PRELIMINARY INSTRUCTION BOOK FOR NAVY MODEL RBL-5 RADIO RECEIVING EQUIPMENT

SUPPLY
115 VOLTS
50/60 CYCLES
ONE PHASE

FREQUENCY RANGE
15 to 600 KILOCYCLES

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This Instruction Book is furnished for the information of commissioned, warranted, enlisted and civilian personnel of the Navy and persons authorized by the Bureau of Ships whose duties involve design, manufacture, instruction, operation, and installation of radio, radar, or underwater sound equipment. The word "RESTRICTED", as applied to this instruction book signifies that it is to be read only by the above personnel, and that the contents should not be made known to unauthorized persons not connected with the Navy.

MANUFACTURED FOR U.S. NAVY DEPARTMENT BY NATIONAL COMPANY, INC. BUREAU OF SHIPS MALDEN, MASS. U.S.A.

CONTRACT NXsr-38306 DATE OF CONTRACT SEPTEMBER 22, 1943
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GUARANTEE

The equipment including all parts and spare parts, except vacuum tubes, batteries, rubber and material normally consumed in operation, is guaranteed for a period of one year from the date of delivery of the equipment to and acceptance by the Government with the understanding that all such items found to be defective as to material, workmanship or manufacture will be repaired or replaced, f.o.b. any point within the continental limits of the United States designated by the Government, without delay and no expense to the Government; provided that such guarantee will not obligate the Contractor to make repair or replacement of any such defective items unless the defect appears within the aforementioned period and the Contractor is notified thereof in writing within a reasonable time and the defect is not the result of normal expected shelf life deterioration.

To the extent the equipment, including all parts and spare parts, as defined above, is of the Contractor's design or is of a design selected by the Contractor, it is also guaranteed, subject to the foregoing conditions, against defects in design with the understanding that if ten per cent (10%) or more of any such said item, but not less than two of any such item, of the total quantity comprising such item furnished under the contract, are found to be defective as to design, such item will be conclusively presumed to be of defective design and subject to one hundred per cent (100%) correction or replacement by a suitably redesigned item.

All such defective items will be subject to ultimate return to the Contractor. In view of the fact that normal activities of the Naval Service may result in the use of equipment in such remote portions of the world or under such conditions as to preclude the return of the defective items for repair or replacement without jeopardizing the integrity of Naval Communications, the exigencies of the Service, therefore, may necessitate expeditious repair of such items in order to prevent extended interruption of communications. In such cases the return of the defective items for examination by the Contractor prior to repair or replacement will not be mandatory. The report of a responsible authority, including details of the conditions surrounding the failure, will be acceptable as a basis for affecting expeditious adjustment under the provisions of the contractual guarantee.

The above one year period will not include any portion of time the equipment fails to perform satisfactorily due to any such defects, and any items repaired or replaced by the Contractor will be guaranteed anew under this provision.
REPORT OF FAILURE

Report of failure of any part of this equipment, during its service life, shall be made to the Bureau of Ships in accordance with current instructions. The report shall cover all details of the failure and give the date of installation of the equipment. For procedure in reporting failures see Chapter 31 (mimeographed form) of the Manual of Engineering Instructions, or Bureau of Ships Radio and Sound Bulletin Number 7, dated July 1, 1942, or superseding instructions.

PERTINENT DATES

Contract NXsr-38306 Date of Contract September 22, 1943
Serial number of equipment.................................
Date of acceptance by the Navy.............................
Date of Delivery to contract destination..................
Date of completion of installation........................
Date placed in service.....................................

Blank spaces in this book shall be filled in at time of installation. Operating personnel shall also mark the "date placed in service" on the date plate located below the model nameplate on the equipment, using suitable methods and care to avoid damaging the equipment.
REQUESTS FOR REPLACEMENT MATERIAL

All requests or requisitions for replacement material should include complete descriptive data covering the part desired, in the following form:

1. Name of part desired.
2. Navy Type number (if assigned) including prefix and suffix as applicable.
3. Model designation (including suffix) of equipment in which used.
4. Navy Type designation (including prefix and suffix where applicable) of major unit in which part is used.
5. Symbol designation of part.
6. (a) Navy Drawing Number.
   (b) Manufacturer's Drawing Number.
7. Rating or other descriptive data.
1. GENERAL DESCRIPTION

1-1 The Model RBL-5 Radio Receiving Equipment is suitable in all respects for use at Naval Radio Stations ashore or afloat.

1-2 The equipment may be used for the reception of radio telephone and telegraph signals (either CW or MCW) when detector radiation measured at the antenna input circuit must be less than 400 micro-micro-watts.

1-3 Each complete equipment consists of the following:

1 Type CNA-46161-B Radio Receiver
1 Type CNA-10124 Mounting Base
1 Set of Spare Parts
   Stock Spare Parts } - Furnished on the basis of one set per ten equipments.
   Tender Spare Parts }
   Instruction Books

1-4 Power Requirements

The Model RBL-5 Radio Receiving Equipment is intended to operate from a 115 volt, 50-60 cycle A.C. supply source or from batteries or other D.C. sources capable of supplying 6.3 volts D.C. at 2.2 amperes and 135 volts D.C. at 30 milliamperes. Normal power consumption on A.C. is 45 watts.

1-5 Net Weights and Overall Dimensions

Net Weights:

Type CNA-46161-B Radio Receiver..... 75 lbs.
Type CNA-10124 Mounting Base........... 5-1/2 lbs.
Equipment Spare Parts, packed........... 64 lbs.
Shipping Weight, crated................ 225 lbs.
Stock Spares, packed....................
Tender Spares, packed....................

Overall Dimensions

<table>
<thead>
<tr>
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<th>Receiver on Base</th>
<th>Receiver</th>
</tr>
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<tbody>
<tr>
<td>Depth</td>
<td>17-1/4 in.</td>
<td>16-5/8 in.</td>
</tr>
<tr>
<td>Height</td>
<td>12-10/32 in.</td>
<td>10-21/32 in.</td>
</tr>
<tr>
<td>Width</td>
<td>17-11/16 in.</td>
<td>17-3/16 in.</td>
</tr>
</tbody>
</table>

Dimensions, crated........... 42\(\frac{1}{2}\)" X 22\(\frac{1}{2}\)" X 17\(\frac{1}{2}\)" Deep
Cubic Volume.................. 9.7 cu. ft.
1-6 Description of Major Units

1-6-1 Type CNA-46161-B Radio Receiver

The type CNA-46161-B Radio Receiver is a seven tube, table mounting, tuned radio frequency receiver covering a continuous frequency range of from 15 to 600 kilocycles in six working bands. The receiver is enclosed within a copper-plated steel cabinet having a black wrinkle finish. The chassis and other steel parts are copper-plated and given a gray enamel finish. The circuit employed on all bands is shown in the schematic diagram Figure No. 1.

It comprises two stages of radio frequency amplification, a regenerative detector, a resistance coupled audio stage, a low pass filter with two possible cut-off frequencies, a high pass filter with fixed cut-off, an adjustable audio limiter, and a resistance coupled audio output stage. The audio output is available at a phone jack and at a terminal strip on the rear of the receiver. A built in A.C. power supply provides the proper filament and plate voltages required by the receiver. Provision is made for battery operation in the form of a D.C. power socket mounted on the rear of the receiver chassis.

1-6-2 The frequency range of the receiver is covered in five working bands as follows:

<table>
<thead>
<tr>
<th>Band</th>
<th>Frequency Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>15 - 25 Kilocycles</td>
</tr>
<tr>
<td>B</td>
<td>25 - 45 Kilocycles</td>
</tr>
<tr>
<td>C</td>
<td>45 - 80 Kilocycles</td>
</tr>
<tr>
<td>D</td>
<td>80 - 155 Kilocycles</td>
</tr>
<tr>
<td>E</td>
<td>155 - 310 Kilocycles</td>
</tr>
<tr>
<td>F</td>
<td>310 - 600 Kilocycles</td>
</tr>
</tbody>
</table>

The Type CNA-46161-B Radio Receiver has a dial with six scales calibrated in accordance with the frequency coverage of the six bands. A moving pointer indicates the frequency setting. The band in use is indicated by a band indicator dial, which turns with the band change knob. In addition to the frequency calibrated scales, an auxiliary numerical dial is employed. This dial may be read to one part in one thousand and is useful when logging signals.

