INSTRUCTION MANUAL

for

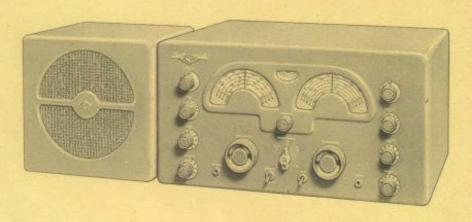
THE NATIONAL NC-173

RADIO RECEIVER

A new moderate-priced versatile Receiver engineered and built to National Company's established standards of excellence and performance.







NC-173 RECEIVER

FEATURES ...

- * 540. kc. to 31. mc. plus 48-56 mc. Frequency Coverage.
- Calibrated Amateur Band Spread on 6, 10-11, 20, 40, and 80 meter bands.
- Double-Diode Noise Limiter Effective on Both Phone and C.W. Reception.
- * 6 Position Wide Range Crystal Filter.
- * AVC for both Phone and C.W. Reception.
- * Stabilized Voltage Regulated Circuits.
- * S-Meter with Adjustable Sensitivity for Phone and C.W. Reception.
- * Highly Attractive Modern Cabinet.
- * Speaker in Matching Cabinet.
- * Phonograph or Microphone Pick-up Jack.

National Company, Inc.

THE NC-173 RADIO RECEIVER

SIMPLIFIED OPERATION INSTRUCTIONS

1. Operating Instructions

This preface to the NC-173 Instruction Manual is presented here to familiarize the non-technical owner of an NC-173 with the procedure to be followed in operating his Receiver. The actual controls requiring adjustment for the reception of broadcast and short wave stations are very few and are extremely simple to operate. The illustration on this page, identifying and locating Receiver controls, shows the operating procedure to follow in the proper sequence. This same procedure is outlined below with an explanation of the function of each control. As this section has been kept brief intentionally, the reader should refer to Section 3 of the Instruction Manual if more detailed and technical information is desired. To tune the Froadcast and Short Wave bands the operating instructions are as follows:

(1) Turn R.F. Gain control to 10. This is a dual-purpose control; when turned from AC Off to On the Receiver is turned on; when turned from 0 to 10 the sensitivity (ability to receive week and distant stations) is progressively increased to a maximum at 10.

(2) Set the Send-Receive switch at Receive. The Send position of this switch silences the Receiver for a period of time after which immediate resumption of reception may be had by setting the switch at Receive.

(3) Set the AVC-MVC switch at AVC. Automatic Volume Control is provided when this switch is in the AVC position to compensate for fluctuating volume due to fading.

(4) Turn A.F. Gain control to 5. Adjustment of the audio volume is made with this control from a minimum at 0 to a maximum at 10. The setting given here is for average volume and should be adjusted to suit the listener.

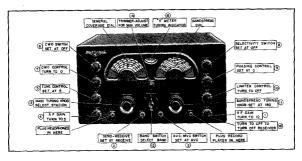
(5) Set the Tone control at 5. A variable selection of tonel output from a bass tone at 0 to a tone at 10 in which the highs are predominant is provided by this control. The setting recommended here will give a normal tonal output but may be changed for different types of programs.

(6) Set the CNO switch at Off. This switch is used only for the reception of code signals.

(7) Turn the CMO control to 0. This control is used only for the reception of code signals.

(8) Set the Selectivity switch at Off. This switch is generally used only when interference by other stations is encountered. Its operation is somewhat complex and is not recommended for the inexperienced operator. See Section 3 for detailed instructions.

(9) Turn the Phasing control to 0. The Phasing control is used in conjunction with the Selectivity switch.



- (10) Turn the Limiter control to Off. Reduction of interference caused by static, automobile ignition, etc., can be effected by turning on the Limiter. Its action is increasingly effective as the control is turned towards 10.
- (1) Turn the Bandspread tuning dial knob to the set mark at 180 on the linear scale of the Bandspread dial. The Bandspread dial knob and scale should be kept at the above setting when the Main Tuning dial knob and scale are used. However, the Bandspread dial may be rotated to either side of the set mark if fine tuning is preferred for Short Wave or Amateur bands.

-NOTE-

The operator is now ready to adjust the tuning controls to select the desired station. Let us, for example, suppose that the desired station is one on the froadcast band at 1,000 kilocycles.

- (12) Set the Band Switch at E. The Band Switch selects the band of frequencies to be tuned and is marked with designating letters which correspond to the markings at the edges of the dial scales.
- (13) Turn the Main Tuning dial knob to set the pointer on the General toverage dial at 1.0 on the E band. Stations on the General Coverage dial scale are selected by means of this control.
- (14) Adjust the Trimmer control for maximum volume. After a station has been tuned in, adjust this control for best reception.
- (15) S-Meter. Maximum deflection of the meter pointer indicates the dial and Trimmer control setting for optimum tuning.
- (16) Shutting off the Receiver. To shut off the Receiver, turn the R.F. Gain control to Off. This is the only adjustment which completely shuts off the Receiver and the only one which need be made.

2. Frequency Coverage

The General Coverage dial has five scales; four of which are calibrated directly in megacycles and the other has a linear scale numbered 0 to 200. Marked at each edge of the dial scales is the band letter designation and frequency coverage for each band. The Band Switch positions are also marked with band letter designations to correspond to the markings at the edges of the dial scale. Newspapers and other publications sometimes give the frequency of stations in kilocycles, and as the dial scales of the NC-173 are calibrated in megacycles conversion from kilocycles to megacycles will facilitate location of the station on the Receiver dial. This is done by pointing off three places to the left of the decimal point on the kilocycle figure. For example, to convert a figure of 1,000. kilocycles into megacycles point off three places to the left of the decimal point and it becomes 1.0 megacycles which is the figure appearing on the Receiver dial.

The following table lists each band by its designating letter and the frequency coverage of that band. The frequencies are listed in both megacycles and kilocycles. Also listed are the frequencies of some short wave features to be found on the various bands.

BAND	FREQUEN	CY COVERAGE	POLICE	INT. B'DCAST	AMATEUR
	Megacycles	Kilocycles	Megacycles	Megacycles	Megacycles
В	12.0 -30.0	12,000-30,000		15. 1-15. 3 17. 7-17. 9 21. 5-21. 7	14.0 -14.4 21.0 -21.5 27.185-27.455
С	4.3 -12.0	4,300-12,000		6.0- 6.2 9.5- 9.7	28.0 -29.7 7.0 - 7.3
D	1.6 - 4.3	1,600- 4,300	1.6 -1.8 2.25-2.5	11.7-11.9	3.5 - 4.0
E	0.54- 1.6	540-1,600	2.7 -2.85		

THE NC-173 RADIO RECEIVER

SECTION 1. DESCRIPTION

1-1. General

The new NC-173 Beceiver features a wide frequency coverage which includes the conventional 540 to 31 mc. range and in addition encompasses the Amateur six meter band in its 48 to 56 mc. range. The tuning system employs separate directly-calibrated dial scales for general coverage and bandspread tuning. Calibrated bandspread tuning is provided for the main amateur bands i.e.; 6, 10-11, 20, 40 and 80. The NC-173 selectivity characteristic is adjustable over a wide range from broad band broadcast requirements to sharp amateur single signal CW reception. The adjustable selectivity plus high sensitivity assures the operator of optimum Receiver performance at all times.

The NC-173 also employs a voltage regulator tube to minimize frequency drift in the high frequency oscillator and also in the beat frequency oscillator. This assures a minimum of frequency drift for both phone and code reception.

These stabilized circuits plus a very effective new noise limiter enables the operator to cope with the most adverse receiving conditions.

1-2. Circuit

The NC-173 utilizes 13 tubes in a superheterodyne circuit, featuring such circuit refinements as an RF amplifier stage, a separate AVC amplifier, a voltage regulator for circuit stabilization and a double diode noise limiter.

The circuit employed on all bands conpilification, a first detector and separate stabilized high frequency oscillator, two intermediate frequency oscillator, two dide type second detector, an audio limiter, a high gain audio stage and an audio output stage. The remainder of the Receiver includes automatic volume control, beat frequency oscillator, voltage regulator and rectifier circuits. The crystal filter is connected between the first detector and first IF stages.

1-3. Tube Complement

The NC-173 is supplied complete with tubes which are tested in the receiver at the time of alignment.

The tubes employed are as follows:

R.F. Amplifier6SG7
First Detector6SA7
H.F. Oscillator
First I.F. Amplifier6SG7
Second I.F. Amplifier6SG7
Second Det AVC Det6H6
AVC Amplifier
Peat Frequency Oscillator6SJ7
Limiter
1st. Audio6SJ7
Audio Output
Voltage RegulatorOD3/VR-150
Rectifier

1-4. Tuning System

The main tuning capacitor C-2 and the bandspread tuning capacitor C-3 are connected in parallel on all bands. Separate knobs with associated dial scales are used to operate these two capacitors to tune the frequency range of the Receiver in five bands as follows:

BAND	GENERAL COVERAGE		BANDSPREAD	
Α			48 - 56 Mc.	
В	12 - 31	Mc.	27 - 30 Mc.	
			14.0 -14.4Mc.	
С	4.3 - 12	Mc.	7.0 - 7.3Mc.	
D	1.6 - 4.3	Mc.	3.5 - 4.0Mc.	
E	0.54 - 1.6	Mc.		

This tuning system requires that the bandspread dial be set at the proper point when using the general coverage dial and vice versa. The accuracy of the dial calibration will not be maintained unless these settings are properly observed. The correct setting of the Bandspread dial for general coverage tuning is at 180 on the linear scale. The following table lists the dial settings for bandspread tuning of the various amateur hands.

80

AMATEUR BAND GEN. COV. DIAL SETTING 6 198 on Linear Scale 10-11 30.0 Mc. 20 14.4 Mc. 40 7.3 Mc.

