

Voltage - 115 Volts
Output - 50 ms at phonejack (4 ohms)
Input Frequency - Norm
Input to grid of 12SA7 Converter, Pin #8
Mod. A.P. Signal Modulation - 400 cycles
1 Switch-in

SERVICE NOTES

FOR NATIONAL

RECEIVERS



NATIONAL COMPANY, INC.
MALDEN, MASS.
U. S. A.

NATIONAL COMPANY, INC.Service and Test DataNC-33 RECEIVER Model 226 and PreviousTest Conditions:

Line Voltage - 115 Volts
 Audio Output - 50 mw at phonejack (4 ohms)
 R.F. Input Dummy - None
 I.F. Input-to grid of 12SA7 Converter, Pin #8
 R.F. Aud. I.F. Signal Modulated - 400 cycles
 Control Switch-in "phone" position

R.F. Sensitivity and Image Ratio (AVC off)

<u>Band</u>	<u>Frequency</u>	<u>10 DB Sig/noise</u>	<u>Image</u>
D	.6 Mc	2.0 uv	46 db
	1.0	2.5	
	1.4	2.5	
C	1.6	4.0	36
	3.0	5.0	20
	4.0	7.0	17.5
B	5.0	25.0	12
	8.0	18.0	18
	11.0	20.0	10
A	12.0	25.0	12
	22.0	25.0	9
	30.0	20.0	6

R.F. Sensitivity Check at 1000 KC

60-100 uv input at input for 50 milliwatts
 Output at phone jack

AVC Action

15 db output change with change in input from 10 to 1000 uv.

I.F. Bandwidth

<u>Attenuation (DB)</u>	<u>Bandwidth (KC)</u>
6	6.4
20	15.3
40	36.5

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Overall Fidelity at 1000 KC

<u>Frequency Cycles</u>	<u>Response - DB</u>
60	-12
100	- 7
200	+ 1.75
400	- .3
1000	0
2000	- .7
4000	-10.5

Audio Output Power

Maximum undistorted power output at 400 cycles is 1.5 watts.

Frequency Calibration

<u>Band</u>	<u>Frequency</u>	<u>Dial Reading Average Receiver</u>
D	1.5 Mc	1.502 Mc
	1.4	1.39
C	1.6	1.606
	4.0	4.0
B	4.0	4.055
	12.0	11.97
A	12.0	12.02
	34.0	33.9

Alignment Note

The H.F. oscillator is tuned 455 KC higher than the mixer on band B, C, and D, and 455 KC lower on A.

Grounding

If grounding the receiver result in audio hum, put a 250 to 500 mmf condenser from antenna to ground in place of link.

NATIONAL COMPANY, INC.Notice

Subject: Grounding Receiver.

A. C. Operation:

The cabinet can be grounded directly by connecting to the ground post at the rear of the cabinet. This connection is recommended if the receiver is placed on or near grounded metal objects, to prevent annoyance to the operator from the alternating current potential between the cabinet and the grounded objects. After having been grounded the receiver should be turned on and checked for hum from the loud-speaker. If a pronounced hum is heard when the Audio Gain or Volume Control is turned up, reversing the position of the A.C. cord plug in the 110 volt receptacle will remove it.

D. C. Operation:

The receiver may be grounded if desired, but it is not necessary to do so to prevent annoyance to the operator as before, as the potential between the cabinet and ground is very low. If the cabinet is to be grounded, try grounding the cabinet directly. If no hum is noticed from the loud-speaker with the Audio Gain or Volume Control turned up, this ground is satisfactory. If hum is objectionable, the cabinet should be grounded by a capacitor of about .001 microfarads. This capacitor is connected to the ground post from ground in place of a direct connection. If this connection is necessary and the antenna system is grounded directly, the link connecting the cabinet ground post to the antenna coil ground post should be opened to avoid grounding the cabinet directly by way of the antenna ground. In this case, the .001 capacitor could then be connected between the two ground posts.

NATIONAL COMPANY, INC.Service and Test Data

NC-46 RECEIVER Model 203 and Previous

Test Conditions

Line Voltage - 115 Volts
 R.F. Input Dummy - 500 ohms
 R.F. and I.F. Signal modulated - 400 cycles

R.F. Sensitivity and Image Ratio

<u>Band</u>	<u>Frequency</u>	<u>10 DB S/N</u>	<u>50 MW</u>	<u>Image</u>	
A	29 Mc	15 uv	1.2 uv	13 Db	
	22	30	1.5	21	
	14	25	3.5	22	
B	11.5	22	5.0	11	
	8.5	20	4.5	19	
C	5.0	32	6.0	30	<u>Production Check</u>
	4.2	13	2.0	19	
	3.0	12	1.8	24	
D	1.6	14	1.7	26	
	1.5	10	1.3	27	- 10 uv input = 1W Ou
	1.0	14	2.2		(at this frequency)
	0.6	12	3.0	33	

AVC Action

6 to 10 db output change with change in input from 10 to 100,000 microvolts

Stage Gain Measurements

(Microvolts input for 1 watt output)

<u>Input to</u>	<u>Frequency</u>	<u>Input</u>
Mixer Grid	456 KC	15 uv ± 5
1st. I.F. Grid	456 KC	375 uv ± 25
2nd. I.F. Grid	456 KC	22,000uv ± 5000
6SC7 Grid	400 cycles	.1 volt

I.F. Bandwidth

<u>Attenuation DB</u>	<u>Bandwidth KC</u>
6	4
20	8
40	12.5
60	19

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Overall Fidelity at 1000 KC

(100 microvolt input, 100 mw output)

<u>Frequency</u>	Tone Control	
	<u>High</u>	<u>Low</u>
100 cycles	- 2 db	- 1.5 db
400	+ 1	- 0.5
1000	0	- 7
2000	- 5	-18
3000	-15	-28
4000	-25	-35
5000	-30	-39
6000	-39	

Audio Output Power

Maximum undistorted power output at 400 cycles - 2.5 watts.
Maximum Power Output 4.5 watts.

Hum Level

40 microwatts - approximately

Frequency Calibration

1% Frequency tolerance on all bands.

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NATIONAL COMPANY, INC.Service and Test DataNC-57 RECEIVER Model 225 and PreviousTest Conditions

Line Voltage - 115 volts
 R.F. Input Dummy - 300 ohms
 I.F. Input-to grid of 6 SB7Y Converter (Pin #8)
 R.F. and I.F. Signal-modulated 400 cycles
 Control switch-in MVC position
 Tone Control-in High position
 R.F. and AFGAIN controls-Full on

R.F. Sensitivity and Image Ratio

<u>Band</u>	<u>Frequency</u>	<u>10 DB S/N</u>	<u>Image</u>	<u>Production Check</u>
E	.6 mc	9 uv	80 (DB)	10uv Input= 1 watt Output (at this frequency)
	.95	3	70	
	1.5	3	60	
D	1.6	2.2	70	
	2.6	1.4	50	
	4.2	1.7	44	
C	4.5	2.8	48	
	7.5	1.6	40	
	12.0	2.3	30	
B	12.5	3.5	38	
	20.0	6.0	32	
	33.0	6.0	20	
A	35	20	34	
	40	17	16	
	54	5	5	

AVC Action

Change in input from 10 to 10,000 microvolts = 17 db output change

I.F. Sensitivity

15 to 30 uv input at mixer grid for .5 watt output. (10-20)

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Stage Gain

Signal required for .5 watt output
 6V6 Grid - 2.9 volts
 6SL7 Grid - .05 volts
 6H6 Det pin #5 - 1 volt at 455 KC= 300 mw.
 6SG7 2 ND I.F. pin #4 - 10,000 uv
 6SG7 1st. I.F. pin #4 - 270 uv
 6SB7-Y Det. pin #8 - 20 uv (455 KC)
 6SB7-Y Det. pin #8 - 13 uv (4.4 mc)
 6SB7 R.F. pin #4 - 2.5 uv (4.4 mc)
 Antenna .5 uv (4.4 mc)

I.F. Bandwidth

<u>Attenuation DB</u>	<u>Bandwidth KC</u>
6	4.2
20	8.0
40	12.0
60	17.5

Audio Fidelity - Tone Control "High"

<u>Cycles</u>	<u>Response</u>
100	-10 DB
200	- 4
400	0
1000	+ 1.5
2000	+ 2.0
4000	+ 1.5
10,000	- 4.0

Audio Output Power

Maximum undistorted power output at 400 cycles is 1.5 watts
 measured at 1 mc. at phone jack (4 ohms)

Maximum Audio Output is 4 watts.

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Frequency Calibration - (Tolerance $1\frac{1}{2}\%$)

<u>Band</u>	<u>Frequency</u>	<u>Dial Reading</u> <u>Average Receiver</u>
E	.6 mc	.6 mc
	1.0	.984
	1.5	1.5
D	1.6	1.6
	3.0	2.955
	4.0	4.0
C	5.	5
	8.	7.91
	12.	12.
B	12.	12.19
	15.	14.98
	30.	30.00
A	35.	35.1
	45.	45.0
	54.	54.0

Quality Control Checks

Check dial set screws for tightness
 Check dials for slipping and backlash
 See that dials do not scrape on pointers.

Troubles Common to NC-57

1. Audio Oscillation with ANL on and AF gain on full.

Dress primary leads to output transformer under ANL switch. Pull excess length of leads through hole to top of chassis.

