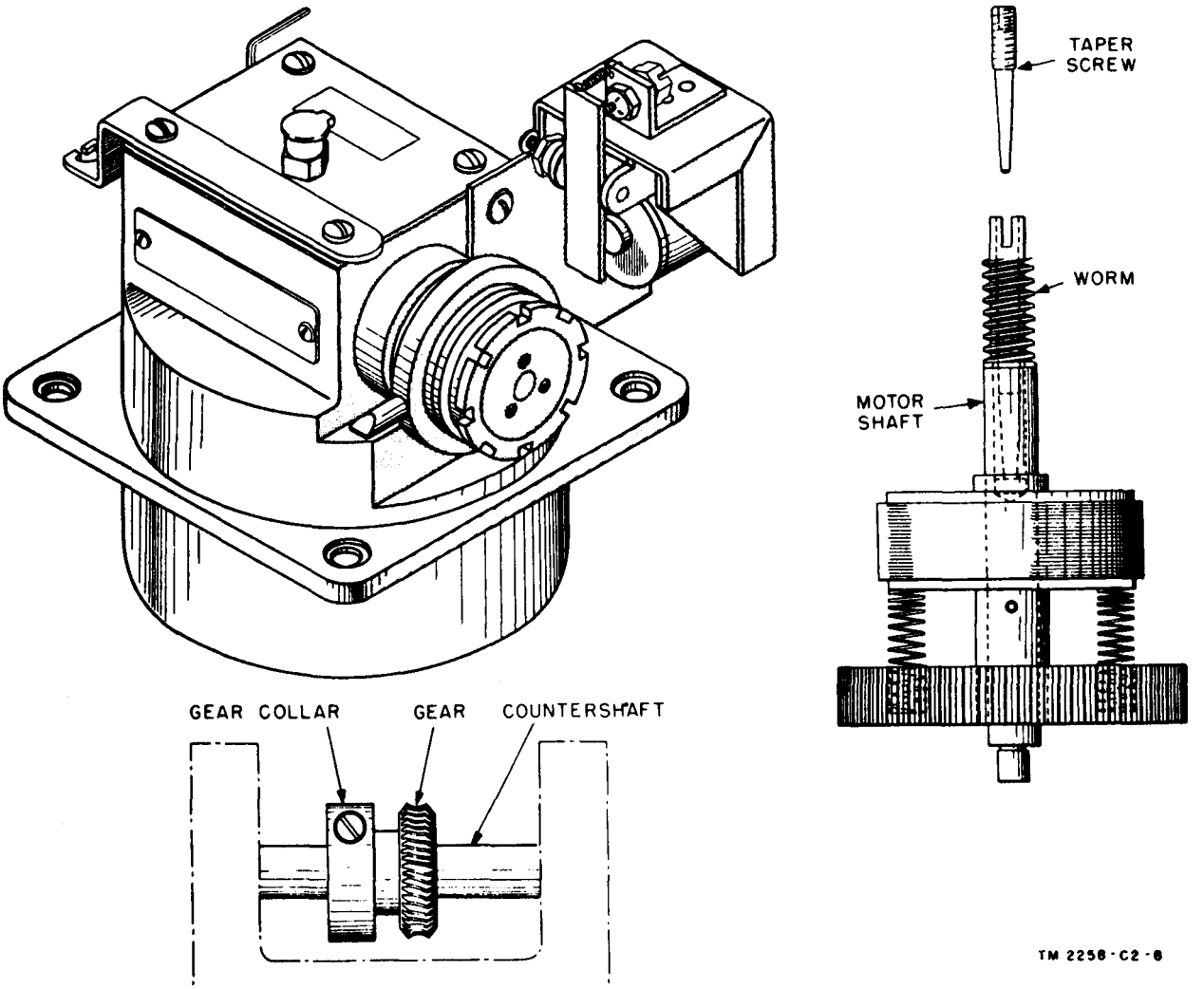


Figure 106. Synchronous motor, KBA-2.

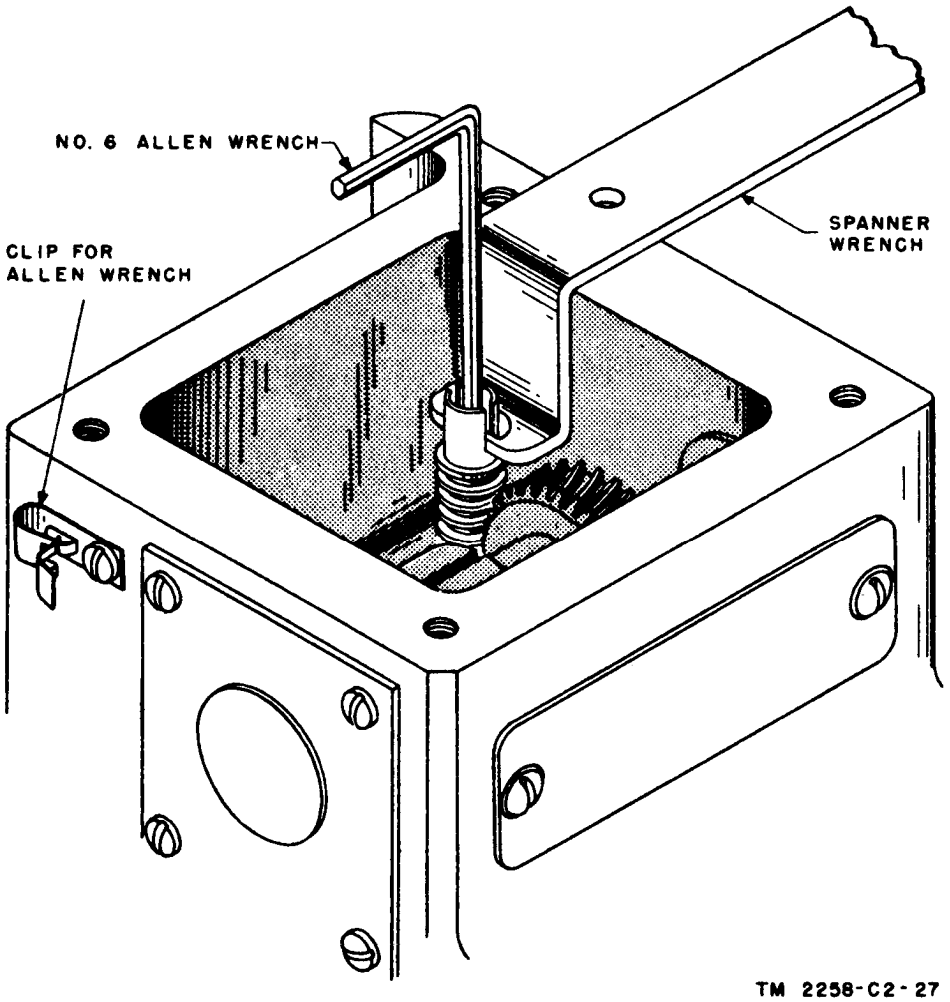


Figure 107. Synchronous motor KBA-2, showing use of spanner wrench.

to a position halfway betweem the two points. The head of the screw is hexagonal so that fractions of turns can be counted. The armature should operate satisfactorily over a range of approximately 1 turn. If the range is less than 1 turn, the armature return spring may be too tight or the armature may be binding at the pivots. If the range is greater than 1 turn, the spring may be too loose.

k. Start Magnet (fig. 109). Poor operation of the start magnet in motors with serial numbers below 1193 may be caused by the magnet armature rubbing against the motor casting. This can be cleared by loosening the magnet mounting screws and shifting the frame slightly. Check the action of the armature and brushes for freedom from finds. A lug which straddles the armature spring serves as a backstop to limit the upward movement of the armature. Adjust this backstop by bending the lug so that brushes lift approximately one-sixteenth of an inch off the armature. Test by pushing the armature downward with a pencil and noting the free armature travel before the brush springs begin to compress. Motors with serial numbers above 1193 are provided with a different type backstop which eliminates this trouble. Motors in Facsimile Transceivers TT-1B/TXC-1 through TT-1F/TXC-1 have no start magnet.

l. Phase Magnet, Parts Description (fig. 108).

Ref symbol	Name of part and description	Function
	PHASE MAGNET ASSEMBLY.	Phase drum.
A	ARMATURE	Armature a nd stop latch.
B	SCREW, backstop	Armature backstop adjustment.
C	COIL, solenoid: 3,000 ohms.	Electromagnet.
D	SCREW, core locating: No. 6–32.	Core position adjustment.
E	SCREW, sets: No. 8–32	Set screws for locking core in place.
F	PIVOT	Fixed armature fulcrum pivot.
G	PIVOT	Adjustable armature fulcrum pivot.
H	SPRING	Armature return spring.

Note. The core locating screw (D) is not used in the phase magnet assembly of Facsimile Transceiver TT–1C/TXC–1.

m. Start Magnet, Parts Description (fig. 109).

Ref symbol	Name of part and description	Function
	START MAGNET ASSEMBLY.	Moves brushes in contact with commutator.
A	ARMATURE EXTENSION.	Brush actuator.
B	BRUSH ASSEMbLY electrical contact: motor; includes brushes, sleeves, springs, brush arms, and nuts.	Brush and brush holders.
C	BRUSH, electrical contact.	Commutator brush.
D	SPRING, brush	Brush pressure control.
E	SPRING, armature	Armature return spring.
F	BACKSTOP, armature	Armature backstop.
G	SCREW, armature extension.	Remove brush assembly for replacement.
H	SCREW, binding head	Brush pigtail connector.
I	NUT: No. 2–56	Hold brush assembly in place.

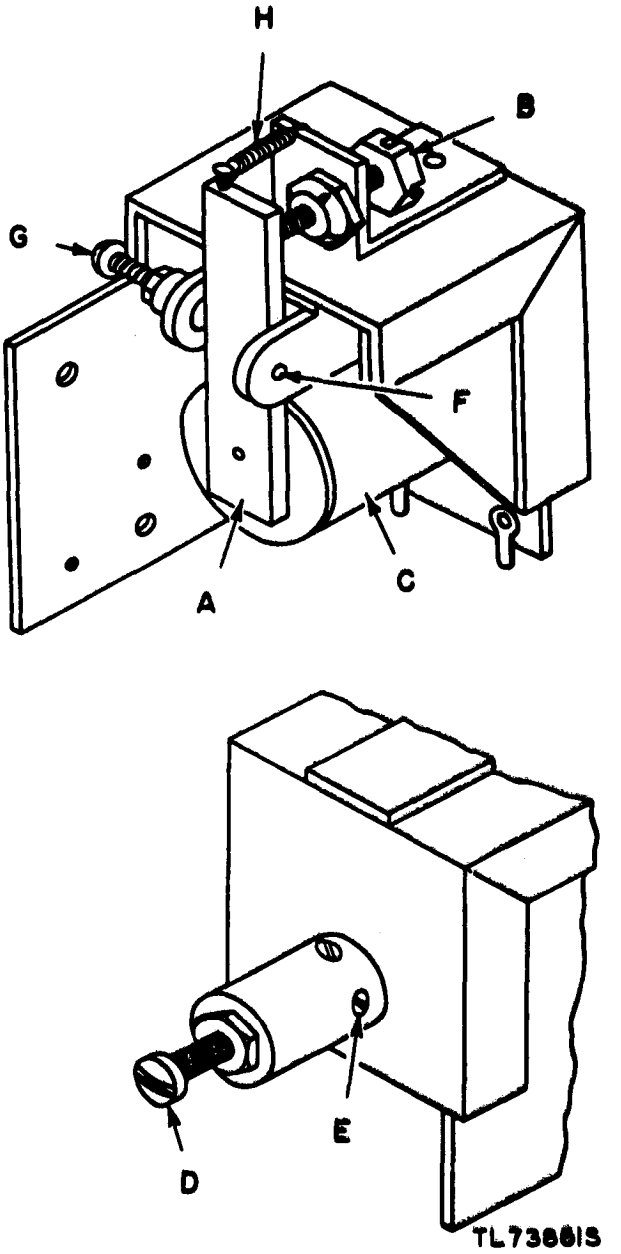
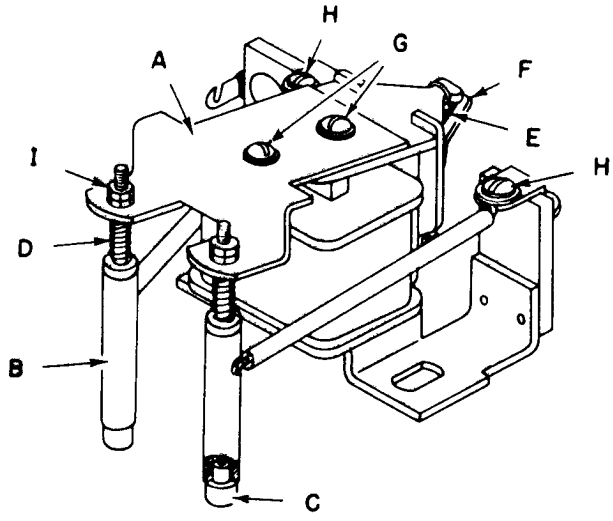


Figure 108. Phase magnet.



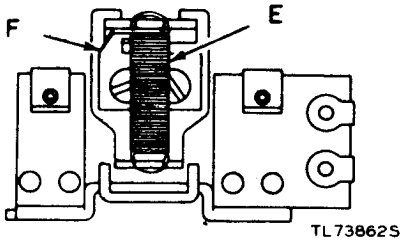


Figure 109. Start magnet.

105. Replacing Worm and Gear in Synchronous Motor KBA-2

C 1 (figs. 110 through 113)

Normally, the gear should be replaced when the worm is replaced. Although the gear may not display excessive wear, it becomes, in time, charged with abrasive particles which may cause undue wear on a new worm. Refer to figures 110 through 113 before starting replacement. The motor may be left mounted on the facsimile set during replacement.

a. Remove the spanner wrench and the top cover plate (four screws) from the gearbox. Remove the No. 6 Allen setscrew wrench (mounted on clip on gearbox).

b. Insert the No. 6 Allen setscrew wrench in the taper screw of the worm, and grip the slot with the spanner wrench (figs. 110 and 113).

c. Loosen the taper screw, remove the Allen wrench and the spanner wrench, and pull the worm gear up out of the motor shaft.

d. Remove the bearing cover plate (four screws).

e. Loosen the gear-collar set screw (fig. 113).

f. Remove the bearing, gear collar, and gear from the countershaft with finger pressure applied as shown in figure 112.

g. Remove the gear collar from the gear and place this collar on the new gear.

h. Slide the assembly (gear collar and new gear) onto the countershaft.

i. Inspect the bearing. Note that on one side of the bearing the inner race is flush with the outside race. The inner race is recessed on the other side of the bearing. Insert the bearing onto the countershaft with the recessed inner race side toward the outside of the gearbox (the side upon which the bearing cover plate is mounted). Since the inner race rotates with the countershaft, assembly in this manner will insure against the inner race rubbing on the bearing plate when the plate is replaced.

j. Replace the bearing cover plate.

k. Center the gear (and the gear collar) on the countershaft so that the gear is at the hole in the motor shaft that receives the worm.

l. Place the new worm into the motor shaft hole and tighten it with the Allen setscrew wrench and the spanner wrench. The worm now should be in mesh with the gear.

m. Move the gear (and the gear collar) along the countershaft in either direction until it is stopped by the worm. Now move the gear in the other direction along the countershaft until it is stopped by the worm. The distance of lateral movement of the gear along the shaft allowed by the worm will be approximately one-sixteenth of an inch. Moving the gear one-half of this distance from either extreme will center the gear on the worm.

n. Tighten the gear-collar set screw.

o. The new worm must be mounted with particular orientation to the motor shaft where worm and gear run smoothest. Turn the power on and start the motor.

Note. There is danger of high-voltage shock when working near the motor with the power on. Use extreme caution when making adjustments described in the rest of this paragraph.

p. With the motor running at synchronous speed, place two fingers of the left hand on the top of the motor gearbox, one finger above each countershaft bearing. The trembling sensation that will be felt must be minimized to insure smooth worm and gear operation. (To ascertain

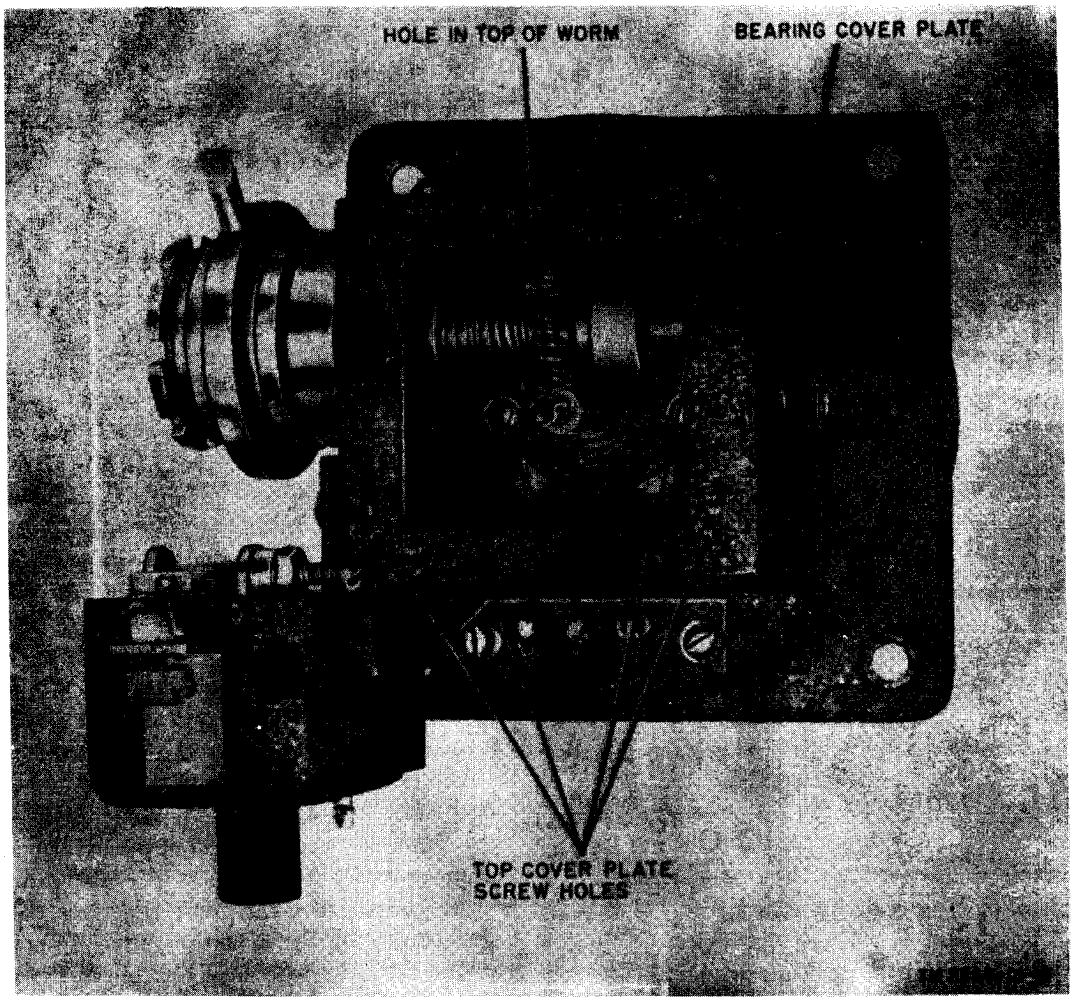


Figure *110. Top plate removed from* motor.

how much this trembling can be minimized, let the motor run with no worm in the motor shaft while feeling with the fingers on top of the motor gearbox.)

q. Stop the motor. Place the transceiver in the SET RANGE position. In this position, the field coils of the motor will offer enough resistance to rotation of the motor shaft to permit the worm, when the taper screw is sufficiently loosened, to be rotated without, rotating the motor shaft. Loosen the taper screw, using the Allen and spanner wrenches.

r. Slightly rotate tile worm in the motor shaft and retighten the taper screw.

s. Start the motor and, once again, feel the gearbox above the countershaft bearings to see whether the trembling has increased or decreased.

t. Repeat the procedures in *r* and s above; always rotate the worm slightly in the same direction until little or no trembling is felt.

u. Check the tightness of both the worm taper screw and the gear-collar setscrew. Lubricate with a thin film of Grease, Aircraft and Instruments (GL) on the worm and gear.

v. Replace the spanner wrench and the gearbox cover and replace the Allen setscrew wrench in its clip.

106. Clutch

(figs. 114, 115, and 116)

a. *Primary Clutch.* The primary clutch tension should be 12 to 14 ounces. Make a dynamic measurement with the motor running and the drum held stationary by means of a string wrapped around the drum and attached to the scale (fig. 114). To adjust primary clutch tension, stop the motor and loosen the clamp screw (G, figs. 115 and 116). The spring retainer (F) can be pushed forward or backward in Facsimile Transceiver TT-1/TXC-l, serial numbers 1 through 90; in

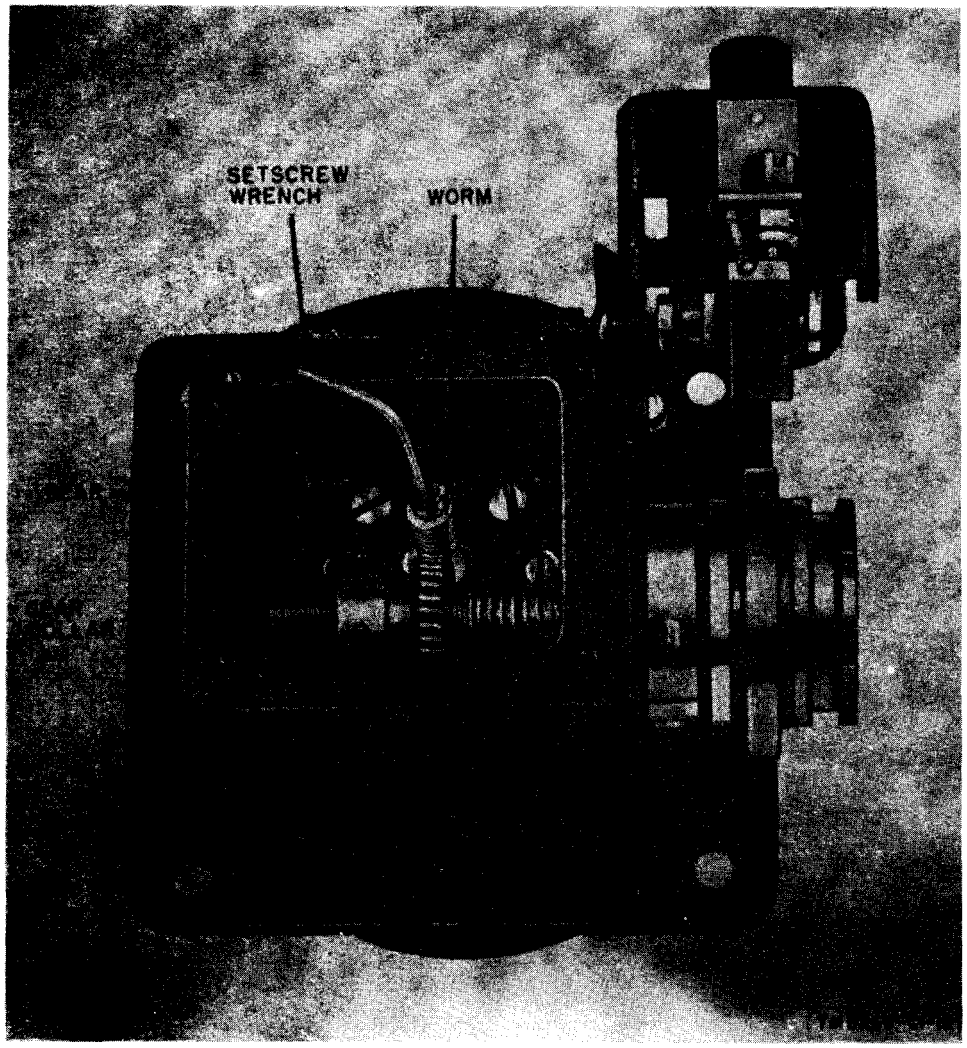


Figure 111. No. 6 setscrew wrench inserted into worm.

all later models, tension is adjusted by turning the retainer on its screw thread.

Warning: Never run the motor with the clamp screw (G) loose, or the gears may be stripped.

b. Secondary Clutch. The secondary clutch tension should be approximately one-half that of the primary clutch (6 to 7 ounces). In Facsimile Transceivers TT-1D/TXC-1, TT-1E/TXC-1, and TT–1F/TXC-1, the secondary clutch tension should be between 3 and 6 ounces. If the secondary clutch is too loose, the stop arm and dog trip will come together too rapidly and possibly throw the motor out of synchronism or slip the primary Clutch. Slipping of the primary clutch during the phasing operation will result in out-of-phase recording. If the secondary clutch tension is too heavy, the secondary clutch load added to the primary clutch load may cause the motor to stall during the phasing operation. Make a static measurement of the secondary clutch tension. With the motor stopped, and the string wrapped around the drum, pull the string to rotate the drum while reading the scale. Be sure that the measurement is taken when the dog latch is engaged with the secondary clutch ring to obtain a correct measurement. The secondary clutch tension is adjusted by means of screws (P, figs. 115 and 116). If screws work loose, lock the heads in place with glyptal after making correct adjustments. Before using glyptal, remove all grease with solvent (SD). If the screws are of the slotted type, spread the sides slightly by inserting a small screw driver or knife into the slot.

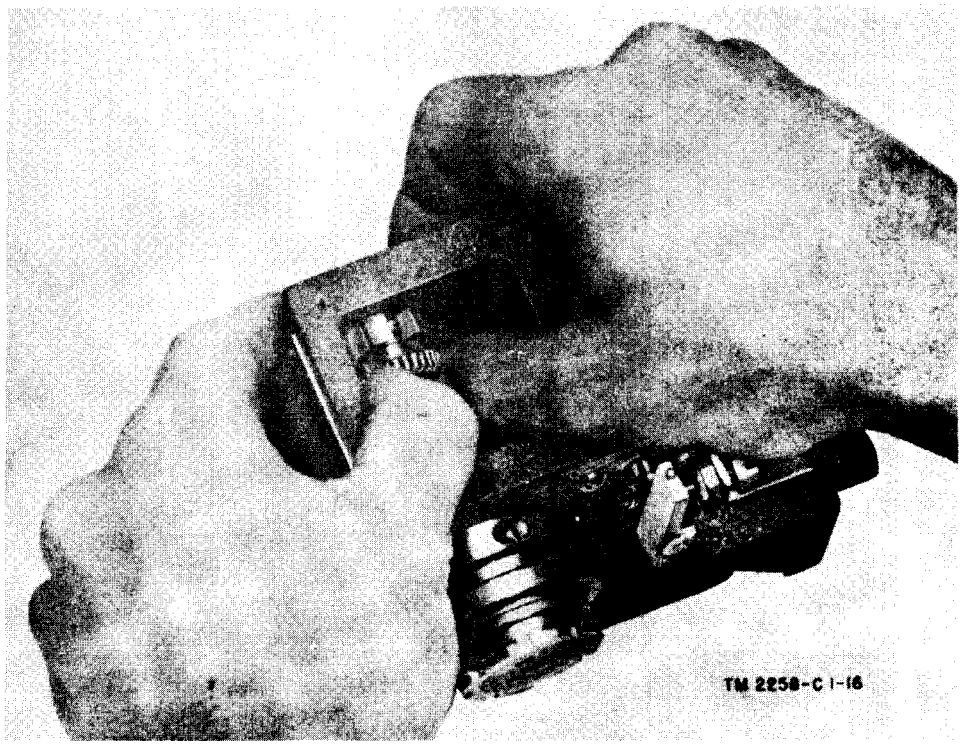


Figure 112. Placement of fingers behind the gear, to remove gear, gear collar, and bearing.

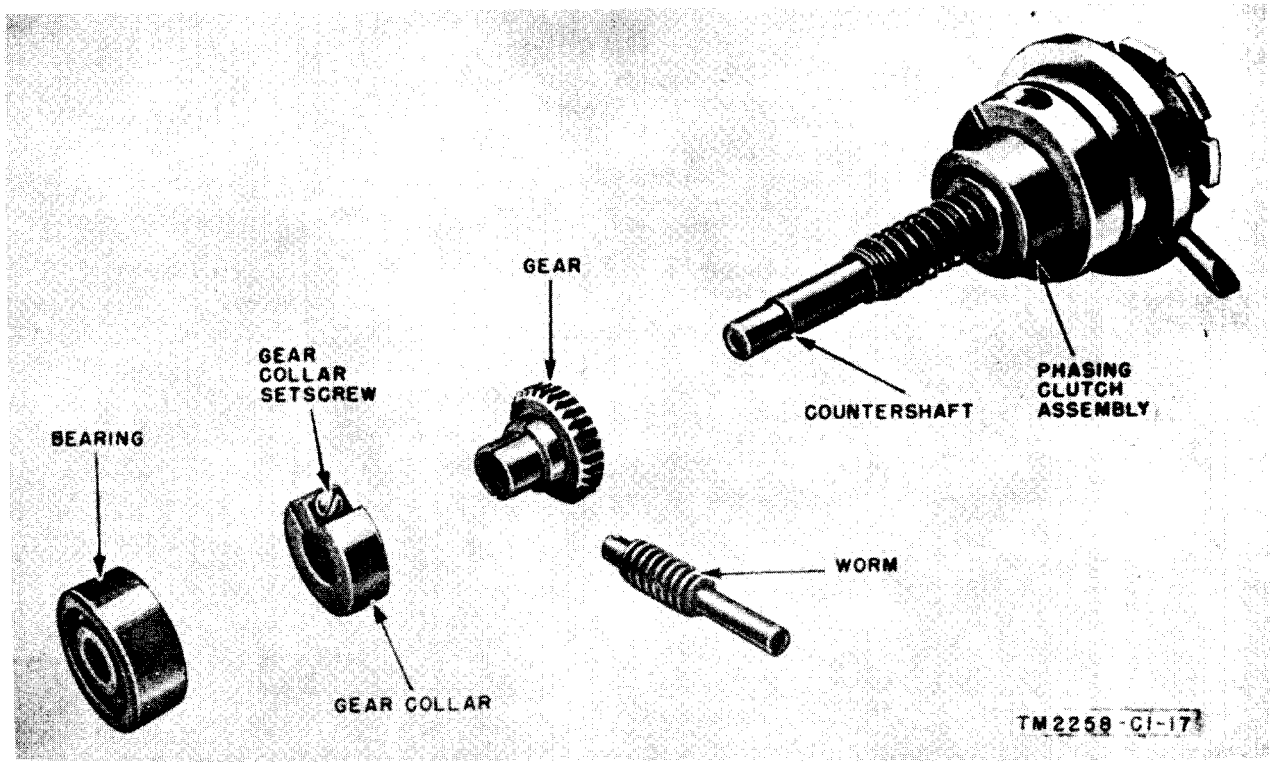


Figure 113. Bearing, gear collar, gear worm, and phasing clutch assembly, exploded view.

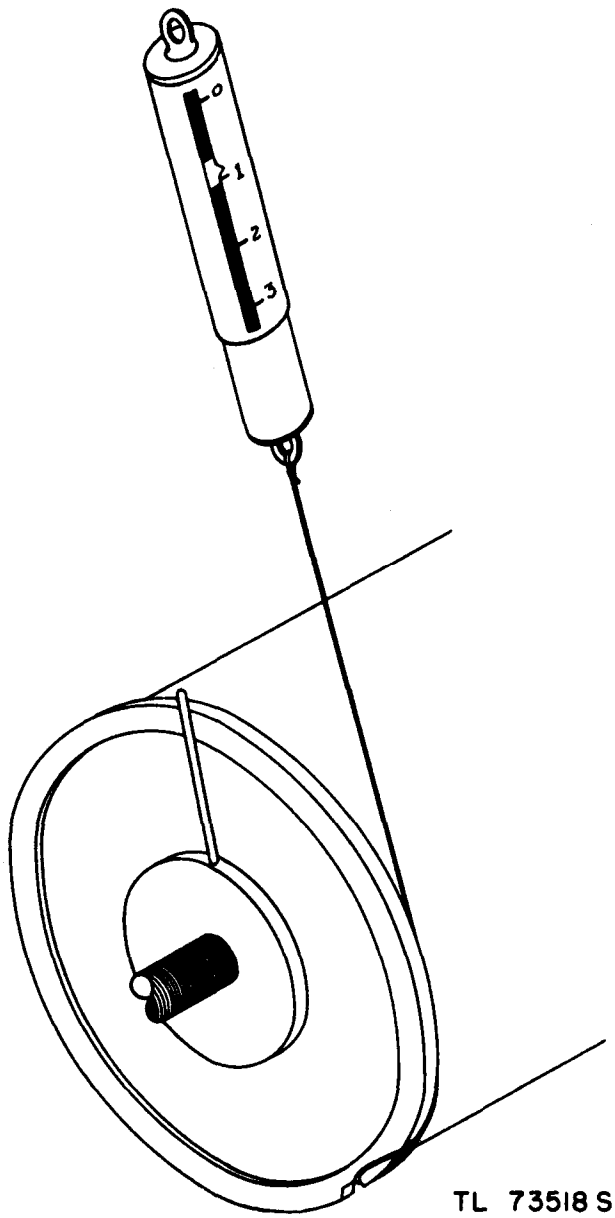


Figure 114. Method of measuring primary clutch tension,

***c. Clutch Assembly, Facsimile Sets AN/TXC-1, -1A, and -1B, Parts Description* (fig. 115).**

Ref symbol	Name of put and description	Function
	CLUTCH ASSEMBLY: Part of countershaft drive assembly.	Holds back drum while phasing.
A	ARM, stop.	Stop arm and driver.
B	CLUTCH, ring.	Retainer for friction driver plugs.
C	RING: composition, clutch plates.	Driving part of clutch.
D	PLUG: composition, clutch,	Driven part of clutch,
E	SPRING ----------	Clutch pressure springs.
F	RETAINER, spring----	Clutch pressure spring,
G	SCREW, clamp: No. 6-32	Clamps spring retainer to shaft.
H	RETAINER: clutch assembly.	Clutch assembly retainer and clutch plate driver.
I	BEARING, clutch ------	Hub for clutch assembly.
J	PIN, taper: 7/0---------	Secures clutch bearing to drive shaft.
K	SCREW: No. 4-40 ftat-head.	Holds clutch retainer to clutch bearing.
L	PLATE, pressure-- - - - -	Transfers spring pressure to clutch.
M	SHAFT, drive ---------	Drives clutch assembly.
N	CLUTCH: secondary, bearing.	Secondary clutch bearing.
0	SPRING, secondary clutch.	Secondary clutch* pressure.
P	SCREWS: No. 4-40 . _.	Adjust pressure on secondary clutch.
		Secondary clutch ring.

Note. In the clutch assembly ueed on Facsimile Transceiver TT-1C/TXC-1, serial numbers 1-165, Espey part No. A21.771 replaces parts with reference symbols C and H, shown above.

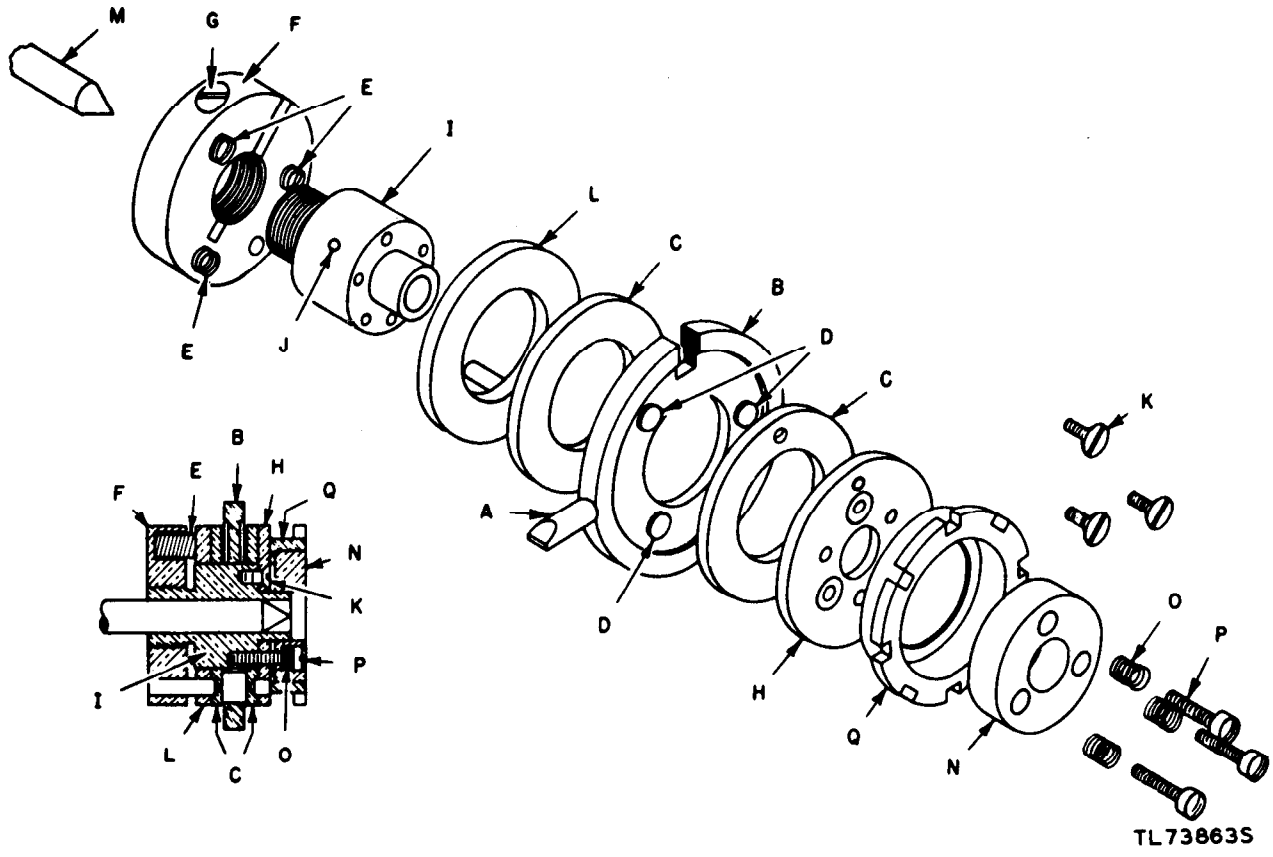


Figure 115. Clutch assembly, Facsimile Sets AN/TXC-1, -1A, and -1B.

d. Clutch Assembly, Facsimile Sets AN/TXC-1C, and AN/TXC–1D, Parts Description (fig. 116).

Ref. symbol	Name of part and description	Function
	CLUTCH ASSEMBLY; p/o countershaft drive assembly.	Holds back drum while phasing.
A	ARM: stop ----------	Stop arm and driver.
B	CLUTCH RING --------	Retainer for friction driver plugs.
C	RING: composition, clutch plates.	Driving part of clutch.
D	PLUG: composition, clutch.	Driven part of clutch.
E	SPRING ----------	Clutch pressure spring.
F	RETAINER, spring -----	Clutch pressure spring.
G	SCREW, clamp: No. 6-32; fillister head.	Clamps spring retainer to shaft.
H	RETAINER PLATE: clutch assembly.	Clutch assembly retainer and clutch plate driver.
1	BEARING, clutch ------	Hub for clutch assembly.
J	PIN, taper -.----------	Secures clutch bearing to drive shaft.
K	SCREW: No. 4-40; flathead.	Holds clutch retainer to clutch *bearing.*
L	PLATE, preasure -------	Transfers spring pressure to clutch.
M	SHAFT, drive ------.--	Drives clutch assembly.
N	BEARING, secondary clutch.	Secondary clutch bearing.
0	SPRING, secondary clutch.	Secondary clutch pressure.
P	SCREW ----------	Adjusta pressure on secondary clutch.
Q	RING, secondary clutch-	Secondary clutch rings.
R	BEARING, needle- - ---	Bearing for clutch assembly.

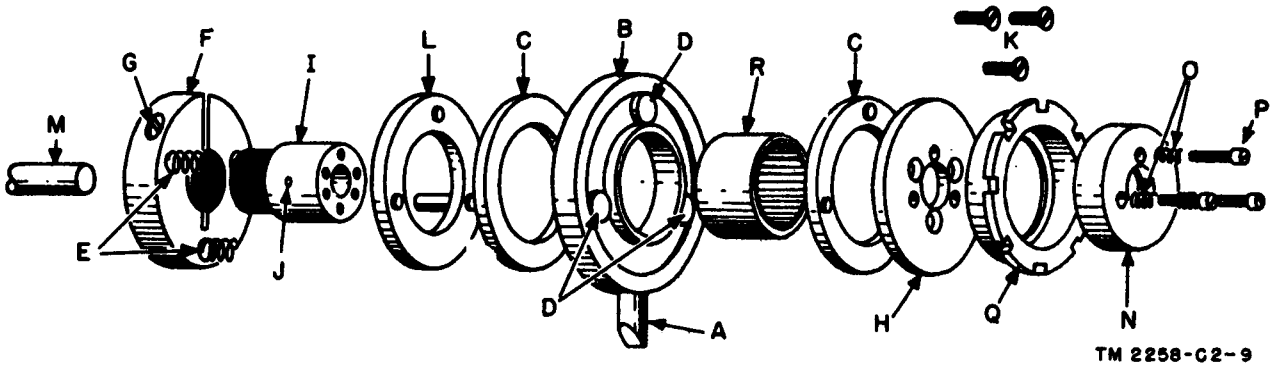


Figure 116. Clutch assembly, Facsimile Sets AN/TXC-1C and AN/TXC-1D.

e. Lubrication. Erratic clutch tension usually indicates the need for lubrication. Refer to paargraph 136.

f. Alinement of Shaft. For proper operation of the clutch and drive assembly, the shaft (M) must be in alinement with the lead screw. The up-and-down alinement can be controlled in Facsimile Transceiver TT–1/TXC–l by the mounting screws of the motor, provided the motor has rubber grommets in the mounting holes. Motors without grommets are machined in a jig and should give no trouble in this respect.

g. Dog Latch Cam Plate. Excessive wear and damage are caused to the dog latch cam plate by setting it improperly. The cam plate should be adjusted so that it first begins to trip the dog latch after the dog latch haa traveled approximately one-fourth of an inch past the end of the plate. The plate must engage the dog latch near the tip to insure enough leverage. Adjustment can be made by sliding the entire dog trip arm assembly along the lead screw or by changing shims under the cam plate. The dog latch and trip arm must operate freely under a light tension from the springs.

107. Drum

(figs. 117 and 118)

a. General. The drum of Facsimile Transceiver TT–1(*)/TXC–1 is constructed as illustrated in figures 117 and 118.

b. Half Nuts. If the half nuts (split nuts) become damaged, replacement may be made from the spares provided with the equipment. In older equipments, each half nut holder is numbered. Later equipments will accept stock half nub, and their retainers are lettered *A and B.* The half nuts must be matched with the corresponding markings on the retainer.

c. Binding. If the drum tads to bind on the lead screw when it is turned or moved along the lead screw by hand, it is possible that the lead screw is bent or nicked. A nick in the guide rail may cause binding. Do not blame the drum unless other repairs fail to solve the trouble. Binds sometimes can be cleared by flushing the drum bearings with solvent (SD) and relubricating with oil (PL Special).

d. Jitters (fig. 102). If the key (B, figs. 117 and 118) is too loose and is free to move sidewise, jitters may occur in the recorded copy. If replacement parts are not available, a temporary repair may be made by squeezing the walls of the key retainer.

e. Tension Adjustment. If phasing troubles occur in Facsimile Transceivers TT-1B/TXC-1 through TT-1F/TXC-1, tighten the drum-tension adjusting screw one-half turn. This is the upper screw on the left-hand lead-screw bearing block (fig. 1 19).

f. Removal of Paper Clamp in Facsimile Transceiver TT–1C/TXC-1.

(1) To remove the paper clamp from the drum, proceed as follows:

(a) Place a blunt instrument, preferably a piece of hard wood, against the left-hand edge of the paper clamp (C, fig. 117) and give it a sharp rap with a hammer.

(b) Slide the paper clamp to the right about one-half inch, then lift the clamp out of the drum.

(2) To remove the interred lever assembly, proceed as follows:

(a) Remove the knob on the right-hand side of the drum.

(b) Remove the mounting plate and slide the assembly out of the drum.