The flexibility of this tuning system should be noted. If bandspread coverage is desired on any band in the \$40 kc. to 31 mc. range, the main tuning dial can be set at the high frequency end of the band to be spread and the Bandspread dial used for tuning. Stations may be logged and bandspread tuning calibrated by means of the 0 to 200 numerical scale on the Bandspread dial. In the 48 to 56 mc. range the Bandspread tuning dial only is used for tuning.

4.0 Mc.

spread tuning dial only is used for tuning.

Band changing is accomplished by means of a highly efficient band switch.

Tuning of the first RF stage on all bands can be readily adjusted to compensate for a wide range of antenna loading conditions by means of the panel mounted antenna compensating capacitor.

1-5. Crustal Filter

Adjustable selectivity is obtained in the NC-173 by means of a crystal filter. This crystal filter is newly designed and incorporates features which make it highlesible in its adjustments and superior in performance. The crystal filter provides uniform selectivity variation from the broad Off position to the sharp No. 5 position as well as phasing action for the attenuation of interfering signals. The broader selectivity positions are used during phone reception; the sharper selectivity positions are used during to the sharper selectivity positions are used during code reception.

1-6. Noise Limiter

A new concept in noise limiter design is introduced in the NC-173 Receiver. This new limiter could be termed "double action plus" and the noise limiting action is equally effective whether receiving phose or code signals (that is with the CW Oscillator On or Off). A threshold control on the front panel permits adjustment of the level at which limiting action starts.

1-7. Tone Control

The Tone control is a variable poten-

tiometer functioning to adjust the tonal output of the audio amplifier. The control is helpful when receiving weak signals through interference.

1-8. Signal Strength Meter

A signal strength meter is associated with the AVC circuit. The S-Meter scale is calibrated in S units from 1 to 9 with approximately 4 db per S unit and in db above S-9 from 0 to 40 db. The "no signal" S-Meter reading does not require adjustment. If it is necessary to compare strong signals which cause the S-Meter to read off scale, the S-Meter sensitivity may be reduced by retarding the #F Gain control.

1-9. Antenna Input

Antenna input terminals are located at the rear of the receiver chassis near the center. The input circuit is suitable for use with a single wire antenna, a balance feed line or a low impedance (70 ohm) concentric transmission line. The average input impedance is routably 500 ohms.

1-10. Audio Output

Two audio output circuits are pro-

- (1) A headphone jack is frontpanel mounted and is wired so as to silence
 the loud-speaker on the insertion of the
 phone plug. The headphone load impedance
 is not critical allowing a wide range of
 headphone types to be used. Greater audio
 output at the headphone jack may be obtained, if desired. This is accomplished
 by unsoldering the headphone jack connection at terminal No. 2, the 8 ohm tap, on
 the audio output transformer and resoldering it to terminal No. 3. the 500 ohm tap.
- (2) An output terminal strip is mounted at the rear of the Receiver having both 8 and 500 ohm terminals and a common ground terminal. The 8 ohm terminal is suitable for connection to the loud-speaker supplied with the NC-173 Receiver and the 500 ohm terminal may be used for connection to a 500 ohm line.

1-11. Power Supply

The NC-173 Receiver is designed for operation from a 110/120 volt or 220/240 volt 50/60 cycle power source. The Receiv-

er is shipped from the factory with the power transformer wired for 110/120 volt operation only. A few simple wiring changes in the dual primary of the power transformer are necessary to adapt the NC-173 Receiver for 220/240 volt operation. These changes are made directly on the power transformer terminal panel and are as follows:

(a) Remove the jumper between terminals 1 and 4 and between 2 and 5.

(b) Connect a jumper between terminals 4 and 5.

A drawing of both receible primary circuits

A drawing of both possible primary circuits is shown on the Schematic Diagram.

Normal power consumption is approximately 83 volt-amps. The built-in power unit supplies all voltages required by the heater and B supply circuits - *45\(^{\pm}\)

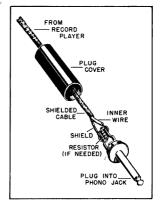
1-12. Loud Speaker

The loud-speaker supplied with the table model NC-173 is of the permanent magnet field type and is mounted in a cabinet finished to match the Receiver. The loudspeaker impedance is 8 olms and connects to the 8 ohm Receiver output circuit.

1-13 Pick-up Jack

A pick-up jack is mounted on the front panel and can be used to connect auxiliary apparatus, such as a phonograph pick-up, to the audio system of the Receiver. This input circuit is high impedance and feeds into the high gain 6SJ7 first audio amplifier stage. The Audio Gain and Tone controls are operative with this connection.

Most record players are terminated in a single shielded wire. As the Phono input jack on the NC-173 is designed to accomodate a phone plug, it is necessary that this single shielded wire be attached to a phone plug. If the output circuit of the record player is low impedance (less than 100,000 ohms) better results will be obtained if a suitable resistor, with a value as specified for the particular record player, is connected across the phone plug to properly load the record player output circuit. The accompanying illustration shows how these connections can be made.



SECTION 2. INSTALLATION

2-1. Arrangement

The Receiver and loud-speaker may be arranged in any desired position although it is not recommended that the loud-speaker be placed on top of the Receiver as undesirable microphonics may result.

2-2. Antenna Recommendations

The antenna input circuit of the Receiver is arranged for operation from either a single-wire antenna, a doublet antenna or other types having impedances of 70 ohms or more. The antenna terminal strip, at the rear of the Receiver. has three terminals, two are for antenna connections and the other for a ground. The ground terminal has connected to it a metal link which is used to ground one antenna lead as necessary. With balanced antenna systems, such as the doublet type, the metal link is not used. With an unbalanced system, such as the single-wire antenna, it is desirable to ground the unused antenna terminal by means of the metal link. For an unbalanced system of the concentric transmission line type, it is recommended that the outside of the concentric line be grounded directly to the ground lug below the antenna terminal strip. The external ground connection to the ground lug below the antenna terminal strip should be maintained at all times.

For best impedance matching to the antenna input circuit, an antenna with a 300 to 600 ohm transmission line is recommended. If a doublet type with a 300 to 600 ohm balanced transmission line is used the metal grounding link should not be used. For optimum results the antenna should be cut to the proper length corresponding to the desired operating frequency. See Fig. No. 1. It must be remembered that an antenna installation of this type will have maximum efficiency over a narrow band of frequencies near the frequency for which the antenna was designed and will be most useful in installations where the Receiver is tuned to one frequency or narrow band of frequencies. For other frequencies it would be desirable to connect the two transmission line leads together at one an-

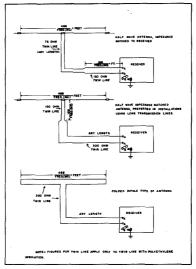


Figure No. 2. Typical Antenna Installations

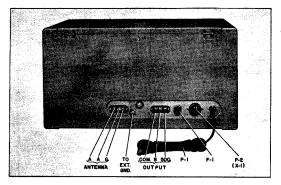


Figure No. 1. Rear View of Receiver

tenna post and the metal link used to ground the other post. The antenna is thus utilized as a single wire type.

The most practical antenna for use in installations where the Receiver is to be used over a wide range of frequencies is the single wire type. An antenna length of from 50 to 100 feet is recommended. The antenna lead-in should be connected to one antenna post and the metal link used to ground the other post.

In an installation where the Receiver is to be used as the receiving unit in a transmitting station, the most efficient operation will usually result from use of the transmitting antenna as a receiving antenna also. This is especially true if the transmitting antenna is of the multi-element, directional type as the same antenna gain is available for both receiving and transmitting -- a very desirable condition. For switching the antenna from transmitter to receiver, an antenna change-over relay with good high-frequency insulation is recommended. A second relay for controlling the transmitter plate supply and the Receiver B+ circuit may be used to achieve single-switch control of the station. This second relay should be a double pole, single throw type having one normally open pair of contacts and one normally closed pair of contacts.

2-3. Installation Procedure

After unpacking the Receiver and Speaker procede as follows:

(1) Seat A.C. jumper plug and all tubes firmly in their sockets.

(2) Connect the loud-speaker to the 8 ohm output terminals at the rear of the Receiver.

(3) Connect a good external ground to the screw-type lug located at the rear of the Receiver below the antenna terminal strip.

(4) Connect the antenna as recommended in paragraph 2-2.

(5) Connect the power cord to a 115 volt, 50/60 cycle AC source of supply.

(6) Set controls as recommended in Section 3 for reception of signals.

NOTE

Where the Receiver is located in the field of a relatively powerful transmitter, it is advisable to provide some means of preventing damage to the Receiver antenna coil. If a separate receiving antenna is used, a means for disconnecting or grounding the antenna during transmission periods should be provided.

2-1. Battery Operation

The NC-173 may be operated in portable or emergency service by connecting batteries to the terminals of the power socket located at the rear of the receiver. The AC jumper plug may be rewired for battery connection or if changeover operation is desired any octal plug or octal tube base may be used. In any of the above circumstances the battery plug used should be wired according to the drawing shown on the schematic diagram, A 6 volt heater supply (storage battery) should be connected to terminals 3 and 5 and 135 to 250 volt "B" supply connected to terminals I and 8. The recommended "B" voltage supply for battery economy is between 135 and 180 volts. The voltage regulator tube will not ignite with this recommended "B" supply but regulation is not required for battery operation. A suggested refinement is to include a switch in the A+ lead so that the tube heaters may be turned off when the receiver is not in use without the necessity of removing the battery plug from the battery socket. The Receiver's "B" switch may be used to silence the receiver with battery operation the same as for AC operation.

The recommendations of Section 3, Operation apply to the battery powered NC-173 Receiver.

2-5. Loud Speaker

If the installation is such that the loud-speaker will be placed close to the receiver, the most desirable position is at the side.

SECTION 3. OPERATION

3-1. Controls

All controls are identified by front panel markings for ease of identification. The controls are located in a symmetrical manner and are arranged for ease of operation.