1-7 Circuit Details

1-7-1 Two sets of tapped radio frequency transformers are mounted in six copper shield cans. Band selection is accomplished by means of a six section coil switch which selects the correct taps for the antenna, plate, and grid circuits of the transformers. A seventh section of the band switch selects the proper tap on the detector transformer tickler. Dead spots are avoided by grounding or detuning unused portions of the transformer windings. Trimmer capacitors are connected where necessary to compensate for inductive or capacitive variations. The r.f. transformers are wound on ceramic forms and are wax-impregnated.
1-7-2 R.F. Amplifier

A two-stage impedance coupled r.f. amplifier is used and is provided with an automatic sensitivity control consisting of a rheostat ganged to the main tuning capacitor. The rheostat serves to adjust the amplification of the r.f. tubes to compensate for the variation in gain due to change of L/C ratio with tuning. The plate taps on the tuned circuits are selected so as to maintain satisfactory sensitivity and selectivity over the wide frequency range covered by the receiver.

1-7-3 Detector Stage

The detector stage utilizes a pentode tube connected in an electron-coupled regenerative circuit. The plate of the tube is at ground potential for radio frequencies, thus serving to isolate the regenerative circuit from loading effects or other variations in the audio circuit. Regeneration is controlled by means of a screen potentiometer and an oscillation test button is provided.

1-7-4 Audio Amplifier

The audio system consists of two stages of amplification which are resistance coupled. Filters between the first and second audio tubes are used to reduce noise and unwanted signal components as well as to improve the CW audio selectivity. An audio output limiter is connected before the input of the second audio stage.

An output transformer, having a balanced secondary, couples the output of the second audio stage to a phone jack and to a terminal strip on the rear of the chassis.

1-7-5 Low Pass Filter

A low pass filter is connected directly after the first audio stage. A two-position switch permits adjustment of the filter to provide a broad and sharp audio characteristic. In the sharp position the pass band is approximately 500 cycles wide at 20 db. down, peak response occurring at 700 cycles per second. In the broad position the pass band is approximately 3500 cycles wide at 20 db. down with the peak response at 1100 cycles per second.

1-7-6 High Pass Filter

Following the low pass filter is a high pass filter which is connected to the input of the audio limiter tube. The high pass filter has a fixed cut-off frequency of 800 cycles/sec. increasing attenuation taking place at frequencies lower than 800 cycles per second.
1-7-7 Output Limiter

The audio output from the audio filters is coupled to the elements of a twin-diode tube which is connected so as to limit or clip the peaks of both alternations of an audio cycle, the amount of limiting being dependent on the setting of an output level control. With the output level control set to give a particular audio level, noise and audio peaks will be limited to this level, thus providing an automatic volume control action.

1-7-8 Power Supply

The power supply is of the transformer-rectifier type having a two-section filter. Two power input sockets are mounted on the rear of the chassis. A.C. power is supplied through a removable connector plug together with a jumpered plug in the D.C. power socket, the jumpers serving to complete the A.C. connections. For D.C. operation, the jumper plug is removed and replaced with a similar plug wired to the D.C. or battery supplies.

1-7-9 Tube complement

The tubes employed in the Type CNa-46161-B Radio Receiver are as follows:

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<tr>
<th>Symbol</th>
<th>Navy Type</th>
<th>Function</th>
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<tr>
<td>V-101</td>
<td>-6SK7</td>
<td>First R.F. Amplifier</td>
</tr>
<tr>
<td>V-102</td>
<td>-6SK7</td>
<td>Second R.F. Amplifier</td>
</tr>
<tr>
<td>V-103</td>
<td>-6SK7</td>
<td>Regenerative Detector</td>
</tr>
<tr>
<td>V-104</td>
<td>-6SC7</td>
<td>First Audio Amplifier</td>
</tr>
<tr>
<td>V-105</td>
<td>-6S6</td>
<td>Audio Limiter</td>
</tr>
<tr>
<td>V-106</td>
<td>-6K6GT/G</td>
<td>Power Audio Amplifier</td>
</tr>
<tr>
<td>V-107</td>
<td>-5Y3G</td>
<td>Rectifier</td>
</tr>
</tbody>
</table>

1-8 Type CNa-10124 Mounting Base

The Type CNa-10124 Mounting Base is a cradle or frame work which is fitted with four rubber shock mounts. The shock mounts are rubber insulated bushings and serve to pass the mounting bolts. Thumb screws at the front and rear corner of the base are used to secure the receiver to the base. The outline drawing and mounting dimensions for the mounting base are shown in Figure No. 4.

2. INSTALLATION

2-1 The major units and spare parts of the Model RBL-5 Equipment are packed in a single wooden crate. The recommended procedure to employ in unpacking the equipment is as follows:
(1) Place the packing crate so that the identification stenciling is uppermost.
(2) Remove the side or cover of the packing crate which is now uppermost. This cover is secured by nails and an ordinary nail puller or claw hammer may be employed.
(3) Remove the receiver by carefully turning the crate upside down and lifting the crate off. The receiver is protected from scratching or marring by the cardboard carton in which it is enclosed.
(4) Remove the receiver from the cardboard carton.
(5) Release the spare parts container from the crate by removing the retaining cleats with a pry bar or claw hammer.
(6) Remove the spare parts container from the crate.
(7) Inspect the parts and controls of the receiver for any damage incurred during shipment.
(8) The packing crate, cardboard carton and spare parts container should be saved if the equipment is to be repacked and re-shipped.

2-2 Mounting

After unpacking, the Type CNA-10124 Mounting Base should be fastened to the operating table, allowing clearance for the external connections at the rear of the receiver. The receiver should be secured to the mounting base by means of the thumb-screws located at the front and rear corners of the mounting base. The outline drawing and mounting dimensions for the Type CNA-10124 Mounting Base are shown in Figure No. 4.

2-3 External Connections

2-3-1 Power Connections

For A.C. operation connect the A.C. connector plug P-102 to a 115 Volt 50/60 cycle power source; plug the A.C. connector plug P-102 into the A.C. power socket J-102; A.C. JUMPER plug P-103 must be plugged into D.C. Power socket J-103 to complete A.C. power connections.

For D.C. operation, remove A.C. JUMPER plug from the D.C. POWER socket J-103 and replace with a similar plug wired to a suitable D.C. source. If the receiver is to be operated mainly from a D.C. source, the A.C. JUMPER plug P-103 may be revised for use on D.C. For D.C. cable connections see FIG. NO. 1. Two separate supplies must be used for D.C. operation, a 6.3 volt filament supply and a 125 volt D.C. supply.

2-3-2 Antenna Connections

The input circuit is so arranged as to be suitable for
use with either an unbalanced feed-line or a simple antenna-ground combination. Static drain resistors are incorporated in the receiver for the protection of the antenna series capacitors.

A concentric jack J-104 is mounted near the left end of the chassis as viewed from the rear. A matching plug P-104 is provided to which the antenna must be connected. When a single wire lead-in is used, it should be soldered to the center pin of P-104. In an installation having a concentric feed-line, connect the inner conductor to the center pin of plug P-104 and the outer conductor should be securely connected to the shell of P-104.

Provision is made for use of either a short or long antenna; this adjustment consists of insulated binding posts E-102 to which may be clamped a flexible lead connected to antenna jack J-104. For use with a short antenna, the flexible lead should be clamped to the left-hand insulated terminal, as viewed from the front of the receiver. The right-hand insulated terminal is for use with a long or high capacity antenna. This adjustment should be checked by means of the ANTENNA COMPENSATOR which should resonate the first R.F. stage on all bands.

The equipment should be permanently grounded by means of a properly grounded concentric feed-line or by means of a ground connection made to terminal E-103.

2-3-3 Output Connections

The 600 ohm balanced secondary of the output transformer is terminated at the OUTPUT terminals E-101 located at the rear of the receiver. Connected in parallel with E-101 is the head-phone jack J-101 which is mounted on the front panel. An amplifier or other equipment may be connected to terminal strip E-101. The total impedance of the output load should be 600 ohms.

Since the output transformer secondary is of the balanced type having a grounded center tap, no ground connection should be made to this circuit at any other point.

