PRELIMINARY INSTRUCTION BOOK

for

NAVY MODEL TBX-8 PORTABLE RADIO EQUIPMENT

RESTRICTED

(For Official Use Only)

Manufactured By

GAROD RADIO CORPORATION

Brooklyn, N. Y.

For

U. S. NAVY DEPARTMENT

BUREAU OF SHIPS

Contract NXsr-69224

15 March 1945

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RECORD OF CORRECTIONS MADE

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GUARANTEE

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

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

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

As applied to quartz crystals, it is assmed that crystals returned under the terms of the above guarantee will be returned with the seals unbroken and showing no evidence of mechanical abuse and with the understanding that the crystals were used only in the model TBX series of portable radio equipment.

WARNING NOTE

OPERATION OF THIS EQUIPMENT INVOLVES THE USE OF HIGH VOLTAGES WHICH ARE DANGEROUS TO LIFE. OPERATING PERSONNEL MUST AT ALL TIMES OBSERVE ALL SAFETY REGULATIONS. DO NOT CHANGE OR MAKE ADJUSTMENTS INSIDE EQUIPMENT WITH HIGH VOLTAGE SUPPLIES ON. ALWAYS SHUT DOWN GENERATORS OR OTHER POWER EQUIPMENT. UNDER CERTAIN CONDITIONS, SUCH AS THE FAILURE OF A "BLEEDER" RESISTOR, DANGEROUS POTENTIALS MAY EXIST IN CIRCUITS WITH POWER CONTROLS IN THE OFF POSITION DUE TO CHARGES RETAINED BY CAPACITORS. TO AVOID CASUALTIES ALWAYS REMOVE POWER, DISCHARGE AND GROUND CIRCUITS BEFORE TOUCHING THEM.

Since the use of high voltages, which are dangerous to human life, is necessary to the successful operation of TBX-8 equipments, certain reasonable precautionary measures must be carefully observed by operating personnel during the adjustment and operation of the equipment.

The major portions of the equipment are within shielding enclosures, but INTERLOCK SWITCHES ARE NOT PROVIDED. Therefore, all power should be shut off before removing covers for adjustment or servicing, as removal of the covers allows access to circuits carrying voltages dangerous to human life.

While every practicable safety precaution has been incorporated in the TBX-8 equipment, the following safety rules must be strictly observed.

KEEP AWAY FROM LIVE CIRCUITS

Under no circumstances should any person be permitted to reach within, or in any manner gain access to the enclosure, with power supply line switches to the equipment closed; or to approach or handle any portion of the equipment which is supplied with power, or to connect any apparatus external to the enclosure to circuits within the enclosure except as provided for by protected cabling, or to apply voltages to the equipment while it is out of its cover or case. Wherever feasible in testing circuits, check for continuity and resistance rather than directly checking voltage at various points.

DO NOT SERVICE OR ADJUST ALONE

Under no circumstances should any person reach within or enter the enclosure for the purpose of servicing or adjusting the equipment without the immediate presence or assistance of another person capable of rendering aid.

If it is ever necessary to operate any of the power supplies without connecting it to the equipment, care should be taken to CLOSE AND LOCK power socket covers to prevent accidental contact with the output terminals, all of which carry dangerous potentials.

THE ATTENTION OF OFFICERS AND OPERATING PERSONNEL IS DIRECTED TO BUREAU OF SHIPS MANUAL OF ENGINEERING INSTRUCTIONS, CHAPTER 31 (MIMEOGRAPHED FORM) OR SUBSEQUENT REVISIONS THEREOF ON THE SUBJECT OF "RADIO-SAFETY PRECAUTIONS TO BE OBSERVED."