2. Hum with ANL on and AF gain on full.

Change 6H6

3. Oscillation on B and C Bands.

Check C19 H.F. osc. grid coupling cond. Should be 100 mmf. A higher value than this will produce oscillation. Also change oscillator grid resistor from 47,000 to 22,000 ohms.

4. Parasitic oscillation on A Band above 50 mc.

Check ground lead of RF amp screen bypass cond. Should be short as possible and soldered to lug on socket mounting ring adjacent to pin #4 R.F. amp cathode bias resistor should be 220 ohms.

5. Noisy Band switch

Poor contacts in switch

Poor contact between switch shaft and ground brushes on ER 210 coil.
 Ground brushes on switch shaft rubbing on coil partition ER 210 coil.
 Coil partition mounting screws not tightened down.

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6. Noisy Trimmer Control

Shorted plates.

Poor rotor brush contact.

Rotor brush not grounded to mounting bracket.

Rotor shaft grounding spring on front end of chassis loose or missing.

7. Oscillation on E Band at twice the I.F. Frequency

Check to see that there is a metal shield mounted on trimmer control bracket.

8. Backlash or slipping in main tuning or bandspread dials

Check end bearing of main tuning and bandspread condensers.

Check tension of springs on anti-backlash gears.

Tighten dial drive strings.

Check setscrews in shaft coupling.

Note:

Tuning slug L-13 has been omitted from B Band 1st. Det. coils on late models. There is a $\frac{1}{2}$ turn loop instead of slug shown in manual.

August 5, 1949

NC-57

NATIONAL COMPANY, INC.

Change Notice

Subject: Sensitivity of NC-57 on B Range at 14 mc.

Reason: Insufficient coupling in B Band detector coil.

Change: Change C-7 from 5 mmf to 15 mmf. on all receivers returned from service.

Note: If receiver is "cold" a higher value may be used without oscillation difficulties.

NATIONAL COMPANY, INC.Service and Test DataNC-108 RECEIVER MODEL 212Test Conditions

Line Voltage - 115 Volts
 R.F. Input Dummy - 300 ohms
 I.F. Input Dummy - .01 ufd Condenser
 R.F. and I.F. signal - Am modulated 30% at 400 cycles
 Crystal Oscillator with 88, 98 and 108 mc. test frequencies.

R.F. Sensitivity

Sig. Generator modulation off, 300 ohm dummy antenna, Voltohmyst Jr. connected to junction of R-27 and C-36.
 (See section 7)

I.F. Sensitivity

Connect Signal Generator to tube grid lead through .01 mfd. isolation condenser and to the chassis.

Connect the Voltohmyst to the junction of R-27--C-36 and the Chassis.

<u>Input To</u>	<u>Volts</u>	<u>Limits</u>
3rd. I.F. Grid 105 Microvolt	-3	±0.5 volts at voltmeter
2nd. I.F. Grid 6500 "	-3	±1500 microvolt at input
1st I.F. Grid 250 "	-3	±100 "
*Mixer I. F. Grid 350 "	-3	±100 "

* This value does not indicate actual gain but is for comparison only

I.F. Bandwidth

Connect S. G. to mixer grid, and voltmeter as for gain test. Disable the A.V.C. system by disconnecting R-12 from R-28 and connecting R-12 to chassis during test.

<u>Input</u>	<u>Bandwidth KC</u>	<u>Limits</u>
X1	80 KC	
X2	170 KC	120 KC
X10	270 KC	
X100	410 KC	
X1000	600 KC	150 KC

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Audio Fidelity at Output Terminal

Volume control at 10.0 DB = 5 volts at terminal, A.F. source connected through 22K ohm resistor to R-29, C-35 and chassis. Output terminals to G.R. 1800A VTVM.

Output at Terminal

<u>Frequency Cycles</u>	<u>Tone Control at 10</u>	<u>Tone Control at 0</u>
60	-2.0 DB	-2.0 DB
100	-0.5	- .75
400	0	-5.75
1000	-1.2	-15.2
5000	-9.5	-38.5
10000	-16.0	-49.0
15000	-20.0	-54.0

Audio Fidelity at Voice Coil (Output meter in place of voice coil)

Output at Voice Coil

<u>Frequency Cycles</u>	<u>Tone Control at 10</u>	<u>Tone Control at 0</u>
60	-7.0 DB	-7.0 DB
100	-2.5	-2.75
400	0	-5.75
1000	-1.1	-15.1
5000	-9.5	-38.5
10000	-16.5	-49.5
15000	-22.0	-56.0

Audio Output

G. R. 608-A Audio Osc. Freq. 400 cycles and G. R. 546-B Microvolter. Input to A.F. Gain control (Control at 10)

G. R. 1800A VTVM at output terminals.

G. R. 583-A output meter 3.0 ohms impedance in place of speaker voice coil.

<u>Input</u>	<u>Output at Term.</u>	<u>Output Meter</u>
70 Millivolts	5.6V A.C.	1 watt
100 "	8.2V A.C.	2 "
130 "	10.8 A.C.	3 "

R.F. Alignment Instructions

Two R.F. alignment frequencies are needed. 108 Mc. for the high end of the band and 88 Mc. for the low end. Thirty percent amplitude modulation will make signal identification easier.

Connect the 108 mc. signal generator to the antenna input terminals through a 300 ohm dummy antenna. With the tuning dial set at 108 Mc., align the oscillator, mixer, and R.F. trimmers for maximum deflection of tuning indicator. The oscillator frequency must be higher than the signal frequency.

With the dial at 88 mc. adjust the tuned section of the oscillator inductance to the 88 mc. signal. The coil inductance can be changed by increasing or decreasing the coil length. Repeat these two oscillator adjustments until the dial is calibrated accurately.

Trim the mixer and RF circuits at 108 Mc. Adjust the mixer and RF inductances by compressing or lengthening the coils at 88 Mc. For proper tracking it will be necessary to increase the capacity of the mixer section of the tuning condenser in the center of the range. This can be done by slightly pressing inward the two outside rotor plates of this section. A signal at 98 mc. is useful to check the proper alignment and calibration of the RF section of this receiver.

Check the receiver on an F.M. Signal or program source for proper tone and quality. Check the volume control for proper control action. Ten is maximum and zero is off. Maximum attenuation of the high frequencies is at zero on the tone control with a gradual decrease to minimum attenuation atten. The A.C. off position should disconnect the power from the receiver and the accessory socket. The output terminal can be checked with a pair of headphones. At the same time turn the monitor switch to the off position. This should shut off the speaker without affecting the output at the terminals.

NC-1-10

Socket Voltages-Cathode Currents

Terminal To Chassis	Pin No.	Voltage	Cathode Current
954 Grid	Cap	- 1.5	.
954 Cathode	5	0	4.25 Ma.
954 Screen	2	+95	
954 Plate	Cap	+192	
954 Suppressor	3	0	
955 Grid	3	- 1.8	
955 Cathode	5	0	1.5 Ma.
955 Plate	2	+30	
6C5 Grid	5	0	
6C5 Cathode	8	+4.5	10 Ma.
6C5 Plate	3	+110	
6F6 Grid	5	0	
6F6 Cathode	8	+10	26 Ma.
6F6 Screen	4	+192	
6F6 Plate	3	+185	

CONTROLS SET FOR NORMAL OPERATION

NATIONAL COMPANY, INC.Service and Test Data

NC-173 RECEIVER Model 209 and Previous

Test Conditions

Line Voltage - 115 volts
 R.F. Input Dummy - 300 ohms
 Input to grid of 6SA7 mixer (Pin #8)
 R.F. and I.F. signal modulated-400 cycles
 AVC - MVC switch - at MVC
 Noise limiter-Off
 Tone Control - 10

R.F. Sensitivity and Image Ratio

<u>Band</u>	<u>Frequency</u>	<u>6 DB Sig/Noise</u>	<u>Image</u>	<u>Production Check</u>
E	.6 mc	1 uv	90 db	
	1.0	1	78	
	1.5	1	60	- 1 uv input * 3 watts Output (at this frequency)
D	1.7	.9	80	
	2.8	1.0	65	
	4.0	1.0	56	
C	4.3	1.0	60	
	7.0	1.3	46	
	11.0	1.5	40	
B	13.	1.6	38	
	20.	.8	30	
	30.	.5	22	
A	50.	.6	14	
	54	.9	14	

R.F. Noise

<u>Band</u>	<u>Output</u>
AVC off - Full Gain	
A	.05 watt
B	.10 "
C	.40 "
D	2. Watts
E	2. "

AVC Action

2 DB Output change with change in input from 1 to 10,000 microvolts.

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Stage Gain Data

Input for 1 watt output		
<u>Input to</u>	<u>Frequency</u>	<u>Input Volts</u>
6v6 Grid	400 cycles	3.6 volts
Phono Jack	400 "	.1 volts
6H6 Diode	400 "	.28 volts
2nd I.F. Grid	455 KC	33,000 \pm 6000 uv
1st I.F. Grid	455 KC	170 \pm 30 uv
Mixer Grid	455 KC	13 \pm 3 uv

I.F. Bandwidth

<u>Attenuation DB</u>	<u>Bandwidth KC</u>
6	3.9
20	8.
40	14.
60	19.5

Overall Fidelity at 2 MC. - Tone Control at 10

<u>Cycles</u>	<u>Response</u>
60	-7 db
100	-2
200	+ .5
400	+1
1000	0
2000	-4
4000	-20

Audio Output Power

Maximum undistorted power output at 400 cycles is 3 watts.
Maximum power output is 5 watts.