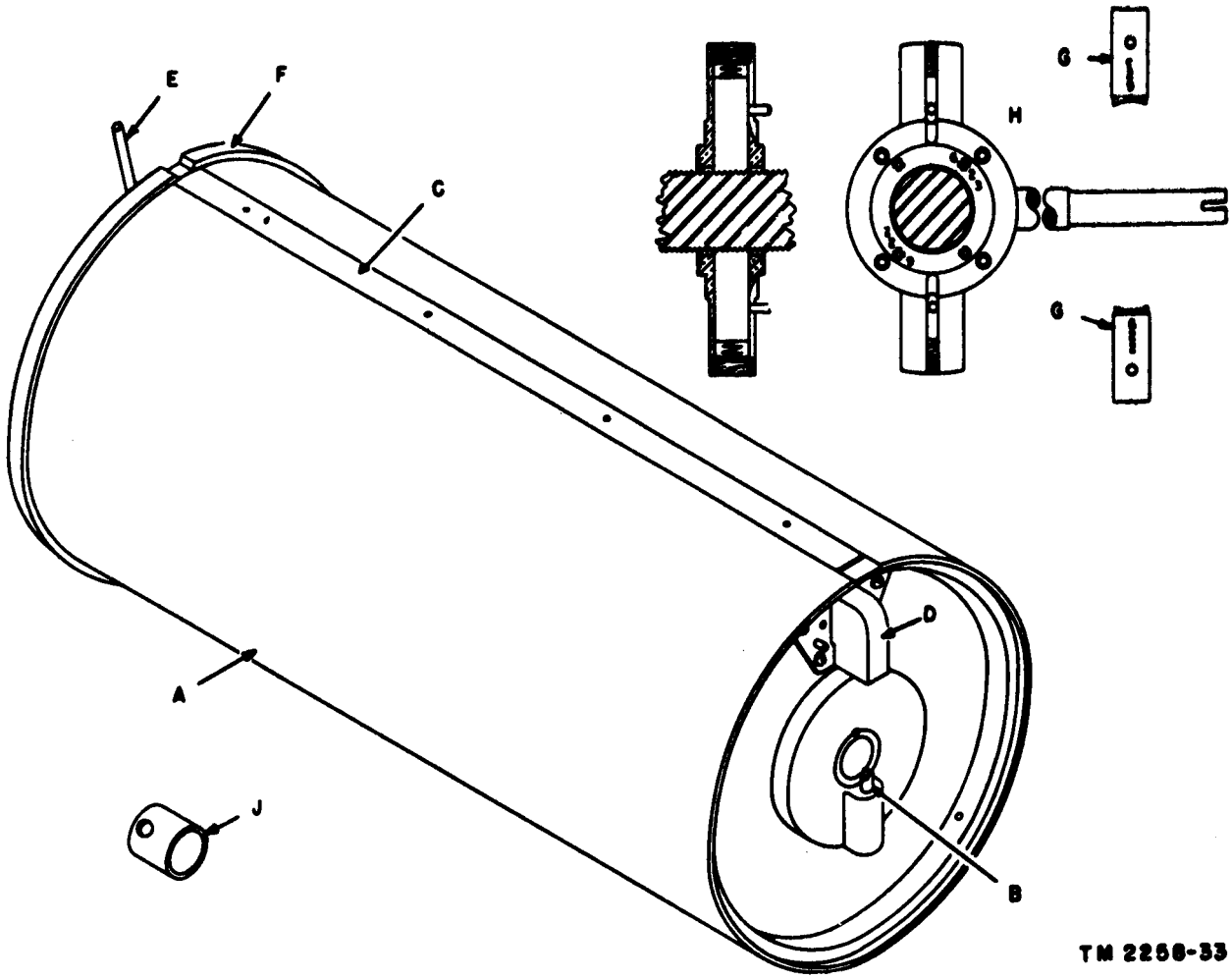


Figure 117. Drum assembly, Facsimile Transceivers TT-1/TXC-1, TT-1A/TXC-1, and TT-1B/TXC-1.

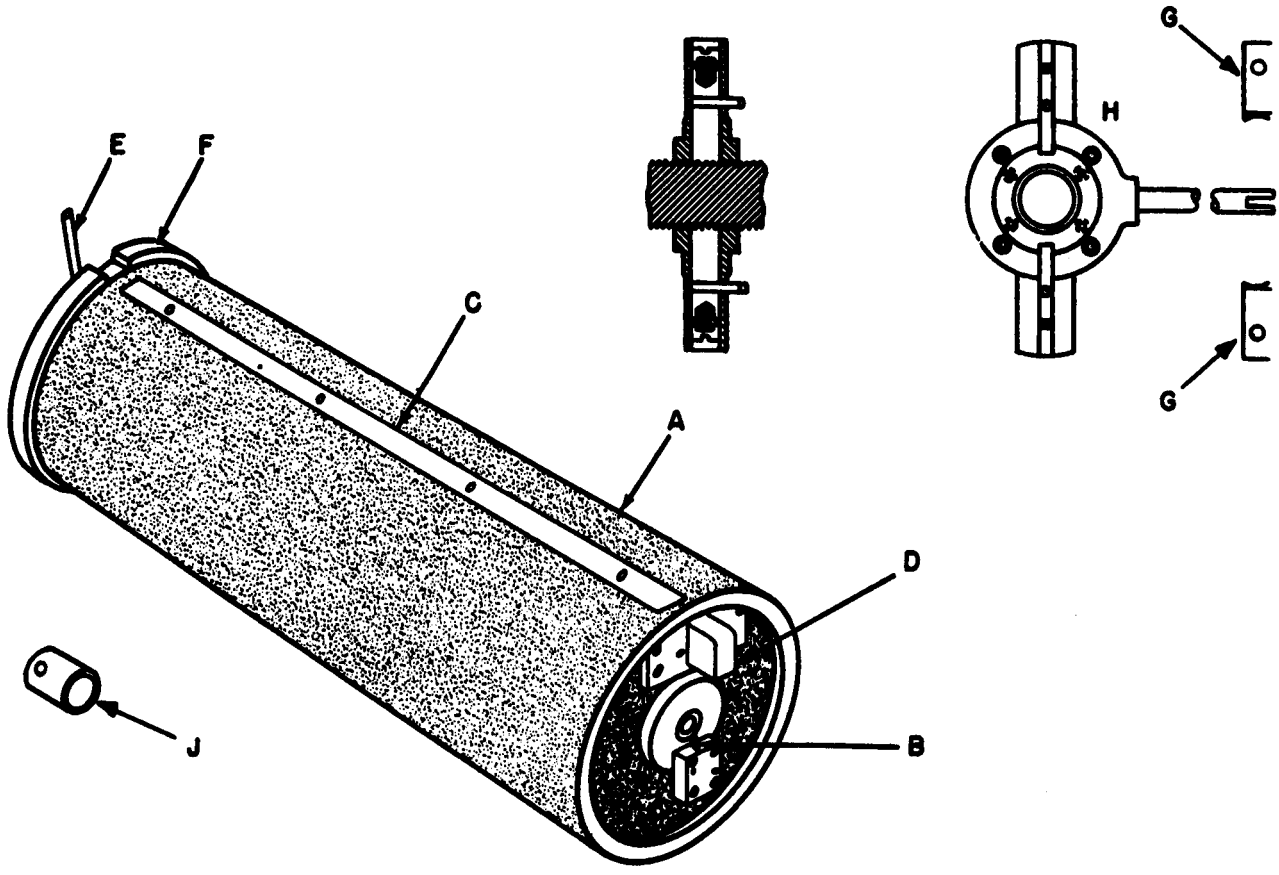


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Figure 118. *Drum assembly, Facsimile Transceivers TT-1C/TXC-1, TT-1D/TXC-1, TT-1E/TXC-1, and TT-1F/TXC-1.*

g. Drum Assembly, Parts Description (figs. 117 and 118).

Ref symbol	Name of part and description	Function
	DRUM, facsimile transceiver.	Holds, rotates, and spirals copy.
A	DRUM SLEEVE..	Outside of drum.
B	KEY----------	Drives drum through contact with keyway in lead screw.
C	CLAMP, paper and film-	Secures copy to drum.
D	CONTROL LEVEL, paper and film clamp.	Opens and closes paper and film clamp.
E	LEVER, cam plate -----	Operates cam controlling half nuts.
F	RING, phasing ----------	Reflects light during phasing.
G	HALF NUTS ----------	Feed drum along lead screw.
H	RETAINER, half nut---	Mounting for half nuts and left-hand end drum support.
J	STOP, drum ----------	Bumper between drum and bearing block.

108. Lead Screw

(fig. 119)

a. Cleaning. Clean the lead screw thoroughly with solvent (SD). Be careful not to scratch the threaded portion. After cleaning, inspect for scratches and nicks, using a magnifying glass. If nicks appear in the threaded portion, the threads sometimes may be *chased* by a skilled machinist working with a hand tool. Any nicks or dents in the other portion of the lead screw should be emoothed out with a fine oil stone. Examination of the lead screw should include an inspection of the bearing (K, fig. 119). Replace the bearings that cause the lead screw to bind.

b. Keyway. Nicks in the keyway will cause jitters in the recorded copy. A nick sometimes can be smoothed out with a very fine three-cornered file; the file mark may be smoothed out with a fine stone.

c. Lubrication. After a lead screw has been cleaned, inspected, and repaired, lubricate it as directed in paragraph 46.

d. Lead Screw, Dog, and Bearing Parts Description (fig. 119).

Ref symbol	Name of part and description	Function
A	LEAD SCREW ASSEMBLY: lead screw.	Rotates and feeds drum assembly.
B	LEAD-SCREW PRESSURE PLATE.	End thrust bearing.
C	DRIVE DOG ASSEMBLY.	coupled lead screw to motor clutch.
D	CAM, dog latoh ---------	Causes dog latch to to disengage from clutch.
E	BLOCK, bearing: rh----	Supports right-hand end of lead screw.
F	BLOCK, bearing: 1h. ----	Supports left-hand end of lead screw.
G	SPRING ----------	Preloads thrust bearing.
H	ARM, dog trip ----------	Drives lead screw from primary clutch.
I	LATCH, dog ----------	Drives lead screw from secondary clutch.
J	PLATE, drum stop ----B-	Dust shield for bearing and drum stop.
K	EARING, ball -------	Lead-screw bearings.

109. Transmitter Optical System

a. General. Dirt on the lenses or poor adjustment of the optical system will cause insufficient light on the photocell.. Before tracing trouble, clean and adjust the system in accordance with *e* and *f* below. Aline the exciter lamp after each 100 transmissions, Refer to figure 120 for transmitter optical system used in Facsimile Transceiver TT-1/TXC-1 through TT-1C/TXC-1. Refer to figure 121 for transmitter optical system used in Facsimile Transceiver TT-1D/TXC-1, TT-1E/TXG-1, and TT-1F/TXC-1.

b. Inspection. The following points in the transmitter optical system muet be examined for defects before starting any repair work:

(1) *Exciter lamp.* The exciter lamp may have a poor internal contact which causes it to flicker. Try a second lamp known to be good to determine whether the first lamp is at fault. Be sure the lamp is in ita right position and not rotated 180° in the socket. Check the position each time the lamp is removed.

(2) *Socket.* Examine the socket for good contact. Be sure there is no corrosion.

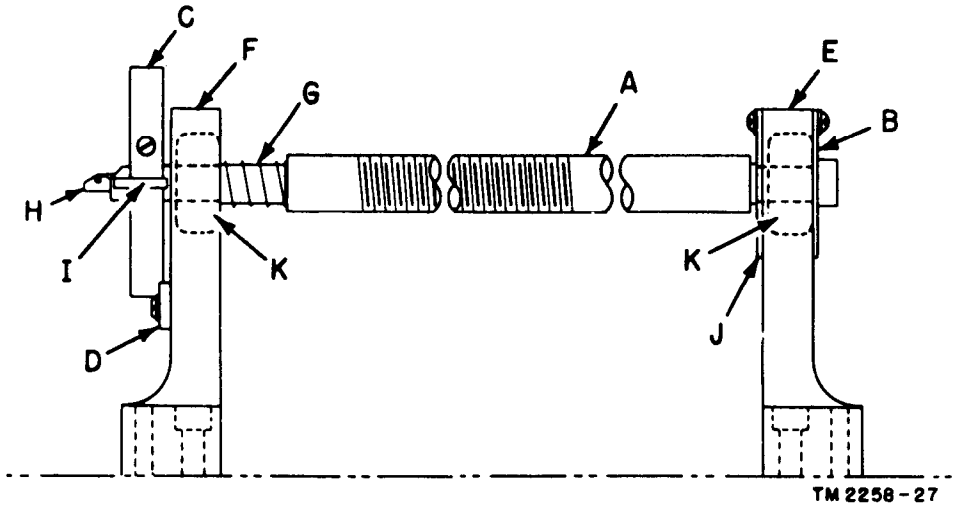

Figure 119. Lead screw, dog, and bearings.

This can be done by forcing the lamp up and down and sideways with the current on. If the lamp flickers, repair or replace the socket. Side play may cause the lamp to go out of focus. Examine the connections to the socket, especially the connection to the shell of the socket. Test the spring in the socket to be sure that it operatea freely to give a strong contact pressure to the lamp.

(3) *Socket mounting plate.* Examine the screws that hold the socket mount in place to be sure that they are set up tightly on the bakelite holder, There is a possibility that the bakelite may have shrunk away from the screws, causing them to become loose.

(4) *Lamp holder bracket assembly.* The bracket assembly must not move when a pressure of approximately 10 pounds is applied by hand. If it does move, spring tension (L) under the cam screws (G) and (F) (fig. 120) is too light. The tension may be increased by taking 1 full turn on the screw. It is possible that the spring leaves may be broken. If so, replace them.

(5) *Condenser lens.* Examine the condenser lens for dirt and improper fitting in the mount.

(6) *Objective lens barrel.* Inspect the objective lens for dirt and fitting in the mount. The barrel must not be loose in the block. Inspect the lens for defects. It may be necessary to remove the lens barrel. If the cement between the elements of the lens appears to be fern-like when examined under a magnifying glass, replace the lens. If any other defects appear under examination with a magnifying glass, replace the lens unless the defects occur only at the outer rim of the lens.

(7) *Photocell socket.* Remove the pan under the photocell and examine the socket connections.

c. Exciter Lamp Socket. Do not replace the exciter lamp socket with any ordinary type automobile socket. The socket must be constructed with strong springs behind the contact, and insulated with bakelite, not hard rubber.

d. Lamp Bracket. If it is necessary to tighten the lamp bracket, keep in mind that the eccentric action of the top screw moves the bracket sideways, and the eccentric action of the bottom screw raises and lowers the bracket. The center operating position of the screw heads is marked with a red dot. Do not attempt to obtain alinement with the red dot one-fourth or one-half turn off center. The dot should not move more than 45° either side of center. If it is necessary to take up a turn on either the lower or upper cam screw, it may be necessary to make a partial turn of the second cam to obtain a complete revolution of the first one. This holds true if one cam is removed to replace a spring. Under emergency conditions, a spring may be replaced with a heavy piece of rubber that has a thin washer on each side.

e. Condenser Lens. In most cases, the condenser lens may be cleaned sufficiently for operation by dusting off the top surface and wiping it

with a soft cloth. It is this top surface that collects most of the dirt. If the lens is fogged on the inside surface, it must be removed for cleaning. The nut is cemented in place with glyptal, which first must be loosened with a solvent such as glyptal thinner or paint remover. Use a form tool as shown in figure 124 to unscrew the nut. Take care not to damage the paper washers.

j. Objective Lens. The objective lens must not be removed unless it is necessary to make a replacement because of a cracked element or because of bad cementing. Cleaning of the front surfaces of the lens may be done without removing the barrel. To remove the objective lens, first remove the entire barrel. In removing the barrel, first loosen the locking screws of the clamp (R, figs. 120 and 121). From sheet metal, form a screwdriver or spanner wrench tool (fig. 124). Do not use a single pointed screwdriver, as it may slip and scratch the lens. Try to loosen the nut without using solvent (SD), as the solvent will damage the cement between the lens elements. If it is necessary to use the solvent, use it very sparingly and keep the lens barrel in a vertical position with the lens down.

g. Photocell. Do not remove the photocell unless there is good reason to suspect that replacement is necessary. If subjected to high humidity, the base of the cell may absorb moisture, making replacement of the photocell necessary. To remove the photocell, take off the cover (D, figs. 120 and 121) and eject the cell by lifting the ejector rod (E, fig. 120). In replacing the cell, have the single-wire anode in the cell pointing to the back. After replacing the photocell, be sure to readjust resistor R42, To remove photocell V24 in Facsimile Transceiver TT-1F/TXC-1, take off the cover (D, fig. 121) and the exciter lamp socket assembly (N). Remove the shield (HH, fig. 121) from the bottom and push the tube out with a screwdriver. Insert a new photocell and replace (D), (N), and (HH). Adjust the exciter as instructed in h below. Adjust variable resistor R42 in the photocell circuit (par. 114 *c*).

h. Exciter Lamp and Condenser Optical System.

(1) Center the cam screws so the red dot is up. Set the photocell lens barrel with the dot. or line marker in the top position (U, fig. 120). If the lens barrel has been removed, and the focal point is not known, set the barrel back so that the face of the lens is about one-half inch from the surface of the drum. Tighten the screw in the clamp (R). Wrnp a piece of white paper around the drum, turn on the power, set the selector switch for TRANSMIT, set the CONTRAST control about five points higher than the balance point for negative transmission, and set the GAIN control at 100.

(2) Loosen the clamps on the socket and adjust the alinement of the filament; move the socket up and down in the clamp until the maximum meter reading is obtained. If there is no meter reading, adjust the top adjusting cam until there is a meter reading.

(3) If the alinement of the condenser lens system is uncertain, loosen the mounting screws and move the system laterally for maximum reading. Return the top adjusting cam screw to center position and readjust the system for maximum reading.

(4) Loosen the clamp screws that hold the bakelite block to the mounting plate. Swing the block to and from the condenser lens and lock it in position at the point of maximum reading. If the adjustment is not critical, clamp the block in the center position. With the drum rotating, readjust the eccentric screws for the steadiest signal. If, at any time during the procedure, the meter indicates above +2, adjust the GAIN control to bring the indication into the range between – 4 and +2.

(5) In Facsimile Transceivers TT-1D/TXC-1, TT-1E/TXC-1, and TT-1F/TXC-l, use the following procedure. Remove the white paper from the drum and wrap an 18 1/16-inch -inch long piece of white paper bearing printed or typed matter around the drum, and position the drum to scan copy with the half nuts disengaged. Connect a jumper between R41 and R44 and the junction of R43 and R46. (This shorts the signal to the photocell.) Turn the power on and set the selector switch on TRANSMIT. Set the GAIN control on 50 and start the motor. Connect a pair of headphones to plug J1. Loosen the screw (JJ, fig. 121) and move it in its slot until minimum signal is heard. Lock the screw (JJ) and remove the jumpers from

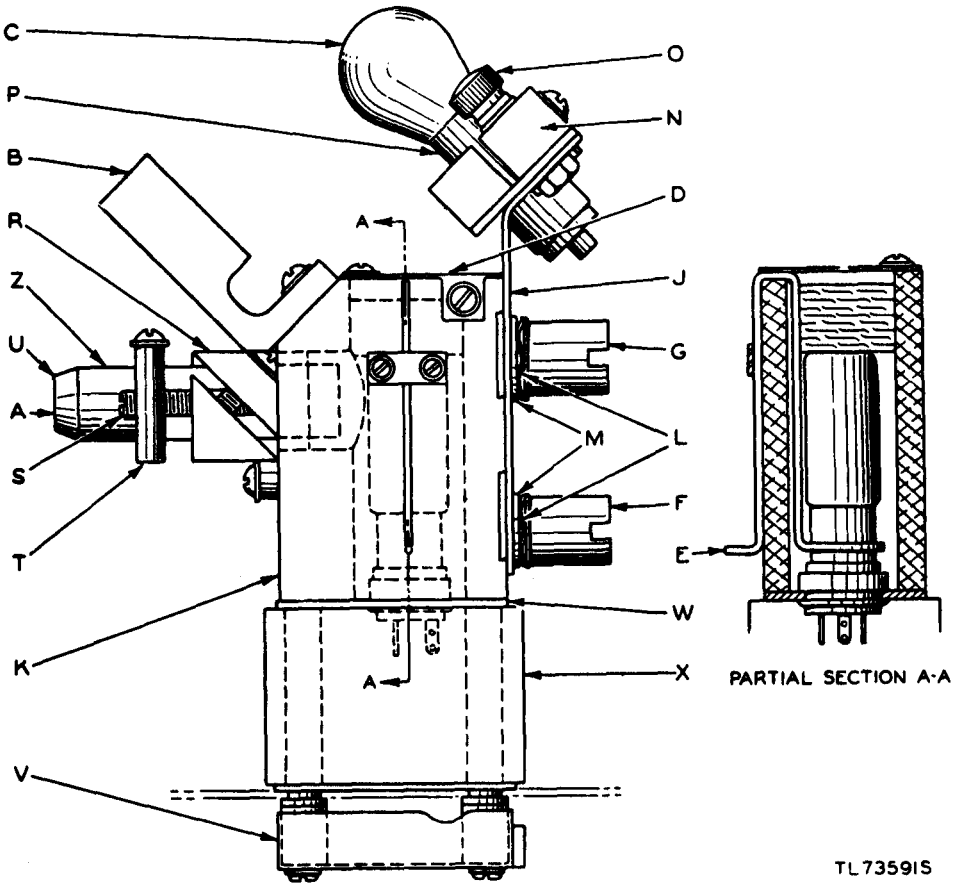

Figure 120. Transmitter optical system, Facsimile Transceivers TT-1/TXC-1, TT-1A/TXC-1, TT-1B/TXC-1, and TT-1C/TXC-1.

the resistors. There should be a loud modulated signal in the phonea.

(6) The focus of the exciter lamp is adjusted by loosening the locking screws (O, fig. 121) and moving the socket holder (N) until the sharpness of the light spot on white paper on the drum is a maximum. The horizontal and vertical position of the light spot relative to the lens barrel (Q) is controlled by the knobs (AA) and (II) which can be turned after the locknuts (E) and (EE) have been loosened. The desired vertical position of the spot will be indicated by a dip of the DB METER as a thin horizontal line drawn on the white paper reaches a point about one-third of the way down from the top of the spot. This is done with the transceiver set for maximum contrast (minimum signal on black).

i. Photocell Lens Barrel. Remove the white paper from the drum and replace it with a sheet of 65-line half-tone or very fine print. The 65-line half-tone copy may be obtained from large newspaper photographs having light gray or white background. Connect a headset across the line terminals. If the tone is not loud enough, use the LINE JACK. Listen to the signal as the drum rotates; move the lens barrel in and out until the sharpest and loudest modulation tones are heard. To make the modulation tones distinct, the 1,800-cycle carrier can be cut off by shorting terminals 1 and 2 of T5. Keep the line or indicator (U, figs. 120 and 121) in the top position. At the point of loudest or sharpest tone, lock the lens barrel in position. Again. set the adjustments of the exciter lamp position with the cam screws. Replace the white sheet on the drum for a final check. An alternate method of alining the photocell lens barrel is to connect an oscilloscope across the line terminals and move the drum by hand, alternately scanning black and white copy. Adjust the lens barrel for maximum contrast between black and white, as indicated on the

oscilloscope. By using a synchronized horizontal sweep on the oscilloscope and letting the motor turn the drum, the wave envelope can be studied.

j. Transmitter Optical System, Facsimile Transceivers TT-1/TXC-1, TT–1A/TXC-1, TT–1B/TXC–1, and TT–1C/TXC-1, Parts Description (fig. 120).

Ref symbol	Name of part and description	Function
	TRANSMITTER OPTICAL SYSTEM.	Scans subject matter for transmission.
A	LENS, objective.. ------	Focuses image of scanned spot on aperture.
B	LENS ASSEMBLY-- --.	Focuses light from exciter lamp onto spot to be scanned.
C	LAMP, incandescent: Mazda 6-volt, 21 cp auto lamp.	Illuminates spot to be scanned; exciter lamp.
D	COVER, block ---------	Cover for photocell chamber.
E	CELL EJECTOR -------	Removes photocell.
F	SCREW, adjusting: eccentric.	Adjusts vertical position of exciter lamp.
G	SCREW, adjusting: eccentric.	Adjusta horizontal position of exciter lamp.
J	PLATE, adjusting: for exciter lamp.	Mounts exciter lamp to cell block.
K	BLOCK, cell ------..----	Mounts optical system and supports photocell.
L	SPRING, leaf compression.	Presses exciter lamp adjusting plate against cell block.
M	WASHER, adjusting plate.	Washer between leaf compression springs and cell block.
N	HOLDER, socket ------	Mounts exciter lamp socket to permit vertical adjustment of socket and adjustment of distance between exciter lamp and condensing lens.
O	SCREW, locking- -------	Locks socket holder in correct focusing position.
P	SOCKET, lamp ---------	Lamp socket.
R	CLAMP -:-..-;---------	Clamps lens barrel.
S	SCREW, set: lens barrel focus adjust.	Adjusts focus.
T	CLAMP ----------	Transmits motion from adjustment screw S to lens barrel.
U	INDICATOR SPOT- ---	Indicates UP position of lens barrel.
v	SHIELD, photocell and grid connection.	Shield.
w	SOCKET PLATE ASSEMBLY: TTE No. 90-01-01-2 including socket TTE No. 90-01-01-23.	Photocell socket and mouting plate.
x	BLOCK, raising ---------	Rakes optical system.
z	LENS BARREL ASSEMBLY.	Scans area of predetermined size (elemental area) passing light through aperture to photocell.

Note. In the optical system of Facsimile Transceiver TT-1C/TXC-1, the socket with reference symbol P is a Millen .No. 33991 (less mounting bracket).

k. Transmitter Optical System, Facsimile Transceivers TT-1D/TXC-1, TT-1E/TXC–1, and TT–1F/TXC-1, Parts Description (fig. 121).

Ref symbol	Name of part and description	Function
	TRANSMITTER OPTICAL SYSTEM.	Scans subject matter for transmieeion.
A	LENS, objective. -------	Focuses image of scanned spot on aperture.
B	CONDENSER LENS MOUNT ASSEMBLY.	Focuses light from exciter lamp onto spot to be seanned.
C	LAMP, incandescent: 6 v, 21 cp, auto lamp, GE Mazda #1129.	Illuminates spot to be scanned; exciter lamp.
D	COVER, block ----------	Cover for phototube chamber.
E	LOCKNUT ----------	Locks the adjusting plate (J).
F	PLATE, stop ----------	Limits travel of eccentric (H).
G	SPRING ----------	Maintains eccentric (H) in engagement with adjusting plate (J) when locknut (E) is backed off.
H	GEAR, eccentric ----------	Converts rotary motion of adjusting knob (AA) to lateraf motion of adjusting plate (J).
I	CLAMP, cable--.-------	Clamp wires to exciter lamp.
J	PLATE, adjueting: for exciter lamp.	Mounts exciter lamp to cell block.

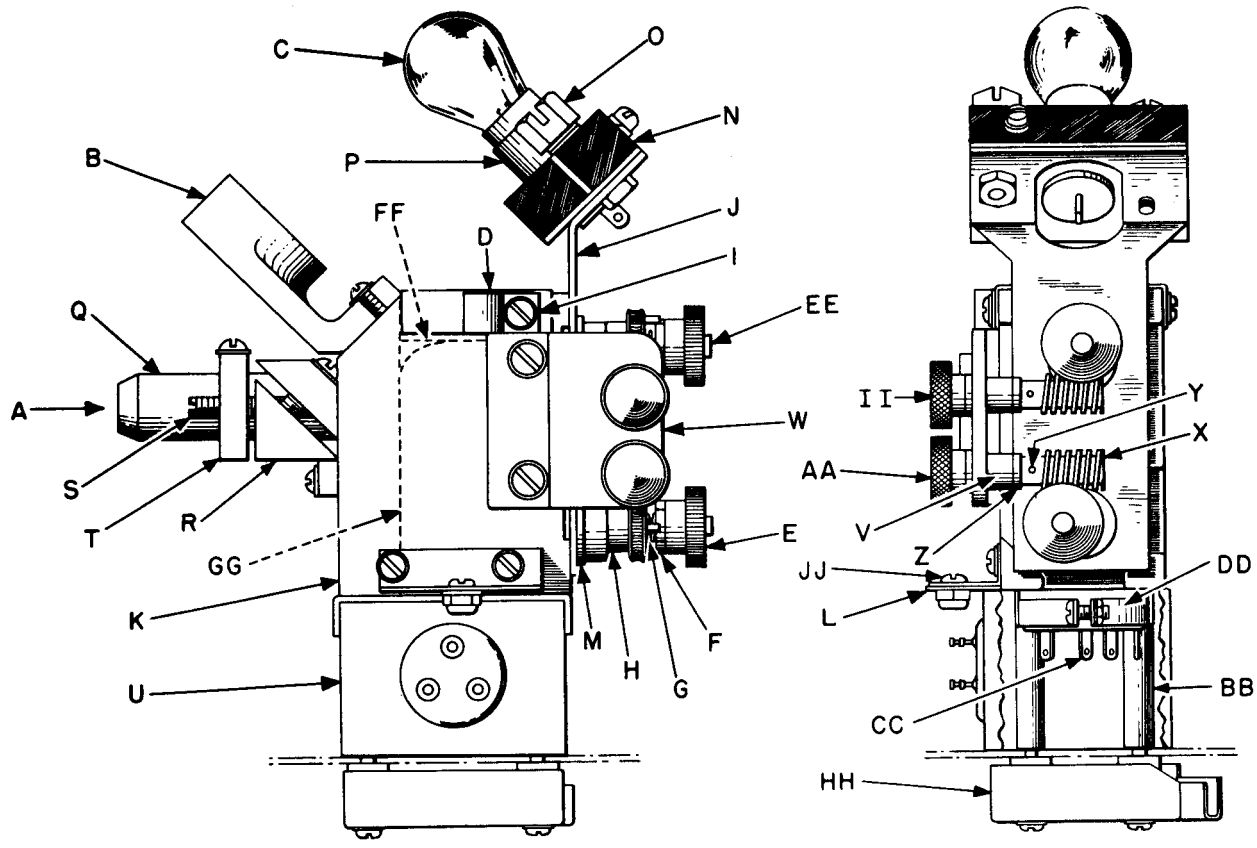

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Figure *121. Transmitter optical system, Facsimile Transceivers TT-1D/TXC-1, TT-1E/TXC-1, and TT-1F/TXC-1.*

Ref symbol	Name of part and description	Function
K	BLOCK, cell ----------	Mounts optical system and supports phototube.
L	BRACKET, socket swivel.	Locks rotary position of phototube.
M	WASHER, adjusting plate.	Washer between exciter lamp adjusting plate (J) and eccentric gear (H).
N	HOLDER, socket- -----	Mounts exciter lamp socket to permit vertical adjustment of distance between exciter lamp and condenser lens.
O	SCREW, locking -------	Locks socket holder in correct focusing position.
P	SOCKET, lamp. .--	Exciter lamp socket.
Q	LENS BARREL ASSEMBLY.	Scans area or predetermined size (elemental area), passing light through aperture to phototube.

Ref symbol	Name of part and description	Function
R	CLAM P--	Clamps lens barrel.
S	SCREW, set	Adjusts lens barrel focus.
T	CLAMP	Transmits motion from adjusting screw (S) to lens barrel.
U	ADAPTER ASSEMBLY	Raises optical system.
V	BEARING	Bearing support for adjusting knob (AA).
W	PLATE, adjusting . .._.	Support plate for bearing (V).
X	WORM ----------	Drives eccentric gear (H).
Z	SPACER ----------	Washer between worm (X) and bearing (V).
AA	KNOB, adjusting	Knob for adjusting lateral and vertical position of adjusting plate (J).
BB	STUD, adapter.....	Raises optical system to proper level.
c c	SOCKET ----------	Socket for phototube (GG).

Ref symbol	Name of part and description	Function
DD	CLAMP, socket	Calmp for phototube socket *(CC)*.
EE	STUD, threaded..	Pivot and locking studs for eccentric gear (H).
FF	CUSHION	Tube clamp and vibration dampener.
GG	PHOTOTUBE: type 5652.	Converts fluctuations in light intensity entering phototube into fluctuations in electrical resistance to amplitude-modulate a carrier.
HH	SHIELD, phototube and grid connection.	Electrostatic shield for phototube leads.
II	KNOB ----------	Knob for adjusting lateral and horizontal position of adjusting plate (J).
JJ	SCREW, locking -------	Locks socket holder in correct focusing position.

110. Recorder Optical System

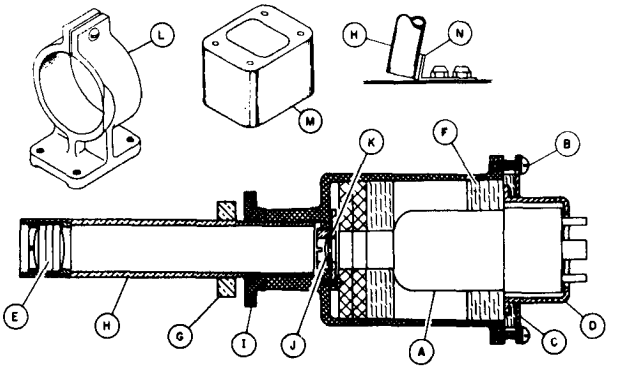
(fig. 122)

a. *General.* Failure to obtain recordings of sufficient density, in most cases, can be traced to a weak recorder lamp. Check the current that goes through the recorder lamp and make a test with a replacement lamp before suspecting faults in the optical system.

b. Cleaning Lenses. The lens surfaces, with the exception of the front face of the objective lens (E, fig. 122) are protected. Dust usually can be removed with a camel's-hair brush without tampering with the adjustments of the optical system.

c. Recorder Lamp Replacement. The recorder lamp can be replaced without removing the recorder lamp optical system from its bracket in the following manner:

(1) Remove connectors or sockets from the recorder lamp (A).
(2) Remove the four screws (B) at the rear of recorder optical system.
(3) Remove the pressure plate (C) and sleeve (D).
(4) Pull the lamp (A) carefully out of the optical system. If the lamp comes out without the rubber ring (F) around the, bulb, remove the rubber ring from the inside of the optical system.
(5) Place the rubber ring (F) on the bulb of the new recorder tube and reassemble the system; leave the four pressure-plate screws loose.
(6) Connect the recorder-tube leads to the prongs, the red lead (+) going to the No. 7 prong which is nearest the alining projection. (Most sets have a socket, not individual connectors.)
(7) Connect the UC coupling coil to the transceiver and place the coil near the motor.
(8) Turn the selector switch to RECORD PHOTO.
(9) Adjust the GAIN control and the position of the UC coupling coil until the meter indicates about +2 db.
(10) Move the drum to the extreme right and shade the transceiver from direct light; slip a piece of tissue paper or a piece of undeveloped film in front of the recorder optical system, close to the objective lens. A ring of light should be visible on the tissue or film. This ring must be within the field of the lens, preferably in the center. If the light is off to one edge so that some of the light is being shut off by the lens barrel or the light is not visible at all, orient the recorder tube by pressing on the retainer cup in different directions to center the ring of light well within the confines of the objective lens. Once the ring of light is centered, tighten the plate screws progressively and recheck the ring of light. If there is a clamp under one of



NOTE: LENS J IS OMITTED IN FACSILIE TRANSCEIVERS TT-1C/TXC-1, TT-10/TXC-1, AND TT-1E/TXC-1

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Figure 122. Recorder optical system.

the pressure-plate screws, the recorder-tube wires should be placed under the clamp so that they are captive, but free enough to slip and prevent cutting of the insulation.

Caution: There are 250 volts dc on the recorder-tube terminals.

d. Testing Alinement of Recorder Optical System. Set up for photographic reception and make a test run on photographic paper or film. Recording for 1 minute is required at the following levels: -4, –2, 0, and +2 db, Develop the exposed paper, examine it under a magnifying glass, and note how the rectangular images stack up on one another in sharpness and size (fig. 123). When in proper adjustment, the rectangles just touch one another on all four sides. If the rectangular images are not obvious to the naked eye at 8- to 10-inch distance, the images can be considered satisfactory. If the rectangles are obviously undersized or oversized, readjust the lens barrel.

e. Alinement of Recorder Optical System. Loosen the locking ring (I, fig. 122), and turn the adjusting ring (G) and lens barrel (H) 2 turns in the proper direction. If the rectangles are too small, turn the lens barrel into the housing. If they are too large, turn the lens barrel out of the housing and tighten the locking ring. Move the drum to the extreme left and place a thin negative on the drum so that the negative is perfectly tight and extends one-fourth inch over the right-hand edge of the drum: keep the emulsion side out. Adjust the transceiver so that the meter indicates +2. The image of the rectangle should be visible on the film beyond the edge of the drum. If it is not visible, remove the motor and clutch cover and push the drum farther to the left. If the readjustment has caused the image to go out of focus, loosen the screw in the clamp (L) which supports the optical system. Carefully slide the optical system back and forth until the image is sharp. A magnifying glass is necessary to see the image clearly. It may be necessary to repeat this image size adjustment several times to get satisfactory results, Tighten screws and locking rings securely after each adjustment. The square image should have two sides parallel to the axis of the drum. When focus adjustment is made, the optical system

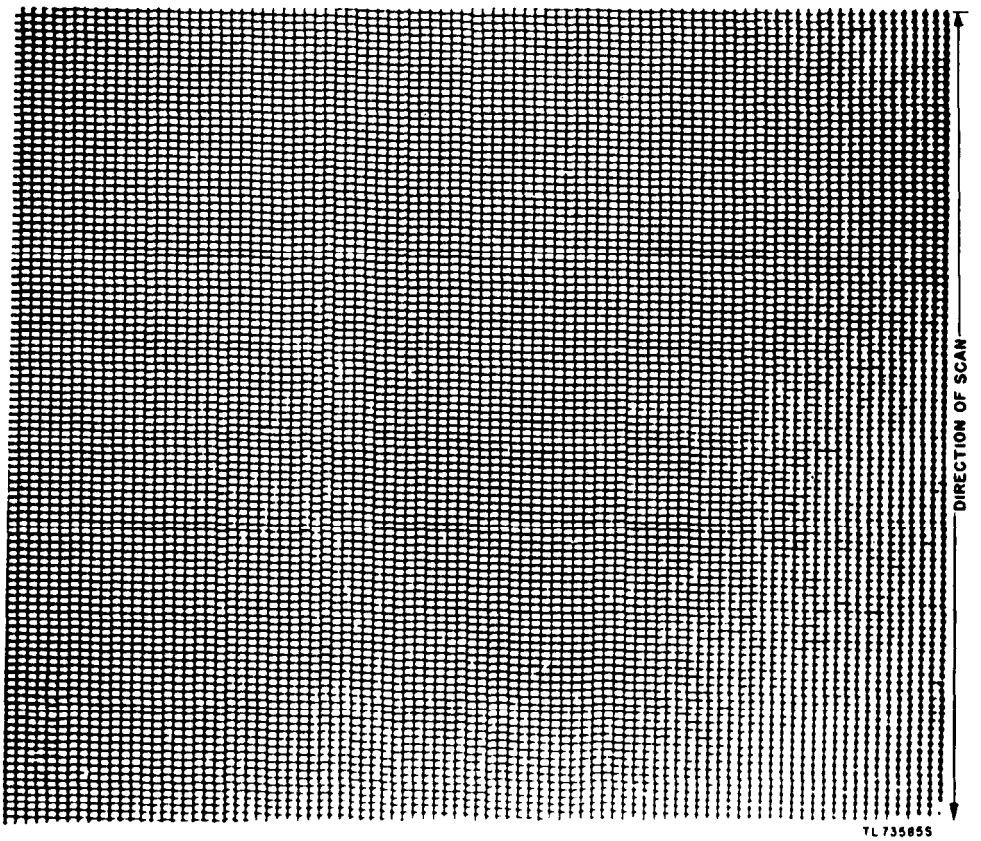


Figure 123. Enlarged section of photo recording.

ut ds to turn since it is being moved in and out of the clamp The direction of the image, therefore, must be restored to its original position.

f. Recorder Optical System, Parts Description (fig. 122).

Ref symbol	Name of part and description	Function
	RECORDER L A M P ASSEMBLY.	Recorder optical system.
A	LAMP, recorder ---------	Converte signal light.
B	SCREW: 3/8 No. 6-32.	Fastens pressure plate.
C	PLATE, pressure --------	Clamps lamp base sleeve.
D	SLEEVE, lamp base --------	Clamps recorder lamp in place.
E	LENS, objective: double convex; Hasting Triplet 10x.	Focuses light passing through aperture onto drum.
F	RING, rubber ---------	Protects recorder lamp.
G	RING, knurled ----------	Adjusts lens barrel.
H	BARREL SUBASSEMBLY: lens.	Mounts and shields objective lens.
I	LOCKNUT ----------	Locknut.
J	LENS, condensing: piano convex: 18-mm focal length.	Field lens (eee note).
K	PLATE, aperture: for AN/TXC-1.	Light aperture.
L	CLAMP, lamp recorder: zinc diecast.	SupPorte lamp housing.
M	BLOCK, raising ---- ----	Raises optical support.
N	SNUBBER ----------	Prevents vibration of lens barrel.

Note. In Facsimile Transceiver TT-1C/TXC-1, TT-1D/TXC-1, TT-1E/TXC-1, and TT-1F/TXC-1, this lens is omitted, since it is not necessary for proper operation.

111. Motor Amplifier

a. Motor Amplifier Driver V4. Facsimile Transceivers TT-1C/TXC-1 and TT–1A/TXC-1 differ from Facsimile Transceivers TT-1B/TXC-1 through TT-1F/TXC-1 in the grid and cathode circuits of V4. MWO SIG 11-2258-2 modifies the 1 and 1A models to make these circuits the same as in the later models.

(1) *Facsimile Transceivers TT-1/TXC-1 and TT-1A/TXC-1.* In these two transceivers, the cathode bias for V4 is developed across resistors R66 and R67 and the phase magnet coil. The resistors are associated with V13. The value of R67 may be altered to improve the direct recording. If this is done, it may be necessary to increase *or* decrease the value of R34 to obtain the normal operating current of 75 to 85 ma in the synchronous motor. Before changing any resistor, see that the tubes involved are not defective and that the resistance of other resistora in the circuit is correct. Transformer T1 is a class B driver transformer and may be replaced with any similar transformer that will fit. When making a replacement, try reversing the direction of current through the primary winding to obtain the maximum current in the motor circuit.

(2) *Facsimile Transceivers TT-1B/TXC-1 through TT-1F/TXC-1.* These models have control R93, in the input circuit of V4, which is used to adjust the motor current to 90 ma as indicated on meter M2. Another control, R97, is located in the cathode circuit of V13 so that bias may be adjusted for best direct recording results without changing the value of R67.

b. Output Stage, V5 and V6. Flashovers may occur in the sockets of V5 and V6. Do not scrape away the carbonized portion of the sockets. Replace them with new ones. If the plate circuit becomes shorted to ground either through the socket, wiring, or tubes, the motor of Facsimile Transceiver TT–1/TXC-1 will burn out if the power is left on for more than a few seconds. Motors of Facsimile Transceivers TT-1A/TXC-1 through TT-1F/TXC-1 are protected by fuses. In Facsimile Transceiver TT-1F/TXC-1, capacitor C69 has been added as a plate bypass capacitor to reduce the high peak voltages on motor amplifier tubes V5 and V6 in the 1,800-cycle (60RPM) position of the speed switch. This reduces arcing in the tubes and flashovers in the sockets.

Caution: Under normal operating conditions, the ac voltage across choke T6 is approximately 800 volts. Be careful when testing the circuit with the power on.

c. Filter. A high-voltage leak in choke T6 or in capacitor C28 or C29 may not interfere with the operation of the synchronous motor, but will cause disturbances in nearby radio-reoeiving equipment. In such cases, replace the choke or capacitor. A short to ground in this circuit will cause the synchronous motor or fuse to burn out.

d. MOTOR JACK.. The input circuit includes MOTOR JACK J6 which may develop contact

trouble. Examine the contacts for dirt, corrosion, or pits. The contact pressure is increased by bending the springs with long-nosed pliers.

e. Alignment. With proper voltage on grid 6 of tube V4, the direct current in the synchronous motor should be between 75 and 85 ma in Facsimile Sets AN/TXC-1A; and approximately 90 ma in Facsimile Set AN/TXC-1B. In Facsimile Set AN/TXC-1C, motor current should be 40 to 60 ma on 30-rpm operation and 55 to 80 ma on 60-rpm operation. If the input voltage is not correct, adjust it by changing R34 in Facsimile Transceivers TT-1/TXC-1 and TT-1A/TXC-1 to a higher or lower value, or adjusting R93 in Facsimile Transceivers TT-1B/TXC-1 through TT-1F/TXC-1. If the voltage is not correct as indicated by the signal-tracing chart, try changing the tubes. Make current measurements with the motor running.

112. Fork Oscillator Unit

The fork oscillator unit is designed to supply an 1,800-cycle signal of extreme accuracy. The regulated B+ voltage must not vary more than ±5 volts. The oscillator unit is calibrated at the factory; however, small adjustments in frequency may be made in the field by varying cathode resistor R25 of the unsealed unit or R304 of the sealed unit. Enough adjustment is available to compensate for minor changes caused by aging of tubes, new tubes, and small differences in the RB+ voltage. Since the frequency of the fork oscillator unit is upset easily, it is not practical, in most cases, to make repairs at the installation.

113. Phasing Circuit

a. General. The phasing circuit is inoperative except during the phasing operations. During phasing operations, the input signal is picked up across cathode resistor R72 of V14. The signal is rectified by the recorder lamp in the plate circuit.

b. Pulse Filter. The phasing pulse, which is represented by a dip or an increase in the steady 1,800-cycle signal, is smoothed out into a dc pulse by the action of 50-microfarad smoothing capacitor C45.

c. Stage V15. The pulse-amplifier stage, V15, is similar to a normal voltage amplifier. The signal is applied to the cathode and the grid is at ground potential. This must be taken into account in tracing trouble, since it is frequently a cause of confusion. Capacitor C47, connected from plate to ground, helps to eliminate the 1,800-cycle ripple in the amplifier pulse.

d. Stage V16. As the strength of the pulse increases, a positive potential is applied to the grid of thyratron tube V16 (884), causing current to flow in the plate circuit. The positive voltage develops at the beginning of the phasing pulse when transmitting for negative reception. At this time, the signal level increases, scanning from black to white. A positive pulse is generated immediately after scanning the phasing pulse when transmitting for positive reception. At this point, the signal increases when scanning from white to black. The exact phasing point for negative recording is displaced from the exact phasing point for a positive recording by the length of the phasing pulse. The dog trip arm (fig. 19) must be positioned so that it will split the two pulses (positive and negative) evenly on each side of center. The plate of V16 is connected directly to RB+. Plate current flow must paas through the cathode circuit. The low impedance path to the cathode is through the phase magnet and capacitor C50. Before phasing, one side of C50 is at cathode potential and the other side at ground potential. After the capacitor is charged, the impedance of the cathode circuit is very high, and the plate current ceases to flow. If C50 fails, current flows in the plate circuit at all times. The failure can be detected by watching for the glow in the tube. The normal bias voltage is controlled by voltage bias resistors R78 and R17. If the phase magnet fails to operate and no discharge glow is noted in V16, try another tube before tracing trouble in the phase magnet.