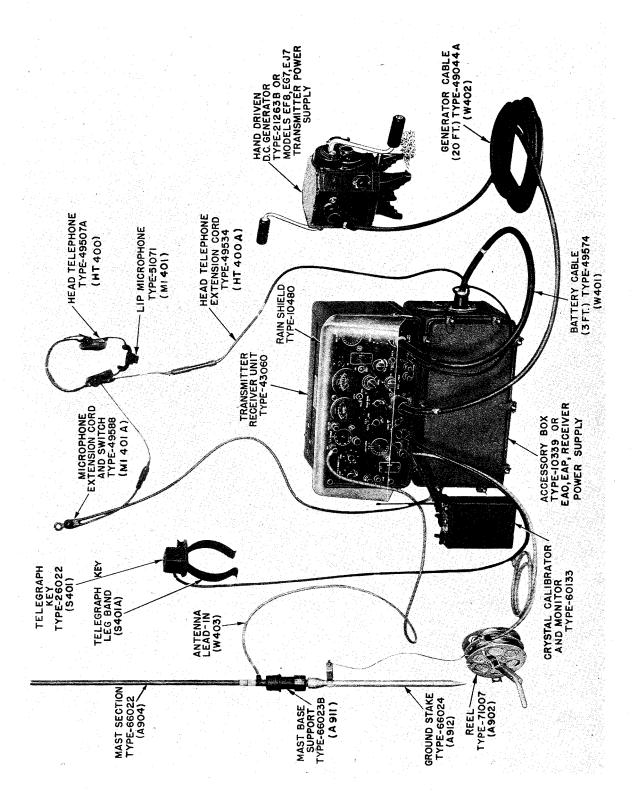


Fig. I. Model TBX Series of Portable Kadio Equipments: A Typical Assembly Showing Basic Transmitter-Receiver Unit Type -43060, Auxiliary Crystal Calibrator and Monitor Type -60133, and Rain Shield Type -10480 Set Up for Operation and Indicating Possible Selection of the Various Power Supplies

Model TBX-8 Portable Radio Equipment

1. TBX SERIES OF EQUIPMENTS

The Model TBX Series of Portable Radio Equipments are designed to meet the paramount requirement of providing satisfactory communication between similar equipments installed ashore, aboard ship, or in small boats, and between such equipments and other units of the Naval Communication System at ranges of approximately 30 miles for CW transmission and 15 miles for Phone transmission.

The TBX-8 differs from earlier equipments of the TBX Series in many respects. Various additional features have been incorporated. These are as fol-

1. Previous models required the application of power to the transmitter for approximately 15 seconds before operation commenced. This has now

been reduced to 4 seconds.

2. "PUSH TO TALK" and "BREAK-IN" operation permit immediate change-over from Send to Receive, without the necessity of manual switching. When the microphone switch is released, the receiver becomes operative. Likewise on "C.W.",

with the key up the receiver functions.

3. Provision is made for the use of either low level microphones such as the lip type furnished with the basic equipment, or the high level hand microphone used with earlier models of the TBX Series. A modulation control contained within the Transmitterreceiver case is connected so that optimum "VOICE" operation may be obtained under all conditions.

4. During "C.W." operation, an audible tone is heard in the headphones so that the operator can hear

hs own "keying".

5. If necessary, Signal Corps Type -FT243 (or similar crystal and holder) may be used in place of the type normally supplied with TBX equipment.

- 6. An additional binding post is included, which by means of a link arrangement, makes possible the use of individual antennas for the Transmitter and
- 7. In addition, numerous circuit changes have been incorporated resulting in improved perform-
- 8. The addition of the following auxiliary equipment when in use with the TBX-8 basic equipment adds various additional features. These are as fol-
- (a) By means of the type -23453 "Remote Control" unit, remote operation of the TRANSMIT-TER-RECEIVER is made possible over a field telephone line (W-110 or equivalent) up to one mile in
- (b) By means of the type -60133 Crystal Calibrator and Monitor, crystal controlled accuracy and monitoring of the transmitter during self-excited transmission over the entire frequency range at any one of ten preselected crystal channels is possible. This also applies for the receiver between the frequency limits of 2 to 6 mc. Transmitter and receiver operating frequencies can be continuously monitored during operation and any deviation in frequency immediately corrected from the initial setting by zero beating with the selected crystal channel in use of the Crystal Calibrator and Monitor.