Hum

Less than 7 Microwatts with full A.F. gain,- limiter on. -
R.F. Gain - OFF.

Frequency Calibration

High end of each band should be on frequency. All other
points of calibration should be within 1% error.

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Line Voltage Test

Line voltage shift from 105 to 125 volts should result in negligible change in oscillator frequency.

"S Meter" Calibration

A Band 50 to 100 uv for S-9

Noise Limiter Effectiveness

Modulation - 400 cycles at 30%
Noise peaks should be effectively brought down to level of modulated output without introducing appreciable distortion, when viewed on an oscilloscope.

Backlash

No noticeable backlash.

Quality Control

Check for microphonic tubes by tapping tubes and jarring receiver while listening to CW signal.

Leakage occurring in the 1st R.F., and 1st and 2nd I.F. stages due to bakelite sockets should be corrected by substituting isolantite sockets.

NATIONAL COMPANY, INC.Service and Test DataNC 183 RECEIVER

MODEL 251 AND PREVIOUS

Test Conditions

Line Voltage - 115 Volts
 R.F. Input Dummy - 300 ohms
 I.F. Input - to grid of 6SA7 Mixer (Pin #8)
 R.F. and I.F. signal - modulated 400 cycles
 AVC - MVC switch at MVC
 Noise Limiter off
 Tone Control at 10

R.F. Sensitivity and Image Ratio

<u>Band</u>	<u>Frequency</u>	<u>10 DB sig/noise</u>	<u>Image</u>
E	.6 mc	6 uv	80+DB
	1.0	4.4	
	1.5	3	
D	1.7	2.2	----- <u>Production Check</u>
	2.8	2.2	80+DB 1 uv input - 4 watts
	4.0	2.2	output
C	4.3	2.5	(at this frequency)
	7.0	2.5	80+DB
	11.0	2.5	70
B	13	5.2	58
	20	4.0	48
	30	2.8	40
A	50	1.5	20
	54	1.5	20

AVC Action (0 db = 100 milliwatts)

3 DB output change with change in input from 10 to 100,000uv

Stage Gain Measurements at 455 KC

Microvolts Input for 1 watt Output
 Mixer Grid - 13 ± 3 uv
 First I.F. Grid - 170 ± 30 uv
 Second Det. Grid - 33000 ± 6000 uv
 Audio Input - .2 volts

I.F. Bandwidth

<u>Attenuation DB</u>	<u>Bandwidth KC</u>
6	4.0 \pm .4 KC
20	8.0 \pm 1.0
40	12.5 \pm 1.0
60	18.0 \pm 2.0

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Overall Fidelity at 1000 KC

<u>Tone control at 10 (Off)</u>		<u>Audio Section only</u>	
<u>Cycles</u>	<u>Response</u>	<u>Tone Off</u>	<u>Tone On</u>
60	-1.5 db	-2.0 db	-1.0 db
100	- .75	-1.0	0
200	0	- .5	0
400	0	0	-1.5
1000	0	0	-6
2000	-2	+1.0	-10.5
4000	-11		-14
5000	-19	+3.0	
10000		+1.0	-26
15000		-4.0	

Audio Output Power

Maximum undistorted power output at 400 cycles - 8 watts.
Maximum power output - 11 watts.

Frequency Calibration

All Points of calibration should be within 1% error.

"S Meter" Calibration (No dummy antenna)

<u>Band</u>	<u>S-1</u>	<u>S-9</u>
E	2-5uv	
D	1-4	35 to 70 nV
C	1-2	30 to 35
B	1-3	30 to 50 -- set to 50 mv at 28 mc
A	1	10 to 20

Line Voltage Test

Line voltage shift from 105 to 125 volts should result in negligible change in oscillator frequency.

Noise Limiter Effectiveness

Modulation 400 cycles - 30%

Noise Peaks should be effectively brought down to level of modulated output without introducing appreciable distortion, when viewed on an oscilloscope.

Backlash

No noticeable backlash.

Quality Control

Check for microphonic tubes and stability by jarring set while listening to cw signal.

Checking the NBFM Adaptor

Plug NBFM Adaptor into accessory socket.

Selectivity off

C.W.O. Off.

Limiter Off.

R.F. Gain full.

Audio Gain full.

Connect signal generator to grid and ground of mixer 6SA7.

Signal modulated 30% with 400 cycles -Freq. 456 KC/s

Radio-phonograph switch to phono.

Advance signal generator output until a signal is heard in the phones. Tune signal generator through 456 Kc/s. and listen for a null in audio output. Remove signal generator and listen for background noise.

The noise with the Radio phono switch in the phono position should be very nearly equal to the noise with the radio-phonograph switch in the radio position. Check accessory socket voltages on all sets. Refer to voltage chart.

Troubles Common to NC-183

1. Osc. in the E band at twice and three times the I.F. Freq.
 - (a) Look for loose screws on sides of coil compartment
 - (b) Be sure second I.F. and A.V.C. amp. plate leads are down near the chassis.
 - (c) Be sure the diode leads of the 6H6 are down near the chassis.
 - (d) Check ground leads on side of coil compartment
 - (e) Be sure that the first R.F. grid lead is down near the chassis.
 - (f) Check ground at the end of the shield on the B.F.O. lead near the 6h6 det. tube

2. Osc. at low end of the B band.
 - (a) Check grounds on main tuning condenser
 - (b) Check ground brushes on band-change switch shaft.
 - (c) Be sure first I.F. plate lead is down near the chassis.

Troubles Common to NC-183 (Continued)

3. Pulling of signal with antenna trimmer on the A band.
 - (a) Check ground on band-change switch shaft.
 - (b) Check ground from tie rod on tuning condenser to chassis.

4. Motor boating with both R.F. and audio gains at zero.
 - (a) Check value of inverse feedback resistor R47. This resistor should be 4700 ohms. A lower value than this would cause the motor boating as above.

5. Audio Osc.
 - (a) Output transformer may be wired wrong
 - (b) Connecting leads to the transformer may be reversed

6. Hum with limiter on.
 - (a) Change limiter tube

7. Backlash in main tuning or bandspread dials.
 - (a) Check end bearings of main tuning and bandspread condensers
 - (b) Check tension of springs on antibacklash gears.

NATIONAL COMPANY, INC.Service and Test DataNC-200 RECEIVERTest Conditions

Line Voltage - 115 Volts
 R.F. Input Dummy -
 R.F. and I.F. Signal - Modulated 400 cycles

R.F. Sensitivity and Image Ratio (limits)

(10 mw noise level - 1 watt output)

<u>Band</u>	<u>Frequency</u>	<u>MCW</u>	<u>CW</u>	<u>Image</u>
A	29.mc	2uv	5uv	20 DB
C	4.	4	5	35
F	.55	10	10	50

AVC Action

Change in input from 10 to 100,000 uv results in less than 10 db change in output.

Stage Gain - (for 1 watt output)

1st Det. - 25 ± 5 uv
 1st I.F. - 250 ± 50 uv
 2nd I.F. - $50,000 \pm 10,000$ uv

Bandwidth (at 4. mc) (limits)

<u>Attenuation</u>	<u>Less than</u>
20 db	10 kc
40 db	18 kc
60 db	28 kc

Audio Power Output

5 watts undistorted output at speaker-6mw at phone jack

Overall Fidelity at 4 mc. (limits)

100 cycles	0 ± 3
200	2 ± 2
400	2 ± 2
1000	0
2000	-5 ± 5
4000	-20 ± 10

Hum level at speaker

50 microwatts - approximately

Dial Calibration

± 1 dial division

"S" Meter Calibration

S-9 = 50 to 100 uv at 750 kc.

NATIONAL COMPANY, INC.Service and Test DataNC-2-40 D RECEIVER MODEL 195 and PREVIOUSTest ConditionsLine Voltage - 115 VoltsAudio Output - 1 wattR.F. Input Dummy - 75 ohm resistor shunted with 250 mmf condenser

I.F. Input-to grid of 6K8 mixer tube

R.F. & I.F. Signal-Modulated 400 cyclesNoise limiter-offTone Control-Normal positionR.F. Sensitivity and Image Ratio (5 mw reference)

<u>Band</u>	<u>Frequency</u>	<u>10 DB Sig/noise</u>	<u>Image</u>	<u>Production Test</u>
F	.6mc	1.4uv	93 DB	1uv Input = 3 W
F	1.0	2.6	64	Output (at 2.0m)
E	1.0	1.5	70	
E	2.0	.7	45	
D	1.9	1.2	67	
D	3.9	1.1	42	
C	3.8	1.0	40	
C	7.0	0.6	46	
B	7.85	0.8	48	
B	14.0	0.9	38	
A	14.5	1.4	32	
A	29.5	.7	30	

AVC Action

2 DB Output change with change in input from 10 to 100,000 uv.

I.F. Sensitivity

20-30uv input at mixer grid for 1 watt output.

I.F. Bandwidth

<u>Attenuation (DB)</u>	<u>Bandwidth (KC)</u>
20	8
40	16
60	22

Overall Fidelity at 4 mc.