The five positions of the Band Switch are marked with identifying band letters plus the Amateur bands covered in each band corresponding to the band designations on the dial escutcheons. The Band Switch does not have any limit stops so that band changing may be accomplished with a minimum of Band Switch turning.

The General Coverage dial knob operates the main tuning capacitor and turns the main dial scale through a combination pinch drive and anti-backlash gear train. The main dial scale is calibrated directly in frequency for each band covered and also carries a 0-200 linear scale for auxiliary logging purposes. The main dial escutcheon is marked with the frequency band limits in megacycles and also with band letter designations which correspond to the Band Switch markings.

The Bandspread tuning dial knob operates the bandspread tuning capacitor and bandspread dial scale through a combination pinch drive and anti-backlash gear train which is similar to that used for general coverage tuning. The bandspread dial scale is marked directly in frequency for the amateur 6, 10-11, 20, 40 and 80 meter bands and also has a 0-200 linear scale for bandspread logging on other than the frequency calibrated bandspread frequencies.

The RF Triamer control operates a uning capacitor trimmer which is connected across the first RF Amplifier main tuning capacitor section. The RF Triamer can be used to tune the first RF Amplifier stage properly under a wide variety of antenna loading conditions.

The RF Gain control adjusts the amplification of the RF and IF Amplifier stages. Clockwise rotation of the control increases Receiver gain. The AC Power switch is associated with the RF Gain control and AC power is turned On as the RF Gain control is advanced from AC Off to 0 on the scale.

The AF Gain control adjusts the amount of audio voltage applied to the first audio tube. Clockwise rotation of the control increases the Receiver audio power output. The AF Gain control is operative when an audio signal is applied to the Phono input iack.

The Limiter control is used both to switch the limiter into the circuit and also to adjust the threshold at which limiting action starts. The limiter is turned on as the Limiter control is advanced from

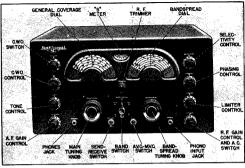


Figure No. 3. Front View of Receiver

Off to 0 and the threshold is lowered as the control is advanced toward 10. Any noise peak voltages in excess of this adjustable threshold are prevented from reaching the audio amplifier. The limiter circuit is of the double diode type and is equally effective for either phone or CW reception.

The Tone control is used to vary the frequency characteristic of the audio portion of the Receiver. Turning this control toward 10 on its scale increasingly attenuates the lower frequencies.

The CMO Switch and CMO control are used for radiotelegraph code reception. The CMO Switch is used to turn the CMO Oscillator On and the CMO control is used to adjust the pitch of the CMO note. At zero on the CMO scale, the CMO oscillator is tuned to the Receiver's intermediate frequency.

The Phasing and Selectivity controls adjust the operation of the crystal filter. Receiver selectivity is made progressively sharper as the Selectivity control is sturned from Off toward 5 on its scale. The Phasing control is inoperative with the Selectivity control in the Off position. The Phasing control is used to attenuate interfering signals and is connected in a bridge circuit so that the bridge can be balanced

to reject the undesired signal frequency.

The Send-Receive switch is used to quiet the Receiver during transmission periods or other times when it is desirable to be able to turn on the Receiver immediately after a period of silence (i.e. not having to wait for the tubes to warm up). The Send-Receive switch is connected in the Be-circuit and functions when the Receiver operates from batteries as well as during normal AC operation. The Send-Receive switch should not be used to silence the Receiver after the completion of an operating period. The Receiver should be turned Off by turning the RF Gain control to the AC Off position.

External (remote) stand-by control of the Receiver may be accomplished by connecting a switch or relay to terminals δ' , and'8 of the AC jumper plug as shown on the Schematic Diagram. This is a parallel arrangement thus permitting the Send-Receive switch to remain operative with the external switch or relay in the circuit.

The AVC-MVC switch is used to adjust the Receiver for either Automatic Volume Control or for Manual Volume Control can be used for either phone or code reception. Automatic volume Control can be used for either phone or code reception. The AVC time constants have been adjusted so that Receiver gain does not change appreci-

ably during average code speed reception.

3-2. Phone Recention

After the equipment is properly installed, as outlined in Section 2, it is placed in operation by adjusting the receiver controls as follows:

- 1. Advance the RF Gain to a point between 8 and 10.
- 2. Set the Send-Receive switch at Receive.
 - 3. Set the AVC-MVC switch at AVC.
- 4. Turn the CWO switch to Off.
 5. Set the Selectivity Control at
- Off.
 - Set the Phasing control at 0.
 - Set the Limiter control at Off.
- Set the AF Gain control to the point providing the audio volume desired by the operator.

 Adjust the Tone control to give the desired audio characteristic.

The Receiver is now adjusted for the reception of phone signals and will tune to the frequency indicated by the tuning dial and band switch settings. Set the RF Trimmercontrol for maximum S-Meter reading after the desired station has been selected, or alternately in the absence of a signal the RF Trimmer may be set for maximum Receiver background noise.

The tuning system in the NC-173 is arranged for ease of operation and accuracy of calibration. However, it is necessary that the proper settings of the General Coverage and Bandspread dials be observed for tuning of signals. For general coverage tuning the Bandspread dial must be set at 180 on its linear scale; for bandspread tuning the General Coverage dial must be set at the proper point corresponding to the Amateur band being tuned. The General Coverage dial settings for bandspread tuning of the various amateur bands are listed in Section 1. The various "set points" are marked directly on the General Coverage dial scale at the upper frequency limit of the amateur band being tuned and are easily located by the identifying circular markers. As stated in Section 1, tuning of the 6 meter band is accomplished by use of the Bandspread dial entirely. The correct setting of the General Coverage dial for 6 meter band operation is at the scale marker position located at approximately 198 on

the linear scale.

The Band Switch setting determines the band of frequencies which the Receiver will tune at any one time. The dial scale in use is indicated by the identifying markers on the dial escutcheons which correspond to the markings on the Band Switch control.

With the AVC-MVC switch set in the AVC position, the RF Gain control should be advanced as far as receiving conditions permit, or until background noise becomes objectionably loud. Audio output should be adjusted entirely by means of the AF Gain control. The operator must remember that automatic volume control action will be restricted unless the RF Gain control is fully advanced.

The AVC-MVC switch may be set at the manual volume control position, in which case the operator must be careful not to advance the RF Gain control to a point where IF or audio amplifier overload occurs. Such overload is indicated by distortion. In general, the AF Gain control may be set at a fixed position and the RF Gain control used to adjust the volume of the audio output.

If a signal is weak and partially obscured by background noise and static, best signal-to-noise ratio will be obtained by turning the Tone control towards 0 on its scale. The most effective setting must be determined by trial as too much attenuation of the higher sudio frequencies will impair the intelligibility of speech.

When a signal is accompanied by static peaks or noise pulses of high intensity and short duration, the best signal-to-noise ratio will be obtained by advancing the Limiter control clockwise from the Off position. The best setting must be determined by trial as too much limiter action will impair the audio quality.

The selectivity of the receiver is adjusted by means of the crystal filter Selectivity control. The normal setting of the Selectivity control in phone reception is at one of the positions affording broad selectivity. Positions marked Off. 1 or 2 are recommended. Selectivity may be progressively increased by turning the Selectivity control to positions 3, 4 or 5. The evidences of increasing selectivity will be the attenuation of the higher frequency audio tones of the signal as well as sharper

tuning. Increasing selectivity too much will attenuate these higher tones to such an extent that phone signals will become unintelligible.

The Phasing control is used to eliminate or attenuate interfering heterodynes. The normal setting of the Phasing control with the crystal filter On for phone reception is at 0 on the scale. If, after a signal has been tuned in, an interfering signal causes a heterodyne or whistle the Phasing control should be adjusted until interference is reduced to a minimum. The setting of the Phasing control which provides maximum attenuation of the heterodyne will depend on the pitch of the heterodyne whistle. If the best note is above 1000 cycles, the optimum Phasing control setting will be near one end of the scale or the other, depending upon whether the interfering signal has a higher or lower frequency than the desired signal. The Phasing control is inoperative with the Selectivity control in the Off position, but the Phasing control is operative at all other Selectivity control settings.

3-3. C.W. Reception

The Receiver is placed in operation for the reception of CW signals in the same manner as that outlined for phone reception, (Section 3-2), except that the CWO switch should be set at On and the CWO control set at mid-scale. The CW code characters are made audible by the heterodyning action of the CWO coillator with the incoming signal. The frequency of the CWO oscillator can be varied by rotation of the CWO control.

The sensitivity of the receiver should be adjusted by means of the RF Gain control and the audio volume by means of the RF Gain control. When receiving CM characters with slow keying or long pauses during keying it may be desirable to set the MCC-MFC such at MFC so that the receiver gain does not change during keying pauses. In this case, the AF Gain control should be set at a fixed position and the sudio volume adjusted by means of the RF Gain control. In either of the above cases, care should be taken not to advance the RF Gain to a point where IF or audio amplifier overload will occur.

The action of the Tone and Limiter

controls will be similar to that described under Section 3-2. However, in CW reception it will be possible to advance these controls considerably further than is desirable in phone reception since audio distortion is relatively unimportant.

Turning the CMO control to either side of zero will change the characteristic pitch of the receiver background noise thus providing a means of adjusting the audio beat note to the operator's preference. The pitch will become higher as the CMO oscillator is detuned from the IF Amplifier.

A distinct advantage in the reception of weak signals through interference can be realized by the use of the "single-signal" properties of the NC-173 Receiver. The CW oscillator should be detuned until the nitch of the receiver background noise is roughly 2000 cycles. Under this condition the audio beat note of any CW code signal will show a broad peak in output at approximately 2000 cycles. This peak is easily found by rotating the tuning dial slowly through the carrier of a received signal. This peak will appear on one side of "zero beat" only and on the other side of "zero beat" the 2000 cycle note will be considerably weaker. It should be noted that depending on the frequency of the interfering signal better receiving conditions will be obtained by detuning the CWO on one side of zero than on the other. The best setting of the CWO can only be determined by trial settings on either side of zero until optimum results are obtained.

