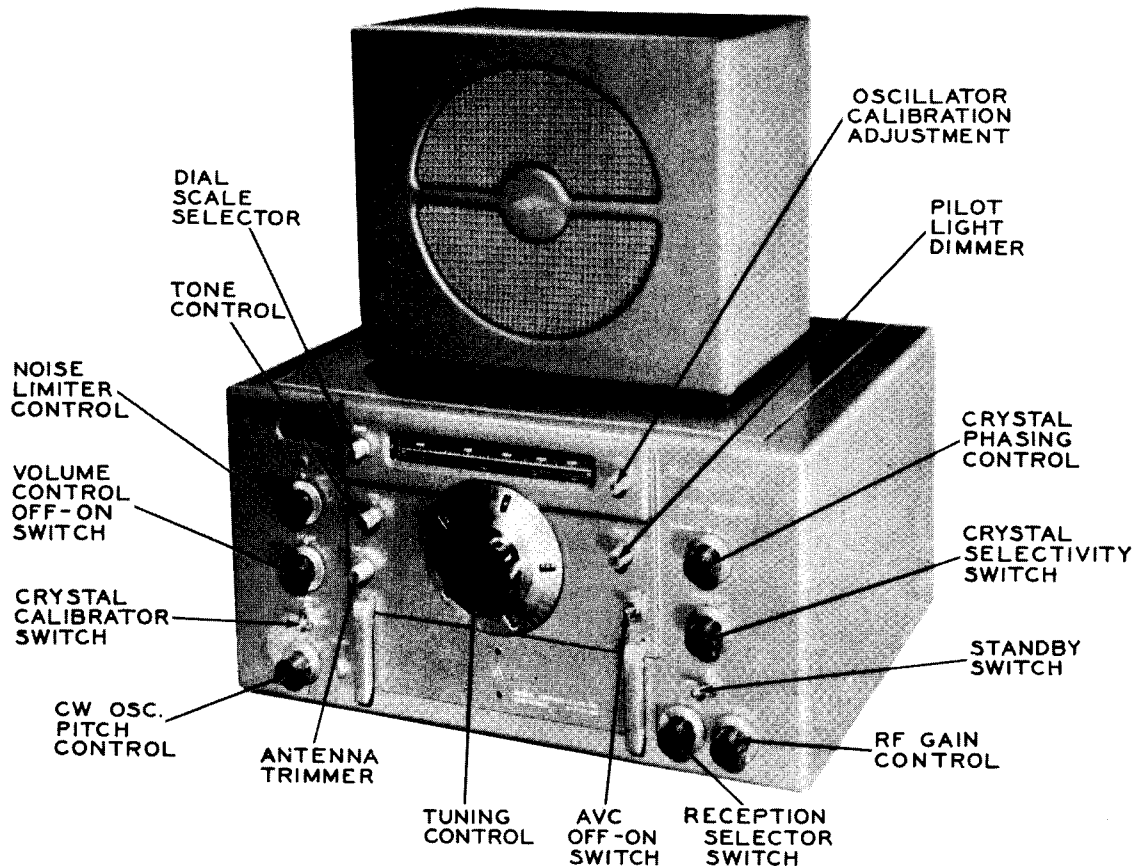




NATIONAL
MODELS HRO-50R1, HRO-50T1



NATIONAL
MODELS HRO-50R1, HRO-50T1

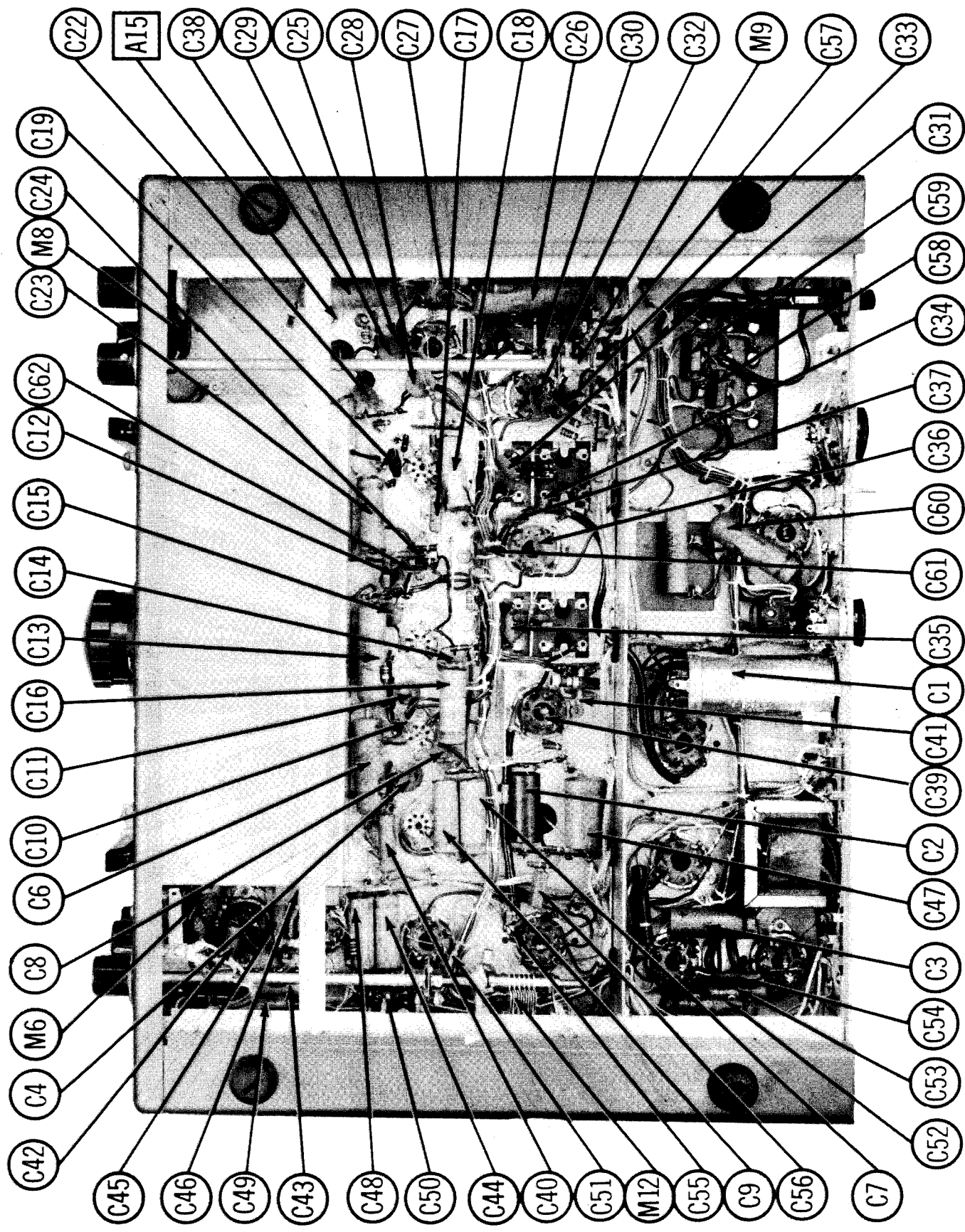
TRADE NAME	National Models HRO-R1 (Rack), HRO-T1 (Table)		
MANUFACTURER	National Co., Inc., 61 Sherman St., Malden 48, Mass.		
TYPE SET	AC Operated Multi-Band Communications Receiver		
TUBES	Sixteen		
POWER SUPPLY	110-120 Volts AC	RATING	.880 Amp. @ 117 Volts AC
TUNING RANGES	Coil Set	Range	Coil Set
	A	14.0 - 30.0 MC	G
	B	7.0 - 14.4 MC	H
	C	3.5 - 7.3 MC	J
	D	1.7 - 4.0 MC	AA
	E	.900 - 2050 KC	AB
	F	480-960 KC	AC
			180 - 430 KC
			100 - 200 KC
			50 - 100 KC
			27.5 - 30 MC
			25 - 35 MC
			21.0 - 21.5 MC