114. Photocell Circuit

a. Resistance and Voltage Measurements. The balancing anode of the photocell should have between .3 and .6 volt dc, depending on the value of R49 in Facsimile Transceivers TT-1/TXC-1 through TT-1B/TXC-1. With the power turned off, measure all resistances. Check potentiometer R45 for good contact between the contact arm and resistor. A poor contact in equipment that has been standing idle for some time may be cleared by rapidly rotating the CONTRAST control back and forth 15 or 20 times. Check for a good contact between resistor R42 and the sliding contact. This can be done by connecting the meter on one side of R42 to the contact and applying a light pressure to the contact ring. Capacitor C58 usually does not develop trouble because

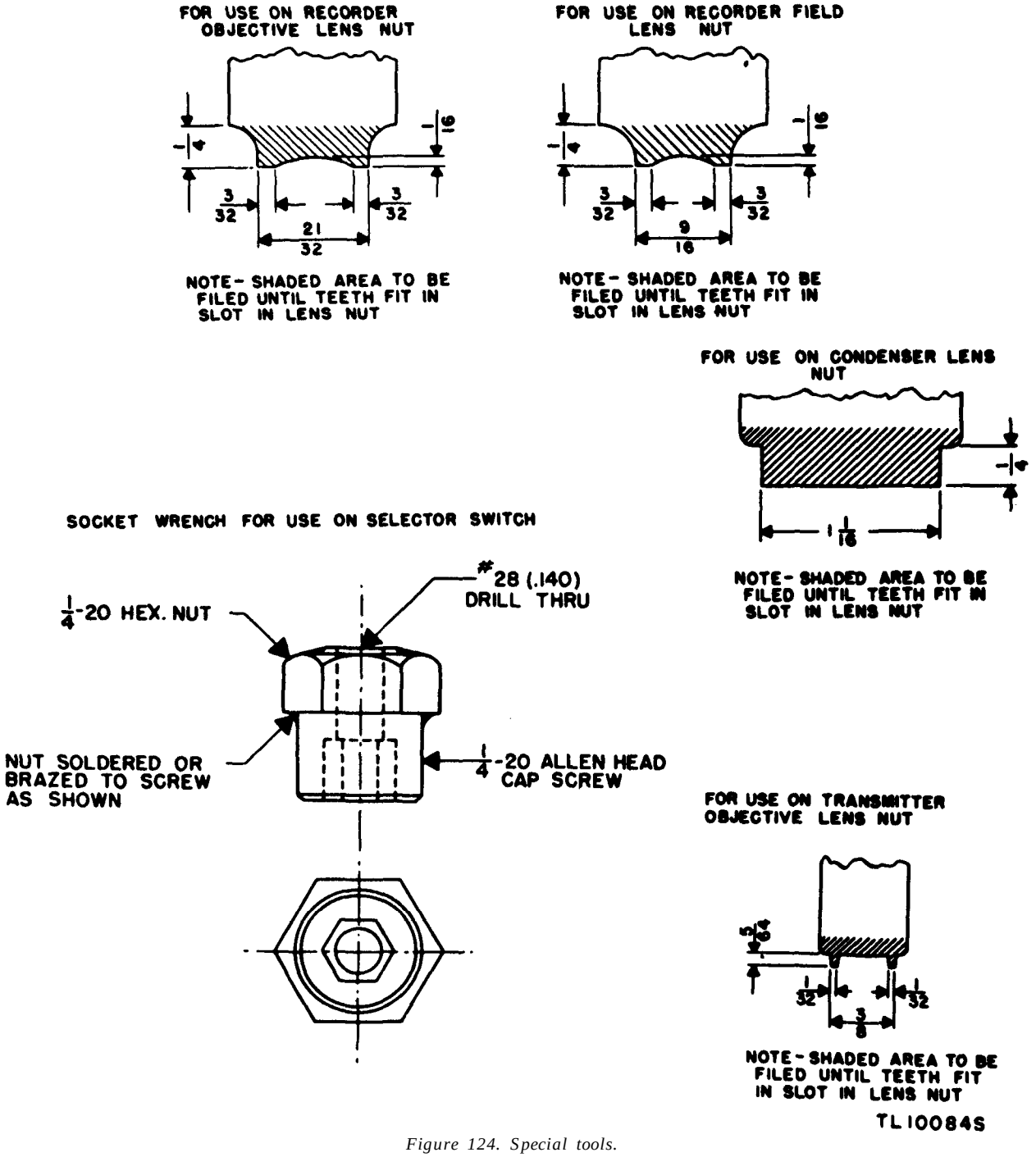


Figure 124. Special tools.

the voltage across it is very low. In Facsimile Transceivers TT-1D/TXC-1, TT-1E/TXC-1, and TT-1F/TXC-1, C58 and R49 have been omitted. The balancing electrode of phototube 5652 has no dc voltage (figs. 168 and 169).

b. Switching Circuit. Any unbalance in the bridge circuit develops a voltage across R50 which is applied to the grid of V10. In tracing circuit continuity, section 2 of the selector switch S1 must be taken into account.

c. Adjustment and Alinement. With the power turned on and the selector switch set at TRANSMIT, adjust the CONTRAST control and R42 for the best possible balance with the beam scanning the black portion of the phasing strip. If it is not possible to obtain a minimum signal of

at least 20 db below the maximum signal (1/10 maximum value on the oscilloscope), it is necessary to improve the balance. This may require changing the photocell or checking the transmitting optical system. After proper contrast is obtained between black and white, as adjusted for negative transmission, set the CONTRAST control for positive transmission and obtain as good a balance on white as possible. Readjust the balance by adjusting the sliding contact on R42. If further improvement is necessary, adjust the value of R49, except in TT-1D/TXC-1, TT-1E/TXC-1, and TT-1F/TXC-1 models, by changing the resistor to a higher or lower value. The balance on either white or black copy of 20 db below the maximum signal can be obtained by adjusting the CONTRAST control and the sliding contact on R42.

115. Signal Amplifier

a. General. The alinement of the signal amplifier involves nothing more than step-by-step checks of signal voltages and waveforms. If there is any deviation from the voltages in the tracing chart, or if there is any tendency for the signal to flatten as shown by the oscilloscope, locate the faulty stage and take corrective measures. All parts may be replaced with approximate equivalents, with the exception of transformer T2. In emergencies, this transformer can be replaced with a driver transformer designed to operate into a 6N7 tube or a pair of 6V6 tubes. Such a transformer should have a turns ratio of 1 to 1½ for full secondary. Connect one-half of the low impedance secondary of the driver transformer to terminals 1 and 2. Leave the other half of the secondary open. If such an emergency replacment is made, low-voltage line terminal connections may be obtained by using the UC feed coil.

b. Stylus Transformer. Stylus transformer T3 should be replaced with an exact equivalent. In an emergency, a driver transformer, such as one designed to operate into a pair of 6V6 tubes or a single 6N7 tube, will serve the purpose. The voltage breakdown rating of the transformer should be above 2,000 volts. The line side should be connected to terminals 1 and 2. *A* line-to-line transformer may be used, but the recording will not be at full density.

116. Selector Switch

a. Wafer Replacement. If a wafer is defective, it is easier to replace the wafer than to replace the entire switch and cable assembly. At the factory, a special socket wrench (fig. 124) is used for removing the nuts of the entire switch assembly. Similar socket wrenches can be made easily in the field. If materials are not available, long-nosed pliers will serve the purpose.

b. Grounding Switch. A leaf switch is actuated by the selector switch when in the transmitting position. This switch grounds the tip of the RADIO XMTR jack for the purpose of controlling the power relays in the radio transmitter. Clean and burnish the springs. If proper operation is not obtained after cleaning the springs, they may be bent for better contact.

c. Sylus Actuating System. After working the switch, be sure that the adjustments of the stylus actuating system are not upset. If the stroke is too long, make correction by bending the actuating arm attached to the selector switch. The stylus holder assembly for Facsimile Transceiver TT-1/TXC-1 through TT-1C/TXC-1 is shown in figures 125 and 126. Figure 127 shows the stylus holder assembly for Facsimile Transceivers TT-1D/TXC-1, TT-1E/TXC-1, and TT-1F/TXC-1.

d. Stylus *Holder Assembly, Facsimile Transceivers TT-1/TXC-1, TT-1A/TXC-1, TT-1B/TXC-1, and TT-1C/TXC-1, Parts Description* (figs. 125 and 126).

Ref Symbol	Name of part and description	Function
	STYLUS ASSEMBLY	Supports stylus needle.
A	STYLUS	Conducts high voltage to recording paper.
B	HOLDER, stylus	Holder for stylus A.
C	SCREW	Clamps stylus in holder.
D	PIVOT, fixed	Left-hand pivot for stylus shaft.
E	PIVOT, adjustable	Right-hand pivot for Stylus shaft.
F	SPRING, bracket	Spring support for adjustable pivot.
G	BRACKET ASSEMBLY: including fixed pivot.	Supports pivote.

Ref symbol	Name of part and description	Function
H	LEVER, stylus shaft -----	Rotates stylus shaft to remove needle from drum.
I	SPRING ----------	Rotates stylus shaft to bring stylus in contact with drum; electrical connection between stylus holder and connecting terminal.
J	INSULATOR, feed-through.	Insulates connection to terminal lug.
K	DAMPENER ----------	Dampens vibration of needle holder when riding over paper clamp of drum.
L	INSULATOR ----------	
M	SHAFT, stylus ----------	Supports needle holder.

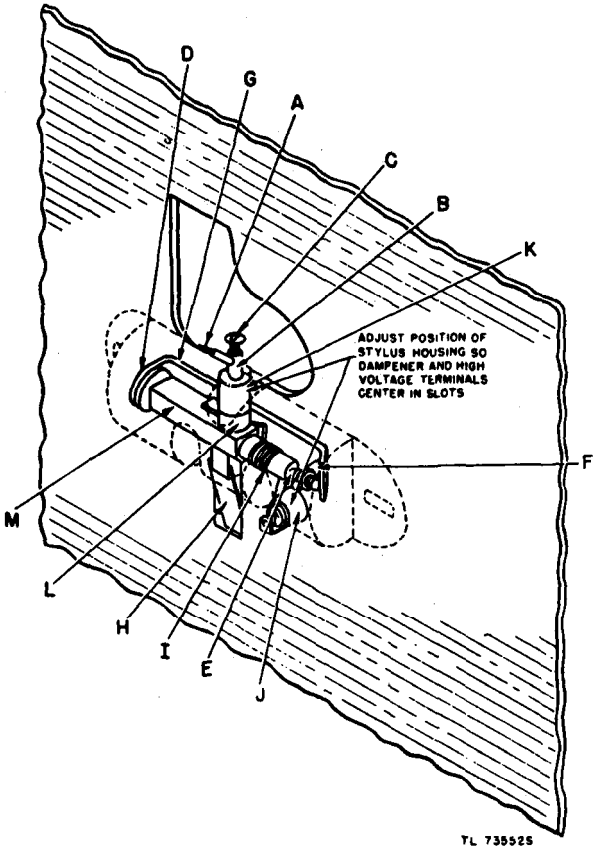


Figure 125. Stylus holder assembly, Facsimile Transceivers TT-1/TXC-1, TT-1A/TXC-1, and TT-1B/TXC-1.

e. Stylus Holder Assembly, Facsimile Transceivers TT-1D/TXC-1 and TT-1E/TXC-1, and TT-1F/TXC-1, Parts Description (fig. 127).

Ref symbol	Name of part and description	
	STYLUS ASSEMBLY--	Supports stylus needle.
A	STYLUS ----------	Conducts high voltage to recording paper.
B	HOLDER, stylus -------	Holder for stylus A.
C	PIVOT, adjustable -----	Left-band pivot for stylus shaft.
D	BRACKET ASSEMBLY	Supports pivot and thrust spring.
E	SPRING, thrust-------	For adjusting end play.
F	LEVER, stylus shaft----	Rotates stylus shaft to remove needle from drum.
G	SPRING ----------	Rotates stylus shaft to bring stylus in contact with drum; electrical connection between stylus holder and connecting terminal.
H	SCREW: No. 2-56-----	Holds thrust spring on bracket assembly.
I	SHAFT, stylus ---------	Supports needle holder.
J	INSULATOR, feed-through.	Insulates connection to terminal lug.
K	DAMPENER ----------	Dampens vibration of needle holder when riding over paper clamp of drum.
L	SPRING, stylus needle-	Holds stylus needle in needle holder.
M	SCREW: No. 2-56-----	For mounting bracket assembly to front panel.
N	HEX NUT: No. 6-32--	Locks pivot in position.

117. Replacing Stylus in Facsimile Transceivers TT-1D/TXC-1, TT-1E/TXC-1, and TT-1F/TXC-1

(fig. 117)

Follow the procedure outlined below when replacing the stylus in Facsimile Transceivers TT-1D/TXC-1, TT-1E/TXC-1, and TT-1F/TXC-1.

a. Turn the power off.

b. Remove the motor cover.

c. Move the drum to the left as far as it will go.

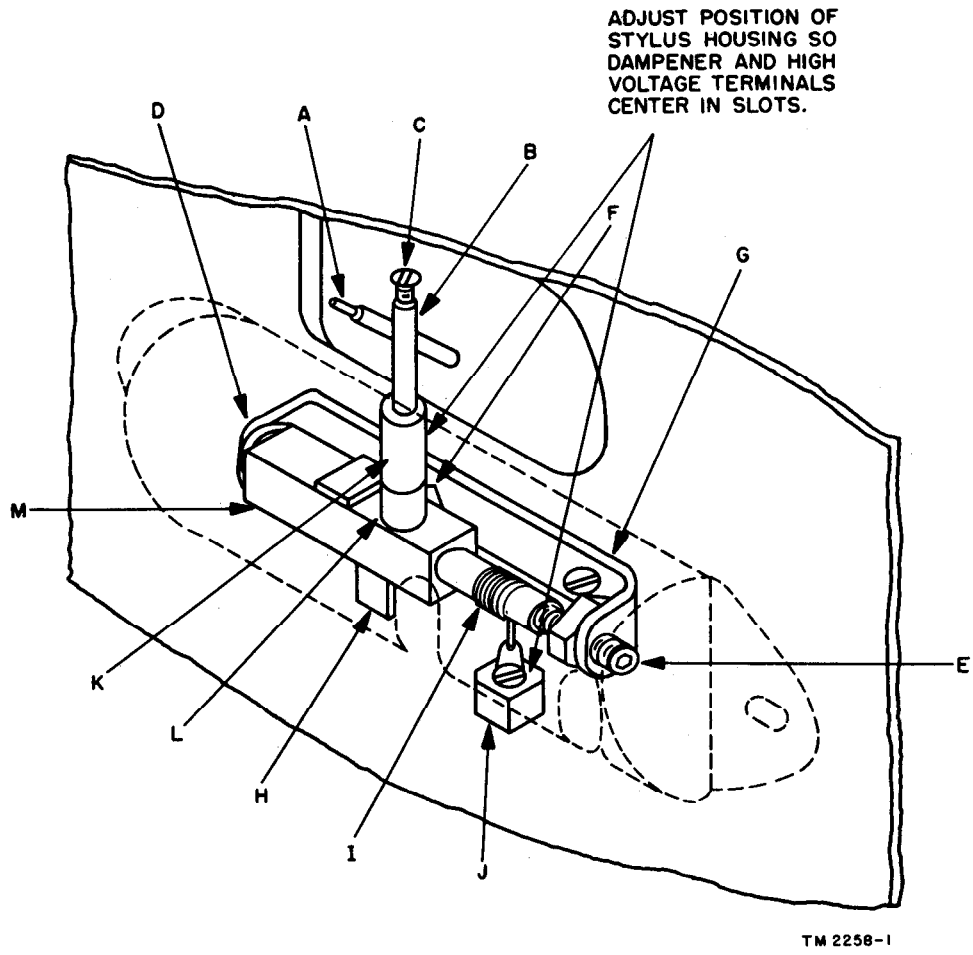


Figure 126. Stylus holder assembly, Facsimile Transceiver TT-1C/TXC-1.

d. Set the transceiver to the RECORD DIRECT position.

e. Turn the stylus one-fourth turn counterclockwise, remove, and discard it.

f. Place the new stylus into the holder with the needle pointing to the right.

g. Push the stylus against the spring in the holder and turn one-fourth turn clockwise until it snaps into position.

h. Return the transceiver to the STANDBY position, move the drum to the right, and replace the motor cover.

118. Adjustment of Stylus Holder in Facsimile Transceivers TT-1D/TXC-1, TT-1E/TXC-1, and TT-1F/TXC-1

There are two adjustments that can be made to the stylus holder in these models (fig. 127).

a. The pressure exerted by the stylus against the drum can be adjusted if difficulty is encountered caused by stylus bounce as the stylus crosses the paper clamp bar at each revolution of the drum. The tension of the spring (G) is varied as follows:

(1) Loosen the screw that clamps the collar to which one end of the spring is attached.

(2) Rotate the collar to increase or decrease the spring tension.

(3) Retighten the clamping screw.

b. The other adjustment concerns the adjustable pivot (C). This should be advanced enough to place a small amount of tension on the pivot spring (E) to prevent longitudinal movement of the stylus shaft.

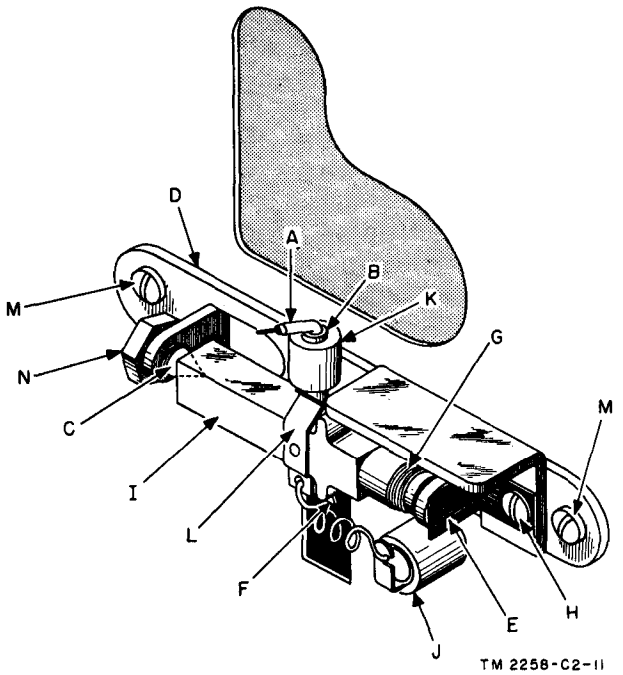


Figure 127. Stylus holder assembly, Facsimile Transceivers TT-1D/TXC-1, TT-1E/TXC-1, and TT-1F/TXC-1.

119. DB METER Circuit

If the DB METER readings are not correct, first try a new 7N7 tube in stage V13. If the results still are not satisfactory, replace the original tube. Check the resistance of R61, R62, R68, and R69. If the value of these resistors is found to be correct within 10 percent, select the value for R70 to get the required reading. The value of R71 should be as specified. The DB METER used with Facsimile Transceivers TT1D/TXC-1 and TT-1E/TXC-1 is hermetically sealed. To zero-adjust the meter, use a 20-watt soldering iron having a small chisel-shaped tip. Insert the heated tinned iron into the slot of the zero corrector. When the solder so softens, rotate as necessary for correct zero setting. Remove the soldering iron and the seal will solidify. The instrument is then ready for use. This procedure will be used in an emergency *only*. In Facsimile Transceiver TT-1F/TXC-1, the zero adjustment of the DB METER is made with a screwdriver.

120. B+ Voltage Regulator

a. Regulator lamp V25 is designated as type R1160A or 1B46 in unmodified Facsimile Transceivers TT-1/TXC-1 and TT1A/TXC-1, and a type 5651 in the modified unlettered and -A models and in Facsimile Transceivers TT-1B/TXC-1 through TT-1E/TXC-1. The voltage range of the 1B46 or the R1160A is 79 to 85 volts, that of the 5651 is 82 to 92 volts. Both must be measured with a high impedance voltmeter. When making a replacement, measure the voltage across the lamp. If the voltage is not within the proper range, try another lamp.

Caution: Do not remove regulator lamp V25 or tube V7 with the power turned on. If this is done, the RB+ voltage will rise to approximately 350 volts and possibly damage some of the components.

b. Tube V7 is a critical factor in the voltage control. There are times when it may be easier to select a tube for V7 than to select a voltage regulator lamp to produce the desired output voltage.

c. Oscillations develop in the regulator circuit at low line voltages; that is, at the point where the voltage regulator lamp drops out of control. Oscillations sometimes are aggravated by a feedback condition. Feedback can be remedied by separating the connections to the screen grid of tube V7 from the connections to the plate and grid of other tubes in the regulator circuit. Replacement of V25 may be necessary in some cases.

121. Rectifier Power Supply

a. Power Transformer T11. The original transformer used in earlier equipment was Kenyon type T246. This transformer may be used as a replacement, but the filament winding feeding the transceiver unit will be overloaded. The original T246 has two 6.3-volt, 3-ampere filament windings. The modified transformers have one 6.5-volt, 1.75-ampere filament winding, and one 6.5-volt, 6.25-ampere filament winding. The filament windings of a replacement transformer may not be phased the same as the original. If the phasing is not correct, the motor start voltage across terminals 5 and 8 of the Jones plug will be about 3 volts instead of the required 10. To phase the windings, remove the jumper wire from the 1.75-ampere winding. Connect it to the other end of the same winding. For example, if the jumper is on the terminal with the green wire, move it to the terminal with the brown and yellow wires.

b. Chokes T12 and T13. These chokes may be replaced with close equivalents that fit in the space available.

c. Capacitors C12, C13, and C14. These capacitors have a rating of 1,000 volts. *In an emergency,*

600-volt capacitors may be used, but should be changed when the correct rated capacitor is available.

d. Power Cable. If the power cable or Jones plug is damaged, a replacement may be made with a complete cable and plug assembly available at signal depots. If it is only nicked or scuffed (not beyond insulation) it may be repaired with rubber tape.

122. Hum Balance Control R107

Facsimile Transceiver TT-1F/TXC-1 has a hum balance control, R107. It is connected across the filaments of the tubes and is adjusted for minimum hum. This control is set at the factory. If readjustment of the control is necessary, proceed as follows: With the selector switch set at RECORD PHOTO, connect an oscilloscope between pin 3 of V14 and ground. Turn the set ON and set the GAIN control at 100 with no signal input. Set the oscilloscope for a low sweep rate and observe the 60-cycle hum pips as control R107 is varied. When the hum pips are at a minimum, R107 is set properly. An ac voltmeter may be used in place of the oscilloscope. Connect the voltmeter between one side of the filament and ground. Adjust R107 until a reading of 3 volts is obtained. Satisfactory recording can be made at this level.

123. Exciter Lamp Supply

a. Condition. Set the selector switch to the SET RANGE or TRANSMIT position. Turn the power on. Measure the exciter lamp voltage at secondary No. 2 on transformer T15 (fig. 158). A regular ac voltmeter will not give an accurate reading of this voltage, which is not a sine wave. First calibrate an oscilloscope to serve as a voltmeter by applying 6.5 volts from one of the filament windings of the facsimile set to the vertical input terminals of the oscilloscope. Note the deflection. Without changing the setting of the vertical gain control on the oscilloscope, disconnect it from the filament supply and connect it across the exciter lamp supply. The exciter lamp voltage should cause approximately the same peak deflection on the oscilloscope (90 percent is sufficient). With the exciter lamp voltage properly set in this manner, it may be measured on a conventional ac voltmeter and the voltmeter reading recorded as a standard against which future checks may be made. If the exciter lamp is lighted, and the voltage across it is slightly low, check output tubes V19 and V20. If the tubes are in good condition, readjust control R15. If correct voltage cannot be obtained, check the regulator lamp with a vacuum-tube voltmeter, Set the meter on the 250-volt scale and connect across the regulator lamp (V23) terminals. The voltage should be between 82 and 92 volts dc. If the reading is out of this range, replace the tube. If the regulator lamp is in good condition, check tube V21. If the output voltage is below 5 volts ac, check tubes V19 and V20. If the tubes are in good condition, check the signal voltage on the grids (pin 6) of V19 and V20. If the grid voltage is normal or above normal, transformer T15 is defective. See the signal-tracing chart (fig. 81). This transformer must be replaced with an exact equivalent. The exciter lamp may be checked by connecting it to a 6-volt battery.

Caution: If the exciter lamp is removed, a replacement must be made before the power is turned on. Operation without an exciter lamp may cause damage to transformer T15.

b. Replacement Parts. Control R15 (fig. 158) may be replaced with any close equivalent which fits into the available space. Transformer T14 may be replaced with a conventional driver transformer having a ratio ranging from 1:1 to 1:¼ between primary and one-half of the secondary.

Section IV. EMERGENCY REPAIRS AND OPERATION

124. General

Emergency conditions of operation and repair may require deviation from normal procedures and standards. This section covers information required for operation under emergency conditions and for making emergency repairs which will keep the equipment in operation until full repairs can be made (figs. 128 through 140, and 145 through 195).

125. Emergency Parts Replacements

a. Resistors. All ½-watt resistore may be replaced with ½- or 1-watt resistors. When making a replacement, select a resistor having a value as near as possible to the value specified.

b. Capacitors. Except for capacitors C28 and C29 in the motor circuit and capacitors in the unsealed fork oscillator unit, the capacitance

ratings are not critical. Replacements may be made with approximate equivalent.

c. Transformers and Chokes. Most replacement transformers are of the hermetically sealed type. These fit into the space provided for the original units.

(1) Transformers T1 and T14 are not critical and may be replaced by any one of several types and makes of driver transformed stocked by depots. The first choice is a transformer designed as a driver transformer for a pair of 6V6 tubes or a single 6N7.

(2) Transformer T5 may be replaced by a plate-to-line transformer of the ouncer type.

(3) Transformers T12 and T13 may be replaced by similar chokes having a current rating of about 250 ma. In an emergency, T12 may be eliminated if the line voltage does not exceed 115 volts.

126. Emergency Transmitting Allowances

a. The specified requirements for contrast call for a 20-db difference between black and white. In an emergency, a range as low as 4 db will still permit the receiving station to record intelligible photographic copy. For direct recording, a range of 10 db is considered minimum. The transmitted copy must have extreme range between black and white so that the transmitted signal will have the maximum possible range. If the recording is to be made on film, the receiving operator can assist by setting his equipment for reception of minimum signal 1 or 2 db above the normal setting. Film should be developed in a D-72 developer instead of a DK-60A. A high-contrast printing paper such as Azo No. 5 should be used.

b. Under most operating conditions, the facsimile transceiver will deliver a signal strong enough to feed a wire line or radio set, even though the signal level at the transceiver output is considerably lees than the rated minimum. For example, if the line is connected to the LINE binding posts, and it is found that the output level is only one-half or one-fourth of the specified level, the receiving operator will, in most cases, be able to make up for the difference by adjusting the GAIN control of the receiving transceiver. If he is unable to do so, the UC coupling coil may be plugged into the LINE JACK and the line connected to the 6-volt output of the feed coil.

Caution: If there is danger of causing cross talk into another circuit, do not put more signal onto the line than necessary. The LINE binding post output, RADIO XMTR jack output, or the 1-volt output of the UC coupling coil will not give an excessive signal. Never put more than a 0-dbm signal into a line that feeds a carrier system unless there is loss in the line between the facsimile transceiver and the carrier equipment. For example, if there is a 10-dbm loss in the line between the transceiver and the carrier equipment, a +10-dbm output at the transceiver will not overload the carrier equipment.

Note. In transmitting to a nearby receiving station over a line having very little loss, the transmitting operator can reduce the signal by readjusting tbe GAIN control to give a low meter reading (for example-10 db for maximum signal) after the CONTRAST adjustments have been made.

127. Emergency RECORD PHOTO Allowances

a. Normally, the transceiver must be capable of producing a +2db meter reading with a line signal input of .0035 volt. Under fixed conditions, where it is known that the available signal is considerably more than .0035 volt, the equipment may be put into service if it does not meet this sensitivity requirement.

b. If the phasing system does not operate over the normal GAIN control range, the receiving operator can obtain satisfactory operation by readjusting the GAIN control during the phasing operation. For recording, the GAIN control is reset to its normal position. If it is essential that equipment be used when the phasing system is inoperative, it is usually possible to obtain intelligible copy by recording on direct recording paper, cutting the paper at the proper point, and fitting the picture together. If the recording must be made on film, fasten the film onto the drum with transparent Scotch tape. Remove the tape before developing the film. With skill and practice the drum can be hand-phased. To do this, hold the drum by hand (with motor running) with the paper overlap or film clamp directly in front of the lens system. Watch or listen for the phasing pulse and release the drum at the instant the pulse is received.

c. If the recorder lamp becomes weak and a replacement lamp is not available, satisfactory results may be obtained by using a faster recording film or paper. Be careful to avoid fogging the film. A paper which will give the effect of a signal

increase of 2 or 3 db is Eastman 797. This paper will not give the contrast given by the Royal Bromide F1, but the lack of contrast can be compensated for by having the transmitting operator transmit a signal of greater range between black and white. If the low density of a recording is the result of fogging of the recording lamp, the fog or sputter usually can be removed partially by heating the end of the tube in a flame. The heating must be done by bringing the temperature up gradually; the cooling also must be gradual. The heat evaporates the deposited coating.

128. Emergency RECORD DIRECT Allowances

a. If there is no supply of stylus needles, ordinary steel phonograph needles may be used, but they must be replaced often. Steel spring wire with a diameter of approximately .010 inch may be used in an emergency. If the stylus holder has become damaged beyond repair, a light steel spring may be mounted in a fixed position to serve as a stylus.

b. If Teledeltos or Timefax paper is not available, readable copy can be made on black interleaving paper used in the packing of transmission film.

129. Radio Interference (TRANSMIT)

Under some conditions, a radio transmitter will feed back into a facsimile transceiver when the transceiver is set for TRANSMIT. This feedback condition may occur when the facsimile set is close to the radio transmitter. Feedback may be caused by circulating currents through the ground system or in the general line connections. The feedback is indicated by a short contrast range when the radio set is turned on. Do not attempt to operate when there is an indication of radio feedback; it must be eliminated. There is no fixed rule for doing this. In most cases, proper isolation may be secured by trying different coupling circuits and grounding systems between the facsimile transceiver and the radio modulator input circuit.

130. Radio Interference (RECORD DIRECT)

Sparking at the recorder stylus sometimes causes radio interference. Interference in radio reception may be reduced by the use of proper grounding systems. It is sometimes necessary to use a common ground for the radio receiver and the facsimile transceiver.

131. Field Wire Operational Troubles

The signal attenuation over field wire such as Wire W-110B is very high as compared with commercial telephone circuits. If only one circuit is involved, make the line connection to the LINE JACK through the test cord provided with alligator clips. This permits the satisfactory transmission of signals over approximately 25 miles of field line. If there are adjacent circuits, it may not be possible to operate directly from the LINE JACK, because the facsimile signal will produce cross talk. The next best method of feeding the line is to use the UC feed coil and connect the line to the 6-volt receptacle.

Caution: Never connect a commercial telephone circuit to the LINE JACK.

132. Loaded Cable Circuit Operational Troubles

Telephone circuits carried in cables usually have loading coils inserted in the cable at regular intervals to improve the voice transmission characteristics. The insertion of the loading coils produces a distortion effect which is quite noticeable in some of the older type commercial circuits. If the received copy shows an out-of-focus or stutter effect, this degradation in many cases can be traced to delay distortion on the telephone transmission line. Under normal operating conditions, nothing can be done to correct this trouble. The only remedy is to obtain a better circuit.

133. Recording Paper Substitutes

If Royal Bromide F1 paper is not available, the recordings should be made on film and contact prints made from the film. If too much time is required for this process, bromide enlarging papers may be used. Fairly good results can be obtained from photostatic paper. Experiments must be made to determine the correct DB METER reading for the proper exposure. Most papers require a higher signal level than Royal Bromide F1. If it is necessary to go up to +4 or +5 db for recording, do not attempt to handle half-tone copy. The shadows will be badly flattened because of the overloading of the amplifier.

134. Use of Old Rectifier Power Unit with New Transceiver

Rectifier Power Unit PP-86/TXC-1, which is a component of Facsimile Sets AN/TXC-1 and AN/TXC-1A, will not operate Facsimile Trans-

ceivers TT-1B/TXC-1 through TT-1F/TXC-1. No provision is made to connect 115 volts, 60 cycles ac from the power unit to the transceiver to start the new motor on the new or modified transceivers. Application of MWO SIG 11-2258-2 to Rectifier Power Unit PP-86/TXC-1 makes possible the use of this unit with all models of the transceiver.

Section V. DISASSEMBLY AND LUBRICATION OF EQUIPMENT AT FIELD MAINTENANCE LEVEL

135. Lubrication Chart

Disassemble and lubricate the items listed in the following chart; use paragraphs 136 through 139, and Lubrication Order 11-2258 (fig. 26) for reference.

Item No. (fig. 26)	Lubrication point	Lubricant	Amount	Interval
6	Secondary clutch dog latch pivot	PL SPECIAL	1 drop	Monthly
7	Dog trip arm pivot	PL SPECIAL	1 drop	Monthly
8	Clutch rings	OCW	1 or 2 drops	Semiannually
9	Phasemagnet armature pivots	OCW	½ drop	Semiannually
10	Drive shaft bearings:			
	Sealed bearings	PL SPECIAL	1 or 2 drops	Semiannually
	Unsealed bearings	GL	Pack	Semiannually
11	Lead-screw bearings:			
	Sealed bearings	PL SPECIAL	1 or 2 drops	Semiannually
	Unsealed beatings	GL	Pack	Semiannually
12	Motor bearings:			
	AN/TX-1 and -1A, top and bottom bearings.	GL	Thin film	Weekly
	AN/TXC-1 and -1A, top bearing (no disassembly required).	PL SPECIAL	1 or 2 drops	Weekly
	AN/TXC-1B and -1C	PL SPECIAL	1 or 2 drops	Monthly
	Synchronous rotor bearing	OCW	1 or 2 drops	Monthly

136. Clutch

Disassembly of the clutch for cleaning should be performed only by qualified personnel. Organizational personnel should clean the external surfaces of the clutch daily with a lint-free cloth slightly dampened in solvent (SD). Dry thoroughly with a dry, lint-free cloth. Lubricate the clutch in accordance with the chart in paragraph 135, items 6, 7, 8, and 9. Clean the clutch internally every 3 months. Refer to figures 115 and 116 for location of parts. Use the following procedure to disassemble the clutch for cleaning:

a. Remove the motor from its mountings (par. 139) and place it in a convenient position for working on the clutch.

b. Remove the three screws (P, figs. 115 and 116) from the secondary clutch bearing (N). Be careful not to lose the pressure springs (0).

c. Remove the secondary clutch bearing (N) and secondary clutch ring (Q).

d. Remove the three flathead screws (K) from the retainer (H).

e. The remaining retainers and plates will slide free. It will not be necessary to remove the hub for cleaning purposes; the hub can be cleaned on the drive shaft.

f. Thoroughly clean all parts with a clean, lint-free cloth dampened in solvent (SD). Dry the parts with a clean, lint-free cloth.

g. Lubricate the rings in accordance with the chart in paragraph 135. To reassemble, reverse the order for disassembly.

h. Run the motor for a few minutes with the clutch stop arm stopped. Wipe off excess oil and adjust the tension of both primary and secondary clutches (par. 106). Run the motor for at least 15 minutes with the clutch locked up. Again measure the tension of both clutches. If the tension of the clutches is not stabilized, repeat adjustments and running-in process.

137. Drive Shaft Bearings

a. Equipment with Sealed Bearings. Disassembly of equipment using sealed bearings (later models) is not required for lubrication. Place 1 or

2 drops of oil (PL SPECIAL) on the drive shaft and casing; wipe off the excess oil. Refer to item 10 in the lubrication chart.

b. Equipment with *Unsealed Bearings.* Disassembly of the drive shaft of equipment using unsealed bearings (earlier models) should be performed only by qualified personnel. Disassemble as follows:

(1) Remove the motor from its mounting posts (par. 139).
(2) Remove the clutch from the shaft (par. 136).
(3) Remove the retainer plate from the clutch end of the shaft and the thrust plate from the other end of the shaft.
(4) The shaft and bearings will slide free of the motor casing. Do not remove the gear from the shaft.
(5) Clean the bearings and shaft by flushing or by immersion in solvent (SD). Dry thoroughly with a clean, lint-free cloth. Use air pressure, if available, to dry the interior of the bearings.
(6) Repack the bearings with grease (GL) in accordance with the chart in paragraph 135. Wipe off the excess grease.
(7) Reassemble in the reverse order of disassembly, and make proper adjustments.

138. Lead-Screw Bearings

a. Equipment with Sealed Bearings. Disassembly of equipment with sealed bearings (later models) is not required for lubrication. Place 1 or 2 drops of oil (PL SPECIAL) on the shaft and casing; wipe off the excess oil. Refer to item 11 in the lubrication chart.

b. Equipmenti with Unsealed Bearings. Disassembly of the lead screw of equipment using unsealed bearings (earlier models) should be performed only by qualified personnel. Disassemble as follows:

(1) Remove the mounting screws that secure the bearing brackets to the chassis base.
(2) Rotate the drum so that the clutch dog trip arm and dog latch are in a horizontal position with relation to the chassis base. Release the secondary clutch dog latch.
(3) Lift the entire lead-screw and drum assembly clear of the chassis. Be careful not to damage the lead-screw threads or to bend the shaft. Place the assembly on a suitable bench for the balance of the cleaning operation.
(4) Loosen the setscrew that secures the dog trip arm assembly to the lead-screw shaft and remove the dog trip arm assembly from the shaft.
(5) Slide the bearing assemblies free of the shaft, remove the retaining plates, and clean the assemblies by flushing or by immersion in solvent (SD). The bearings need not be removed from the mounting brackets for this operation.
(6) Dry with a clean, lint-free cloth. Use air pressure, if available, to dry the interior of the bearings. Repack the bearings with grease (GL) as outlined in the chart in paragraph 135 and wipe off all excess grease.
(7) Reassemble in the reverse order of disassembly. Check all adjustments.

Note. When the dog trip arm assembly is finally positioned on the lead-screw shaft, the secondary clutch dog latch should be in line with the keyway in the lead-screw shaft.

139. Motor

Motors used in unmodified Facsimile Sets AN/TXC-1 and AN/TXC-1A use brushes on the starting motor and require cleaning and lubrication quarterly. Motors used in Facsimile Set AN/TXC-1B, AN/TXC-1C, and AN/TXC-1D have no brushes, and require cleaning and lubrication semiannually.

a. Motors in Facsimile Sets AN/TXC-1 and AN/TXC-1A. The following instructions are applicable to the motors which use brushes:

(1) *Disassembly.* Disassemble as follows:
(a) Remove the four screws that secure the motor to the mounting posts.
(b) If care is taken to avoid undue strain on the connecting leads, they need not be unsoldered.
(c) Remove the four screws that secure the bottom bell to the motor case and carefully remove the bell. Be careful not to lose the thrust ball.
(d) Carefully withdraw the rotor, rotating it in a counterclockwise direction as it is being withdrawn.

(2) *Cleaning.* Clean as follows:
(a) Clean the exterior of the motor with a dry, clean cloth. If necessary, slightly dampen the cloth with solvent (SD). Be careful not to get any of the solvent on the coils or windings. Dry all parts

thoroughly after using the solvent. Carefully clean the interior with a lint-free cloth and a clean, dry, soft-bristle brush. Remove the accumulated dirt, carbon dust, and grease from the coils and high-voltage terminals. Be careful to clean the portions under the terminals. Clean the upper end bell.

(b) Clean the commutator with a clean, dry cloth. If necessary, the commutator can be polished with a piece of crocus cloth or rubber eraser. Do not use emery cloth. Remove dirt, grease, and metallic particles from the spaces between the segments of the commutator. If the surface of the commutator is dark, smooth, and highly polished, and the commutation is satisfactory, the commutator surface should be left alone. This condition should not be mistaken for a burned condition.

(c) Clean the brushes with a clean, lint-free cloth.

(d) Clean the upper motor bearing with a cloth dampened in solvent (SD).

(e) Clean the lower bearing with a solvent.

(3) *Lubrication.* Lubricate the bearings in accordance with the chart (par. 135). Before reassembling the motor, coat the bearing with a light film of grease. Between cleaning periods, lubricate by applying 1 or 2 drops of oil to the top bearing without disassembling the motor. The amount of oil and the frequency of application will depend largely on operating conditions. Be careful not to overlubricate, as excessive oiling will cause gum to form on the commutator.

(4) *Reassembly.* Reassemble the motor by reversing the disassembly procedure. Check for proper alinement with the lead screw.

b. Motors in Facsimile Sets AN/TXC-1B, AN/TXC-1, and AN/TXC-1D. Instructions for the brushless motors in Facsimile Sets AN/TXC-1B, AN/TXC-1C, and AN/TXC-1D are similar to those above, with the exception that instructions concerning brushes and commutator do not apply.

Section VI. FINAL TESTING

140. General

This section is intended as a guide to be used in determining the quality of a repaired Facsimile Transceiver AN/TXC-1(*). The minimum test requirements outlined in paragraph 142 may be performed by maintenance personnel with adequate test equipment and the necessary skills. Repaired equipment meeting these requirements will furnish uniformly satisfactory operation.

141. Test Equipment Required for Final Testing

The items of test equipment required for the final testing of the facsimile transceiver are listed below. The manuals associated with each item also are listed.

Test equipment	Technical manual
Electronic Multimeter ME-6A/U	TM 11-5549
Radio Receiver R-388/URR	TM 11-854
Multimeter TS-352/U	TM 11-5527
Test Set TS-140/PCM	
Signal Generator SG-15/PCM	TM 11-2096
Decibel Meter ME-22/PCM	

142. Tests

a. Transmitting. Make the following tests with the transceiver operating as a transmitter:

Test	Requirement
1. Fork frequency: TRANSMIT position. DB METER at 0.	Maximum deviation from standard, 1 cycle in 2 minutes.
2. Contrast: TRANSMIT position.	Minimum wedge of 20 db for both positive and negative settings.
3. Voltage regulation: TRANSMIT position. Balance on black, and shine light on white. DB METER at 0 with light shining on white.	Maximum deviation of 1 db on meter while varying power-line voltage between 100 volts and 130 volts ac, at the rate of about 1 cycle per second.
4. LINK JACK output into 600-ohm load: TRANSMIT position. DB METER at +2db.	Voltage measured across 600-ohm load resistor: maximum, 17 volts ac; minimum, 14 volts ac.
5. LINE binding post output into 600-ohm load: TRANSMIT position. DB METER at +2db.	Voltage measured across 600-ohm load resistor: maximum, .85 volt ac; minimum, .7 volt ac.

Test	Requirement
6. LINE binding post balance: TRANSMIT position. DB METER at +2 db. 600-ohm load resistor across binding posts.	Voltages measured from each binding post to ground differ by no more than 1 db.
7. RADIO XMTR jack out-into 100-ohm load: TRANSMIT position. DB METER at +2 db.	Voltage measured across 100-ohm load resistor: maximum, .44 volt ac; minimum, .36 volt ac.

b. Receiving. Make the following tests with the transceiver operating as a receiver:

Test	Requirement
1. Fork beat: FORK PHOTO position. GAIN at 100. No connections to input circuits.	DB METER gives no indication of signal.
2. LINE JACK input .0035 volt ac, 1,800 cycles: RECORD PHOTO position. GAIN at 100.	DB METER reading: maximum, +4 db; minimum, +1 db. Recorder lamp current measured on dc milliammeter in series with lamp: maximum, 33 ma; minimum, 28 ma.
3. LINE binding post input .0035 volt ac, 1,800 cycles: RECORD PHOTO position. GAIN at 100.	DB METER readings: maximum, +1 db; minimum, -1 db.
4. LINE binding post input balance to REC. C. T., .0035 volt ac, 1,800 cycles: RECORD PHOTO position. GAIN at 100.	Connect ground lead of signal generator to REC. C. T. post and hot side alternately to each LINE binding post. Difference in two readings on DB METER should not exceed 1 db.
5. RADIO RCVR jack input .14 volt ac, 1,800 cycles: RECORD PHOTO position. GAIN at 100.	DB METER reading: maximum, +5 db; minimum, +2 db.
6. Motor action: RECORD PHOTO position. Drum-engaging lever disengaged from lead screw. *Note.* In Facsimile Transceivers TT-1D/TXC-1, TT-1E/TXC-1, and TT-1F/TXC-1, the rector action requirement should be performed at 30 rpm as well as at 60 rpm.	Set power line voltage at 100 volts ac. Depress START button until motor speed is slightly above synchronous speed, then release button. Motor should lock into synchronous speed an average of four times out of five. After several trials, depress PHASE button while motor is running. Primary clutch should stop without stopping motor. If primary clutch does not rotate when PHASE button is released and motor is running, rotate top of drum manually toward front panel about one-half inch, and release. If clutch tension is too tight or motor current is too low, motor will stall. Repeat above tests with power-line voltage at 115 to 130 volts ac.
7. RECORD DIRECT: RECORD PHOTO position. DB METER at +2 db. LINE JACK input approximately .005 volt ac, 1,800 cycles. Fasten sheet of Teledeltos paper to drum. Start motor. Engage drum to lead screw. Turn selector switch to RECORD DIRECT.	Stylus should contact drum and continuously record at least a dark gray.