Crystal filter operation for CW reception is similar to that described in Section 3-2 with the exception that it is possible to utilize maximum selectivity without the loss of intelligibility experienced in phone reception. When maximum selectivity is employed, i.e. Selectivity control at 5, tuning is very critical and care must be taken to assure proper tuning. At this setting the "single-signal" effect, previously described, is very pronounced. When tuning across the carrier of a received signal the audio beat note is very sharply peaked at a definite audio frequen-The maximum response indicates the proper dial setting. The pitch of the beat note peak may be adjusted by use of the CWO control to provide an audio tone pleasing to the operator. With the Receiver tuned to "crystal peak" an interfering signal may be attenuated by proper setting of the Phasing control since this control does not appreciably affect the desired signal.

3-1. Measurement of Signal Strength

The S-Meter in the NC-173 Receiver furnishes a means for the measurement of signal strength of incoming signals. To utilize the S-Meter the following control settings must be observed: RF Gain at 10, AVC-MVC at AVC, Selectivity at Off, and Phasing at 0. The RF Trimmer should be adjusted for maximum S-Meter reading of

a particular incoming signal. The CWO Tone, Limiter and AF Gain control settings do not affect meter readings.

Tuning the Receiver to a signal will cause a meter deflection indicating the signal strength in S-units or in decibels above the S-9 level.

In instances where a strong signal causes the S-Meter to read off scale the S-Meter sensitivity may be reduced by retarding the RF Gain control until an on scale reading is obtained. Without disturbing the setting of the RF Gain control the comparative strength of this strong signal may be compared with other signals.

SECTION 4. SERVICE AND TEST DATA

1-1. Tube Fallures

The partial or complete failure of a sensitivity, produce intermittent operation, or cause the equipment to be completely inoperative. If tube failure is suspected all tubes should be checked in suitable tube testing equipment, or by replacement with tubes of proven quality. Care should be taken that any tubes removed for checking purposes be returned to their original sockets thereby reducing the necessity for realizmment.

Tubes of the same type will vary slightly in their individual characteristics and this fact should be borne in mind when replacements become necessary. The high frequency oscillator and I.F. tubes should be chosen with care to select a replacement which most nearly approaches the characteristics of the original tube. A replacement high frequency oscillator tube can be readily checked by noting any change in dial calibration, particularly in the amateur bandspread bands. Substitution of new I.F. amplifier tubes may possibly alter overall gain and selectivity characteristics. Instructions for realignment are given in detail in Section 5-2.

4-2. Circuit Failures

All components parts in the NC-173 Receiver have been carefully selected to assure an ample factor of safety yet failure may occur in individual cases. The most common failure, excluding tubes, will probably be due to a defective capacitor or resistor. Measurement of voltage in accordance with Section 4-4 will most likely indicate where failure has occurred. A bypass capacitor which has failed may cause overload of associated resistors. These resistors should be checked for any change in resistance value. An overloaded or shorted resistor will sometimes be evidenced by scorching or discoloration on the surface of the resistor. An open capacitor, often the cause of oscillation or loss of sensitivity, may be checked by temporarily connecting a good capacitor across it. Intermittently poor connections can usually be located by lightly tapping each part with a piece of insulating material.

4-3. Stage Gain Measurements

The sensitivity measurements listed below are made with the equipment set up as specified in Section 3-2 except that the AVC-MVC switch should be set at MVC and the AF Gain control at 10. The signal generator should be adjusted to deliver a test signal of 455 kc. plus or minus 2 kc. either modulated or unmodulated. The high output lead should be connected through a 0.001 capacitor to the pin of the tube as specified in the following table and the ground lead connected to the receiver chassis.

With 1 watt output at the audio output

terminals the test signal should be within the limits specified below. It is important that the proper output impedance matching be observed, i.e., 8 or 500 ohms depending upon which terminal is used, when making these tests.

The Band Switch must be set at the mid-position between the A and E bands.

TERMINAL	TEST SIGNAL			
Mixer Grid	13 ± 3 Microvolts			
First IF Grid	170 ± 30 Microvolts			
Sec. Det. Grid	33,000±6,000 Microvolts			

4-4. Voltage Tabulation

All voltage measurements are made with the Receiver controls adjusted for normal operation as outlined in Section 3-2 except that the AVC-MVC switch should be set at MVC and the AF Gain control at 30, except as noted on Figure No. 4. A high-impedance vacuum tube voltmeter should be used to make these measurements. Readings taken with any other type of instrument will differ greatly from those shown on Figure No. 4. All voltages are measured between specified terminal and chassis.

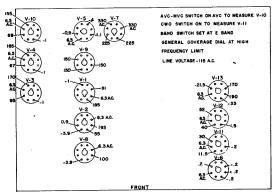


Figure No. 4. Tube Socket Voltages

SECTION 5. ALIGNMENT DATA

5-1. General

All circuits in the NC-173 Receiver carefully aligned, before shipment, using precision crystal controlled oscillators which insure close conformability to the dial calibration. No realignment of the various adjustments will be required, therefore, unless the receiver is tampered with or damaged in transit.

The necessity for any realignment can be determined by checking the performance of the Receiver against its normal operation as outlined in Section 3. In no case should realignment be attempted unless tests indicate that such realignment is necessary. Even then, it must be remembered that the NC-173 is a communications receiver and should not be serviced or realigned by any individual who does not have

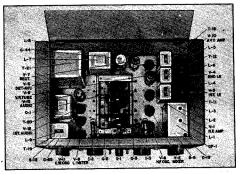


Figure No. 5. Top View of Receiver (Tuning Capacitor Cover Removed)

a complete understanding of the functioning of the equipment and who has not had previous experience adjusting a similar type of receiver.

The RF coil groups are mounted in an aluminum compartment which is directly below the main tuning capacitor. The HF oscillator coils are nearest the front panel, the first detector coils are in the center of the compartment and the RF coil group is nearest the rear of the Receiver.

All HF oscillator and first detector coils have individual general coverage trimmer capacitors. The E band has also a general coverage variable series padding capacitor. These capacitors are identified in Figure No. 6.

The IF transformers, crystal filter, amplifier and CW oscillator transformers all have individual permeability-tuned iron core inductors with screwadjustments for alignment purposes. These adjustments are identified on Figure No. 5.

Pefore proceding with the alignment of any circuit of the Receiver, the equipment must be set up as specified in Section 2-3, except that the antenna lead-in must be disconnected. An output meter having an 8 or 500 ohm resistive load should be connected to the matching terminal on the Receiver's output terminal strip. If it is so desired a high impedance AC voltmeter having a resistive load of over 8 ohms may be connected to the phone output jack and used in place of the output meter. The RF Gain control should be set at 10 and the Tone control at 0.

Alignment of the equipment may be divided into two major steps:

(1) IF and AVC Amplifier Alignment.

(2) General Coverage Alignment.

(a) HF Oscillator. (b) First Detector.

The circuits must be tuned in the above order when complete alignment is necessary.

5-21F and AVC Amplifier Alignment

The intermediate frequency of the NC-173 Receiver is 455 kilocycles, plus or minus 2 kilocycles. The exact frequency is determined by the quartz crystal resonator Y-1.

The preliminary alignment procedure is as follows:

(1) Connect the high output lead of an accurately calibrated signal generator to the stator portion of the detector section of the main tuning capacitor, C-2E, and the grounded lead to any convenient grounded

point on the chassis. This is a direct connection no dummy antenna being required.

- (2) Set the CWO switch at On.
- (3) Set the AVC-MVC switch at MVC.
 (4) Set the Phasing control at 0.
- (5) Set the Selectivity control at 5.
- (6) Set the AF Gain control at 10.
- (7) Turn the modulation of the signal generator off to provide a steady CW test signal.

Adjust the output attenuator of the signal generator to provide a signal of approximately 100 microvolts and vary the tuning control of the signal generator slowly between the frequencies of 455 and 457 kilocycles. At some frequency between these limits the IF amplifier of the receiver will show a very sharply peaked response, as indicated on the output meter. The absence of such a sharply peaked response will serve to indicate that the crystal resonator, Y-I, is defective. The CMO control must be set to provide an audible beat note at all times.

While making IF amplifier adjustments, it will be necessary to retard the attenuator of the signal generator if the readjustment increases IF amplifier gain to a point where overload occurs. Without altering the frequency setting of the signal generator set the Selectivity and CMO switches at Off, and turn the modulation of the signal generator On. The IF tuned inductors L-1 through L-6 should each be carefully adjusted to give a maximum reading on the output meter. The order in which these adjustments are made is not importable.

To align the AVC amplifier turn the AVC-MVC switch to AVC. Adjust L-8 of transformer T-18 until a well-defined dip is observed in the output meter readings. The setting of L-8 where this dip occurs will provide maximum AVC action.

Turn the modulation of the signal generator Off and turn the CMO switch On and set the CMO control at 0 at which setting the CM oscillator should be at zero beat with the test signal. If zero beat does not occur at 0, readjust the tuneable inductor L.9 of transformer T-19 for the correct setting.

5-3. General Coverage Alignment

The control settings used for align-

ment are as outlined in Section 3-2 except that the AVC-MVC switch should be at MVC. Throughout the alignment procedure outlined below it is important that the Bandspread dial is set at 180 on the linear scale.

(a) HF Oscillator

Alignment is effected as follows: Set the Band Switch at the position indicating the band to be aligned. Set the General Coverage tuning dial near the high frequency end of the band. Connect a signal generator to the antenna input terminals through a standard dummy antenna and accurately tune the signal generator to deliver a signal of the same frequency as that indicated by the receiver dial setting. If, when this signal is tuned in, the dial reading is too high, decrease the capacity of the HF oscillator circuit trimmer until the signal appears at the proper point on the dial. Conversely low dial readings are corrected by increasing the capacity of this trimmer to make correction. Care should be taken to insure that the HF oscillator is tuned to the fundamental frequency and not the image. This can be checked by tuning to the image frequency which should appear 910 kilocycles below the fundamental frequency and be considerably weaker. If the image does not appear at the lower dial setting the HF Oscillator trimmer capacity must be decreased until the fundamental and image frequencies appear at the proper points on the dial.