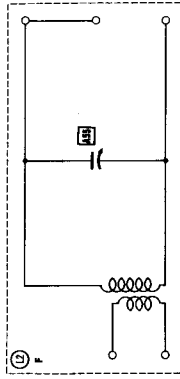
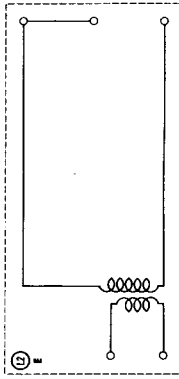
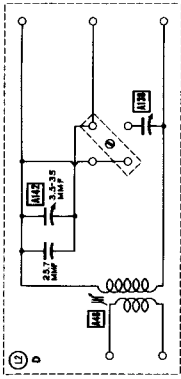
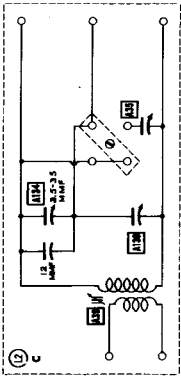
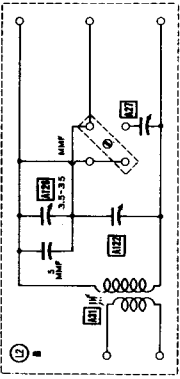
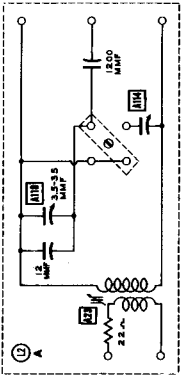
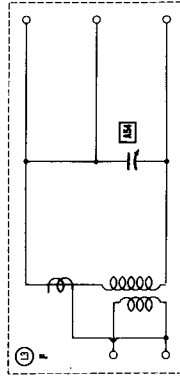
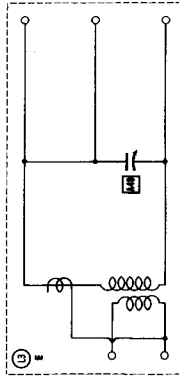
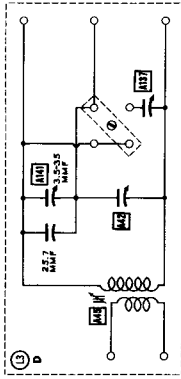
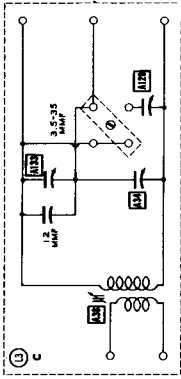
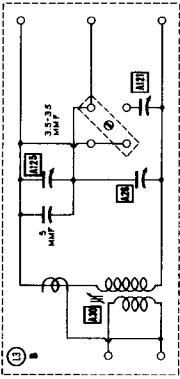
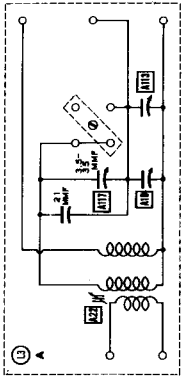
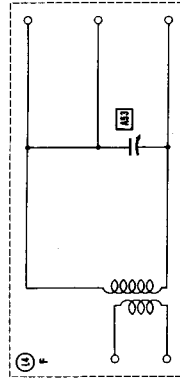
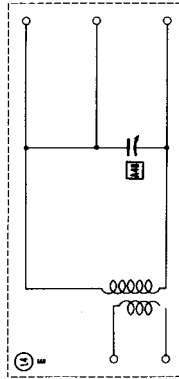
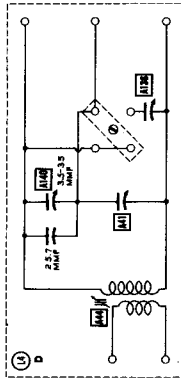
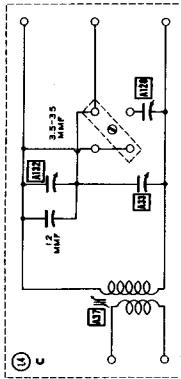
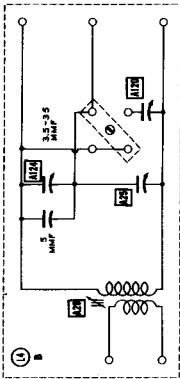
