RESTRICTED

INSTRUCTION BOOK

FOR

RADIO RECEIVING EQUIPMENT
MODEL RBO-1

SUPPLY 115 VOLTS, 60 CYCLES. ONE PHASE

NAVY DEPARTMENT
BUREAU OF SHIPS

CONTRACTOR

E. H. SCOTT RADIO LABORATORIES, INC.
CHICAGO, ILL., U. S. A.

CONTRACT NXss-20313

RESTRICTED

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

GUARANTEE

All items used in this equipment, except vacuum tubes will be guaranteed by the contractor for a period extending one year from the installation date of the equipment, provided that in no case will the guarantee extend longer than two years, after the date of acceptance. This guarantee will cover items failing in normal operation and the contractor will replace these at no cost to the Government and with transportation charges prepaid to destination. If the contractor elects to have the defective unit returned to his plant for examination, he will be required to pay the transportation charges.

Contract NXss-20313

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.....

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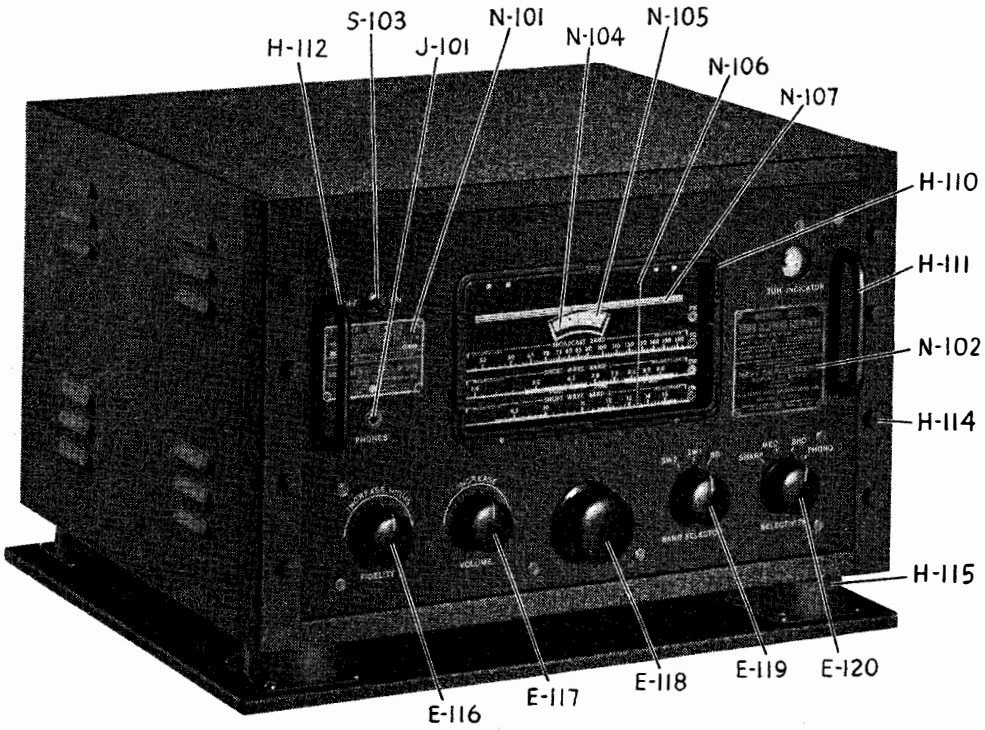

FIG. 1. LEFT FRONT OBLIQUE VIEW, RADIO RECEIVER

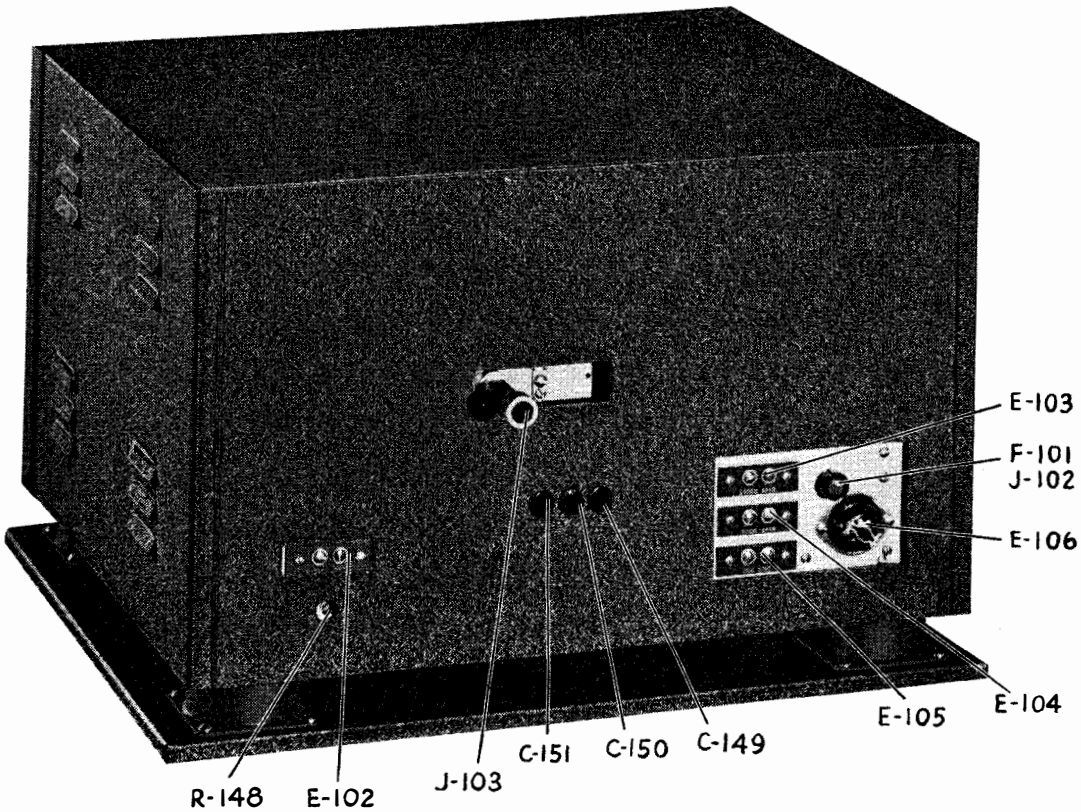

FIG. 2. LEFT REAR OBLIQUE VIEW, RADIO RECEIVER

1. GENERAL

1.1 INTRODUCTION

1.101 These instructions cover the installation, operation, and servicing of the Model RBO-1 Radio Receiving Equipment. THEY SHOULD BE READ AND STUDIED WITH GREAT CARE BEFORE THE INSTALLATION OR OPERATION OF THE EQUIPMENT IS ATTEMPTED IN ORDER THAT OPTIMUM PERFORMANCE MAY BE OBTAINED.

1.102 The Model RBO-1 Radio Receiving Equipment is suitable and is primarily intended for use aboard Naval vessels of all types. It is equally suitable for use at Naval Radio shore stations.

1.103 The receiving equipment covers the frequency ranges of 0.53 to 1.60 and 5.55 to 15.60 megacycles in three frequency bands. It is specifically designed to provide optimum performance and high quality reception of voice or tone modulated radio frequency signals, on all frequency bands, by head telephone or loud speaker methods. For this reason, no beat frequency oscillator for the reception of radio telegraph signals is provided.

1.104 Special circuits and features are incorporated in the Model RBO-1 Radio Receiving Equipment to preclude its oscillator feeding voltages into the antenna circuit and radiating interferences which could be detected by sensitive radio receiving or radio direction finding equipments in the same, or close vicinity.

1.105 The receiving equipment is designed for a-c operation, being equipped with a self-contained rectifier type power supply for supplying all operating voltages required from an a-c source of 110/125 volts, 58/62 cycles, single phase.

1.106 The audio frequency output circuits of the receiving equipment are designed to permit the use of one pair of Navy standard 600 ohm head telephones separately or in conjunction with a suitable local loud speaker, of the permanent magnet type, coupled to the equipment by means of either a 600 ohm or 5000 ohm matching transformer; or, with a number of loud speakers with self-contained amplifiers, installed in various locations throughout the vessel, and fed by low impedance transmission lines.

1.107 The Model RBO-1 Radio Receiving Equipment consists of one major unit, namely, the Type CZC-46224 Radio Receiver. This major unit, as supplied, employs the cabinet type of construction and is designed for installation atop an operating table or bench by means of a cradle type shock mounting. The chassis of the Type CZC-46224 Radio Receiver is of such design and construction as to be amenable to mounting in a standard, cabinet type, relay rack with one or more other major units of the same type. Loud speakers and head telephones are not furnished as parts of the complete equipment.

1.108 The equipment is supplied with one set of vacuum tubes contained within the Type CZC-46224 Radio Receiver. Instruction books and one set of spare parts are also supplied with each equipment.

1.109 The net weights and overall dimensions of the major unit of the complete equipment are listed in Par. 1.31.

1.110 The Type CZC-46224 Radio Receiver is a 12 tube superheterodyne covering the frequency ranges of 0.53 to 1.60 and 5.55 to 15.60 megacycles in three frequency bands, as follows:

BROADCAST BAND
0.53 to 1.60 MEGACYCLES
SHORT WAVE BAND-1
5.55 to 9.55 MEGACYCLES
SHORT WAVE BAND-2
9.20 to 15.60 MEGACYCLES

1.111 This major unit employs the cabinet type of construction, with the cabinet suitably shock mounted and designed for top of table or bench mounting. The chassis design and construction are such that the chassis may be mounted in a standard, cabinet type, relay rack. However, this type of mounting is not recommended for installations where the equipment will be subjected to severe shock or vibration, owing to the fact, that it can be accomplished only with the sacrifice of the shock mounting feature.

1.112 The major unit contains, on a single chassis, all apparatus, (including power supply) necessary for taking energy from an antenna, amplifying and converting such energy into intermediate frequency energy, amplifying the intermediate frequency energy and then demodulating such energy into audio frequency energy for delivery, through an audio frequency amplifier to a phone jack on the front operating panel and/or one of three sets of loud speaker terminals at the rear of the chassis.

1.113 The electrical circuits of the Type CZC-46224 Radio Receiver employed for signal reception on all frequency ranges,

comprises one stage of radio frequency amplification, first detector (or mixer), high frequency oscillator, two stages of intermediate frequency amplification operating at 455 kilocycles, a diode type second detector, two stages of resistance coupled audio frequency amplification and an audio frequency power output stage. The second detector utilizes one set of elements of a dual diode; the other set of elements is utilized for an efficient peak noise limiter. Inverse feedback is incorporated, within the audio output circuits, to maintain a relatively constant voltage across the primary of the output transformer, when the output load is varied upon connection of one or more amplifier type loud speakers across the secondary winding of the output transformer which also feeds the front panel mounted phone jack.

1.114 The power supply section of the Type CZC-46224 Radio Receiver, which is employed for supplying the necessary operating voltages for the receiver circuits, is designed for operation from a 110/125 volt, 58/62 cycle, single phase source of a-c power. The power supply includes a power transformer with r-f input filter and primary fuse, two vacuum tube rectifiers, and a two-section a-f filter.

1.115 Four audio output circuits are provided.

(1) A phone jack is mounted on the front panel and is supplied from one of three output windings on the audio output transformer. This winding is directly connected to one pair of speaker terminals at the rear of the chassis and to the phone jack through an attenuation network which limits the maximum available power at the phone jack to approximately 30 milliwatts. The phone jack is provided for monitoring purposes, by head telephone methods, since the equipment is primarily intended for loud speaker signal reproduction. Only Navy Type-49016, Navy Type-49023, or equivalent, head telephones having a nominal impedance of 600 ohms should be employed for monitoring the receiver.

(2) The pair of speaker terminals, referred to in (1), above, is provided for the connection of the audio output of the Type CZC-46224 Radio Receiver to a system of remotely installed, parallel connected, Type CRV-49131A Speaker-Amplifiers. The output winding on the audio output transformer supplying these terminals, as well as the phone jack, is capable of supplying, by virtue of the inverse feedback associated with the audio output stage of the receiver, substantially constant voltage at the speaker terminals for any variation in load impedance from 60 to 600 ohms.

(3) A second pair of speaker terminals at the rear of the receiver chassis is supplied from a separate output winding on the audio output transformer. These terminals are provided for the connection of a high quality, permanent magnet type, locally installed loud speaker having a self-contained input transformer designed to match the 600 ohm impedance of the audio output transformer winding supplying the speaker terminals. The maximum undistorted audio power available at these terminals is nominally 2 watts.

(4) A third pair of speaker terminals, also supplied from a separate output winding on the audio output transformer, provides for the connection, at the rear of the receiver chassis, of a high quality, permanent magnet type, locally installed loud speaker having a self-contained input transformer designed to match the 5000 ohm impedance of the winding supplying the terminals. The maximum undistorted audio power available at these terminals is nominally 2 watts.

(5) FOR ANY INSTALLATION, ONLY ONE OF THE THREE SETS OF SPEAKER TERMINALS MAY BE EMPLOYED AT ANY ONE TIME FOR SUPPLYING AUDIO POWER TO LOUD SPEAKER CIRCUITS. This does not preclude the use of a head telephone set for monitoring while the required loud speaker system is in operation.

1.116 A concentric jack, Navy Type 49120, is mounted at the rear of the chassis of the Type CZC-46224 Radio Receiver for antenna and ground connection. A hole in the rear of the cabinet provides access to the jack. A concentric plug, Navy Type 49121A, which mates with the concentric jack is furnished as part of the complete Model RBO-1 Equipment but with no antenna or ground leads attached.

1.117 A power receptacle and mating plug are also provided at the rear of the chassis for a-c power input connection. No power input cable is furnished.

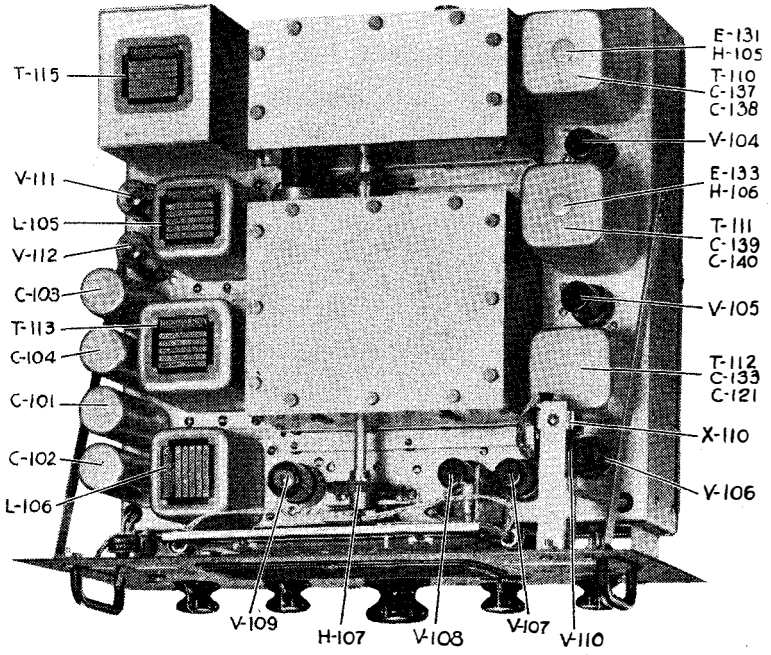

FIG. 2.13. TOP VIEW RADIO RECEIVER CHASSIS

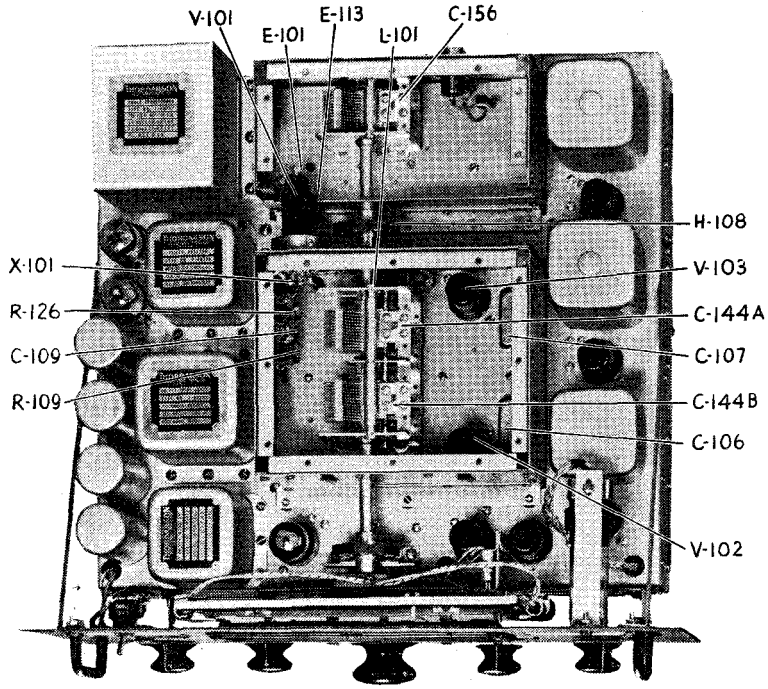

FIG. 2.15. TOP VIEW RADIO RECEIVER, CHASSIS, COMPARTMENT SHIELD, COVERS REMOVED

1.118 The fuse, in the primary circuit of the power supply, is mounted adjacent to the power input receptacle at the rear of the receiver chassis. The fuse mounting is of such design that the fuse, which is of the miniature cartridge type, is replaceable without the use of tools, and without the necessity for the removal of the receiver chassis from its cabinet.

1.119 Facilities are also provided, in the form of separate auxiliary terminals at the rear of the receiver chassis and a suitable switching arrangement, for connecting a phonograph pickup to the input circuits of the audio frequency amplifier. With the necessary switching completed, the radio frequency circuits are rendered ineffective during operation of the audio frequency circuits in conjunction with a phonograph pickup.

1.2 TUBE COMPLEMENT

1.21 The vacuum tubes employed in the Type CZC-46224 Radio Receiver are as follows:

Symbol	*Commercial and Navy Type*	*Function*
V-101	6K7	R.F. Amplifier
V-102	6J5	H.F. Oscillator
V-103	6SA7	First Detector and MIXER
V-104	6SK7	First I.F. Amplifier
V-105	6SK7	Second I.F. Amplifier
V-106	6H6	Second Detector, A.V.C., N.L.
V-107	6J5	First A.F. Amplifier
V-108	6SJ7	Second A.F. Amplifier
V-109	6K6GT	A.F. Power Output
V-110	6E5	Tuning Indicator
V-111	5Y3GT	Rectifier (Full Wave)
V-112	5Y3GT	Rectifier (Full Wave)

1.3 DIMENSIONS AND WEIGHTS

1.31 The dimensions and weights of the CZC-46224 Radio Receivers are as follows:

(1) Dimensions:

	Chassis in Cabinet	*Chassis Only*
Length	20.50 inches	19.00 inches
Depth	18.50 inches	18.50 inches
Height	13.75 inches	10.50 inches

(2) Weights:

Chassis in Cabinet	103 pounds
Chassis Only	79 pounds

1.4 POWER REQUIREMENTS

1.41 The Model RBO-1 Radio Receiving Equipment is designed for operation from a 110/125 volt, 58/62 cycle, single phase power source. The line current at 115 volts is .74 amperes. The nominal power consumption at 115 volts is 85 watts.

1.5 ANTENNA REQUIREMENTS

1.51 The input circuit of the Type CZC-46224 Radio Receiver is primarily designed for operation with a separate antenna not used for other equipment. A conventional single wire antenna will suffice since the antenna requirements are not critical. Such a single wire antenna should be spaced at least six feet away from any parallel stay, mast, or stack. It should be well insulated and should be erected as high as possible. The recommended minimum overall length of antenna and lead-in is fifty feet. The antenna proper (not including lead-in) should be at least fifty feet in the clear. A one-half megohm static-drain resistor should be permanently installed between the antenna and ground.

1.52 In an installation having a simple antenna-ground combination, solder the antenna lead-in to the retaining nut for the jack socket of the Navy Type 49121A concentric plug. Connect the ground lead to the terminal provided for this purpose and mounted adjacent to the Navy Type 49120 concentric jack at the rear of the receiver chassis.

2. DESCRIPTION

2.1 CONSTRUCTION

2.11 The Type CZC-46224 Radio Receiver is primarily designed for top of table or bench mounting. It is furnished with its chassis housed in a metal cabinet supported from its mounting base with rubber shock-mounts at the four bottom corners of the cabinet. The front panel, to which the chassis is secured, forms the enclosure for one side of the cabinet. The general appearance and type of construction employed are shown in Figures 1 and 2.

2.12 The cabinet is of fabricated construction with ventilating louvers in its two sides and clearance apertures in the rear for access to the antenna and power input receptacles, fuse, and speaker and phonograph feeder connection terminals.

2.13 The chassis assembly is rigidly secured to the front panel. All component items, exclusive of those mounted on the front panel, entering into the construction of the Type CZC-46224 Radio Receiver, are mounted either on top or underneath the chassis structure. The chassis and front panel form a basic assembly capable of being inserted or withdrawn from the cabinet, as a unit.