(b) First Detector

Adjust the signal generator to deliver a modulated signal near the high frequency limit of the band to be checked, tune the receiver to give maximum output, as indicated on the output meter. Adjust the first detector trimmer capacitor until the output reading shows maximum. If these trimmers require considerable realignment, it may be necessary to readjust the high frequency oscillator trimmer in order to maintain correct calibration.

An alternate method of aligning the first detector stage in the event a signal generator is not available is to set the first detector trimmer capacitors for maximum background noise. It will be found that trimmer settings under this method are sufficiently sharp to provide good alignment, although the adjustment must be made with care to avoid alignment to the image.

SECTION 6.

PARTS LIST

Symbol	Function	Type	Rating			
CAPACITORS						
C-1	RF Trimmer	Air	Variable			
C-2	Main Tuning	Air	Variable			
C-2A	RF Amp. Tuning	Air	Part of C-2			
C-2B	1st Det. Tuning	Air	Part of C-2			
C-2C	HF Osc. Tuning	Air	Part of C-2			
C-3	Eandspread Tuning	Air	Variable			
C-3A	RF Amp. Fandspread Tuning	Air	Part of C-3			
C-38	1st Det. Bandspread Tuning	Air	Part of C-3			
C-3C	HF Osc. Bandspread Tuning	Air	Part of C-3			
C-4	HF Amp. Grid Coupling	Mica	0.001 mfd., 300 VDCW			
C-5	RF Amp. Screen Bypass	Paper	0.01 mfd., 600 VDCW			
C-6	.PF Amp. Plate Filter	Paper	0,05 mfd., 600 VDCW			
C-7	A Band 1st Det. Trimmer	Mica	Variable			
C-8	F Band 1st Det. Trimmer	Mica .	. Variable			
C-9	P Band 1st Det. Pri. to Sec. Coupling	Ceramic	10 mmf., 500 VDCW			
C-10	C Band 1st Det. Trimmer	Mica	Variable			
C-11	I Eand 1st Det. Trimmer	Mica	Variable			
C-12	E Band 1st Det. Trimmer	Mica	Variable Variable			
C-13	Mixer Cathode Bypass	Paper	0.1 mfd., 400 VDCW			
C-14	Mixer Screen Bypass	Paper	0.01 mfd., 600 VDCW			
C-15	Mixer Plate Filter	Paper	0.05 mfd., 600 VDCW			
C-16	Crystal Filter Input Tuning	Mica	510 mmf., 500 VDCW			
C-17	Crystal Filter Bridge	Ceramic	85 mmf., 500 VDCW			
C-18	Crystal Filter Bridge	Ceramic	50 mmf., 500 VDCW			
C-19	Crystal Filter Phasing	Air	Variable			
C-20	Crystal Filter Coupling	Ceramic	10 mmf., 500 VDCW			
C-21	Selectivity Adjusting	Ceramic	25 mmf., 500 VDCW			
C-22	Selectivity Adjusting	Ceramic	100 mmf., 500 VDCW			
C-23	Selectivity Adjusting	Ceramic`	100 mmf., 500 VDCW			
C-24	Selectivity Adjusting	Ceramic	50 mmf., 500 VDCW			
C-25	Crystal Filter Output Tuning	Mica	510 mmf., 500 VDCW			
C-26	1st IF Grid Filter	Paper	0.01 mfd., 600 VDCW			
C-27	1st IF Screen Bypass	Paper	0.01 mfd., 600 VDCW			
C-28	lst IF Plate Filter	Paper	0.05 mfd., 600 VDCW			
C-29	T-11 Primary Tuning	Mica	510 mmf., 500 VDCW			
C-30	T-11 Secondary Tuning	Mica	510 mmf., 500 VDCW			
C-31	2nd IF Grid Filter	Paper	0_1 mfd., 400 VDCW			
C-32	2nd IF Grid to AVC Grid Coupling	Ceramic	47 mmf., 500 VDCW			
C-33	2nd IF Screen Bypass	Paper	0.01 mfd., 600 VDCW			
C-34	2nd IF Plate Filter	Рарег	0.05 mfd., 600 VDCW			
C-35	T-12 Primary Tuning	Mica	510 mmf., 500 VDCW			
C-36	T-12 Secondary Tuning	Mica	510 mmf., 500 VDCW			
		1				

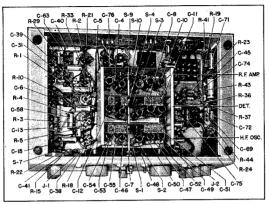


Figure No. 6. Bottom View of Receiver

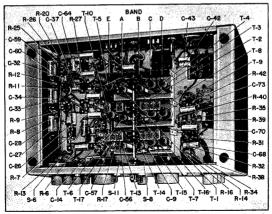


Figure No. 7. Bottom View of Receiver, Coil Compartment Side Plates Removed.

SECTION 6.

PARTS LIST (Continued)

Symbol	Function,	Type	Rating		
CAPACITORS (Continued)					
C-37	2nd Det. Load '	Mica	270 mmf., 500 VDCW		
C-38	Limiter Plate Filter	Paper	0.1 mfd., 400 VDCW		
C-39	Det. Plate to BFO Plate Coupling	Ceramic	10 mm f., 500 VDCW		
C-40	AVC Cathode Bypass	Paper	0.1 mfd., 400 VDOW		
C-41	1st Audio Coupling	Paper	0.01 mfd., 600 VDCW		
C-42	AC Line Bypass	Paper	0.01 mfd., 600 VDCW		
C-43	AC Line Bypass	Paper	0.01 mfd., 600 VDCW		
C-44	Power Supply Filter	Elec.	848 mfd., 475 VDCW		
C-44A	Power Supply Filter	Elec.	Part of C-44		
C-44B	Power Supply Filter	Elec.	Part of C-44		
C-45	B Minus Bypass	Elec	25 mfd., 50 VDCW		
C-46	A Band HF Osc. Trimmer	Mica	Variable		
C-47	B Band HF Osc. Trimmer	Mica	Variable		
C-48	B Band HF Osc. Padder	Mica	0.0085 mfd., 300 VDCW		
C-49	C Band HF Osc. Trimmer	Mica	Variable		
C-50	C Band HF Osc. Padder	Mica	0.0042 mfd., 300 VDCW		
C-51	D Band HF Osc. Trimmer	Mica	Variable		
C-52	D Band HF Osc. Padder	Mica	1250 mmf., 500 VDCW		
C-53	E Band HF Osc. Trimmer	Mica	Variable		
C-54	E Band HF Osc. Padder	Mica	420 mmf., 500 VDCW		
C-55	E Band HF Osc. Padder	Mica	Variable		
C-56	HF Osc. Plate Coupling	Mica	0.001 mfd., 300 VDCW		
C-57	HF Osc. Grid Coupling	Ceramic	100 mmf., 500 VDCW		
C-58	B Supply Filter	Paper	0.1 mfd., 400 VDCW		
C-59	AVC Amp. Screen Bypass	Paper	0.01 mfd., 600 VDCW		
C-60	AVC Amp. Plate Filter	Paper	0.05 mfd., 600 VDCW		
C-61	T-18 Tuning	Mica	510 mmf., 500 VDCW		
C-62	AVC Amp. to AVC Coupling	Mica	0.001 mfd., 300 VDCW		
C-63	AVC Fus Filter	Paper	0.1 mfd., 400 VDCW		
C-64	S-Meter Bypass	Paper	0.01 mfd., 600 VDCW		
C-65	T-19 Tuning	Air	Variable		
C-66	CWO Tuning	Mica	270 mmf., 500 VDCW		
C-67	CWO Grid Coupling	Mica	270 mmf., 500 VDOW		
C-68	CWO Osc. Screen Bypass	Paper	0.1 mfd., 400 VDCW		
C-69	lst Audio Cathode Bypass	Elec.	25 mfd., 50 VDOW		
C-70	1st Audio Screen Bypass	Paper			
C-71	1st Audio Screen Bypass 1st Audio Plate Filter	Paper	0.1 mfd., 400 VDCW		
C-72	Tone Adjusting	Paper	0.1 mfd., 400 VDCW 0.005 mfd., 500 VDCW		
C-73	2nd Audio Grid Coupling	Paper	0.005 mia., 500 VDCW		
C-74	2nd Audio Cathode Sypass	Elec.			
C-75	2nd Audio Cathode Hypass 2nd Audio Tone		25 mfd., 50 VDCW		
C-76		Paper	0.005 mfd., 500 VDCW		
U-10	Power Supply Filter	Paper	0.1 mfd., 400 VDCW		

PARTS LIST (Continued)

SECTION 6.