<u>Cycles</u>	<u>Response</u>
100	0.5 DB
200	1.0
400	1.0
1000	0
2000	-4.0
4000	-14.5

Audio Output Power

Maximum undistorted Power Output at 400 cycles is more than 5 watts on Speaker; 6 mw. on Phones.

Frequency Calibration

All points of calibration should be well within 1% error, \pm the width of the dial pointer is round calibration accuracy.

S Meter Calibration

S meter should read approximately 4 db per S unit \pm .5 db. 50 microvolts = S9 at 1.5 mc.

Line Voltage Test

<u>Line Voltage</u>	<u>Frequency</u>	<u>Change</u>
105 to 125	29.0 mc	1500 cycles
105 to 125	3.7 mc	175 cycles

Noise Limiter Effectiveness

Modulation 400 cycles - 30%

Noise peaks should be effectively brought down to level of modulated output without introducing appreciable distortion.

Backlash

No noticeable backlash

Quality Control

Test for microphonic tubes or instability by jarring set while listening to cw signal.

NATIONAL COMPANY, INC.Service and Test DataHRO-5A1 RECEIVERTest Conditions

Line Voltage - 115 Volts
 Noise Level - 10 mw
 RF Input Dummy - 300 ohm resistor
 RF and IF signal modulated - 400 cycles

R.F. Sensitivity and Image Ratio

10 mw noise - 1 watt output

<u>Band</u>	<u>Frequency</u>	<u>*MCW</u>	<u>*CW</u>	<u>Image</u>	
A	29 mc	4 uv	5 uv	25	
B	14	4	5	50	
C	7	4	5	70	<u>PRODUCTION TEST</u>
D	3.800	4	5	80	
E	1.950	4	5	80+	1 uv input =
F	.900	4	5	80+	2 watts output
G	.400	3.0	4	80+	(at 4 mc)
H	.190	3.0	4	80+	
J	.090	3.0	4	80+	

* Limits

AVC Action

Change in input from 10 to 100,000 microvolts results in not more than 20 db change in output. (10 uv input = 10 mw output)

I.F. Bandwidth

<u>Attenuation DB</u>	<u>Bandwidth KC*</u>
6	3.0
20	8.5
40	16.0
60	26.0

*Limits

-2-

Overall Fidelity at 4 megacycles

(Output level 200 mw - input 100 uv)

<u>Cycles</u>	<u>Response*</u>
100	.5±2
200	1 $\frac{1}{2}$ ±2
400	2±2
1000	
2000	-6 $\frac{1}{2}$ ±2
4000	-21±4

*Limits

Audio Output Power

Maximum undistorted output power at 400 cycles is not less than 2.0 watts.

Hum Level

Approximately 10 microwatts

Antenna Input Impedance

Approximately 500 ohms (Varies from 110 to 1250 ohms)

Frequency Calibration

All frequencies should be within calibration line width of frequency shown on calibration chart.

Calibration Points

Band	<u>BANDSPREAD</u>				<u>GENERAL COVERAGE</u>			
	Hi		Lo		Hi		Lo	
	<u>Freq.</u>	<u>Dial</u>	<u>Freq.</u>	<u>Dial</u>	<u>Freq.</u>	<u>Dial</u>	<u>Freq.</u>	<u>Dial</u>
A	30 mc	450	28mv	50±5	30mc	485	14.mc	30±10
B	14.4	450	14	50±5	14.4	485	7.0	25±5
C	7.3	450	7	50±5	7.3	490	3.5	10±5
D	4.0	450	3.5	50±5	4.0	490	1.7	15±5
E					2.0	470	.9	10±5
F					.9	430		25±5
G					.4	450	200.	75±5
H					.2	490	100.	15±5
J					.1	490	50.	10±10

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Line Voltage Test

A Range	29mc.	700 cycles per volt shift
	15mc.	80 cycles per volt shift
B Range	14mc.	40 cycles per volt shift
	7.5mc.	7 cycles per volt shift
C Range	Negligible	
D Range	Negiligible	
E Range	Negiligible	

Warm Up Drift -- 29 mc. (Bandsread Coil)

	9.5 kc.	1st 5 minutes	
Addl.	4.0 kc.	2nd 5 minutes	
Addl.	2.5 kc.	3rd 5 minutes	Total Drift
Addl.	1 kc.	4th 5 minutes	17.5 kc.
Addl.	$\frac{1}{2}$ kc.	next 10 minutes	($3\frac{1}{2}$ dial divisions)
		No drift after 30 minutes	

Crystal Insertion Loss

Input adjusted 25 mw - Crystal On
 Crystal Off - output should not read less than 10 mw

HRO-7 BANDSPREAD SERIES PADDERS

10-11 Meters		20 Meters		40 Meters		80 Meters	
A-1	M-30 Shunted by 12 mmf. ceramic	B-1	M-30 Shunted by 5 mmf. ceramic	C-1	M-30 Shunted by 12 mmf. ceramic	D-1	M-30 Shunted by 25.7 mmf. ceramic
A-2	M-30 Shunted by 21 mmf. ceramic	B-2	M-30 Shunted by 5 mmf. ceramic	C-2	M-30 Shunted by 12 mmf. ceramic	D-2	M-30 Shunted by 25.7 mmf. ceramic
A-3	M-30 Shunted by 21 mmf. ceramic	B-3	M-30 Shunted by 5 mmf. ceramic	C-3	M-30 Shunted by 12 mmf. ceramic	D-3	M-30 Shunted by 25.7 mmf. ceramic
A-4	30 mmf. var. air condenser shunted by 10 mmf. .00075 negative temp. coeff.	B-4	21 mmf. variable air condenser	C-4	30 mmf. variable air condenser	D-4	45 mmf. variable air condenser

HRO-7

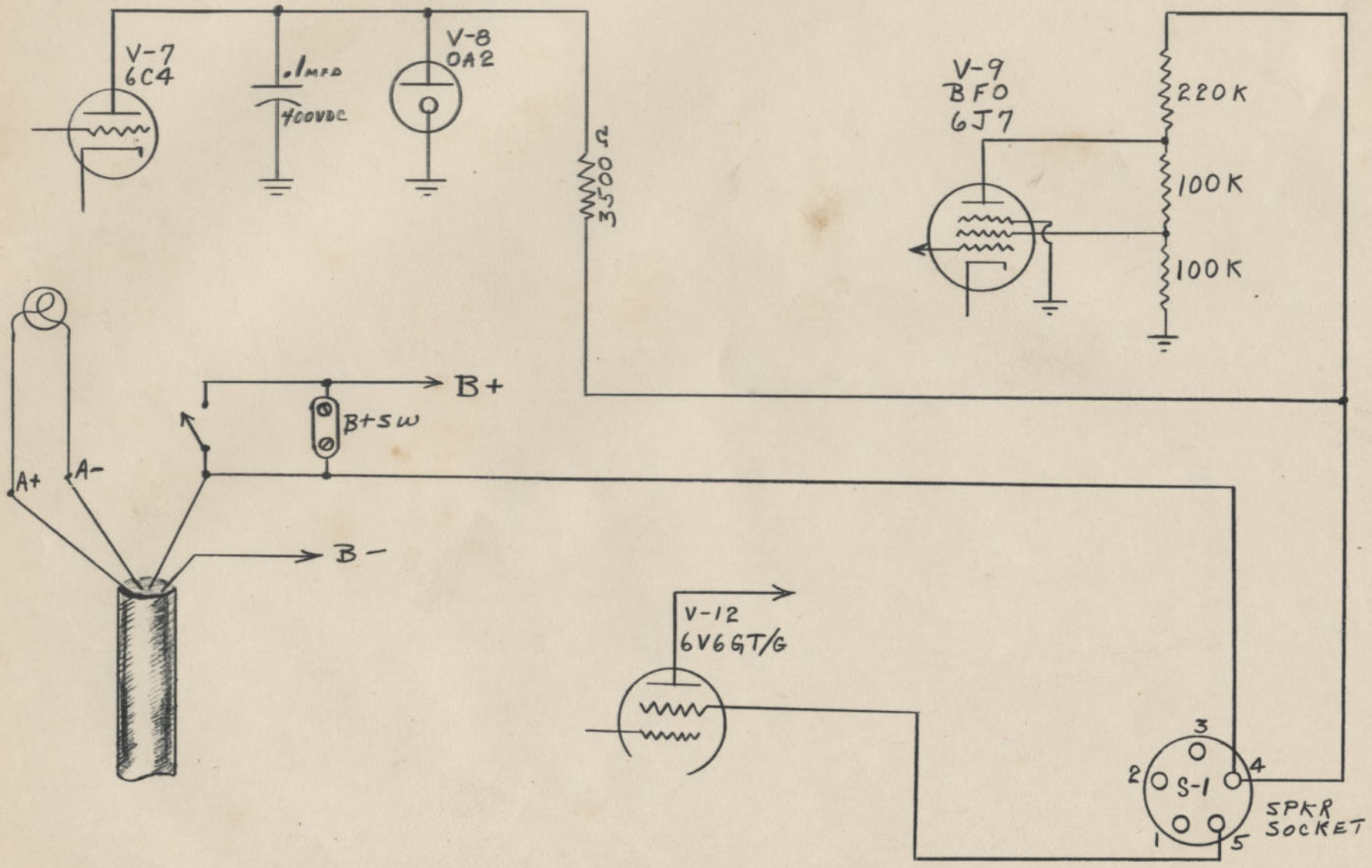
Note: Average capacity range of M-30 is 3.5 to 35 mmf.