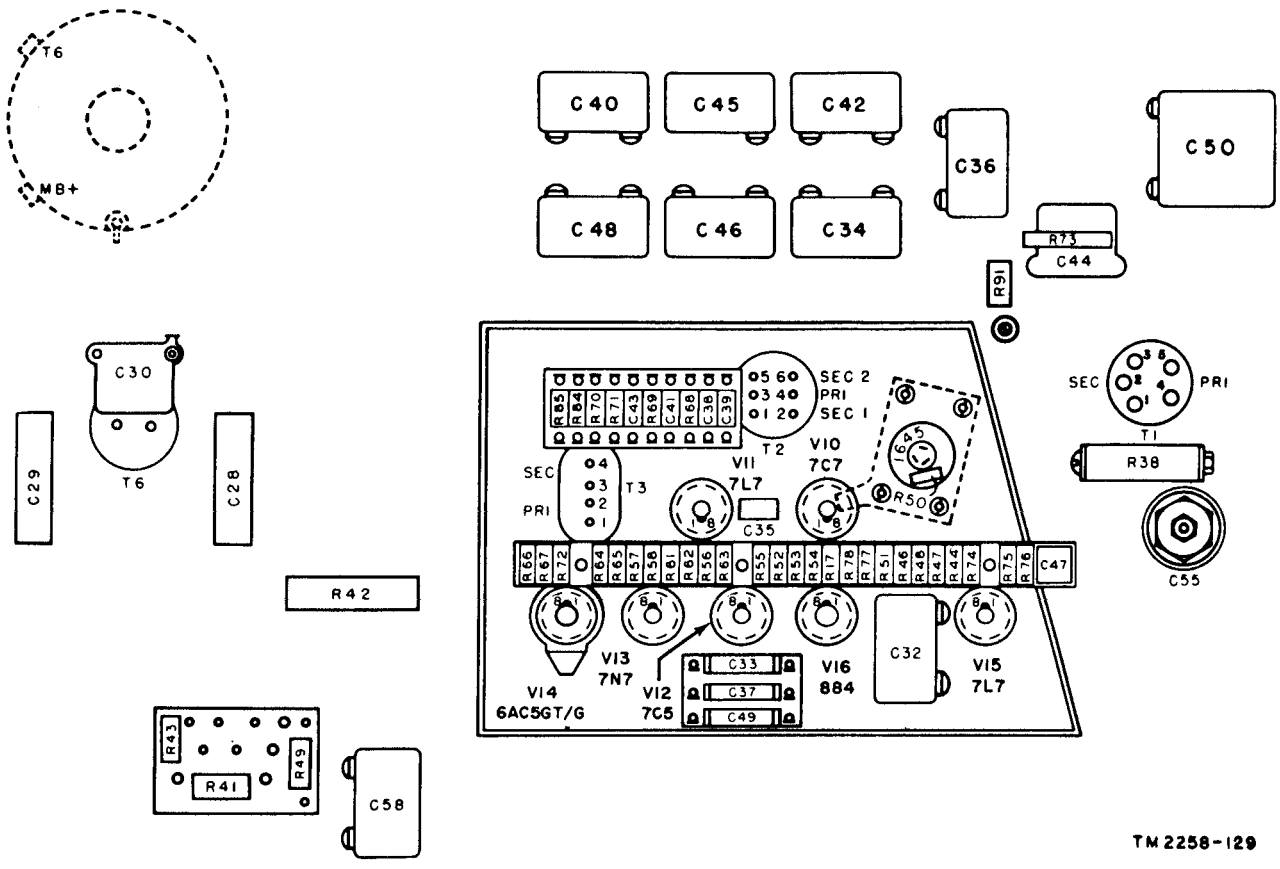
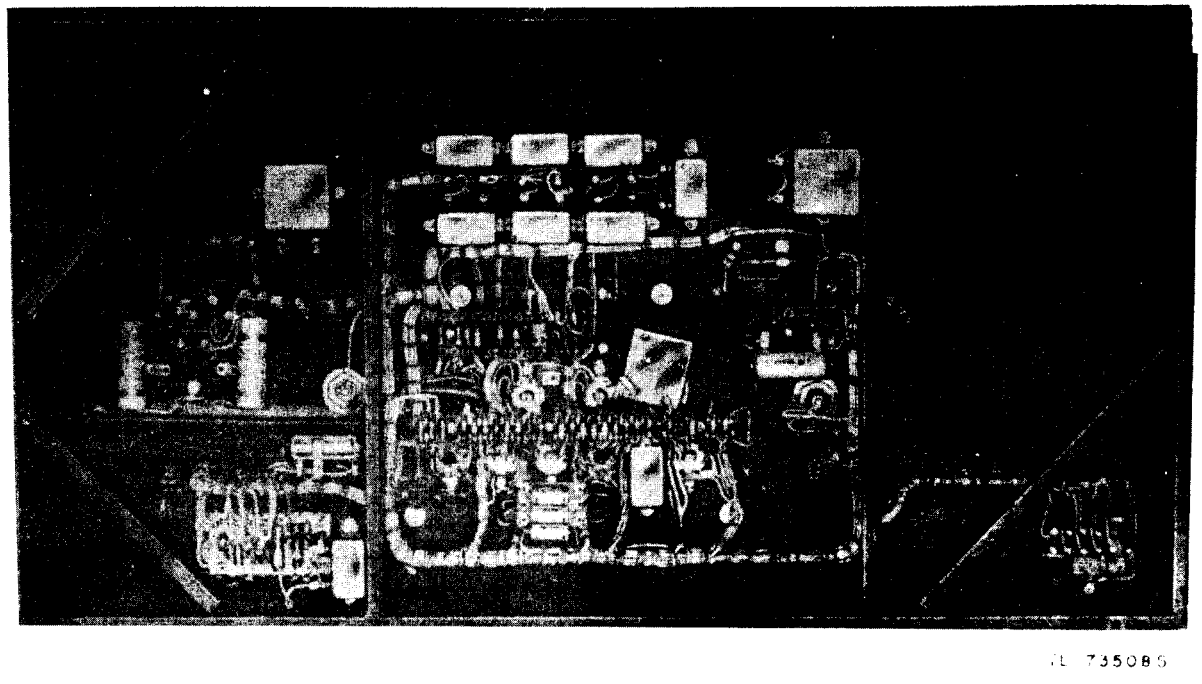


Figure 128. Facsimile Transceivers TT-1/TXC-1 and TT-1A/TXC-1, bottom view, parts identification.



TL 735085

Figure 129. Facsimile Transceiver TT-1B/TXC-1, bottom view.

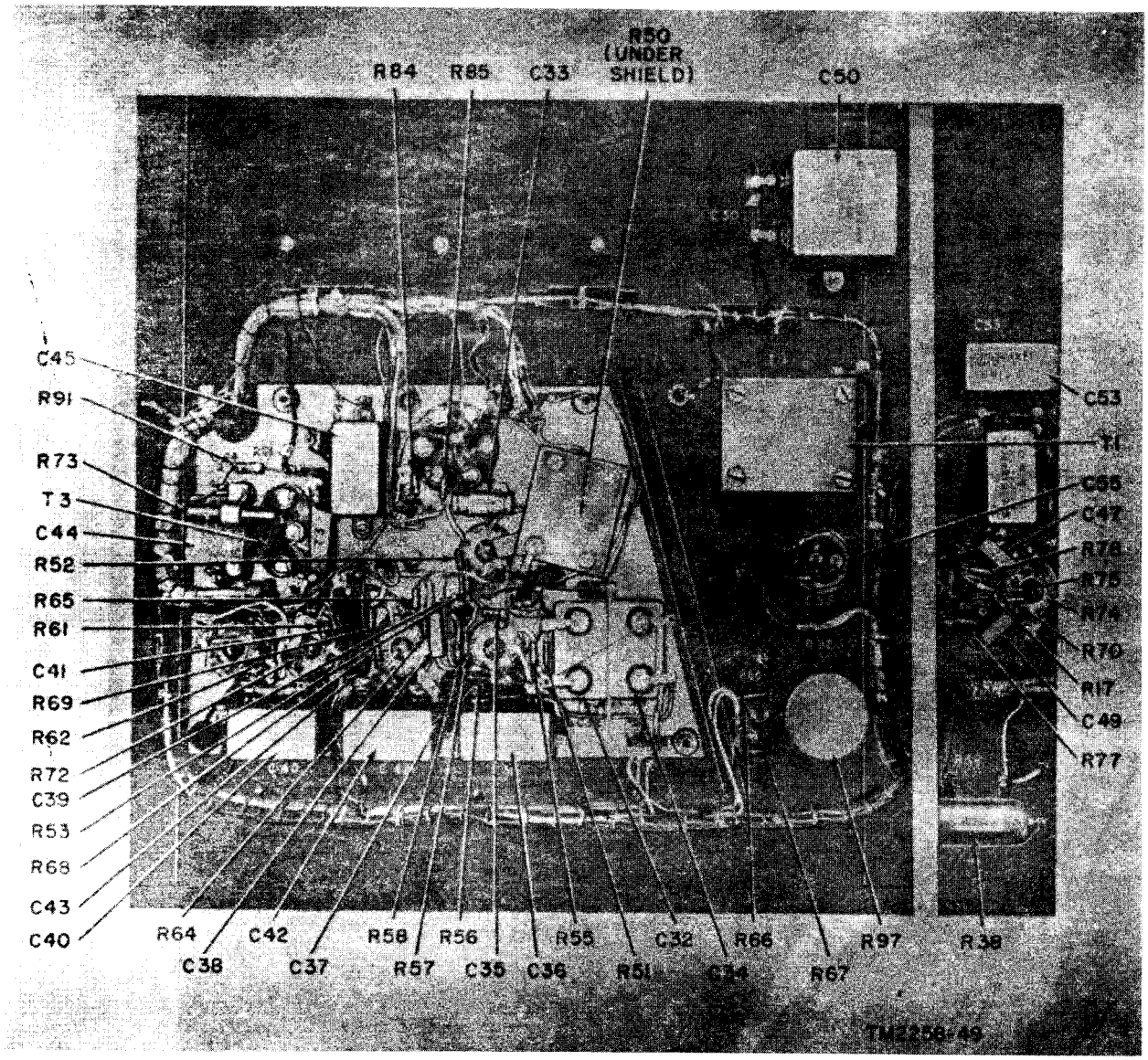
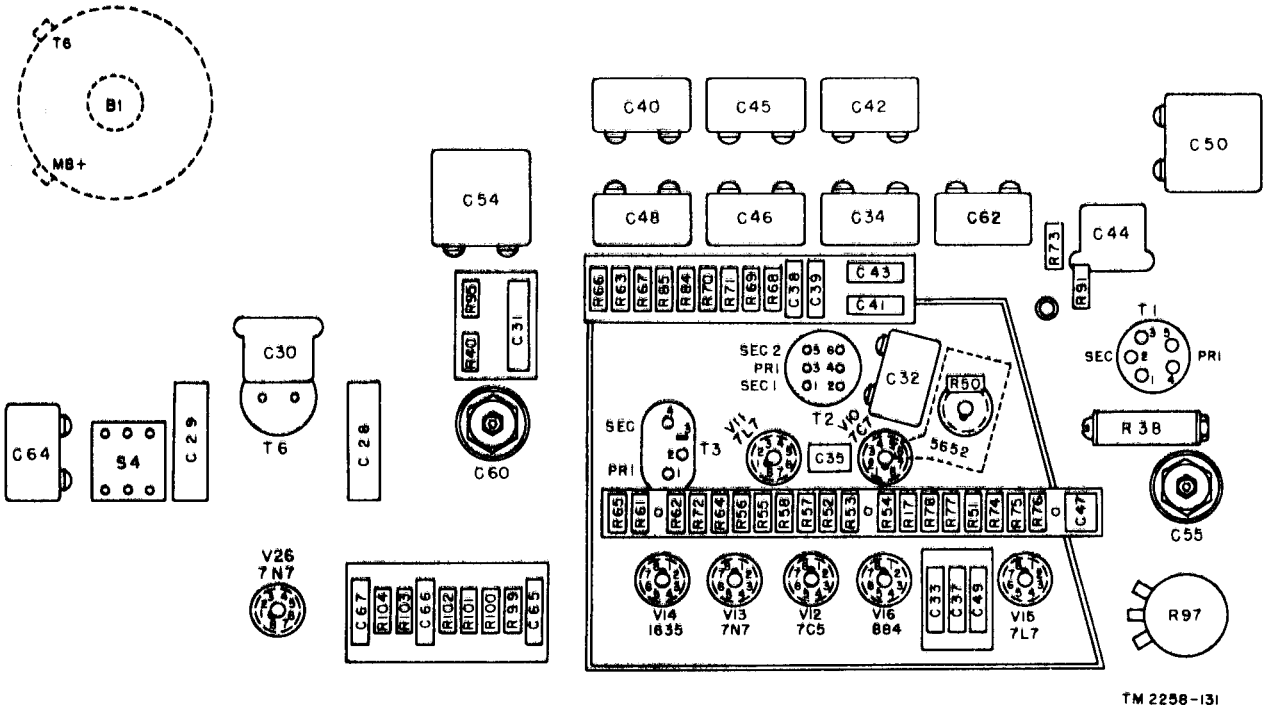


Figure 130. Facsimile Transceiver TT-1C/TXC-1, botttom view, parts identification.



Facsimile Transceiver TT-1D/TXC-1, bottom view, parts identification.

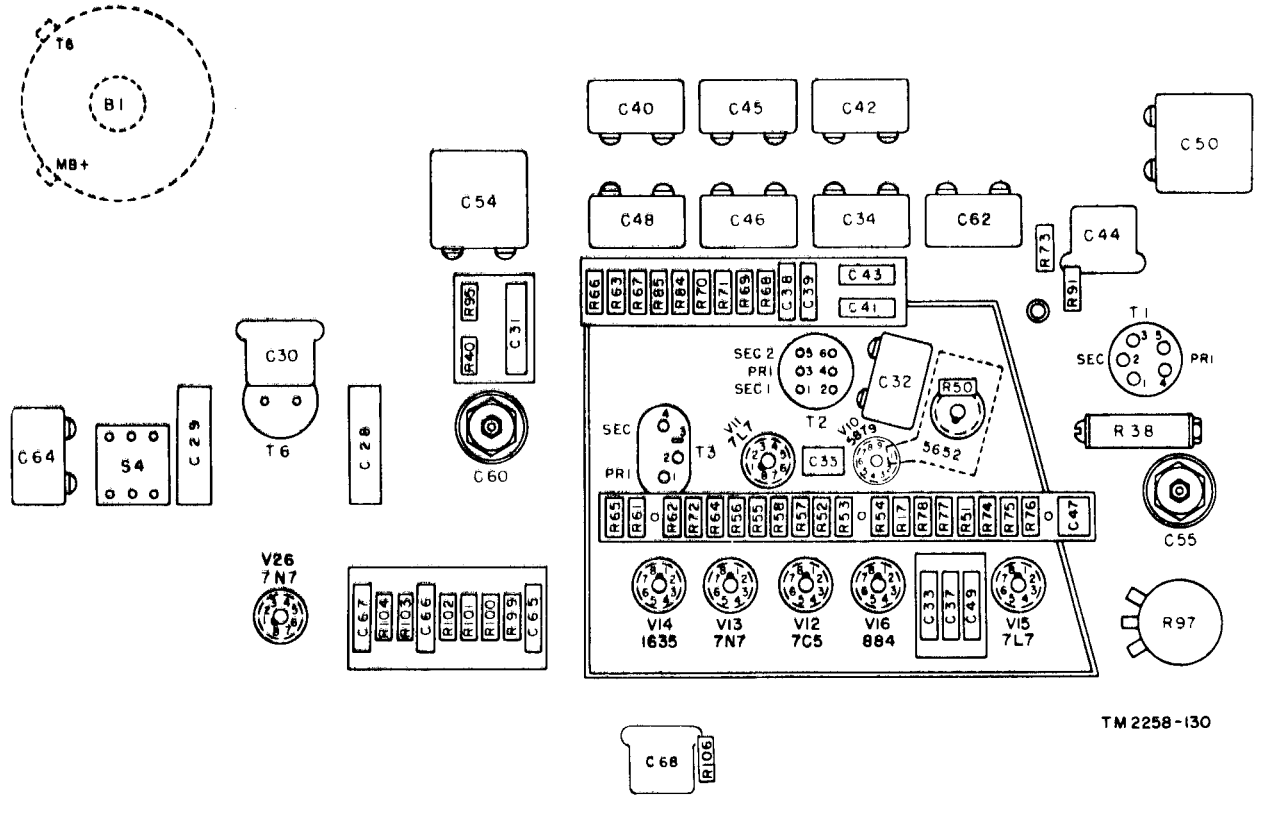


Figure 132. Facscimile Transceiver TT-1E/TXC-1, bottom view, parts identification.

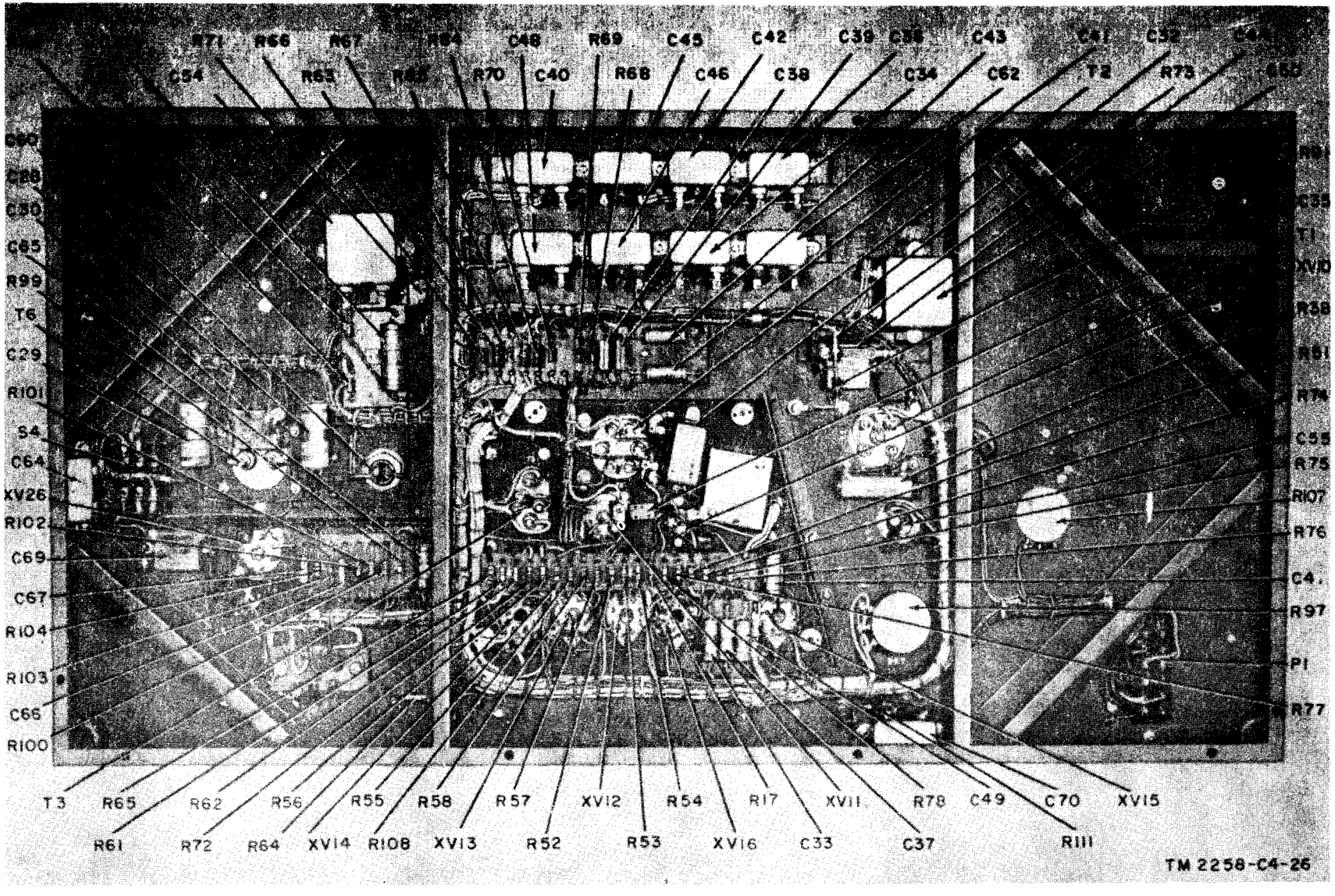


Figure 133. Facsimile Transceiver TT-1F/TXC-1, bottom view, parts identification.

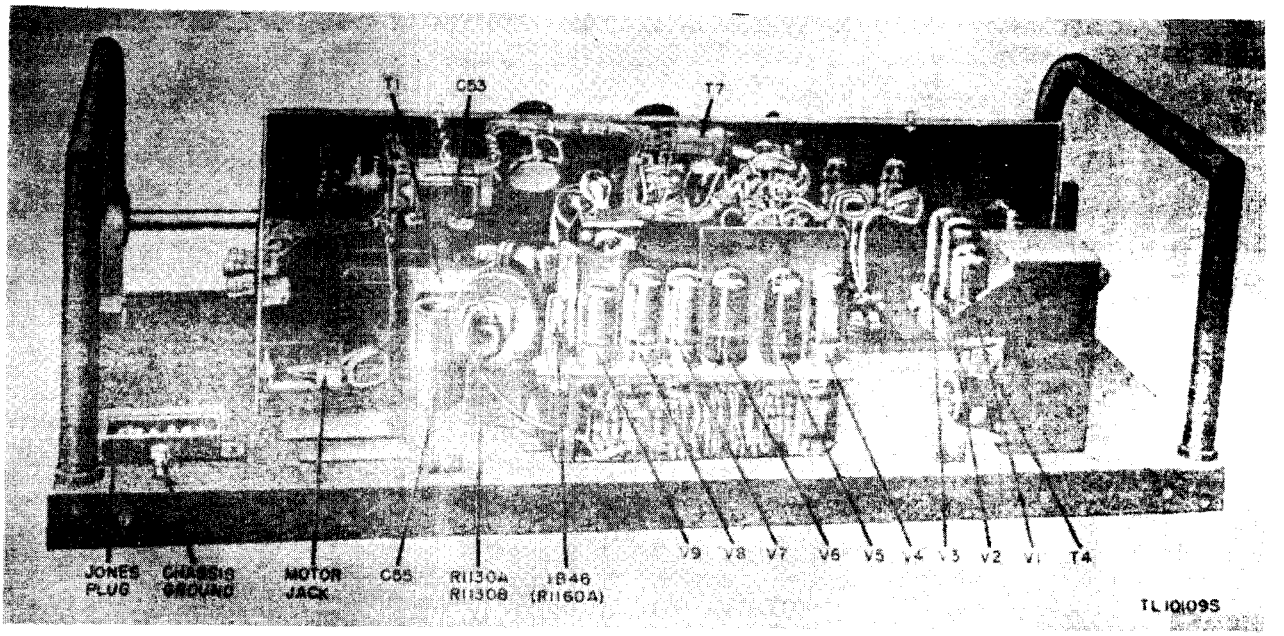


Figure 134. Facsimile Transceiver TT-1/TXC-1, rear view, parts identification.

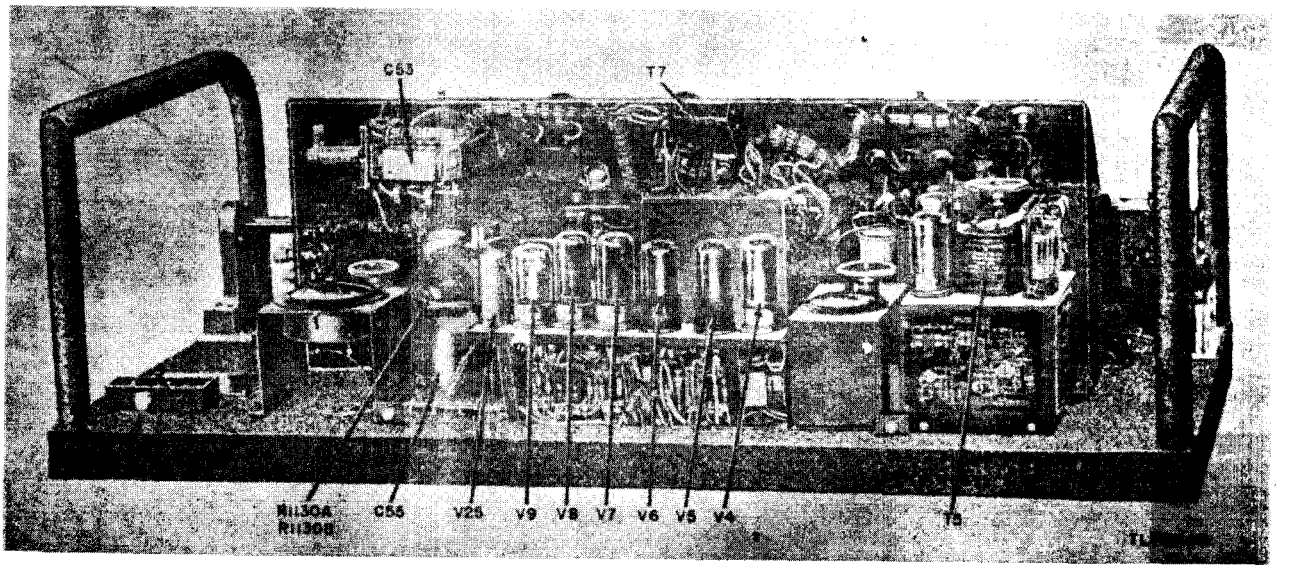


Figure 135. Facsimile Transceiver TT-1B/TXC-1, rear view, parts idenification.

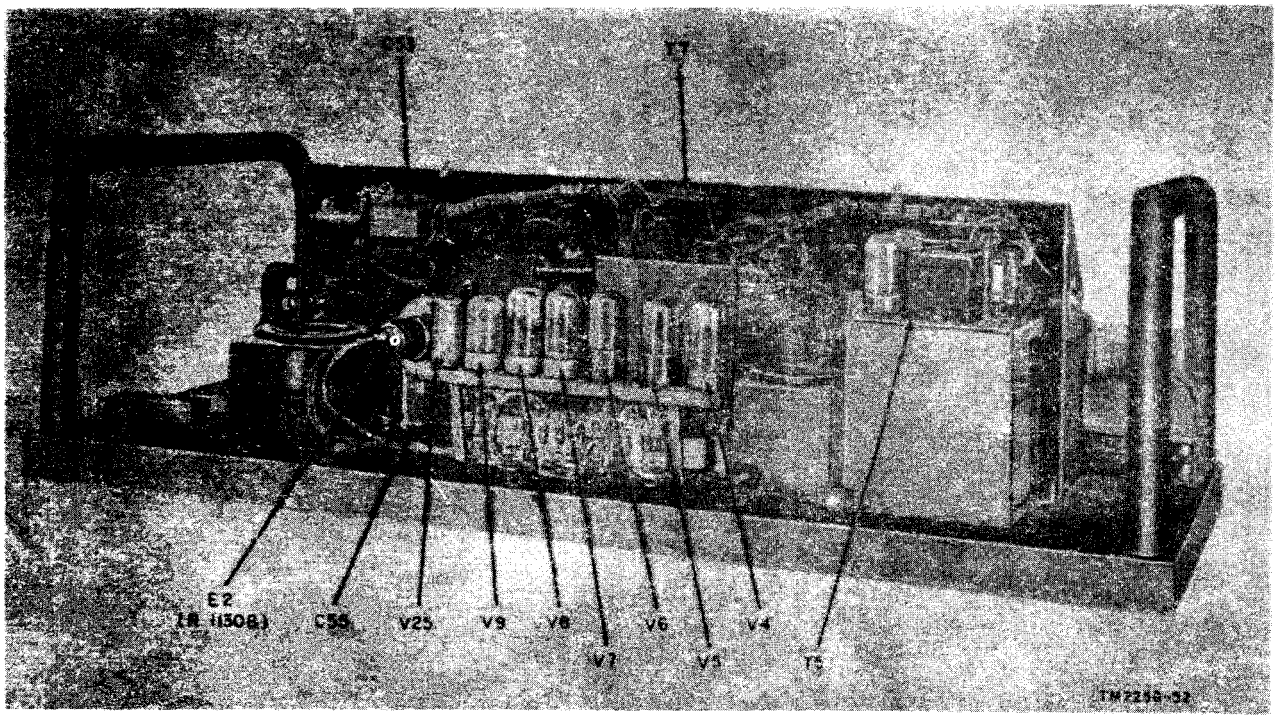


Figure 136. Facsimile Transceiver TT-1C/TXC-1, rear view, parts identification.

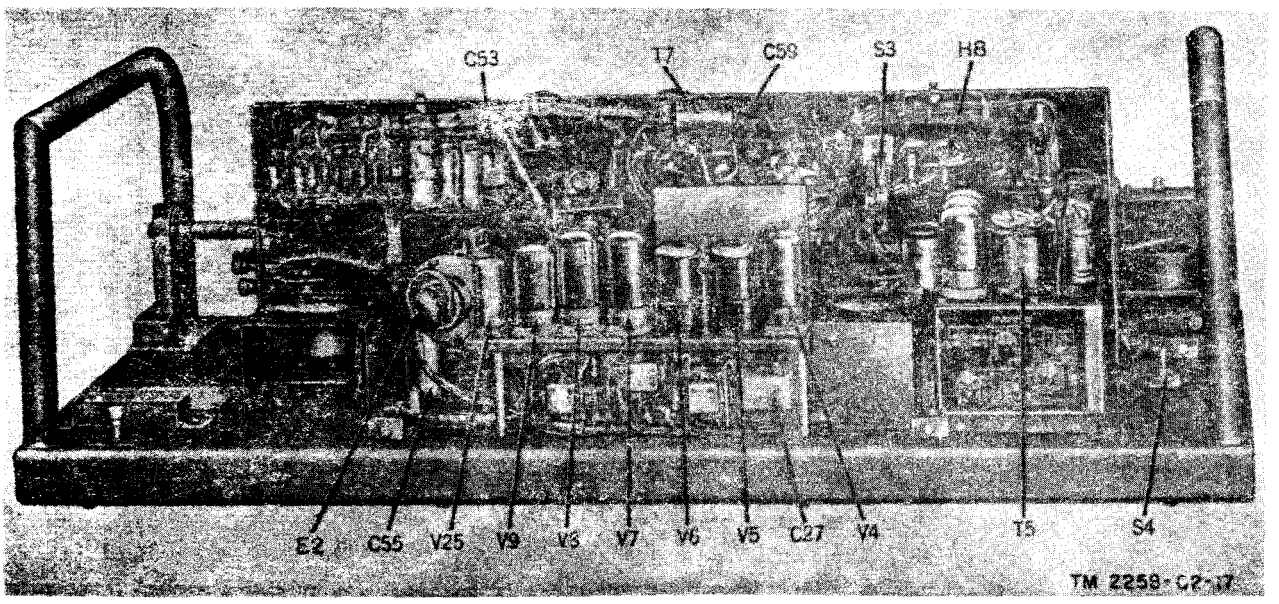


Figure 137. Facsimile Transceivers TT-1D/TXC-1 and TT-1E/TXC-1, rear view, parts identification.

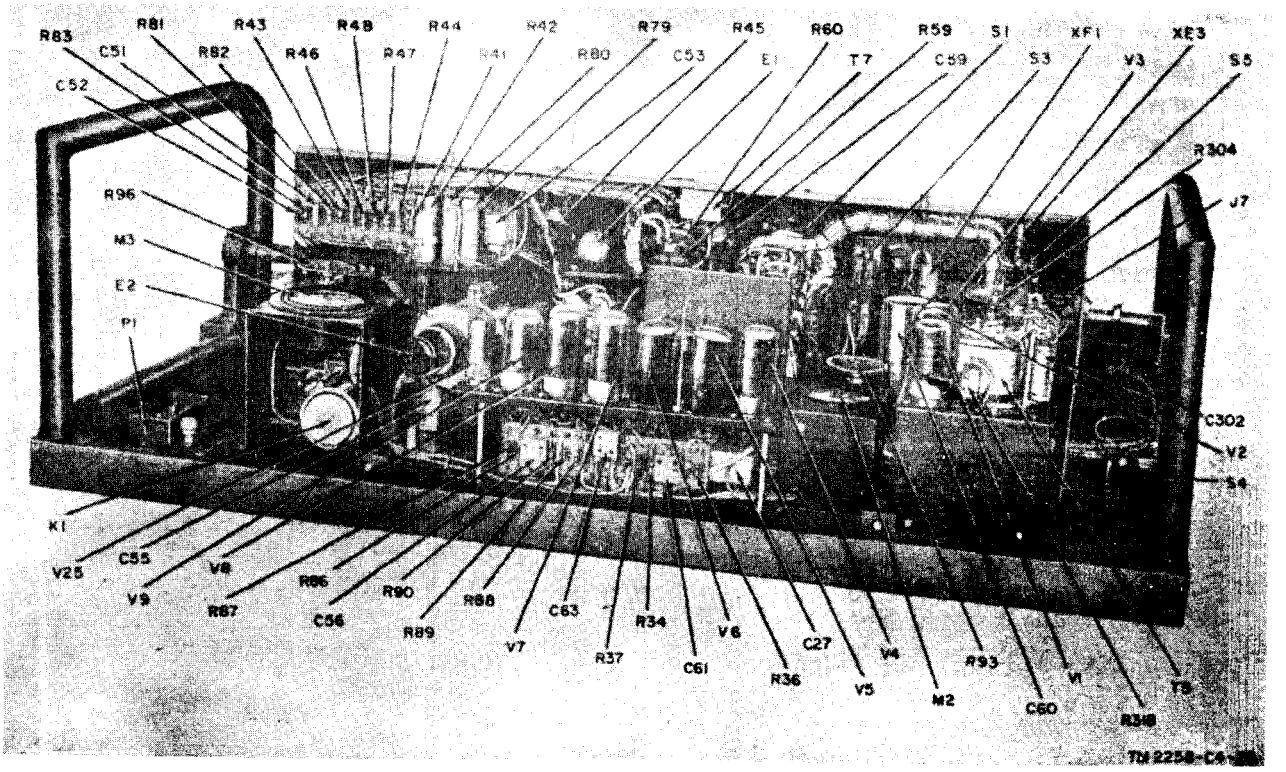


Figure 138. Facsimile Transceiver TT-1F/TXC-1, rear view, parts identification.

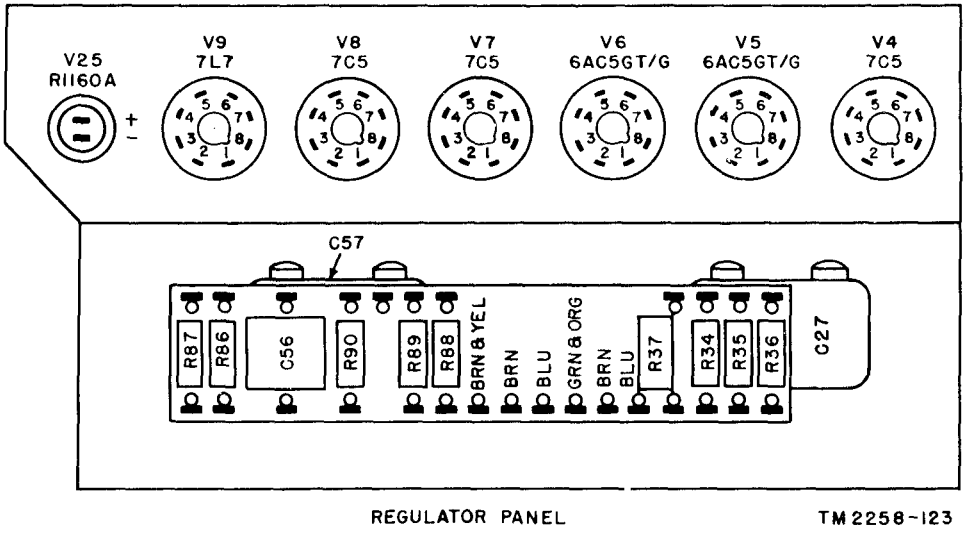


Figure 139. Facsimile Transceivers TT-1/TXC-1 and TT-1A/TXC-1, regulator panel, bottom view, parts identification.

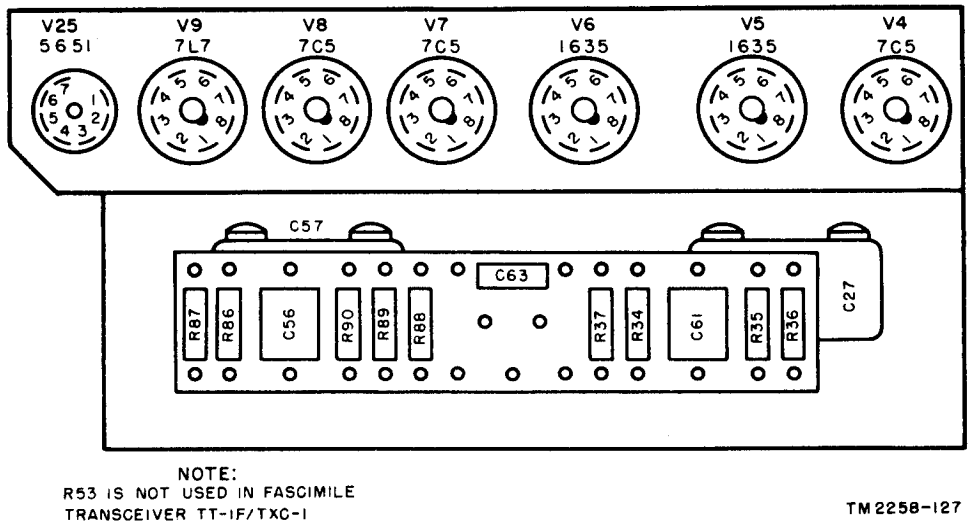


Figure 140. Facsimile Transceivers TT-1D/TXC-1, TT-1E/TXC-1, and TT-1F/TXC-1, regulator panel, bottom view, parts identification.

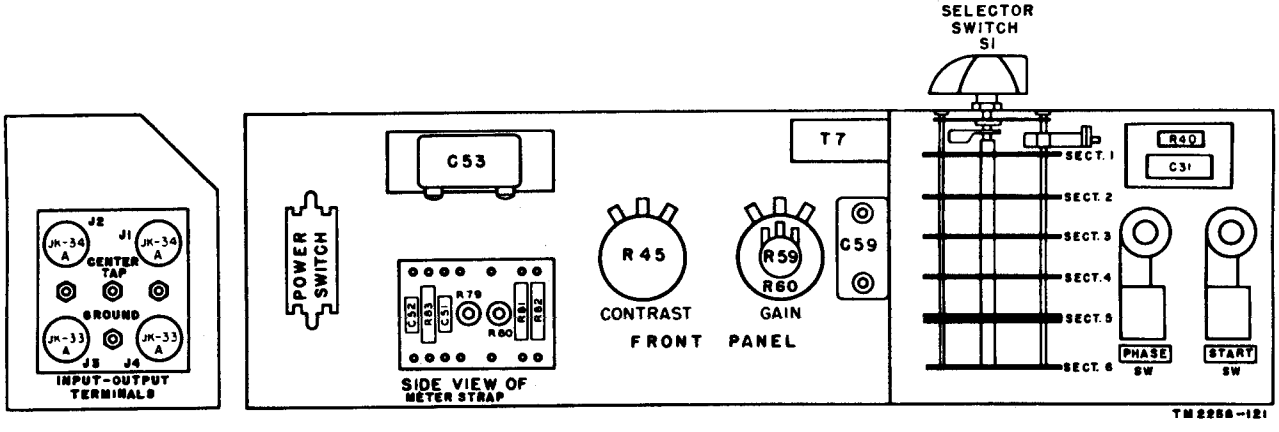


Figure 141. Facsimile Transceiver TT-1/TXC-1, rear of front panel, parts identification.

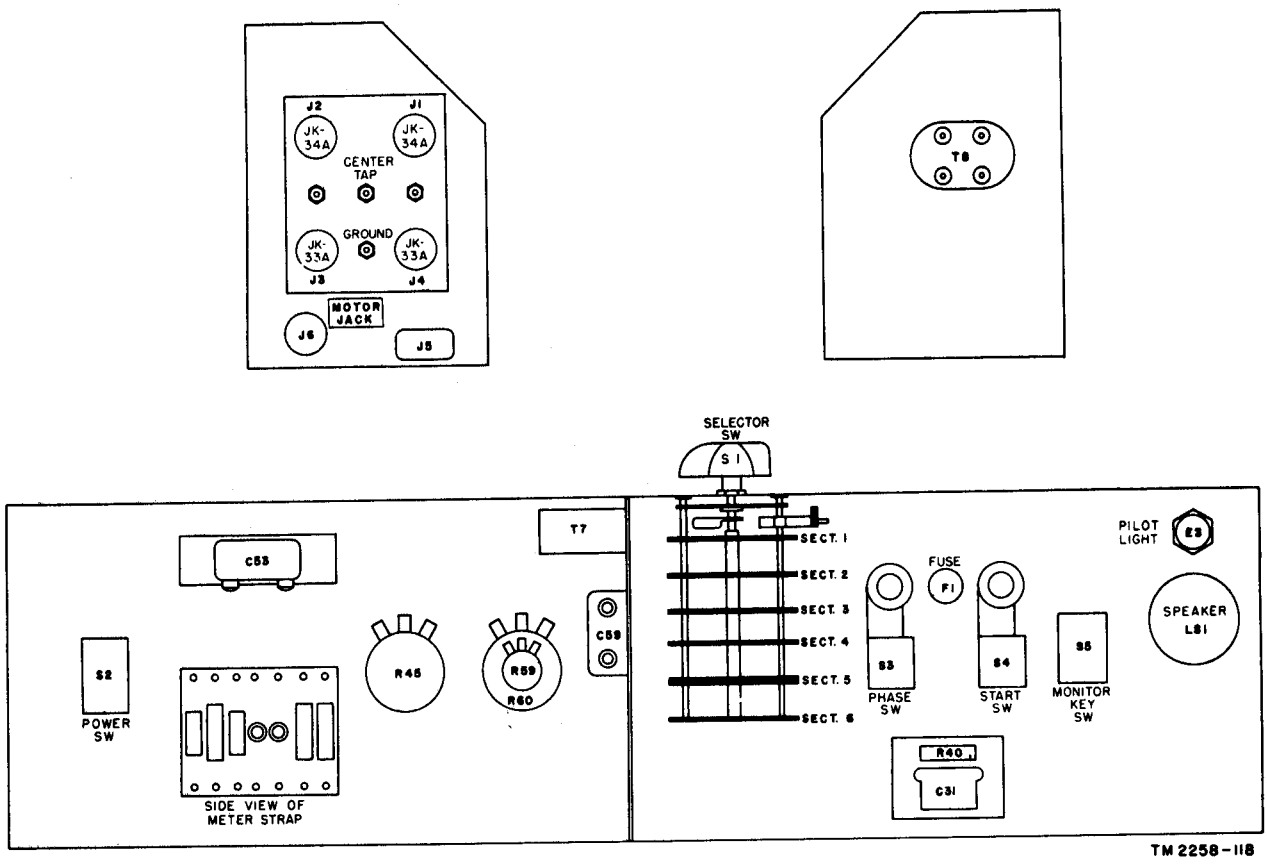


Figure 142. Facsimile Transceiver TT-1A/TXC-1, rear of front panel, parts identification.

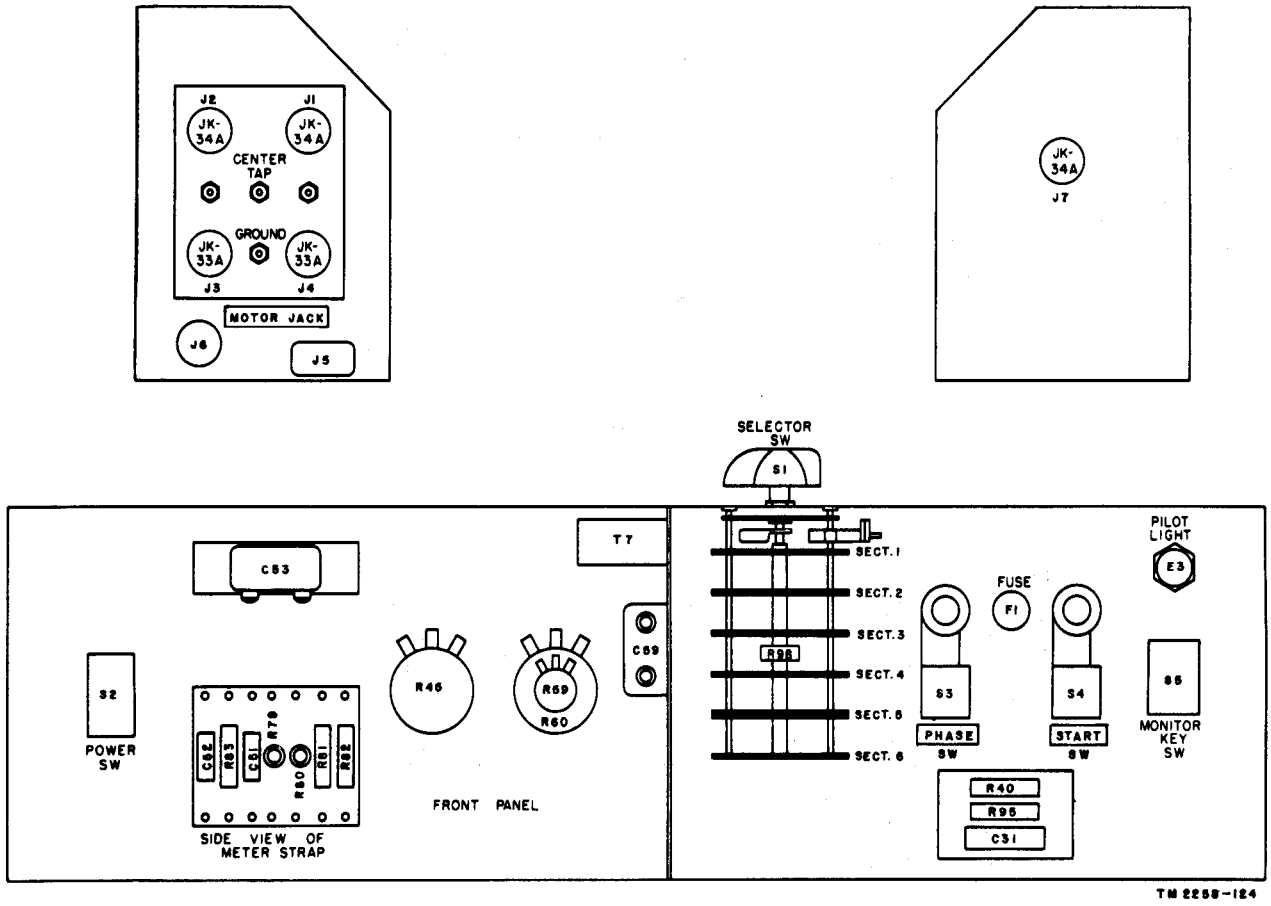


Figure 143. Facsimile Transceivers TT-1B/TXC-1 and TT-1C/TXC-1, rear of front panel, parts identification.