Symbol	Function	Type	Rating			
RESISTORS						
R-1	RF Amp. Grid	Fixed	100,000 Ohms, 1/2 W.			
R-2	BF Amp. Screen Filter	Fixed	33,000 Ohms, 1/2 W.			
R-3	RF Amp. Plate Filter	Fixed	2,200 Ohms, 1/2 W.			
R-4	Mixer Cathode	Fixed	220 Ohms, 1/2 W.			
R-5	Mixer Screen Filter	Fixed	33,000 Ohms, 1/2 W			
B-6	Mixer Plate Filter	Fixed	2,200 Ohms, 1/2 W			
B-7	lst IF Grid Filter	Fixed	470,000 Ohms, 1/2 W.			
B-8	lst IF Screen Filter	Fixed	33,000 Ohms, 1/2 W			
B-9	1st IF Plate Filter	Fixed	2,200 Ohms, 1/2 W			
R-10	2nd IF Grid Filter	Fixed	470,000 Ohms, 1/2 W			
B-11	2nd IF Screen Filter	Fixed	100,000 Ohms, 1/2 W			
R-12	2nd If Plate Filter	Fixed	2,200 Ohms, 1/2 W			
F-13	Limiter Control	Variable	100,000 Ohms, 1 W			
R-14	Limiter Plate	Fixed	68,000 Ohms, 1/2 W			
R-15	Limiter Plate Filter	Fixed	270,000 Ohms, 1/2 W			
R-16	Limiter Load	Fixed	270,000 Ohms, 1/2 W			
B-17	HF Osc. Grid	Fixed	22,000 Ohms, 1/2 W			
B-18	hF Osc. Plate	Fixed	47,000 Ohms, 1/2 W			
B-19	VR Dropping	Fixed	2,200 Ohms, 2 W			
B-20	AVC Amp. Grid	Fixed	470,000 Ohms, 1/2 W			
R-21	Voltage Divider	Fixed	330 Ohms, 1/2 W			
B-22	RF Gain Control	Variable	10,000 Ohms, 1.5 W			
P-23	Voltage Divider	Fixed	1,800 Ohms, 2 W			
R-24	Voltage Divider	Fixed	1.800 Ohms, 2 W			
P-25	AVC Amp. Screen Filter	Fixed	33,000 Ohms, 1/2 W			
R-26	AVC Amp. Plate Filter	Fixed	2,200 Ohms, 1/2 W			
B-27	AVC Filter	Fixed	470,000 Ohms, 1/2 W			
F-28	AVC Load	Fixed	. 33,000 Ohms, 1/2 W			
F-29	AVC Filter	Fixed	100,000 Ohms, 1/2 V			
B-30	CW Osc. Grid Bias	Fixed	47,000 Ohms, 1/2 V			
B-31	CW Osc. Screen Filter	Fixed	100,000 Ohms, 1/2 W			
B-32	Ow Osc, Screen Eleeder	Fixed	100,000 Ohms, 1/2 W			
B-32	CW Osc. Screen preeder	Fixed	220,000 Ohms, 1/2 W			
R-33	AF Gain Control	Variable	500,000 Ohms, 1 W			
H-34 H-35	lst Audio Cathode	Fixed	2, 200 Ohms, 1/2 W			
H-35 H-36	Inverse Feedback Voltage Divider	Fixed	100 Ohms, 1/2 W			
	Inverse Feedback Voltage Divider	Fixed	10,000 Ohms, 1/2 W			
R-37		Variable	500,000 Ohms, 1 W			
B-38	Tone Control	Fixed	470,000 Ohms, 1/2 W			
F-39	lst Audio Screen Filter	Fixed	100,000 Ohms, 1/2 W			
B-40	1st Audio Plate	Fixed	47,000 Ohms, 1/2 W			
R-41	1st Audio Plate Filter		470,000 Ohms, 1/2 W			
R-42	2nd Audio Grid	Fixed	4:0,000 Omms, 1/2 W			
L						

SECTION 6.

PARTS LIST (Continued)

Symbol	Function	Туре	Rating			
RESISTORS (Continued)						
P-43	2nd Audio Cathode	Fixed	270 Ohms, 2 W.			
P- 44	Headphone Load	Fixed	470 Ohms, 2 W.			
	MISCELLANBOUS					
CF-1	Crystal Filter		455 Kc.			
F-1	AC Line Fuse	Cart.	2 Amp., 250 V.			
I-1	S-Meter Lamp	No. 47	0.15 Amp., 6-8 V.			
I-2	Dial Lamp	No. 47	0.15 Amp., 6-8 V.			
I-3	Dial Lamp	No. 47	0.15 Amp., 6-8 V.			
J-1	Phono Jack		Multi-Circuit			
J-2	Phones Jack		Multi-Circuit			
L-1	CF-1 Input Tuning	Variable	Iron-Core Inductor			
L-2	CF-1 Output Tuning	Variable	Iron-Core Inductor			
L-3	T-11 Input Tuning	Variable	Iron-Core Inductor			
L-4	T-11 Output Tuning	Variable	Iron-Core Inductor			
L-5	T-12 Input Tuning	Variable	Iron-Core Inductor			
L-6	T-12 Output Tuning	Variable	Iron-Core Inductor			
L-7	Filter Choke	No. 80	17 Henries			
L-8	T-18 Tuning	Variable	Iron-Core Inductor			
L-9	1-19 Tuning	Variable	Iron-Core Inductor			
M-1	Signal Strength Meter	S-Meter				
P-1	AC Line Plug and Cord		2 Contact			
P-2	AC Jumper Plug	Octal				
S-1	BF Trans. Switch	Rotary	DP 5 Position			
S-1A		1	Part of S-1			
S-16			Part of S-1			
S-2	BF Trans. Band Switch	Rotary	DP 5 Position			
S-2A		' '	Part of S-2			
S-26			Part of S-2			
S-3	lst Det. Trans. Band Switch	Rotary	IP 5 Position			
S-3A			Part of S-3			
S-3B			Part of S-3			
S-4	1st Det. Trans. Eand Switch	Rotary	DP 5 Position			
S-4A	20-20-1		Part of S-4			
S-4B			Part of S-4			
S-5	Selectivity Control Switch	Rotary	IP 6 Position			
S-6	Limiter Switch	1,	S.P.D.T.			
S-7	AC Line Switch	1	S.P.S.T.			
S-8	Send - Beceive Switch	Toggle	S.P.S.T.			
S-9	HF Osc. Band Switch	Rotary	DP 5 Position			
S-9A	THE PARTY DIVINITION OF THE PARTY OF THE PAR		Part of S-9			
S-9B			Part of S-9			
S-10	HF Osc. Band Switch	Rotary	DP 5 Position			
S-10A	in oper pane present		Part of S-10			
, , , , , ,						

PARTS LIST (Continued)

SECTION 6.

Symbol	Function	Type	Rating			
MISCELLANEOUS (Continued)						
S- 10B S-11	AVC Switch	Toggle	Part of S-10 S.P.S.T.			
S-12	CN Osc. Switch	Rotary	S.P.D.T.			
T-1	RF Amp. Trans.	A Band				
T-2	RF Amp. Trans.	B Band				
T-3	RF Amp. Trans.	C Bend				
T-4	RF Amp. Trans.	D Band				
T-5	RF Amp. Trans.	E Band				
T-6	1st Det. Trans.	A Band				
T-7	lst Det. Trans.	B Band				
T-8	lst Det. Trans.	C Band				
T-9	1st Det. Trans.	D Band				
T-10	1st Det. Trans.	E Band				
T-11	2nd IF Trans.		455 Kc.			
T-12	Det. Input Trans.	1 1	455 Kc.			
T-13	HF Osc. Trans.	A Bend				
T-14	HF Osc. Trans.	B Band				
T-15	HF Osc. Trans.	C Band				
T-16	HF Osc. Trans.	D Band				
T- 17	HF Osc. Trans.	E Band				
T- 18	AVC Amp. Trans.	1				
T-19	OW Osc. Trans.	1 1	455 Kc.			
T-20	Audio Output Trans.	1 '				
T-21	Power Transformer					
V-1	RF Amplifier	6SG7				
V-2	Mixer	6SA7				
V-3	1st IF Amp.	6SG7				
V-4	2nd IF Amp.	6SG7				
V-5	2nd DetAVC	6H6				
V-6	Limiter	6H6				
V-7	Rectifier	5Y3GT/G				
V-8	HF Osc.	6J5				
V-9	Voltage Regulator	OD3/VR-150	*			
V-10	AVC Amo.	6AC7				
V-10 V-11	CW Osc.	6SJ7				
V-11 V-12	Ist Audio	6817				
V-12 V-13	Audio Output	6V6GT/G				
X-13	Lattery Socket	Octal				
X-1 Y-1		Jan Land	455 Kc.			
1-1	Crystal Resonator		TOO INC.			