- (c) Operation of the type -43060 TRANS-MITTÉR-RECEIVER during periods of rainy weather such as is encountered in the tropics is made possible by the addition of the type -10480 Rain Shield. The Rain Shield is constructed of transparent plastic material and fits over the front of the Transmitter-Receiver unit. Protection from a driving rain descending at any angle down to 45° from the vertical is obtained with the Rain-Shield installed on the Transmitter receiver unit set up for operation as shown in figure 1.
- (d) The second detector socket of the Receiver has been "Shock Mounted" to further minimize "Microphonic Noise."
- (e) Operation of the TBX-8 with the older type -10026A ACCESSORY BOX or Model EL thru EQ series of receiver power supplies is made possible by the addition of the type -632246 Adapter unit.
- 9. The units of the TBX-8 basic equipment and the auxiliary equipment except power equipments described above have all been tropicalized to eliminate the effects of moisture and fungus growth encountered when in use in tropical climates. Refer to section XII under Maintenance for a detailed descrip-

The Condensed Instructions For Installation and Operation included in the covers of Accessory Box Type -10339 and Transmitter-receiver Unit Type -43060, are intended for ready reference only and do not obviate the necessity of a careful study of this Instruction Book. Complete instructions for operation of the Model TBX-8 Portable Radio Equipment and Auxiliary Power Equipments are covered in this Instruction Book. One or more of the Auxiliary Power Equipments, for use with the Basic Model TBX Series of Portable Radio Equipment, may be

The Models EF-8, EG-7 and EJ-7 Auxiliary Transmitter Power Equipments filtered for R. F. "Hash" to permit CW (A 1) "Break-in" operation are supplied for use with the transmitter of the model TBX-8 portable radio equipment.

CW "Break-in" operation is not possible when older models of the EF, EG, EH and EJ series of Auxiliary Power Equipments other than those models described above are used unless filtered for R. F. "Hash". Use of older model Transmitter Auxiliary Power Equipments can be made simply by turning OFF the Transmitter Power Equipment in use when the receiver portion of the TBX-8 is in operation. This will prevent R. F. "Hash" from interfering with receiver operation.

The individual ratings of each of the Transmitter Auxiliary Power Equipments are given under section VI B.

The Models EL, EN series and models EAO and EAP Receiver Power Equipments are supplied for use with the model TBX series of Radio Equipments in lieu of the dry batteries used in Accessory Box Type -10339 for the Receiver Power Supply. With models EAO and EAP BATTERY CABLE TYPE

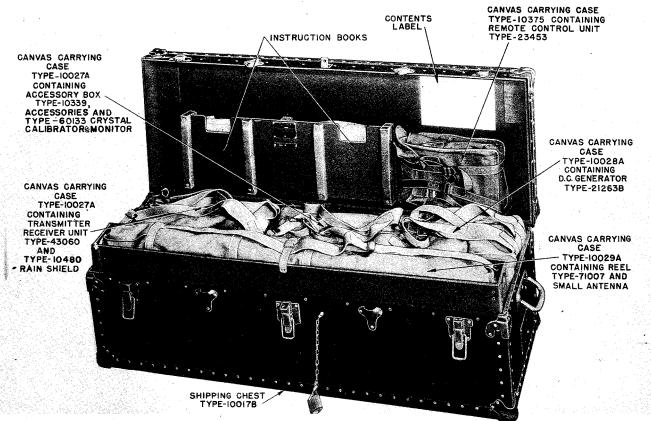


Fig. 2. Model TBX Series of Portable Radio Equipments: An Equipment Packed for Transportation in Shipping Chest Type -10017B



FIG 2-A MODEL TBX SERIES OF PORTABLE RADIO EQUIPMENTS: AN EQUIPMENT PACKED FOR TRANS-PORTATION

-49574 SUPPLIED WITH TBX-8 EQUIPMENT MUST BE USED FOR CORRECT OPERA-TION OF THE RECEIVER. This cable may be readily distinguished from the previous TBX battery cable type -49046 by means of a RED marker band.

If, however, OPERATION IS DESIRED FROM THE MODELS EN and EL SERIES, an

ADAPTER type -632246 and battery cable type -49574 described above must be used. Should it be necessary to operate an older model TBX from Receiver Power Equipments type EAO and EAP simply connect the battery cable type -49046 in the normal manner. In this case, no adapter is necessary as all connections have been made internally.