2.14 When the chassis assembly is housed in the cabinet, it is secured to the cabinet by the front panel through the use of

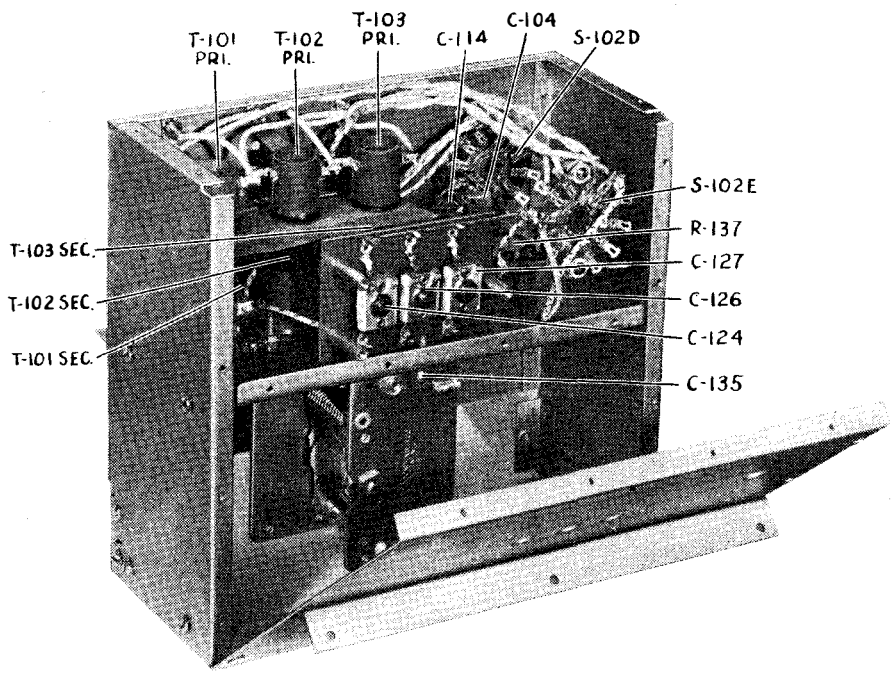

FIG. 2.18. LEFT OBLIQUE, INVERTED VIEW, ANTENNA COMPARTMENT

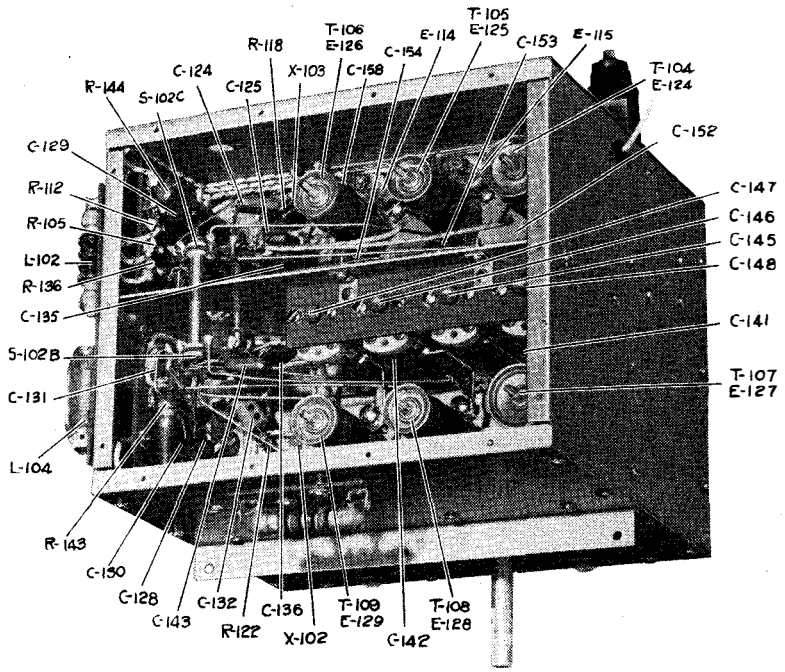

FIG. 2.19. BOTTOM OBLIQUE VIEW, R.F. AND H.F. OSC. COMPARTMENT

eight knurled, captivated type, thumb screws which pass through four slots in opposite edges of the panel and engage with suitable inserts in the flanged sides of the front opening of the cabinet. The captivated type thumb screws are retained, when loosened, in groups of four in removable angles which also serve as "trim", for the front side corners of the cabinet, by concealing the mounting screw slots in the front panel. Two handles are conveniently arranged on the front panel to permit the insertion or removal of the chassis assembly without subjecting any of the operating controls to strain.

2.15 The construction of the chassis assembly and the arrangement and mounting of the component parts are clearly depicted in Figures 2.13, 2.15, 2.17 and 2.111. All vacuum tubes are accessible from the top side of the chassis upon removal of the chassis from the cabinet. The design and construction of the chassis assembly, and the arrangement of the component items mounted thereon, provides a high degree of accessibility to all items for inspection, servicing, or replacement. A bottom cover plate, not shown in Figures 2.17 and 2.111, completely encloses the bottom of the chassis proper. It is provided as an added shielding feature, and for the protection of the under side chassis mounted components against damage due to careless handling. It is secured to the chassis with machine screws so that it is readily removable, as and when necessary to make repairs or to effect replacement of chassis mounted components.

2.16 The receiver panel layout is shown in Figure 1, and the location and functions of the various controls are described in Section 10, Operating Instructions.

2.17 The Type CZC-46224 Radio Receiver is especially designed to minimize radiation from the high frequency oscillator. This is accomplished by isolating the antenna input circuits from the first detector (or mixer) and the high frequency oscillator circuits, through the use of extensive shielding and filtering, and by the employment of a type of construction which reduces, to practical limits, undesirable circuit coupling by virtue of circulating currents in common shields.

2.18 A separate shielded compartment, designed as a complete sub-assembly and easily detachable, as such, from the chassis for inspection and servicing of the component parts which it houses, contains all the circuit elements between the antenna input and the signal grid of the R.F. amplifier tube. This sub-assembly, as pictured in Figure 2.13 and 2.15 is mounted at the rear center of the chassis, and is centrally disposed, above and below the chassis, through an aperture in the chassis. The compartment is grounded at only one point on the chassis and since the mounting flanges are insulated from the chassis this ground constitutes the only grounding for the compartment. Details of the construction of the shielded compartment and the arrangement and mounting of the component parts, which it contains, are shown in Figure 2.18. The figure depicts an oblique rear view of the shielded compartment with the sides removed or opened to display the internal components. The compartment, as pictured, is inverted with respect to its normal position in the receiver.

2.19 A second shielded compartment, constructed and mounted in the same manner as for that containing the antenna circuit elements, but larger in overall dimensions, contains all of the circuit elements from the R.F. amplifier tube to the 1st I.F. amplifier input transformer, and includes also all circuit elements associated with the high frequency oscillator. This compartment, as pictured in Figures 2.13 and 2.15, is mounted on the chassis between the front panel and the compartment containing the antenna input circuit elements. The arrangement and mounting of the circuit components are depicted in Figure 2.19 which portrays an oblique view of the sub-assembly with the bottom cover plate removed to show the disposition of the internal circuit components. This view depicts the sub-assembly in an inverted position with respect to its normal position in the receiver. Circuit components, associated with the compartment sub-assembly, and not visible in Figure 2.19, are shown in Figure 2.15 which shows the two compartment sub-assemblies, described above, mounted in their normal positions, but with their top shield cover plates removed.

2.110 Insulated mechanical couplings are employed for joining together the shafts of the tuning capacitors and band selector switches in the two shielded compartments. These couplings are shown in Figures 2.13 and 2.17. The R.F. amplifier tube is mounted in a horizontal position in a socket which is provided with a clamp for securing the tube in place. The socket is mounted on one side wall of the large compartment and all wiring thereto is contained within the shielded compartment. The vacuum tube then projects into the side of the compartment containing the antenna circuit components, and connection to the signal grid cap is made within the confines, of this compartment. The internal shields in the vacuum tube isolates the signal grid circuit from the plate circuit, and, in effect, completes the shielding of the antenna circuit compartment so that these

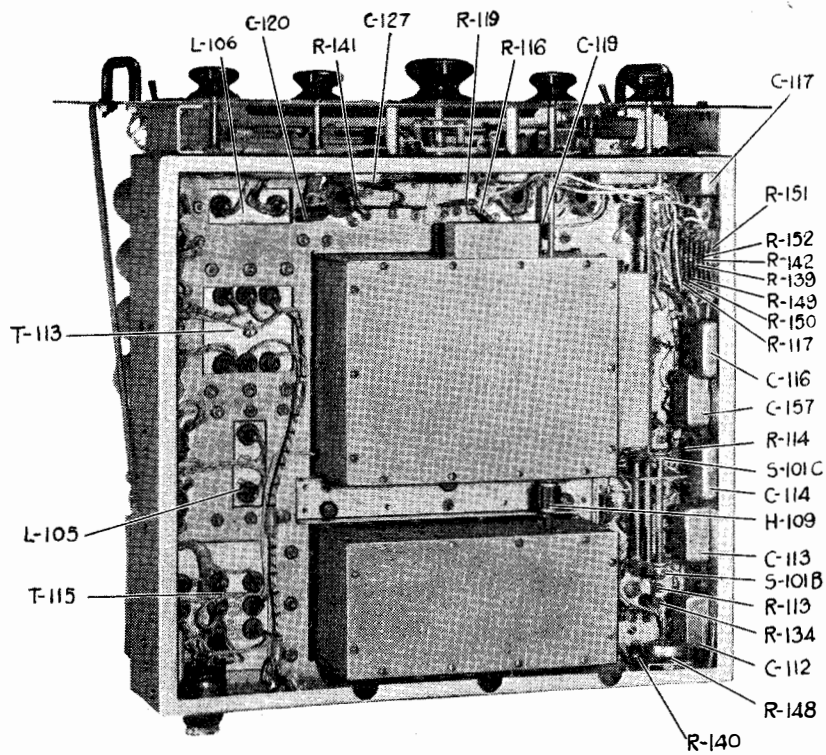

FIG. 2.17. LEFT BOTTOM OBLIQUE VIEW, RADIO RECEIVER CHASSIS

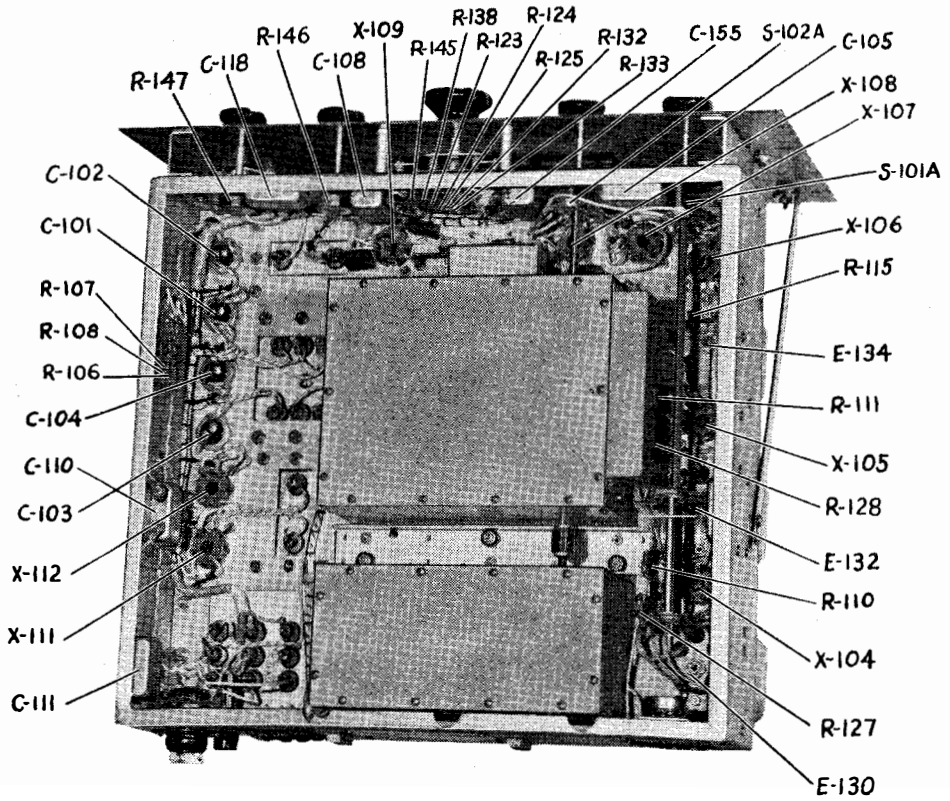

FIG. 2.111. RIGHT BOTTOM OBLIQUE VIEW, RADIO RECEIVER CHASSIS

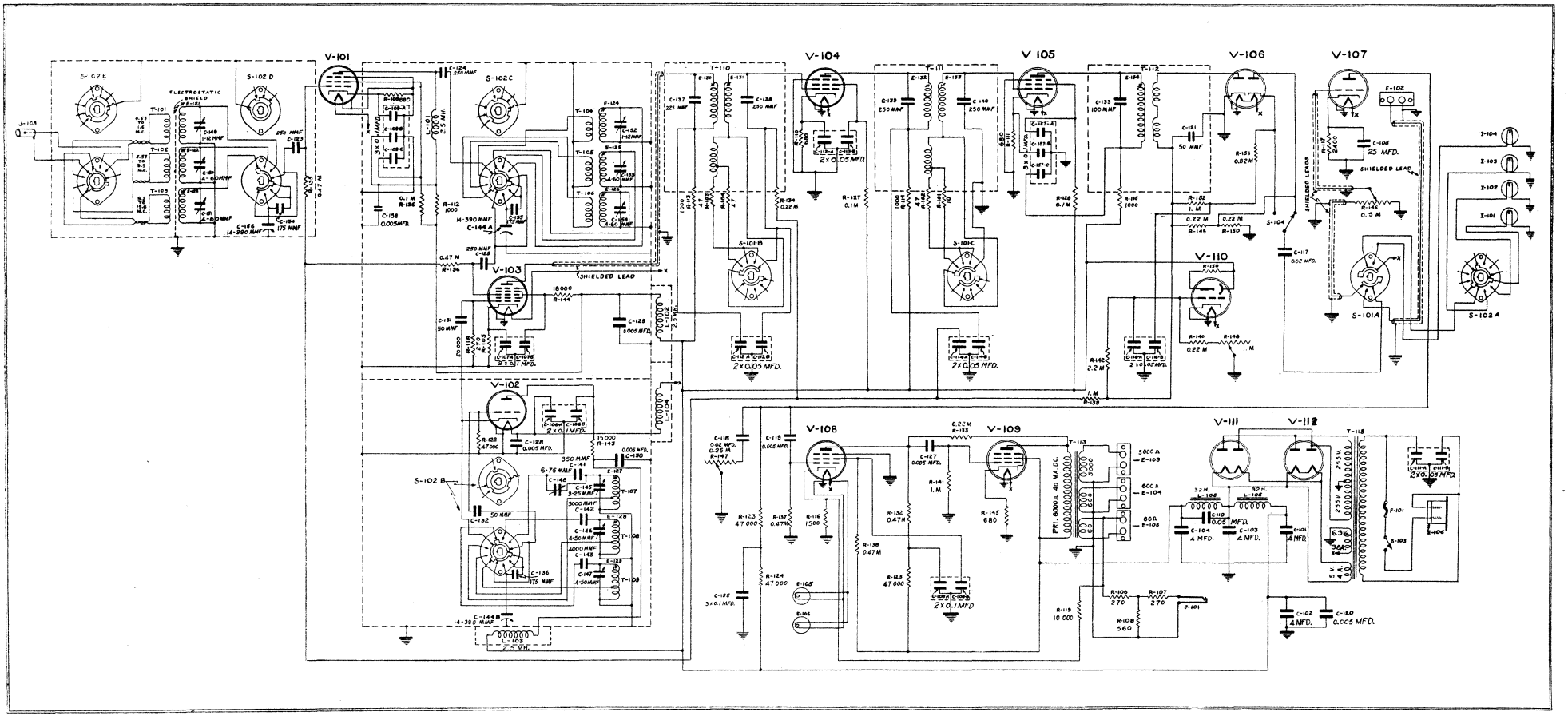

FIG. 2.2. SCHEMATIC DIAGRAM. TYPE CZC-46224 RADIO RECEIVER

circuits are electrically isolated from the plate circuit of the R.F. amplifier tube, insofar as stray coupling from the high frequency oscillator is concerned.

2.111 Removable cover plates, secured with thumb screws, are provided on the two shielded compartments for access to the vacuum tubes contained within. Similar cover plates on the bottoms of the shielded compartments are secured with conventional machine screws. Either the top or bottom cover plate, as described above, must be removed for access to the circuit trimmers of the R.F. amplifier, 1st detector and high frequency oscillator, since it was not possible to provide access holes in the plates themselves, without compromising the shielding integrity of the receiver.

2.112 The secondary windings of the antenna coupling transformers feeding the grid of the R. F. amplifier tube are provided with individual adjustable iron cores for inductance trimming, and adjustable mica dielectric trimmer capacitors for capacity trimming during circuit alignment. Adjustment of the trimmer capacitors is afforded through access holes in the rear of the shielded compartment housing these transformers. Corresponding holes in the rear of the chassis and cabinet permits the adjustment of the trimmer capacitors, as a final adjustment, in the installation of the equipment for optimum performance with the specific antenna employed, without the necessity for the removal of the receiver chassis from its cabinet. Access to the adjustable iron cores is provided upon the removal of the top cover plate of the shielded compartment containing the antenna coupling transformers.

2.113 The r-f transformers, coupling the plate of the R.F. amplifier tube with the signal grid of the first detector, are each provided with both inductance trimmers, in the form of adjustable iron cores, and capacity trimmers in the form of adjustable mica dielectric trimmer capacitors, for purposes of alignment, of these circuits with the high frequency oscillator circuits. Access to all trimmers, either capacitive or inductive, is afforded upon the removal of the bottom cover plate from the shielded compartment containing these transformers.

2.114 The inductors employed in the high frequency oscillator circuits are similarly provided with adjustable powdered iron cores, and adjustable, air dielectric trimmer capacitors for inductance and capacity trimming. These adjustable trimmers, together with "padder" capacitors, permit the "tracking" of the high frequency oscillator circuits with the R.F. amplifier circuits. The "padder" capacitors are, except for the BROADCAST BAND, of the fixed, molded phenolic, mica dielectric type. In the excepted case, an adjustable, air-dielectric capacitor is employed in parallel with the fixed capacitor. All adjustable trimmer and "padder" capacitors are accessible for adjustment upon the removal of the bottom cover plate of the compartment containing these circuit elements.

2.115 The cabinet, front panel and mounting base of the Type CZC-46224 Radio Receiver have a Navy standard black wrinkle finish. All metallic parts which enter into the construction of the chassis are finished with a suitable plating or paint to provide; first, a high degree of protection to these parts against the deleterious effects of corrosion; and second, a chassis assembly presenting a pleasing appearance.

2.2 CIRCUIT DESCRIPTION

2.21 GENERAL

2.211 The actual schematic diagram of the Type CZC-46224 Radio Receiver is shown in Figure 2.2. For purposes of illustration, it will be assumed that the circuits are set up as for signal reception on SHORTWAVE BAND-2, as depicted in the diagram. The following description will refer, therefore, to the symbol numbers of the circuit elements of the band as, or when, pertinent to the description. It shall be assumed that, unless otherwise specifically noted, the description will be equally applicable to SHORTWAVE BAND-1 and the BROADCAST BAND.

2.22 SIGNAL FREQUENCY CIRCUITS

2.221 Signal input to the receiver through concentric jack J-103 is connected to the primary winding of antenna input transformer T-103 by switch S-102E. An electrostatic shield, at ground potential, separates the secondary winding from the primary winding. The secondary winding together with variable, air dielectric capacitor C-156 and series capacitor C-134, constitutes the first tuned circuit. Transfer of r-f signal, at the resonant frequency of this tuned circuit, from the antenna to the control grid of R.F. amplifier tube V-101, is accomplished by inductive coupling through antenna input transformer T-103. Variable capacitor C-156 is ganged with variable capacitors C-144A and C-144B to provide uni-controlled tuning of the receiver. Capacitor C-134 is shorted out for the BROADCAST BAND and its selection and proper connection is controlled by switch S-102D. The secondary winding of transformer T-103 is provided with adjustable iron core E-123, for inductance trimming, and a shunt connected, variable,

mica dielectric capacitor C-151 for capacity trimming. These trimmer elements permit the accurate alignment of the tuned circuit with the succeding tuned circuit, at both ends of the frequency band, and are accessible for adjustment, as described under Section 8. The high potential end of the tuned circuit is connected to the control grid of R.F. amplifier tube V-101 by switch S-102D and through coupling capacitor C-123. The low potential end of the tuned circuit is returned to ground. The d-c bias return from the control grid of R.F. amplifier tube V-101 to the A.V.C. bus is closed through grid resistor R-135.

2.222 Plate potential from the high voltage d-c bus is applied to the plate of R.F. amplifier tube V-101 through decoupling filter resistor R-112, by-passed to ground by capacitor C-109B, and r-f inductor L-101. Screen potential, also obtained from the high voltage d-c bus, is applied to the screen through a decoupling filter consisting of filter resistor R-126 and by-pass capacitor C-109C. The suppressor is connected to the side of the heater circuit which is operated at ground potential. Initial grid bias is obtained by means of cathode resistor R-109, by-passed by capacitor C-109A.

2.223 The amplified signal voltage from the plate of R.F. amplifier tube V-101 is applied to the primary winding of R.F. transformer T-106, through coupling capacitor C-124, by switch S-102C. The low potential end of the primary winding is returned to ground. The secondary winding of transformer T-106, together with variable, air dielectric tuning capacitor C-144A and series connected capacitor C-135 (the latter employed for the same purpose and in the same manner as capacitor C-134), constitute the second and final tuned circuit operating at the signal frequency. Transfer of signal energy from the plate circuit of R.F. amplifier tube V-101 to the control grid of first detector tube V-103 is accomplished by inductive coupling through R.F. transformer T-106 and by the connection of the high potential end of the tuned circuit to the control grid of first detector tube V-103 by switch S-102C, through coupling capacitor C-125. The low potential end of the tuned circuit connects to ground. Adjustable iron core E-126 and parallel connected (variable) mica dielectric trimmer capacitor are associated with the tuned circuit for purposes of circuit alignment and are accessible for adjustment as described in Par. 2.113. The d-c bias return from the control grid of first detector tube V-103 to the A.V.C. bus is closed through grid resistor R-136.