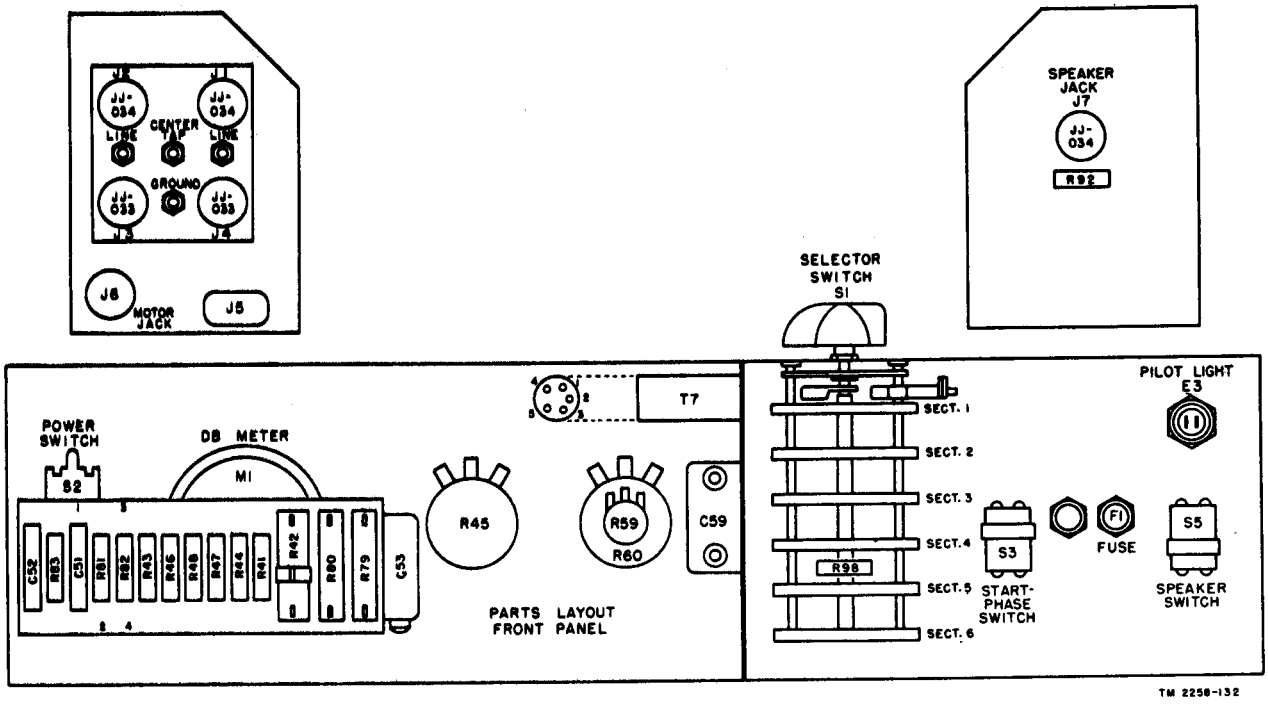


Figure 144. Facsimile Transceivers TT-1D/TXC-1, TT-1E/TXC-1, and TT-1F/TXC-1, rear of front panel, parts identification.

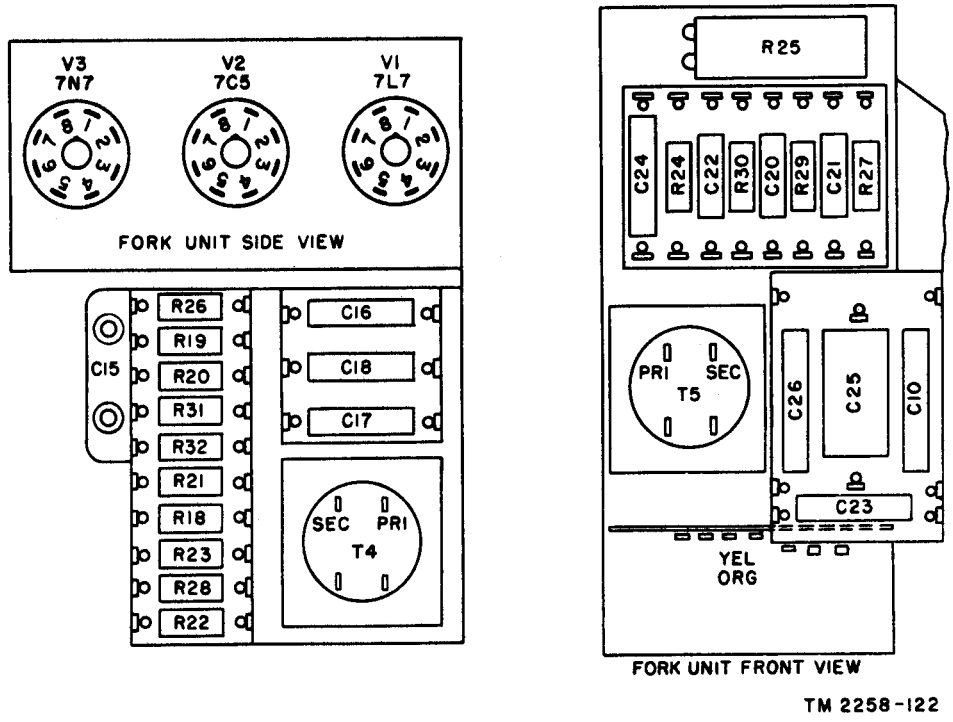


Figure 145. Unsealed fork oscillator unit, parts identification.

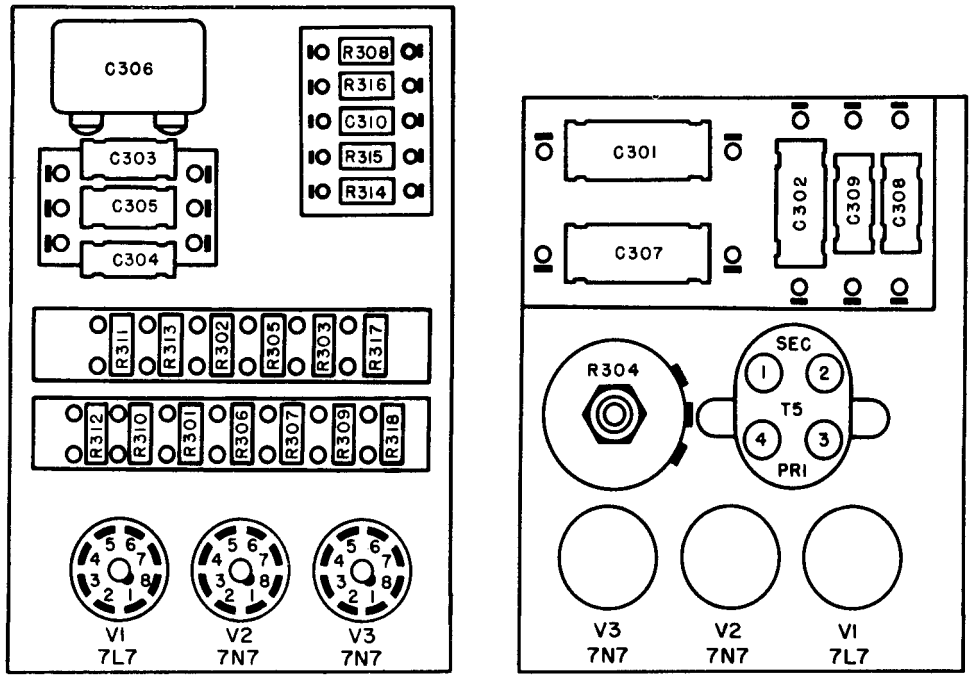


Figure 146. Sealed fork oscillator unit, Facsimile Sets AN/TXC-1, AN/TXC-1A, and AN/TX C-1B, parts identification.

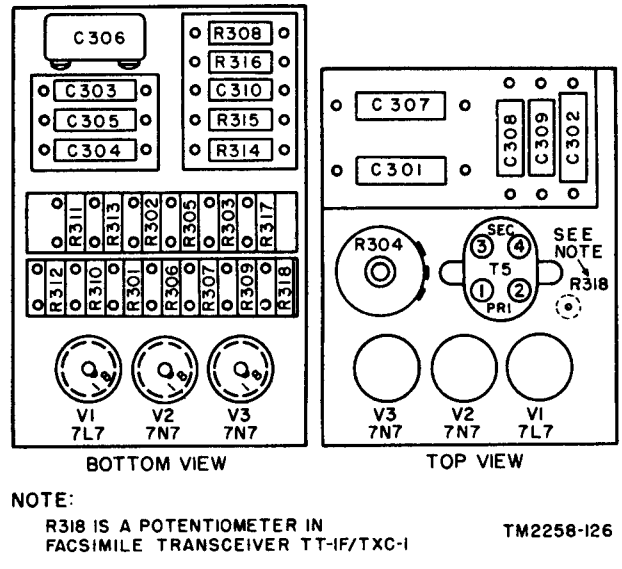


Figure 147. Sealed fork oscillator, Facsimile Sets AN/TXC-1C and AN/TXC-1D, parts identification.

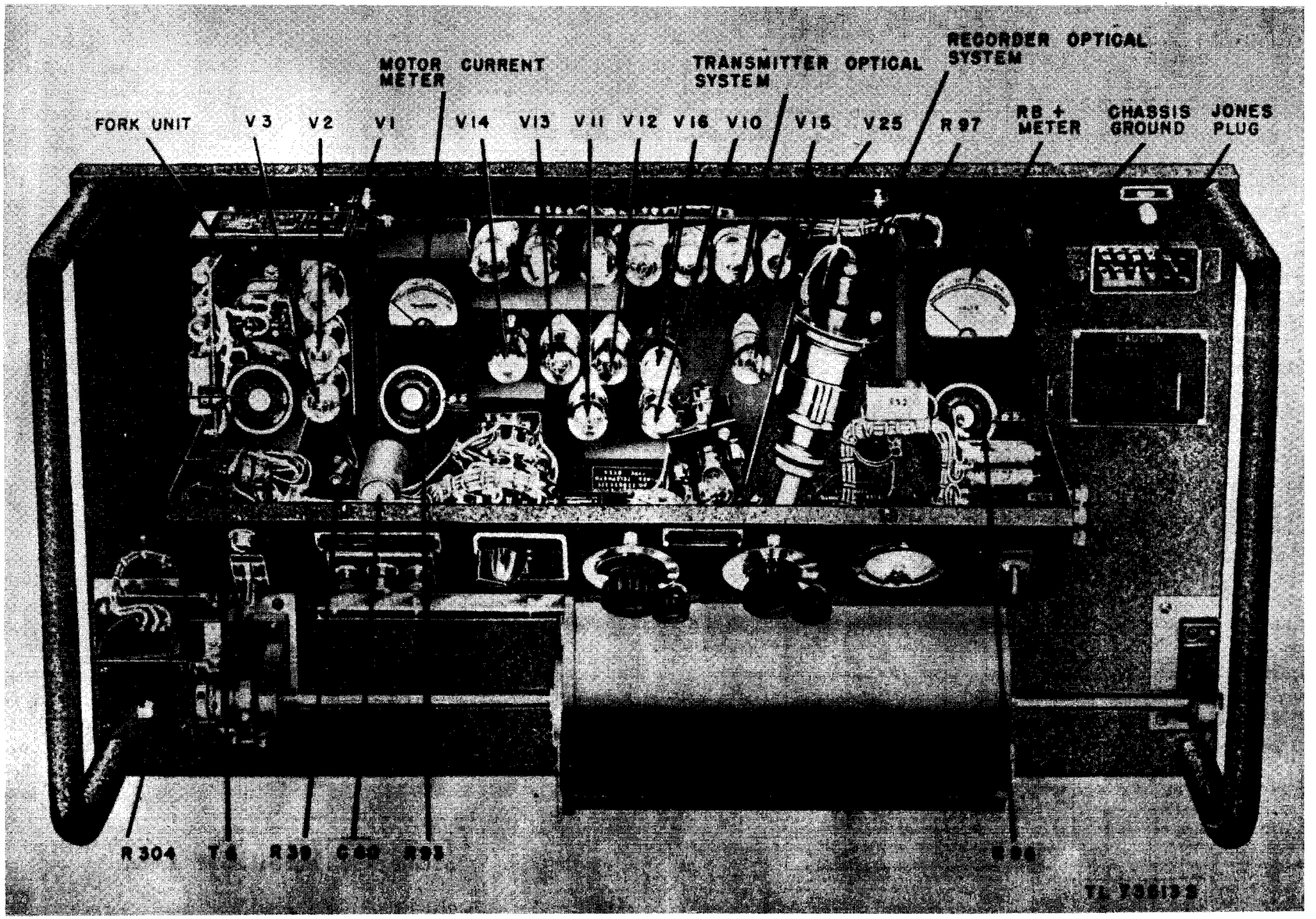


Figure 148. Facsimile Transceiver TT-1B/TXC-1, top view, parts identification.

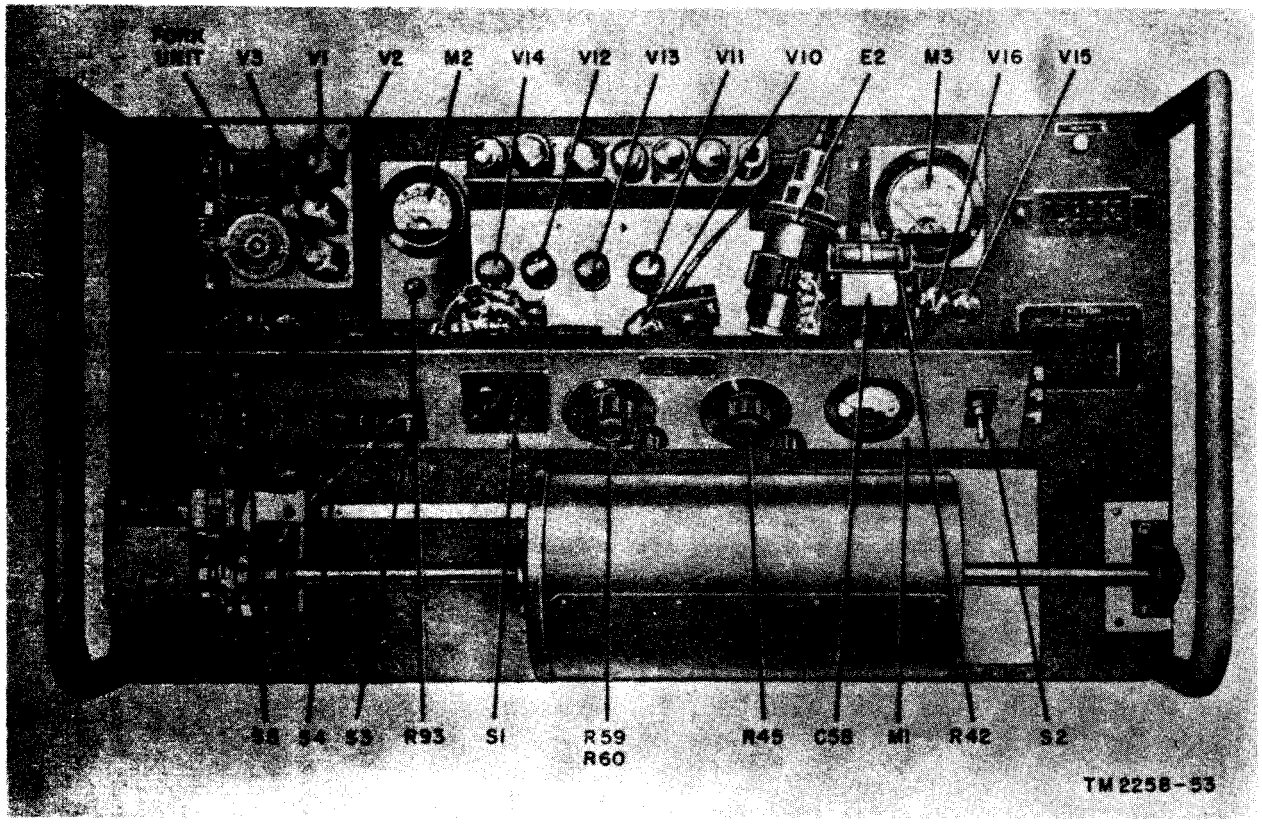
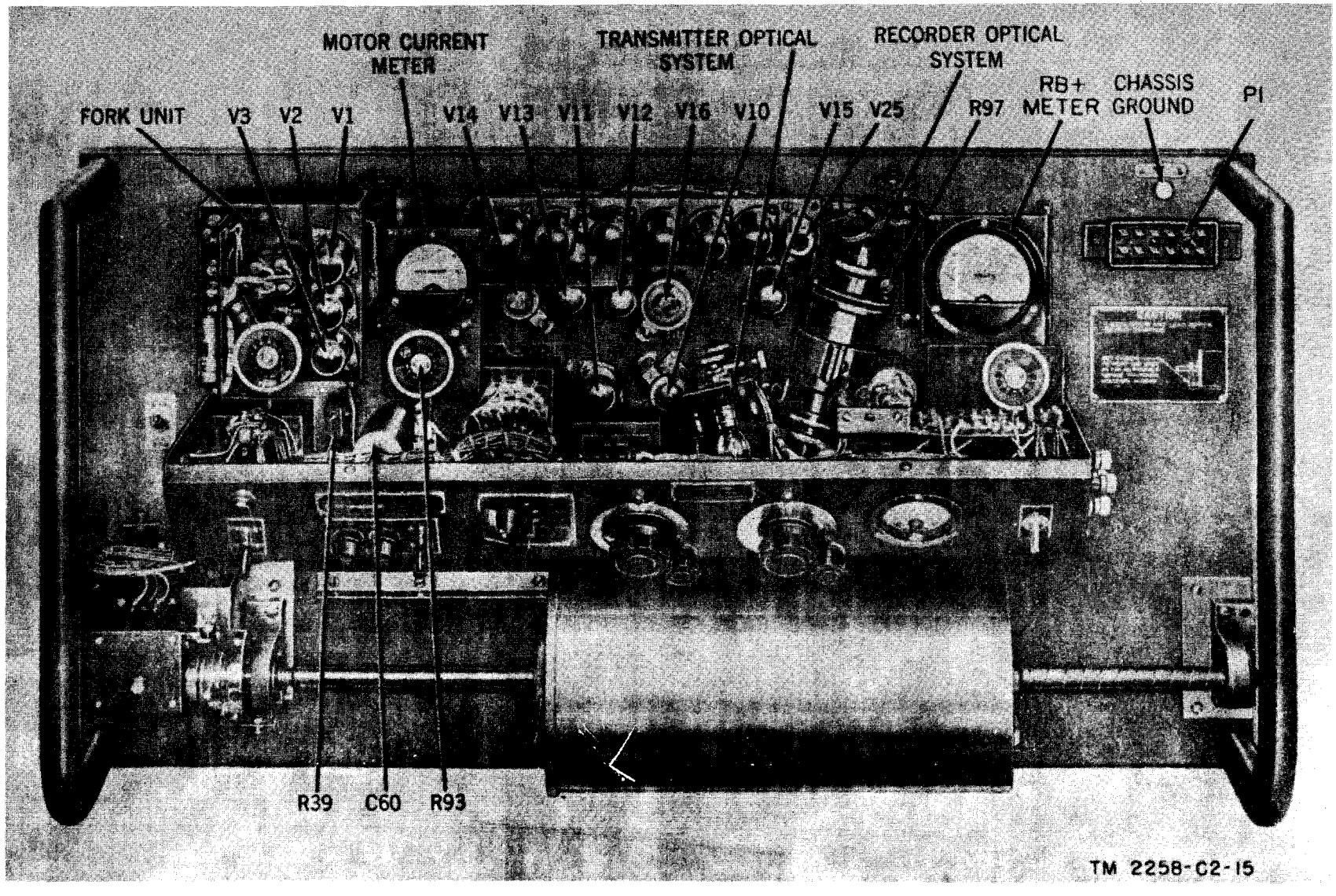
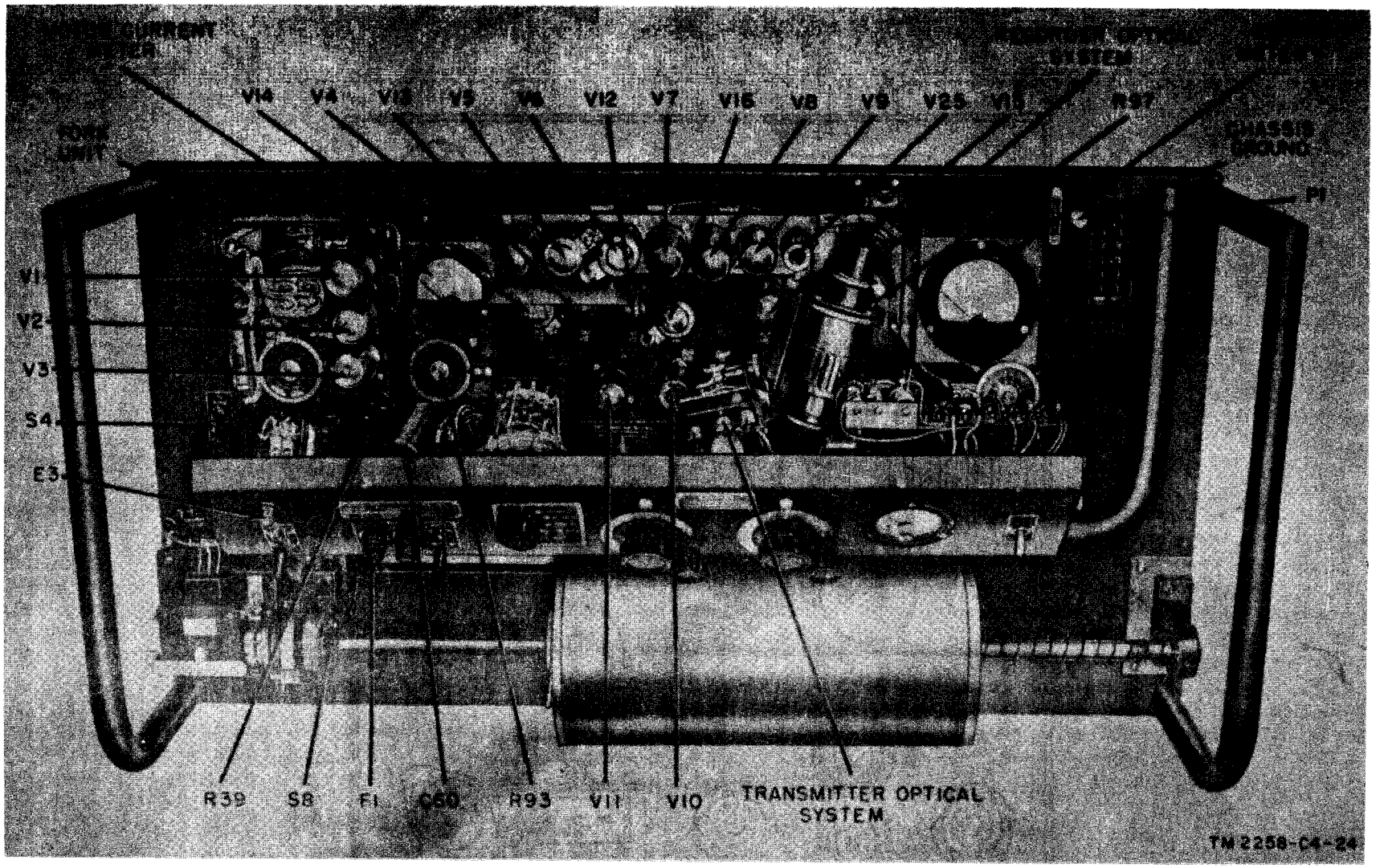


Figure 149. Facsimile Transceiver TT-1C/TXC-1, top view, parts identification.


MOTOR CURRENT METER
TRANSMITTER OPTICAL SYSTEM
RECORDER OPTICAL SYSTEM
FORK UNIT
V3
V2
V1
V14
V13
V11
V12
V16
V10
V15
V25
R97
RB+ METER
CHASSIS GROUND
P1
R39
C60
R93
TM 2258-C2-15


V14
V4
V13
V5
V6
V12
V7
V16
V8
V9
V25
R37
P1
V1
V2
V3
S4
E3
R39
S8
F1
C60
R93
V11
V10
TRANSMITTER OPTICAL SYSTEM
TM 2258-C4-24

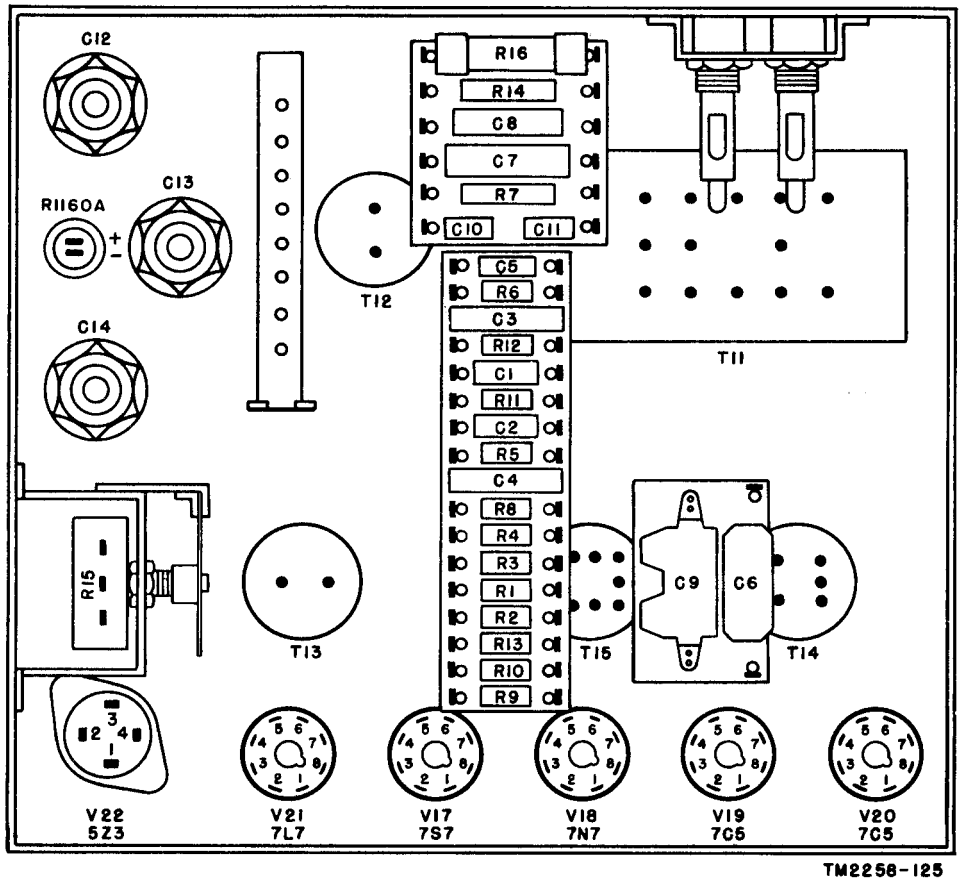


Figure 152. Rectifier Power Unit PP-86/TXC-1, bottom view, parts identification.

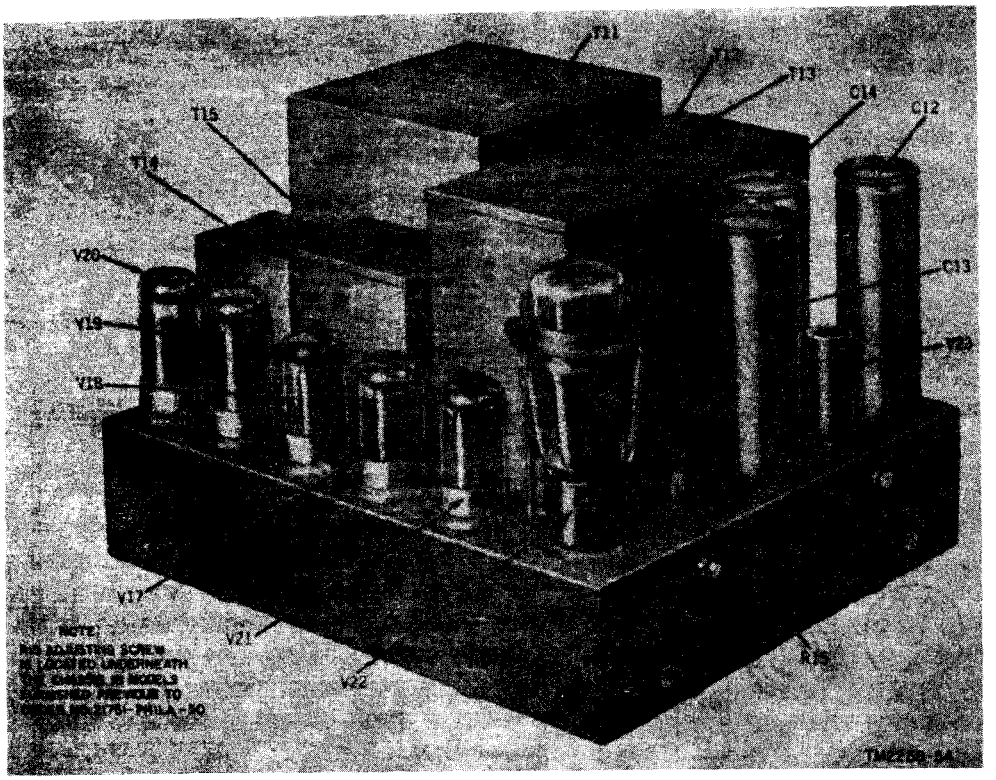


Figure 153. Rectifier Power Unit PP-86A/TXC-1, furnished on Order No. 21751-Phila-50, top view, parts identification. Also Rectifier Power Unit PP-86E/TXC-1

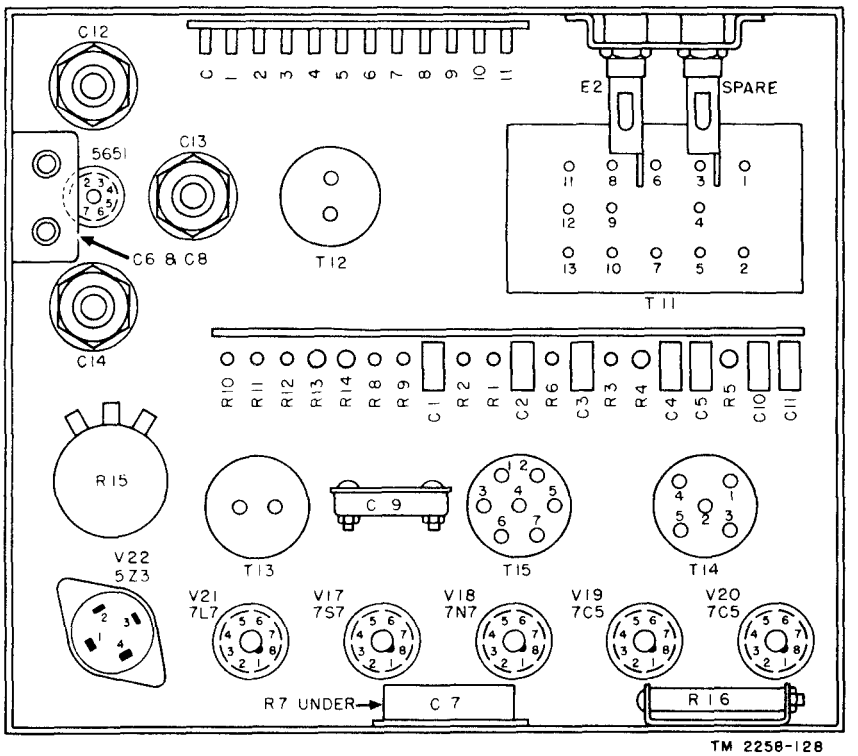


Figure 154. Rectifier Power Unit PP-86A/ TXC-1, furnished on Order No. 21761-Phila-50, bottom view, parts identification.

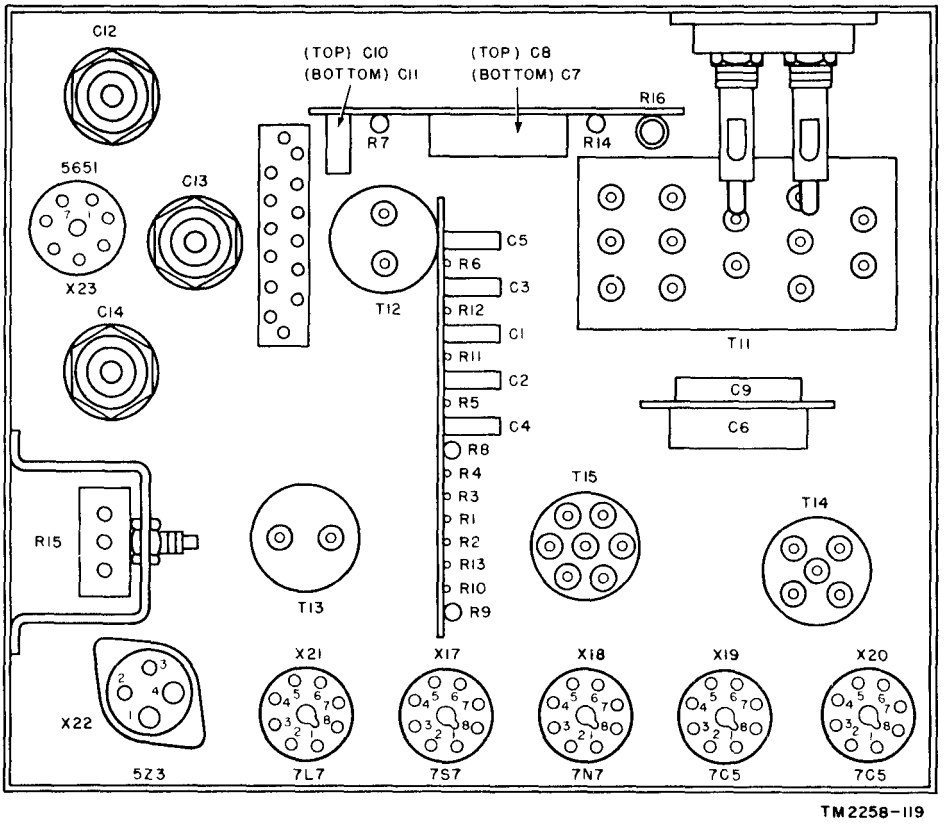


Figure 155. Rectifier Power Unit PP-86B/TXC-1, bottom view, parts identification.

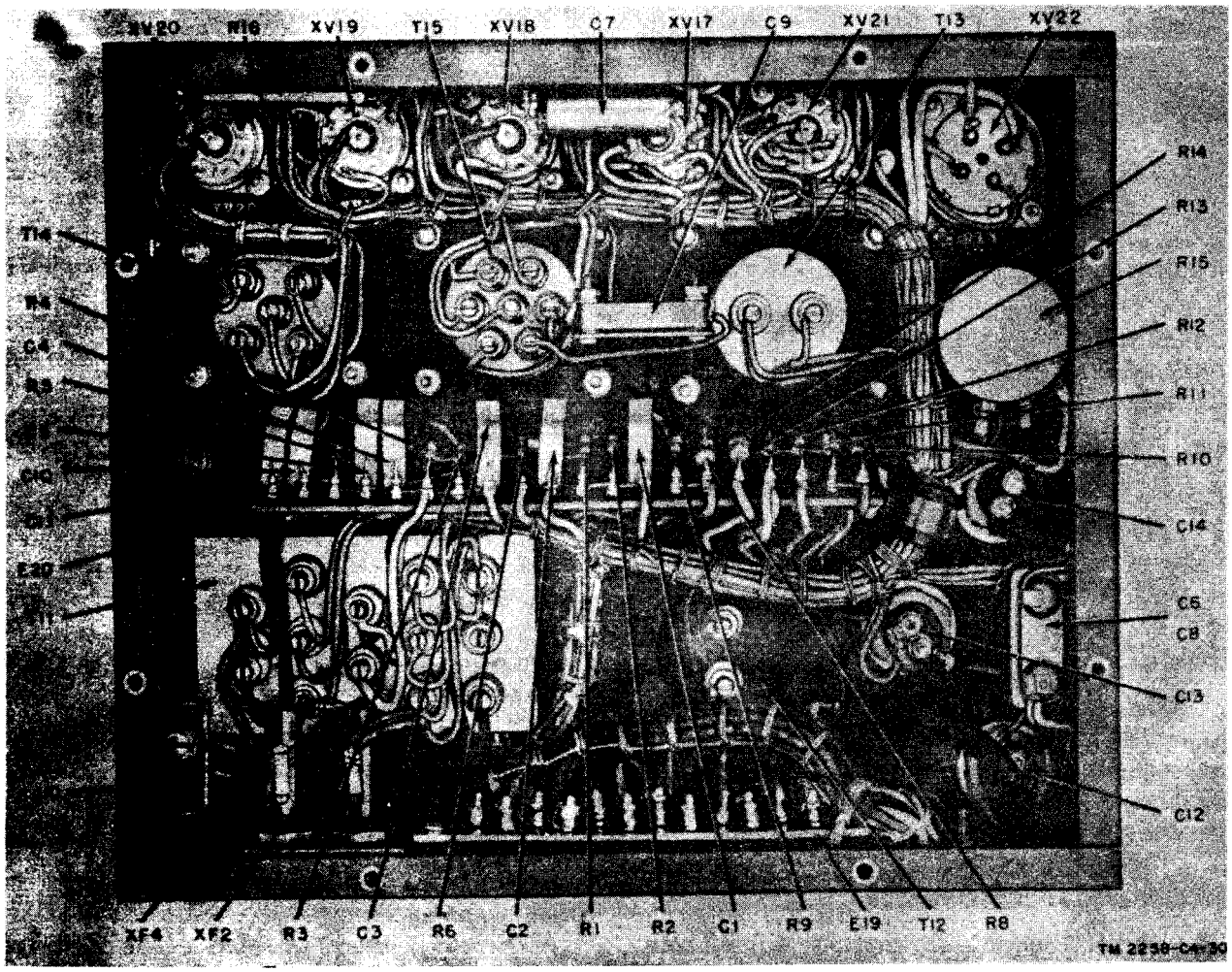


Figure 156. Rectifier Power Unit PP–86E/TXC–1, bottom view, parts identification.

CHAPTER 7

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

143. Disassembly

Disassembly of Facsimile Set AN/TXC-1(*) consists of removing cabling between components and disconnecting the transmission lines. All controls should be placed in the off or standby position, and any parts which may become loose during shipment should be properly secured to prevent damage to the equipment.

144. Repacking
(fig. 7)

The exact procedure in repacking for shipment or limited storage depends on the material available and the conditions under which the equipment is to be shipped or stored. Cushion the developer bottles and thermometer adequately. Whenever practicable, place a dehydrating agent such as silica gel inside the boxes. Protect the boxes with a waterproof paper barrier. Seal the seams of the paper barrier with waterproof sealing compound or tape. Pack the protected boxes in a padded wooden case, providing at least three inches of excelsior padding or similar material between the paper barrier and the packing case.

Section II. DEMOLITION OF MATERIEL TO PREVENT ENEMY USE

145. General

The demolition procedures outlined in paragraph 146 will prevent the enemy from using or salvaging this equipment. Demolition of the equipment will be accomplished only upon order of the commanding officers.

146. Methods of Destruction

a. Smash. Smash the controls, tubes, coils, switches, capacitors, transformers, headsets and bottles; use sledges, axes, handaxes, pickaxes, hammers, crowbars, or heavy tools.

b. Cut. Cut cords, headsets wiring, and other wiring; use axes, handaxes, or machetes.

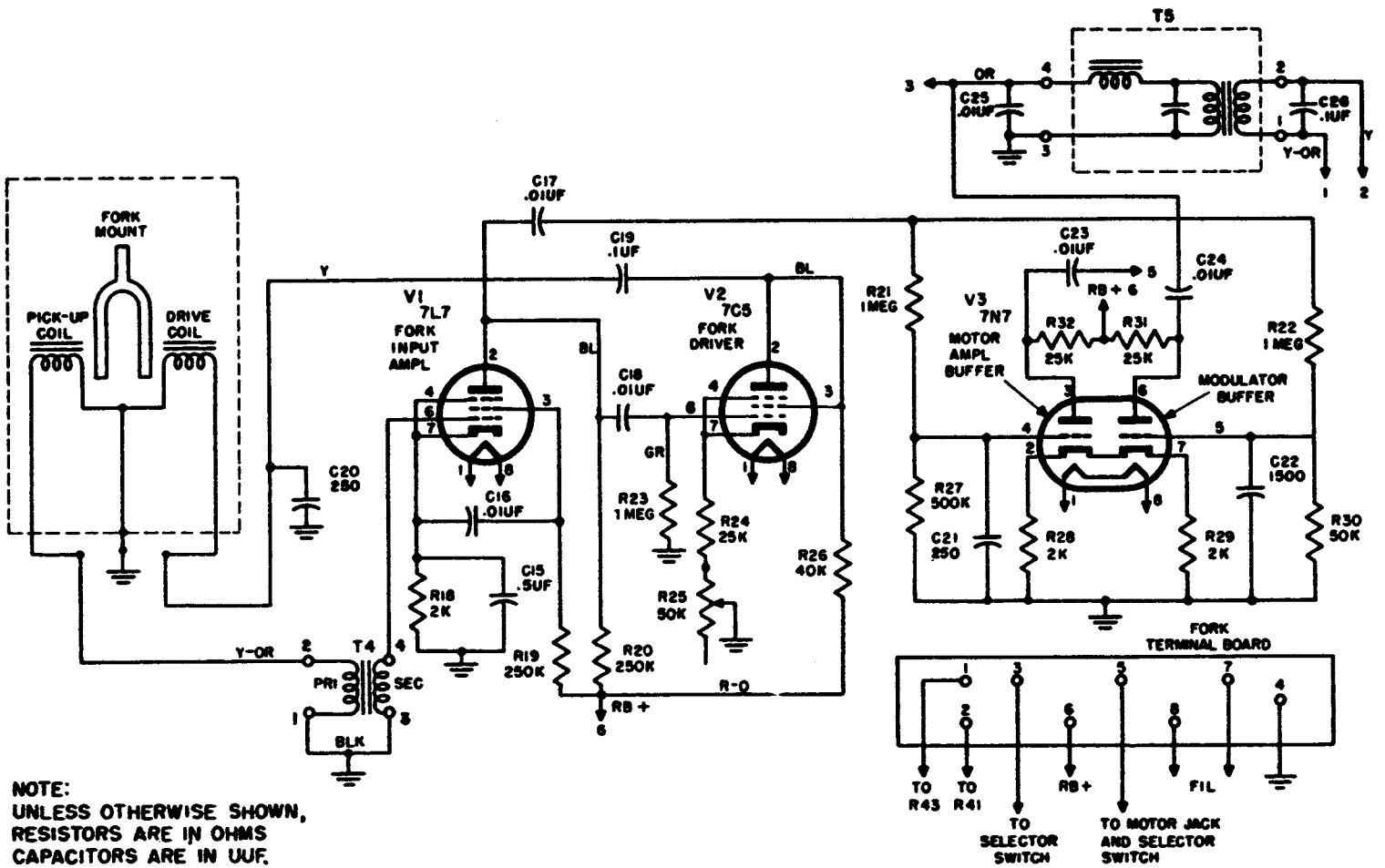
c. Burn. Burn cords, resistors, capacitors, wiring, and technical manuals; use gasoline, kerosene, oil, flame throwers, or incendiary grenades.

d. Bend. Bend panels, cabinet, chassis, and table.

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

f. Disposal. Bury or scatter the destroyed parts in slit trenches, fox holes, or other holes, or throw them into streams.

g. Destroy. Destroy everything.



TM 2298-68

Figure 157. Unsealed fork oscillator unit, schematic diagram.