3. OPERATING INSTRUCTIONS

3-1 Preliminary Test

3-1-1 When the Type CNA-46161-B Radio Receiver has been installed and connected to the proper power source and all other connections have been made in accordance with the data in Sec. 2-3, External Connections, a preliminary test of the receiver should be made by setting the controls as follows:
Control Symbol | Control                  | Setting                  
--------------|-------------------------|--------------------------
S-102 - S-103 | POWER Switch            | ON                       
S-106         | AUDIO Switch            | BROAD                    
R-134         | R.F. GAIN               | 10                       
S-105         | OUTPUT LIMITER Switch   | OFF                      
R-120         | OUTPUT LEVEL            | 0                        
R-127         | REGENERATION            | Below Oscillation        
C-104         | ANT. COMPENSATOR        | For Maximum Gain         
C-109         | R.F. TRIMMER            | For Maximum Gain         
S-107         | BAND SELECTOR           | To Desired Band          
C-103         | MAIN TUNING             | To Signal Frequency      

After the tubes have warmed up, background noise should be heard and MCW signals from a test oscillator or transmitter may be tuned in. For CW signals advance REGENERATION control to point of oscillation. To turn off Power: Turn Power switch to OFF.

3-2 Controls

3-2-1 All switches and controls (with the exception of the main tuning dial and the band selector knob) of the Type CNA-46161-B Radio Receiver are identified by etched panel plates or dial scales. The symbol numbers in the following paragraphs of this Section refer to the schematic diagrams and the Parts List.

3-2-2 The POWER switch (S-102, S-103) is located at the left-hand side of the receiver panel near the top. Turning this control to the maximum clockwise position completes the necessary supply circuits and places the receiver in operation.

3-2-3 The main tuning dial is located at the center of the front panel of the receiver. The dial scale is calibrated in accordance with the frequency response of the six bands. In addition to the frequency calibrated scales, an auxiliary numerical dial is employed. This dial has 100 divisions and makes 10 revolutions while the tuning capacitor rotates 180 degrees; it is direct reading to one part in one thousand. The accuracy of calibration can be relied upon to plus or minus 2%.

3-2-4 The band selector knob is located near the bottom of the front panel at the center. The knob must be rotated approximately one sixth of a turn to change from one band to an adjacent band. The band in use is indicated by the pointer attached to the band selector knob. A positive detent insures proper positioning of the band selector switch contacts.

3-2-5 Directly beneath the power switch is located the AUDIO band-width control switch. In the sharp position the pass band
is approximately 500 cycles wide at 20 db. down, with the peak response occurring at 700 cycles per second. In the broad position the pass band is approximately 3500 cycles wide at 20 db. down with the peak response occurring at 1100 cycles per second.

3-2-6 The REGENERATION control is located directly below the AUDIO band-width control. Clockwise rotation of this control increases the regeneration in detector circuit. The detector tube may be made to oscillate when the REGENERATION control is turned sufficiently in the clockwise direction thus providing a means for heterodyne detection of CW radio telegraph signals.

3-2-7 The R.F. GAIN control is located to the left of the REGENERATION control. Clockwise rotation of this control increases the amplification of the two R.F. amplifier tubes V-101 and V-102.

3-2-8 The ANTENNA COMPENSATOR control is located at the right of the band selector control. This control is used to compensate for antenna capacity, which tends to detune the first R.F. stage. It should be adjusted for maximum amplification.

3-2-9 The R.F. TRIMMER control is located to the right of the ANTENNA COMPENSATOR. The function of this control is to compensate for unavoidable error in tracking in the second R.F. stage and should be adjusted for maximum amplification.

3-2-10 The OSCILLATION TEST button is located between the ANTENNA COMPENSATOR and R.F. TRIMMER. In the absence of a received signal, this control is useful in determining whether or not the detector is oscillating. The detector slides in and out of oscillation so smoothly that it is often difficult to determine whether or not it is oscillating. If a click is heard in the headphones when the OSCILLATION TEST button is pressed and another click observed when it is released, this indicates that the detector is in the oscillating condition.

3-2-11 The OUTPUT LIMITER control is located directly above the ANTENNA COMPENSATOR control. In the OFF position the limiter circuits are inoperative. In the ON position the limiter circuits are operative and limit all audio voltage peaks to a definite maximum value determined by the setting of the OUTPUT LEVEL control. The type of limiter employed limits both alternations of an audio frequency cycle to approximately the same peak value.

3-2-12 The OUTPUT LEVEL control is located directly above the OUTPUT LIMITER control. Turning this control in a counterclockwise direction increases limiter action by decreasing the peak value.
of audio frequency voltages that appear in output of the limiter circuit. The limiter may thus be used to limit noise peaks or pulses which are greater than the maximum value that the limiter will pass, or in addition to this action it may also be used to provide a means of automatic volume control. Automatic volume control action is obtained by increasing the receiver gain and decreasing the output level by means of the limiter so that when the desired signal fades to the lowest usable level, the limiter still cuts off the desired signal peaks to a slight extent.

3-3 C.W. Reception

3-3-1 After the Model RBL-5 Equipment is properly installed, in accordance with Section 2, it is put into operation by turning the POWER switch to the ON position. The AUDIO band-width switch should be at the SHARP position; the radio frequency GAIN control well advanced; the REGENERATION control advanced sufficiently to cause the detector to oscillate; the OUTPUT LIMITER control turned OFF; and the ANTENNA COMPENSATOR and R.F. TRIMMER adjusted for maximum receiver background noise. The receiver is now adjusted for the reception of C.W. signals and will tune to the approximate frequency indicated by the main tuning dial and band in use.

3-3-2 In order to obtain heterodyne detection and the desired resultant audio beat note, the REGENERATION control must be advanced sufficiently to cause the detector tube to oscillate. This condition may be checked by the OSCILLATION TEST button. (Par. 3-2-10). With the AUDIO band-width switch in the sharp position, the heterodyne beat note frequency should be approximately 700 cycles per second to insure that the beat note will pass through the audio band pass filter with minimum attenuation. This condition must be fulfilled by adjusting the main tuning dial to the high frequency side of the point where oscillations from the detector "zero beat" with the received signal. The ANTENNA COMPENSATOR and R.F. TRIMMER should then be adjusted for maximum signal. Should adjustment of the ANTENNA COMPENSATOR or R.F. TRIMMER cause any change in the frequency of the beat note produced, this change may be corrected by readjustment of the main tuning control.

3-3-3 The selectivity of the Type CNA-46161-B Radio Receiver may be reduced by turning the AUDIO band-width control to the BROAD position. This makes the tuning less critical and the frequency of the heterodyne beat note may be any value between 700 to 2,500 cycles per second. Preliminary adjustment of the ANTENNA COMPENSATOR and R.F. TRIMMER should be made in accordance with Par. 3-3-1. The ANTENNA COMPENSATOR and R.F. TRIMMER will then be in correct adjustment when the AUDIO switch is turned from the SHARP to the BROAD position.
If the signal is partially obscured by static peaks or noise pulses of high intensity and short duration, the best signal-to-noise ratio will be obtained by turning the OUTPUT LIMITER control to the ON position and adjusting the OUTPUT LEVEL control. Automatic volume control action may be obtained at a sacrifice in audio quality by advancing the OUTPUT LEVEL control counterclockwise beyond the point where audio distortion is observed. See Par. 3-2-12.

3-4 M.C.W. Reception

Although primarily suited to C.W. reception, the Type CNA-4616l-B Receiver may be used for M.C.W. reception on frequencies between 200 and 600 Kc. Set controls as follows: POWER switch in the ON position, AUDIO band-width switch in the BROAD position, R.F. GAIN control well advanced, OUTPUT LIMITER switch ON, and OUTPUT LEVEL control at 10. The REGENERATION control should be set just below the point where the detector starts to oscillate. Adjust ANTENNA COMPENSATOR and R.F. TRIMMER controls for maximum background noise. The receiver is now adjusted for M.C.W. reception.

3-4-2 The OUTPUT LEVEL control may be used in M.C.W. code reception as described in Par. 3-3-4. When receiving voice, the OUTPUT LEVEL control may be used to suppress undesired static peaks, but cannot be used to provide AVC action without excessive distortion.

4. ALIGNMENT

Realignment of the Type CNA-4616l-B Radio Receiver is indicated if the frequency calibration is found to be in error by more than plus or minus 2 per cent or if the panel trimmers cannot be resonated throughout any band.

4-1-1 The complete alignment of the receiver may be divided into three steps:

1. Detector alignment
2. Second R.F. Amplifier alignment
3. First R.F. Amplifier alignment

Each band must be checked in the above order, commencing with the highest frequency band.