2.224 Screen potential from the high voltage d-c bus is applied to the screen of first detector tube V-103 through r-f inductor L-102, by-passed to ground by capacitor C-129, and thence through decoupling filter resistor R-144, by-passed to ground by capacitor C-107B. The suppressor is internally connected to the shell of the tube. Initial bias is obtained by means of cathode resistor R-105, by-passed to ground by capacitor C-107A.

2.23 HIGH FREQUENCY OSCILLATOR CIRCUITS

2.231 The H.F. oscillator circuit is of the so called "electron coupled" type. The tuned circuit consists of tapped inductor element T-109, shunted with variable, air dielectric trimmer capacitor C-147 and tuned with variable, air dielectric tuning capacitor C-144B, series connected capacitor C-136 and padder capacitor C-143. Capacitor C-136 is shorted out by the switch S-102B for the BROADCAST BAND. The inductor element is also provided with adjustable iron core E-129 for inductance trimming. Padder capacitor C-143 is used to modify the tuning of the H.F. oscillator so that it will maintain a fixed frequency difference of 455 kilocycles with respect to the signal frequency when tuning capacitors C-156, C-144A, C-144B are simultaneously varied from minimum to maximum capacity. The high potential end of the oscillator tuned circuit is connected, by Switch S-102B, through coupling capacitor C-132 to the control grid of the H.F. Oscillator tube V-102. This grid is returned to ground through grid resistor R-122 for d-c bias return. The low potential end of the tuned circuit is also returned to ground. The cathode of H.F. oscillator tube V-102 is connected, by switch S-102B, to the tap on inductor element T-109, and through coupling capacitor C-131 to the oscillator injector grid of first detector tube V-103. This grid has a d-c return to ground through grid resistor R-118.

2.232 The plate of H.F. oscillator tube V-102 is connected to the high voltage d-c bus through decoupling filter resistor R-143, by-passed to ground by capacitor C-106B, and r-f filter inductor L-103, by-passed to ground by capacitor C-130. One side of the heater circuit operates at ground potential while the other side is filtered by capacitors C-106A and C-128 and r-f filter inductor L-104.

2.24 I.F. AMPLIFIER CIRCUITS

2.241 The signal frequency arriving at the control grid of first detector tube V-103 and the H.F. oscillator frequency arriving at the injector grid of this tube are mixed (or hetrodyned) and the resultant difference frequency (455 kilocycles) is fed to

the input of the intermediate frequency amplifier.

2.242 Transfer of intermediate frequency energy, from the first detector tube V-103 to second detector tube V-106 is accomplished by inductive coupling through I.F. transformer T-110, T-111 and T-112 and amplified through I.F. amplifier tubes V-104 and V-105. First I.F. transformer T-110 consists of two tuned circuits, primary and secondary, with the secondary tuned circuit operating in conjunction with switch S-101B, resistors R-103 and R-104 and a tertiary winding to provide three degrees of selectivity by changing the electrical constants of the secondary tuned circuit and its coefficient of coupling with the primary tuned circuit. The primary and secondary windings are each tuned to the intermediate frequency by fixed, mica dielectric capacitors C-137 and C-138, augmented by adjustable iron cores E-130 and E-131, provided for inductance trimming, and accessible through the top and bottom of the transformer shield can. The high potential end of the primary tuned circuit connects to the plate of first detector V-103 through a shielded conductor, while the low potential end connects to the high voltage d-c bus through decoupling filter resistor R-113, by-passed to ground by capacitor C-112A. The high potential end of the secondary tuned circuit is connected to the grid of first I.F. amplifier tube V-104 while the low potential end is connected to the A.V.C. bus through A.V.C. filter R-134 and C-112B.

2.243 Screen potential from the high voltage d-c bus is applied to the screen of first I.F. amplifier tube V-104 through decoupling filter resistor R-127, by-passed to ground by capacitor C-113B. Initial cathode bias is applied through bias resistor R-110, by-passed by capacitor C-113A.

2.244 Second I.F. transformer T-111 is identical to first I.F. transformer T-110, with respect to its design, construction, and operating characteristics. Accordingly, except for differences in circuit symbol designations, which becomes obvious upon examination of Fig. 2.2, the circuit description of paragraph 2.242 is applicable to this transformer, in all details, except that the low potential end of the secondary tuned circuit is returned to ground instead of to the A.V.C. bus.

2.245 The circuit arrangement of second amplifier tube V-105 is the same, except for symbol designations, as described for the first I.F. amplifier tube V-104, in paragraph 2.243 above. No automatic control of control grid bias is provided for this tube, however.

2.246 Third I.F. transformer T-112 contains a tuned primary circuit and an untuned secondary circuit. The primary tuned circuit consists of the primary winding shunted by fixed, mica dielectric capacitor C-133, and permeability tuned by adjustable iron core E-134 which is accessible, for adjustment at the bottom of the receiver. Plate potential to the plate of third I.F. amplifier tube V-105 is applied from the high voltage d-c bus through the primary winding and decoupling filter resistor R-115, by-passed to ground by capacitor C-157C. The high potential end of the secondary winding feeds the second detector diode while its low potential end connects to the A.V.C. bus through filter R-139 and C-114A.

2.25 SECOND DETECTOR CIRCUITS

2.251 Tube V-106 is a dual diode tube, one section is used as a second detector, the plate of which is connected to the high potential end of the secondary winding of third I.F. transformer T-112. The cathode is grounded, thus the tube acts as a half-wave rectifier. The voltage appearing across diode load resistor R-149, R-150 is filtered by resistor R-139 and condenser C-114A and the resulting direct current A.V.C. voltage is used to control the gain of amplifier tubes V101, V-103, V-104, the degree of control being dependent on the strength of the incoming signal. The other half of dual diode V-106 is used in a very efficient noise limiter circuit which reduces peak noise levels so that weak signals may be received in locations where the noise level is high.

2.252 The voltage appearing across the diode load resistor is also filtered by resistor R-142 and capacitor C-116A and the resultant d-c voltage is applied to the control grid of electron-ray indicator V-110. This d-c voltage regulates the shadow angle of the electron ray tube to indicate when the receiver is tuned to resonance with the received signal.

2.26 A.F. AMPLIFIER CIRCUITS

2.261 The a-f voltage developed across the diode load resistor R-150, as the result of the demodulating action of the second detector tube V-106, is applied to the control grid of first A.F. amplifier tube V-107, through coupling capacitor C-117, by switch S-101A and VOLUME control potentiometer R-146.

2.262 Switch S-101A is ganged with switch S-101B and S-101C. It operates to transfer the input to VOLUME control potentiometer R-146, and hence, the input cir-

cuits of first A.F. amplifier tube V-107 from the second detector circuit to PHONO terminals E-102 to permit the operation of the audio amplifier system of the Receiver with a high impedance phonograph pick-up. Low impedance pick-ups may also be employed provided that their connection to E-102 are made through suitable matching transformers.

2.263 Amplification of the a-f signals from the second detector is accomplished by resistance-capacity coupling between first and second A.F. amplifier tubes V-107 and V-108, respectively, and the output amplifier tube V-109. Transfer of audio frequency energy, from the plate of output amplifier tube V-109 to head telephone PHONE (S) jack J-101, and loud speaker terminals E-103, E-104 and E-105, is accomplished through output transformer T-113, E-104 and E-105, which matches the plate impedance of the tube with the separate loads with which the Receiver is designed to operate. A resistance net work, consisting of resistors R-106, R-107 and R-108 is connected between head telephone jack J-101 and the secondary winding of output transformer T-113 to reduce the maximum audio power below that available at speaker terminal E-105.

2.264 Inverse feed back is provided for the second A.F. and output amplifier stages to maintain approximately constant voltage across the primary winding of output transformer T-113 for relatively wide changes in output load, as specified elsewhere in these instructions.

2.265 A separate high voltage d-c bus supplies d-c voltage to the plates and screens of A.F. amplifier tubes V-108 and V-109. Direct current potential is applied to the plate of first A.F. amplifier tube V-107 through load resistor R-123 and decoupling filter R-124 and C-155; to the screen of second amplifier tube V-108 through decoupling filter R-138 and C-108B, to the plate of this tube through load resistor R-132, and decoupling filter R-125 and C-108A; and finally, to the screen and plate of output amplifier tube V-109, directly, with respect to the screen, and through the primary of output transformer T-113.

2.266 Variable potentiometer R-147 and series connected capacitor C-118 constitutes the control for regulating the fidelity of the audio amplifier system of the Receiver. The series combination is connected between the plate of first A.F. amplifier tube V-107 and ground.

2.27 RECTIFIER POWER CIRCUITS

2.271 The proper a-c heater potential for all vacuum tubes except Rectifiers, is obtained from a common secondary winding of power transformer T-115. One side of the secondary is operated at ground potential. High voltage a-c plate potential from a second secondary winding of the transformer is applied to the parallel connected plates of rectifier tubes V-111 and V-112. The rectified pulsating potentials are derived from the filament and fed through separate filters to two separate high voltage d-c feeder circuits to the Receiver vacuum tubes. The rectifier tubes V-111 and V-112 supply d-c power to one feeder line through filter L-105, C-103, C-104 and C-110, and supplies d-c power to the second feeder line through filter L-106, C-101, C-102 and C-120.

2.272 The a-c power input line to the primary winding of power transformer T-114 is filtered by capacitors C-111A and C-111B to prevent stray r-f potentials from being applied across the primary winding. Power is applied through switch S-103 in one side of the line circuit, which also is fused by F-101.

2.3 PERFORMANCE DATA

2.31 The SENSITIVITY vs FREQUENCY curves are plotted in Plate 1 and are representative of the overall sensitivity of the Model RBO-1 Radio Receiving Equipment over the three frequency bands covered by the Type CZC-46224 Radio Receiver. These curves, together with the OVERALL SELECTIVITY curves shown in Plate 2, provide data for definitely checking the Type CZC-46224 Radio Receiver to determine if repairs or re-alignment are necessary since the majority of circuit element failures or any misalignment will reduce the sensitivity of the equipment. The data referred to above will, therefore, also serve to show the efficacy of repairs or realignment.

2.32 The selectivity of a radio receiving equipment is that characteristic which determines the extent to which it is capable of differentiating between the desired signal and disturbances of other frequencies. The OVERALL SELECTIVITY curves of Plate 2, are representative of the overall selectivity characteristics of the equipment for the three degrees of selectivity, that is made possible by suitable adjustment of the SELECTIVITY control of the CZC-46224 Radio Receiver. Over the frequency ranges covered by the Model RBO-1 Radio Receiving Equipment, the OVERALL SELECTIVITY, for any adjustment of the SELECTIVITY control, will be essentially the SELECTIVITY characteristics of the intermediate frequency amplifier. For signal frequencies below 1000 kilocycles, the OVERALL SELECTIVITY characteristics for the BROAD and MEDIUM adjustments of the SELECTIVITY control will

be somewhat sharper than shown by the corresponding curves in Plate 2, due to "side band cutting" by the tuned circuits of the r-f amplifier preceding the first detector.

2.33 The image attenuation is the degree to which a superheterodyne type of radio receiving equipment is capable of rejecting signals off resonance which, in combination with the fundamental or any harmonic of the conversion oscillator, produce intermediate frequencies which are amplified by the intermediate frequency amplifier and result in spurious responses. The IMAGE ATTENUATION vs. DESIRED SIGNAL FREQUENCY curves of Plate 3, show the extent to which the Model RBO-1 Radio Receiving Equipment is capable of rejecting image responses. The curves of Plate 3 are representative of the extent to which primary image frequencies are attenuated by the preselector tuned circuits of the Type CZC-46224 Radio Receiver. The primary image frequency is equal to the desired signal frequency plus two times the intermediate frequency. The attenuation of the primary image, corresponding to any desired signal frequency, as derived from the curves of Plate 3, is predicated on the ratio between the r-f inputs, at the desired signal and primary image frequencies, to produce a constant output as measured with the receiver tuned for resonance with the desired signal frequency.

2.34 The intermediate frequency rejection offered by the Type CZC-46224 Radio Receiver is better than 75.0 decibels. This expression is the ability of the Model RBO-1 Radio Receiving Equipment to reject signals at the frequency to which the intermediate frequency amplifier is resonated.

2.35 The A.V.C. OVERALL FIDELITY, and A.F. AMPLIFIER FIDELITY characteristics shown on Plates 4, 5, and 6 are necessary when particular performance checks are desired, but are of secondary importance in most cases in the determination of the necessity for repairs or realignment.

2.36 The maximum undistorted power output, as measured at 400 cycles across a load impedance of 600 ohms connected to terminals E-105, is approximately 2 watts. Due to the inverse feed-back feature associated with the audio amplifier system of the Type CZC-46224 Radio Receiver, the voltage appearing across terminals E-105 remains constant, within a total tolerance of 2 decibels, as the load impedance is varied from 60 to 600 ohms. A maximum undistorted power output of approximately 2 watts may also be obtained across terminals E-104 and E-103 when connected to load impedances of 600 and 5000 ohms, respectively, providing that at no time more than one set of output terminals E-103, E-104, or E-105 are used.

2.37 The high frequency oscillator radiation, as measured at the r-f input terminals of the Type CZC-46224 Radio Receiver, is less than 100 micro-microwatts at any frequency covered by the Model RBO-1 Radio Receiving Equipment. This characteristic will permit "safe" operation of the equipment on Naval vessels.

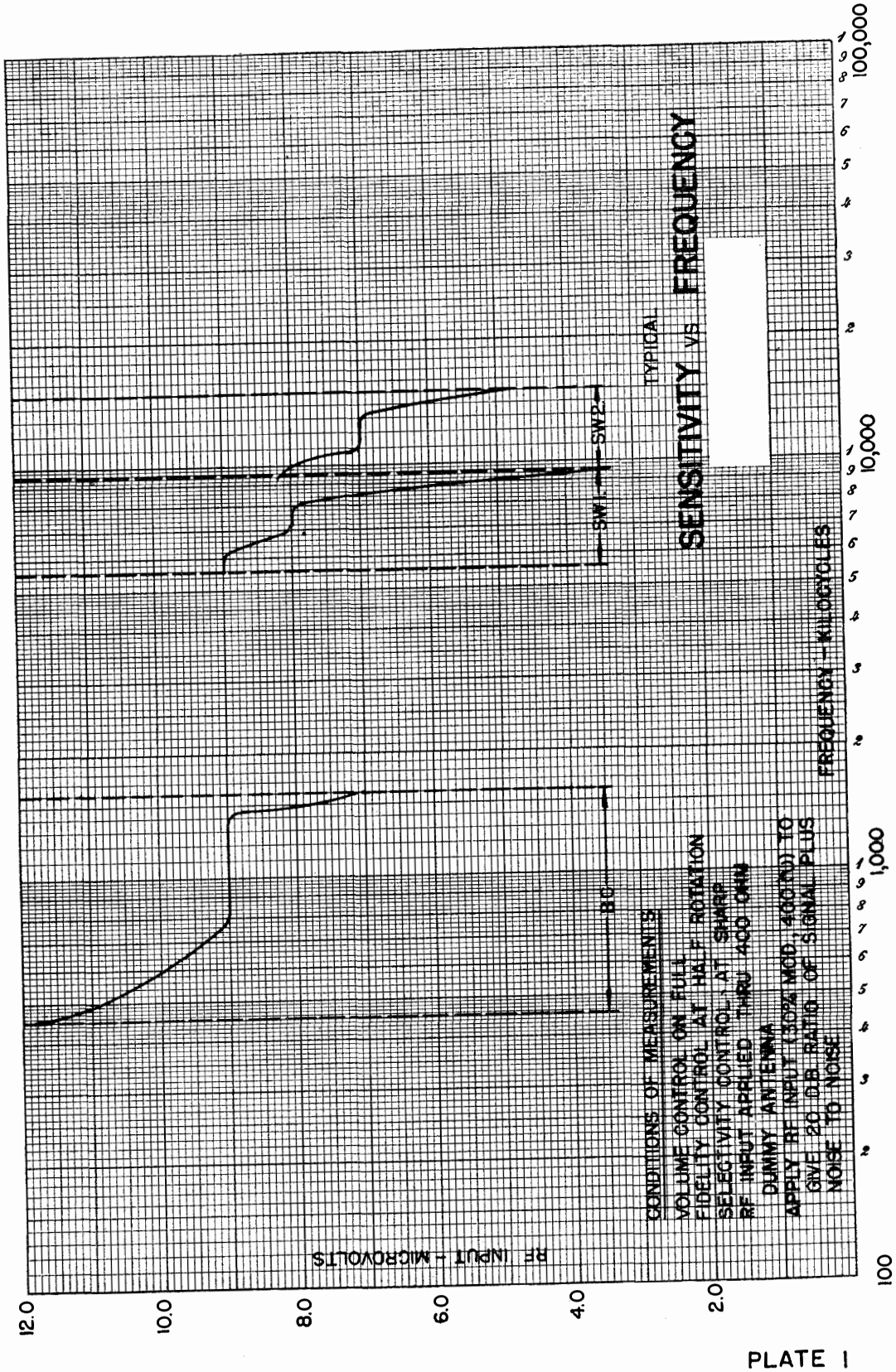
TYPICAL
SENSITIVITY VS FREQUENCY
SW1
SW2
BC
CONDITIONS OF MEASUREMENTS
VOLUME CONTROL ON FULL
FIDELITY CONTROL AT HALF ROTATION
SELECTIVITY CONTROL AT SHARP
RF INPUT APPLIED THRU 400 OHM
DUMMY ANTENNA
APPLY RF INPUT (30% MOD. 400CPS) TO
GIVE 20 DB RATIO OF SIGNAL PLUS
NOISE TO NOISE
RF INPUT - MICROVOLTS
12.0
10.0
8.0
6.0
4.0
2.0
FREQUENCY - KILOCYCLES
100,000
10,000
1,000
100

PLATE I

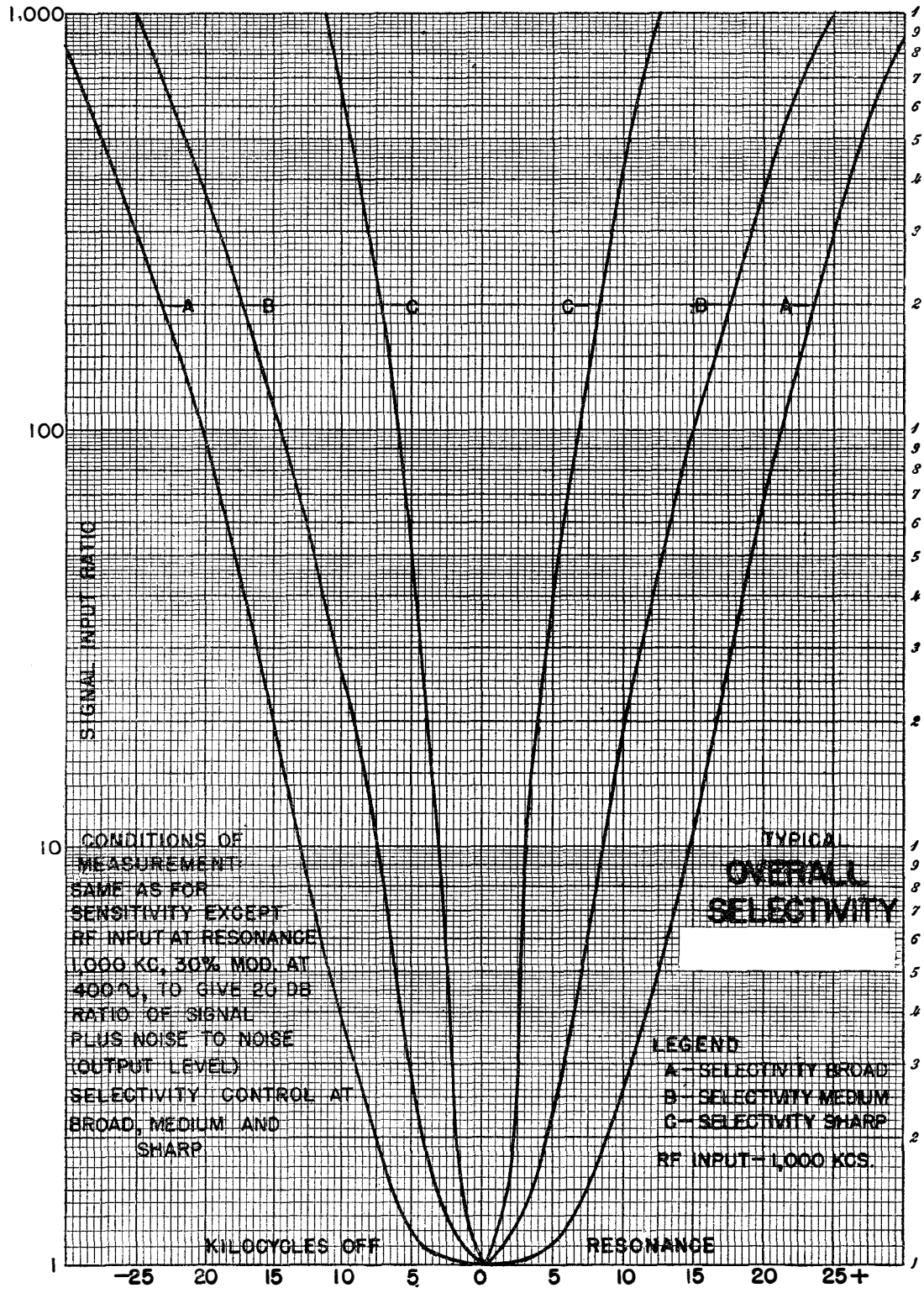
1,000
100
10
1
SIGNAL INPUT RATIO
A
B
C
C
B
A
CONDITIONS OF MEASUREMENT: SAME AS FOR SENSITIVITY EXCEPT RF INPUT AT RESONANCE 1,000 KC, 30% MOD. AT 400 ~, TO GIVE 20 DB RATIO OF SIGNAL PLUS NOISE TO NOISE (OUTPUT LEVEL) SELECTIVITY CONTROL AT BROAD, MEDIUM AND SHARP
TYPICAL OVERALL SELECTIVITY
LEGEND
A – SELECTIVITY BROAD
B – SELECTIVITY MEDIUM
C – SELECTIVITY SHARP
RF INPUT – 1,000 KCS.
KILOCYCLES OFF RESONANCE
–25 20 15 10 5 0 5 10 15 20 25+