All ceramics have zero temperature coefficient except in A-4.

NATIONAL COMPANY, INC.Change NoticeHRO-7 Stand-by Switch Wiring RevisionTo Minimize Oscillator Drift

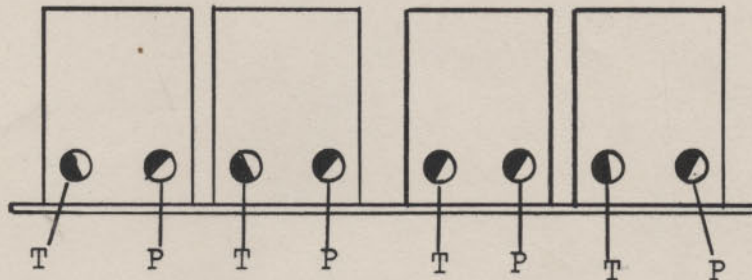
1. Move B+ end of R-24 from B+ tie-point to pin #6 of V-9.
2. Connect pin #6 of V-9 to pin #5 of S-1 using 8 3/4" of red wire.
3. Move red lead supplying pin #4 of S-1 from cold terminal of BSW to hot terminal.
4. Move red lead running to tie-point located on chassis between C-31 and C-37 from pin #4 of S-1 to cold terminal of BSW.
5. Change R-21 from 2500 ohms 5 watt to 3500 ohms 5 watt.

The wiring of the HRO-7 shall be changed according to the attached diagram and above directions. This allows the H.F. oscillator, BFO oscillator and Output tubes to remain on all the time whether the B+ switch is turned on or off. The reason is to eliminate drift occurring during stand-by periods.



HRO-7 AA COIL SET

Location of adjustments



T = Trimmer--Adjust these at high end of band (30 mc.-450 on dial)

P = Padder--Adjust these at low end of band (27 mc.-50 on dial)

Position of black dot indicates correct position (Approximately) when coil is properly adjusted.

Calibration Chart

<u>Dial</u>	<u>MC</u>
50.	27
235.5	28
357.	29
450.	30

NATIONAL COMPANY, INC.Service and Test DataHFS RECEIVER

MODEL 213

Test Conditions

Line Voltage - 115 volts
 Audio Output - 2.5 watts maximum
 R.F. Input Dummy - 150 ohms
 I.F. Input Dummy - .001 ufd cond. shunted by 50 K ohms
 I.F. Input - to Mixer Coil Socket
 I.F. Frequency - 10.7 megacycles
 Connect output meter - to plate and B+ of 6V6 tube
 Output Impedance - 5000 ohms
 Power Supply - Natco #5886 supplying 170 volts b+ at 38 ma.
 and 6.3 watts at 2.12 amp.

R.F. Sensitivity (at antenna terminals)

Using Broad Band Noise Generator (50 ohm)
 0.3 to 1.0 uv for 6 db noise suppression.

I.F. Sensitivity (Measured at 6AK5 grid)

2.5 to 4.5 uv for 6 db noise suppression.

I.F. Alignment

Equipment required for I.F. alignment is as follows:

Signal Generator G.R. 605-B
 Output Meter G. R. 583-A
 Output Meter Clip Leads
 Alignment Tool SA:3156
 Protective Dummy Antenna (consists of .001 or
 larger condenser shunted by 50K ohms).
 Coil base with pins (to connect dummy ant.)

Connect output meter to plate and b+ of 6V6 tube by means of clip leads taking care to avoid shorts or grounds. Set output meter to 5,000 ohms and power multiplier switch to X1 position.

Plug power cable into 5886 power pack and turn A.C. switch on. Switch B+ ON and INT*EXT. switch to INT.

Connect signal generator to protective dummy and plug into mixer coil socket (nearest to speaker).

Advance AUDIO control to about 7; REG. control to about 4. Tune signal generator to 10.7 Mcs. and apply on unmodulated signal of 4 or 5 uv. Adjust 2nd detector transformer slug for minimum hiss when signal is located. Set generator attenuator to zero and adjust REG. control to setting which gives about 5 or 10 MW of hiss noise. Then peak up first I.F. transformer slugs for maximum noise. A false peak will be observed if REG. control is advanced too far. The I.F. amplifier will now be almost perfectly aligned. Check alignment by applying about 3-4 uv unmodulated signal and adjusting first I.F. can slugs for minimum hiss noise. The 2nd. detector tuning need not be disturbed.

I.F. Sensitivity

With attenuator at zero, advance REG control to give 16.5 MW of noise (12 db) apply signal until noise drops to 4 MW. The sensitivity for this 6 db noise suppression can now be read from the microvolts dial of generator and should be between the limits of $2\frac{1}{2}$ to $4\frac{1}{2}$ uv.

Maximum Noise Output

Advance AUDIO and REG controls full ON. With no signal input the hiss noise should be between 100 to 150 milliwatts.

I.F. Rejection Test (F Band coils in mixer and osc. sockets)

Connect hot generator lead to top antenna post and ground lead of generator to bottom antenna post; connect ground braid to bottom post also. Tune generator to 10.7 mc. and increase signal (unmodulated) for 6 db noise suppression. The input required should be not less than 900 uv.

Controls

Check operation of controls for any evidence of noisy action. Particular attention should be given the REG control; regeneration to super-regeneration should occur within approximately one division of REG control knob.

Converter TestAdditional Equipment Required.

- NC-173 Receiver or equivalent (tunable to 10.7 mc.)
- 3 ft. 50-70 ohm coaxial cable
- 300 ohm dummy antenna

Connect chassis connector of HFS receiver to NC-173 antenna post and grounded posts by means of above cable. Set controls of NC-173 for normal AM operation A.V.C. on, AUDIO retarded; and R.F. GAIN full ON. Turn on HFS Receiver and with converter switch to EXT peak up R.F. TRIMMER of both receivers, and peak tuning of NC-173 to 10.7 mc. The "S" meter of NC-173 should show a noise level between 2 and 4 "S" units for normal converter operation. Check operation of converter OUTPUT control.

Converter Sensitivity

With the HFS and NC-173 set up as indicated, connect a G.R. 583-A output meter to output terminals of NC-173 and feed a 28 Mc. signal (30% mod.) of about 1 uv to HFS antenna terminals using a 300 ohm dummy. The R.F. GAIN of NC-173 should be full advanced. Tune HFS to signal and advance AUDIO of NC-173 until 100 Mw. is obtained on output meter. Now, with generator modulation OFF, retune generator slightly. Cutting modulation should result in a 10 db drop in output reading. It will be necessary to adjust AUDIO of NC-173 and reduce signal input to HFS to get exactly 10 db drop in output. The input required for this 10 db. signal to noise ratio may now be read from the attenuator dial of signal generator. At 28 Mc. this should be better than 1 uv., a typical reading being .6 uv.

Converter INT-EXT Calibration

Due to the broadness of the INT. I.F. amplifier as against the sharp EXT. I.F., the tuning of the HFS dial may not coincide when switching between INT-EXT amplifier.

Test as follows: Tune in signal on HFS with EXT. amplifier peaked to center of 10.7 band pass. Switch to INT. amplifier (adjusted for superregeneration) if signal is not received at same dial setting as for EXT. operation, do not disturb dial of HFS, adjust 2nd detector slug slightly until signal is received at same dial setting when switching between INT. and EXT.

Retune I.F. amplifier slugs, if not on 10.7 Mc.

R.F. Alignment Procedure

Equipment Required -

Insulated Screwdriver
Tuning Wand
150 Ohm Ant. load
Broad-Band Noise Generator

Test Signals as follows:

A Band	178 Mc.	-	247 Mc.
B Band	120 Mc.	-	178 Mc.
C Band	80.4Mc.	-	120 Mc.
D Band	57 Mc.	-	80.4Mc.
E Band	41 Mc.	-	57 Mc.
F Band	27 Mc.	-	41 Mc.

General:

Note that the high freq. oscillator is operated 10.7 Mc. lower than the signal on the "A" band. On all other bands the oscillator operates 10.7 Mc. higher than signal. The image of 178 Mc. on "A" band will be received 21.4 Mc. higher on the receiver dial (at about 200). For B, C and D bands the image will appear 21.4 Mc. lower than signal.

The mixer TRIMMER should peak at about $1/3$ to $1/2$ capacity on A and B bands. Rock tuning dial and TRIMMER for maximum sensitivity and true trim point. On remaining bands TRIMMER should peak at about $1/2$ to $2/3$ capacity when antenna primary is loaded with 50 ohm line or generator.

The trimmer on the oscillator section of tuning capacitor is used to set the high end of A band only; therefore only the inductance of the remaining oscillator coils can be adjusted during oscillator calibration. It is best to start calibration at the low end of each band by adjusting oscillator coil so that the low frequency signal is correctly located on the receiver dial; the high frequency signal will probably fall quite close to the specified dial reading unless the minimum capacity of the oscillator tuned circuit or oscillator tube is not within tolerances. If this is the case, look for misplaced wiring or grid condensers jammed against other parts.

Since there are only two tuned circuits any unusual tendency for tracking to run out will be indicated by the mixer TRIMMER although the tuning wand may be used to estimate inductance changes required in either mixer or oscillator coils. Tracking in the middle of the band can in some cases be improved by carefully adjusting position of oscillator series padder with respect to oscillator coil, after which check high and low ends of band again.