4-1-2 Dial scales bearing drawing number D-581 are calibrated for detector "zero beat" with C.W. signals of known frequency. The 1st and 2nd R.F. stages are aligned with the receiver tuned 750 cycles higher than "zero beat".

Dial scales bearing drawing number D-581-1 are calibra-
ted and all stages aligned with receiver tuned 750 cycles higher than the signal.

4-1-3 An accurate signal generator covering the frequency range from 15-600 kilocycles together with a 600 ohm output meter are required to make the alignment adjustments. A standard dummy antenna should be used between the generator and the receiver input circuit.

The receiver must be adjusted for C.W. operation as described in Sec. 3-3 with the antenna jumper connected as for use with a short antenna. The 600 ohm output meter should be connected to the phone jack circuit or to the OUTPUT terminal strip E-101. The bottom plate of the receiver must be removed to gain access to the various trimmer capacitors. Trimmer positions are shown in Fig. No. 5.

4-2 Detector Alignment

With the main tuning dial set at the high frequency end of the band being adjusted, apply a signal of correct frequency and adjust detector trimmer in accordance with dial calibration, which was explained in Par. 4-1-2. Detector trimmer capacitor C-113 serves to align the high frequency end of bands D, E, and F; a compromise setting should be made if the setting is not the same for these bands.

4-3 Second R.F. Amplifier Alignment

With the receiver producing a 750 cycle beat note, (change main tuning 750 cycles higher if dial is calibrated for "zero beat"), set panel R.F. TRIMMER at "0" and adjust second R.F. trimmer of band being aligned for maximum reading as indicated by the output meter. Trimmer capacitor C-110 serves to align the second R.F. circuits of bands D, E, and F while trimmer capacitor C-112 is used to align the second R.F. circuits of bands A and B. A compromise setting should be made if the trimmer setting is not the same for different bands.

4-4 First R.F. Amplifier Alignment

The range of the Antenna Compensator is great enough to provide proper alignment of all bands without additional trimmer capacitors. The setting of this control should remain fairly constant over any given band for good alignment. Antennas having different characteristics will cause some change in the setting of the antenna compensator.

4-5 Alignment Data

The alignment frequencies for the various bands and their associated trimmers are shown in the following table:
<table>
<thead>
<tr>
<th>Band</th>
<th>Frequency (Kc.)</th>
<th>Trimmer</th>
<th>2nd R.F. Amplifier</th>
<th>Detector</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>600</td>
<td></td>
<td>C-110</td>
<td>C-113</td>
</tr>
<tr>
<td>E</td>
<td>310</td>
<td></td>
<td>C-110</td>
<td>C-113</td>
</tr>
<tr>
<td>D</td>
<td>155</td>
<td></td>
<td>C-110</td>
<td>C-113</td>
</tr>
<tr>
<td>C</td>
<td>80</td>
<td></td>
<td>C-111</td>
<td>C-114</td>
</tr>
<tr>
<td>B</td>
<td>45</td>
<td></td>
<td>C-112</td>
<td>C-115</td>
</tr>
<tr>
<td>A</td>
<td>25</td>
<td></td>
<td>C-112</td>
<td>C-116</td>
</tr>
</tbody>
</table>

4-5-1 Errors in calibration from the middle to the low frequency end of the bands may be corrected by bending the end plates of the main tuning capacitor; this adjustment should not be made unless it is required by all or a majority of the bands.

4-5-2 Alignment adjustments should be made using the Standard Output level of 6 milli-watts into a 600 ohm output meter. A larger output level will require a stronger signal at the antenna input which may result in overloading the R.F. amplifier.

4-5-3 To check sensitivity after alignment adjustments are completed, connect the signal generator and receiver as for alignment adjustments (see Par. 4-1-3). The bottom plate of the receiver should be in place. Apply an unmodulated signal of correct frequency for the band under test and adjust receiver to produce a 750 cycle beat note. Set the Regeneration control for Standard Oscillation (3 db. below output level with optimum oscillation). Adjust R.F. Gain control for Standard Noise Level of 60 micro-watts with generator off. Turn generator on and adjust signal strength until 6 milli-watts is indicated on the 600 ohm output meter with the 750 cycle beat note being maintained. The strength of the signal applied by the generator indicates the sensitivity of the receiver. Nominal sensitivity measurements of a typical receiver are as follows:

<table>
<thead>
<tr>
<th>Band</th>
<th>Frequency (Kc.)</th>
<th>SENSITIVITY (uV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>600</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>310</td>
<td>4.8</td>
</tr>
<tr>
<td></td>
<td>150</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>160</td>
<td>3.3</td>
</tr>
<tr>
<td></td>
<td>80</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>44.7</td>
<td>3.5</td>
</tr>
<tr>
<td></td>
<td>25.5</td>
<td>7.5</td>
</tr>
<tr>
<td></td>
<td>25.5</td>
<td>7.5</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td></td>
</tr>
</tbody>
</table>

Sensitivity measurements using "BROAD" audio selectivity should be made with a 1000 cycle beat note which corresponds with the audio response. The sensitivity is slightly lower for "BROAD" audio operation.
5. MAINTENANCE

5-1 Location of Troubles

A thorough inspection of the receiver and its external connections should be made before any adjustments or repairs are attempted.

Fuses F-101 and F-102 are connected in the A.C. supply circuit. These fuses protect the receiver from damage in the event of a high voltage surge on the A.C. supply line or if a short circuit occurs in the power supply section of the receiver. A burned out fuse does not necessarily indicate a fault in the receiver as excessive line voltage or surges may be the cause.

Failure of a vacuum tube in the receiver may reduce the sensitivity, produce intermittent operation, or cause the equipment to be completely inoperative. In all cases of reduced sensitivity or noisy operation, all tubes should be checked, preferably by replacement with tubes of proven quality. The replacement tube should be selected with care to avoid changes in calibration and sensitivity. A poor connection in a tube can usually be found by lightly tapping the tube in question with the receiver adjusted for normal operation. Measurement of voltages will show which tube is bad. If the failure is a short between tube elements, the filter resistors or voltage divider resistor associated with the tube should be checked for burnout or possible change in value.

Failure of any by-pass or filter capacitor may seriously overload resis tors of the associated circuits. Overloads of sufficient magnitude to permanently damage a resistor will cause the painted surface of the resistor to be scorched, making the defective unit easy to locate by visual inspection.

By-pass or filter capacitors which develop poor connections internally, or which become open-circuited, will in most cases cause decreased sensitivity, oscillation, or affect the normal characteristics of the equipment. The defective unit can be located by temporarily connecting a good capacitor in parallel with each capacitor that is under suspicion.

Intermittent or noisy operation of the receiver may be caused by loose connections in the wiring or external circuits. Noise may also be caused by solder or metallic particles which cause false connections and/or capacitive changes in r.f. circuits. Such faults are often difficult to find but can usually be located by lightly tapping each circuit element or component with a piece of insulating material. Faults may sometimes be located by observing some peculiar action of one of the controls.

The table of Socket Voltages and Cathode Currents, Par. 5-2, should be consulted when locating faults, and to check the correctness of repairs.

ALL TUBES SUPPLIED WITH THE EQUIPMENT OR AS SPARES ON THE EQUIPMENT CONTRACT SHALL BE USED IN THE EQUIPMENT PRIOR TO EMPLOYMENT OF TUBES FROM GENERAL STOCK.
5-1-1 Replacement of Band Switch Section

Provision has been made to permit removal of faulty switch sections when necessary. Often, however, it is possible to correct switch contact faults by bending the control springs slightly to assure a good contact.

In instances where it is necessary to replace a switch section, this replacement is most easily accomplished by the following procedure:

1. Remove the cover plate at the rear of the chassis, which will permit the desired switch shaft to be removed.

2. Loosen the set screws which fasten the shaft to the indent mechanism. The shaft may now be slid rearward until free of the switch section to be removed.

3. Remove the two mounting screws which secure the switch section to the switch frame.

4. Unsolder the leads of the faulty switch and, if practical, immediately resolder to the new switch section. With short leads, this procedure may be impractical and in such cases due care should be exercised to assure that proper connections are made.

5. Remount the switch section, replacing the spacer washers and lock washers, but leaving the mounting screws loose enough to permit aligning the switch section with the shaft.