PLATE 2

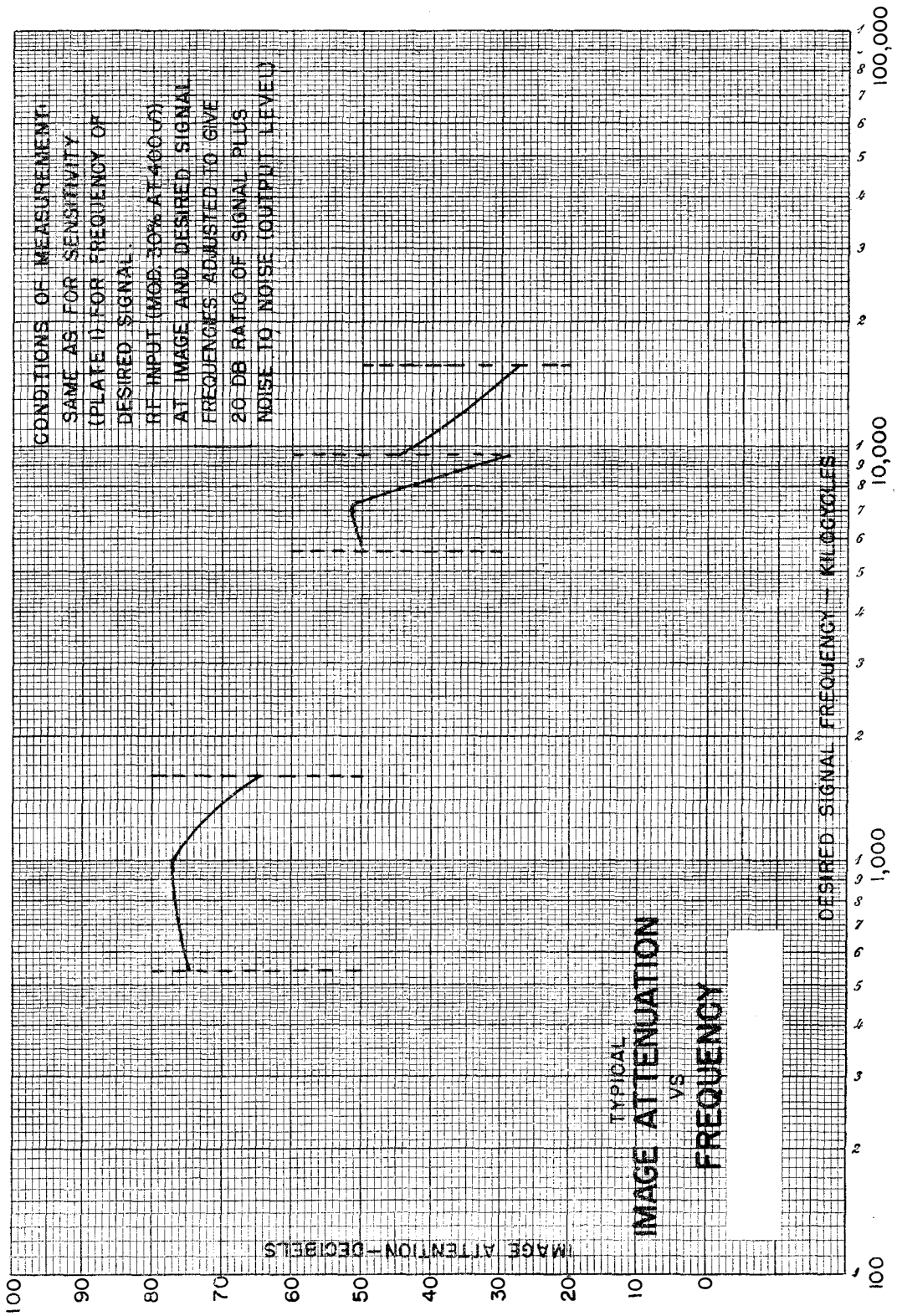
CONDITIONS OF MEASUREMENT:
SAME AS FOR SENSITIVITY
(PLATE 1) FOR FREQUENCY OF
DESIRED SIGNAL.
RF INPUT (MOD. 30% AT 400 CPS)
AT IMAGE AND DESIRED SIGNAL
FREQUENCIES ADJUSTED TO GIVE
20 DB RATIO OF SIGNAL PLUS
NOISE TO NOISE (OUTPUT LEVEL)
TYPICAL
IMAGE ATTENUATION
VS
FREQUENCY
IMAGE ATTENUATION - DECIBELS
100
90
80
70
60
50
40
30
20
10
0
100
1,000
10,000
100,000
DESIRED SIGNAL FREQUENCY - KILOCYCLES

PLATE 3

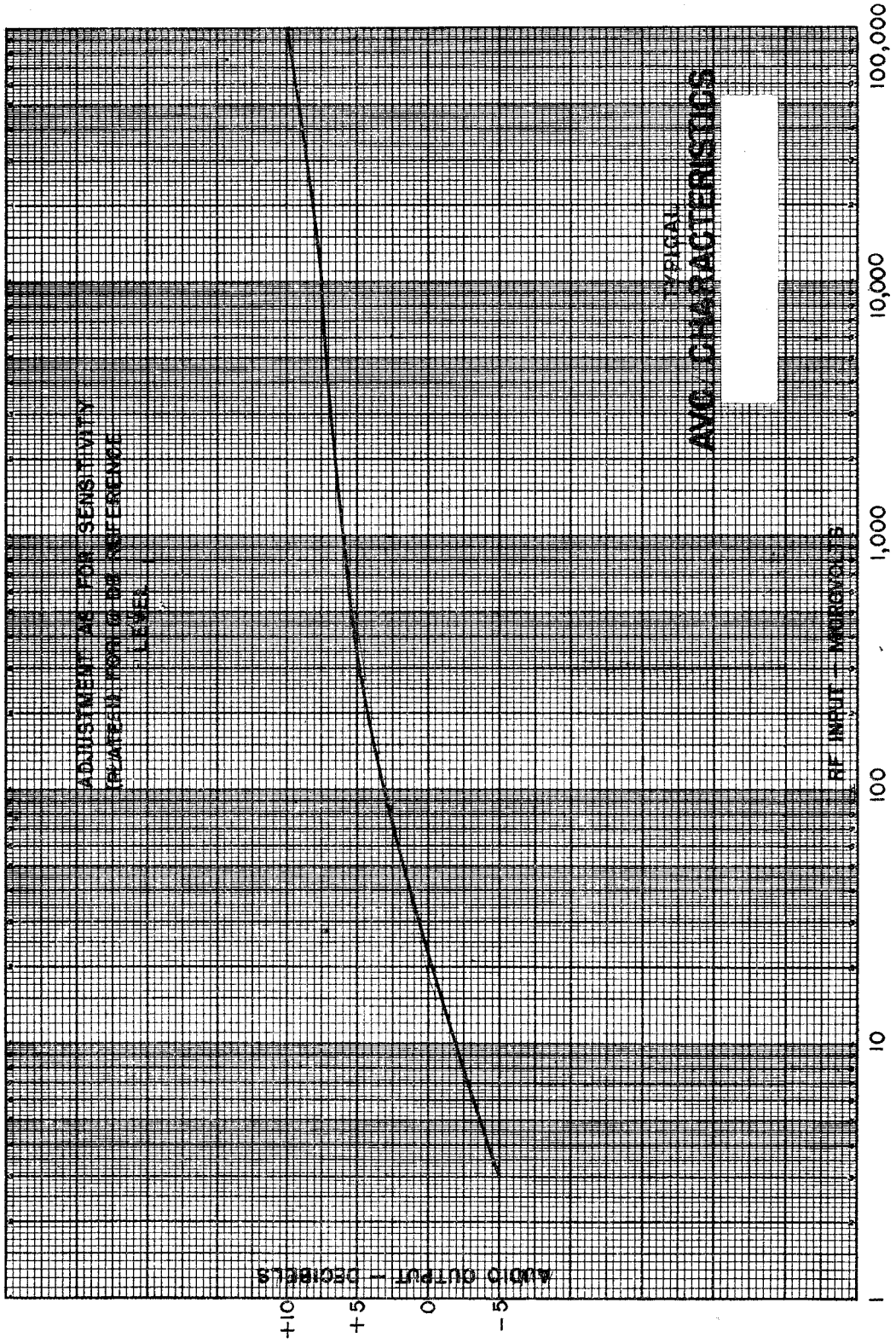
TYPICAL
AVC CHARACTERISTICS
ADJUSTMENT AS FOR SENSITIVITY
PLATE 2 FOR 6 DB REFERENCE
LEVEL
RF INPUT — MICROVOLTS
AUDIO OUTPUT — DECIBELS
100,000
10,000
1,000
100
10
1
+10
+5
0
-5

PLATE 4

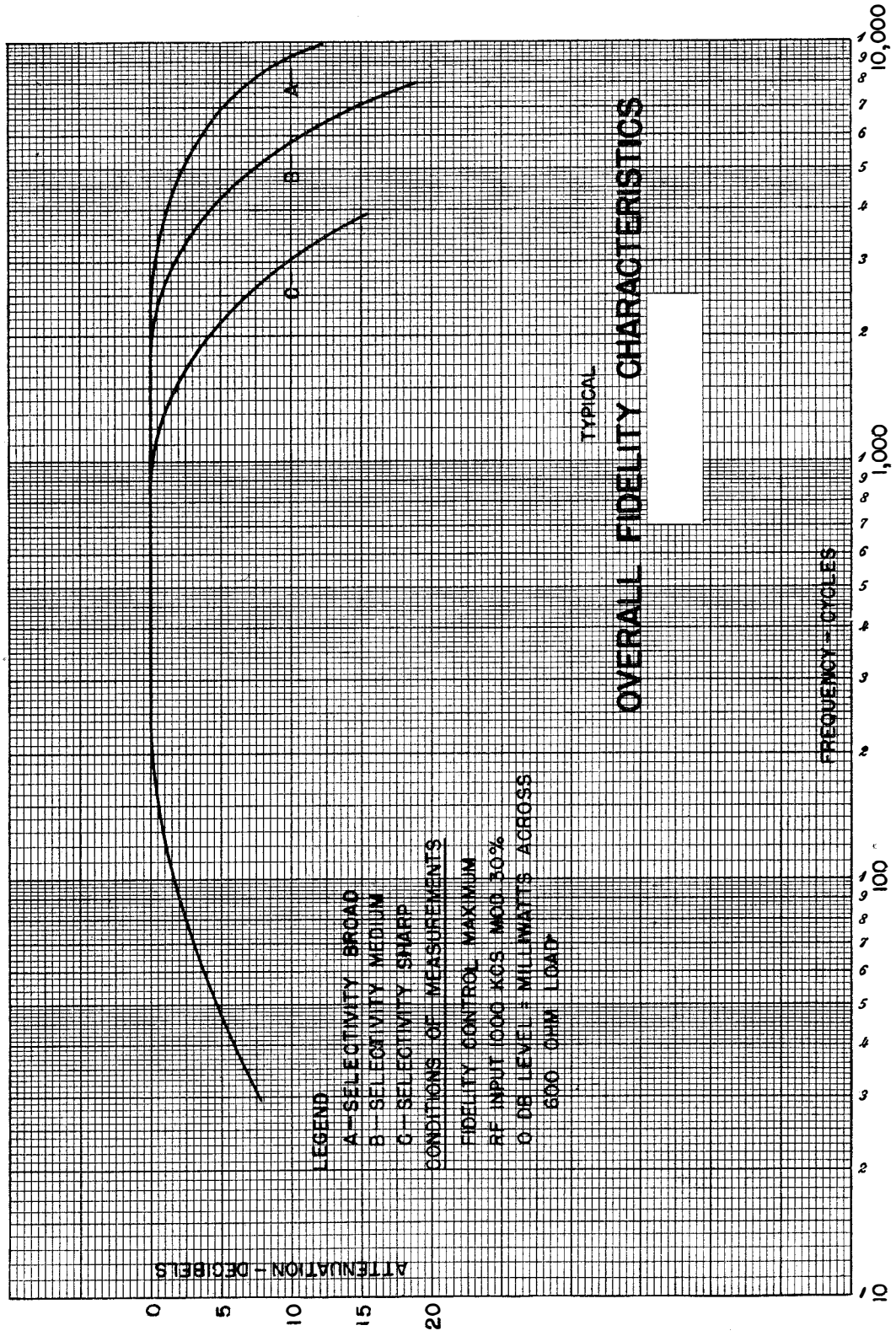
OVERALL FIDELITY CHARACTERISTICS
TYPICAL
LEGEND
A-SELECTIVITY BROAD
B-SELECTIVITY MEDIUM
C-SELECTIVITY SHARP
CONDITIONS OF MEASUREMENTS
FIDELITY CONTROL MAXIMUM
RF INPUT 1000 KCS MOD 30%
0 DB LEVEL = MILLIWATTS ACROSS
600 OHM LOAD
ATTENUATION - DECIBELS
0
5
10
15
20
FREQUENCY - CYCLES
10
100
1,000
10,000

PLATE 5

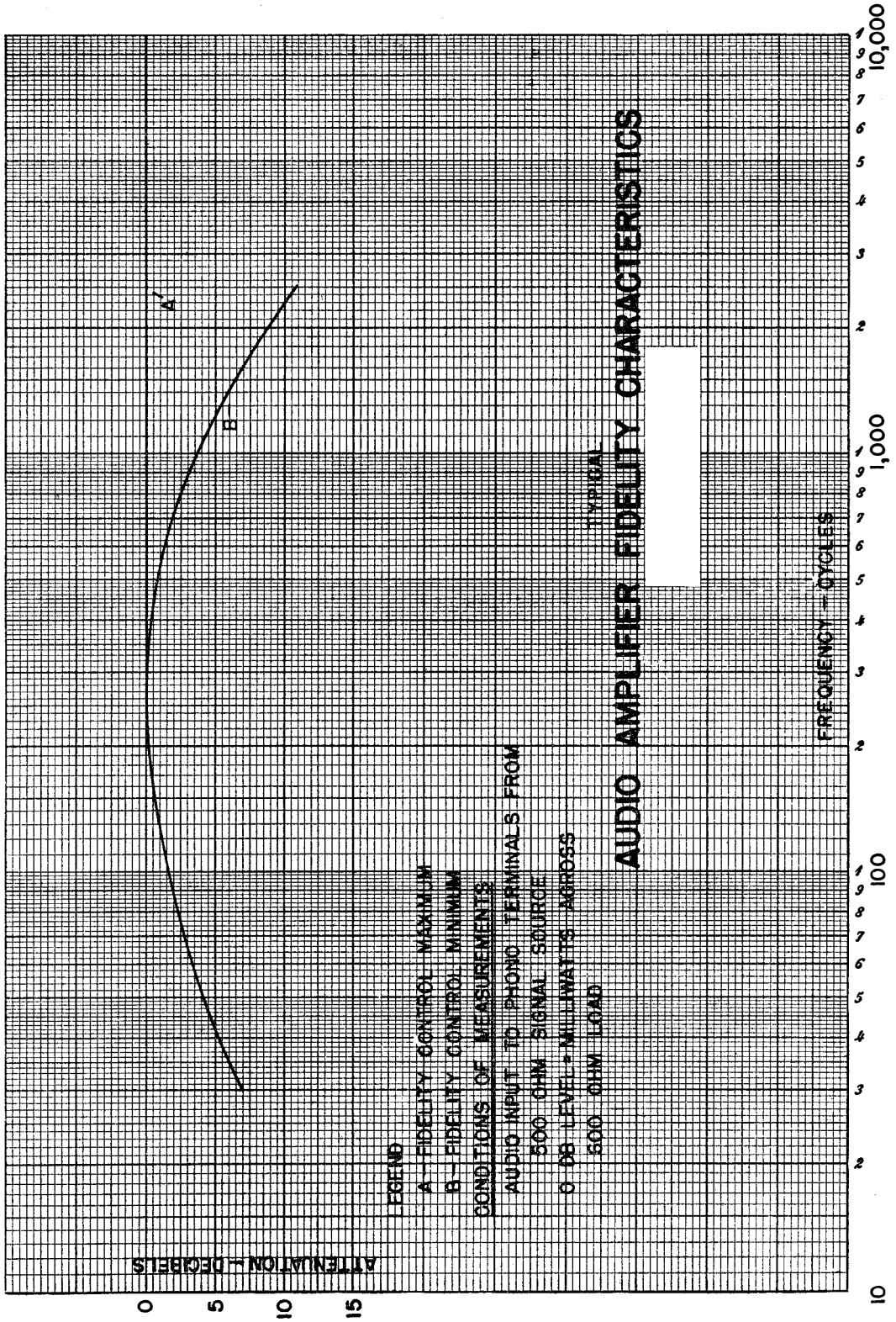
AUDIO AMPLIFIER FIDELITY CHARACTERISTICS
TYPICAL
LEGEND
A—FIDELITY CONTROL MAXIMUM
B—FIDELITY CONTROL MINIMUM
CONDITIONS OF MEASUREMENTS
AUDIO INPUT TO PHONO TERMINALS FROM
500 OHM SIGNAL SOURCE
0 DB LEVEL = MILLIWATTS ACROSS
500 OHM LOAD
ATTENUATION — DECIBELS
0
5
10
15
FREQUENCY — CYCLES
10
100
1,000
10,000
A
B

PLATE 6

3. INSTALLATION

3.1 The Model RBO-1 Equipment, with its Type CZC-46224 Radio Receiver equipped with one full complement of vacuum tubes, one Navy Type-49121A concentric antenna-ground connecting plug, and one female power input plug, is shipped in a single wooden packing box.

3.2 After unpacking the equipment it should be inspected for any possible damage that might have resulted from careless handling in transit. Make certain that all vacuum tubes in the Type CZC-46224 Radio Receiver are firmly seated in their respective sockets. Inspection of the chassis and vacuum tubes may be readily effected upon the removal of the chassis from its cabinet. This is accomplished by loosening the four thumb screws and removing their respective retaining plates at either side of the front operating panel. The chassis may then be drawn out of the cabinet by pulling on the two handles on the front panel.

3.3 The mounting base, to which the shock mounts for the Type CZC-46224 Radio Receiver are attached, should be removed to permit the drilling of four mounting holes in this item. The location and size of the mounting holes should be such as permit the use of sufficiently large screws or bolts to provide a secure mounting for the Type CZC-46224 Receiver when the mounting base is fastened on the top of an operating table or bench. Such security should predicate freedom from loosening or "tearing away" of the mounting screws or bolts when the equipment is subjected to the shock of gun fire or strains resulting from vessel rolling in heavy seas.

3.4 In planning an installation, care should be exercised to provide adequate clearance from the back of the Type CZC-46224 Radio Receiver to the bulkhead or nearest obstruction in order to provide access to the power input plug, the antenna-ground concentric plug, speaker output or phonograph input terminals, fuse, or the movement of feeder cables when withdrawing the chassis from the cabinet for servicing, vacuum tube replacement, or inspection.

3.5 Make connection to the proper 110/125 volt, 58/62 cycle, single phase, a-c power source by means of a suitable, two conductor, shielded cable for connecting the power source with plug P-102 which is then inserted in receptacle E-106 at the rear of the receiver chassis.

3.6 Make antenna connections in accordance with Section 1.5, Antenna Requirements. The antenna lead, or shielded patch cable, should be soldered to concentric plug P-101 in accordance with previously described methods.

3.7 No loud speakers are furnished with the equipment as it is primarily designed to be operated with a separate system of remotely located, parallel connected, Type CRV-49131A Speaker-Amplifiers; the number of such units being governed by the size and type of vessel, and the number of loud speaker positions desired throughout the vessel. Should the size and type of vessel, in which an installation of a Model RBO-1 Equipment is to be made, be such as not to warrant the use of more than a single loud speaker, and presumably one located near or at least in the same compartment with the receiver installation, such a loud speaker may be of the following:

(1) A Type CRV-49131A Speaker Amplifier; or,

(2) A high quality permanent magnet type of loud speaker, with self-contained matching transformer for 600 ohm input, capable of handling 2 watts of audio power; or,

(3) A loud speaker similar to (2) above, but containing a matching transformer for a 5000 ohm input.

3.8 The exact details concerning the installation and interconnection of the Type CRV-49131A Speaker-Amplifiers, whether such units are employed singly or in parallel groups, as well as similar details relative to other types of loud speakers that might be involved in any particular installation or operation of a Model RBO-1 Equipment, are outside of the scope of this Instruction Book. Separate instructions will be furnished to cover the installation of the required number and type of loud speakers, the size and character of wiring to be employed for interconnections between the loud speakers and the Model RBO-1 Equipment, etc., to meet the specific requirements of each vessel or each class of vessel. Suffice it to state, that all external wiring between the Type CZC-46224 Radio Receiver and speaker amplifiers or loud speakers should be of the shielded type. Where several Type CRV-49131A Speaker-Amplifiers are involved in a particular installation, careful attention should be exercised in the laying of the interconnecting wiring to these units to preclude audio cross-talk between units. This problem is partially solved by the fact that the input impedance of the Type CRV-49131A Speaker-Amplifier is low, and hence, the audio power to these units may be "piped" around the vessel at low impedance. In any event, in making the connections between the loud speaker feeder

leads and the speaker terminals on the receiver, sufficient slack in the leads to the terminal should be allowed to permit the removal of the receiver chassis from its cabinet without disturbing the connections.