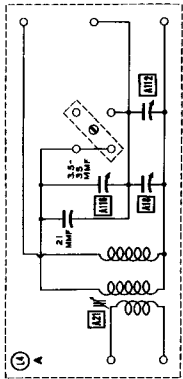
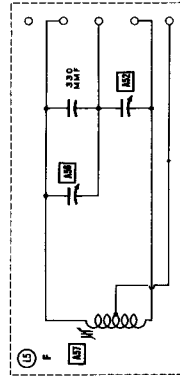
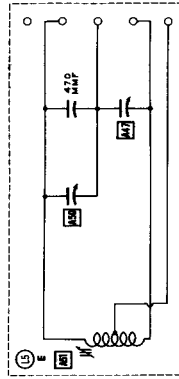
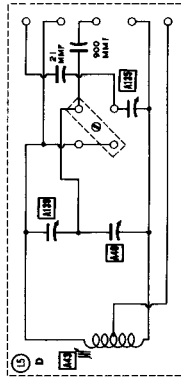
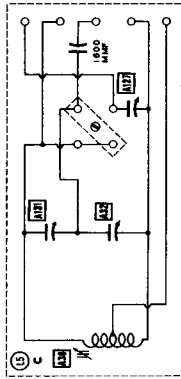
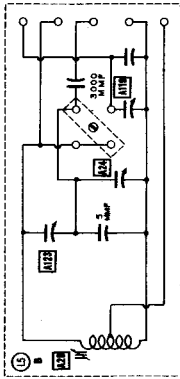
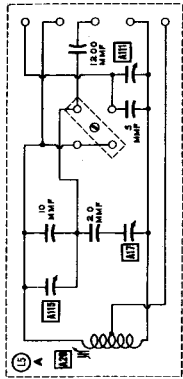
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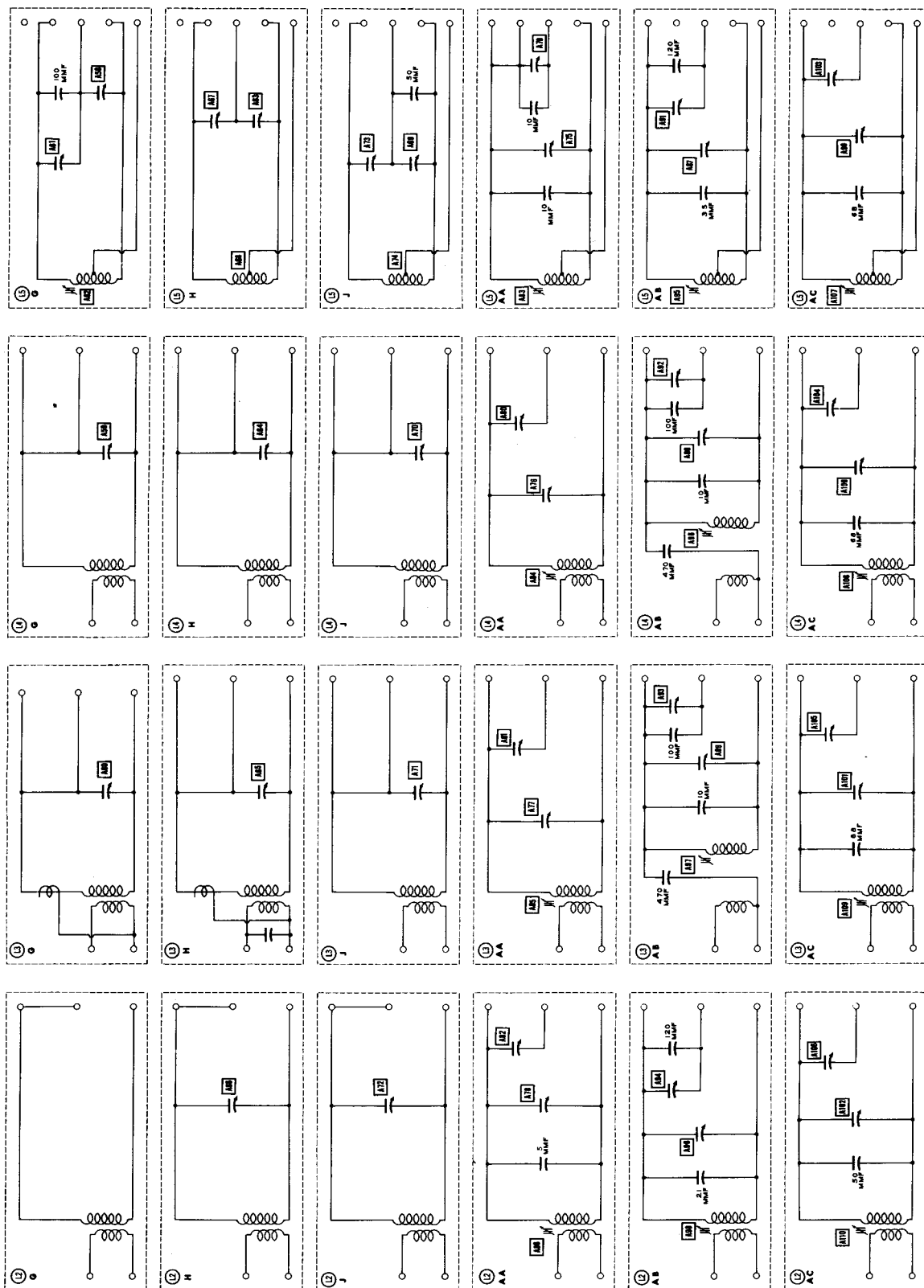
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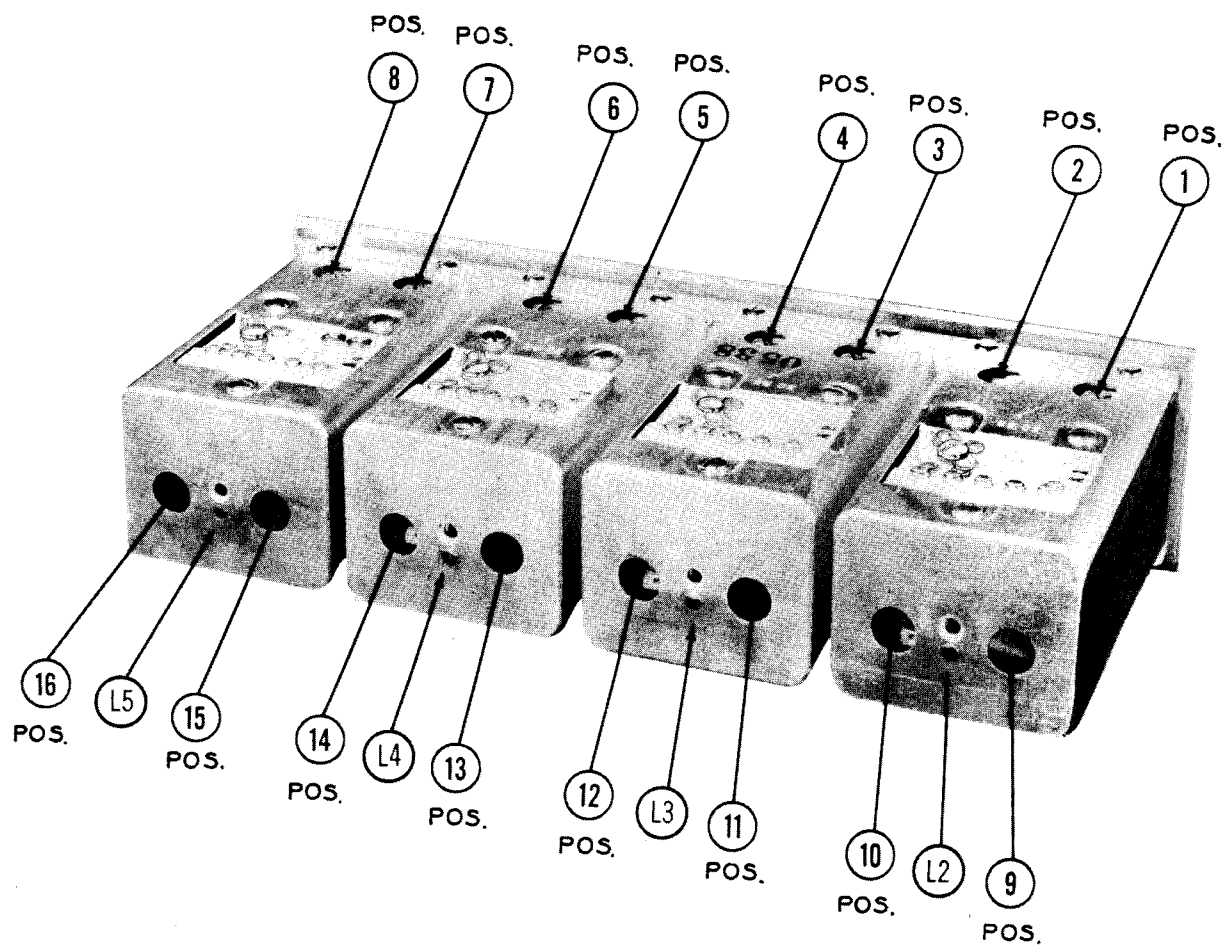
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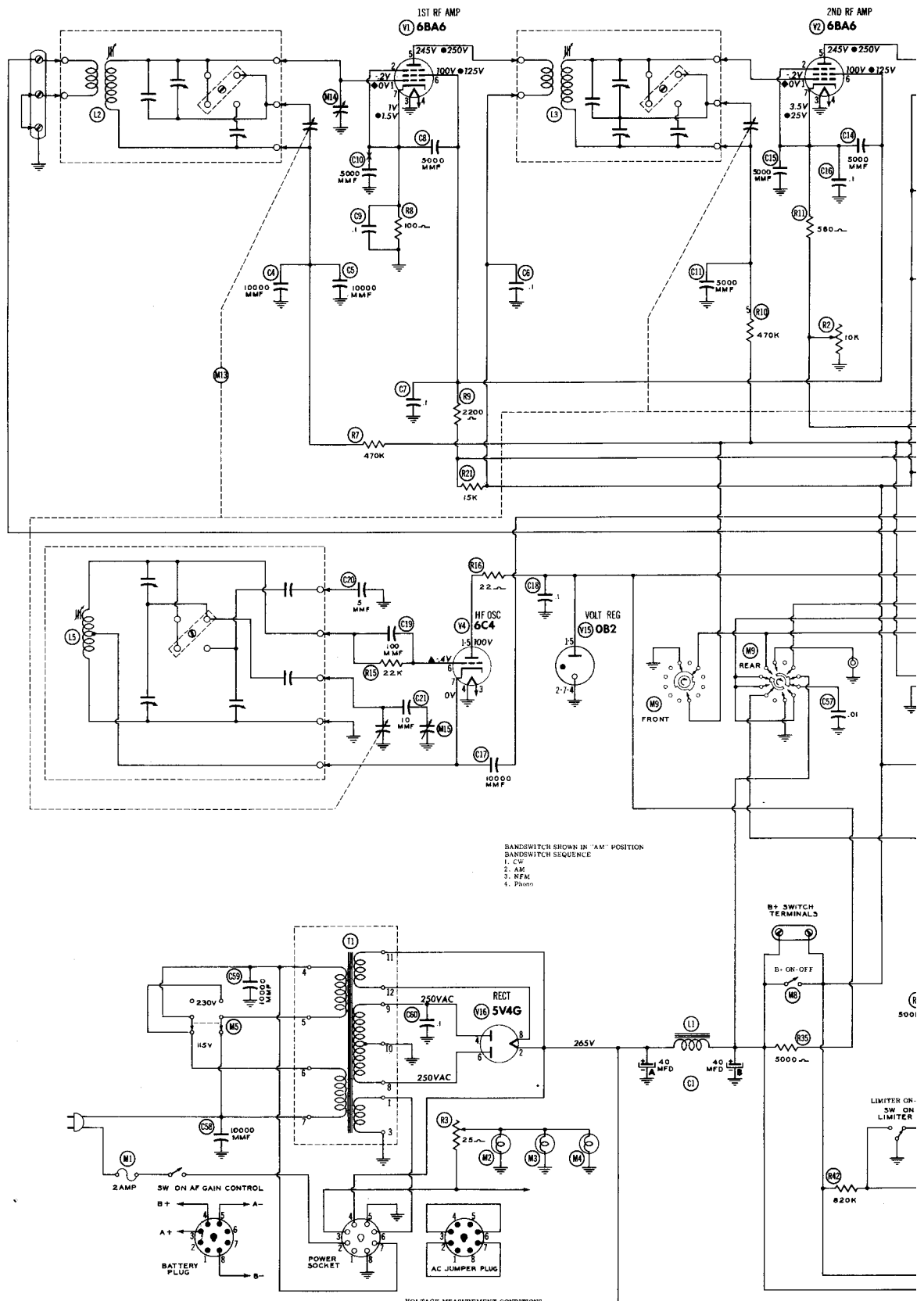
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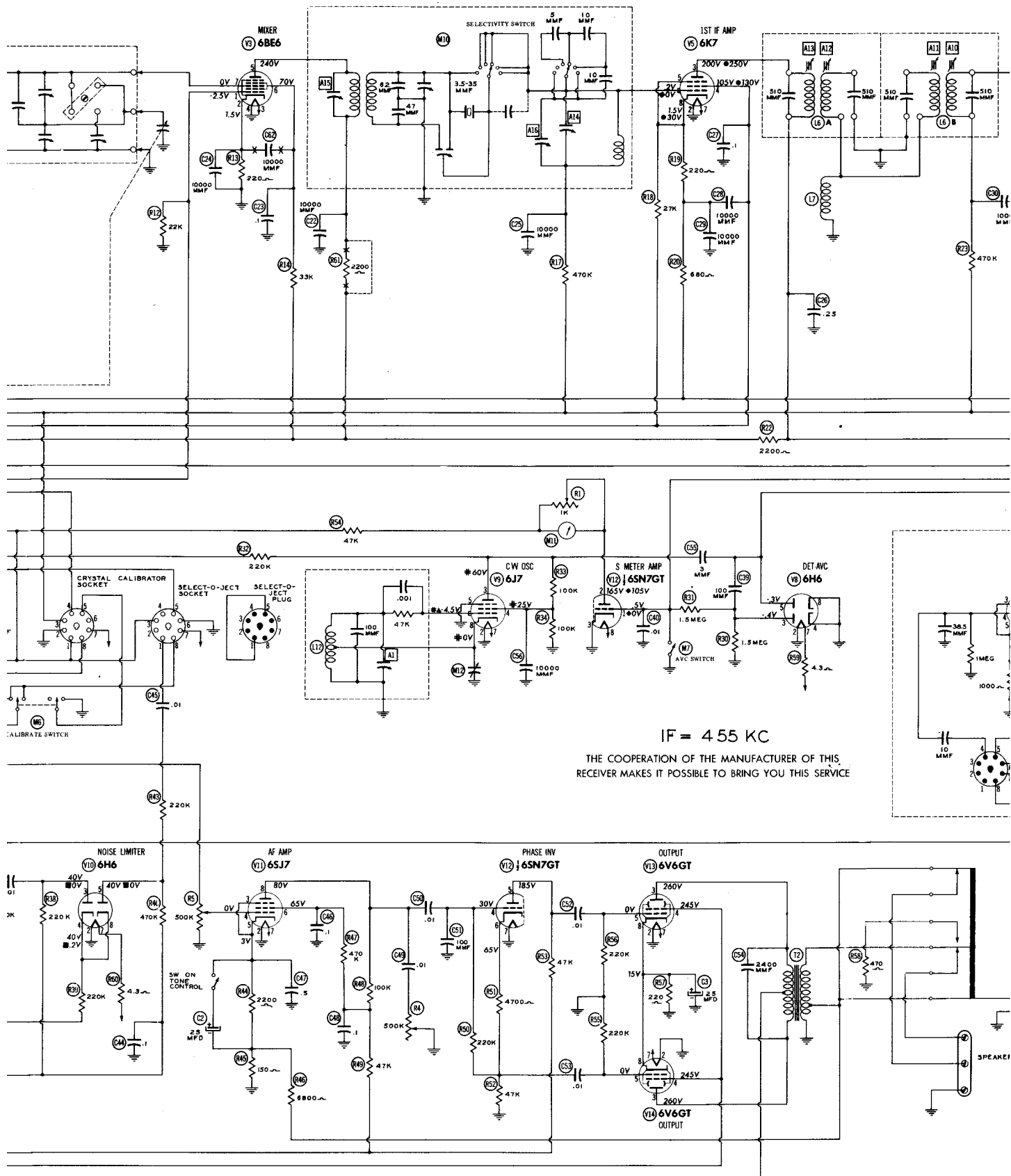