Note that a broad band source of noise, e.g. buzzer, may be used to definitely indicate when the mixer is trimming correctly in any part of a band.

The "A" band strap type coils are adjusted for inductance by bending sides of coil outward to increase inductance and squeezing together to reduce inductance. Care should be taken to avoid deformation of the straps during inductance adjustment. All other coils are adjusted in the conventional manner by spreading turns apart to reduce inductance or squeezing coil turns together to increase inductance. D, E and F coils are provided with inductance loops which can be used to increase or decrease inductance.

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Tuning condenser and coil contacts:

Before alignment check tuning condenser for bad fitting caused by mounting strain. Coils, especially A and B must seat flat without wobble and contacts must grip prongs firmly.

"A" Band:

Test Signals 247 Mc. Image ---
178 Mc. 200 on dial

Connect a small antenna to upper antenna terminal and shunt the 150 ohm resistor across antenna terminals.

The high end of the "A" band must be set before aligning any other ranges. The trimmer for this purpose is located on the oscillator section of tuning condenser and is accessible from the chassis bottom through hole near REG. control. A preliminary setting to about 1/2 capacity should be made. With the 247 Mc. signal switched on, locate signal near 450 on receiver dial and adjust trimmer a little at a time until signal is set on 450 or slightly higher. The mixer TRIMMER should peak at about 1/3 capacity. Note that an incorrect trim point may be obtained at about 2/3 capacity. Switch test signal to 178 Mc. which should appear between 0 and 10 on dial. Check calibration at high end if oscillator inductance was adjusted to set 178 Mc. TRIMMER should peak at about 1/2 capacity for 178 Mc. and at middle of band.

"F" Band:

Test Signals 41 Mc. Image ---
27 Mc.

With "F" coils in place switch signal to 27 Mc. which should be received at 10 or 15 on dial. If, after adjusting loop in oscillator coil to maximum and considerable inductance is still needed to receive 27 Mc., check for insufficient tuning capacity by replacing coils with standard "F" coils. A low value padder condenser may also make it impossible to receive 27 Mc. An inspection mirror may be used to check fitting of tuning condensers to note whether end stator plates nearest front panel of receiver may be bent toward rotor plates so as to increase capacity. The tuning condenser must be replaced and refitted if above adjustments are made and 27 Mc. can not be set properly. The "A" band must be retrimmed after any condenser adjustments.

After 27 Mc. calibration is complete switch signal to 41 Mc. which should fall at about 400 on dial. TRIMMER should peak at about 1/2 capacity at high end and middle of band. (Note: Condenser adjustment should be avoided if at all possible.)

-6-

"E" Band:

Test Signals 57 Mc. Image ---
41 Mc.

Plug in E coils and with 41 Mc. signal on turn receiver dial to 40 and adjust oscillator loop to set 41 Mc. Adjust mixer loop to make TRIMMER peak at about 2/3 capacity. Switch signal to 57 Mc. which should appear near 450 on dial. TRIMMER should peak at about 1/2 capacity at high end and middle.

"D" Band:

Test Signals 80.4 Mc. Image 240 on dial
57 Mc. -----

Plug in "D" coils and with 57 Mc. signal on turn receiver dial to 70. A slight adjustment of oscillator loop should set 57 Mc. at about 70; if not adjust bottom lead of coil or outside end turn. Adjust mixer loop so that TRIMMER peaks at 1/2 capacity. Switch test signal to 80.4 Mc. which should fall near 480 on receiver dial. TRIMMER should peak at about 1/2 capacity at high end and middle.

"C" Band:

Test Signals 120 Mc. Image 290 on dial
80.4Mc. -----

With "C" coils plugged in, switch on 80.4 Mc. signal and turn receiver dial to 15; adjust oscillator inductance to set 80.4 Mc. Adjust mixer coil so that TRIMMER peaks at about 1/2 capacity. Switch signal to 120 Mc. which should be received at about 480 on receiver dial. The mixer TRIMMER should peak at about 1/2 capacity; look for a false peak at about 1/3 capacity if signal is too strong. Check TRIMMER peak at middle of band.

"B" Band:

Test Signals 178 Mc. Image 350 on dial
120 Mc.

Change to "B" band coils and switch on 120 Mc. signal; with receiver dial at 10 or slightly higher, adjust oscillator coil so that 120 Mc. is received at above dial setting. Adjust mixer coil until TRIMMER peaks at 1/2 capacity. Switch signal to 178 Mc. which should tune in at 480 on higher on dial. Mixer TRIMMER should peak at about 1/2 capacity at high end and middle.

Back-lash and Stability:

Back-lash should not exceed one-quarter of a division.

Jarring cabinet or drive unit should not cause detuning of signal on A or B band. With the REG. control adjusted to give a CW beat note, the frequency stability should be comparable to the HRO when the cabinet is jarred.

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COMMON TROUBLES
(HFS. Receiver)

The stage by stage tests, if made in the order shown, will definitely indicate the section of the circuit in which a faulty component or wiring is the cause of weak signals or an inoperative receiver. Set controls for normal operation. If dead at any TEST POINT see CHECK column.

<u>TEST POINT</u>	<u>TEST SIGNAL</u>	<u>CHECK</u>
1. Grid, Pin #4 6SK7	Audio or touch with Prod.	Voltages 6SK7, 6J5, 6V Audio trans. and speak
2. Grid, Pin #4 6SG7	10.7 Mc. Mod. 30%	I.F. Cans, voltages 6SG7
3. Grid, Pin #1 6AK5	10.7 Mc. Mod. 30%	I.F. Can, voltages 6AK5
4. Ant.	Freq. to suit band	Voltages 6AK5 and sock connections

COMMON TROUBLES (HFS Receiver)

NOISE: Check tubes and wiring connections; spattered solder or other metal particles adhering to H.F. oscillator stators will cause severe noise or frequency instability. Hiss noise which exceeds 200 MW. may be caused by oscillation in I.F. stage or by audio feedback from plate lead of 6V6.

ROUGH REG. CONTROL: An abrupt noise peak occurring when REG. control is advanced from regeneration to super-regeneration indicates misalignment and oscillation in the I.F. stage. Keep input and output wiring of 6SG7 dressed toward chassis and realign I.F. A weak 6SG7 which loads the 2nd. detector without contributing much amplification will require that the REG. control be advanced more than normal to obtain super-regeneration.

TUBES: A weak 6SK7 or 6SG7 tube will generally result in poor regenerative action and low I.F. gain. A high pitched squeal observed with some 6SK7 tubes with REG. control fully advanced is normal provided it does not exceed 50 MW. when hiss is blocked with an unmodulated signal.

Note that some 6AK5 and 9002 tubes have a fluorescent glow on mica supports during operation; this is normal and is caused by ion bombardment and not by gas.

5/1/49

686-S Power
Supply

NATIONAL COMPANY, INC.

CHANGE NOTICE

Subject: Hash in 686-S Power Supply when used with
HFS receiver.

Reason: Additional filtering is needed.

Procedure: Add the following capacitors:

C-203 - .01 mfd-300VDCW
C-204 - .0043 mfd-500VDCW
C-205 - .0001 mfd-500VDCW

Note: All models of this power supply
manufactured on or after this date will
have the above changes.

INSTRUCTIONS FOR NATIONAL POWER UNITS
TYPE 686S and 1286S

The National Type 686S Table Model Power Unit operates from a 6 volt D.C. supply to provide approximately 165 volts at 45 milliamperes D.C. under typical operating conditions with a maximum permissible loading of 80 milliamperes D.C. The Power Unit filtering effectively eliminates vibrator hash from the B supply leads as well as hash radiation from the A supply leads. The Power Unit is recommended for use with receivers tuning to any of the general communications frequencies. Output voltages for both A and B supply are available at a four prong socket for convenient plug and cable connection to associated apparatus. Battery clips are provided for convenient connection to a 6 volt storage battery or similar source of power. It should be noted that B- is not connected to the Power Unit chassis, although it may be connected to the chassis if desired. The A- lead is permanently connected to the chassis.

The National Type 1286S Power Unit is similar to the Type 686S Power Unit except that it is designed to operate from 12 volts D.C. The voltages available at the output socket are 12 volts D.C. and 165 volts at 45 milliamperes D.C.

The National Type 686SB Power Unit is the same as the Type 686S except that it is equipped with mounting brackets.

The National Type SPU-686S Power Unit is the same as the Type 686S except that it is designed for rack mounting.