3.9 Accordingly, and in view of the foregoing, one of the following connections between loud speakers and the Type CZC-46224 Radio Receiver should be made:

(1) Connect the low impedance transmission line supplying two or more remotely mounted, and one locally mounted, Type CRV-49131A Speaker-Amplifiers to speaker terminals E-105; or,

(2) Connect the feeder leads supplying one locally mounted Type CRV-49131A Speaker-Amplifier to speaker terminals E-105; or,

(3) Connect the feeder leads supplying one locally mounted, high quality, permanent magnet type loud speaker, with self-contained 600 ohm input matching transformer, to speaker terminals E-104; or,

(4) Connect the feeder leads supplying one locally mounted loud speaker, similar to (3) above, except containing a 5000 ohm input matching transformer, to speaker terminals E-103.

3.10 A phonograph pick-up may be connected, through a suitable matching transformer, to terminals E-102 at the rear of the chassis. These terminals are marked PHONO and GND for convenience in making the desired connections.

3.11 The equipment is now ready for operation and is turned on by means of toggle switch S-103 on the front operating panel of the Type CZC-46224 Radio Receiver.

3.12 The Type CZC-46224 Radio Receiver may be mounted with other units of the same type in a common cabinet type relay rack in such installations as, for example, at Naval Radio shore stations where the problem of vibration is relatively unimportant. This is accomplished by removing the receiver chassis from its cabinet and securing the chassis on the relay rack by its front panel, using the same holes in the edges of the panel for the securing screws as for the original securing thumb screws. It is essential that a cabinet type relay rack be employed in order to preclude the accumulation of dust on the chassis mounted components, and in the tuning drive mechanism. This method of installing the Model RBO-1 Equipment does not abrogate the contents of Paragraphs 3.5 to 3.12, inclusive, except as they might be qualified with respect to certain minor details.

4. ALIGNMENT DATA

4.1 GENERAL

4.11 Should realignment of the Type CZC-46224 Radio Rceiver become necessary, the following alignment data should be carefully studied before making any circuit adjustments. It is important that the operator understand the functions of each circuit element so that correct alignment may be obtained quickly and accurately. The alignment data of this section is, therefore, supplemented by Section 2, Description, and Section 2.2, Circuit Description.

4.12 Performance Data and Test Data, presented in Sections 2.3 and 6.4, will be particularly helpful in determining the necessity for making any specific adjustments. The operator is cautioned against making any adjustments indiscriminately and he should not realign any circuit unless tests definitely indicate realignment is necessary.

4.13 All alignment and calibration tests, measurements, etc., may be made with the Model LP Standard Signal Generator, or similar equipment, and an output meter, General Radio Type 583A, or equivalent. All tests are made with the Standard Signal Generator adjusted to provide a test signal having 400 cycles 30% modulation, unless otherwise specified.

4.14 Before proceeding with the alignment of any circuit of the Type CZC-46224 Radio Receiver, other than adjustment of trimmer capacitors associated with the secondary windings of the antenna coupling transformers, then the Receiver chassis must be taken out of its cabinet; the bottom cover plate of the chassis; top cover plate of the shielded compartment (Fig. 2.18), containing the antenna coupling transformers; and the bottom cover plate of the shielded compartment containing the H.F. oscillator and R.F. transformers, (Fig. 2.19) must be removed. Removal of the latter cover plates provide access to the capacitive and inductive trimming components.

4.15 The Type CZC-46224 Radio Receiver must be connected to 115 volt, 60 cycle, single phase, A.C. power source; the power switch S-103 to ON; SELECTIVITY control knob, E-120, to SHARP; FIDELITY

control knob E-116 to approximate mid position, and, VOLUME control knob E-117 to full clockwise rotation. An output meter, General Radio Type 583A, or equivalent, should be connected either to the PHONE (S) output jack J-101, or to speaker terminals E-105, and adjusted for 600 ohm impedance.

4.16 The complete alignment of the Radio Receiver may be divided into four steps:

(1) Intermediate frequency amplifier alignment.

(2) High frequency oscillator alignment.

(3) Radio frequency amplifier alignment.

(4) Trimming of antenna input circuit.

NOTE: THE CIRCUITS MUST BE CHECKED IN THE ABOVE ORDER WHEN COMPLETE ALIGNMENT IS NECESSARY.

4.2 I. F. AMPLIFIER ALIGNMENT

4.21 The intermediate frequency of the CZC-46224 Radio Receiver is 455 kilocycles, plus or minus one kilocycle.

4.22 Tuning adjustments are provided in each I.F. transformer. These adjustments consist of adjustable iron cores and are designated by symbol numbers E-130 to E-134, inclusive, as indicated on schematic diagram, Figure 2.2.

4.23 The high potential lead of the Model LP Standard Signal Generator should be connected to the control grid (terminal No. 8) of the first detector tube V-103 and the ground potential lead to any metal part making direct connection to the chassis.

4.24 The frequency of the Standard Signal Generator should be carefully adjusted to 455 Kilocycles and the signal input to first detector tube V-103 adjusted to provide a reading on the output meter. The I.F. tuning adjustments, listed in Paragraph 4.22, should be carefully adjusted to give a maximum reading on the output meter. The order in which the adjustments are made is unimportant.

NOTE: IT IS ESSENTIAL THAT THE INPUT SIGNAL, FROM THE STANDARD SIGNAL GENERATOR, BE KEPT BELOW THE THRESHOLD OF OPERATION OF THE AUTOMATIC VOLUME CONTROL. EXCESSIVE SIGNAL INPUTS WHICH WILL CAUSE OVERLOAD OF EITHER THE SECOND DETECTOR OR AUDIO CIRCUITS SHOULD ALSO BE AVOIDED.

4.25 The performance of the Type CZC-46224 Radio Receiver, from the control grid of the first detector to the output load, can be checked against the stage gain data in Table 1, Section 6.5, after alignment has been completed. Similarly, the selectivity may be checked against the curves of Plate 2, Section 2.3.

4.3 HIGH FREQUENCY OSCILLATOR ALIGNMENT

4.31 Realignment of the H.F. oscillator circuits for any frequency band is usually necessary if the resonant frequency of the Receiver, as indicated by the tuning dial reading, is in error with respect to the actual resonant frequency by more than ± 1.0 percent.

WARNING: READJUSTMENT OF THE H.F. OSCILLATOR CIRCUIT TRIMMERS SHOULD NOT BE ATTEMPTED UNTIL AFTER THE NEED FOR SUCH READJUSTMENTS HAS BEEN POSITIVELY ESTABLISHED BY TESTS COVERED IN SECTION 6.

4.32 To check the operation of the R.F. amplifier and H.F. oscillator circuits, the Model LP Standard Signal Generator, or equivalent, should be connected to the antenna input jack J-103, using a 400 ohm noninductive resistor as a dummy antenna. The VOLUME control may be retarded somewhat if desired, as background noise may be excessive when the control is fully advanced.

4.33 If error in calibration is found, check the dial pointer to make certain that it has not been pushed out of position. This may be checked by turning the main tuning control knob E-118 until pointer N-106 is at the extreme left position of its travel. At this point the pointer should line up with the vertical lines on the end of the dial scales.

4.34 The following general procedure should be employed in the alignment of H.F. oscillator circuits of any frequency band.

(1) General.

If, when the Receiver is resonated, at the high frequency end of the band, with a test signal frequency, the dial pointer appears above the dial scale marking for this test frequency, then adjustment is made by tuning the oscillator trimmer capacitor, associated with that band, in a clockwise direction to increase its

capacity; conversely, if the Receiver resonants at a lower frequency, as indicated by the markings on the dial, correction is made by turning trimmer counterclockwise.

(2) Broadcast-B.C. position of BAND SELECTOR switch.

(A) Set Signal Generator to 1500 kilocycles.

(B) Set Receiver dial pointer to 1500.

(C) Adjust trimmer C-145 until maximum output is obtained.

(D) Set Signal Generator to 600 kilocycles.

(E) Set Receiver dial pointer to 600.

(F) Adjust padder C-148 for maximum output.

(G) Set Signal Generator to 900 kilocycles.

(H) Set Receiver dial pointer to 900.

(I) Adjust iron core E-127 for maximum output.

(J) Repeat operations A to I, inclusive, until the pointer lines up with the dial markings at all three points on this band.

(3) Shortwave Band I-SW 1 position of BAND SELECTOR switch.

(A) Set Signal Generator to 9.0 megacycles.

(B) Set Receiver dial pointer to 9.0.

(C) Adjust trimmer capacitor C-146 for maximum output.

(D) Set Signal Generator to 5.8 megacycles.

(E) Set Receiver dial pointer to 5.8.

(F) Adjust iron core E-128 for maximum output.

(G) Repeat A to F, inclusive, until the dial markings correspond to these two frequencies without further adjustment.

(4) Shortwave Band II-SW 2 position on BAND SELECTOR switch.

(A) Set Signal Generator to 15 megacycles.

(B) Set Receiver dial pointer to 15.

(C) Adjust C-147 until maximum output is obtained.

(D) Set Signal Generator to 9.3 megacycles.

(E) Set Receiver dial pointer to 9.3.

(F) Adjust E-129 for maximum output.

(G) Repeat A to F, inclusive, until these two frequencies are resonated at the dial markings for these frequencies.

4.4 R.F. AMPLIFIER ALIGNMENT

4.41 The following general procedure should be employed in the Alignment of R.F. and antenna stages.

(1) General.
Standard Signal Generator is adjusted to provide a 30%, 400 cycle modulated carrier, specified in (2), (3) and (4); make connection to the Receiver through J-103 using a 400 ohm, non-inductive resistance as a dummy antenna.

(2) Broadcast Band (BC).

(A) Set Signal Generator to 1500 kilocycles.

(B) Set Receiver dial pointer to 1500.

(C) Adjust C-149 and C-152 for maximum output.

(D) Set Signal Generator to 600 kilocycles.

(E) Set Receiver dial pointer to 600.

(F) Adjust E-121 and E-124 for maximum output.

(G) Repeat A to C, inclusive, for final adjustment.

(3) Shortwave Band I (SW1).

(A) Set Signal Generator to 9.0 megacycles.

(B) Set Receiver dial pointer to 9.0.

(C) Adjust C-150 and C-153 for maximum output.

(D) Set Signal Generator to 5.8 megacycles.

(E) Set Receiver dial pointer to 5.8.

(F) Adjust E-122 and E-125 for maximum output.

(G) Repeat A to C, inclusive, for final adjustment.

(4) Shortwave Band II (SW2).

(A) Set Signal Generator to 15 megacycles.

(B) Set Receiver dial pointer to 15.

(C) Adjust C-151 and C-154 for maximum output.

(D) Set Signal Generator to 9.3 megacycles.

(E) Set Receiver dial pointer to 9.3.

(F) Adjust E-123 and E-126 for maximum output.

(G) Repeat A to C, inclusive, for final adjustment.

5. OPERATING INSTRUCTIONS

5.1 All switches and controls (with the exception of the main tuning control) of the Type CZC-46224 Raido Receiver are identified by panel engraving.

5.2 The main tuning control knob E-118 is centrally located near the bottom of the front panel and is secured to a shaft which drives the ganged, main tuning capacitors through a friction operated mechanical drive. The mechanical drive, also controls the movement of dial pointer N-106, through a system of pulleys and a flexible bronze cable, across the face of main tuning dial, N-107. Dial disk N-104, which carries a linear dial scale and operates in conjunction with fixed index plate N-105, is rotated by the tuning drive mechanism in such a manner that one rotation is completed with a complete traverse of dial pointer N-106 across the face of main tuning dial N-107. Main tuning dial N-107 is of Lucite with white scale markings and characters on a black background. This dial carries a frequency scale for each band. The Lucite dial is framed with escutcheon plate H-110, fitted with a transparent shatterproof lense. Indirect dial illumination is afforded by edge lighting of the Lucite dial plate, from suitably placed dial lamps mounted behind the panel and at the two sides of the dial plate.

5.3 The VOLUME control is located at the left of the main tuning control and is operated by control knob E-117. The control is a potentiometer which operates to adjust the signal input level that is applied to the grid of the first A.F. amplifier tube, and hence, the signal level at the output terminals of the receiver, since the A.F. amplifier is operated at constant gain. Clockwise rotation of control knob E-117 increases the audio output signal level.

5.4 The FIDELITY control, located at the left of the VOLUME control, is operated by control knob E-116. It is a rheostat which operates, in conjunction with a series connected fixed capacitor, in the plate circuit of the first A.F. amplifier tube to limit the high frequency response of the receiver. Full clockwise to full counter-clockwise rotation of this control affords a continuous reduction of the high frequency audio response. The control should be adjusted to an extreme clockwise setting for high fidelity reception. For such reception, the SELECTIVITY control, described in Paragraph 5.8 should be set at BROAD.

5.5 Immediately above the FIDELITY control is mounted PHONE(S) jack J-101 which is provided to permit monitoring of the received signals by head telephone methods, as described in previous portions of these instructions.

5.6 The power on-off toggle switch, located at the upper left-hand corner of the operating panel of the receiver, is connected in the power line input circuit and is provided to apply or remove line power to or from the complete equipment.

5.7 A BAND SELECTOR switch, operating by control knob E-119, is located at the right of the main tuning control knob E-118. This control operates to select the R.F. and high frequency oscillator circuits for the three frequency ranges covered by the Type CZC-46224 Radio Receiver. The settings of this switch for the three frequency bands covered by the Receiver are marked SW2, SW1 and BC, in left to right sequence.

5.8 The SELECTIVITY control is located adjacent to the BAND SELECTOR control. It operates the ganged, rotary type, four-position switches, operating in conjunction with the second I.F. transformers, to vary the selective characteristics of the I.F. amplifier. Selectivity control is afforded by three positions of the ganged selector switches to provide for three degrees of selectivity, namely SHARP, MEDIUM and BROAD; while the fourth position of the ganged switches connects the "PHONO" input terminals, at the rear of the Receiver chassis, to the input of the audio amplifier through the VOLUME control. The panel markings for the four-positions of the SELECTIVITY control are marked in left to right sequence, SHARP, MED, BRD, and PHONO.

5.9 The NOISE LIMITER toggle switch is located directly above the SELECTIVITY switch and is provided to turn the noise limiter on or off as desired.

5.10 There is located at the upper right hand corner of the Receiver panel an electron ray indicator which indicates when the Receiver is tuned to resonance with the frequency of the received signals. Resonance is indicated by the shadow angle of the electron ray indicator, which should be adjusted, by manipulation of the main tuning control, until the two halves of the shadow approximately meet. The shadow of the electron ray indicator can be adjusted on a strong signal, so that the two halves of the shadow just meet, by turning the eye-adjusting control R-148 with a screwdriver. CAUTION: WHEN TUNING THE RECEIVER ALWAYS TURN THE SELECTIVITY CONTROL TO THE SHARP POSITION AND TUNE FOR MAXIMUM SIGNAL AS INDICATED BY THE ELECTRON RAY INDICATOR. Should the receiver be tuned while the SELECTIVITY control is at MEDIUM or BROAD, the electron ray indicator may indicate maximum signal on either side of resonance owing to the fact that the selectivity characteristic of the I.F. amplifier has somewhat of a flat-top characteristic in each of these two positions of the selectivity control. After the Receiver has been properly tuned to resonance, as described above, the SELECTIVITY control may then be adjusted to the BROAD and MEDIUM positions as desired. Hand grips H-111 and H-112, are mounted on either side of the panel for convenience in the removal of the chassis from its cabinet without subjecting any of the operating controls to undue strain.

5.11 A DIAL BRAKE control is provided adjacent to the main tuning control. This knob is used to clamp the main tuning control firmly in place at any frequency in the range of the receiver so that it will not be jarred out of position by vibration or accidently detuned.

5.12 A set screw wrench for hollow head set screws is furnished with each equipment. It is retained under two clips on the front of the Oscillator Mixer shield component. This wrench can be used for removing all the control knobs, also for loosening the set screws holding the R.F. tube V-101. If this tube is removed for servicing or replacement make certain that the three screws holding it in place are securely tightened after replacing the tube in the socket.

6. MAINTENANCE-FAILURES AND REMEDIES

6.1 GENERAL

6.11 Adequate test equipment for maintenance of Model RBO-1 Radio Receiving Equipment should include the following items:

(1) A Model LP Radio Frequency Standard Signal Generator, or equivalent.

(2) An audio output meter, General Radio Company Type 583A, or equivalent.

(3) A Model OE Analyzer, or equivalent, for resistance measurements, testing vacuum tubes and measuring a-c and d-c potentials and currents in the circuits with which the tube under test is associated. The Performance and Test Data of Sections 2.3 and 6.4 may be determined with equipment as listed above.

6.12 In making any tests or adjustments, it is essential that the operator consider the influence that any one circuit element may have upon other associated circuits. The Test Data of Section 6.4 will be particularly helpful in determining extent of such influences and the necessity for making further replacement after a fault in one particular circuit element has been located and repaired.

6.13 Any repairs in the Model RBO-1 Radio Receiving Equipment which necessitate resoldering of joints should be made with care. The new joint should be such that the pieces to be soldered are firmly connected mechanically before solder is applied.

6.2 TUBE REPLACEMENT

6.21 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.

6.22 Failure of a vacuum tube in the Receiver may reduce the sensitivity of the equipment to radio signals, produce intermittent operation or cause the equipment to be completely inoperative. In such cases all tubes should be checked either in an analyzer, or similar tube testing equipment, or by replacement with tubes of proven quality. When any tube is tested it should be tapped or jarred to make sure it has no internal loose connections or intermittent short-circuits.

6.23 When tube replacements become necessary, substitution of new tubes may

alter alignment of r-f or i-f amplifier circuits inasmuch as the replacement tubes may not be identical with those originally employed. The necessity for realignment as well as alignment procedure are discussed in Section 4.

6.3 FAILURE OF THE RADIO RECEIVER

6.31 In case of breakdown or failure of the Type CZC-46224 Radio Receiver, the fault must first be localized in one portion of the circuit. This can be accomplished by observation of some peculiar action of one of the controls or by checking the Receiver against Test Data tabulated in Section 6.4. Reference to Figures 1 to 2.111, inclusive, will show the location of any component part of the Receiver. Functions and rating of component parts are given in Parts List, Section 7.

6.32 It must be remembered that the Test Data of Section 6.4 will not positively locate certain faults. For instance, an open-circuited by-pass capacitor will not appear in point to point resistance tests and may introduce regeneration or oscillation in certain circuits which effect the stage gain of other circuits. Similarly, a short circuit occurring in a low resistance inductor will not appear in point to point resistance tests and if the short appears in an R.F. coil, a false indication of the necessity for realignment may result.

6.33 By-pass or filter capacitors, which develop poor internal connections or which become open-circuited, will cause decreased sensitivity and/or poor stability. The defective unit can generally be located by temporarily connecting a good capacitor in parallel with each capacitor that is under suspicion.

6.34 Failures of any by-pass or filter capacitor may seriously overload resistors of 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.

6.35 Open or short-circuited resistors can be definitely located by testing the resistance of each individual resistor. The Schematic diagram, Figure 2.2, should be consulted to make sure that any particular resistor under test is not connected in parallel with some other circuit element which might produce misleading measurements.

6.36 Loose connections, causing intermittent or noisy operation, and which cannot be found by point to point resistance tests, can usually be located by individually testing each circuit element, or by tapping or shaking the component, under suspicion, when the Receiver is adjusted for normal operation.

6.37 The primary fuse F-101 will "blow" when the primary circuit, of transformer T-115, is subjected to a sustained primary current in excess of approximately two amperes.

6.4 TEST DATA

6.41 THE TUBE SOCKET VOLTAGES AND CATHODE CURRENTS, Table 2 must not be considered as a list of the actual operational voltages and currents in the circuits of the Type CZC-46224 Radio Receiver. The resistance of the measuring instruments, together with capacitive and resistive loading effects, will disturb many of the circuits to such an extent that they become inoperative, thus altering normal voltage and current distribution.

6.42 The only currents listed in Table 2 are those in the various cathode circuits. This listing is a desirable simplification, inasmuch as measurements of cathode current constitutes a definite check on all circuits directly associated with the vacuum tube in question.

6.43 The POINT TO POINT RESISTANCE Table 3 shows average resistance values in the Type CZC-46224 Radio Receiver with speakers disconnected from terminal panels E-103, E-104, E-105 and headphones removed from PHONE(S) jack J-101. The vacuum tubes need not be removed from their sockets. In using Table 3, the statements of Par. 6.32 must be given consideration.

6.44 All measurements in Table 1 are made with the Receiver connected for normal operation at 115 volt, 60 cycle, single phase a-c power source. The VOLUME control should be adjusted for full clockwise rotation and the FIDELITY control for approximately mid rotation.

6.5 STAGE GAIN MEASUREMENTS

6.51 The sensitivity measurements, listed below, are made under the following conditions:

(1) The Model RBO-1 Radio Receiving Equipment is set up in accordance with Par. 4.14. The Standard Signal Generator is connected in accordance with Par. 4.23, except that the high potential output lead is connected to the control grid of the tubes specified in Table 1.

(2) Adjust the Standard Signal Generator for a test signal frequency of

455 kilocycles, modulated 30% at 400 cycles.

(3) The VOLUME control of the Receiver is fully advanced, the FIDELITY control set approximately mid position and the SELECTIVITY control on SHARP position.

(4) Table 1 is a tabulation of the minimum allowable I.F. sensitivity (maximum signal input) for 10 milliwatts as measured at the PHONE(S) jack with the General Radio Type 583A output meter.