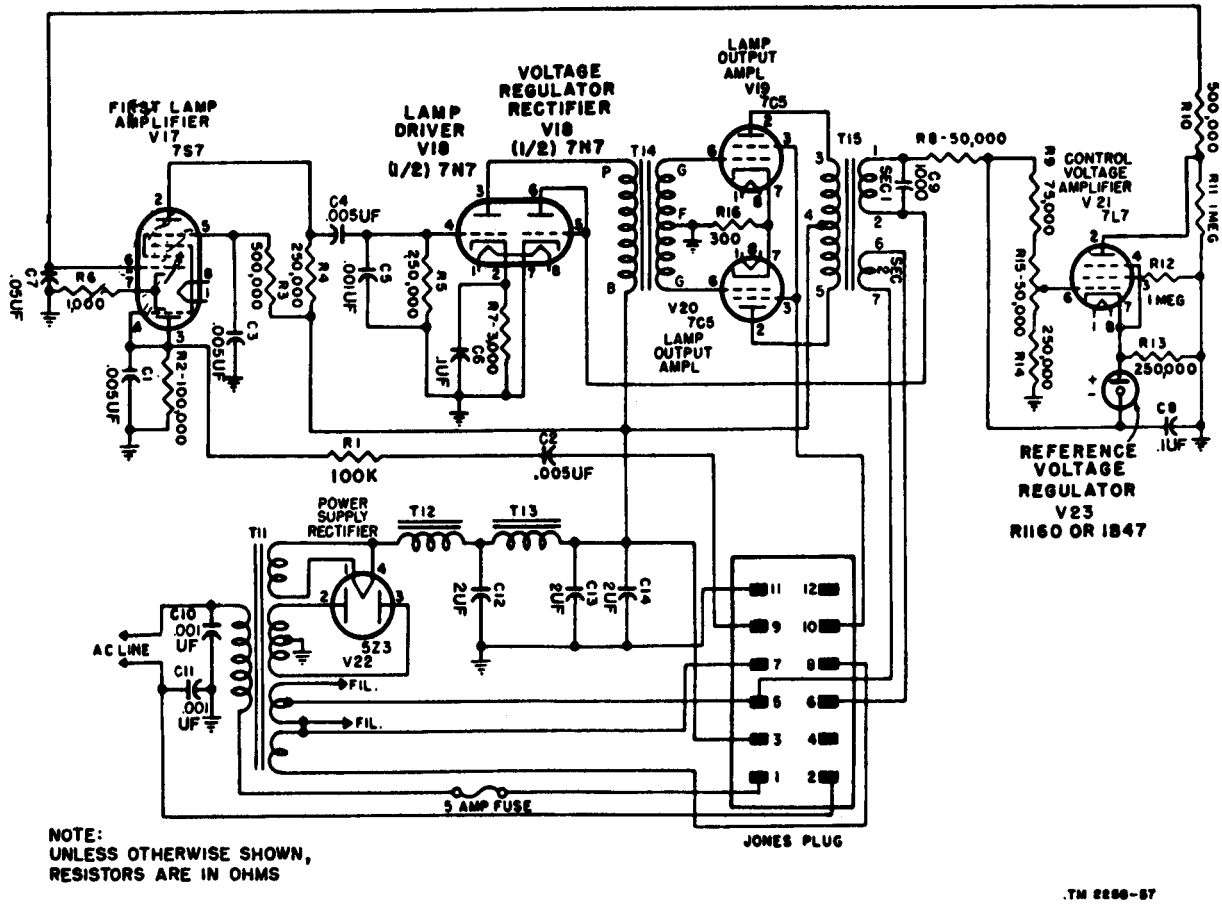


Figure 158. Rectifier Power Unit PP-86/TXC-1, schematic diagram.

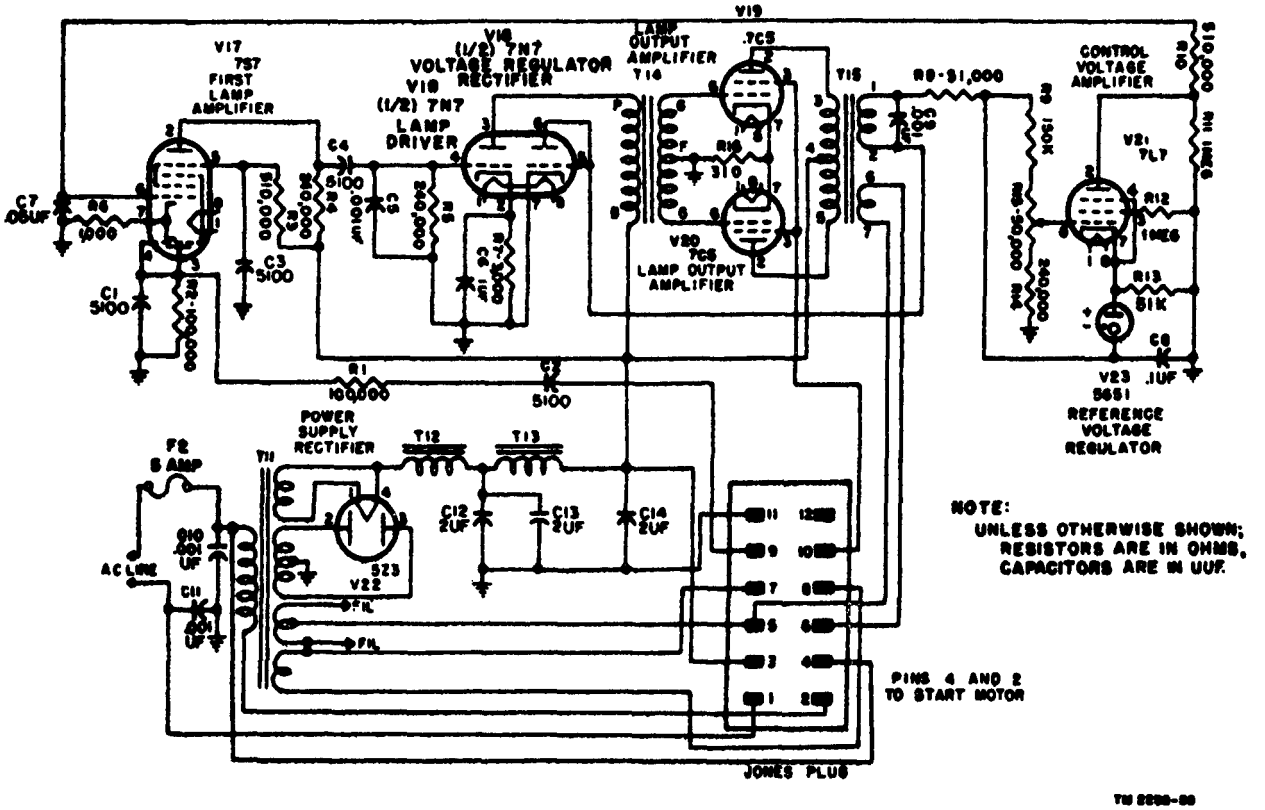
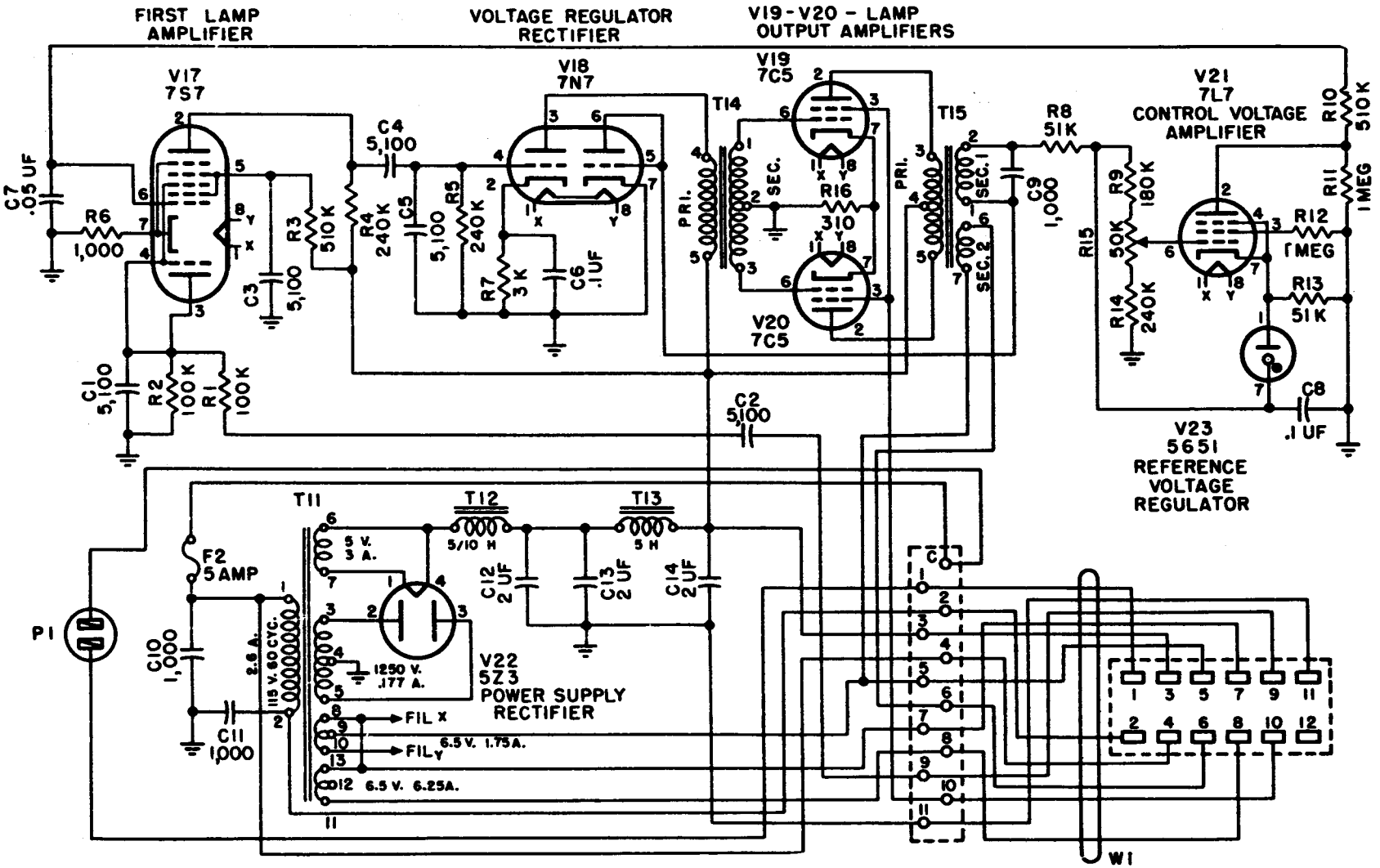


Figure 159. Rectifier Power Unit PP-86A/TXC-1, furnished previous to Order No. 21751-Phila-50, schematic diagram.



NOTE - UNLESS OTHERWISE SHOWN:
RESISTORS ARE IN OHMS
CAPACITORS ARE IN UUF

TM 2258-34

Figure 160. Rectifier Power Unit PP-86A/TXC-1, furnished on Order No. 6457-Phila-51, schematic diagram.

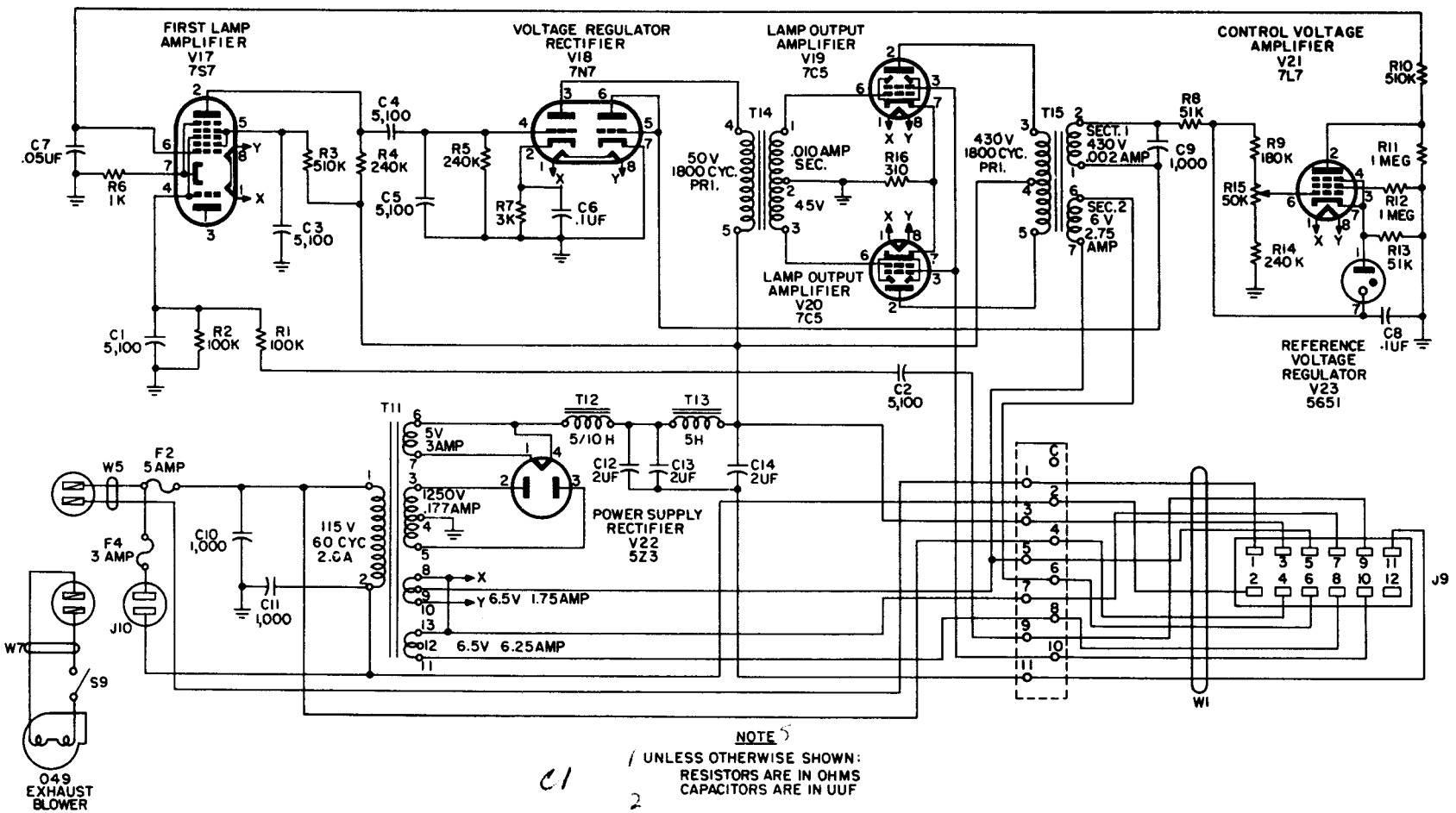


Figure 161. Rectifier Power Unit PP–86E/TXC–1, schematic diagram.

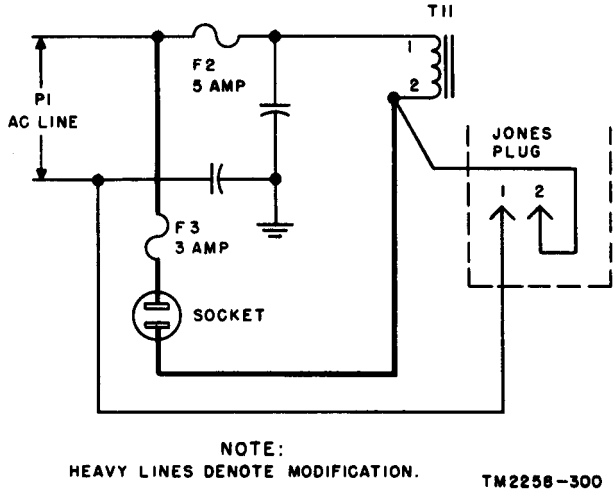


Figure 162. Modification of a portion of schematic of Rectifier Power Unit PP-86(*)/TXC-1.

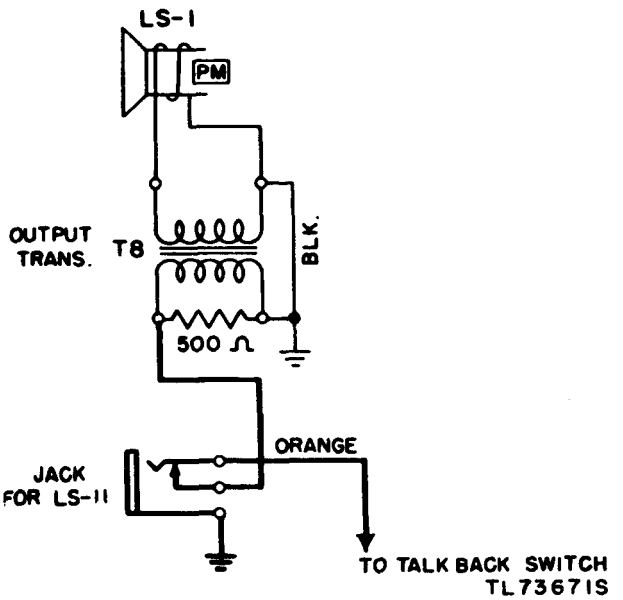


Figure 165. Modified schematic of loudspeaker jack.

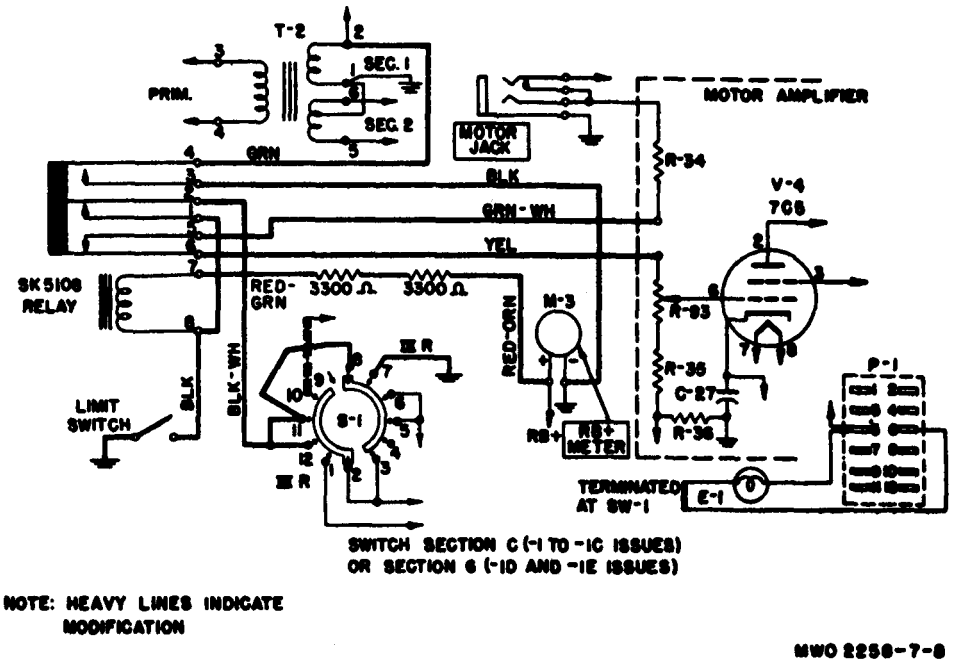


Figure 170. Automatic stop circuit Facsimile Transceiver TT-1(*)/TXC-1.

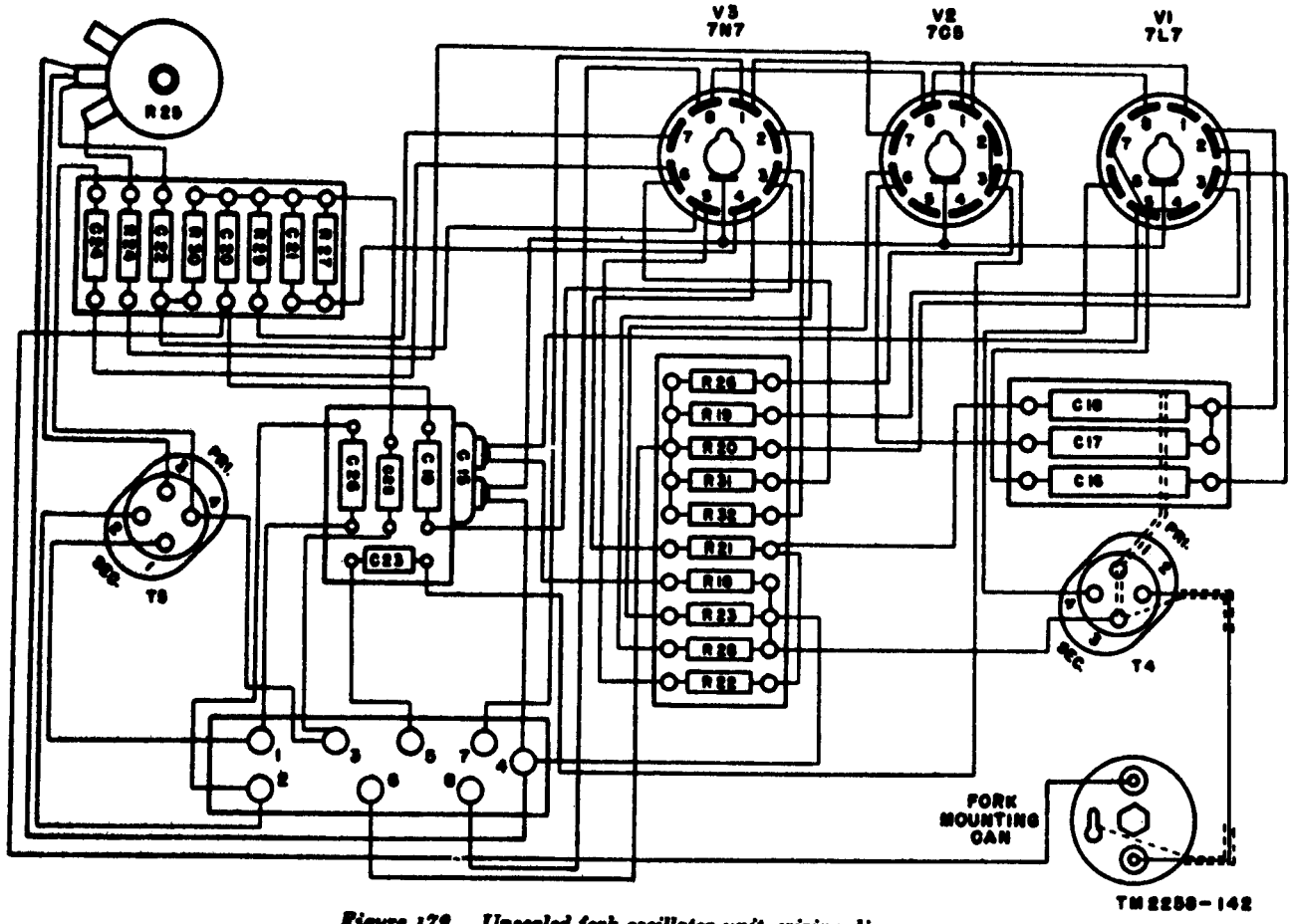


Figure 178. Uncooled fork oscillator unit, wiring diagram.

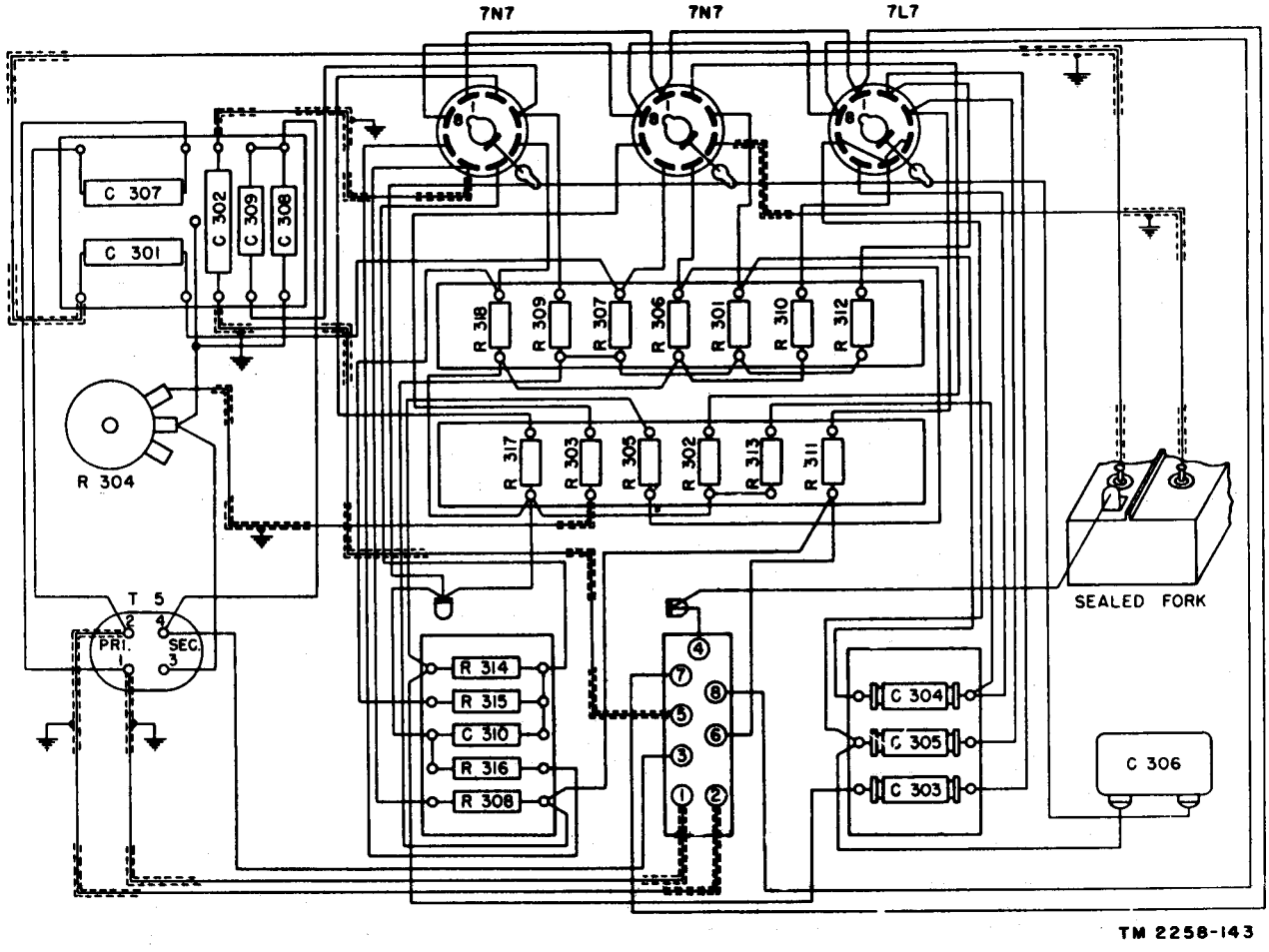


Figure 173. Sealed fork oscillator unit, wiring diagram.

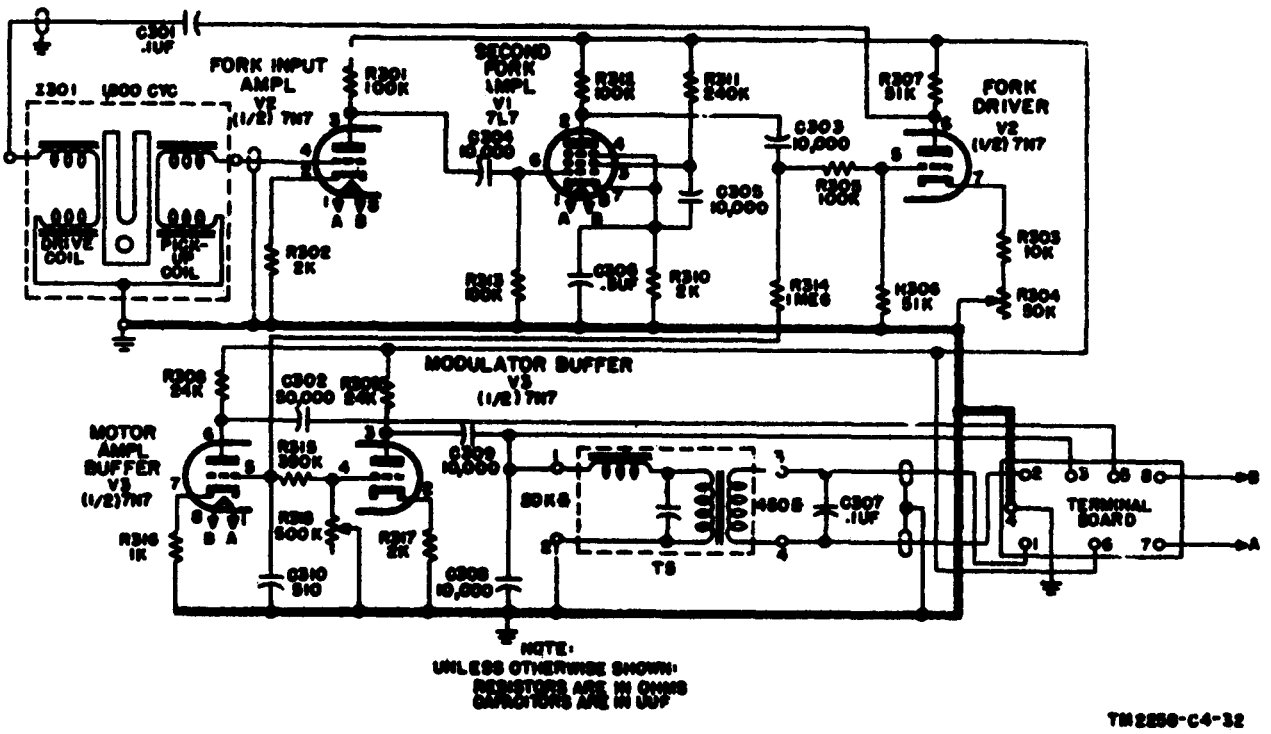


Figure 174. Sealed fork oscillator unit, schematic diagram.

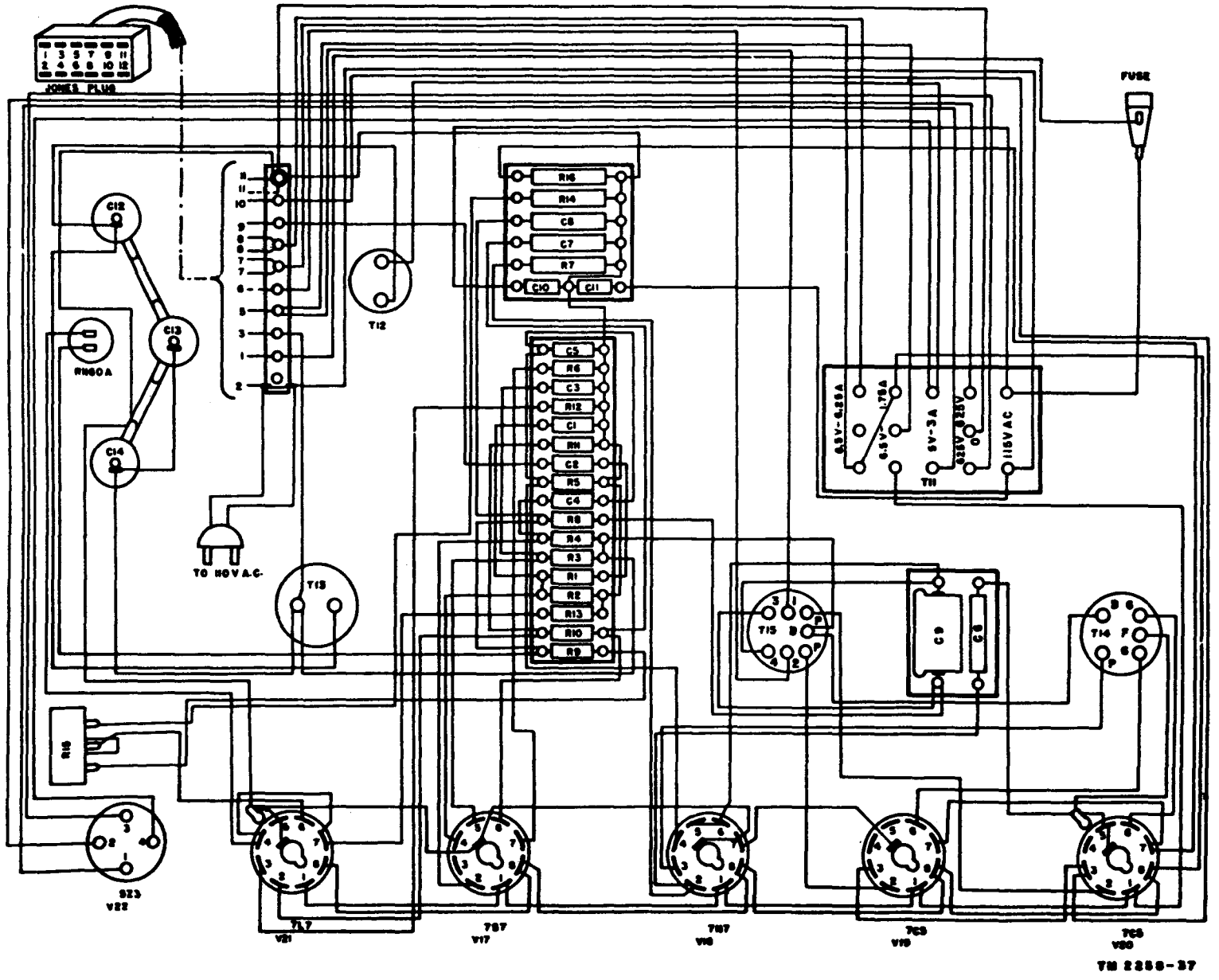
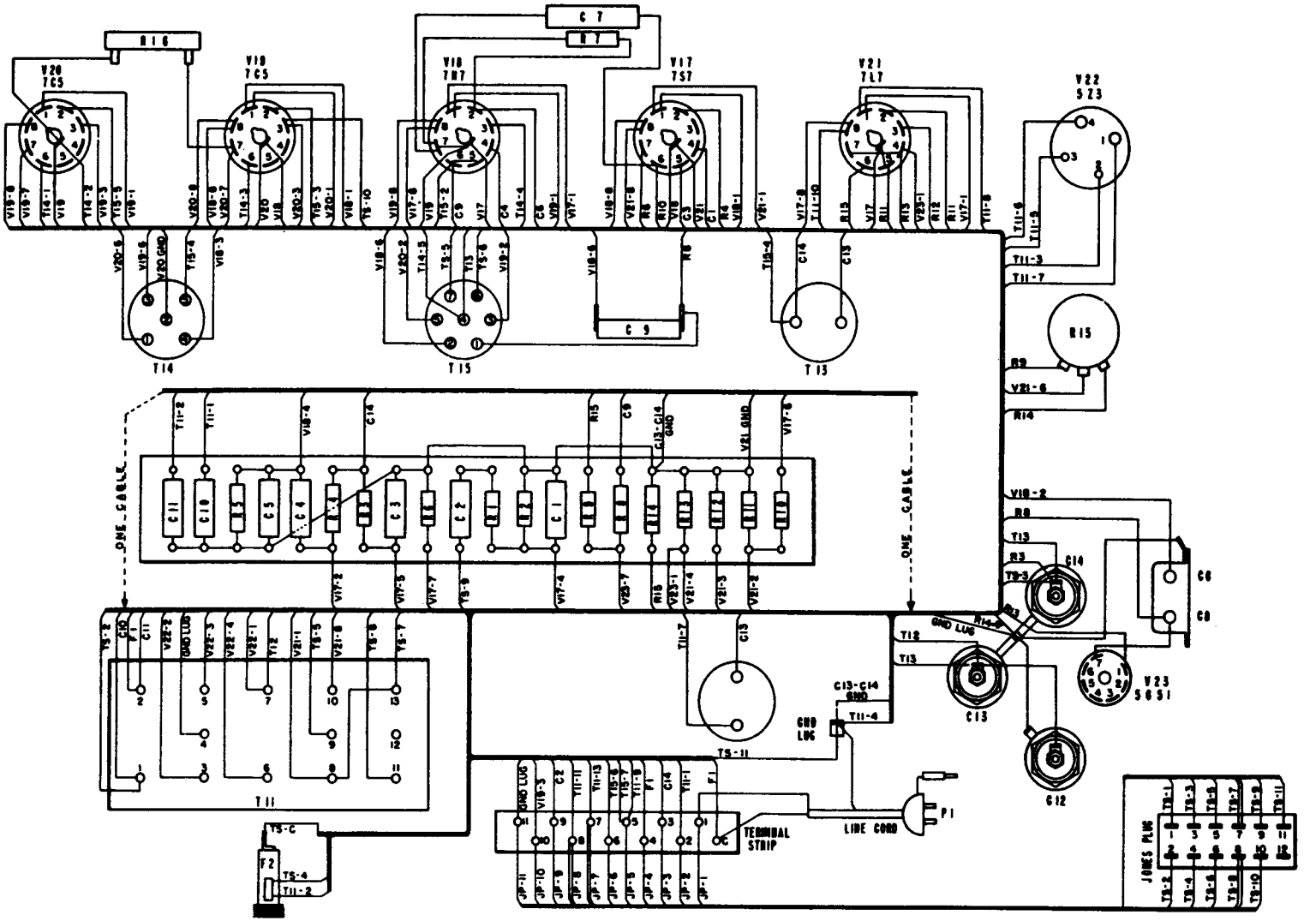


Figure 176. Rectifier Power Unit PP-86/TXC-1, wiring diagram.



TM 2250-C2-22

Figure 176. Rectifier Power Unit PP-86A/TXC-1, furnished on Order No. 6437-Phila-51, wiring diagram.

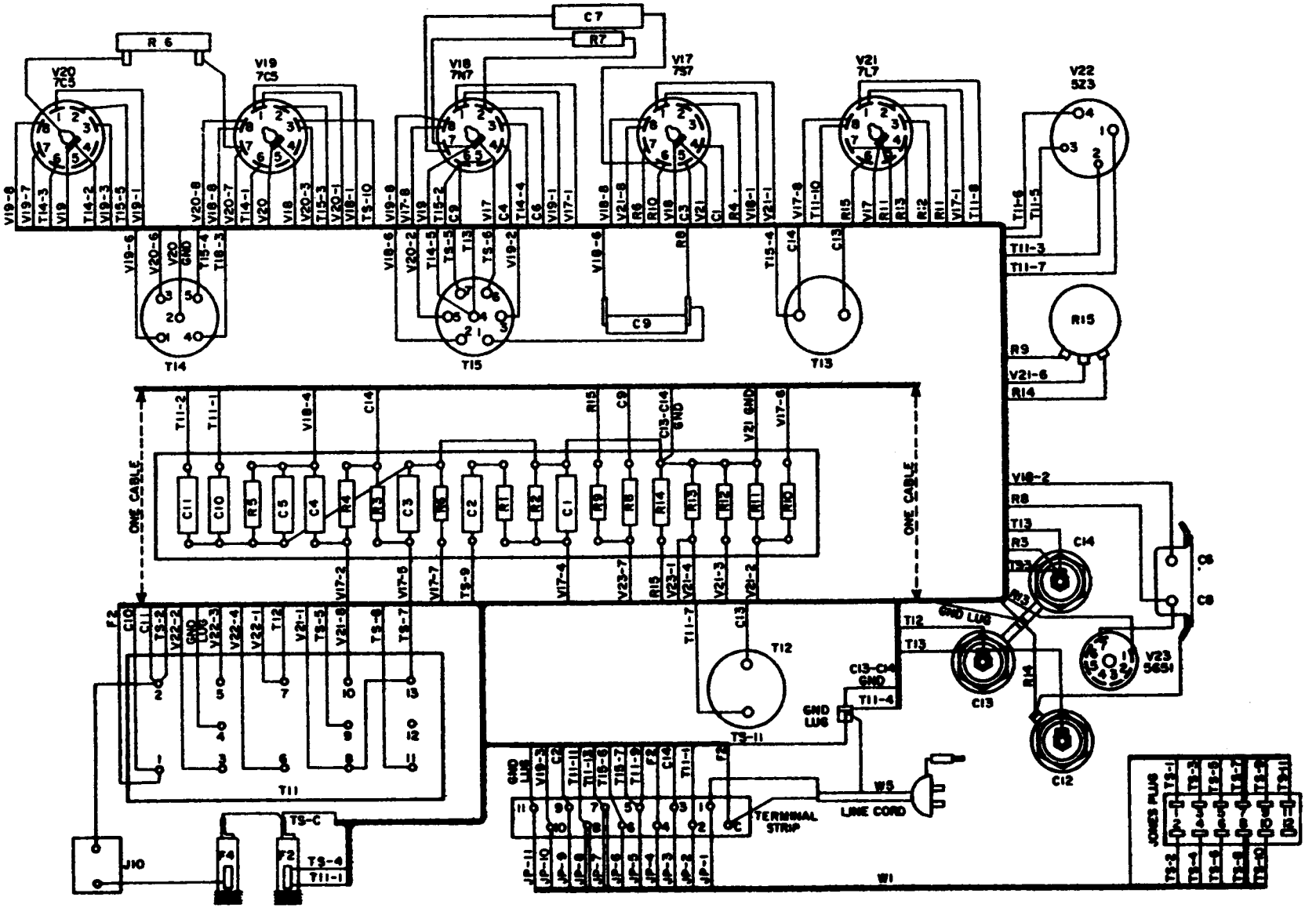


Figure 177. Rectifier Power Unit PP-86E/TXC-1, wiring diagram.

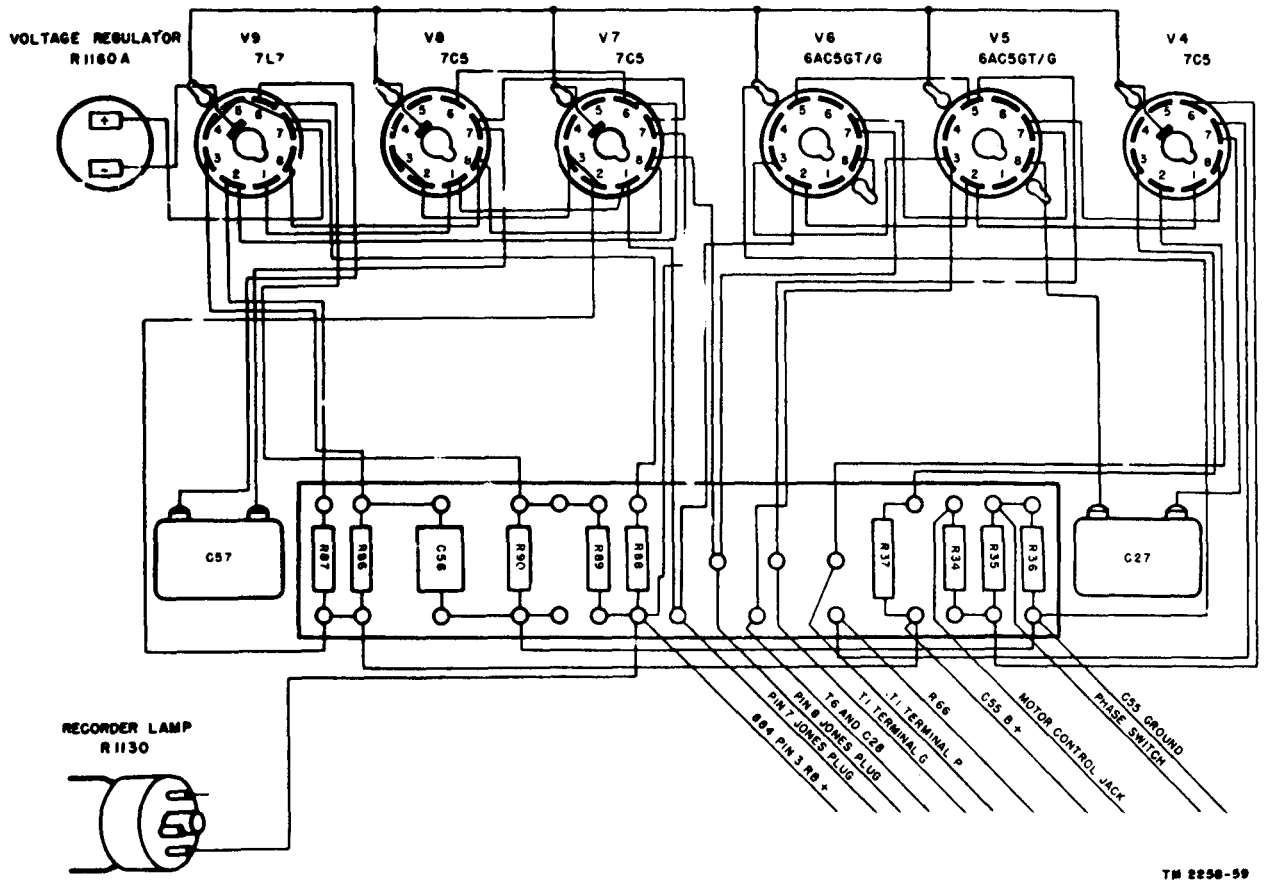
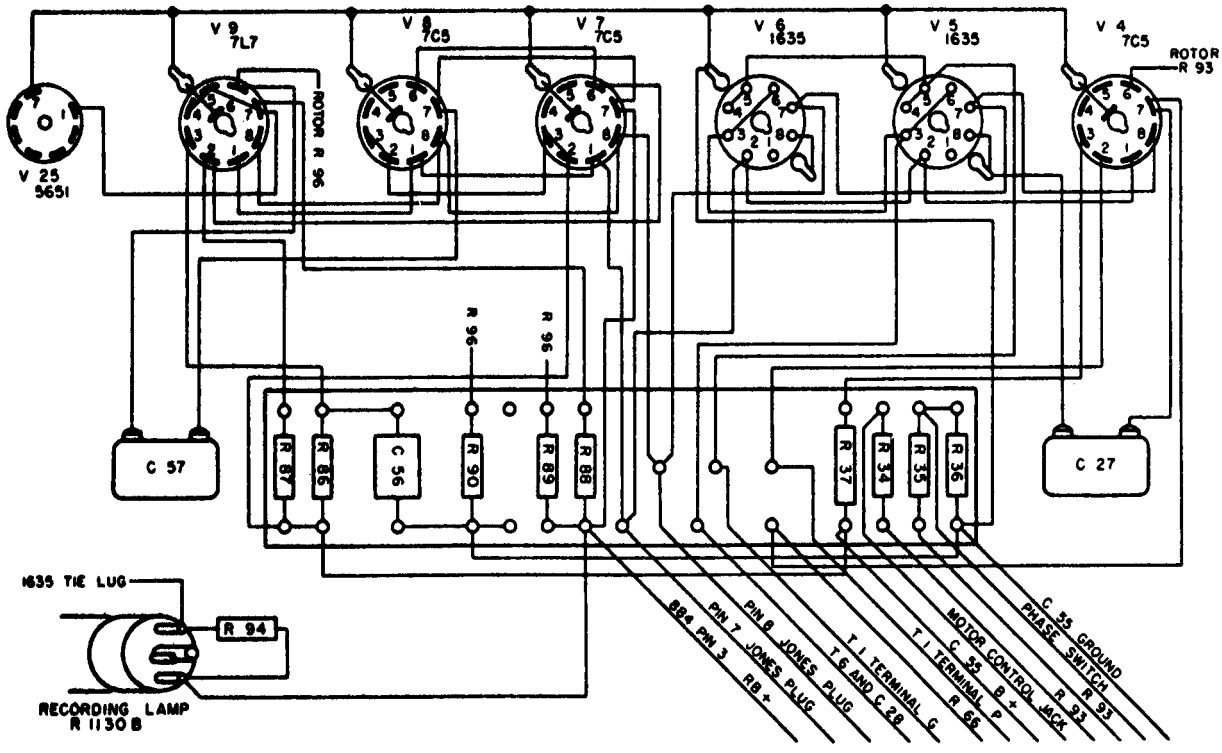


Figure 178. Facsimile Transceivers TT-1/TXC-1 and TT-1A/TXC-1, regulator panel wiring diagram.