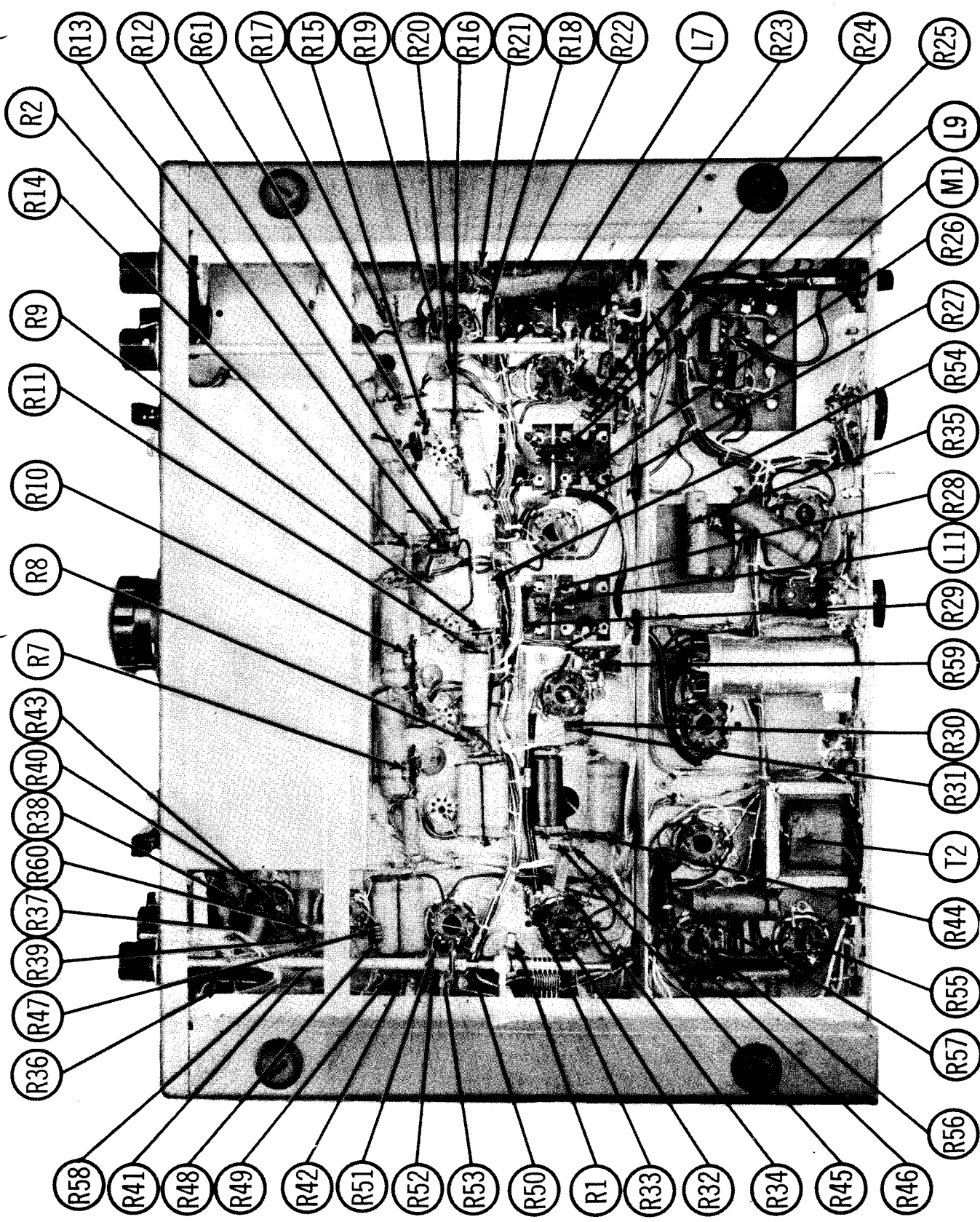




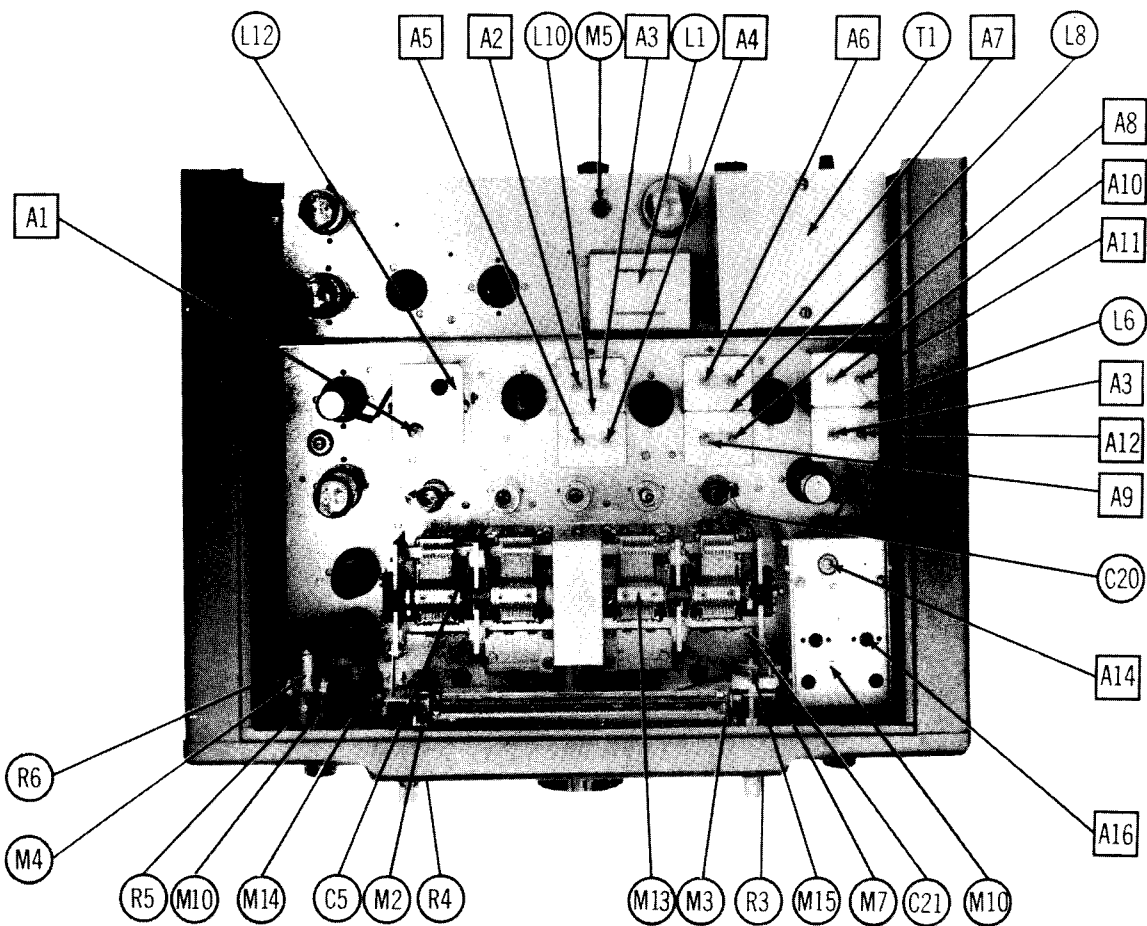
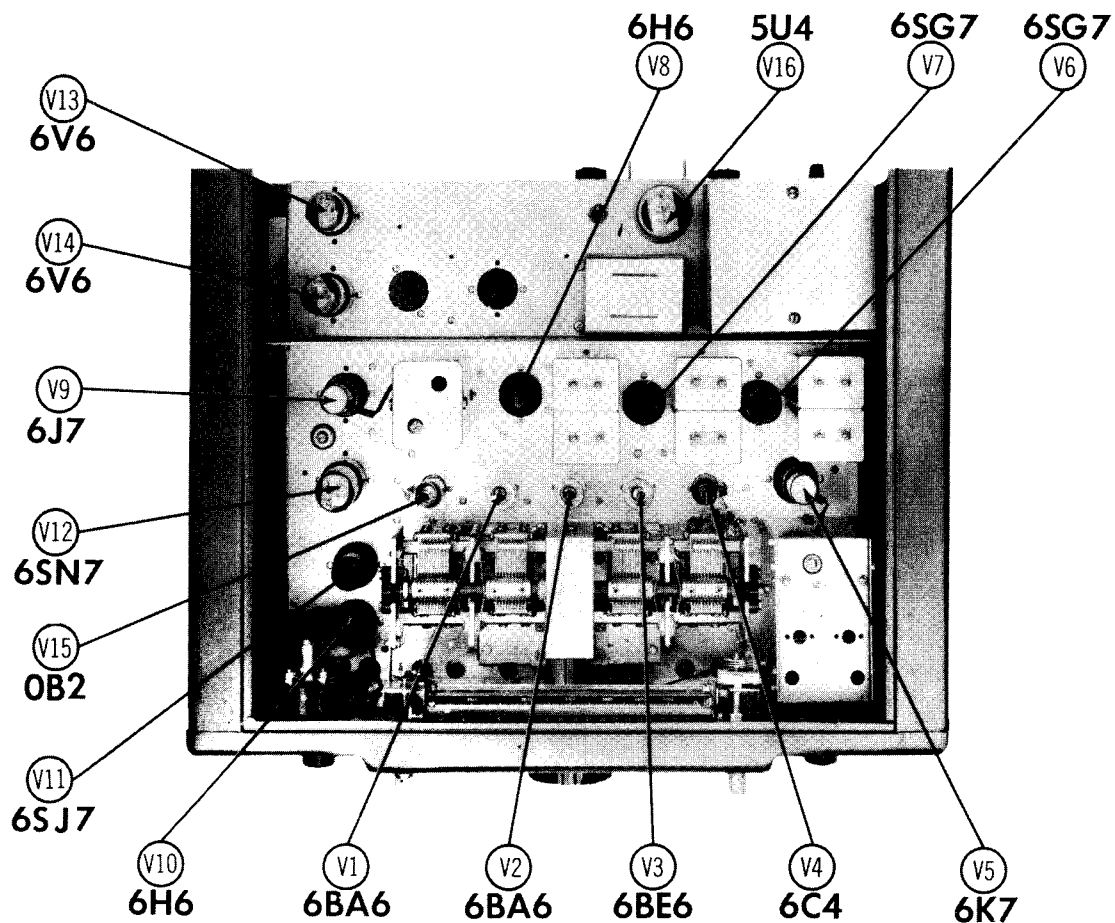
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NATIONAL
MODELS HRO-50R1, HRO-50T1



PARTS LIST AND DESCRIPTIONS (Continued)

CAPACITORS

Capacity values given in the rating column are in mfd. for Electrolytic and Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING CAP. VOLT	REPLACEMENT DATA			IDENTIFICATION CODES AND INSTALLATION NOTES	
		NATIONAL PART No.	AEROVOX PART No.	CORNEL-DUBILIER PART No.	ERIE PART No.	SPRAGUE PART No.
C47	.5	D827-49	P185-5	P12P5	GP2-333-103	2TM-P5
C48	.1	D827-12	P488-1	PT84P1	6TM-SI	4TM-P1
C49	.01	D827-7	PTE6S1	PT86S1	6TM-SI	6TM-SI
C50	.01	D827-7	PTE6S1	PT86S1	6TM-SI	6TM-SI
C51	100	D827-421	SI100	TM571	5GA-T1	Audio Coupling
C52	.01	D827-7	PTE6S1	PT86S1	6TM-SI	6TM-SI
C53	.01	D827-7	PTE6S1	PT86S1	6TM-SI	6TM-SI
C54	2400	7687-68	7685-4	N330K-030	6TM-SI	6TM-SI
C55	3	7685-4	1467-01	ID3S1	6TM-SI	6TM-SI
C56	10000	500	P868-01	PT86S1	6TM-SI	6TM-SI
C57	.01	D827-7	PTE6S1	PT86S1	6TM-SI	6TM-SI
C58	10000	500	7666-56	ID3S1	6TM-SI	6TM-SI
C59	10000	500	7666-56	ID3S1	6TM-SI	6TM-SI
C60	.1	D827-13	P868-1	PT86P1	6TM-SI	6TM-SI
C61	10	D827-13	SI10NP0	TC2-10	6TM-SI	6TM-SI
C62	10000	K948-2	BPD-01	TM5S1	6TM-SI	6TM-SI

* Not used in all models.

† Some models use 10000MMF in this application

CONTROLS

ITEM No.	RATING RESIST. ANCE	WATTS	REPLACEMENT DATA			INSTALLATION NOTES
			NATIONAL PART No.	IRC PART No.	CIAIROSTAT CENTRALAB PART No.	
R1	1000Ω	1	D831-2	WK-1000	VK-129	"S" Meter Zero Adjustment Control - Wire Wound
R2	10KΩ	2	K349-3	W-25	V-111	RF Gain Control - Wire Wound
R3	25Ω	2	K349-3	Q15-133	B-60-S	Dimmer Control - Wire Wound
R4	500KΩ	2	K347-1	Q15-133	Not Req.	Tone Control
B	Shaft	2	Not Req.	PS-3	Not Req.	Attach to R4A per instructions
C	Switch	2	Not Req.	SWA	Not Req.	Attach to R4A per instructions
R5A	500KΩ	2	K347-1	Q15-133	B-60-S	AF Gain Control
B	Shaft	2	Not Req.	PS-3	Not Req.	Attach to R5A per instructions
R6A	500KΩ	2	7681-2	76-1	SW-A	Attach to R5A per instructions