Table 1

Terminal		*I.F. Sensitivity Microvolts*
V-103	Grid	120 uv ± 20 uv
V-104	Grid	1500 uv ± 300 uv
V-105	Grid	60000 uv ± 5000 uv

Table 2: TUBE SOCKET VOLTAGES AND CATHODE CURRENTS

Terminal		*Voltages D.C. Volts*	*Currents D.C. M.A.*
V-101	Grid	0	
	Cathode	5	6.5
	Screen	110	
	Suppressor	0	
	Plate	270	
V-102	Grid	0	
	Cathode	0	8.0
	Plate	150	
V-103	Grid #1	0	
	Cathode	3.2	11.5
	Grid #3	0	
	Grid #5	0	
	Grids #2 & 4	110	
	Plate	270	
V-104	Grid	0	
	Cathode	4.8	6.7
	Screen	100	
	Suppressor	0	
	Plate	270	
V-105	Grid	0	
	Cathode	5.0	7.0
	Screen	100	
	Suppressor	0	
	Plate	270	
V-106	Cathode	0	
	Plate #1	0	
	Plate #2	0	
V-107	Grid	0	
	Cathode	3.0	1.6
	Plate	100	
V-108	Grid	0	
	Cathode	2.6	1.8
	Screen	65	
	Suppressor	0	
	Plate	70	
V-109	Grid	0	
	Cathode	20	29
	Screen	270	
	Plate	260	
V-110	Grid	0	
	Cathode	0	1.4
	Target	270	
	Plate	100	
V-111	Filament	290	31
	Plate #1	255 A.C.	
	Plate #2	255 A.C.	
V-112	Filament	290	42
	Plate #1	255 A.C.	
	Plate #2	255 A.C.	

Measured on 500 Volt Scale

Voltage measurements made with a D.C. Voltmeter, 20,000 ohms per volt. All voltage measurements made between socket terminals and Receiver chassis.

Table 3: POINT TO POINT RESISTANCES
(Terminal to Chassis)

Terminal		Variable		Resistance (Ohms) Plus or Minus 10%
		Symbol	Setting	
V-101	Grid	NONE		1.41 Meg.
	Cathode	NONE		680
	Screen	NONE		Infinite
	Suppressor	NONE		0
	Plate	NONE		Infinite
V-102	Grid	NONE		.047 Meg.
	Cathode	S-102	BC	.72
	Cathode	S-102	SW-1	.17
	Cathode	S-102	SW-2	.167
	Plate	NONE		Infinite
V-103	Grid #1	NONE		20,000
	Cathode	NONE		270
	Grid #3	NONE		1.41 Meg.
	Grid #5	NONE		0
	Grids #2 & 4	NONE		Infinite
	Plate	NONE		Infinite
V-104	Grid	S-101	SHARP	1.2 Meg.
	Grid	S-101	MED	1.2 Meg.
	Grid	S-101	BRD	1.2 Meg.
	Grid	S-101	PHONO	1.2 Meg.
	Cathode	NONE		680
	Screen	NONE		Infinite
	Suppressor	NONE		0
	Plate	NONE		Infinite
V-105	Grid	S-101	SHARP	5
	Grid	S-101	MED	15
	Grid	S-101	BRD	52
	Grid	S-101	PHONO	52
	Cathode	NONE		680
	Screen	NONE		Infinite
	Suppressor	NONE		0
	Plate	NONE		Infinite
V-106	Cathode #1	NONE		0
	Cathode #2	NONE		1.08
	Plate #1	NONE		.4 Meg.
	Plate #2	NONE		.21 Meg.
V-107	Grid	R-146	MIN	0
	Grid	R-146	MAX	.5 Meg.
		S-101	SHARP	
	Grid	R-146	MAX	.5 Meg.
		S-101	MED	
	Grid	R-146	MAX	.5 Meg.
		S-101	BRD	
	Grid	S-146	MAX	.5 Meg.
	Grid	S-101	PHONO	.5 Meg.
V-107	Cathode	NONE		2,400
	Plate	NONE		Infinite
V-108	Grid	NONE		.47 Meg.
	Cathode	NONE		1,500
	Screen	NONE		Infinite
	Suppressor	NONE		0
	Plate	NONE		Infinite

Table 3: POINT TO POINT RESISTANCES (*Continued*)
(*Terminal to Chassis*)

Terminal	*Variable*		*Resistance (Ohms) Plus or Minus* 10%
	Symbol	*Setting*	
V-109 Grid	NONE		1 Meg.
Cathode	NONE		680
Screen	NONE		Infinite
Plate	NONE		Infinite
V-110 Grid	R-148	MAX	.9 Meg.
Grid	R-148	MIN	.22 Meg.
Cathode	NONE		0
Target	NONE		Infinite
Plate	NONE		Infinite
V-111 Filament	NONE		Infinite
Plate #1	NONE		85
Plate #2	NONE		85
V-112 Filament	NONE		Infinite
Plate #1	NONE		85
Plate #2	NONE		85

7. PARTS LISTS

7.1 TABLE I

LIST OF MAJOR UNITS
FOR MODEL RBO-1 RADIO RECEIVING EQUIPMENT

Symbol Group	*Navy Type Designation*	*Name of Major Unit*	*Assembly Drawing Number*
101-199	CZC-46224	RADIO RECEIVER	

7.2 TABLE II
PARTS LIST BY SYMBOL DESIGNATIONS
FOR MODEL RBO-1 RADIO RECEIVING EQUIPMENT

Symbol Desig.	Function	Description	Navy Type Number **	Navy Drawing or Spec.	MFR.	MFR. Desig.	Special Tolerance Rating or Modification	Contractor's Drawing and Part Number
			CAPACITORS					
*C-101	Output Filter	Capacitor, paper, 4mfd, 600 volts DC working.	-481080	RE 48A 223B	9	7577A		5070
*C-102	Output Filter	Same as C-101	-481080					
*C-103	Input Filter	Same as C-101	-481080					
*C-104	Output Filter	Same as C-101	-481080					
*C-105	V-107 Cathode Bypass	Capacitor, electrolytic, 25 Mfd. +50%, —10%, 25 Volts DC working.		RE 13A 549A	9	5088		5088
*C-106		Capacitor, paper, 0.1/0.1 Mfd. each section 600 Volts DC working. Hermetically sealed.	-48703-A10	RE 48A 138D	9	7573		5069
C-106A	V-102 Heater Bypass							
C-106B	V-102 Plate Bypass							
*C-107		Same as C-106	-48703-A10					
C-107A	V-103 Cathode Bypass							
C-107B	V-103 Screen Bypass							
*C-108		Capacitor, paper, 0.1/0.1 Mfd. each section 600 Volts DC working. Hermetically sealed.	-48712-B10	RE 48A 129F	9	7574		5089
C-108A	V-108 Plate Bypass							
C-108B	V-108 Screen Bypass							
*C-109		Capacitor, paper, 0.1/0.1/0.1 Mfd. each section 600 Volts DC working. Hermetically sealed.	-48713-B10	RE 48A 129F	9	7569		5065
C-109A	V-101 Cathode Bypass							
C-109B	V-101 Plate Bypass							
C-109C	V-101 Screen Bypass							
*C-110	Filter Tuning	Capacitor, paper, 0.05 Mfd. 600 Volts DC working. Hermetically sealed.		RE 13A 488E	9	7002		7002
*C-111		Capacitor, paper, 0.05/0.05 Mfd. each section 600 Volts DC working. Hermetically sealed. For replacement use Navy type—48313C.	-48315-B10	RE 48A 129F	9	7571		5067
C-111A	Line Bypass							
C-111B	Line Bypass							
*C-112		Same as C-111	-48315-B10					
C-112A	V-103 Plate Filter							
C-112B	V-104 Grid Filter							
*C-113		Same as C-111	-48315-B10					
C-113A	V-104 Cathode bypass							
C-113B	V-104 Screen bypass							
*C-114		Same as C-111	-48315-B10					
C-114A	A.V.C. Line bypass							
C-114B	V-104 Plate filter							
C-115	Not used							

* Spare parts furnished. Refer to Table IV.

** In many cases the Navy Type Number listed is not the actual item supplied; however, this type will effect a suitable replacement.

7.2 TABLE II (*Continued*)
PARTS LIST BY SYMBOL DESIGNATIONS
FOR MODEL RBO-1 RADIO RECEIVING EQUIPMENT

Symbol Desig.	FUNCTION	DESCRIPTION	Navy Type Number **	Navy Drawing or Spec.	MFR.	MFR. Desig.	Special Tolerance Rating or Modification	Contractor's Drawing and Part Number
		CAPACITORS (*Continued*)						
*C-116		Same as C-111	-48315-B10					
C-116A	V-110 Grid bypass							
C-116B	N. L. Filter							
*C-117	V-106 to V-107 Coupling	Capacitor, paper, 0.02 Mfd. 600 Volts DC working. Hermetically sealed.	-48597-A10	RE 48A 129F	9	7570		5066
*C-118	Fidelity Control Condenser	Same as C-117	-48597-A10					
*C-119	V-107 to V-108 Coupling	Capacitor, mica, 5000 MMF, ±10% 300 Volts DC working.	CM35B502K (-481037-10)	RE 48A 143G RE 48A 154F	4	C-1250		5079
*C-120	+ B bypass	Same as C-119	CM35B502K (-481037-10)					
*C-121	Diode filter bypass	Capacitor, mica, 50 MMF, ±10%, 500 Volts DC working, Low loss case.	CM20B500K (-48895-B10)	RE 48A 148D RE 48A 154F	4	K-1450		5076
*C-122	Not used							
*C-123	Ant to V-101 Coupling	Capacitor, mica, 250 MMF ±10%, 500 Volts DC working. Low loss case.	CM20B251K (-48690-B10)	RE 48A 154F RE 48A 148D	4	K-1325		5077
*C-124	V-101 Plate coupling	Same as C-123	CM20B251K (-48690-B10)					
*C-125	V-103 Grid coupling	Same as C-123	CM20B251K (-48690-B10)					
*C-126	Not used							
*C-127	V-108 to V-109 Coupling	Same as C-119	-481037-10					
*C-128	V-102 Heater bypass	Same as C-119	-481037-10					
*C-129	V-103 B + bypass	Same as C-119	-481037-10					
*C-130	V-102 B + bypass	Same as C-119	-481037-10					
*C-131	Oscillator coupling	Capacitor, Silver mica, 50 MMF ±5%, 500 Volts DC working.	CM20D500J (-48895-D5)	RE 48A 154F RE 48A 148D	4	K-1450		7132
*C-132	Oscillator grid Coupling	Same as C-131	-48895-D5					
*C-133	T-112 Primary tuning	Capacitor, Silver mica, 100 MMF ±5%, 500 Volts DC working.	CM20D101J (-48674-D5)	RE 48A 154F RE 48A 148D	4	K-1310		7133
*C-134	Antenna tuning padder	Capacitor, Silver mica, 175 MMF ±5%, 500 Volts DC working.			4	K-13175		7285
*C-135	R.F. tuning padder	Same as C-134						
*C-136	Oscillator tuning padder	Same as C-134						
*C-137	T-110 Primary tuning	Capacitor, Silver mica, 225 MMF ±5%, 500 Volts DC working.			4	K-13225		7134
*C-138	T-110 Secondary tuning	Capacitor, Silver mica, 250 MMF ±5%, 500 Volts DC working.	CM20D251J (-48690-D5)	RE 48A 154F RE 48A 148D	4	K-1325		7135
*C-139	T-111 Primary tuning	Same as C-138	-48690-D5					
*C-140	T-111 Secondary tuning	Same as C-138	-48690-D5					

* Spare parts furnished. Refer to Table IV.
** In many cases the Navy Type Number listed is not the actual item supplied; however, this type will effect a suitable replacement.

7.2 TABLE II (*Continued*)
PARTS LIST BY SYMBOL DESIGNATIONS
FOR MODEL RBO-1 RADIO RECEIVING EQUIPMENT

Symbol Desig.	FUNCTION	DESCRIPTION	Navy Type Number **	Navy Drawing or Spec.	MFR.	MFR. Desig.	Special Tolerance Rating or Modification	Contractor's Drawing and Part Number
		CAPACITORS (*Continued*)						
*C-141	T-107 Padder fixed	Capacitor, Silver mica, 350 MMF ±5%, 500 Volts DC working.			4	K-1335		7136
*C-142	T-108 Padder	Capacitor, Silver mica, 3000 MMF ±5%, 500 Volts DC working.	CM30D302J (-481036-D5)	RE 48A 154F RE 48A 143G	4	C-1230		7137
*C-143	T-109 Padder	Capacitor, Silver mica, 4000 MMF ±5%, 300 Volts DC working.	CM35D402J (-48929-D5)	RE 48A 154F RE 48A 143G	4	C-1240		7138
C-144 C-144A C-144B	 R.F. tuning Oscillator tuning	Capacitor, variable air, 2 gang. Minimum capacity 14 MMF, Max. capacity 390 MMF. 25 plates each section curve "C", 0.015 inches min. spacing.			20	80063		5101
*C-145	T-107 trimmer	Capacitor, variable air. Minimum capacity 3 MMF, Max. capacity 25 MMF.			23	5072		5072
*C-146	T-108 trimmer	Capacitor, variable air. Minimum capacity 4 MMF, Max. capacity 50 MMF.			23	5073		5073
*C-147	T-109 trimmer	Same as C-146						
*C-148	T-107 variable padder	Capacitor, variable air. Minimum capacity 6 MMF, Max. capacity 75 MMF.			23	5074		5074
*C-149	T-101 trimmer	Capacitor, Var. mica, Min. capacity 1 MMF, Max. capacity 12 MMF. Compression type.			26	T-6616		6093
*C-150	T-102 trimmer	Capacitor, variable mica, Minimum capacity 4 MMF, Max. capacity 60 MMF. Compression type.			26	18F-47		5071
*C-151	T-103 trimmer	Same as C-150						
*C-152	T-104 trimmer	Same as C-149						
*C-153	T-105 trimmer	Same as C-150						
*C-154	T-106 trimmer	Same as C-150						
*C-155	V-107 Plate filter	Same as C-109	-48713-B10					
C-156	Antenna tuning	Capacitor, variable air. min. capacity 14 MMF, Max. capacity 390 MMF 25 plates, curve "C", 0.015 min. spacing.			20	80062		5100
*C-157 C-157A C-157B C-157C	 V-105 screen bypass V-105 cathode bypass V-105 plate bypass	Same as C-109	-48713-B10					
C-158	V-101 plate filter	Capacitor, mica, 5000 MMF ±20%, 300 Volts DC working.	CM35B502M (-481037-20)	RE 48A 148D RE 48A 154F	4	C-1250		7272

* Spare parts furnished. Refer to Table IV.
** In many cases the Navy Type Number listed is not the actual item supplied; however, this type will effect a suitable replacement.

7.2 TABLE II (*Continued*)
PARTS LIST BY SYMBOL DESIGNATIONS
FOR MODEL RBO-1 RADIO RECEIVING EQUIPMENT

Symbol Desig.	FUNCTION	DESCRIPTION	Navy Type Number **	Navy Drawing or Spec.	MFR.	MFR. Desig.	Special Tolerance Rating or Modification	Contractor's Drawing and Part Number
		MISCELLANEOUS ELECTRICAL PARTS						
E-101	V-101 Grid cap	¼" Grid cap for octal tubes			17	Type 8		5045
E-102	Phono input terminals	Phono input two terminal strip marked PHONO and GND, Terminals have captive screws.			11	6001		6001
E-103	Speaker output term. 5000 ohm	Speaker output two terminal strip marked 5000 ohm SPKR. Terminals have captive screws.			11	6003		6003
E-104	Speaker output term. 600 ohm	Speaker output two terminal strip marked 600 ohm SPKR. Terminals have captive screws.			11	6004		6004
E-105	Line term. 60 ohm	Output two terminal strip marked 60 ohm LINE. Terminals have captive screws.			11	6005		6005
E-106	AC power receptacle	Two pole plug set in drawn steel shell for below surface mounting.			2	#61-M-10		7000
E-107	SW II lamp socket	Bayonet type socket			14	5174		5174
E-108	SW I lamp socket	Bayonet type socket			14	5173		5173
E-109	BC lamp socket	Bayonet type socket			14	5172		5172
E-110	Phono lamp socket	Bayonet type socket			14	5171		5171
E-111	Dial lamp socket	Bayonet type socket			14	5041		5041
E-112	Dial lamp socket	Same as E-111						
E-113	V-101 grid lead insul.	Porcelain lead through bushing			12	#44 Code word "STUMP"		5036
E-114	L-101 support insul.	Same as E-113						
E-115	L-101 support insul.	Same as E-113						
E-116	Treble control knob	1½" Black bakelite knob.			27	421027-502		5119
E-117	Volume control knob	Same as E-116						
E-118	Main tuning knob	2⅛" Black bakelite knob.			27	414778-503		5120
E-119	Wave Change knob	Same as E-116						
E-120	Selectivity knob	Same as E-116						
E-121	T-101 Sec. Inductance Trimmer	Compressed powdered-iron core coil inductance trimmer.			22	5103		5103
E-122	T-102 Sec. Inductance Trimmer	Compressed powdered-iron core coil inductance trimmer.			22	5102		5102
E-123	T-103 Sec. Inductance Trimmer	Same as E-122						
E-124	T-104 Sec. Inductance Trimmer	Same as E-121						

* Spare parts furnished. Refer to Table IV.
** In many cases the Navy Type Number listed is not the actual item supplied; however, this type will effect a suitable replacement.

7.2 TABLE II (*Continued*)
PARTS LIST BY SYMBOL DESIGNATIONS
FOR MODEL RBO-1 RADIO RECEIVING EQUIPMENT

Symbol Desig.	Function	Description	Navy Type Number **	Navy Drawing or Spec.	MFR.	MFR. Desig.	Special Tolerance Rating or Modification	Contractor's Drawing and Part Number
		MISCELLANEOUS ELECTRICAL PARTS (*Continued*)						
E-125	T-105 Sec. Inductance Trimmer	Same as E-122						
E-126	T-106 Sec. Inductance Trimmer	Same as E-122						
E-127	T-107 Sec. Inductance Trimmer	Same as E-121						
E-128	T-108 Sec. Inductance Trimmer	Same as E-122						
E-129	T-109 Sec. Inductance Trimmer	Same as E-122						
E-130	T-110 Pri. Inductance Trimmer	Same as E-121						
E-131	T-110 Sec. Inductance Trimmer	Same as E-121						
E-132	T-111 Pri. Inductance Trimmer	Same as E-121						
E-133	T-111 Sec. Inductance Trimmer	Same as E-121						
E-134	T-112 Pri. Inductance Trimmer	Same as E-121						
		FUSES						
*F-101	AC line fuse	Fuse, 2 Amps, up to 250 V., cartridge type, 1¼" long, ferrules ¼" diameter.			13	‡1042(3AG)		5111
		HARDWARE						
H-101	Plug button for T-101 Trimmer	½" Plug button			21	5038		5038
H-102	Plug button for T-102 Trimmer	Same as H-101						
H-103	Plug button for T-103 Trimmer	Same as H-101						
H-104	Not used							
H-105	Plug button for T-110 Shield	½" Plug button			21	5037		5037
H-106	Plug button for T-111 Shield	Same as H-105						
H-107	N-106 to C-144 coupling	Insulated coupling for ⅜" shaft			21	6081		6081
H-108	C-144 to C-156 coupling	Insulated coupling for ⅜" shaft			21	6081A		6081A
H-109	O-101 to O-102 coupling	Insulated coupling for ¼" shaft			21	5106		5106
H-110	Dial escutcheon	Transparent Escutcheon			3	5109		5109
H-111	Pull Handle	Right Pull Handle			3	5115		5115
H-112	Pull Handle	Left Pull Handle			3	5115		5115
H-113	Captive thumb screws	8/32 Captive thumb screws			21	5166		5166
H-114	Panel thumb screws	10/32 thumb screws			21	5167		5167
H-115	Shock Mounting	Rubber Shock Mounting			15	200 PH 20		5170
		INDICATING DEVICES						
*I-101	SW II Indicator lamp	Type 44—6.3V, .25A lamp			8	44		5110
*I-102	SW I Indicator lamp	Same as I-101						
*I-103	B.C. Indicator lamp	Same as I-101						
*I-104	Phono Indicator lamp	Same as I-101						
*I-105	Dial lighting lamp	Same as I-101						
*I-106	Dial lighting lamp	Same as I-101						

* Spare parts furnished. Refer to Table IV.
** In many cases the Navy Type Number listed is not the actual item supplied; however, this type will effect a suitable replacement.

7.2 TABLE II (*Continued*)
PARTS LIST BY SYMBOL DESIGNATIONS
FOR MODEL RBO-1 RADIO RECEIVING EQUIPMENT

Symbol Desig.	Function	Description	Navy Type Number **	Navy Drawing or Spec.	MFR.	MFR. Desig.	Special Tolerance Rating or Modification	Contractor's Drawing and Part Number
			JACK AND RECEPTACLES					
J-101	Phone Jack	Jack, single, open circuit, short, for 2 conductor plugs, with tip and sleeve only.			16	#501		5118
J-102	Fuse Holder	Extractor type fuse holder			13	#1075		5112
J-103	Concentric Antenna Jack	Concentric line jack for RF connections	-49120	RA 49F 215D	5			7010
			INDUCTORS R.F. & A.F.					
L-101	V-101 Plate choke	Radio Frequency choke, 2.5 M H., 125 MA.DC, distributed capacity 1MMF 50 ohms DC resistance. Pigtail terminals.	-47122		17	R-100		5047
L-102	V-103 + B choke	Same as L-101	-47122					
L-103	V-102 + B choke	Same as L-101	-47122					
L-104	V-102 heater filter	RF choke, 32 turns of #20 wire			21	5046		5046
L-105	Audio + B filter choke	32 H, 40MA choke ±10% Test voltage 1500 RMS 3900 T #34E, 450 OHMS.			25	T-46788		5048
L-106	RF + B filter choke	Same as L-105			25			
			NAMEPLATES, DIALS, CHARTS					
N-101	Type nameplate	Etched type plate			7	7281		7281
N-102	Model nameplate	Etched Model plate			7	7280		7280
N-103	Service nameplate	Etched Service Plate			7	6082		6082
N-104	Linear dial	Etched linear scale			7	5107A		5107A
N-105	Dial Index plate	Etched indicator index plate			7	5107B		5107B
N-106	Dial main tuning	Friction Drive dial pointer			3	5107		5107
N-107	Frequency dial	Dial plate with lucite calibration			3	5108		5108
			PLUGS					
P-101	Antenna and ground plug	Concentric plug single circuit for RF connection	-49121-A	RA 49F 216D	5			7009
P-102	Power input receptacle & plug	Receptacle, 2 pole			2	61-F11		7006
			MECHANICAL PARTS, SHAFTS					
O-101	Band switch shaft	Switch shaft & detent plate			18	5195-A		5195-A
O-102	Band switch shaft extension	Shaft extension			21	7018		7018
O-103	Selectivity switch shaft	Switch shaft & detent plate			18	5196-A		5196-A

* Spare parts furnished. Refer to Table IV.
** In many cases the Navy Type Number listed is not the actual item supplied; however, this type will effect a suitable replacement.