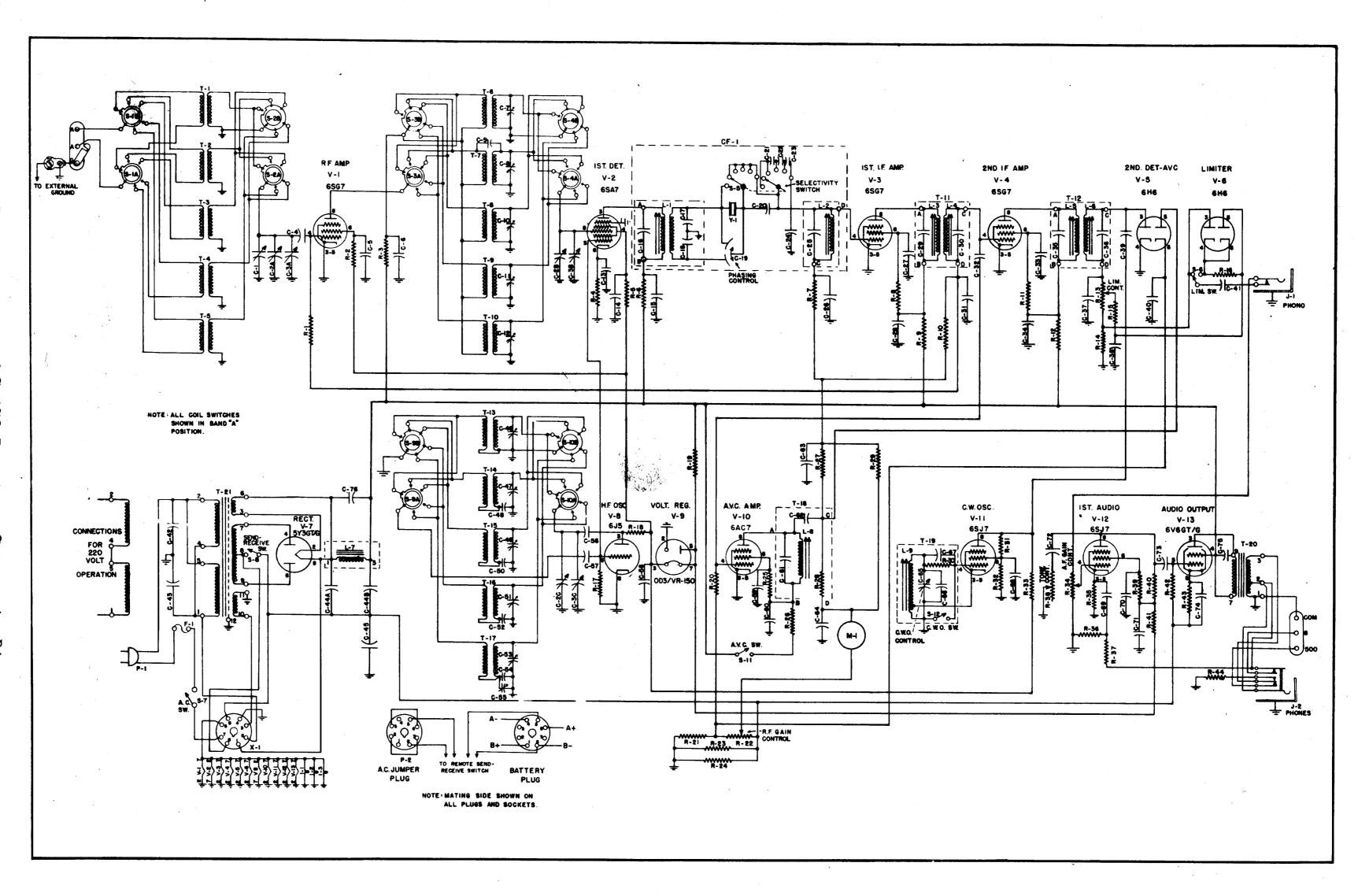


Figure No. 8. NC-173 Receiver Schematic Diagram

INSTRUCTION SHEET

for the

NATIONAL NFM-73 NARROW-BAND F.M. ADAPTOR

Installation

The NRM-73 is installed in the NC-173 Receiver by plugging the adaptor unit into the Accesspry Connector Socket, X-2, at the rear of the receiver and by plugging the phone plug, P-2, into the Phono input jack on the front of the receiver. A mounting bracket is furnished to hold the adaptor unit securely in position. The bracket is fastened to the receiver by means of the proper receiver cabinet drive screw. The adaptor is aligned at National Company laboratories and realignment is not necessary in either the adaptor or receiver.

Operation

The instructions given in Section 3, Operation, of the NC-173 Instruction Book are applicable for the reception of narrowhand F.M. signals except that the A.V.C. M.V.C. switch must be at the A.V.C. position. Changeover from F.M. to A.M. operation is accomplished by partially withdrawing the phone plug from the Phono input jack. It is recommended that when the operator is scanning a band for signals that the NC-173 is operated in the A.M. condition (the phone plug withdrawn from the Phono iack). When an F.M. signal is encountered the phone plug should then be pushed all the way into the Phono jack and the signal tuned for maximum S-meter reading. An F.M. signal is usually indicated by the presence of an audio null in the center of the signal carrier.

Alignment

The NPM-73 is carefully aligned, before shipment, and no realignment is required unless the adaptor is accidently misaligned. The necessity of realignment can be determined by the A.M. rejection capabilities of the adaptor unit. Proper alignment will be indicated when the maximum A.M. rejection occurs at the center of the A.M. carrier. Maximum S-meter reading will indicate the center of the carrier.

The equipment required for alignment is a high-impedance vacuum tube voltmeter and an A.M. signal generator. The signal generator used should have an output resonably free of any frequency modulation. The use of a standard broadcast station as a signal source, in place of a signal generator, would provide a test signal meeting: the above requirement. In any case, the signal strength of the test signal should be of the order to provide an S-meter reading of from 2 to 5 S units when the NC-173 is correctly tuned to the test signal.

The preliminary alignment procedure is as follows:

- 1. Connect the high-impedance voltmetre between the test point jack, J-I, and chassis. The polarity of the voltage will depend on the alignment of the adaptor, connect the voltmeter to obtain an up-scale reading.
- Connect a signal source to the antenna terminals, A and A, at the rear of the NC-173. If a signal generator is used make the connection through a 300 ohm dummay load and select a frequency in the standard broadcast band.
- Push the NFM-73 phone plug all the way into the Phono input jack.
 - 4. Set the C.W.O. switch at Off.
- 5. Set the Selectivity control at Off.
 - Set the Limiter control at Off.
 - 7. Set the Bandswitch at E band. 8. Set the Send-Receive switch at
- Receive.
 9. Set the A.V.C.-M.V.C. switch at
- A:V.C. 10. Turn the R.F. Gain control to
- 11. Turn the A.F. Gain for the de-
- sired volume.

 12. Tune to the test signal by adjustment of the Main Tuning knob. The correct tuning coint is the setting that pro
 - duces maximum S-meter reading.

 Alignment is effected as follows:

- Detune both primary, L-1, and secondary, L-2, I.F. trimmers by rotating the screw adjustments until they few withdrawn from the shield can as far as possible. The adjustment with the shorter screw length is the primary trimmer L-1.
- Tune the primary trimmer, L-1, for maximum reading on the voltmeter. If two peaks in output are observed, the correct peak will be the first one encountered when rotating the screw adjustment into the shield can.
- 3. Tune the secondary trimmer, L-2, for a zero reading on the voltmeter. It

- will be noted that there is a crossover in the polarity of the test voltage at this point.
- Adjust the capacitor, C-9, for a null in the audio output. This capacitor, is accessible after removal of the button plug on the side of the adaptor unit.
- 5. Adjustment of capecitor, C-9, may affect the zero voltage reading obtained by adjustment of the secondary trimmer, L-2. Retrim L-2 and C-9, as necessary, until both a zero voltage reading on the voltmeter and a null in the audio output are obtained.

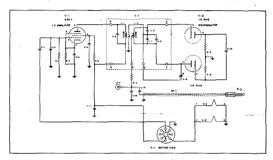
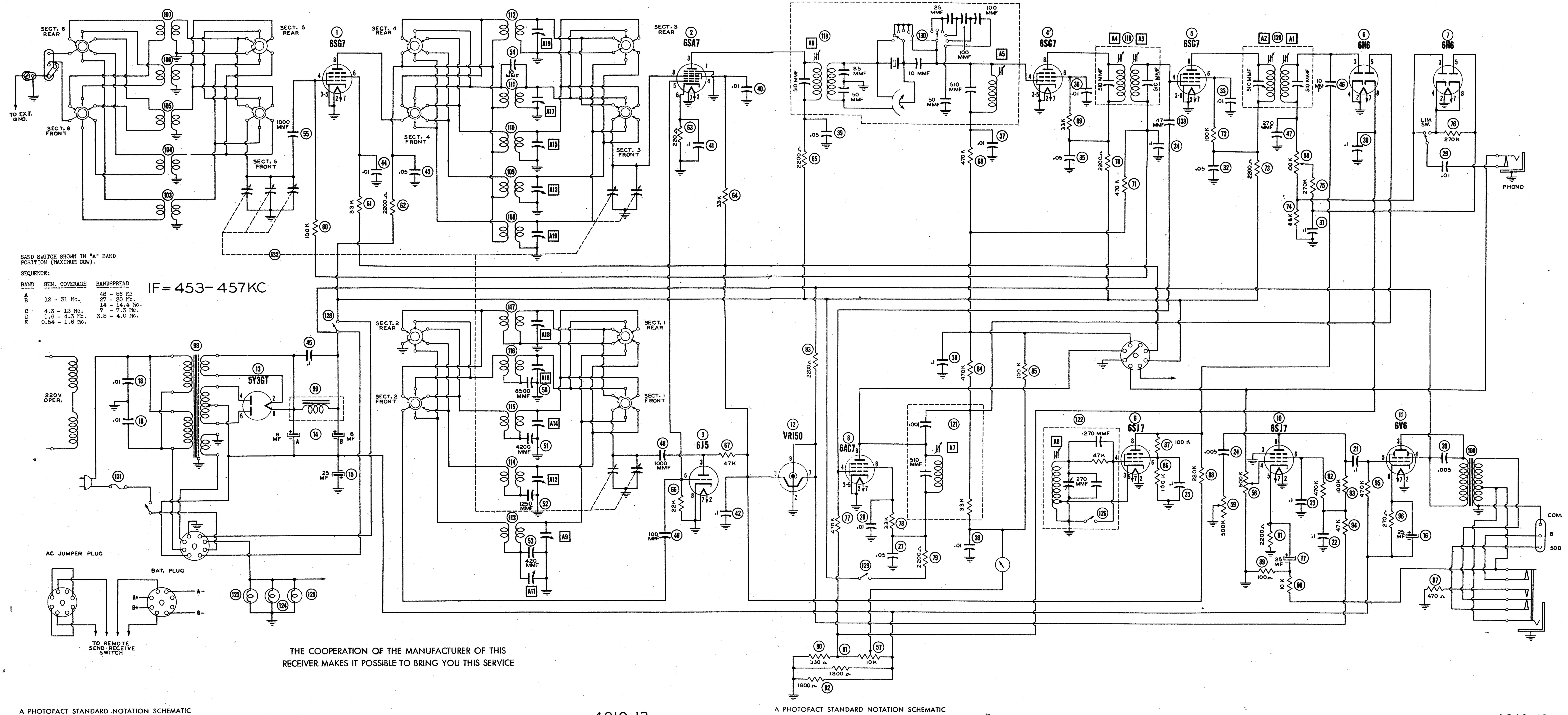