RESISTORS

ITEM No.	RATING RESISTANCE	WATTS	REPLACEMENT DATA			IDENTIFICATION CODES
			NATIONAL PART No.	IRC PART No.	CIAIROSTAT CENTRALAB PART No.	
R7	470K	1	J569-57	BTS-470K	AVC Network	AVC Network
R8	100Ω	1	J569-13	BTS-100	1st. RF Amp. Cathode	1st. RF Amp. Cathode
R9	2200Ω	1	J569-29	BTS-2200	Screen Dropping	Screen Dropping
R10	470KΩ	1	J569-57	BTS-470K	AVC Network	AVC Network
R11	560Ω	1	J569-22	BTS-560	2nd. RF Amp. Cathode	2nd. RF Amp. Cathode
R12	22KΩ	1	J569-41	BTS-220	Mixer Grid	Mixer Grid
R13	220Ω	1	J569-17	BTS-220	Mixer Cathode	Mixer Cathode
R14	33KΩ	1	J571-43	BTA-33K	HF Osc. Grid	HF Osc. Grid
R15	22KΩ	1	J569-41	BTS-220	Parasitic Suppressor	Parasitic Suppressor
R16	22Ω	1	J569-5	BTS-22	AVC Network	AVC Network
R17	470KΩ	1	J569-47	BTS-470K	Voltage Divider	Voltage Divider
R18	27KΩ	1	J572-42	BTS-27K	1st. IF Amp. Cathode	1st. IF Amp. Cathode
R19	220Ω	1	J569-17	BTS-220	Screen Dropping	Screen Dropping
R20	680Ω	1	J572-39	BTA-680	Decoupling	Decoupling
R21	15KΩ	1	J569-29	BTS-15K	AVC Network	AVC Network
R22	2200Ω	1	J569-29	BTS-2200	2nd. IF Amp. Cathode	2nd. IF Amp. Cathode
R23	470KΩ	1	J569-57	BTS-470K	2nd. IF Amp. Cathode	2nd. IF Amp. Cathode
R24	68Ω	1	J569-45	BTS-68	3rd. IF Amp. Cathode	3rd. IF Amp. Cathode
R25	47KΩ	1	J569-57	BTS-47K	Decoupling	Decoupling
R26	470KΩ	1	J569-57	BTS-47K	AVC Diode Load	AVC Diode Load
R27	68Ω	1	J569-45	BTS-68	AVC Network	AVC Network
R28	47KΩ	1	J569-57	BTS-47K	C.W. Osc. Plate	C.W. Osc. Plate
R29	2200Ω	1	J569-29	BTS-2200	Voltage Divider	Voltage Divider
R30	1.5Meg	1	J569-63	BTS-1.5Meg		
R31	1.5Meg	1	J569-63	BTS-1.5Meg		
R32	220KΩ	1	J569-53	BTS-220K		
R33	100KΩ	1	J569-49	BTS-100K		
R34	100KΩ	1	J569-49	BTS-100K		

PARTS LIST AND DESCRIPTIONS (Continued)

FUSES

Capacity values given in the rating column are in mfd. for Electrolytic and Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	TYPE	RATING	REPLACEMENT DATA		
			NATIONAL PART No.	LITTELFUSE PART No.	BUSS PART No.
M1	AGC	2A, 250V.	F135-4	312002 (3AG)	AGC2 HRP

DIAL LIGHTS

ITEM No.	BASE TYPE	VOLTS	AMPS.	BEAD COLOR	REPLACEMENT DATA		NOTES
					NATIONAL	PART No.	
M2	Bayonet	6-8	.15	Brown	F136-6		Type #47
M3	Bayonet	6-8	.15	Brown	F136-6		Type #47
M4	Bayonet	6-8	.15	Brown	F136-6		Type #47

MISCELLANEOUS

ITEM No.	PART NAME	NATIONAL PART No.	NOTES
M5	Switch	H340-4	Line Voltage
M6	Switch	P738-1	Calibrate
M7	Switch	E230-2	AVC
M8	Switch	E230-2	B+ on/off
M9	Switch	SA-3564	Function Selector
M10	Trimmer	7695-3	IF Primary
	Capacitor	D832-2	62 MMF
	Capacitor	SA-3655	Phase Balance Adj. (3.5-35MMF)
	Trimmer	7695-1	47MMF
	Crystal	E979-1	Phasing Control
	Switch	E195-3	455KC
	Capacitor	D825D-401	Selectivity
	Capacitor	D825D-426	5MMF
	Capacitor	D825D-426	10MMF
	Trimmer	D832-2	Selectivity (3.5-35MMF)
	Trimmer	SA-1841	IF Output
	Coil		IF Output
M11	Meter	T984-5	Carrier Level (0-1MA)
M12	Tuning Cap.	SA-3580	CW Osc. Adj.
M13	Tuning Cap.	SA-3592	Main (4 Sections)
M14	Tuning Cap.	SA-3577	Antenna
M15	Tuning Cap.	PI36-1	Oscillator
	Dial Scale	PI36-2	Band "A"
	Dial Scale	PI36-3	Band "B"
	Dial Scale	PI36-4	Band "C"
	Dial Scale	PI36-5	Band "D"
	Dial Scale	PI36-6	Band "E"
	Dial Scale	PI36-7	Band "F"
	Dial Scale	PI36-8	Band "G"
	Dial Scale	PI36-9	Band "H"
	Dial Scale	PI36-10	Band "I"
	Dial Scale	PI36-11	Band "J"
	Dial Scale	PI36-12	Band "K"
	Dial Scale	PI36-13	Band "L"
	Dial Scale	PI36-14	Band "M"
	Knob	SA-7021	Tone, Ant. Trimmer, and Dimmer Controls (3 used)
	Knob	SA-3586	Main Tuning
	Window	P211-1	Dial Scale
	Knob	SA-3587	RF Gain Control
	Knob	SA-3588	Phasing and CWO Controls (2 used)
	Knob	SA-3589	Selectivity Control
	Knob	SA-3590	Limiter Control
	Knob	SA-3591	Function Selector Switch
	Knob	SA-3592	AF Gain Control
	Knob	SA-7021	Band selector and Oscillator Control (2 used)
	CWO Shaft	Q534-1	

NATIONAL MODELS HRO-50R1, HRO-50T1

PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS

ITEM No.	RATING		REPLACEMENT DATA		IDENTIFICATION CODES
	RESISTANCE	WATTS	NATIONAL PART No.	IRC PART No.	
R35	500KΩ	10	E989-10	1 3/4A-5000	Decoupling - Wire Wound
R36	22KΩ		J569-41	BTS-22K	Diode Filter
R37	470KΩ		J569-57	BTS-470K	Det. Diode Load
R38	220KΩ		J569-53	BTS-220K	Noise Limiter Plate
R39	220KΩ		J569-53	BTS-220K	Noise Limiter Cathode
R40	470KΩ		J569-57	BTS-470K	Noise Limiter Plate
R41	220KΩ		J569-53	BTS-220K	Voltage Divider
R42	220KΩ		J569-60	BTS-820K	Decoupling
R43	220KΩ		J569-53	BTS-220K	Voltage Divider
R44	220KΩ		J569-29	BTS-220K	AF Amp. Cathode
R45	150Ω		J569-15	BTS-150	AF Amp. Cathode
R46	6800Ω		J569-35	BTS-6800	Feedback Network
R47	470KΩ		J569-57	BTS-470K	AF Amp. Screen
R48	100KΩ		J569-49	BTS-100K	AF Amp. Plate
R49	47KΩ		J569-45	BTS-48K	AF Amp. Decoupling
R50	220KΩ		J569-53	BTS-220K	Phase Inv. Grid
R51	4700Ω		J569-33	BTS-4700	Phase Inv. Cathode
R52	47KΩ		J569-45	BTS-47K	Phase Inv. Cathode
R53	47KΩ		J569-45	BTS-47K	Phase Inv. Plate
R54	47KΩ		J569-45	BTS-47K	"S" Meter Amp. Plate
R55	220KΩ		J569-53	BTS-220K	Output Grid
R56	220KΩ		J569-53	BTS-220K	Output Cathode
R57	220Ω		J572-17	BTS-220K	Voice Coil Shunt
R58	470Ω		J572-21	BTS-470	Filament Dropping - Wire Wound
R59	4.3Ω		K099-48		Filament Dropping - Wire Wound
R60	4.3Ω		K099-48		Mixer Plate Decoupling - See Note 2
R61	2200Ω			BTS-2200	

Note 1. This Resistor may be of any value from 330Ω to 1000Ω

Note 2. Not used in all Models

TRANSFORMER (POWER)

ITEM No.	RATING			REPLACEMENT DATA		
	PRI.	SEC. 1	SEC. 2	NATIONAL PART No.	STANCOR PART No.	CHICAGO PART No.
T1	117VAC 0.880A Pri #2 220VAC	510VCT .135ADC 2A	5VAC 4.8A	6.3VAC 4.8A SA:6566		

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	RATING			REPLACEMENT DATA			INSTALLATION NOTES
	IMPEDANCE	DC RES.	PRI. SEC.	NATIONAL PART No.	STANCOR PART No.	CHICAGO PART No.	
T2	6.7KΩ CT	500Ω CT	310Ω CT	20Ω Tap@ .7Ω	P187-1		

SPEAKER

ITEM No.	RATINGS		REPLACEMENT DATA		NOTES
	FIELD RES.	V. C. IMP.	NATIONAL PART No.	JENSEN PART No.	
SP1A	P. M.	6.50	P297-1	ST-120 P10-5	
SP1B	CONE DIA. 10"	V. C. DIA. 3/4"			

RESISTANCE READINGS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V 1	6BA6	3.5 Meg 1470KΩ	100Ω	0Ω	.1Ω	1280Ω	117KΩ	100Ω		
V 2	6BA6	3.5 Meg 1470KΩ	560Ω 5.5KΩ	0Ω	.1Ω	1280Ω	117KΩ	560Ω 5.5KΩ		
V 3	6BE6	22KΩ	220Ω	.1Ω	0Ω	12.5KΩ	135KΩ	9Ω		
V 4	6C4	15.3KΩ	0Ω	.1Ω	0Ω	15.3KΩ	22KΩ	0Ω		
V 5	6K7	0Ω	0Ω	12.5KΩ	115KΩ	1KΩ	900Ω	0Ω	1KΩ	3.5Meg 1470KΩ
V 6	6SG7	0Ω	0Ω	68Ω	3.5Meg 1470KΩ	68Ω	5.6KΩ	.1Ω	5.6KΩ	
V 7	6SG7	0Ω	0Ω	68Ω	3.5Meg 1470KΩ	68Ω	4.6KΩ	.1Ω	12.5KΩ	
V 8	6H6	0Ω	0Ω	68Ω	4.6KΩ	68Ω	4.6KΩ	.1Ω	14.7KΩ	
V 9	6J7	0Ω	0Ω	150KΩ	1.5Meg	10KΩ	10KΩ	.1Ω	0Ω	
V 10	6H6	0Ω	0Ω	1120KΩ	100KΩ	0Ω	4120KΩ	.1Ω	1.8Ω	47KΩ
V 11	6S7	0Ω	0Ω	11Meg	220KΩ	11Meg	11.3Meg	.1Ω	220KΩ	
V 12	6SN7GT	100Ω	153KΩ	0Ω	220KΩ	440KΩ	440KΩ	1.9Ω	444KΩ	
V 13	6V6GT	0Ω	0Ω	0Ω	2.3KΩ	7Ω	2.3KΩ	.1Ω	1150KΩ	
V 14	6V6GT	0Ω	0Ω	1155Ω	1280Ω	220KΩ	147KΩ	0Ω	.1Ω	
V 15	6B2	15.3KΩ	0Ω	1155Ω	1280Ω	220KΩ	1280Ω	.1Ω	220Ω	
V 16	5V4G	INF	32KΩ	INF	119Ω	INF	114Ω	0Ω	32KΩ	