TABLE 1
TYPICAL OPERATING CONDITIONS

VARIABLE	686S	1286S
Primary Voltage	6 V.D.C.	12 V.D.C.
Heater Voltage	6 V.D.C.	12 V.D.C.
Heater Current	3 Amp. D.C.	
B Voltage	165 V.D.C.	165 V.D.C.
B Current	45 Ma. D.C.	45 Ma..D.C.
Line Current (Including Heater Current)	6.3 Amp. D.C.	
Total Power Consumption	38 Watts	

TABLE 2

PARTS LIST

NATIONAL C
DRAWING NO

SYMBOL	FUNCTION	DESCRIPTION	
Capacitors			
C-201	Line Filter	Elect., 500 mfd. 15 vdcw	E338-7
C-202		Elect., 8+8 mfd. 475 vdcw	E337-3
C-202A	B Supply Input Filter		
C-202B	B Supply Output Filter		
C-203	A+ Filter	Mica; 0.01 mfd. $\pm 10\%$, 300 vdcw	J666-56
C-204	B+ Filter	Mica; 0.0043 mfd. $\pm 10\%$, 500 vdcw	J666-38
C-205	Filter	Mica; 100 mmf. $\pm 10\%$, 500 vdcw	J665-32
Miscellaneous			
E-201*	6 Volt Vibrator Unit		SA:2864
E-201**	12 Volt Vibrator Unit		F205-2
F-201	Line Fuse	10 Amp. 25 volt	F135-6
L-201	Line Filter	Choke, 16 Microhenries	SA:869
L-202	B Supply Filter	Choke, 17 henries at 80 Ma.	SA:31-B
S-201	Line Switch	SPST Toggle 3A at 250 V.	D851-2
V-201	Rectifier Tube	6X5GT	
W-201	Line Connector	Two conductor with clips attached	SA:1999
Y-201	Vibrator	Non-Synchronous Type	F206-1
X-201	Output Socket	Four prong female	E319-9

* Used on 686S Power Unit only.
 ** Used on 1286S Power Unit only.

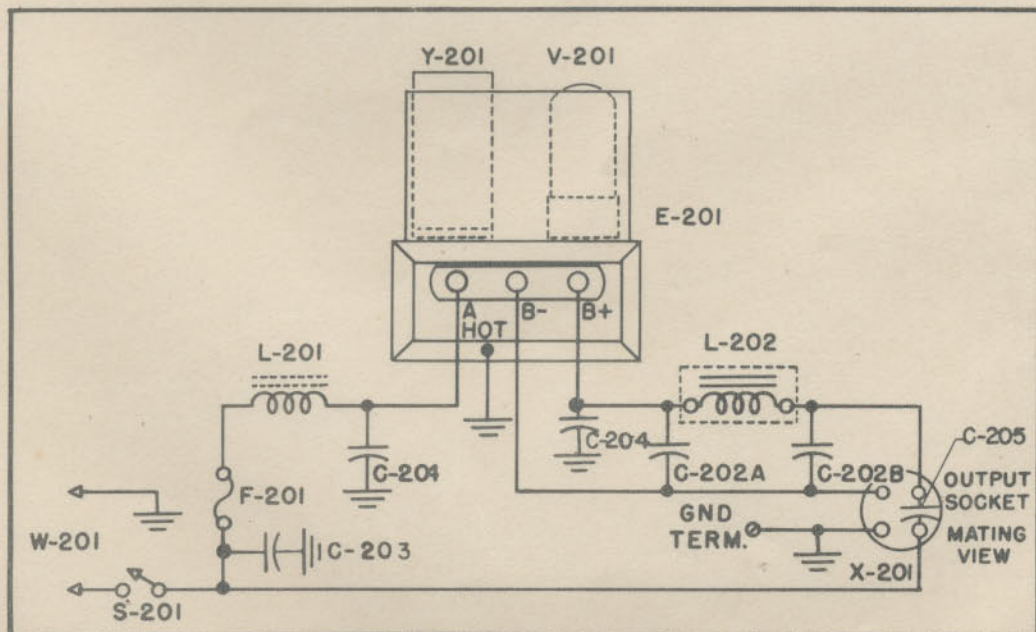


FIGURE 1
 SCHEMATIC DIAGRAM 686S AND 1286S POWER UNITS

PORTABLE OPERATION DATA ON NATIONAL RECEIVERS

Receiver	<u>Battery Operation</u>				<u>686S Vibrator Power Supply</u>				Remarks
	"A" Battery		"B" Batteries		Storage Battery		686S Output		
	Volts	Amp.	Volts	Amps	Volts	Amps	Volts	Amps	
NC-57	6	2.4	180	.057	6	6.2	165	.049	VR not lighted
	6	2.4	250	.080					VR lighted
	6	2.4	135	.039					VR not lighted
		2.4	250	.077					VR tube removed
NC-173	6	4.1	135	.046	6	8.0	140	.050	VR not lighted
	6	4.1	180	.065					VR not lighted
	6	4.1	240	.113					VR tube lighted
		4.1	250	.093					VR tube removed
NC-183	6	5.1	135	.047	6	8.9	140	.050	VR tube not lighted
	6	5.1	180	.065					VR tube not lighted
	6	5.1	250	.098					VR tube lighted
		5.1	250	.090					VR tube removed
HRO-7	6	3.45	180	.060	6	7.4	150	.051	
	6	3.45	240	.085					
	6	3.0	180	.032	6	6.1	180	.036	Output tube removed
HFS	6	2.13	135	.028	6	5.4	180	.038	
	6	2.13	180	.038					
	6	1.7	180	.018	6	3.9	215	.020	Output tube removed
Variable					6	1.7	250	.009	
Load on 686S					6	2.7	200	.030	
Vibrator					6	4.0	150	.058	
Power Supply					6	4.5	125	.070	

NATIONAL COMPANY, INC.
SERVICE AND TEST DATA

Misc.

IF GAIN FIGURES
±20%

RECEIVER	1st Det.	1st IF	2nd IF	Phone Output	Speaker Output
NC-44	20 uv	500 uv	10,000 uv		100 MW
NC-44B	11 uv	370 uv	6,300 uv		50 MW
NC-44BV	17 uv	540 uv	9,000 uv		50 MW
NC-100	25 uv	1100 uv	60,000 uv		1 Watt
NC-100XAB	27 uv	720 uv	60,000 uv		1 Watt
NC-100XAV	15 uv	550 uv	30,000 uv		1 Watt
NC-200	33 uv	520 uv	42,000 uv		1 Watt
NC-2-40	25 uv	520 uv	42,000 uv		1 Watt
NHU	50 uv	200 uv	3,500 uv	3rd IF 30,000 uv	1 Watt
HRO(697)	50 uv	1500 uv	75,000 uv	.14 watt	1 Watt
HRO(5886)	8 uv	500 uv	12,000 uv		50 MW
HRO Jr	60 uv	1500 uv	75,000 uv		1 Watt
RAS	37 uv	1200 uv	53,000 uv	6 MW	
RAO	25 uv	750 uv	59,000 uv	6 MW	
RCK	25 uv	720 uv	40,000 uv		1 Watt

<u>Set or Model</u>	<u>Output Impedance</u>	<u>Maximum Out. Watts</u>
100A	10000 - P. to P.	8
100AL	10000 - P. to P.	8
100ALB	7000	2
100ALV	5000	2
NC-200	10000 - P. to P.	10
NC-2-40	500	10
RCK	20000	3.5
NC-44	1500	2
RMCA	4	2
NC-44B	5000	1.5
HRO	7000	2
RAS	500	2
NHU	5000	2
NC-80	1500	2
RAO	5000	2
RCF	20000	3.5

5/1/49

NC-TV-7

NATIONAL COMPANY, INC.

CHANGE NOTICE

Subject: Fuse blowing in NC-TV-7 Receivers, Series 249.
Reason: Current Surge, when receiver is first turned
on, sometimes blows 2 ampere fuse.
Change: Replace with 3 ampere fuse.

August 5, 1949

NC-TV-7

NATIONAL COMPANY, INC.

Change Notice

Subject: Resistors overheating and changing value.

Reason: Power rating too low.

Changes: Examine receivers for symptoms indicated and make following changes where necessary.

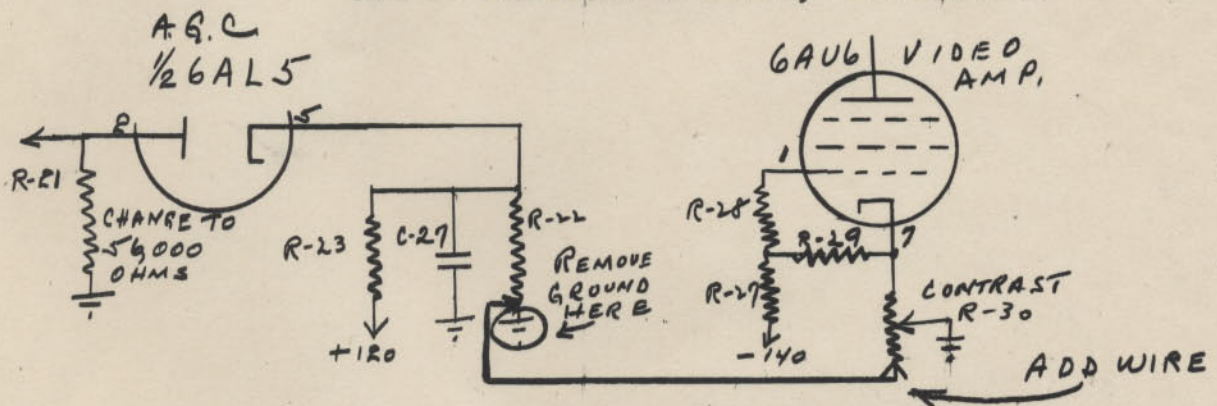
- R-90 -- Change from .82 meg. 1/2 watt to 56 meg. 1/2 watt
- R-86 -- Change from 2.2 meg 1/2 watt to 1.8 meg. 1/2 watt
- R-77 -- Change from 100,000 ohm 1 watt to 2 watt
- R- 94-- Change from 100,000 ohm 1 watt to 2 watt
- R-104-- Change from 47,000 ohm 1 watt to 2 watt
- R-81 -- Change from .47 meg 1/2 watt to 1 watt
- R-104-- Change from 47,000 ohm 2 watt to two 100,000 ohm
2 watt resistors in parallel. To do this, the
single lug terminal lug should be replaced by a
double terminal lug with a ground lug in the center.