6. Carefully replace the switch shaft, first ascertaining that the rotor blades of all switch sections are indexed alike. After tightening the shaft set screws, check the band switch at either end of its travel; the selector knob should be at the corresponding band A or F position. The mounting screws should be secured after the operation of the band switch has been checked.
<table>
<thead>
<tr>
<th>Terminal to chassis</th>
<th>Pin No.</th>
<th>Symbol</th>
<th>Variable Setting</th>
<th>Voltage at 0</th>
<th>Voltage at 10</th>
<th>Current DC Ka.</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>V-101 Grid</td>
<td>4</td>
<td>R-134</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>V0101 Cathode</td>
<td>5</td>
<td>R-134</td>
<td>59(100)</td>
<td>0.025</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>V-101 Screen</td>
<td>6</td>
<td>R-134</td>
<td>110(250)</td>
<td>0.45</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>V-101 Plate</td>
<td>8</td>
<td>R-134</td>
<td>210(250)</td>
<td>1.7</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>V-101 Suppressor</td>
<td>3</td>
<td>R-134</td>
<td>59(100)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>V-102 Grid</td>
<td>4</td>
<td>R-134</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>V-102 Cathode</td>
<td>5</td>
<td>R-134</td>
<td>59(100)</td>
<td>0.15</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>V-102 Plate</td>
<td>6</td>
<td>R-134</td>
<td>110(250)</td>
<td>0.3</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>V-102 Suppressor</td>
<td>3</td>
<td>R-134</td>
<td>59(100)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>V-103 Grid</td>
<td>4</td>
<td>R-134</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>V-103 Cathode</td>
<td>5</td>
<td>R-134</td>
<td>59(100)</td>
<td>0.1</td>
<td>0</td>
<td>0</td>
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<tr>
<td>V-103 Screen</td>
<td>6</td>
<td>R-127</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
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<td>V-103 Plate</td>
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<td>R-127</td>
<td>190(250)</td>
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<td>0</td>
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<td>3</td>
<td>R-127</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>V-104 Grid</td>
<td>4</td>
<td>R-127</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>V-104 Cathode</td>
<td>3-5</td>
<td>R-127</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>V-104 Screen</td>
<td>6</td>
<td>R-127</td>
<td>31(50)</td>
<td>0.35</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>V-104 Plate</td>
<td>8</td>
<td>R-127</td>
<td>90(100)</td>
<td>1.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>V-104 Suppressor</td>
<td>3-5</td>
<td>R-127</td>
<td>0.7(1.0)</td>
<td>0.15</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>V-105 Plate D2</td>
<td>3</td>
<td>S-105</td>
<td>Off</td>
<td>0.4</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>V-105 Cathode D2</td>
<td>4</td>
<td>S-105</td>
<td>Off</td>
<td>0.4</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>V-105 Plate Dl</td>
<td>5</td>
<td>S-105</td>
<td>Off</td>
<td>0.4</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>V-105 Cathode Dl</td>
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<td>S-105</td>
<td>Off</td>
<td>0.4</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>V-106 Grid</td>
<td>5</td>
<td></td>
<td>55(100)</td>
<td>0.4</td>
<td>0</td>
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<td>8</td>
<td></td>
<td>14(25)</td>
<td>0.3</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>V-106 Screen</td>
<td>4</td>
<td></td>
<td>205(250)</td>
<td>25</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>V-106 Plate</td>
<td>3</td>
<td></td>
<td>192(250)</td>
<td>25</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>V-107 Heater</td>
<td>2-8</td>
<td></td>
<td>218(250)</td>
<td>25</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>V-105 Plate D2</td>
<td>3</td>
<td>S-105</td>
<td>On</td>
<td>0.03</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>V-105 Cathode D2</td>
<td>4</td>
<td>S-105</td>
<td>On</td>
<td>0.03</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>V-105 Plate Dl</td>
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<td>S-105</td>
<td>On</td>
<td>0.07</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>V-105 Cathode Dl</td>
<td>8</td>
<td>S-105</td>
<td>On</td>
<td>0.07</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

All measurements should be made with the equipment connected for normal operation as follows: R.F. Gain at 10, Regeneration at 0 Audio at Broad, Output Limiter at Off, Dial at High Frequency End of Band F, Output Level at 0 and Power Switch at On.

Voltage measurements are made with a 20,000 ohms per volt voltmeter such as the Navy Model CE or equivalent set analyzer. Numbers in parenthesis after voltage readings indicate the voltmeter range that should be used for each measurement.

All readings will depend upon the resistance of the meter and therefore upon the meter range that is used. These voltages should not be considered as operating voltages as in many cases the voltmeter loading renders circuits inoperative with resultant departure from true operating voltages.
6. PARTS LISTS

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Symbol Group</th>
<th>Navy Type Designation</th>
<th>Name</th>
<th>Assembly Drawing No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>101-199</td>
<td>CNA-46161-B</td>
<td>Radio Receiver</td>
<td>F-680</td>
</tr>
<tr>
<td>1</td>
<td>201-299</td>
<td>CNA-10124</td>
<td>Mounting Base</td>
<td>D-911</td>
</tr>
</tbody>
</table>

NOTICE

References to RBL Equipment in Table II headings should be interpreted to mean RBL-5 Equipment.
<table>
<thead>
<tr>
<th>SYMBOL DESC.</th>
<th>FUNCTION</th>
<th>DESCRIPTION</th>
<th>NAVY TYPE NUMBER</th>
<th>NAVY DRAWING OR SPEC.</th>
<th>MFR. MFR. DESIG.</th>
<th>SPECIAL TOLERANCE, RATING OR MODIFICATION</th>
<th>NATIONAL CO. DRAWING AND PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-101</td>
<td>Main Dial Window</td>
<td>Window, Cellulose Acetate</td>
<td>1</td>
<td>B-513</td>
<td>B-513</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAPACITORS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;C-101</td>
<td>Long Antenna Coupling</td>
<td>Mica: .0003 Mfd. ±10%, 500 V DC W</td>
<td>-481014-10</td>
<td>RL-48A 148C</td>
<td>14</td>
<td>1468</td>
<td>WAX DIP</td>
</tr>
<tr>
<td>C-101*</td>
<td>Long Antenna Coupling</td>
<td>Ceramic: .0003 Mfd. ±10%, 500 V DC W</td>
<td>10</td>
<td>Dual C</td>
<td>E-603</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C-101</td>
<td>Long Antenna Coupling</td>
<td>Ceramic: .0003 Mfd. ±10%, 500 V DC W</td>
<td>10</td>
<td>C</td>
<td>D-225-D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;C-102</td>
<td>Short Antenna Coupling</td>
<td>Mica: .0008 Mfd. ±10%, 500 V DC W</td>
<td>-481428-10</td>
<td>RL-48A 148A</td>
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*For actual quantity of Spares furnished refer to Table IV.

*May be used in place of part listed with corresponding symbol.
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*For actual quantity of Spares furnished refer to Table IV.
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**PLUGS**

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*For actual quantity of Spares furnished refer to Table IV.
'May be used in place of part listed with corresponding symbol.
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*For actual quantity of Spares furnished refer to Table IV.