FUNCTION SWITCH IN "AM" POSITION UNLESS NOTED

LIMITER IN "OFF" POSITION UNLESS NOTED

B+ SWITCH IN "ON" POSITION

CALIBRATE SWITCH IN OFF POSITION

AVC SWITCH IN "ON" POSITION UNLESS NOTED

RF GAIN CONTROL FULLY CLOCKWISE UNLESS NOTED

† MEASURED FROM PIN 2 OF V16

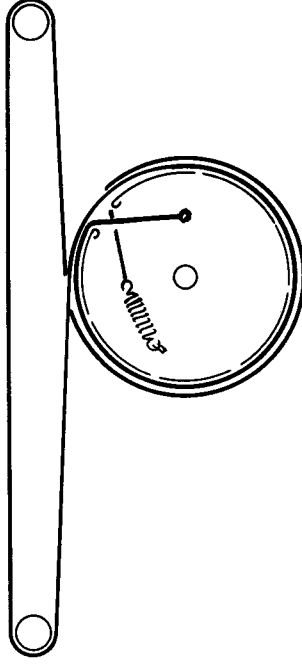
FUNCTION SWITCH IN "CW" POSITION

† AVC SWITCH IN "OFF" POSITION

LIMITER SWITCH IN "ON" POSITION FULLY CLOCKWISE

■ RF GAIN CONTROL AT ZERO

TUNING GANG FULLY CLOSED



DIAL CORD DRIVE

ALIGNMENT INSTRUCTIONS

MAIN TUNING DIAL

The main tuning dial should normally give no trouble.

In the event that the dial should become removed from the receiver it should NOT be operated until mounted on the capacitor shaft with set screws tight. The dial is designed to rotate for ten revolutions and if it is turned farther, damage to the mechanism may result.

Procedure for re-mounting the dial is as follows:

(a) Place the dial on the shaft, tighten set screws and turn the dial counter clockwise to fully mesh the capacitor plates. Tips of the rotor plates should be flush with the edge of the stator plates.

(b) Loosen the set-screws and rotate the dial slowly to read zero.

(c) Tighten the set-screws and check to insure that the tips of the rotor plates are flush with the edge of the stator plates. Slight readjustment may be necessary and this done by loosening the set-screws, readjusting the dial position, and tightening the set-screws again.

Should it ever be necessary to remove the dial, turn to 250 before removing, and do not disturb the setting of either the dial or capacitor until reassembled. When the dial reads 250 the springs on the back of dial should be straight up and down.

It is important that the backplate and dial do not become separated, as they may be returned in an incorrect relationship and the proper dial numbers will not appear in the dial windows.

To determine that the two parts are correctly positioned proceed as follows:

(a) Locate small window near outer edge of dial backplate and also locate the dial number window on face of dial which is 180° removed from the small backplate window.

(b) Hold dial so backplate lies flat in palm of left hand and with right hand rotate dial knob until 250 appears in dial window.

(c) If dial is properly adjusted the pointer at the outer edge of the small window lines up with a marked tooth on the dial itself. It will be found that the dial and backplate can be moved so that the backplate pointer will mesh between teeth at points equidistant from the marked tooth in either direction.

(d) If, by checking as in paragraph (c), the dial is found not properly adjusted, it will be necessary to separate the backplate and dial enough to bring the two gears out of mesh and then remesh them at another point, repeating until the correct mesh is found.

SLIDE RULE TUNING DIAL

To set the pointer:

(a) Check the main dial at zero setting to see that the tips of the rotor plates are flush with the edge of the stator plates.

(b) Set the Band Selector Control so that the "D" scale appear.

(c) Set the main tuning dial at 490. The correct setting of the pointer for this position is at 4 MC on the dial scale. It should be drawn along the cord to the correct position and cemented securely, meanwhile being careful not to disturb the capacitor setting.

ALIGNMENT INSTRUCTIONS

This receiver has been carefully aligned at the manufacturer's laboratories and is very stable. Realignment should not be necessary unless the receiver has been tampered with or unless component parts or tubes have been replaced.

It is to be preferred that the individual aligning the receiver be one who is familiar with communications receivers and experienced in their alignment.

The following test will determine the necessity of IF amplifier alignment:

1. Adjust the receiver for normal operation with the antenna disconnected.

2. Connect a pair of head phones to the phones jack.

3. Set the AVC switch at OFF.

4. Set the control switch at CW.

5. Set the phasing control at zero.

6. Set the selectivity switch at 5.

7. Set the RF gain at 10.

The AF gain control may be adjusted for comfortable listening volume and will not affect the test results.

Adjust the CWO control to a point where the predominate pitch of the background noise is lowest and a distinct crystal ring is heard. Note this setting of the CWO control.

Turn the selectivity switch to the off position, and again adjust the CWO control for lowest pitch of background noise.

Compare this setting of the CWO control with the first setting.

If they are identical, the IF amplifier is correctly aligned to the crystal filter frequency. If they are not identical, perform the IF amplifier alignment.

IF AMPLIFIER ALIGNMENT

Connect the high side of an accurately calibrated signal generator to the stator portion of the mixer section of the main tuning capacitor, M13. Connect the low side to chassis. Connect an output meter to the output terminals of the receiver.

Set the control switch at CW.

Set the AVC switch at OFF.

Set the phasing control at zero.

Set the selectivity switch at 5.

Set the AF gain control at 10.

Set the RF gain control at 9.

Adjust the signal generator for an unmodulated signal at approximately 455 KC and a generator output of approximately 100 micro-volts.

With the receiver operating, set the CWO control to provide an audio beat-note somewhere between 400 and 10000 cycles. The presence of this beat note is checked by connecting head phones or speaker to the receiver. If difficulty is encountered in obtaining such a beat note, adjust the CWO transformer trimmer, A1.

Slowly tune the signal generator between 453KC and 457 KC while watching the output meter for a sharp peak.

This peak indicated that the signal generator is tuned to the frequency of the IF crystal filter. Leave the generator at this setting for step 1 of the IF alignment.

Set the selectivity switch at OFF and the control switch at A.M.

DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	OUTPUT METER	ADJUST	REMARKS
1. Direct	High side to stator of mixer section of tuning gang. Low side to chassis.	IF Crystal frequency. (See above) (400° Mod.)	Plug in any unit	Point of non-interference.	Across output terminals.	A2, A3 A4, A5 A6, A7 A8, A9 A10, A11 A12, A13 A14, A15	Adjust for maximum output. Attenuate signal generator when necessary, to avoid overloading of circuits.
2. "	"	Frequency of Step 1 plus 2KC.	"	"	"	A14	Set the selectivity control at 1 and adjust A14 for maximum output.
3. "	"	Frequency of Step 1.	"	"	"	A16	Set the selectivity control to "Off" and adjust A16 for maximum output.

Turn the modulation of the signal generator off and set the control switch at CW. Rotate the CWO Control fully clockwise, where it should coincide with 5 on the scale. If it does not, loosen and set to 5. Set the CWO control to obtain a zero beat with the signal generator. If the zero beat does not occur at 0 on the control dial, carefully re-adjust A1 for that condition.

GENERAL COVERAGE OSC. AND RF ALIGNMENT

The original alignment at the manufacturer's laboratories has been made with the use of precision, crystal-controlled test oscillators. Re-alignment requires that a reliable test signal source be available. The signal source should be of 1% accuracy, or better.

The need for realignment of the HF oscillator of any band is indicated when the frequency calibration of the receiver dial is in error by more than 1% at the high frequency end of the band in question.

Perform alignment as follows:

a. Disconnect the antenna.

b. Connect an output meter across the receiver output terminals.

c. Set the control switch at AM.

d. Set the AVC switch at OFF.

e. Set the selectivity switch at OFF.

f. Set the RF gain control at 10.

g. Set the bandspread switch in the general coverage position.

h. Set the AF gain control to provide a suitable output level.

i. The ant. trim. and the osc. trimmer controls should be set with the pointers in vertical position, arrowheads pointing toward the top of the receiver.

Particular care must be taken when adjusting the high frequency oscillator trimmer in each coil set. This adjustment is the one listed first for each set.

It is essential that the high frequency oscillator operates at a frequency above the RF amplifier frequency and not below. Check by tuning in the image of the test signal which must appear 910 KC lower on the dial.

Failure of the image to appear at the proper point is corrected by decreasing the capacity of the oscillator trimmer until image and fundamental signals appear at their normal place on the dial.

After alignment of any coil set, the tracking at the low frequency end may be checked by slightly pressing the outside rotor plates of the main tuning capacitor section.

A change in capacity in either direction should decrease the receiver gain if the stage is tracking properly.

NATIONAL
MODELS HRO-50R1, HRO-50T

ALIGNMENT INSTRUCTIONS (CONT.)

DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	OUTPUT METER	ADJUST	REMARKS
4. 270Ω carbon resistor	High side through 270Ω to Ant. input terminal. Low side to chassis.	30MC (400% Mod.)	Plug in coil set "A"	30 MC	Across Output Terminals.	A17(pos.8) A18(pos.6) A19(pos.4)	Adjust in order given for maximum output.
5. "	"	14.4MC	"	14.4MC	"	A20(pos.16) A21(pos.13) A22(pos.11) A23(pos.9)	Adjust in order given, for maximum output. Check step 4. Repeat steps 4 & 5 if necessary.
6. "	"	"	Plug in coil set "B"	"	"	A24(pos.8) A25(pos.6) A26(pos.4) A27(pos.2)	Adjust in order given for maximum output.
7. "	"	7.0MC	"	7.0MC	"	A28(pos.16) A29(pos.13) A30(pos.11) A31(pos.9)	Adjust in order given for maximum output. Check step 6. Repeat steps 6 & 7 if necessary.
8. "	"	7.3MC	Plug in coil set "C"	7.3MC	"	A32(pos.8) A33(pos.6) A34(pos.4) A35(pos.2)	Adjust in order given for maximum output.
9. "	"	3.5MC	"	3.5MC	"	A36(pos.16) A37(pos.13) A38(pos.11) A39(pos.9)	Adjust in order given for maximum output. Check step 8. Repeat steps 8 & 9 if necessary.
10 270Ω carbon resistor	High side through 270Ω to Ant. input terminal. Low side to chassis.	4.0MC (400% mod.)	Plug in coil set "D"	4.0MC	Across output terminals	A40(pos.8) A41(pos.6) A42(pos.4)	Adjust in order given for maximum output.
11 "	"	1.8MC	"	1.8MC	"	A43(pos.16) A44(pos.13) A45(pos.11) A46(pos.9)	Adjust in order given for maximum output. Check Step 10. Repeat steps 10 & 11 if necessary.
12 "	"	2.0MC	Plug in coil set "E"	2.0MC	"	A47(pos.8) A48(pos.6) A49(pos.4)	Adjust in order given for maximum output.
13 "	"	1.0MC	"	1.0MC	"	A50(pos.7)	Adjust for maximum output.
14 "	"	1.4MC	"	1.4MC	"	A51(pos.16)	Adjust for maximum output. Check Step 12. Repeat steps 12, 13 & 14 if necessary.
15 "	"	0.9MC	Plug in coil set "F"	0.9MC	"	A52(pos.8) A53(pos.6) A54(pos.4) A55(pos.2)	Adjust in order given, for maximum output.
16 "	"	0.5MC	"	0.5MC	"	A56(pos.7)	Adjust for maximum output.
17 "	"	0.7MC	"	0.7MC	"	A57(pos.16)	Adjust for maximum output, check Step 15. Repeat steps 15, 16, & 17 if necessary.
18 270Ω carbon resistor	High side through 270Ω to Ant. input terminal. Low side to chassis.	400KC (400% Mod.)	Plug in coil set "G"	400KC	Across output terminals	A58(pos.8) A59(pos.6) A60(pos.4)	Adjust in order given for maximum output.
19 "	"	200KC	"	200KC	"	A61(pos.7)	Adjust for maximum output.
20 "	"	300KC	"	300KC	"	A62(pos.16)	Adjust for maximum output. Check step 18. Repeat steps 18, 19 & 20 if necessary.
21 "	"	200KC	Plug in coil set "H"	200KC	"	A63(pos.8) A64(pos.6) A65(pos.4) A66(pos.2)	Adjust in order given for maximum output.
22 "	"	100KC	"	100KC	"	A67(pos.7)	Adjust for maximum output.
23 "	"	150KC	"	150KC	"	A68(pos.16)	Adjust for maximum output. Check Step 21. Repeat steps 21, 22 & 23 if necessary.
24 "	"	100KC	Plug in coil set	100KC	"	A69(pos.8) A70(pos.6) A71(pos.4) A72(pos.2)	Adjust in order given for maximum output.
25 "	"	50KC	"	50KC	"	A73(pos.7)	Adjust for maximum output.
26 "	"	75KC	"	75KC	"	A74(pos.16)	Adjust for maximum output. Check Step 24. Repeat steps 24, 25 & 26 if necessary.
27 270Ω carbon resistor	High side through 270Ω to Ant. input terminal. Low side to chassis.	27.2MC	"	27.2MC	"	A75(pos.7) A76(pos.6) A77(pos.4) A78(pos.2)	Adjust in order given for maximum output.
28 "	"	27.2MC	"	27.2MC	"	A79(pos.8) A80(pos.5) A81(pos.3) A82(pos.1)	Adjust in order given for maximum output.
29 "	"	28MC	"	28MC	"	A83(pos.16) A84(pos.13) A85(pos.11) A86(pos.9)	Adjust in order given for maximum output.
30 "	"	35MC	Plug in coil set "AB"	35MC	"	A87(pos.8) A88(pos.6) A89(pos.4) A90(pos.2)	Adjust in order given for maximum output.
31 "	"	25MC	"	25MC	"	A91(pos.7) A92(pos.5) A93(pos.3) A94(pos.1)	Adjust in order given for maximum output.
32 "	"	30MC	"	30MC	"	A95(pos.16) A96(pos.13) A97(pos.11) A98(pos.9)	Adjust in order given for maximum output. Check Step 30. Repeat steps 30, 31 & 32, if necessary. Recheck Step 30.

ALIGNMENT INSTRUCTIONS (CONT.)

33	"	"	21.5MC (400v mod.)	Plug in coil set "AC"	21.5MC	Across output terminals.	A99(pos.7) A100(pos.8) A101(pos.4) A102(pos.2)	Adjust in order given for maximum output.
34	"	"	21MC	"	21MC	"	A103(pos.8) A104(pos.5) A105(pos.3) A106(pos.1)	"
35	"	"	21.3MC	"	21.3MC	"	A107(pos.16) A108(pos.13) A109(pos.11) A110(pos.9)	Adjust in order given for maximum output. Check Step 33. Repeat Steps 33, 34 & 35, if necessary. Recheck Step 33.

BANDSPREAD OSC. & RF ALIGNMENT

Bandsread alignment should not be attempted without the use of a signal generator of crystal accuracy. The entire range of test frequencies required may be covered with the use of nine crystals operating at their fundamental and harmonic frequencies. The frequency of these crystals is as follows: 0.05, 0.1, 1.0, 2.0, 3.5, 5.0, 6.8, 7.0, 7.3, 14.4 and 15 megacycles. Bandsread alignment must not be performed before general coverage alignment, since general coverage adjustments affect bandsread alignment.

The need for realignment of the HF oscillator of any band is indicated when the frequency calibration of the main tuning dial is in error by more than ± 5 divisions.

The pre-alignment settings of the receiver controls for bandsread alignment are the same as for general coverage alignment EXCEPT that the bandsread switch on each of the plug in coils must be in the right hand or bandsread position.

After alignment of any coil set, proper tracking at the low frequency end of the band may be checked by a slight readjustment of the trimmers at positions 1, 3, and 5. Change in capacitance in either direction should result in a decrease in output, indicating proper tracking. The trimmers should then be re-set at the high frequency end of the band.

DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	OUTPUT METER	ADJUST	REMARKS
36 270 Ω Carbon Resistor	High side through 270 Ω to Ant. input terminal. Low side to chassis.	30MC (400v Mod.)	Plug in Coil set "A"	30 MC	Across output terminals	A111(Pos.7) A112(Pos.5) A113(Pos.3) A114(Pos.1)	Adjust in order given for max. output
37 "	"	27.2 MC	"	27.2 MC	"	A115(Pos.15) A116(Pos.14) A117(Pos.12) A118(Pos.10)	Adjust in order given for max. output. Check step 36. Repeat steps 36 and 37, if necessary. Recheck step 36.
38 "	"	14.4 MC	Plug in Coil set "B"	14.4 MC	"	A119(Pos.7) A120(Pos.5) A121(Pos.3) A122(Pos.1)	Adjust in order given, for max. output.
39 "	"	14.0 MC	"	14.0 MC	"	A123(Pos.15) A124(Pos.14) A125(Pos.12) A126(Pos.10)	Adjust in order given for max. output. Check step 38. Repeat steps 38 and 39 if necessary. Recheck step 38.
40 "	"	7.3 MC	Plug in Coil set "C"	7.3 MC	"	A127(Pos.7) A128(Pos.5) A129(Pos.3) A130(Pos.1)	Adjust in order given, for max. output.
41 "	"	7.0 MC	"	7.0 MC	"	A131(Pos.15) A132(Pos.14) A133(Pos.12) A134(Pos.10)	Adjust in order given for max. output. Check step 40. Repeat steps 40 and 41, if necessary. Recheck step 40.
42 "	"	40.0 MC (400v Mod.)	Plug in Coil set "D"	4.0 MC	"	A135(Pos.7) A136(Pos.5) A137(Pos.3) A138(Pos.1)	Adjust in order given, for max. output.
43 "	"	3.5 MC	"	3.5 MC	"	A139(Pos.15) A140(Pos.14) A141(Pos.12) A142(Pos.10)	Adjust in order given, for max. output. Check step 42. Repeat steps 42 and 43 if necessary. Recheck step 42.

FIRST RF STAGE ALIGNMENT WITH LOW IMPEDANCE TRANSMISSION LINE

If a low impedance transmission line is to be used with the receiver, it may be necessary to realign the first RF amplifier at the high frequency end of each band. To check for this possibility, rotate the Ant. Trim. Control. The presence of two definite peaks in output indicates that the first RF amplifier stage is tracking correctly, and either peak may be used. Lack of a peak, or presence of only one peak indicates improper tracking and need for correction.

GENERAL COVERAGE ADJUSTMENTS

Set the bandsread switch on each unit to be aligned to the left hand, or general coverage position.

Set control switch at AM.

Set selectivity switch at OFF.

Set Ant. Trim. Control pointer in a vertical position with arrow pointing to top of receiver.

Set AF gain control at 10.

Set RF gain to provide a suitable listening volume.

Coil sets A and D do not use a first RF amplifier general coverage trimmer but are peak-tuned by the Ant. Trim. control over the full frequency range of each set.

Connect the antenna feeders to the receiver antenna terminals and tune the receiver to the signal frequency first shown on the General Coverage Osc. and RF Alignment Chart for each coil set (Coil Set "A" 30 MC, Coil Set "B" 7 MC, etc.). Peak trimmers as follows for maximum signal or if no signal is present, for maximum background noise.

Coil set A	Adjust Ant. Trim. Control
" " B	" A27
" " C	" A35
" " D	" Ant. Trim. Control
" " F	" A55
" " H	" A66
" " J	" A72
" " AA	" A78
" " AB	" A90
" " AC	" A102

BANDSPREAD ADJUSTMENTS

Set the bandsread switch on each unit to be aligned to the right hand, or bandsread position.

Set the receiver controls in the same manner as for general coverage.

Connect the antenna feeders to the receiver antenna terminals and tune the receiver to the signal frequency first shown on the bandsread osc. and RF alignment chart for each coil set.

Peak trimmers as follows for maximum signal or, if no signal is present, for maximum background noise.

Coil Set A	Adjust A114
" " B	" A122
" " C	" A130
" " D	" A138

S-METER ADJUSTMENT

The S-Meter balancing resistor, R1, is used to obtain a zero meter reading in the absence of a signal input to the receiver.

To adjust set controls as follows:

1. RF gain control at 0.
2. AVC switch at AVC.
3. Control switch at AM.
4. AC switch at ON.

Adjust R1 for a zero reading on the S-Meter.