7.2 TABLE II (*Continued*)
PARTS LIST BY SYMBOL DESIGNATIONS
FOR MODEL RBO-1 RADIO RECEIVING EQUIPMENT

Symbol Desig.	Function	Description	Navy Type Number **	Navy Drawing or Spec.	MFR.	MFR. Desig.	Special Tolerance Rating or Modification	Contractor's Drawing and Part Number
			RESISTORS					
*R-101	T-111 secondary series	Resistor, wire wound, 10 ohms, ±10%, ½ watt, phenolic insulated. Pigtail type terminals.	-63678-10	RE 13A 340C	10	BW½		5131
*R-102	T-111 secondary series	Resistor, wire wound, 47 ohms, ±10%, ½ watt, phenolic insulated. Pigtail type terminals.	-63678-10	RE 13A 340C	10	BW½		5132
*R-103	T-110 secondary series	Same as R-102	-63678-10					
*R-104	T-110 secondary series	Same as R-102	-63678-10					
*R-105	V-103 Cathode bias	Resistor, composition, 270 ohms, ±5%, ½ watt, pigtail terminals	-63355	RE 13A 340C	10	BT½		5133
*R-106	Phone pad resistor	Same as R-105	-63355					
*R-107	Phone pad resistor	Same as R-105	-63355					
*R-108	Phone pad resistor	Resistor, composition, 560 ohms, ±5%, ½ watt, pigtail terminals	-63355	RE 13A 340C	10	BT½		5134
*R-109	V-101 Cathode bias	Resistor, composition, 680 ohms, ±5%, ½ watt, pigtail terminals	-63355	RE 13A 340C	10	BT½		5135
*R-110	V-104 Cathode bias	Same as R-109	-63355					
*R-111	V-105 Cathode bias	Same as R-109	-63355					
*R-112	V-101 Plate filter	Resistor, composition, 1000 ohms, ±10%, ½ watt, pigtail terminals	-63360	RE 13A 340C	10	BT½		5136
*R-113	V-103 Plate filter	Same as R-112	-63360					
*R-114	V-104 Plate filter	Same as R-112	-63360					
*R-115	V-105 Plate filter	Same as R-112	-63360					
*R-116	V-108 Cathode bias	Resistor, composition, 1500 ohms, ±10%, ½ watt, pigtail terminals.	-63360	RE 13A 340C	10	BT½		5137
*R-117	V-107 Cathode bias	Resistor, composition, 2400 ohms, ±10%, ½ watt, pigtail terminals.	-63360	RE 13A 340C	10	BT½		5138
*R-118	V-103 Grid #1 resistor	Resistor, composition, 20,000 ohms, ±10%, ½ watt, pigtail terminals.	-63360	RE 13A 340C	10	BT½		5139
*R-119	T-113 to V-108 Feedback	Resistor, composition, 10,000 ohms, ±10%, ½ watt, pigtail terminals.	-63360	RE 13A 340C	10	BT½		7008
*R-120	Not used							
R-121	Not used							
*R-122	V-102 Grid leak	Resistor, composition, 47,000 ohms, ±10%, ½ watt, pigtail terminals.	-63360	RE 13A 340C	10	BT½		5141
*R-123	V-107 plate load	Same as R-122	-63360					
*R-124	V-107 plate filter	Same as R-122	-63360					
*R-125	V-108 plate filter	Same as R-122	-63360					

* Spare parts furnished. Refer to Table IV.
** In many cases the Navy Type Number listed is not the actual item supplied; however, this type will effect a suitable replacement.

7.2 TABLE II (*Continued*)
PARTS LIST BY SYMBOL DESIGNATIONS
FOR MODEL RBO-1 RADIO RECEIVING EQUIPMENT

Symbol Desig.	FUNCTION	DESCRIPTION	Navy Type Number **	Navy Drawing or Spec.	MFR.	MFR. Desig.	Special Tolerance Rating or Modification	Contractor's Drawing and Part Number
		RESISTORS (*Continued*)						
*R-126	V-101 screen filter	Resistor, composition, 100,000 ohms ±10%, ½ watt, pigtail terminals.	-63360	RE 13A 340C	10	BT½		5142
*R-127	V-104 screen filter	Same as R-126	-63360					
*R-128	V-105 screen filter	Same as R-126	-63360					
*R-129	Not used							
*R-130	Not used							
*R-131	Not used							
*R-132	V-108 plate load	Resistor, composition, .47 Meg. ±10%, ½ watt, pigtail terminals.	-63360	RE 13A 340C	10	BT½		5145
*R-133	V-109 to V-108 feedback	Resistor composition, .22 Meg. ±10%, ½ watt, pigtail terminals.	-63360	RE 13A 340C	10	BT½		5144
*R-134	V-104 grid filter	Same as R-133	-63360					
*R-135	V-101 grid filter	Same as R-132	-63360					
*R-136	V-103 grid filter	Same as R-132	-63360					
*R-137	V-108 grid leak	Same as R-132	-63360					
*R-138	V-108 screen filter	Same as R-132	-63360					
*R-139	A.V.C. filter	Resistor, composition, 1 Meg. ±10%, ½ watt, pigtail terminals.	-63360	RE 13A 340C	10	BT½		5146
*R-140	Eye control limiting	Same as R-133	-63360					
*R-141	V-109 grid leak	Same as R-139	-63360					
*R-142	V-110 indicator filter	Resistor, composition, 2.2 Meg. ±10%, ½ watt, pigtail terminals.	-63360	RE 13A 340C	10	BT½		5147
*R-143	V-102 plate filter	Resistor, composition, 15,000 ohms ±10%, 2 watt, pigtail terminals	-63474	RE 13A 340C	10	BT2		7230
*R-144	V-103 screen filter	Resistor, composition, 18,000 ohms ±10%, 2 watt, pigtail terminals.	-63474	RE 13A 340C	10	BT2		7231
*R-145	V-109 cathode bias	Resistor, wire wound, 680 ohms, ±5%, 2 watts, phenolic insulated, pigtail type terminals.	-63705-5		10	BW-2		6050
*R-146	Volume control	Potentiometer, .5 meg ±20% Composition, semi-logarithmic Clockwise taper, shaft .250x2.187			10	VC-11954		5129
*R-147	Treble control	Potentiometer, .25 meg ±20% Composition, semi-logarithmic Clockwise taper, shaft .250x2.187			10	VC-11955		5130
*R-148	Tuning indicator control	Potentiometer 1 meg ±20% Composition, linear taper Shaft .250 x.500, screwdriver slot			10	VC-11953		5128

* Spare parts furnished. Refer to Table IV.
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7.2 TABLE II (*Continued*)
PARTS LIST BY SYMBOL DESIGNATIONS
FOR MODEL RBO-1 RADIO RECEIVING EQUIPMENT

Symbol Desig.	Function	Description	Navy Type Number **	Navy Drawing or Spec.	MFR.	MFR. Desig.	Special Tolerance Rating or Modification	Contractor's Drawing and Part Number
		RESISTORS (*Continued*)						
R-149	V-106 diode filter	Same as R-133	-63360					
R-150	V-106 diode load	Same as R-133	-63360					
R-151	V-106 noise limiter bias	Resistor, composition, 0.82 Meg. ±10%, ½ watt, pigtail terminals.	-63360	RE 13A 340C	10	BT½		7090
R-152	Noise limiter bias filter	Same as R-139	-63360					
		SWITCHES						
S-101A	Phono Radio section	Selectivity gang switch, rotary type, 3 wafer sections			18	5196-B-#1		5196-B
B	#1 IF selectivity section					5196-B-#2		
C	#2 IF selectivity section							
S-102		Band switch, rotary type, 5 wafer sections			18	5195-B-#1		5195-B
A	Indicator lamp section					5195-B-#2		
B	Oscillator section					5195-B-#3		
C	R.F. section					5195-B-#4		
D	Antenna secondary section					5195-B-#5		
E	Antenna primary section							
*S-103	A.C. - off - on switch	Toggle switch S.P.S.T., silver plated contacts rated 3A, 250 volts DC	-24000	RE 24AA 118A	6	8280		5197
*S-104	N.L. - on - off switch	Toggle switch S.P.S.T., silver plated contacts rated 3A, 250 volts DC	-24002	RE 24AA 118A	1	21350 ES		7091
		TRANSFORMERS R.F., A.F. AND POWER						
T-101	J-103 to V-101 coupling B.C. band	R.F.Transformer assembly antenna section Pri.D.C. resistance 0.58 ohms ±10% Sec.D.C. resistance 4.73 ohms ±10%			21	5050 PRI 5051 SEC		Pri-5050 Sec-5051
T-102	J-103 to V-101 coupling S.W.I. band	R.F.Transformer assembly antenna section Pri.D.C. resistance 0.2 ohms ±10% Sec.D.C. resistance 0.11 ohms ±10%			21	5054 PRI 5055 SEC		Pri-5054 Sec-5055
T-103	J-103 to V-101 coupling S.W. II band	R.F.Transformer assembly antenna section Pri.D.C. resistance 0.16 ohms ±10% Sec.D.C. resistance 0.06 ohms ±10%			21	5058 PRI 5059 SEC		Pri-5058 Sec-5059
T-104	V-101 to V-103 coupling B.C. band	R.F.Transformer assembly R.F. section Pri.D.C. resistance 0.3 ohms ±10% Sec.D.C. resistance 4.82 ohms ±10%			21	5052		5052
T-105	V-101 to V-103 coupling S.W.I. band	R.F.Transformer assembly R.F. section Pri.D.C. resistance 0.14 ohms ±10% Sec.D.C. resistance 0.11 ohms ±10%			21	5056		5056

* Spare parts furnished. Refer to Table IV.
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7.2 TABLE II (*Continued*)
PARTS LIST BY SYMBOL DESIGNATIONS
FOR MODEL RBO-1 RADIO RECEIVING EQUIPMENT

Symbol Desig.	FUNCTION	DESCRIPTION	Navy Type Number **	Navy Drawing or Spec.	MFR.	MFR. Desig.	Special Tolerance Rating or Modification	Contractor's Drawing and Part Number
		TRANSFORMERS R.F., A.F. AND POWER (*Continued*)						
T-106	V-101 to V-103 coupling S.W.II band	R.F.Transformer assembly R.F. section Pri.D.C. resistance 0.094 ohms ±10% Sec.D.C. resistance 0.062 ohms ±10%			21	5060		5060
T-107	B.C. Band oscillator	R.F.Transformer assembly oscillator section Tap, D.C. resistance 0.564 ohms ±10% Total coil, D.C. resistance 3.1 ohms ±10%			21	5053		5053
T-108	S.W.I. Band oscillator	R.F.Transformer assembly oscillator section Tap, D.C. resistance 0.03 ohms ±10% Total coil, D.C. resistance 0.1 ohms ±10%			21	5057		5057
T-109	S.W.II Band oscillator	R.F.Transformer assembly oscillator section Tap, D.C. resistance 0.023 ohms ±10% Total coil, D.C. resistance 0.06 ohms ±10%			21	5061		5061
T-110	V-103 to V-104 coupling	1st I.F. Transformer 455 K.C. Pri.D.C. resistance 4.65 ohms ±10% Sec.D.C. resistance 4.78 ohms ±10%			21	5062		5062
T-111	V-104 to V-105 coupling	2nd I.F. Transformer 455 K.C. Pri.D.C. resistance 4.89 ohms ±10% Sec.D.C. resistance 4.78 ohms ±10%			21	5063		5063
T-112	V-105 to V-106 coupling	3rd I.F. Transformer 455 K.C. Pri.D.C. resistance 13 ohms ±10% Sec.D.C. resistance 17.4 ohms ±10%			21	5064		5064
T-113	V-109 to Speaker terminals	Output Transformer Pri.2500 turns #37 E, D.C. resistance 649 ohms ±10% Sec. #1, 236 turns #26E, D.C. resistance 5.088 ohms ±10% Sec. #2, 753 turns #31E, D.C. resistance 55.8 ohms ±10% Sec. #3, 2250 turns #36E, D.C. resistance 489 ohms ±10%			25	T-46789	Pri. impedance 8000 ±20% at 400 cycles 40 MA. Sec. #1,60 ohms ± 20% Sec. #2,600 ohms ± 20% Sec. #3,5000 ohms ± 20%	6008
T-114	Not used							

* Spare parts furnished. Refer to Table IV.

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7.2 TABLE II (*Continued*)
PARTS LIST BY SYMBOL DESIGNATIONS
FOR MODEL RBO-1 RADIO RECEIVING EQUIPMENT

Symbol Desig.	FUNCTION	DESCRIPTION	Navy Type Number **	Navy Drawing or Spec.	MFR.	MFR. Desig.	Special Tolerance Rating or Modification	Contractor's Drawing and Part Number
		VACUUM TUBES						
T-115	Power transformer	Pri. 82.5VA, 115V, 0.71A ±10% DC resistance 3.1 ohms ±10% Sec. #1, 255V, 40MA ±10% Sec. #1, 255V, 40MA ±10% Center tapped DC resistance total 165.2 ohms ±10% Sec. #2, 6.3V, 3.8A AC DC resistance .075 ohms ±10% Sec. #3, 5V, 4A, AC DC resistance .052 ohms ±10%			25	T-47901		7233
*V-101	R.F. amplifier	Vacuum tube (Receiving—Metal). Triple-grid super-control amplifier. Base: Small wafer octal 7 pin. Miniature cap. Heater: Current 0.30 amp at 6.3 volts AC or DC	-6K7	RE 13A 600E	19	6K7		6017
*V-102	H.F. oscillator	Vacuum tube (Receiving—Metal). Detector amplifier triode. Base: Small wafer octal 6 pin, phenolic. Heater: Current 0.30 amp at 6.3 volts AC or DC	-6J5	RE 13A 600E	19	6J5		6015
*V-103	1st detector and mixer	Vacuum tube (Receiving—Metal). Pentagrid converter. Base: Small wafer octal 8-pin, phenolic. Heater: current 0.3 amp at 6.3 volts AC or DC	-6SA7	RE 13A 600E	19	6SA7		6014
*V-104	1st I.F. amplifier	Vacuum tube (Receiving—Metal). Triple grid super-control amplifier. Base: Small wafer octal 8 pin, phenolic. Heater: Current 0.30 amp at 6.3 volts AC or DC	-6SK7	RE 13A 600E	19	6SK7		6016
*V-105	2nd I.F. amplifier	Same as V-104	-6SK7					
*V-106	Second detector and A.V.C.	Vacuum tube (Receiving tube—Metal). Twin diode. Base: Small wafer octal 7 pin. Heater: Current 0.30 amp at 6.3 volts AC or DC	-6H6	RE 13A 600E	19	6H6		6010
*V-107	Ist Audio amplifier	Same as V-102	-6J5					

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7.2 TABLE II (*Continued*)
PARTS LIST BY SYMBOL DESIGNATIONS
FOR MODEL RBO-1 RADIO RECEIVING EQUIPMENT

Symbol Desig.	FUNCTION	DESCRIPTION	Navy Type Number **	Navy Drawing or Spec.	MFR.	MFR. Desig.	Special Tolerance Rating or Modification	Contractor's Drawing and Part Number
		VACUUM TUBES (*Continued*)						
*V-108	2nd Audio amplifier	Vacuum tube (Receiving — Pentode metal). Triple Grid Detector Amplifier. Base: Small wafer octal 8 pin, phenolic. Heater: current 0.3 amp at 6.3 volts AC or DC	-6SJ7	RE 13A 600E	19	6SJ7		6009
*V-109	Output amplifier	Vacuum Tube (Receiving — Pentode glass). Power amplifier Pentode. Base: Medium Shell Octal 7 pin, phenolic. Heater: current 0.4 amp at 6.3 volts AC or DC	-6K6-GT	RE 13A 600E	19	6K6-GT		6011
*V-110	Tuning indicator	Vacuum Tube (Receiving—Glass). Electron-Ray tube (Indicator). Base: Small 6 pin, phenolic. Heater: Current 0.30 amp at 6.3 volts AC or DC	-6E5	RE 13A 600E	19	6E5		6012
*V-111	Rectifier	Vacuum Tube (Receiving—Glass). Full wave high vacuum rectifier. Base: intermediate shell octal 5 pin, phenolic. Heater: Current 2.0 amp at 5.0 volts AC	-5Y3-GT	RE 13A 600E	19	5Y3-GT		7238
*V-112	Rectifier	Same as V-111	-5Y3-GT					
		SOCKETS						
*X-101	Socket for V-101	Vacuum tube socket eight contact (octal) plug-in type, with retaining ring and spacer washer. Molded ceramic base. Circular.	-49373	RE 49AA 313A	2	RSS8M		5175
*X-102	Socket for V-102	Same as X-101						
*X-103	Socket for V-103	Same as X-101						
*X-104	Socket for V-104	Same as X-101						
*X-105	Socket for V-105	Same as X-101						
*X-106	Socket for V-106	Same as X-101						
*X-107	Socket for V-107	Same as X-101						
*X-108	Socket for V-108	Same as X-101						
*X-109	Socket for V-109	Same as X-101						
X-110	Socket for V-110	Vacuum tube socket, 6 prong, phenolic.			14	5040		5040
*X-111	Socket for V-111	Same as X-101						
*X-112	Socket for V-112	Same as X-101						

* Spare parts furnished. Refer to Table IV.
** In many cases the Navy Type Number listed is not the actual item supplied; however, this type will effect a suitable replacement.