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### SWITCHES

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*For actual quantity of Spares furnished refer to Table IV.*

*May be used in place of part listed with corresponding symbol.*
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*For actual quantity of spares furnished, refer to Table IV*
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**VACUUM TUBES**

**INTERCONNECTING CABLES**

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**SOCKETS**

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*For replacement use

*For actual quantity of spares furnished refer to Table IV.*
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<td>Stamped Bakelite</td>
<td>1</td>
<td>D-930</td>
<td>D-930</td>
<td>RBL-2 Only</td>
<td>D-930</td>
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<td>N-301</td>
<td>Mounting Base Name Plate</td>
<td>Etched Aluminum</td>
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<td>F-678</td>
<td>F-678</td>
<td>RBL-3 Only</td>
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EQUIPMENT SPARE PARTS BY NAVY TYPE DESIGNATION
FOR MODEL RBL-5 EQUIPMENT

<table>
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<tr>
<th>QUANTITY</th>
<th>NAVY TYPE NUMBER</th>
<th>ALL SYMBOL DESIGNATIONS INVOLVED</th>
<th>DESCRIPTION</th>
<th>NAVY DRAWING OR SPEC.</th>
<th>MFR. DESIGN.</th>
<th>SPECIAL TOLERANCE OR MODIFICATION</th>
<th>NATIONAL CO. DRAWING AND PART NUMBER</th>
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<tr>
<td>1</td>
<td>E-101</td>
<td></td>
<td>Terminal Panel</td>
<td>1 E-265 Pt 6</td>
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<td>E-265 Pt 6</td>
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<tr>
<td>1</td>
<td>E-102</td>
<td></td>
<td>Binding Posts</td>
<td>1 SA:26-C</td>
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<td>E-808 Pt 1</td>
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<td>1</td>
<td>E-103</td>
<td></td>
<td>Binding Post</td>
<td>1 SA:91-D</td>
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<td>E-769 Pt 1</td>
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<td>4</td>
<td>A-201, A-202, A-203, A-204</td>
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<td>Shockproof Mount</td>
<td>125 ROOFRES 1</td>
<td>1 E-769 Pt 1</td>
<td>D-664</td>
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<td>2</td>
<td>Tube Socket Contact</td>
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<td>Insulator Holder</td>
<td>1 D-664</td>
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<td>D-947 Pt 1</td>
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<td>Insulated Mounting Lugs</td>
<td></td>
<td>Insulated Mounting Lugs</td>
<td>8 1510</td>
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<tr>
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<td>Insulated Mounting Lugs</td>
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<td>D-947 Pt 7</td>
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<td>Insulated Mounting Lugs</td>
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<td>Insulated Mounting Lugs</td>
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<td>Insulated Mounting Lugs</td>
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<td>Insulated Mounting Lugs</td>
<td>1 E-800 Pt 13</td>
<td>1 F-131 Pt 2</td>
<td>E-890 Pt 11</td>
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<td>Spring</td>
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<td>Switch Section</td>
<td>1 E-357 Pt 2</td>
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<td>E-357 Pt 2</td>
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<td>Spanner Wrench</td>
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<td>Allen Wrench, #6</td>
<td>1 SA:101-H</td>
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<td>F-131 Pt 6</td>
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<td>Allen Wrench, #8</td>
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<td>Lamp</td>
<td>1 F-131 Pt 3</td>
<td>18 47</td>
<td>F-131 Pt 6</td>
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<td>I-101, I-102</td>
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</table>

SWITCHES CLASS 24

| 1        | -24047           | S-101               | Switch, Single Circuit Closing | 5 2001          | D-778 Pt 1   |                                     |                                     |
| 1        | -30011           | S-102               | Switch, Dual Rotary Assembly  | 3 1579-1M       | D-666        |                                     |                                     |
| 1        | -30032           | S-105               | Switch, SPDT Rotary Assembly | 3 61021-V       | D-667        |                                     |                                     |
| 1        | -30032           | S-105               | Switch, 4 Pole Rotary, Ceramic | 111 28744-HNC  | D-807        |                                     |                                     |

FUSES CLASS 28

| 20       | F-101, F-102     | Fuse, 2 Amp. Class Enclosed | 76 1042          | F-155 Pt 4     |                                     |                                     |

TRANSFORMERS AND REACTORS CLASS 30

| 1        | -30930           | T-101               | Transformer, 115V 410V, 50 Watts | 1 SA:31-G       | D-778        |                                     |                                     |
| 1        | -30932           | L-100               | Reactor, 17 Henry 120V | 1 SA:31-E       | D-782 Pt 1   |                                     |                                     |
| 1        | -30932           | L-102               | Transformer, 56,000/600 Ohms | 1 SA:31-H       | D-783        |                                     |                                     |

VACUUM TUBES CLASS 36

| 2        | -57S3            | V-107               | Vacuum Tube, Rectifier | 57S3            | A6          |                                     |                                     |
| 2        | -6H6             | V-105               | Vacuum Tube, Dual Diode | 6H6             | 6H6         |                                     |                                     |
| 2        | -6X6GT           | Y-106               | Vacuum Tube, Power Output | 6X6GT           | 6X6GT       |                                     |                                     |
| 2        | -6X6GT           | Y-104               | Vacuum Tube, Pentode   | 6X6GT           | 6X6GT       |                                     |                                     |
| 5        | -5X6GT           | Y-101, Y-102, Y-103 | Vacuum Tube, Triple Grid Amp. | 5X6GT           | 5X6GT       |                                     |                                     |

Spare parts supplied are as listed, or the equivalent.
### EQUIPMENT SPARE PARTS LIST BY NAVY TYPE DESIGNATION
FOR MODEL ESL-5 EQUIPMENT.

#### R. F. TRANSFORMERS AND INDUCTORS CLASS 47

<table>
<thead>
<tr>
<th>QUANTITY</th>
<th>NAVY TYPE NUMBER</th>
<th>ALL SYMBOL DESIGNATIONS INVOLVED</th>
<th>DESCRIPTION</th>
<th>NAVY DRAWING OR SPEC.</th>
<th>MFR. MFR. DESIG.</th>
<th>SPECIAL TOLERANCE OR MODIFICATION</th>
<th>NATIONAL CO. DRAWING AND PART NUMBER</th>
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<tbody>
<tr>
<td>1</td>
<td>-46963</td>
<td>C-106, C-124, C-130, C-131</td>
<td>Misas .001</td>
<td>Mfr. 500 V DC W</td>
<td>14</td>
<td>14667</td>
<td>±10%</td>
</tr>
<tr>
<td>2</td>
<td>-461073</td>
<td>C-154, C-168, C-169</td>
<td>Paper .1</td>
<td>Mfr. 400 V DC W</td>
<td>14</td>
<td>4669</td>
<td>±10%</td>
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<tr>
<td>1</td>
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<td>C-159, C-160, C-161</td>
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<td>Mfr. 600 V DC W</td>
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<td>Misas .0009</td>
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#### CAPACITORS CLASS 48

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<th>DESCRIPTION</th>
<th>NAVY DRAWING OR SPEC.</th>
<th>MFR. MFR. DESIG.</th>
<th>SPECIAL TOLERANCE OR MODIFICATION</th>
<th>NATIONAL CO. DRAWING AND PART NUMBER</th>
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<tr>
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<td>C-156</td>
<td>Paper .025</td>
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<td>4340</td>
<td>±10%</td>
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<td>2</td>
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<td>C-149, C-144</td>
<td>Paper .03</td>
<td>Mfr. 400 V DC W</td>
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<td>±10%</td>
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<td>C-140, C-146, C-148, C-152</td>
<td>Paper .02</td>
<td>Mfr. 400 V DC W</td>
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<td>Ceramic .0005</td>
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<td>Class D</td>
<td>±10%</td>
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<tr>
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<td>C-108</td>
<td>Ceramic .0006</td>
<td>Mfr. 500 V DC W</td>
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<td>±10%</td>
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<td>±10%</td>
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<td>Ceramic .0003</td>
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<td>C-138, C-147</td>
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<td>±10%</td>
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#### PLUGS, JACKS AND SOCKETS CLASS 49

<table>
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<th>QUANTITY</th>
<th>NAVY TYPE NUMBER</th>
<th>ALL SYMBOL DESIGNATIONS INVOLVED</th>
<th>DESCRIPTION</th>
<th>NAVY DRAWING OR SPEC.</th>
<th>MFR. MFR. DESIG.</th>
<th>SPECIAL TOLERANCE OR MODIFICATION</th>
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<td>J-104</td>
<td>Plug, Concentric Antenna</td>
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<td>J-107</td>
<td>Socket, Power, Small 7 Prong</td>
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<td>Plug, Three Wire AC Power</td>
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<td>7484</td>
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<td>Phone Jack</td>
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<td>1J-102</td>
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Spare parts supplied are as listed, or the equivalent.