Figure No. 1. Schematic Diagram - NFM-73

PARTS LIST

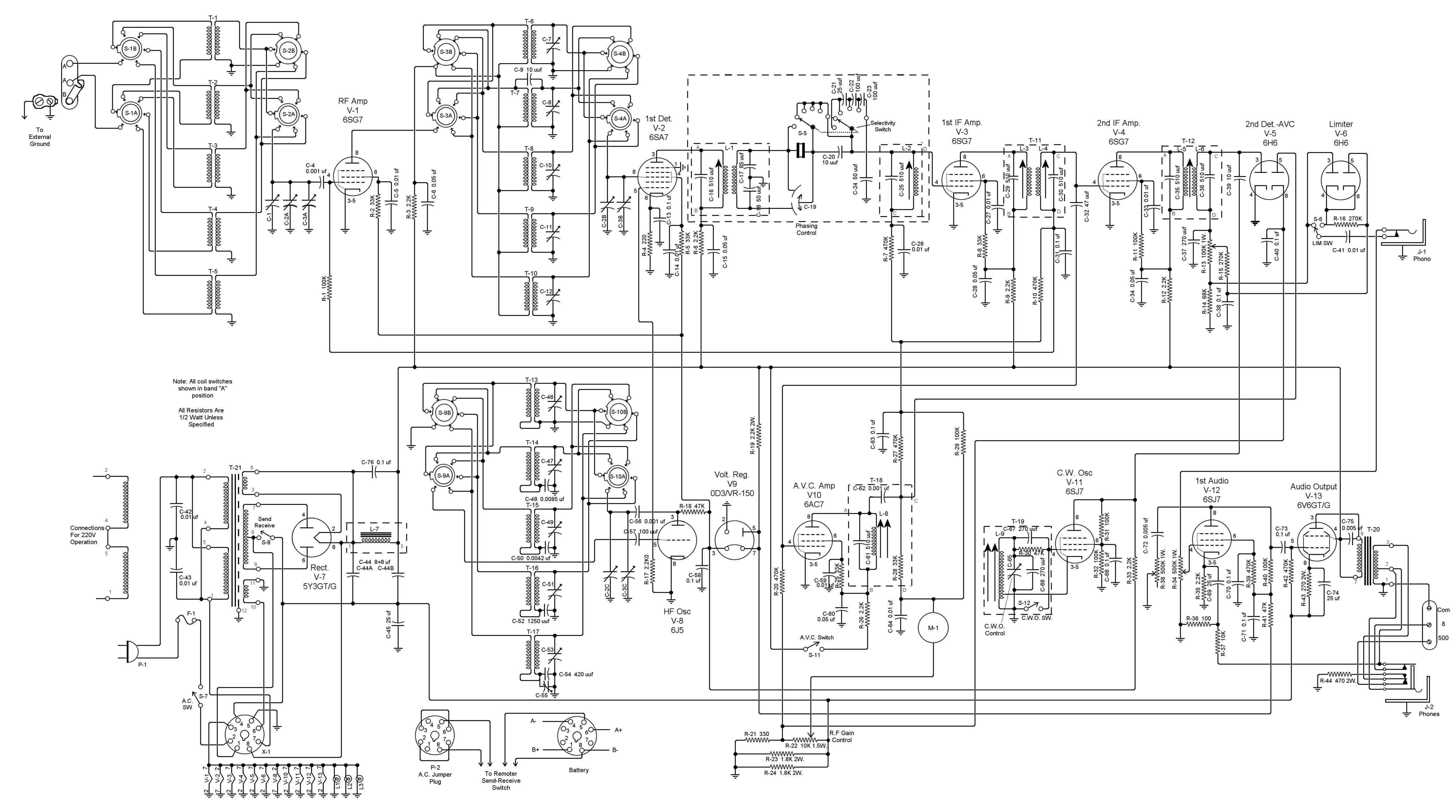
C-1	I.F. Amp. Coupling	Cersmic, 10 Mmf, 500 vdcw	R-2	I.F. Amp. Cathode Bias	Fixed, 1,000 Chms, 1/2 w.
C-2	Input Divider	Ceramic, 38.5 Mmf, 500 volcw	R-3	I.F. Amp. Screen Drop.	Fixed, 47,000 Ohms, 1/2 w.
C-3	I.F. Amp. Cathode Bypass	Mica, 0.01 Mfd, 300 vdcw	R-4	R.F. Filter	Fixed, 47,000 Chms, 1/2 w.
C-4	I.F. Amp. Screen Bypass	Mica, 0.001 Mfd, 300 vdcw	R-5	Diode Load	Fixed, 15,000 Chms, 1/2 w.
C-5	T-1 Primary Tuning	Mica, 100 Mmf, 500 vdcw	R-6	Diode Load	Fixed, 15,000 Chms, 1/2 w.
C-6	T-1 Secondary Tuning	Mica, 180 Mmf, 500 vdcw	J-1	Test Point	Tip Jack, Bakelite
C-7	T-1 Secondary Tuning	Mica, 180 Mmf, 500 vdcw	L-1	T-1 Primary Inductor	Adjustable Iron-Core
C-8	T-1 Secondary Tuning	Ceramic, 50 Mmf, 500 vdcw	L-2	T-1 Secondary Inductor	Adjustable Iron-Core
C-9	T-1 Sec. Zalance Adj.	Ceramic, Var., 5-20 Mmf.	P-1	Adaptor Unit Plug	8 Prong Octal
C-10	Disc. Cathode Filter	Elect, 1 Mfd, 450 vdcw	P-2	Phono Plug	Phone Plug
C-11	B Supply Bypess	Mica, 0.01 Mfd, 300 vdcw	T-1	Discriminator Trans.	Ratio Type 455 Kc.
C-12	R.F. Filter	Mica, 470 Mmf, 500 vdcw	V-1	I.F. Amplifier	6SK7
C-13	Asdio Coupling	Mica, 0.01 Mfd, 300 vdcw	V-2	Discriminator	6H6
R-1	I.F. Amp. Grid Leak	Fixed, 1 Megohm, 1/2 w.	W-1	Ardio Cable	Shielded Cable



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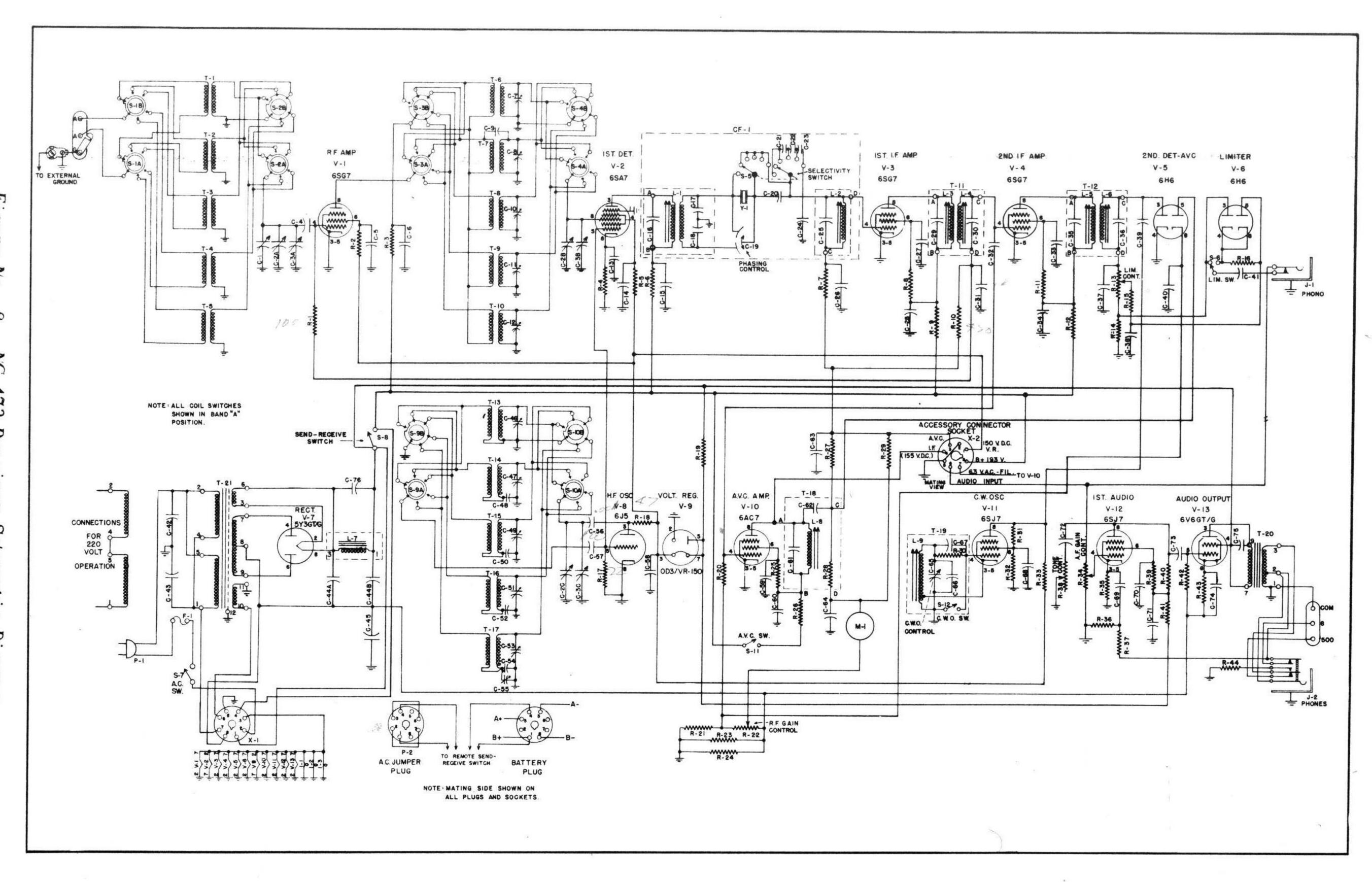


Figure No. 8. NC-173 Receiver Schematic Diagram



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