TM 2256-60

Figure 179. Facsimile Transceivers TT-1B/TXC-1, TT-1C/TXC-1, TT-1D/TXC-1, and TT-1E/TXC-1, regulator panel wiring diagram.

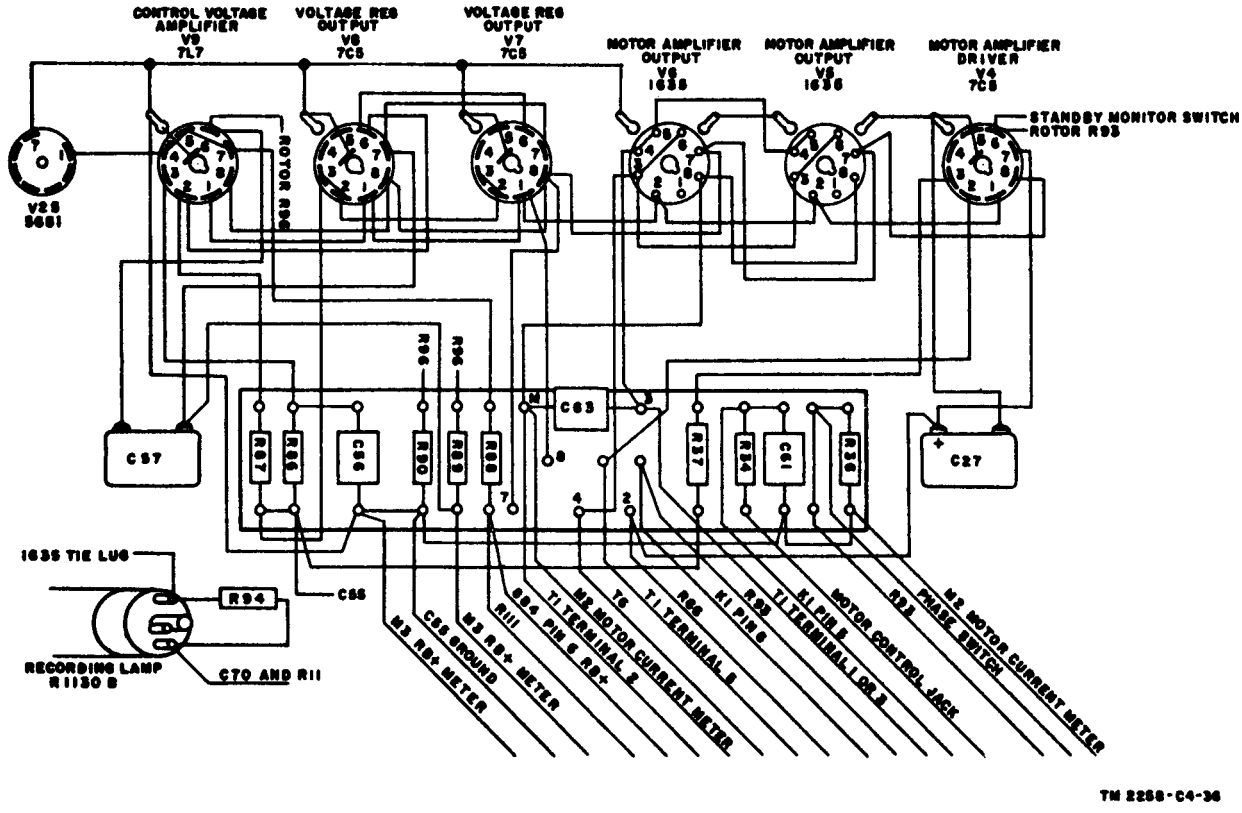


Figure 180. Facsimile Transceiver TT-1F/TXC-1, regulator panel wiring diagram.

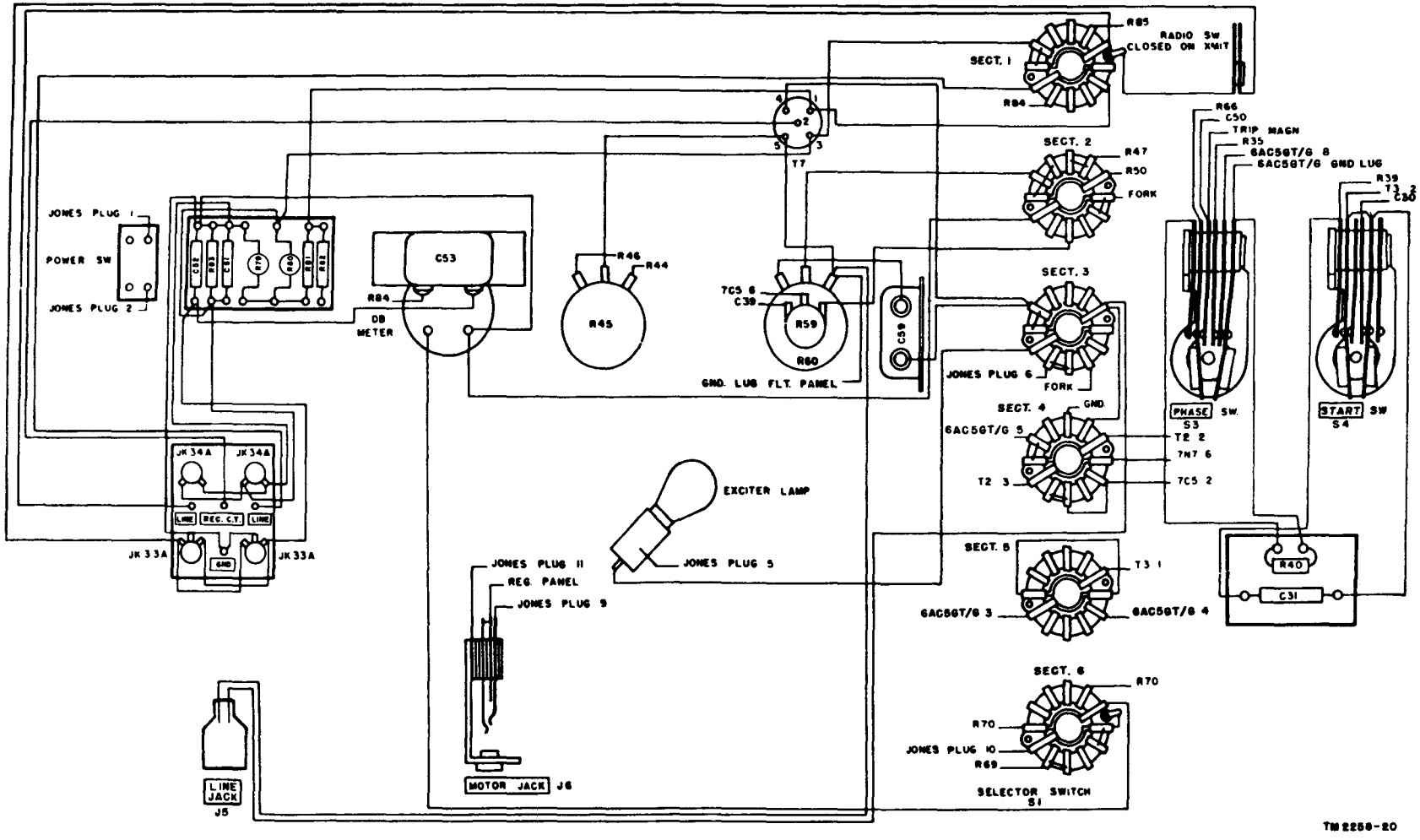


Figure 182. Facsimile Transceiver TT-1/TXC-1, front panel wiring diagram.

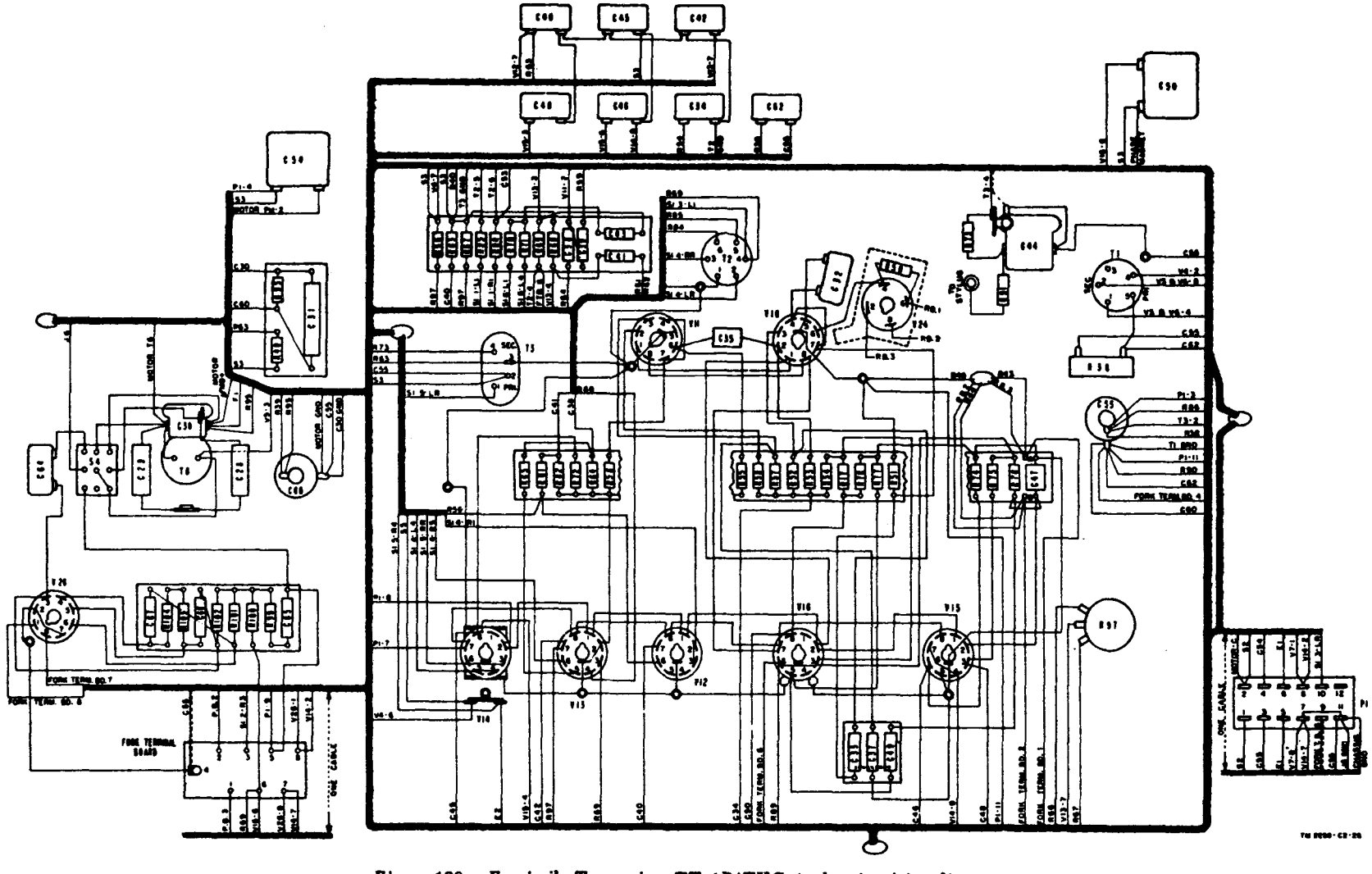


Figure 189. Facsimile Transceiver TT-1D/TXC-1, chassis wiring diagram.

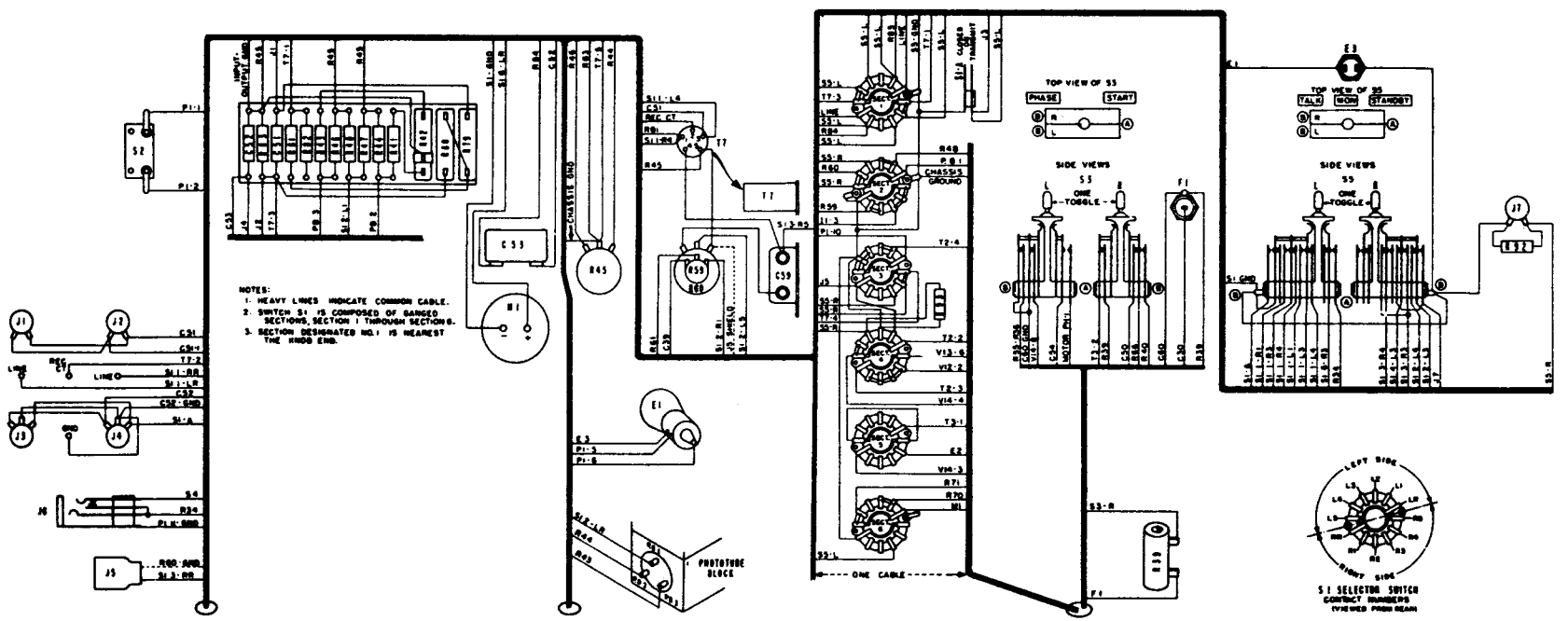


Figure 190. Facsimile Transceivers TT-1D/TXC-1 and TT-1E/TXC-1, front panel wiring diagram.

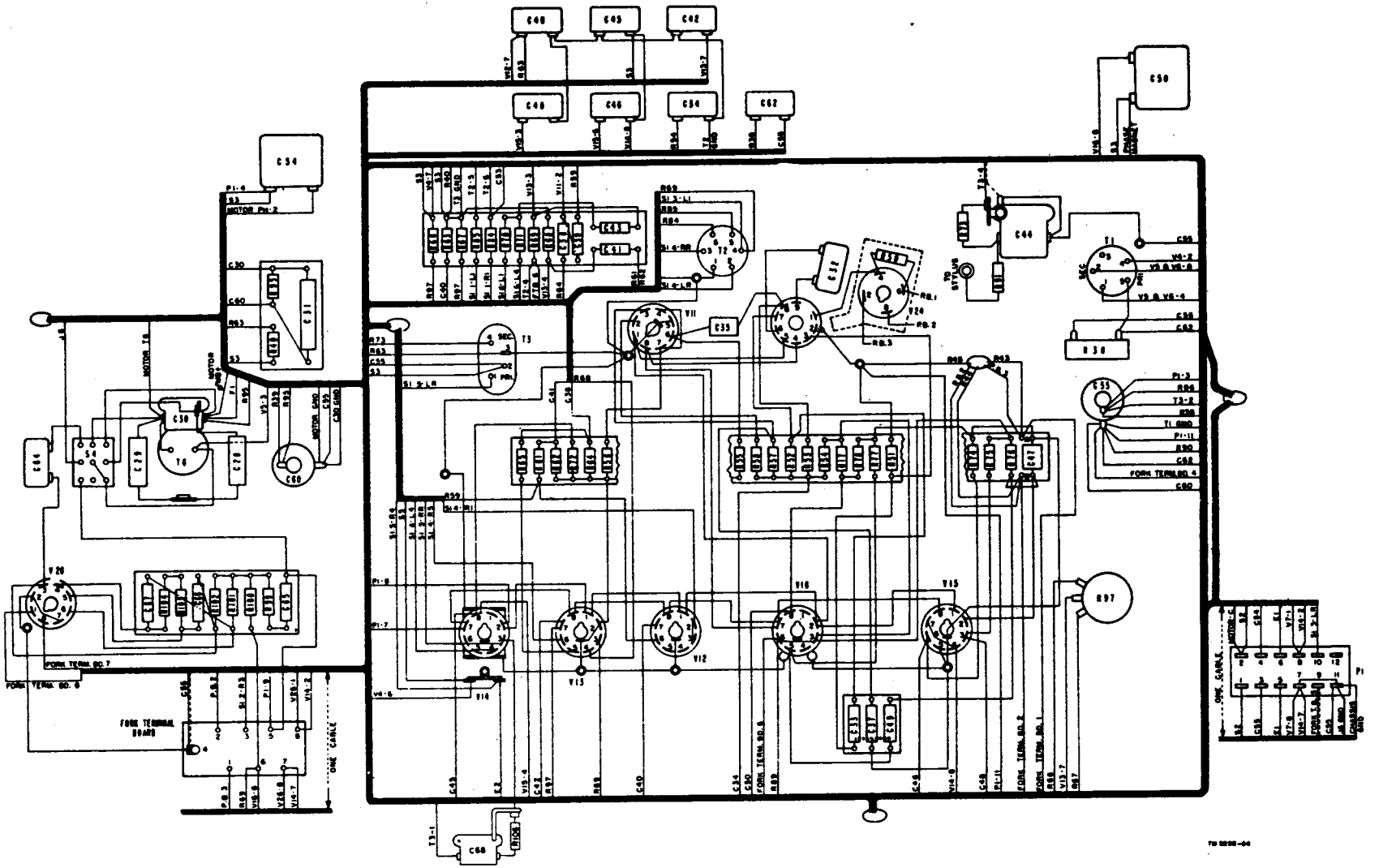
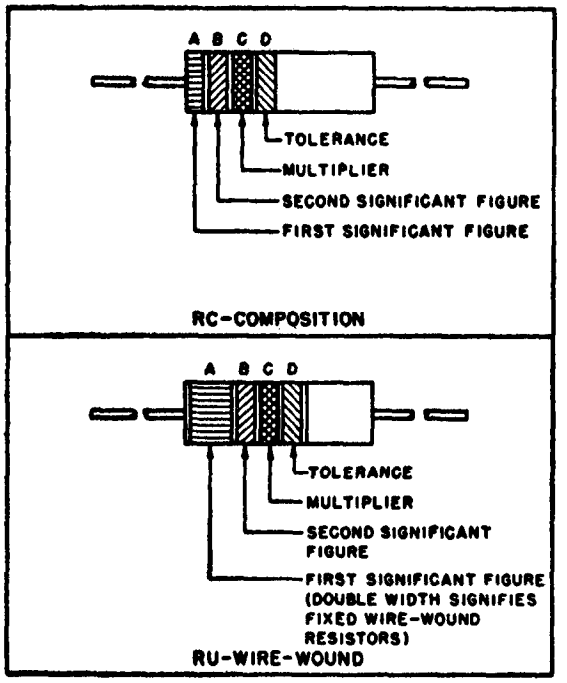


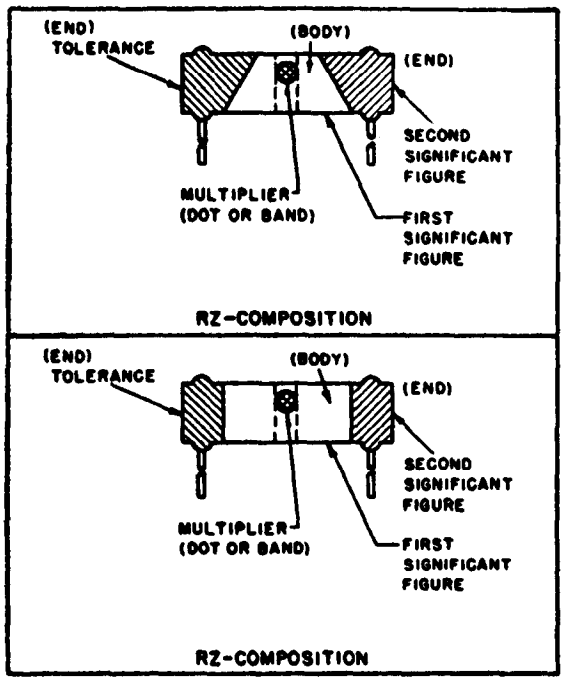
Figure 191. Facsimile Transceiver TT-1E/TXC-1, chassis wiring diagram.

RESISTOR COLOR CODE MARKING
(MIL-STD RESISTORS)

AXIAL-LEAD RESISTORS (INSULATED)



RADIAL-LEAD RESISTORS (UNINSULATED)



RESISTOR COLOR CODE

BAND A OR BODY*		BAND B OR END*		BAND C OR DOT OR BAND*		BAND D OR END*	
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)
BLACK	0	BLACK	0	BLACK	1	BODY	± 20
BROWN	1	BROWN	1	BROWN	10	SILVER	± 10
RED	2	RED	2	RED	100	GOLD	± 5
ORANGE	3	ORANGE	3	ORANGE	1,000		
YELLOW	4	YELLOW	4	YELLOW	10,000		
GREEN	5	GREEN	5	GREEN	100,000		
BLUE	6	BLUE	6	BLUE	1,000,000		
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7				
GRAY	8	GRAY	8	GOLD	0.1		
WHITE	9	WHITE	9	SILVER	0.01		

*FOR WIRE-WOUND-TYPE RESISTORS, BAND A SHALL BE DOUBLE-WIDTH. WHEN BODY COLOR IS THE SAME AS THE DOT (OR BAND) OR END COLOR, THE COLORS ARE DIFFERENTIATED BY SHADE, GLOSS, OR OTHER MEANS.

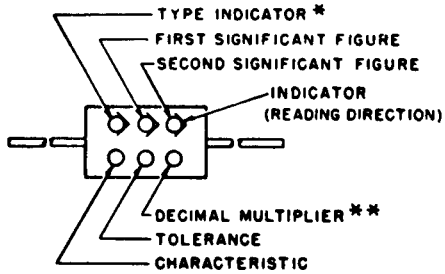
EXAMPLES (BAND MARKING):
10 OHMS ±20 PERCENT: BROWN BAND A; BLACK BAND B; BLACK BAND C; NO BAND D.
4.7 OHMS ±5 PERCENT: YELLOW BAND A; PURPLE BAND B; GOLD BAND C; GOLD BAND D.

EXAMPLES (BODY MARKING):
10 OHMS ±20 PERCENT: BROWN BODY; BLACK END; BLACK DOT OR BAND; BODY COLOR ON TOLERANCE END.
3,000 OHMS ±10 PERCENT: ORANGE BODY; BLACK END; RED DOT OR BAND; SILVER END.

STD-RI

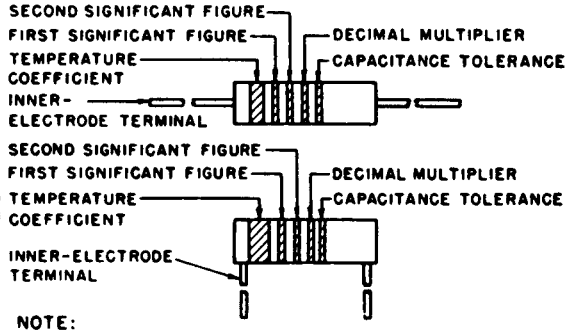
Figure 194. Resistor color code marking.

CAPACITOR COLOR CODE MARKING
(MIL-STD CAPACITORS)



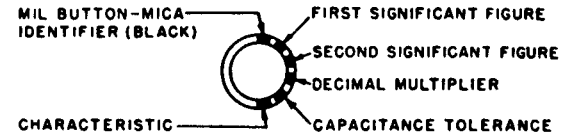
* BLACK DOT: MICA DIELECTRIC
SILVER DOT: PAPER DIELECTRIC
**INDICATES NUMBER OF ZEROS ON PAPER TYPE.

MICA (CM) AND PAPER (CN)

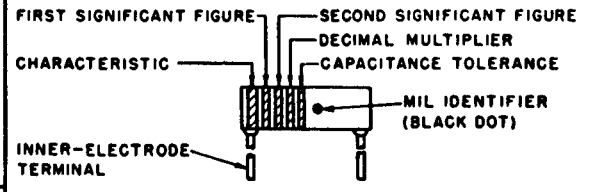


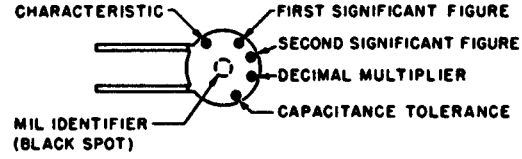
NOTE:
SPOTS MAY BE USED INSTEAD OF BANDS; TEMPERATURE COEFFICIENT MARKING IS LARGER.

CERAMIC-TEMPERATURE COMPENSATING (CC)



BUTTON-MICA (CB)





NOTES:
1. SPOTS MAY BE USED ON TUBULAR CAPACITORS; CHARACTERISTIC SPOT IS LARGER AND MIL IDENTIFIER IS ON SIDE DIAMETRICALLY OPPOSITE COLOR SPOTS.
2. MIL IDENTIFIER OF DISK TYPE IS ON REVERSE SIDE; CHARACTERISTIC SPOT IS LARGER OR SPACE BETWEEN CHARACTERISTIC AND TOLERANCE SPOTS IS THREE TIMES SPACE BETWEEN ADJACENT SPOTS.
3. TOLERANCE: YELLOW, +100%, -20%.

CERAMIC-GENERAL PURPOSE (CK)

CAPACITOR COLOR CODE

COLOR	SIG FIG.	MULTIPLIER		CHARACTERISTIC[1]				TOLERANCE [2]					TEMPERATURE COEFFICIENT (UUF/UF/°C)
		DECIMAL	NUMBER OF ZEROS	CM	CN	CB	CK	CM	CN	CB	CC		
											OVER 10UUF	10UUF OR LESS	CC
BLACK	0	1	NONE		A			20	20	20	20	2	ZERO
BROWN	1	10	1	B	E	B	W				1		-30
RED	2	100	2	C	H		X	2		2	2		-80
ORANGE	3	1,000	3	D	J	D			30				-150
YELLOW	4	10,000	4	E	P								-220
GREEN	5		5	F	R						5	0.5	-330
BLUE	6		6		S								-470
PURPLE (VIOLET)	7		7		T	W							-750
GRAY	8		8			X						0.25	+30
WHITE	9		9								10	1	-330(±500) [3]
GOLD		0.1						5		5			+100
SILVER		0.01						10	10	10			

1. LETTERS ARE IN TYPE DESIGNATIONS GIVEN IN MIL-C SPECIFICATIONS.
2. IN PERCENT, EXCEPT IN UUF FOR CC-TYPE CAPACITORS OF 10 UUF OR LESS.
3. INTENDED FOR USE IN CIRCUITS NOT REQUIRING COMPENSATION.

STD-CI

Figure 195. Capacitor color code marking.

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For explanation of abbreviations used, see SR 320-50-1.

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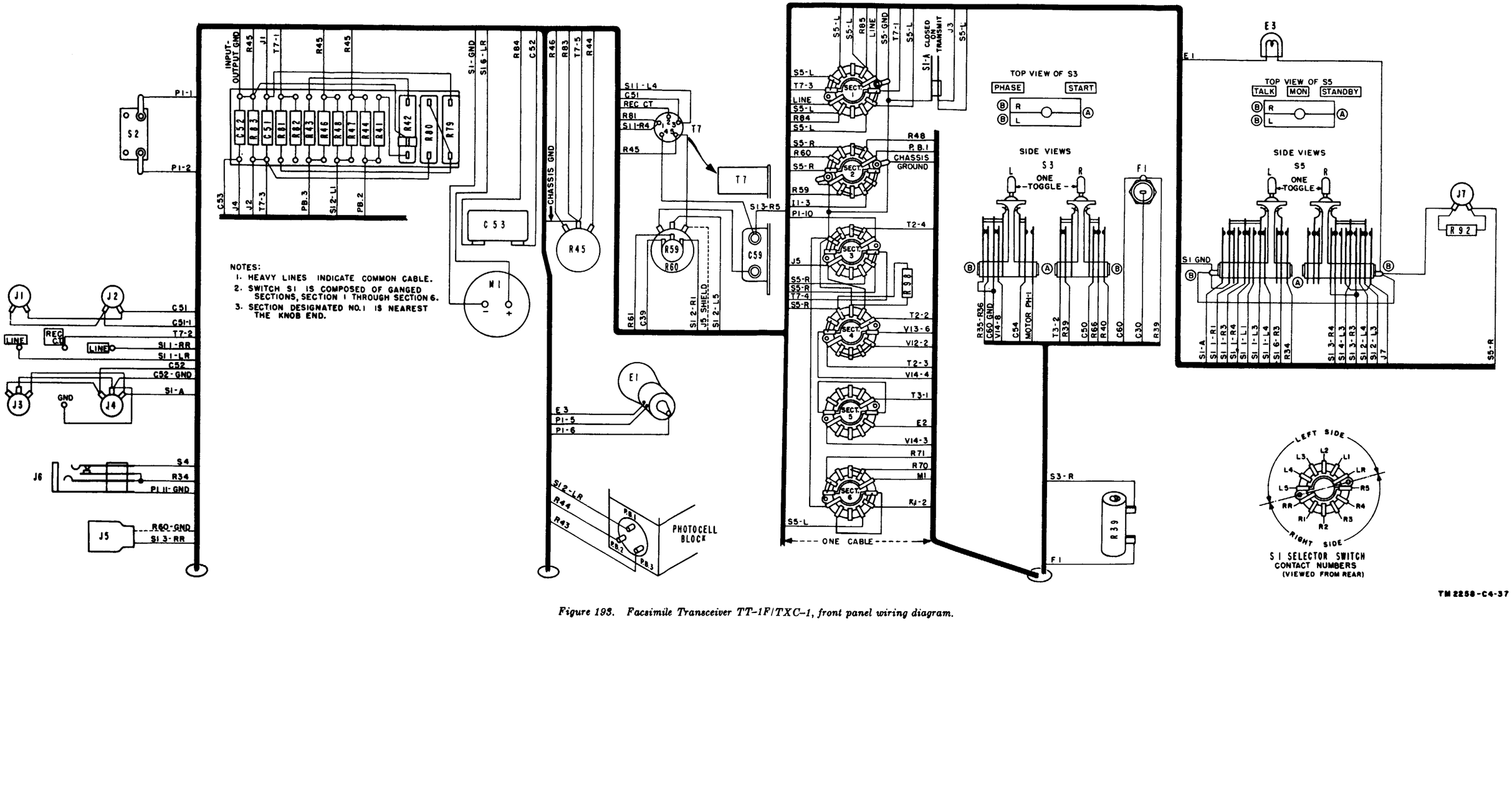


Figure 193. Facsimile Transceiver TT-1F/TXC-1, front panel wiring diagram.

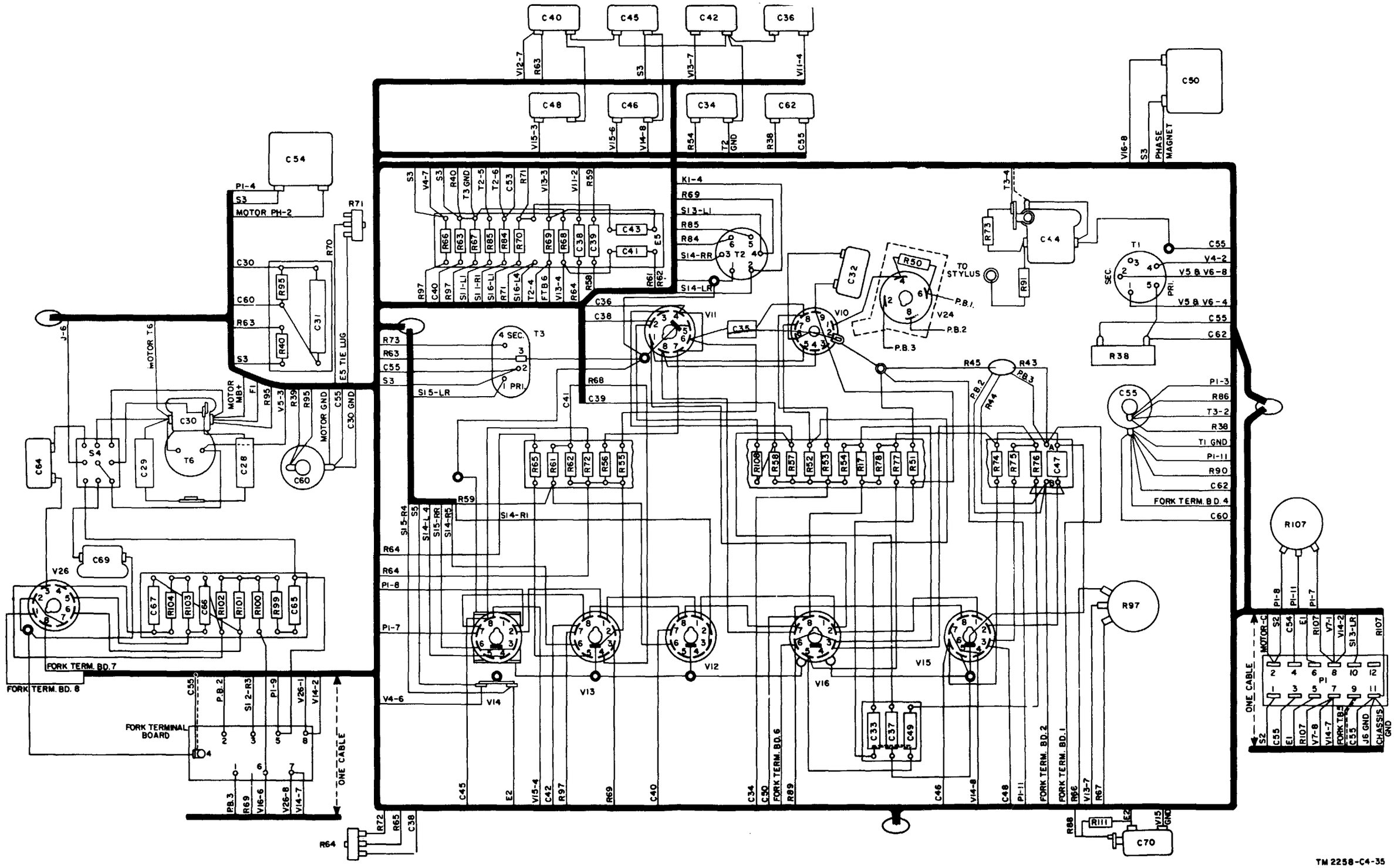


Figure 192. Facsimile Transceiver TT-1F/TXC-1, chassis wiring diagram.

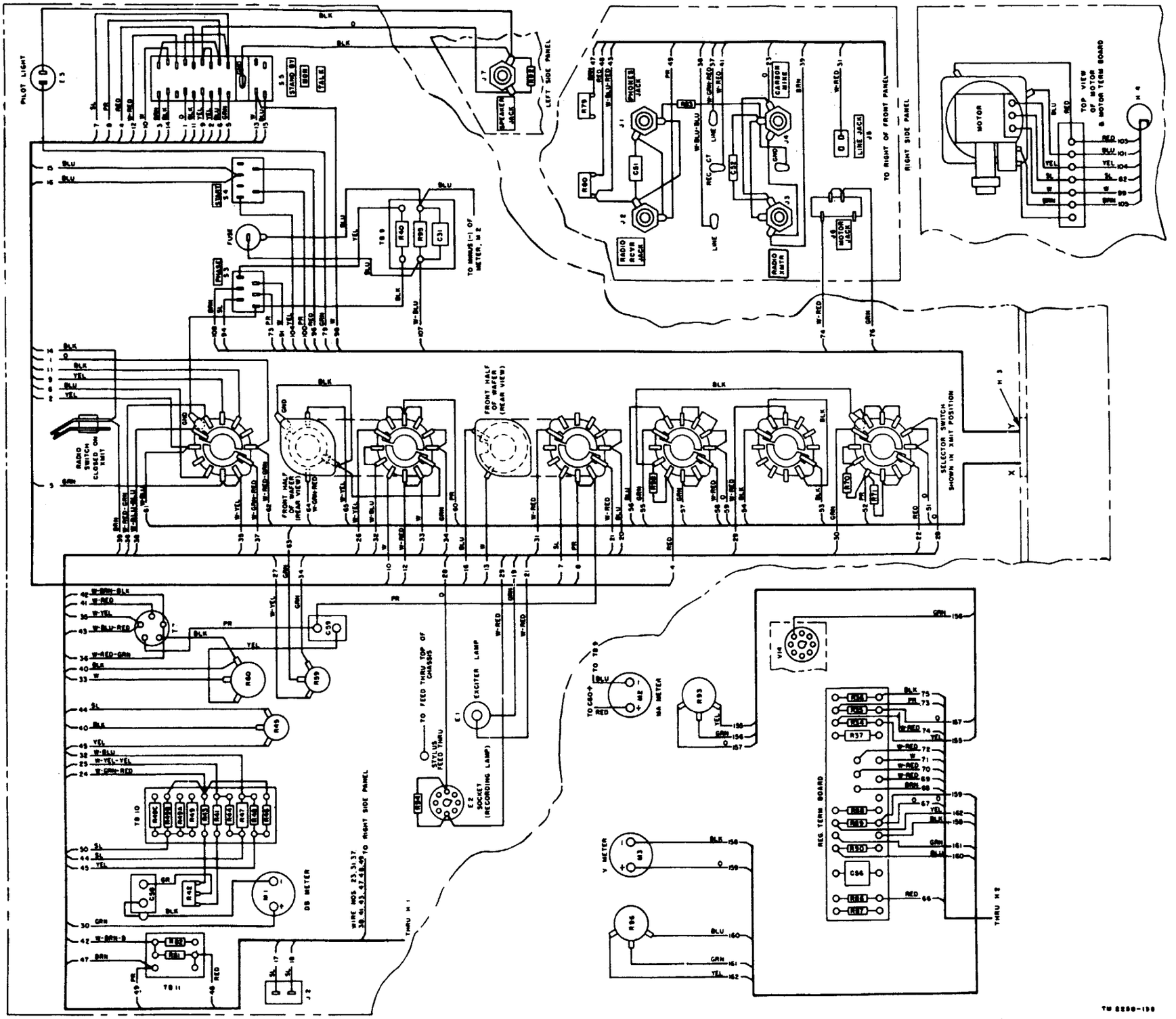


Figure 188. Facsimile Transceiver TT-1C/TXC-1, wiring diagram, showing selector switch.

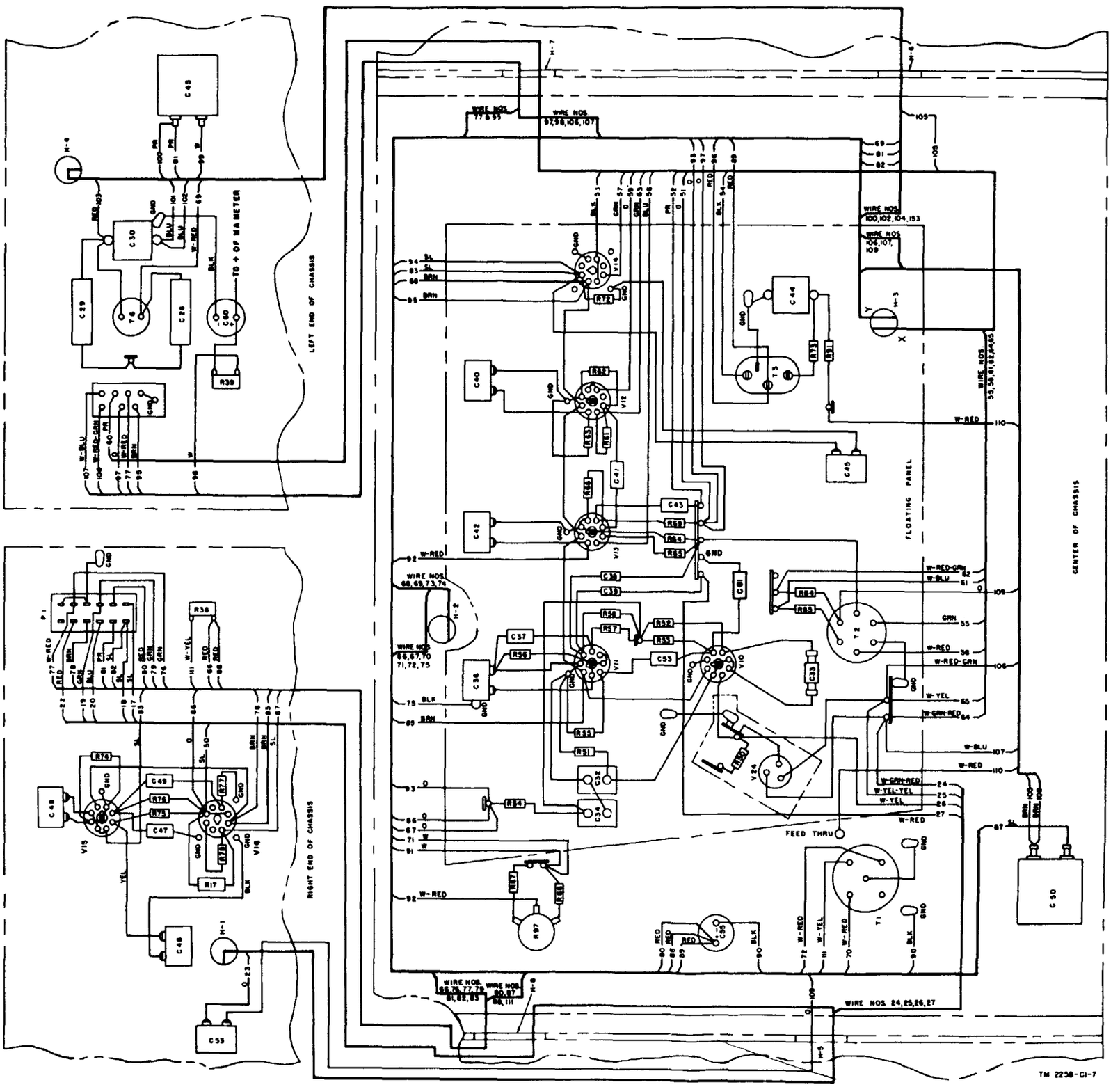


Figure 187. Facsimile Transceiver TT-1C/TXC-1, chassis wiring diagram.