4-5-44
### Equipment Spare Parts List by Navy Type Designation

#### For Model RBL-5 Equipment

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<th>Quantity</th>
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<th>Designation</th>
<th>Description</th>
<th>Navy Drawing or Spec.</th>
<th>Mfr.</th>
<th>Mfr. Design.</th>
<th>Special Tolerance or Modification</th>
<th>National Co. Drawing and Part Number</th>
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<td>X-110, X-111</td>
<td>Fuse Extractor Post</td>
<td>76 1075</td>
<td>127 85-UL</td>
<td>128 RSS-0M</td>
<td>D-687  C-455 Pt 1</td>
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<tr>
<td>4</td>
<td></td>
<td>X-108, X-109</td>
<td>Lamp Socket Assembly, Bayonet Socket, Octal, Ceramic</td>
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<td></td>
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<td>D-506 Pt 1</td>
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#### Filters Class 53

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<th>Description</th>
<th>National Co. Drawing and Part Number</th>
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<tr>
<td>1</td>
<td>-53109</td>
<td>High Pass Filter</td>
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#### Insulators Class 61

<table>
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<th>Description</th>
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#### Resistors Class 63

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<th>Type Number</th>
<th>Designation</th>
<th>Description</th>
<th>National Co. Drawing and Part Number</th>
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<tr>
<td>1</td>
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<td>R-101, R-104</td>
<td>Fixed, 350 Ohms, # Watt</td>
<td>E-635 Pt 2</td>
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<tr>
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<td>Fixed, 350 Ohms, # Watt</td>
<td>E-635 Pt 2</td>
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<tr>
<td>1</td>
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<td>R-108, R-106, R-107, R-110</td>
<td>Fixed, 10000 Ohms, # Watt</td>
<td>E-635 Pt 2</td>
</tr>
<tr>
<td>2</td>
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<td>R-117, R-126</td>
<td>Fixed, 20000 Ohms, # Watt</td>
<td>E-635 Pt 2</td>
</tr>
<tr>
<td>1</td>
<td>-63260</td>
<td>R-109, R-115</td>
<td>Fixed, 20000 Ohms, # Watt</td>
<td>E-635 Pt 2</td>
</tr>
<tr>
<td>2</td>
<td>-63260</td>
<td>R-121, R-122</td>
<td>Fixed, 10000 Ohms, # Watt</td>
<td>E-635 Pt 2</td>
</tr>
<tr>
<td>1</td>
<td>-63260</td>
<td>R-114, R-116, R-117</td>
<td>Fixed, 20000 Ohms, # Watt</td>
<td>E-635 Pt 2</td>
</tr>
<tr>
<td>1</td>
<td>-63260</td>
<td>R-119, R-119, R-117</td>
<td>Fixed, 20000 Ohms, # Watt</td>
<td>E-635 Pt 2</td>
</tr>
<tr>
<td>1</td>
<td>-63260</td>
<td>R-111, R-113, R-123, R-156</td>
<td>Fixed, 20000 Ohms, # Watt</td>
<td>E-635 Pt 2</td>
</tr>
<tr>
<td>1</td>
<td>-63260</td>
<td>R-103</td>
<td>Fixed, 5 Megohms, # Watt</td>
<td>E-635 Pt 2</td>
</tr>
<tr>
<td>1</td>
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<td>R-106</td>
<td>Fixed, 10 Megohms, # Watt</td>
<td>E-635 Pt 2</td>
</tr>
<tr>
<td>1</td>
<td>-63260</td>
<td>R-108</td>
<td>Fixed, 500 Ohms, 2 Watt</td>
<td>E-635 Pt 2</td>
</tr>
<tr>
<td>1</td>
<td>-63260</td>
<td>R-122</td>
<td>Fixed, 500 Ohms, 2 Watt</td>
<td>E-635 Pt 2</td>
</tr>
<tr>
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<td>R-114, R-117</td>
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<td>E-635 Pt 2</td>
</tr>
<tr>
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<td>Fixed, 50000 Ohms, 2 Watt</td>
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<tr>
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<td>E-635 Pt 2</td>
</tr>
<tr>
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<td>E-635 Pt 2</td>
</tr>
<tr>
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<td>R-129</td>
<td>Var., 250000 Ohms, 1 Watt</td>
<td>E-635 Pt 2</td>
</tr>
</tbody>
</table>

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Spare parts supplied are as listed, or the equivalent.

---

4-5-44
## TENDER SPARE PARTS LIST BY NAVY TYPE DESIGNATION

### FOR MODEL BL-5 EQUIPMENT

<table>
<thead>
<tr>
<th>QUANTITY</th>
<th>NAVY TYPE NUMBERS</th>
<th>ALL SYMBOL DESIGNATIONS INVOLVED</th>
<th>DESCRIPTION</th>
<th>NAVY DRAWING OR SPEC.</th>
<th>MFR. MFR. DESIG.</th>
<th>SPECIAL TOLERANCE OR MODIFICATION</th>
<th>NATIONAL CO. DRAWING AND PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>E-101</td>
<td></td>
<td>Terminal Panel</td>
<td>1</td>
<td>E-265 Pt 6</td>
<td>E-265 Pt 6</td>
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</tr>
<tr>
<td>1</td>
<td>E-102</td>
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<td>SA:26-C</td>
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<tr>
<td>1</td>
<td>E-103</td>
<td></td>
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### SWITCHES CLASS 24

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### FUSES CLASS 28

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### A.F. TRANSFORMERS AND REACTORS CLASS 30

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<td>Reactor, 17 Henry ±10%</td>
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Spare parts supplied are as listed, or the equivalent

4-5-44
## TENDER SPARE PARTS LIST BY NAVY TYPE DESIGNATION

FOR MODEL REL-5 EQUIPMENT

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| **R.F. TRANSFORMERS AND INDUCTORS CLASS 47** |
| 2                | -47852                           | L-101       | Inductor, 18 H. ±20% | 1           | SA:53-D  | Bands D, E, & F                   | D-764 Pt 1                           |
| 2                | C-106, C-124, C-130, C-131       | L-113       | R.F. Transformer Assembly, 1st RF | 1           | SA:53-D  | Bands D, E, & F                   | D-764 Pt 1                           |
| 2                | C-136, C-130, C-131             | L-110       | R.F. Transformer Assembly, 2nd RF | 1           | SA:53-E  | Bands D, E, & F                   | D-764 Pt 1                           |
| 2                | C-108, C-119, C-123, C-125      | L-111       | R.F. Transformer Assembly, 1st RF | 1           | SA:53-B  | Bands A, B, & C                   | D-764 Pt 1                           |
| 1                | C-137, C-155, C-156, C-157      | L-112       | R.F. Transformer Assembly, 2nd RF | 1           | SA:53-C  | Bands A, B, & C                   | D-764 Pt 1                           |

| **CAPACITORS CLASS 48** |
| 3                | C-106, C-124, C-130, C-131 | C-124, C-125, C-134, C-135 | Mica .001 Mfd. 500 V DC W | 14 | 1467 | ±10% | D-775 Pt 5 |
| 5                | C-106, C-124, C-130, C-131 | C-106, C-125, C-134, C-135 | Paper .1 Mfd. 400 V DC W | 14 | 489 | ±10% | D-764 Pt 10 |
| 2                | C-117, C-124, C-145            | C-119, C-123, C-125 | Paper .1 Mfd. 600 V DC W | 14 | 3-813 | ±10% | D-764 Pt 14 |
| 12               | C-11997                         | C-120, C-123, C-125, C-128 | Mica .0009 Mfd. 500 V DC W | 14 | 1467 | ±10% | D-764 Pt 14 |
| 15               | C-137, C-155, C-156, C-157    | C-120, C-123, C-125, C-128 | Paper .1 Mfd. 600 V DC W | 110 | CA-601-0 | ±10% | D-764 Pt 14 |
| 2                | C-124, C-125, C-134, C-135    | C-136, C-152, C-154, C-155 | Paper .1 Mfd. 600 V DC W | 110 | CA-601-0 | ±10% | D-764 Pt 14 |

| **PLUGS, JACKS AND SOCKETS CLASS 49** |
| 1                | -49220                          | J-104       | Jack, Concenictric Antenna | 259 | f-455 Pt 1 | ±10% | D-775 Pt 1 |