NATIONAL COMPANY, INC.Change Notice

Subject: "Tearing" or horizontal displacement of picture in series 229, 240, and early 249 TV receivers in presence of very strong signal.

Reason: Overload in detector circuit.

- Changes: (1) Change R-29 from 3900 to 8200.
 (2) Change R-21 from 22,000 to 56,000 ohms, (From pin #2 of 6AL5 to ground.)
 (3) Remove ground end of 1000 ohm resistor on pin #5 of 6AL5 and run a wire from it to unused end of contrast control, as follows:



It may be necessary to add a lug for support of the resistor in its new position.

August 5, 1949

NC-TV-7

NATIONAL COMPANY, INC.

Change Notice

Subject: Flutter at top of picture Series 229, 240, 249.

Reason: Horizontal coupling condenser too large.

Change: C-83 should be 100 to 120 mmf instead of 220 mmf.

10/13/49

NC-TV-7

NATIONAL COMPANY, INC.

CHANGE NOTICE

Subject: Oscillation in NC-TV-7 Receiver, Series 229, 240

Reason: Additional by-passing needed.

Change: (1) Add .01-600V Condenser from pins 3 & 5 of 6X5 to ground.

(2) Change 6AU6 Ratio Detector (V-9) driver by-pass condenser C-41 from .02 mfd.-400VDC to .005 mfd 400 VDC.

Addenda

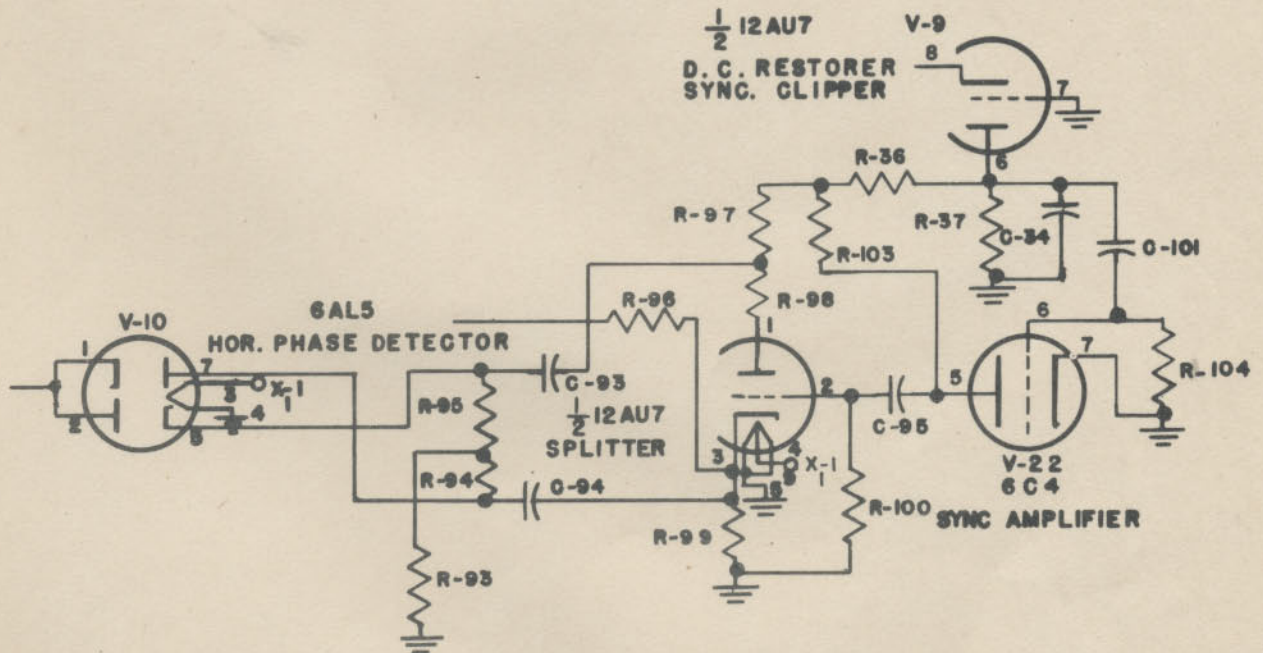
NC-TV 10 Television Receiver

1. A sync-amplifier stage employing a type 6C4 tube has been added to the NC-TV 10 Television Receiver. This change is effective on receivers with serial numbers whose first three digits are 261 or larger.

The components added to the Parts List are as follows:

Symbol	Description	National Co. Type
C-101	Paper capacitor, .1 mfd., 400 vdcw	D827-11
R-103	Resistor, 100,000 ohms $\pm 10\%$, 1/2 watt	J569-49
R-104	Resistor, 470,000 ohms $\pm 10\%$, 1/2 watt	J569-57
V-22	Sync Amplifier tube	6C4

The affected portion of the Schematic Diagram is shown below. Note the phase reversal at the horizontal phase detector tube V-10.



NATIONAL COMPANY, INC.

MALDEN, MASS.
May 26, 1949

NATIONAL COMPANY, INC.Change in NC-TV-10 Receiver

Change: An 1800 ohms $\frac{1}{2}$ watt resistor J569-28 is to be connected between the arm of the Focus potentiometer R-59 and the Focus Control lug which is electrically nearest the receiver (away from the power supply). The leads to these lugs are red and blue wires.

Reason for Change: To extend the range of the focus control in a counter-clockwise direction with the use of a minimum of parts and without changing the range in the clockwise direction.

Time of Change: On all receivers not yet in cabinets.

NATIONAL COMPANY, INC.SERVICE DATA AND CHANGE NOTICE

- Subject: Change in position of high wattage resistors on NC-TV-10, power supply chassis. To be done all sets immediately.
- Reason: To prevent heating of components of horizontal sweep oscillator, causing shift in setting of horizontal sync. control, wax dripping and failure of capacitors.
- Procedure: Remove the assembly consisting of two 12,000 ohm 10 watt resistors R-89 with their two mounting terminal lugs after first removing jumper from one end of resistors to pin #4 of V-18 (5V4G). Remount this assembly in the same holes but on the opposite side of the chassis flange. Connect a new red wire from the resistor end from which the above jumper was removed, to pin #4 of V-18 (5V4G). The red wire is 5 inches long overall.
- Additional Change: Change C-74 and C-77 to 270 mmf. Silver Mica Condenser (H500-6)
- Reason: Heat causes capacity of J665-47 to change and its resistance and Q to decrease, the leakage eventually becoming excessive and permanent. This shows up as loss of horizontal sync. action.
- This change is to take place immediately on all NC-TV-10 sets now in production and on all sets in the field when returned for service.

NATIONAL COMPANY, INC.CHANGE NOTICE

Changes on NC-TV-10

Changes: The Horizontal Flyback Transformer, RCA designation 211T1, is to be replaced by type 211T3. No further changes are necessary for their use on NC-TV-10 receivers.

For the NC-TV-10 receivers on all future models following Model 261, the following changes are to be made:

The value of R-80 shall be changed from 270,000 ohms J569-54, to 180,000 ohms J569-52 $\frac{1}{2}$ watt resistor.

The resistor R-89 in the power supply which consists of two 12,000 ohm 10 watt Koolohm resistors E959-21 connected in parallel will be replaced by two 4200 ohm 10 watt Koolohm (or equivalent) resistors connected in series.

Reason for Change: To standardize on one type of transformer, and to obtain higher voltage and deflection.

Note: The above changes shall have been made on all NC-TV-10C chassis that are sent out without cabinets.

August 5, 1949

NC-TV-10

NATIONAL COMPANY, INC.

Change Notice

Subject: Low Audio in some receivers of series 254, 261.

Reason: Ratio Detector Driver tube has insufficient gain.

Change: Where symptoms indicate need for such action, make the following changes:

1. Increase R-43 from 10,000 to not more than 18,000 ohms. Watch out for oscillation.
2. Decrease value of R-44 and R-43. Omit R-43 if receiver doesn't oscillate.
3. If necessary, disconnect pin #7 of V-11 from R-42 and insert 68 ohm bias resistor and .001 mfd by-pass condenser.

August 5, 1949

NC-TV-10-12

NATIONAL COMPANY, INC.

Change Notice

Subject: Picture Definition.

Reason: Improved frequency response in video amplifier
and better balance of Horizontal Sync. circuit.

Change: (1) Replace Video Det. Peaking coil SA:5489 Sub 0
with SA:5489 Sub 1. See above SA for details of
Change.

(2) Resistor, R-99, change from J-569-32 (3900 ohms)
to J569-33 (4700 ohm).

10/13/49

NC-TV-10-12

NATIONAL COMPANY, INC.

CHANGE NOTICE

Subject: Horizontal Oscillator squeal or erratic Horizontal
Sync. action.

Reason: Changing value of R-80 resistor to heat or scintilla-
tion.

Change: Replace R-80 (180,000 ohms 1/2 watt) with a 220,000 ohm
1 watt resistor.