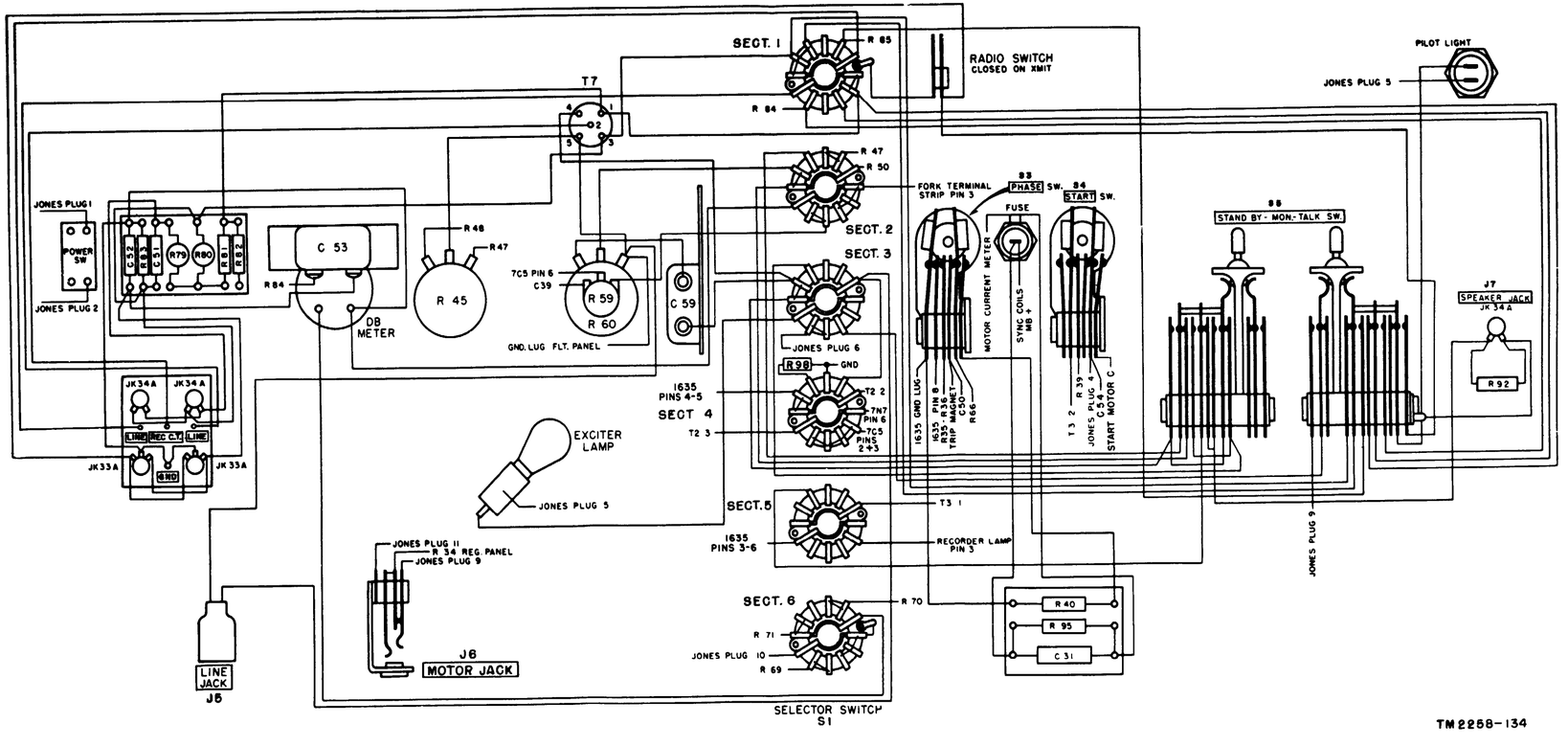


Figure 186. Facsimile Transceiver TT-1B/TXC-1, front panel wiring diagram.

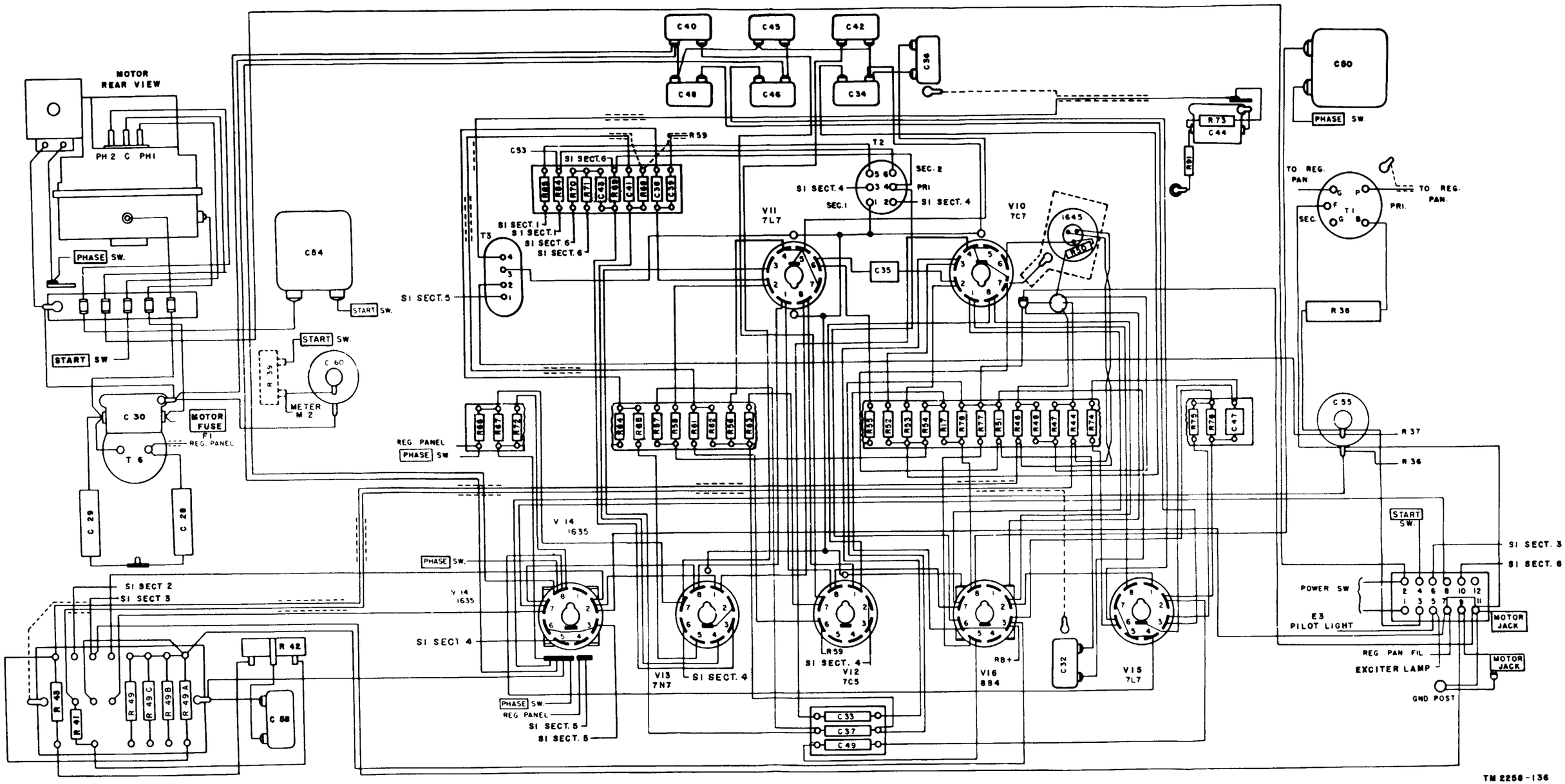


Figure 185. Facsimile Transceiver TT-1B/TXC-1, chassis wiring diagram.

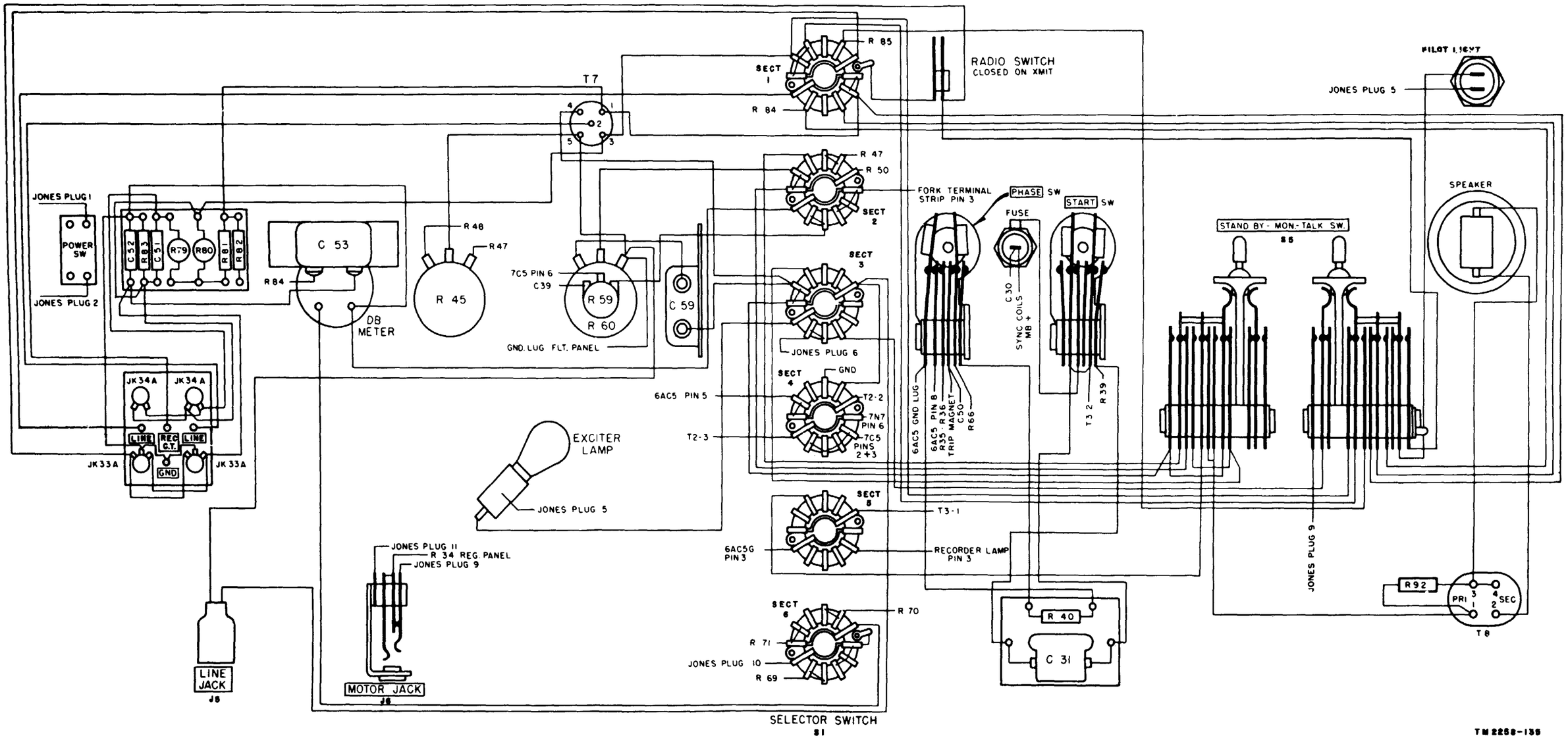


Figure 184. Facsimile Transceiver TT-1A/TXC-1, front panel wiring diagram.

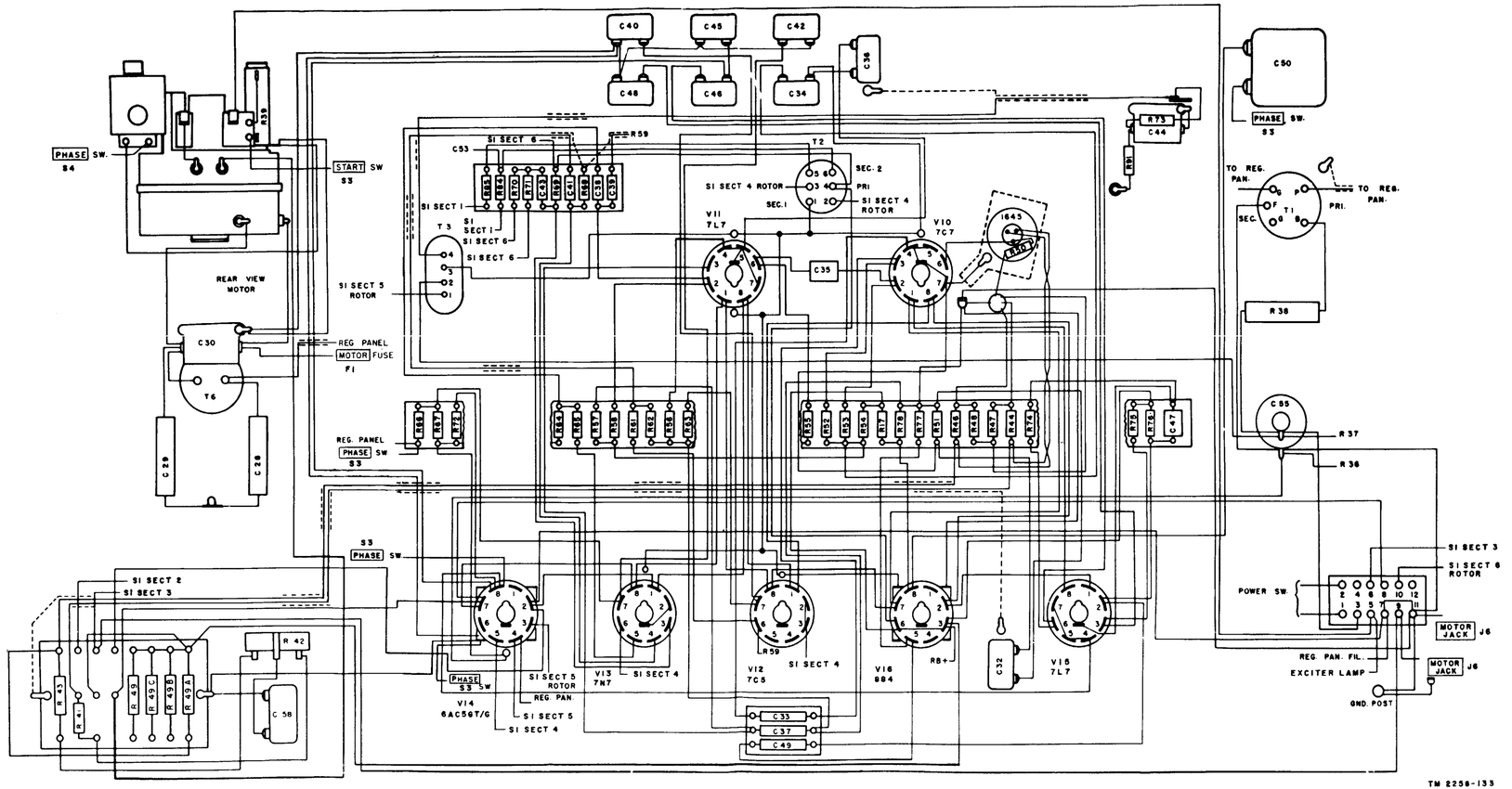


Figure 183. Facsimile Transceiver TT-1A/TXC-1, chassis wiring diagram.

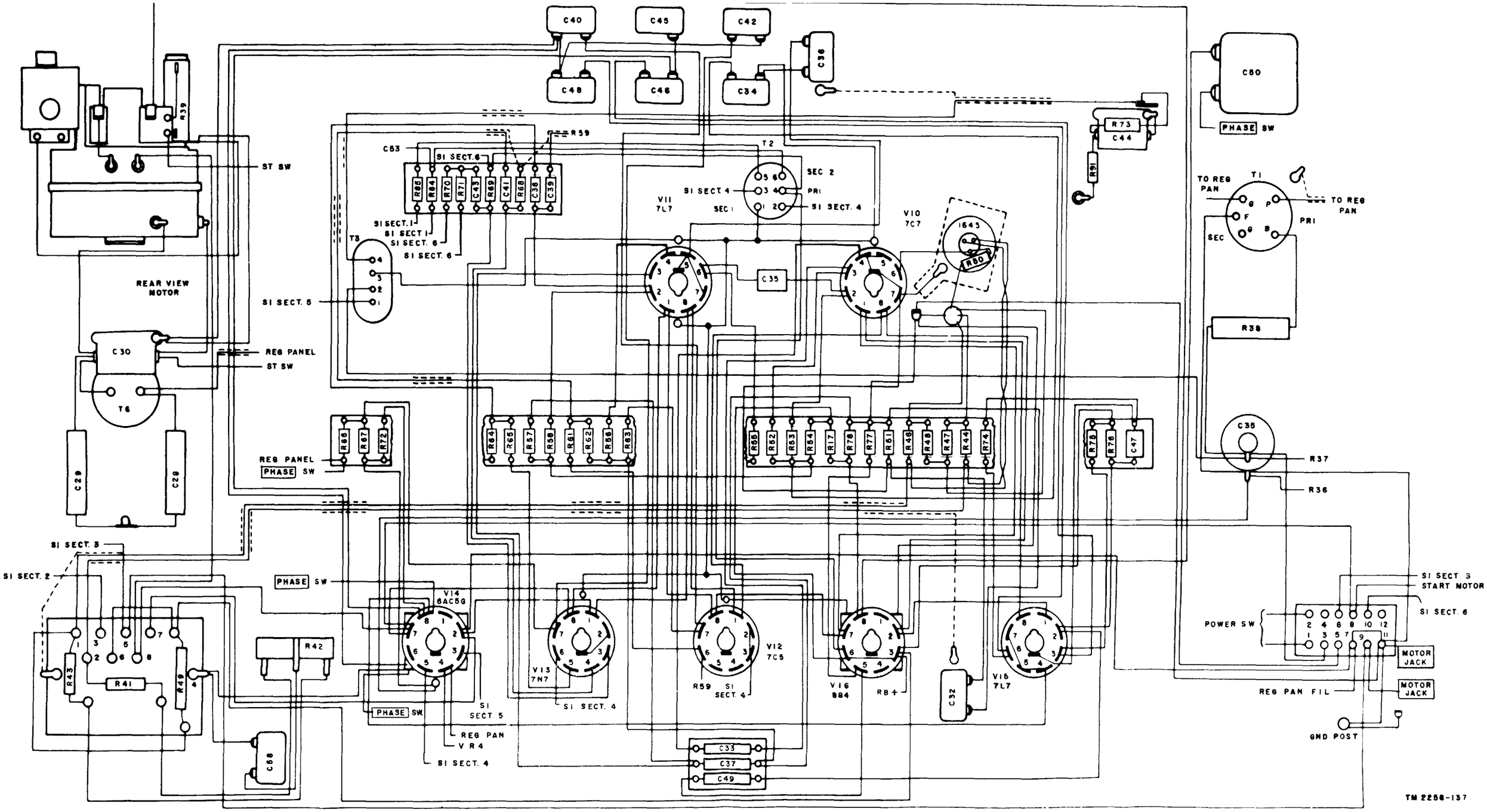


Figure 181. Facsimile Transceiver TT-1/TXC-1, chassis wiring diagram.

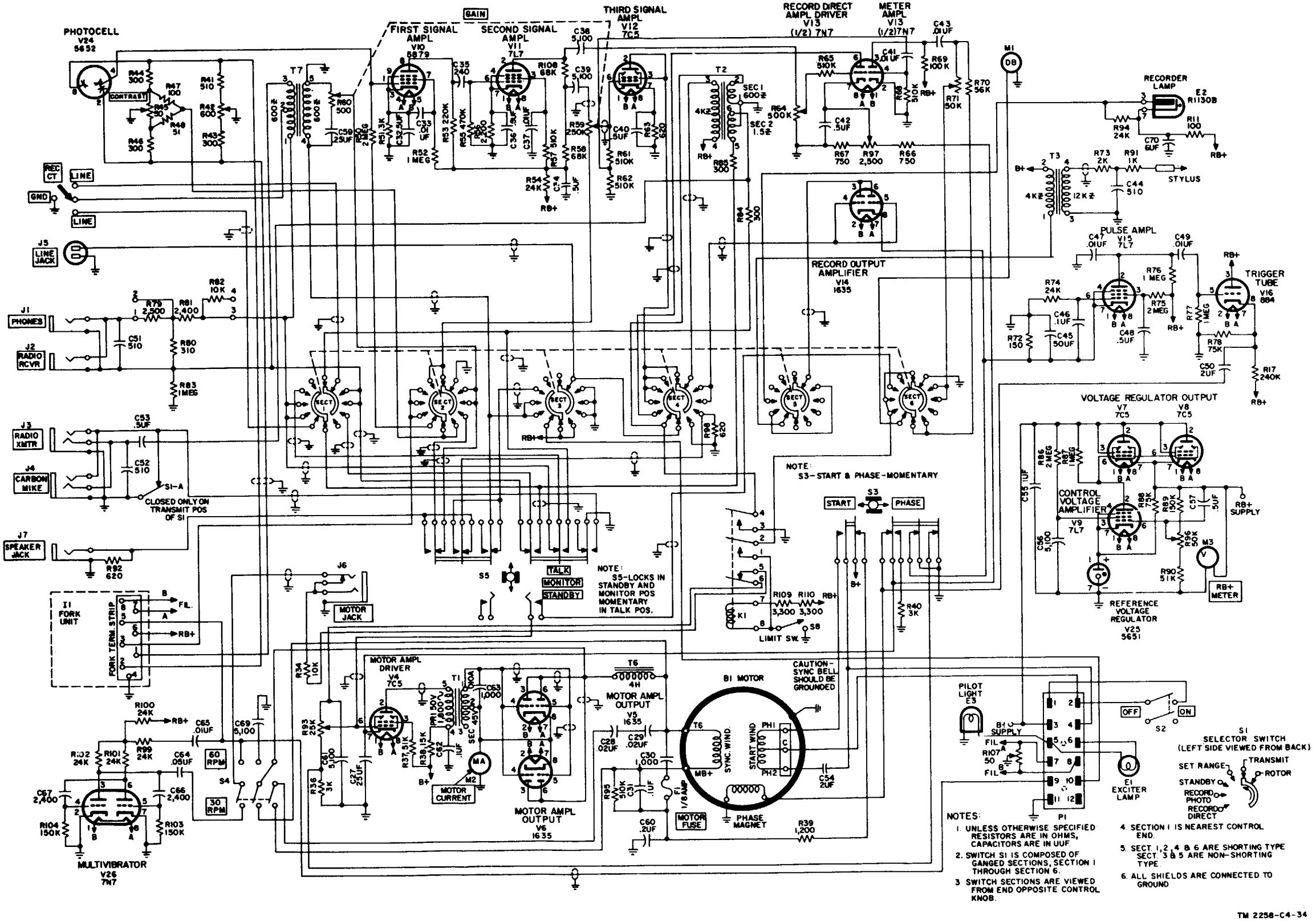


Figure 171. Facsimile Transceiver TT-1F/TXC-1, schematic diagram.

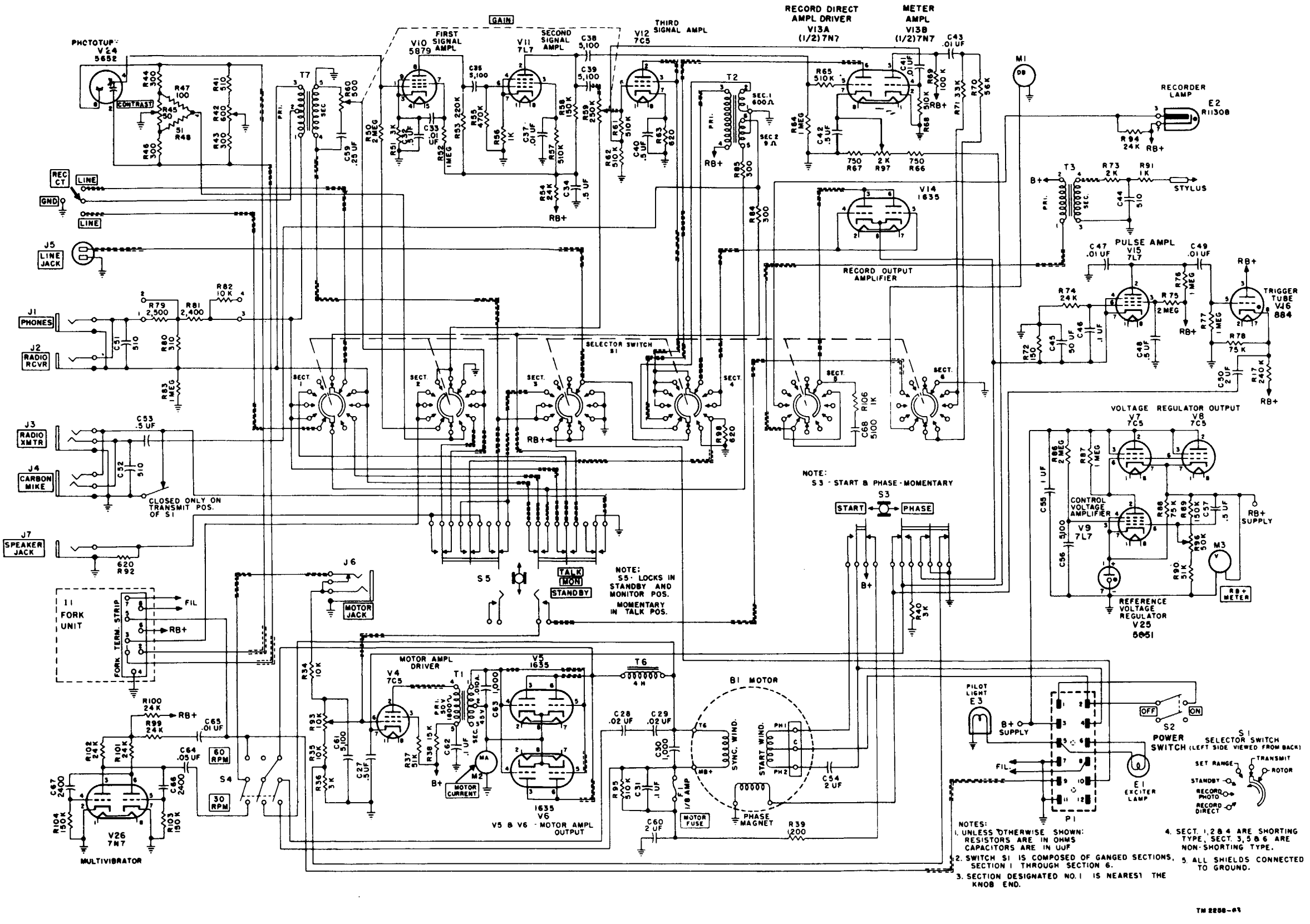


Figure 169. Facsimile Transceiver TT-1E/TXC-1, schematic diagram.

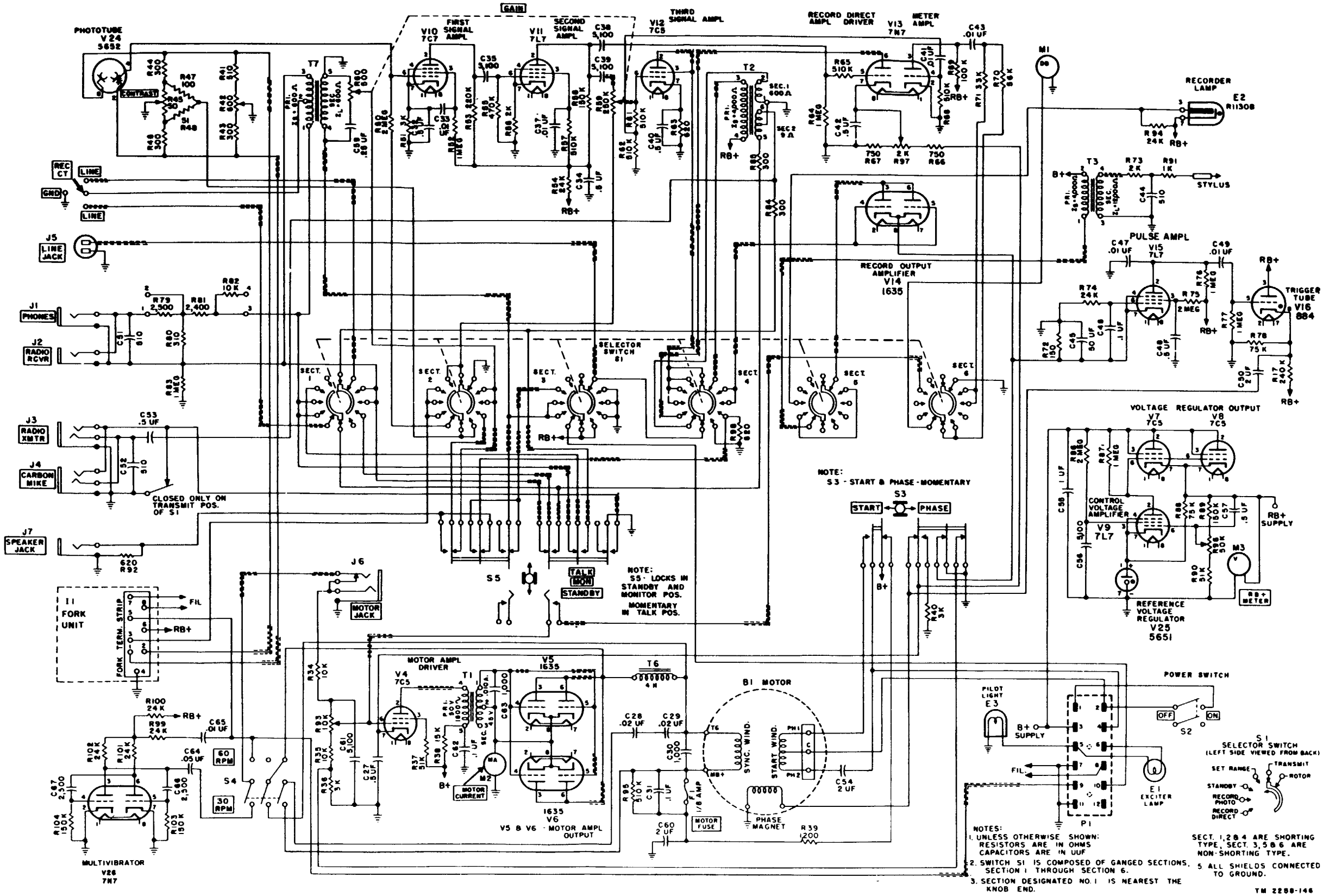


Figure 168. Facsimile Transceiver TT-1D/TXC-1, schematic diagram.

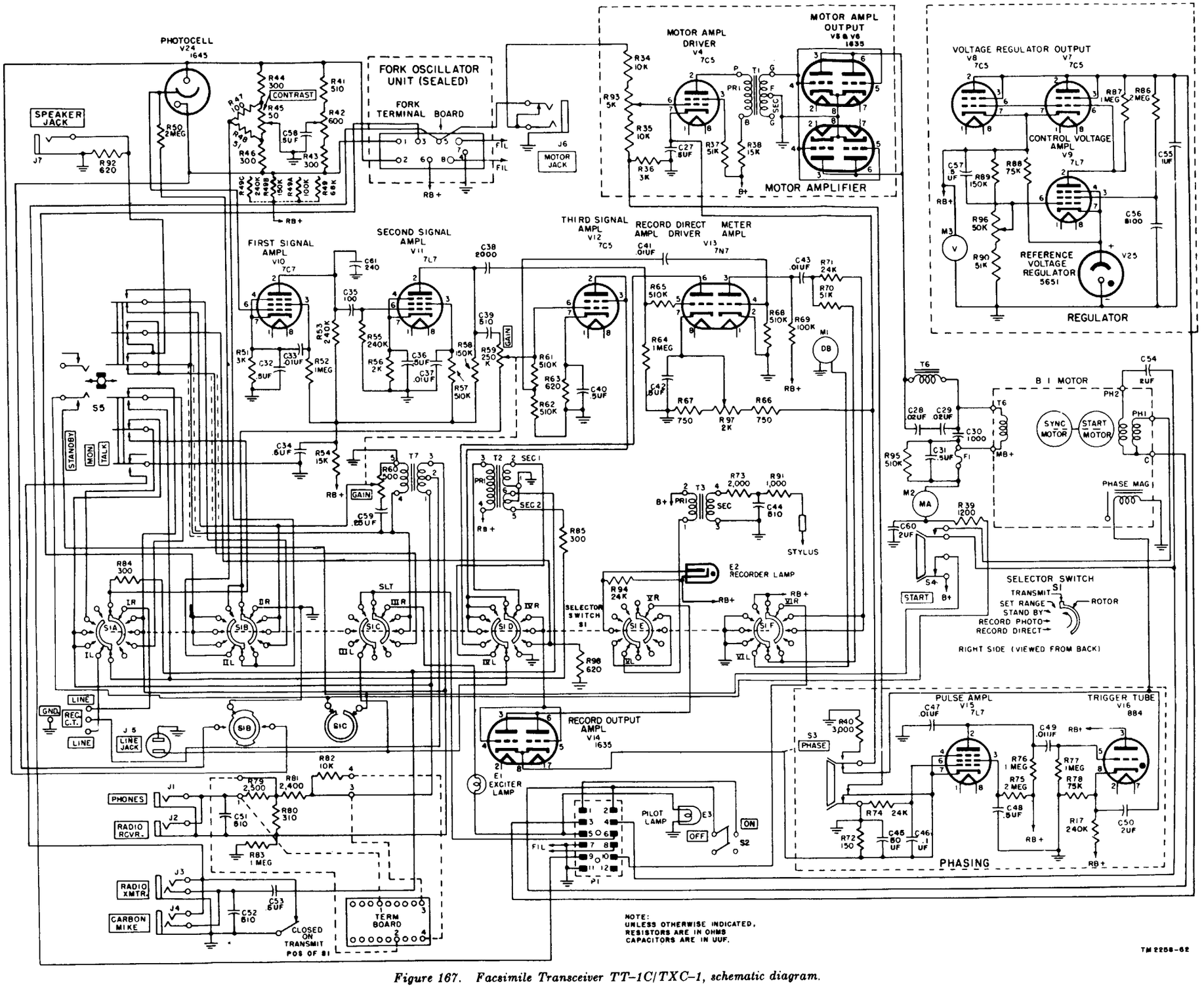


Figure 167. Facsimile Transceiver TT–1C/TXC–1, schematic diagram.

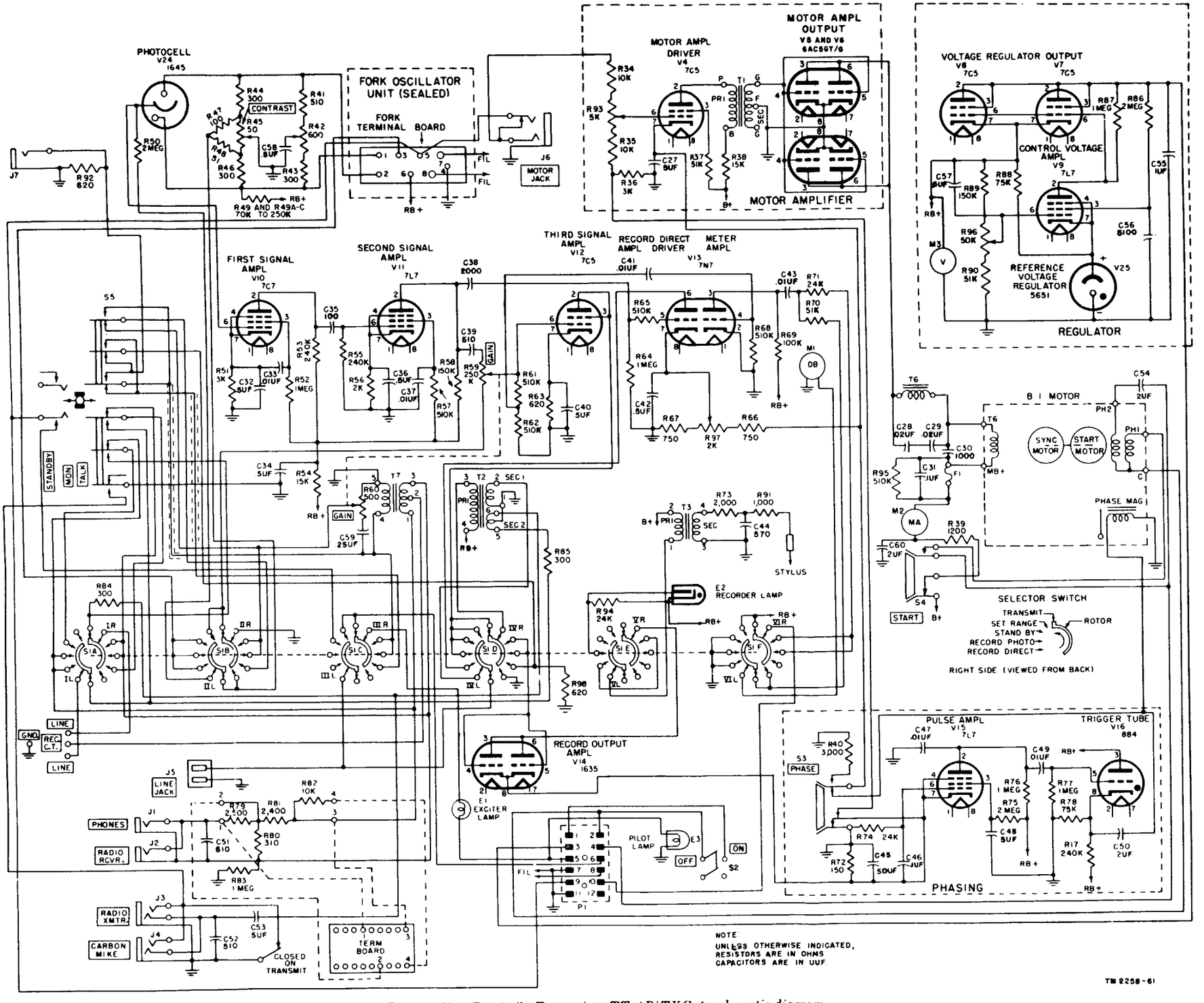


Figure 166. Facsimile Transceiver TT-1B/TXC-1, schematic diagram.

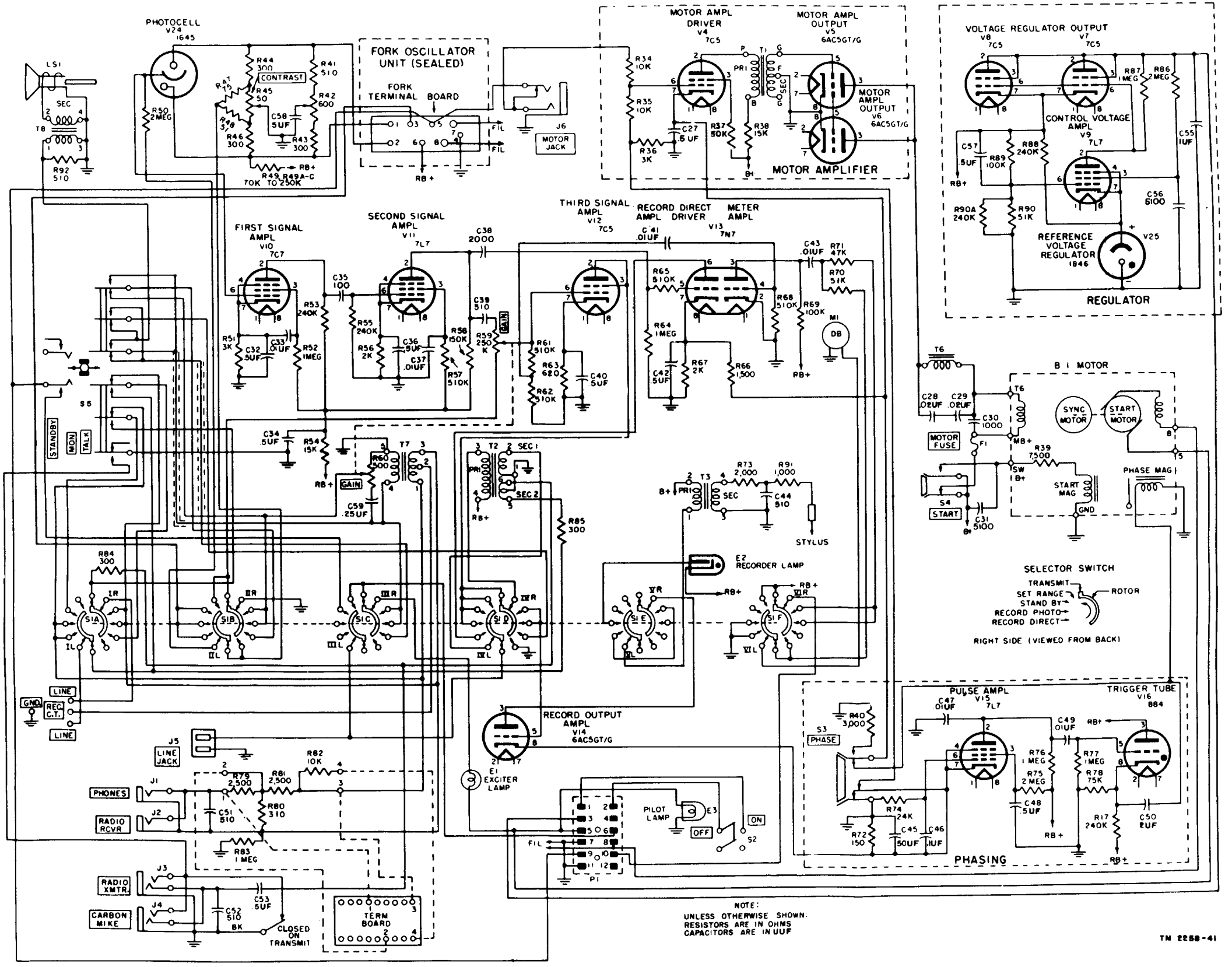


Figure 164. Facsimile Transceiver TT–1A/TXC–1, schematic diagram

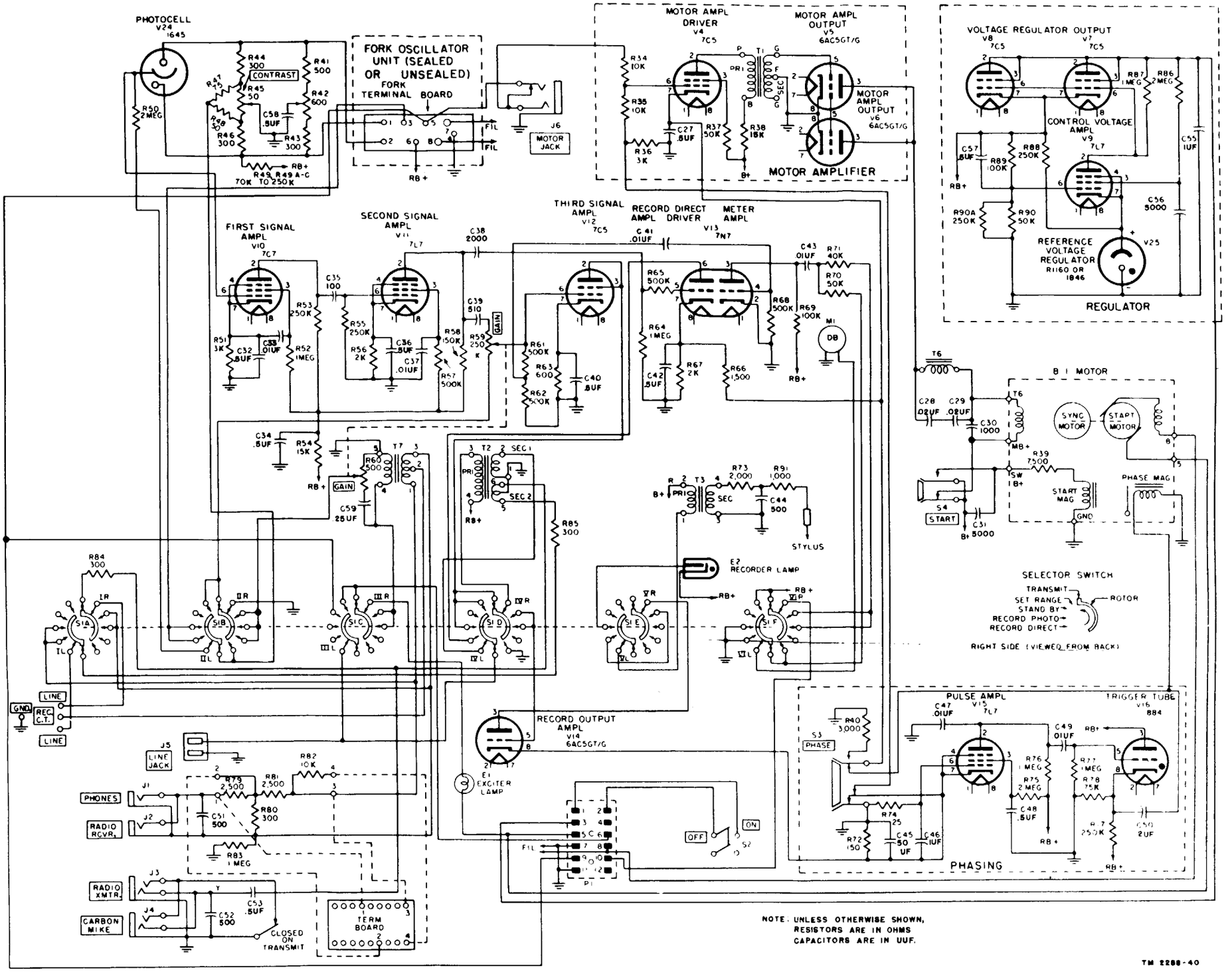
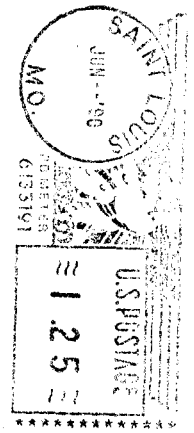


Figure 163. Facsimile Transceiver TT-1/TXC-1, schematic diagram.



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