Spare parts supplied are as listed, or the equivalent.
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<td>National Company, Inc.</td>
<td>Malden, Massachusetts</td>
</tr>
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<td>Arrow, Hart &amp; Hegeman</td>
<td>Hartford, Connecticut</td>
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<td>CMA</td>
<td>P. R. Mallory &amp; Co.</td>
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<td>CBN</td>
<td>Cinch Manufacturing Co.</td>
<td>Chicago, Illinois</td>
</tr>
<tr>
<td>10</td>
<td>CMC</td>
<td>Central Radio Laboratories</td>
<td>Milwaukee, Wisconsin</td>
</tr>
<tr>
<td>11</td>
<td>CSF</td>
<td>Clarostat Manufacturing Co.</td>
<td>Brooklyn, New York</td>
</tr>
<tr>
<td>14</td>
<td>CAV</td>
<td>Sprague Specialties Co.</td>
<td>North Adams, Massachusetts</td>
</tr>
<tr>
<td>18</td>
<td>CG</td>
<td>Aerovox Corporation</td>
<td>North Bedford, Massachusetts</td>
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<td>69</td>
<td>CLF</td>
<td>General Electric Company</td>
<td>Cleveland, Ohio</td>
</tr>
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<td>CLF</td>
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<td>New York City, New York</td>
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<td>Hubbell, Harvey</td>
<td>Bridgeport, Connecticut</td>
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<td>Tobe Deutschmann Corp.</td>
<td>Canton, Massachusetts</td>
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<td>Lord Manufacturing Co.</td>
<td>Erie, Pennsylvania</td>
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<td>Alden Products Co.</td>
<td>Brockton, Massachusetts</td>
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<td>CTD</td>
<td>American Phenolic Co.</td>
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Fig. 3. Outline Drawing - Type CNA-46161-B Radio Receiver
Fig. 5. Trimmer Positions
Fig. 6. Tube Positions

48
Fig. 7. Tube Base Diagrams
TABLE V
COLOR CODE FOR CAPACITORS

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<th>Figures</th>
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<th>Tolerance</th>
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<td>1%</td>
</tr>
<tr>
<td>Brown</td>
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<td>Orange</td>
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<td>300</td>
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<td>Yellow</td>
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<td>400</td>
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<td>Blue</td>
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<td>600</td>
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<tr>
<td>Violet</td>
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<td>10,000,000</td>
<td>700</td>
<td>7%</td>
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<tr>
<td>Gray</td>
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<td>100,000,000</td>
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<td>Silver</td>
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![Diagram of color code for capacitors]

COLOR CODE FOR RESISTORS

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<th>2nd Figure</th>
<th>Multiply By</th>
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<td>1</td>
<td>10</td>
</tr>
<tr>
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<td>1,000,000</td>
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<tr>
<td>Violet</td>
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<tr>
<td>White</td>
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Resistive Tolerance Code
Gold -- 5%  Silver -- 10%  No Color -- 20%

![Diagram of color code for resistors]

Fig. 8. Color Code Chart

50
Rectifier Tube V-107 as listed in Parts List Table II, and shown on the Schematic Diagram Fig. 1, should be Navy Type -5Y3G or -5Y3GT/G, not -5U4G.

Equipments with Serial No. 339 and larger have certain changes in Receiver components, which result in improved performance. To correct the Instruction Book for Equipments with Serial No. 339 and larger the following changes should be made:

In the Parts List, Table II, the following changes should be made:

Capacitor C-127 should be listed as follows:

*C-127 --- V-103 Grid Coupling --- Ceramic: .0001 mfd. 
±10%, 500 V DC W --- xx --- xx --- 10 --- Class C
--- xx --- D-825-C Pt. 324.

Capacitor C-165 should be listed as Same as C-107.

Capacitor C-169 should be added and listed as follows:

*C-169 --- L-103 Tuning --- Same as C-154 --- -461073-10
--- xx --- xx --- xx --- xx --- xx.

Resistor R-106 should be listed as 10 megohms, not 2\(\frac{1}{2}\) megohms.

Resistor R-109 should be listed as follows:

*R-109 --- V-103 Plate --- .25 megohms ±10%, \(\frac{1}{2}\) watt, Fixed
--- -63360-10 --- RE 15A 372G --- 220 --- SCI-\(\frac{1}{2}\) --- xx ---
E-635 Pt. 2.

Resistor R-119 should be listed as Same as R-109.

Resistor R-120 should be listed as follows:

*R-120 --- Limiter Control --- 10000 ohm, W.W. Var., 1.5 watt --- xx --- xx --- 11 --- P58-10000 --- H-6633 ---
D-771 Pt. 8.

Resistor R-137 should be listed as Same as R-109.

Resistor R-138 should be added and listed as follows:

*R-138 --- R.F. Gain Control Bleeder --- Same as R-102
--- xx --- xx --- xx --- xx --- xx --- xx

In the Equipment Spare Parts List the following changes should be made:

Capacitor Symbol C-165 should be listed with C-107, not
with C-127.
Resistor R-120 should be listed as follows:
1. --- xx --- R-120 --- Var., 10,000 ohms, 1/2 watt --- xx ---

Certain changes in components were anticipated in the design of the Receiver and therefore Tender Spare Parts lists include components as supplied in the Receiver before and after these changes, except in instances such as C-108, C-165 and R-120, where improved performance is obtained by the use of the new component without requiring changes in related components.

In the Tender Spare Parts List the following changes should be made:

Capacitor C-108 quantity should be one not two.

Capacitor Symbol C-165 should be listed with C-107 and the quantity increased to two.

The listing for ceramic .0001 Mfd., 500 V DC W Capacitor should not read as shown, but as follows:
1 --- xx --- C-127 --- Ceramic .0001 mfd., 500 V DC W ---
xx --- 10 --- Class C --- ±10% --- D-525-C Pt. 324.

Capacitor C-127 should also be listed as follows:
1 --- xx --- C-127 --- Ceramic .0005 mfd., 500 V DC W ---
xx --- 10 --- Dual C --- ±10% --- E-603 Pt. 3.

Capacitor Symbol C-169 should be added to the listing for Navy Type -481073 capacitor.

Resistor R-106 should be listed as 10 megohms as shown
and also as follows:
2 --- 63360 --- R-106 --- Fixed, 20 megohms, 1/2 watt ---
xx --- 220 --- SCI-1/2 --- ±10% --- E-635 Pt. 2.

Resistor R-109 should be listed with R-119 and R-137
as 250,000 ohms and also listed separately as follows:
2 --- 63360 --- R-109 --- Fixed, 70,000 ohms, 1/2 watt ---
xx --- 220 --- SCI-1/2 --- ±10% --- E-635 Pt. 2.

Resistor R-120 should not be listed as shown but as
follows:
2 --- xx --- R-120 --- Var. 10,000 ohms, 1/2 watt --- xx ---

The correct symbol for Low Pass Filter Navy Type -53108
is AF-101, not AF-102.

The correct symbol for High Pass Filter Navy Type -53109
is AF-102, not AF-101.
### R. F. Transformers and Inductors Class 47

<table>
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<th>QUANTITY</th>
<th>NAVY TYPE NUMBER</th>
<th>ALL SYMBOL DESIGNATIONS INVOLVED</th>
<th>DESCRIPTION</th>
<th>APPROX. UNIT PRICE</th>
<th>MFR.</th>
<th>MFR. DESIG.</th>
<th>SPECIAL TOLERANCE OR MODIFICATION</th>
<th>NATIONAL CO. DRAWING AND PART NUMBER</th>
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<td>SA-55-D</td>
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<td>R.F. Transformer Assembly</td>
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<td>SA-53-B</td>
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### Capacitors Class 48

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<th>MFR. DESIG.</th>
<th>SPECIAL TOLERANCE OR MODIFICATION</th>
<th>NATIONAL CO. DRAWING AND PART NUMBER</th>
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### Plugs, Jacks and Sockets Class 49

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**FILTERS CLASS 53**

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**INSULATORS CLASS 61**

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<td>R-127</td>
<td>Var., 25000 Ohms, 1 Watt</td>
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Spare parts supplied are as listed, or the equivalent.
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<th>NAMES</th>
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<tr>
<td>1</td>
<td>CNA</td>
<td>National Company, Inc.</td>
<td>Malden, Massachusetts</td>
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<td>CHH</td>
<td>Arrow, Hart &amp; Hegeman</td>
<td>Hartford, Connecticut</td>
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<td>CMA</td>
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<td>Cinch Manufacturing Co.</td>
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<td>CBN</td>
<td>Central Radio Laboratories</td>
<td>Milwaukee, Wisconsin</td>
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<td>CMC</td>
<td>Clarostat Manufacturing Co.</td>
<td>Brooklyn, New York</td>
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<td>CSF</td>
<td>Sprague Specialties Co.</td>
<td>North Adams, Massachusetts</td>
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<td>CAW</td>
<td>Aerovox Corporation</td>
<td>North Bedford, Massachusetts</td>
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<td>CG</td>
<td>General Electric Company</td>
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<td>New York City, New York</td>
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