PARTS LIST AND DESCRIPTIONS TUBES (SYLVANIA or Equivalent)

ITEM No.	USE	REPLACEMENT DATA		RMA BASE TYPE	NOTES
		NATIONAL PART No.	STANDARD REPLACEMENT		
V1	1st. RF Amplifier	6BA6	7BK		
V2	2nd. RF Amplifier	6BA6	7BK		
V3	Mixer	6BR6	7CH		
V4	HF Oscillator	6C4	6BG		
V5	1st. IF Amplifier	6K7	7R		
V6	2nd. IF Amplifier	6SG7	6BK		
V7	3rd. IF Amplifier	6SG7	7Q		
V8	Detector-AVC	6H6	6BK		
V9	C.W. Oscillator	6I7	7Q		
V10	Noise Limiter	6H6	7Q		
V11	AF Amplifier	6S7	8N		
V12	Phase Inverter-5 Meter Amp.	6SN7GT	8BD		
V13	Audio Output	6V6GT	7AC		
V14	Audio Output	6V6GT	7AC		
V15	Voltage Reg.	0B2	5B0		
V16	Rectifier	5V4G	5T		

CAPACITORS

Capacity values given in the rating column are in mfd. for Electrolytic and Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING CAP.	VOLT	REPLACEMENT DATA				IDENTIFICATION CODES AND INSTANTANEOUS NOTES	
			NATIONAL PART No.	AEROVOX PART No.	CORNEILL DUBILIER PART No.	SPRAGUE PART No.		
C1A	40	475	K945-3	AFR2-72	UP4450	TVL-2830	• Filter	
C2	25	50	E338-4	PRS50/25	BR255A	TVA-1306	• Filter	
C3	25	50	K946-2	PRS50/25	BR255A	TVA-1306	AF Amp. Cathode Bypass	
C4	10000	500	K946-2	BPD-01	MS51	5HK-SI	Audio Output Cathode	
C5	10000	500	J666-56	1467-01	MS51	1FM-SI	AVC Filter	
C6	1	600	D827-12	P488-1	PTE4P1	6TM-P1	1st. RF Amp. Plate Dec.	
C7	1	400	D827-12	P488-1	PTE4P1	4TM-P1	1st. RF Amp. Screen	
C8	5000	400	D827-12	BPD-005	PTE4P1	5HK-D5	1st. RF Amp. Cathode	
C9	1	400	D827-12	BPD-005	PTE4P1	5HK-D5	1st. RF Amp. Cathode *	
C10	5000	400	K946-1	BPD-005	TM5D5	5HK-D5	2nd. RF Amp. Plate Dec.	
C11	5000	400	K946-1	BPD-005	TM5D5	5HK-D5	2nd. RF Amp. Plate Dec.	
C12	5000	400	K946-1	BPD-005	TM5D5	5HK-D5	2nd. RF Amp. Plate Dec.	
C13	1	600	D827-12	P488-1	PTE4P1	6TM-P1	1st. RF Amp. Cathode	
C14	5000	400	K946-1	BPD-005	TM5D5	5HK-D5	2nd. RF Amp. Cathode	
C15	5000	400	K946-1	BPD-005	TM5D5	5HK-D5	2nd. RF Amp. Cathode	
C16	1	400	D827-12	P488-1	PTE4P1	4TM-P1	Osc. Coupling	
C17	10000	500	J666-56	P488-1	PTE4P1	MS-31	Osc. Plate Bypass	
C18	1	400	D827-12	P488-1	PTE4P1	MS-31	Osc. Grid Cap.	
C19	100	500	D825D-421	1469-0001	5R5T1	MS-31	Fixed Trimmer	
C20	5	500	H872-3	SINP0		5TCC-Q1	Mixer Plate Dec.	
C21	10	10000	K946-2	BPD-01	TM5S1	5HK-SI	Mixer Cathode Bypass	
C22	10000	400	K946-2	BPD-01	TM5S1	5HK-SI	Mixer Cathode Bypass	
C23	1	400	D827-12	P488-1	PTE4P1	4TM-P1	AVC Filter	
C24	10000	400	K946-2	BPD-01	TM5S1	5HK-SI	1st. IF Amp. Plate Dec.	
C25	10000	400	K946-2	BPD-01	TM5S1	5HK-SI	1st. IF Amp. Screen	
C26	1	400	D827-12	P488-1	PTE4P1	4TM-P1	1st. IF Amp. Cathode	
C27	1	400	D827-12	P488-1	PTE4P1	4TM-P1	1st. IF Amp. Cathode	
C28	10000	400	K946-2	BPD-01	TM5S1	5HK-SI	2nd. IF Amp. Plate Dec.	
C29	10000	400	K946-2	BPD-01	TM5S1	5HK-SI	2nd. IF Amp. Screen	
C30	10000	400	K946-2	BPD-01	TM5S1	5HK-SI	2nd. IF Amp. Cathode	
C31	10000	400	K946-2	BPD-01	TM5S1	5HK-SI	2nd. IF Amp. Cathode	
C32	10000	400	K946-2	BPD-01	TM5S1	5HK-SI	2nd. IF Amp. Cathode	
C33	10000	400	K946-2	BPD-01	TM5S1	5HK-SI	2nd. IF Amp. Cathode	
C34	10000	400	K946-2	BPD-01	TM5S1	5HK-SI	2nd. IF Amp. Cathode	
C35	10000	400	K946-2	BPD-01	TM5S1	5HK-SI	2nd. IF Amp. Cathode	
C36	10000	400	K946-2	BPD-01	TM5S1	5HK-SI	2nd. IF Amp. Cathode	
C37	10000	400	K946-2	BPD-01	TM5S1	5HK-SI	2nd. IF Amp. Cathode	
C38	25	400	D827-15	P488-25	TM5S1	5HK-SI	2nd. IF Amp. Cathode	
C39	100	400	D825D-421	SIN00	TM5T1	5GA-T1	IF Coupling	
C40	0.1	600	D827-7	P688-01	PTE6S1	GP2-333-103	S' Meter Amp. Filter	
C41	270	800	J635-2	S1270	5W5T25	5GA-T27	Diode RF Filter	
C42	0.1	800	P688-01	P688-01	PTE6S1	GP2K-271	Audio Coupling	
C43	1	400	D827-12	P488-1	PTE4P1	4TM-P1	RF Bypass	
C44	1	400	D827-12	P488-1	PTE4P1	4TM-P1	RF Bypass	
C45	1	600	D827-7	P688-01	PTE6S1	6TM-SI	Audio Coupling	
C46	1	400	D827-12	P488-1	PTE4P1	4TM-P1	AF Amp. Screen Bypass	

PARTS LIST AND DESCRIPTIONS (Continued) FILTER CHOKE

ITEM No.	TOTAL RESISTANCE	D. C. RESISTANCE	INDUCTANCE (10 CURRENT 1000 A)	REPLACEMENT DATA			INSTALLATION NOTES
				NATIONAL PART No.	STANCO PART No.	CHICAGO PART No.	
L1	.065A	280Ω	17 Henries	SA:1694		C-3192 ①	① Drill New Mig. Holes

COILS (RF-IF)

ITEM No.	USE	DC RES.		REPLACEMENT DATA			NOTES
		PRI.	SEC.	NATIONAL PART No.	MERIT PART No.		
L2A	Ant. Trans.	.20	.10	SA:6654			14.0 - 30MC A Band
B	Ant. Trans.	.20	.10	SA:6755			7.0 - 14.4MC B Band
C	Ant. Trans.	.20	.10	SA:6759			3.5 - 7.3MC C Band
D	Ant. Trans.	.40	.60	SA:6655			1.7 - 4.0MC D Band
E	Ant. Trans.			SA:6313			900 - 2050KC E Band
F	Ant. Trans.			SA:6660			480 - 960KC F Band
G	Ant. Trans.			SA:6665			180 - 430KC G Band
H	Ant. Trans.			SA:6803			100 - 200KC H Band
I	Ant. Trans.			SA:6806			50 - 100KC J Band
J	Ant. Trans.			SA:6814			27 - 30MC AA Band
K	Ant. Trans.			SA:6675			25 - 35MC AB Band
L	Ant. Trans.	.60	.10	SA:8073			21 - 21.5MC AC Band
L3A	1st. RF Trans.	.50	.10	SA:6650			14.0 - 30MC A Band
B	1st. RF Trans.	.50	.10	SA:6650			7.0 - 14.4MC B Band
C	1st. RF Trans.	9.5Ω	.10	SA:6641			3.5 - 7.3MC C Band
D	1st. RF Trans.	22Ω	.60	SA:6637			1.7 - 4.0MC D Band
E	1st. RF Trans.			SA:6640			900 - 2050KC E Band
F	1st. RF Trans.			SA:6662			480 - 960KC F Band
G	1st. RF Trans.			SA:6667			180 - 430KC G Band
H	1st. RF Trans.			SA:6669			100 - 200KC H Band
I	1st. RF Trans.			SA:6809			50 - 100KC J Band
J	1st. RF Trans.			SA:6673			27 - 30MC AA Band
K	1st. RF Trans.			SA:6818			25 - 35MC AB Band
L	1st. RF Trans.	.60	.10	SA:8074			21 - 21.5MC AC Band
L4A	2nd. RF Trans.	.60	.10	SA:6752			14.0 - 30MC A Band
B	2nd. RF Trans.	.60	.10	SA:6756			7.0 - 14.4MC B Band
C	2nd. RF Trans.	9.5Ω	.10	SA:6642			3.5 - 7.3MC C Band
D	2nd. RF Trans.	21Ω	.60	SA:6638			1.7 - 4.0MC D Band
E	2nd. RF Trans.			SA:6789			900 - 2050KC E Band
F	2nd. RF Trans.			SA:6794			480 - 960KC F Band
G	2nd. RF Trans.			SA:6800			180 - 430KC G Band
H	2nd. RF Trans.			SA:6804			100 - 200KC H Band
I	2nd. RF Trans.			SA:6810			50 - 100KC J Band
J	2nd. RF Trans.			SA:6815			27 - 30MC AA Band
K	2nd. RF Trans.			SA:6875			25 - 35MC AB Band
L	2nd. RF Trans.	.10	.10	SA:8075			21 - 21.5MC AC Band
L5A	HF Osc.	.10	.10	SA:6656			14.0 - 30MC A Band
B	HF Osc.	.10	.10	SA:6678			7.0 - 14.4MC B Band
C	HF Osc.	.40	.10	SA:6760			3.5 - 7.3MC C Band
D	HF Osc.			SA:6776			1.7 - 4.0MC D Band
E	HF Osc.			SA:6631			900 - 2050KC E Band
F	HF Osc.			SA:6795			480 - 960KC F Band
G	HF Osc.			SA:6785			180 - 430KC G Band
H	HF Osc.			SA:6805			100 - 200KC H Band
I	HF Osc.			SA:6811			50 - 100KC J Band
J	HF Osc.			SA:6816			27 - 30MC AA Band
K	HF Osc.			SA:6819			25 - 35MC AB Band
L	HF Osc.			SA:8076			21 - 21.5MC AC Band
L6A	2nd. IF Trans.	2Ω	2Ω	SA:8448			Part of L6A
B	2nd. IF Trans.	2Ω	2Ω	SA:8072			Part of L6A
L7	RF Choke	.10	.10	SA:8448			Part of L6A
L8A	3rd. IF Trans.	2Ω	2Ω	SA:8072			Part of L6A
B	3rd. IF Trans.	2Ω	2Ω	SA:8448			Part of L6A
L9	RF Choke	.10	.10	SA:8072			Part of L6A
L10A	4th. IF Trans.	2Ω	2Ω	SA:8948			Part of L10A
B	4th. IF Trans.	2Ω	2Ω	SA:8948			Part of L10A
L11	RF Choke	.10	.10	SA:8952			Tap at 1.80. Includes Trimmer, 2 Capacitors and Resistor.
L12	BFO Coil	47KΩ		SA:3361			