7.3 TABLE III
PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL RBO-1 RADIO RECEIVING EQUIPMENT

Quantity	Navy Type Number	All Symbol Designations Involved
MISCELLANEOUS Class 10		
1		E-101
1		E-102
1		E-103
1		E-104
1		E-105
1		E-106
1		E-107
1		E-108
1		E-109
1		E-110
2		E-111, E-112
3		E-113, E-114, E-115
4		E-116, E-117, E-119, E-120
1		E-118
8		E-121, E-124, E-127, E-130, E-131, E-132, E-133, E-134
6		E-122, E-123, E-125, E-126, E-128, E-129
3		H-101, H-102, H-103
	Not Used	H-104
2		H-105, H-106
1		H-107
1		H-108
1		H-109
1		H-110
2		H-111, H-112
21		H-113
8		H-114
4		H-115
6		I-101, I-102, I-103, I-104 I-105, I-106
1		N-101
1		N-102
1		N-103
1		N-104
1		N-105
1		N-106
1		N-107
1		O-101
1		O-102
1		O-103
SWITCHES Class 24		
1	-24000	S-103
1		S-101
1		S-102
1	-24002	S-104
FUSES Class 28		
1		F-101
POWER TRANSFORMERS and A.F. INDUCTORS Class 30		
2		L-105, L-106
1		T-113
	Not used	T-114
1		T-115
VACUUM TUBES Class 38		
1	-6E5	V-110
1	-6H6	V-106
2	-6J5	V-102, V-107
1	-6K6-GT	V-109
1	-6K7	V-101
1	-6SA7	V-103
1	-6SJ7	V-108
2	-6SK7	V-104, V-105
2	-5Y3-GT	V-111, V-112
R.F. CHOKES and TRANSFORMERS Class 47		
3	-47122	L-101, L-102, L-103
1		L-104
1		T-101
1		T-102
1		T-103
1		T-104
1		T-105
1		T-106
1		T-107
1		T-108
1		T-109
1		T-110
1		T-111
1		T-112
CAPACITORS Class 48		
5	-48315-B10	C-111, C-112, C-113, C-114, C-116

7.3 TABLE III (*Continued*)
PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL RBO-1 RADIO RECEIVING EQUIPMENT

Quantity	Navy Type Number	All Symbol Designations Involved
	CAPACITORS (*Continued*) Class 48	
2	-48597-A10	C-117, C-118
1	CM20D101J (-48674-D5)	C-133
3	CM20B251K (-48690-B10)	C-123, C-124, C-125
3	CM20D251J (-48690-D5)	C-138, C-139, C-140
2	-48703-A10	C-106, C-107
1	-48712-B10	C-108
3	-48713-B10	C-109, C-155, C-157
1	CM20B500K (-48895-B10)	C-121
2	CM20D500J (-48895-D5)	C-131, C-132
1	CM35D402J (-48929-D5)	C-143
1	CM30D302J (-481036-D5)	C-142
6	CM35B502K (-481037-10)	C-119, C-120, C-127, C-128, C-129, C-130
1	CM35B502M (-481037-10)	C-158
4	-481080	C-101, C-102, C-103, C-104
1		C-105
1		C-110
3		C-134, C-135, C-136
1		C-137
1		C-141
1		C-144
1		C-145
2		C-146, C-147
1		C-148
2		C-149, C-152
4		C-150, C-151, C-153, C-154,
1		C-156

Quantity	Navy Type Number	All Symbol Designations Involved
	JACKS and PLUGS Class 49	
1	-49120	J-103
1	-49121A	P-101
1		J-101
1		J-102
1		P-102
	VACUUM TUBE SOCKETS Class 49	
11	-49373	X-101, X-102, X-103, X-104, X-105, X-106, X-107, X-108, X-109, X-111, X-112
1		X-110
	RESISTORS Class 63	
3	-63355	R-105, R-106, R-107
1	-63355	R-108
3	-63355	R-109, R-110, R-111
1	-63360	R-117
1	-63360	R-118
4	-63360	R-112, R-113, R-114, R-115
1	-63360	R-116
1	-63360	R-119
	Not Used	R-121
4	-63360	R-122, R-123, R-124, R-125
3	-63360	R-126, R-127, R-128
5	-63360	R-133, R-134, R-140, R-149, R-150
5	-63360	R-132, R-135, R-136, R-137, R-138
3	-63360	R-139, R-141, R-152
1	-63360	R-142
1	-63474	R-143

Quantity	Navy Type Number	All Symbol Designations Involved
	RESISTORS (*Continued*) Class 63	
1	-63474	R-144
1	-63678-10	R-101
3	-63678-10	R-102, R-103, R-104
1	-63705-5	R-145
1	-63360	R-151
1		R-146
1		R-147
1		R-148

7.4 TABLE IV—SPARE PARTS LIST BY NAVY TYPE NUMBERS FOR MODEL RBO-1 RADIO RECEIVING EQUIPMENT

Quantity	Navy Type Number	All Symbol Designations Involved	Description	Navy Drawing or Spec.	MFR.	Mfr. Desig.	Special Tolerance Rating or Modification	Contractor's Drawing and Part Number
			MISCELLANEOUS (Class 10)					
3		I-101, I-102, I-103, I-104, I-105, I-106	Type 44—6.3 V 0.25A lamp		8	44		5110
44			Tube socket contacts		2			5175A
			SWITCHES (Class 24)					
1	-24000	S-103	Toggle switch S.P.S.T. Silver plated contacts. Rated 3A, 250V. D.C.	RE 24AA-118A	6	8280		5197
1	-24002	S-104	Toggle switch, S.P.D.T. silver plated contacts. Rated 3 amp 250 volts DC	RE24AA 118A	6			7091
			FUSES (Class 28)					
1		F-101	Fuse, 2 Amps, up to 250 V., cartridge type, 1¼" long, ferrules ¼" diameter		13	#1042 (3AG)		5111
			TRANSFORMERS & REACTORS (Class 30)					
1		T-113	Output Transformer. Pri. 2500 turns #37E, D.C. Resistance 649 ohms ±10%. Sec. #1, 236 turns #26E, D.C. Resistance 5.088 ohms ±10%. Sec. #2, 753 turns #31E, D.C. Resistance 55.80 ohms ±10%. Sec. #3, 2250 turns #36E, D.C. Resistance 489 ohms ±10%		25	T-46789	Pri. Impedance 8,000 ohms ±20% at 400 cycles 40 MA. Sec. #1, 60 ohms ±20% Sec. #2, 600 ohms ±20% Sec. #3, 5,000 ohms ±20%	6008
			VACUUM TUBES (Class 38)					
1	-6E5	V-110	Vacuum Tube (Receiving—Glass Electron-Ray tube) (indicator type). Base: Small 6 pin, phenolic. Heater: current 0.3 amp at 6.3 volts AC or DC	RE 13A 600E	19	6E5		6012
1	-6H6	V-106	Vacuum tube (Receiving tube—Metal) Twin diode. Base: Small wafer octal 7 pin. Heater: current 0.30 amp at 6.3 volts AC or DC	RE 13A 600E	19	6H6		6010
2	-6J5	V-102, V-107	Vacuum tube (Receiving—Metal). Detector amplifier triode. Base: Small wafer octal 6 pin, phenolic. Heater: current 0.30 amp at 6.3 volts AC or DC	RE 13A 600E	19	6J5		6015

7.4 TABLE IV (*Continued*) SPARE PARTS LIST BY NAVY TYPE NUMBERS FOR MODEL RBO-1 RADIO RECEIVING EQUIPMENT

Quantity	Navy Type Number	All Symbol Designations Involved	Description	Navy Drawing or Spec.	MFR.	Mfr. Desig.	Special Tolerance Rating or Modification	Contractor's Drawing and Part Number
			VACUUM TUBES (Class 38) (*Continued*)					
1	-6K6-GT	V-109	Vacuum tube (Receiving — Pentode glass). Power amplifier Pentode. Base: Medium Shell Octal 7 pin, phenolic. Heater: current 0.4 amp at 6.3 volts AC or DC	RE 13A 600E	19	6K6-GT		6011
1	-6K7	V-101	Vacuum tube (Receiving—Metal). Triple-grid super-control amplifier. Base: Small wafer octal 7 pin. Miniature cap. Heater: Current 0.30 amp at 6.3 volts AC or DC		19	6K7		6017
1	-6SA7	V-103	Vacuum tube (Receiving—Metal). Pentagrid converter. Base: Small wafer octal 8 pin, phenolic. Heater: Current 0.3 amp at 6.3 volts AC or DC	RE 13A 600E	19	6SA7		6014
1	-6SJ7	V-108	Vacuum tube (receiving—Pentode metal). Triple grid Detector Amplifier. Base: Small wafer octal 8 pin, phenolic. Heater: Current 0.3 amp at 6.3 volts AC or DC	RE 13A 600E	19	6SJ7		6009
2	-6SK7	V-104, V-105	Vacuum tube (Receiving—Metal). Triple grid super-control amplifier. Base: Small wafer octal 8 pin, phenolic. Heater: Current 0.30 amp at 6.3 volts AC or DC	RE 13A 600E	19	6SK7		6016
2	-5Y3-GT	V-111, V-112	Vacuum Tube (receiving—Glass). Full wave high vacuum rectifier. Base: intermediate shell octal 5 pin, phenolic. Heater: Current 2 amp at 5 volts AC		19	5Y3-GT		7238
			CAPACITORS (Class 48)					
3	-48315-B10	C-111, C-112, C-113, C-114, C-116	Capacitor, paper, 0.05/0.05 Mfd., each section 600 Volts DC working. Hermetically sealed. For replacement use Navy type—48313C	RE 48A 129F	9	7571		5067

7.4 TABLE IV (*Continued*) SPARE PARTS LIST BY NAVY TYPE NUMBERS FOR MODEL RBO-1 RADIO RECEIVING EQUIPMENT

Quantity	Navy Type Number	All Symbol Designations Involved	Description	Navy Drawing or Spec.	MFR.	Mfr. Desig.	Special Tolerance Rating or Modification	Contractor's Drawing and Part Number
			CAPACITORS (Class 48) *(Continued)*					
1	-48597-A10	C-117, C-118	Capacitor, paper, 0.02 Mfd. 600 Volts DC working. Hermetically sealed	RE 48A 129F	9	7570		5066
1	CM20D101J -48674-D5	C-133	Capacitor, Silver mica, 100 MMF ±5%, 500 volts DC working	RE 48A 154F RE 48A 148D	4	K-1310		7133
2	CM20B251K -48690-B10	C-123, C-124, C-125	Capacitor, mica, 250 MMF ±10%, 500 Volts DC working. Low loss case	RE 48A 148D RE 48A 154F	4	K-1325		5077
2	CM20D251J -48690-D5	C-138, C-139, C-140	Capacitor, Silver mica, 250 MMF ±5%, 500 Volts DC working	RE 48A 154F RE 48A 148D	4	K-1325		7135
1	-48703-A10	C-106, C-107	Capacitor, paper, 0.1/0.1 Mfd. each section 600 volts DC working	RE 48A 138D	9	7573		5069
1	-48712-B10	C-108	Capacitor, paper, 0.1/0.1 Mfd. each section 600 volts DC working. Hermetically sealed	RE 48A 129F	9	7574		5089
1	-48713-B10	C-109, C-155, C-157	Capacitor, paper, 0.1/0.1/0.1 Mfd. each section 600 Volts DC working. Hermetically sealed	RE 48A 129F	9	7569		5065
1	CM20D500K -48895-B10	C-121	Capacitor, mica, 50 MMF ±10%, 500 Volts DC working. Low loss case	RE 48A 148D RE 48A 154F	4	K-1450		5076
1	CM20D500J -48895-D5	C-131, C-132	Capacitor, Silver mica, 50 MMF ±5%, 500 Volts DC working	RE 48A 154F RE 48A 148D	4	K-1450		7132
1	CM35D402J -48929-D5	C-143	Capacitor, Silver mica, 4000 MMF ±5%, 300 Volts DC working	RE 48A 143G RE 13A 154F	4	C-1240		7138
1	CM30D302J -481036-D5	C-142	Capacitor, Silver mica, 3000 MMF ±5%, 500 Volts DC working	RE 48A 143G RE 48A 154F	4	C-1230		7137
3	-481037-10	C-119, C-120, C-127, C-128, C-129, C-130	Capacitor, mica, 5000 MMF, ±10%, 300 Volts DC working	RE 48A 143G RE 48A 154F	4	C-1250		5079
2	-481080	C-101, C-102, C-103, C-104	Capacitor, paper, 4mfd, 600 Volts DC working	RE 48A 223B	9	7577A		5070
1		C-105	Capacitor, electrolytic, 25 Mfd. +50% —10%, 25 volts DC working	RE 13A 549A	9	5088		5088
1		C-110	Capacitor, paper, 0.05 Mfd. 600 Volts DC working	RE 13A 488E	9	7002		7002
2		C-134, C-135, C-136	Capacitor, Silver mica, 175 MMF ±5%, 500 Volts DC working		4	K-13175		7285

7.4 TABLE IV (*Continued*) SPARE PARTS LIST BY NAVY TYPE NUMBERS FOR MODEL RBO-1 RADIO RECEIVING EQUIPMENT

Quantity	Navy Type Number	All Symbol Designations Involved	Description	Navy Drawing or Spec.	MFR.	Mfr. Desig.	Special Tolerance Rating or Modification	Contractor's Drawing and Part Number
			CAPACITORS (Class 48) (*Continued*)					
1		C-137	Capacitor, Silver mica, 225 MMF ±5%, 500 Volts DC working		4	K-13225		7134
1		C-141	Capacitor, Silver mica, 350 MMF ±5%, 500 Volts DC working		4	K-1335		7136
1		C-145	Capacitor, variable air. Minimum Capacity 3 MMF. Max. capacity 25 MMF		23	5072		5072
1		C-146, C-147	Capacitor, variable air. Minimum Capacity 4 MMF. Max. capacity 50 MMF		23	5073		5073
1		C-148	Capacitor, variable air. Minimum Capacity 6 MMF. Max. capacity 75 MMF		23	5074		5074
1		C-149, C-152	Capacitor, variable mica, Minimum capacity 1 MMF. Max. capacity 12 MMF		26	T-6616		6093
2		C-150, C-151, C-153, C-154	Capacitor, variable mica, Minimum capacity 4 MMF. Max. capacity 60 MMF		26	18F-47		5071
			SOCKETS (Class 49)					
4	-49373	X-101, X-102, X-103, X-104, X-105, X-106, X-107, X-108, X-109, X-111, X-112	Vacuum tube, socket eight contact (octal), plug-in type, with retaining ring and spacer washer. Molded ceramic base. Circular	RE 49AA 313A	2	RSS8M		5175
			RESISTORS (Class 63)					
2	-63355	R-105, R-106, R-107	Resistor, composition, 270 ohms, ±5%, ½ watt, pigtail terminals	RE 13A 340C	10	BT½		5133
1	-63355	R-108	Resistor, composition, 560 ohms, ±5%, ½ watt, pigtail terminals	RE 13A 340C	10	BT½		5134
2	-63355	R-109, R-110, R-111	Resistor, composition, 680 ohms, ±5%, ½ watt, pigtail terminals	RE 13A 340C	10	BT½		5135
2	-63360	R-112, R-113, R-114, R-115	Resistor, composition, 1000 ohms ±10%, ½ watt, pigtail terminals	RE 13A 340C	10	BT½		5136
1	-63360	R-117	Resistor, composition, 2400 ohms ±10%, ½ watt, pigtail terminals	RE 13A 340C	10	BT½		5138
1	-63360	R-118	Resistor, composition, 20,000 ohms, ±10%, ½ watt, pigtail terminals	RE 13A 340C	10	BT½		5139
1	-63360	R-116	Resistor, composition, 1500 ohms ±10%, ½ watt, pigtail terminals	RE 13A 340C	10	BT½		5137
1	-63360	R-119	Resistor, composition, 10,000 ohms ±10%, ½ watt, pigtail terminals	RE 13A 340C	10	BT½		7008

7.4 TABLE IV (*Continued*) SPARE PARTS LIST BY NAVY TYPE NUMBERS FOR MODEL RBO-1 RADIO RECEIVING EQUIPMENT

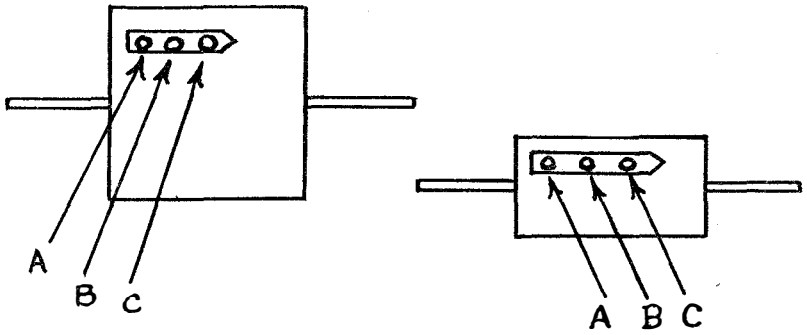
Quantity	Navy Type Number	All Symbol Designations Involved	Description	Navy Drawing or Spec.	MFR.	Mfr. Desig.	Special Tolerance Rating or Modification	Contractor's Drawing and Part Number
			RESISTORS (Class 63) (*Continued*)					
2	-63360	R-122, R-123, R-124, R-125	Resistor, composition, 47,000 ohms ±10%, ½ watt, pigtail terminals	RE 13A 340C	10	BT½		5141
2	-63360	R-126, R-127, R-128	Resistor, composition, 100,000 ohms ±10%, ½ watt, pigtail terminals	RE 13A 340C	10	BT½		5142
3	-63360	R-133, R-134, R-140, R-149, R-150	Resistor, composition, .22 Meg. ±10%, ½ watt, pigtail terminals	RE 13A 340C	10	BT½		5144
2	-63360	R-132, R-135, R-136, R-137, R-138	Resistor, composition, .47 Meg, ±10%, ½ watt, pigtail terminals	RE 13A 340C	10	BT½		5145
1	-63360	R-151	Resistor, composition, 0.82 Meg. ± 10%, ½ watt, pigtail terminals	RE 13A 340C	10	BT½		7090
2	-63360	R-139, R-141, R-152	Resistor, composition, 1 Meg. ±10%, ½ watt, pigtail terminals	RE 13A 340C	10	BT½		5146
1	-63360	R-142	Resistor, composition, 2.2 Meg. ±10%, ½ watt, pigtail terminals	RE 13A 340C	10	BT½		5147
	-63474	R-143	Resistor, composition, 15,000 ohms ±10%, 2 watt, pigtail terminals	RE 13A 340C	10	BT2		7230
1	-63474	R-144	Resistor, composition, 18,000 ohms, ±5%, 2 watt, pigtail terminals	RE 13A 340C	10	BT2		7231
1	-63678-10	R-101	Resistor, wire wound 10 ohms ±10%, ½ watt, phenolic insulated. Pigtail type terminals	RE 13A 340C	10	BW½		5131
2	-63678-10	R-102, R-103, R-104	Resistor, wire wound 47 ohms ±10%, ½ watt, phenolic insulated. Pigtail type terminals	RE 13A 340C	10	BW½		5132
1	-63705-5	R-145	Resistor, wire wound, 680 ohms ±5%, 2 watts, phenolic insulated, pigtail type terminals		10	BW2		6050
1		R-146	Potentiometer, .5 meg ±20%		10	VC-11954		5129
1		R-147	Potentiometer, .25 meg ±20%		10	VC-11955		5130
1		R-148	Potentiometer, 1 meg ±20%		10	VC-11953		5128

7.5 TABLE V

APPLICABLE COLOR CODES AND MISCELLANEOUS DATA FOR MODEL RBO-1 RADIO RECEIVING EQUIPMENT

Color Code in MMFD for Capacitors

Color	*A 1st Digit*	*B 2nd Digit*	*C Ciphers*
Black	—	0	.0
Brown	1	1	0
Red	2	2	00
Orange	3	3	000
Yellow	4	4	0000
Green	5	5	00000
Blue	6	6	000000
Purple	7	7	0000000
Gray	8	8	00000000
White	9	9	—



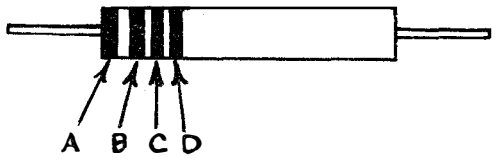
Silver mica capacitors have values stamped into body of condenser.

RMA Color Code for Resistors

Color	*A 1st Digit*	*B 2nd Digit*	*C Ciphers*
Black	—	0	.0
Brown	1	1	0
Red	2	2	00
Orange	3	3	000
Yellow	4	4	0000
Green	5	5	00000
Blue	6	6	000000
Purple	7	7	0000000
Gray	8	8	00000000
White	9	9	—

D—Tolerance Code:

Gold—5% Silver—10%

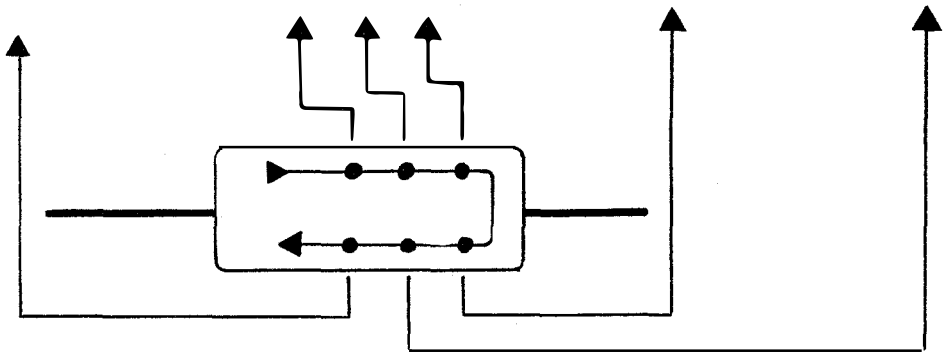


7.5 TABLE V

Applicable Color Codes and Miscellaneous Data for Model RBO-1 Receiver

RMA 6 Dot Color Code
Read In Direction of Molded Arrow

Color of Dot	*Working Voltage*	*Significant Figure of Dot*	*Decimal Multiplier*	*Tolerance*
Black	.....	0	1	.....
Brown	100	1	10	1%
Red	200	2	100	2%
Orange	300	3	1000	3%
Yellow	400	4	.....	4%
Green	500	5	.....	5%
Blue	600	6	.....	6%
Violet	700	7	.....	7%
Gray	800	8	.....	8%
White	900	9	.....	9%
Gold	1000	....	.....	.....
Silver	2000	....	.....	10%



7.6 TABLE VI

LIST OF MANUFACTURERS FOR MODEL RBO-1 RADIO RECEIVING EQUIPMENT

CODE NO.	MFR. PREFIX	NAME	ADDRESS
1	CHH	Arrow Hart and Hegeman Electric Co.	Hartford, Connecticut
2	CPH	American Phenolic Corp.	1250 W. Van Buren St., Chicago, Ill.
3		American Emblem	Utica, N. Y.
4		Sangamo Electric	Springfield, Ill.
5	CN	National Electrical Machine Shops, Inc.	1935 - 5th St., N. E., Washington, D. C.
6	CAE	Cutler-Hammer Mfg. Co.	Milwaukee, Wisconsin
7		Etching Company of America	Chicago, Illinois
8	CG	General Electric Company	Schenectady, N. Y.
9	CIE	Industrial Condenser Corp.	1725 West North Ave., Chicago, Ill.
10	CIR	International Resistance Corp.	401 N. Broad St., Philadelphia, Pa.
11	CJC	Jones, Howard B.	2300 Wabansia Ave., Chicago, Ill.
12	CEJ	Johnson, E. F.	Waseca, Minnesota
13	CLF	Littlefuse Laboratories, Inc.	4238 Lincoln Ave., Chicago, Ill.
14	CLE	Lenz Electric Mfg. Co.	Chicago, Illinois
15		Lord Manufacturing Co.	Erie, Penna.
16	CRA	Utah Radio Products Co.	812 Orleans St., Chicago, Ill.
17	CNA	National Company	Malden, Mass.
18	COC	Oak Manufacturing Co.	711 W. Lake St., Chicago, Ill.
19	CRC	RCA Manufacturing Co.	(Radiotron Div.) Harrison, N. J.
20	CRK	Radio Condenser Company	Camden, N. J.
21	CZC	Scott, E. H. Radio Lab., Inc.	4450 N. Ravenswood Ave., Chicago, Ill.
22	CSA	Stackpole Carbon Co.	St. Mary's Penna.
23	CFW	Sickles, F. W. Co.	Springfield, Mass.
24	CTD	Tobe-Deutschmann Corp.	Canton, Mass.
25	CTH	Thordarson Elec. & Mfg. Co.	500 W. Huron St., Chicago, Ill.
26	CTN	Teleradio Engineering Corp.	484 Broome St., New York, N. Y.
27	CRV	RCA Manufacturing Co.	Camden, N. J.