II. FREQUENCY RANGE, POWER, AND TYPES OF OPERATION

A. RADIO TRANSMITTER: 2000-5800 kc; CW (A1), 9 watts; Voice (A3), 3 watts. Selfexcited transmission is possible at any frequency in the above range; CW and Phone crystal-controlled transmission is possible at any two frequencies in the band for which crystals are provided.

RADIO RECEIVER: 2000-8000 kc; CW and MCW (voice modulated continuous wave or damped radio energy) at any frequency in the above

range.

C. RECEIVER POWER EQUIPMENT: The Receiver Power Equipments are capable of supplying adequately filtered, polarized and isolated-filament, plate, screen, and bias voltages of 1.5, 3, 90, 135, 6, and 15 volts, as required for proper operation of the radio receiver.

The TBX-8 utilizes only the 1.5, 90 and 6 volt connections; the others are for use with older models of the TBX series as described previously.

The Model EN Series and EAP of Receiver Power Equipments are dynamotor-operated d-c equipments.

The Model EL Series and EAO are rectifier-

operated a-c equipments.

These equipments are designed for operation from power sources having characteristics as given in Section VI. B.

III. MAJOR UNITS

A. MODEL TBX SERIES OF PORTABLE RADIO EQUIPMENTS

Each Equipment of the Model TBX-8 Portable Radio Equipment includes the following major units:

(a) Basic Parts List

- Shipping Chest Type -10017B, in which are packed the following:
- Canvas Carrying Case Type -10027A containing
- Transmitter-Receiver Type -43060 including
 - Vacuum Tubes Type -1N5GT/G
 - Vacuum Tube Type -1A7GT/G

 - Vacuum Tube Type -2E22 Vacuum Tubes Type -3A4 Vacuum Tube Type -1A5GT/G
 - Neon Tube Type -991
 - Holders Type -40024A (with crystals)
 - Canvas Carrying Case Type -10027A containing
 - Accessory Box Type -10339 in which are 1 contained
 - Type -49507A Telephone Headset Assembly
 - Type -49534 Telephone Extension Cord
 - Generator Cable (20 ft.) Type -49044A
 - Battery Cable (3 ft.) Type -49574
 - Lip Microphone Assembly Type -51071
 - Microphone Extension Cord and Switch Assembly Type -49588

 - Vacuum Tube Type -1N5GT/G Vacuum Tube Type -1A7GT/G Vacuum Tube Type -2E22 Vacuum Tubes Type -3A4 Vacuum Tube Type -1A5GT/G

 - Neon Tube Type -991
 - Antenna Lead-in (Insulated, 5 ft.)
 - -26022 Telegraph Key Assembly with leg Band

- Sponge Rubber Pads
- Batteries Type -19005 (Radio "B" 45 volts)
- Batteries Type -19010 (Radio "A", 1.5
- Battery Type -19011 (Radio "C", 7.5 Volts)

Note: The above batteries comprise one complete set for operation.

CAUTION: Never leave batteries in Accessory Box Type -10339 when equipment is stored, or during shipment.

- Canvas Carrying Case Type -10027A enclosing Cranks for D-C Hand Generator Type -21263B
- D-C Hand Generator Type -21263B (with Clamping Attachment) rated 12.6/500-550 volts, 2.0/0.085 amp max
- Instruction Books
- Canvas Carrying Case Type -10029A containing
- Antenna System Assembly consisting of:
 - Guy Stakes Type -66013
 - Mast Section Type -66019 (Top Section)
 - Mast Sections Type -66020 (2nd and 3rd from top)
 - Mast Section Type -66021A (4th from top with 3 Insulators Type -61244 and 3 guy lines 20 ft. in length)
 - Mast Sections Type -66022 (5th, 6th and 7th from top)
 - Mast Base Support Type -66023B
 - Ground Stake Type -66024
 - Large Antenna and Counterpoise (Wound on Reel Type -71007)
 - Padlock (attached to chest)
- (b) Auxiliary Equipment Parts List
- -60133 Crystal Calibrator and Monitor (carried in accessory box)
 - 10 -FT243 Holders with crystals
 - -19011 Battery 7.5 Volts "C"

1 -19031 Battery 1.5 Volts "A" -10480 Rain Shield (Packed with Type -43060 TRANS. -REC. Unit)
REMOTE CONTROL Unit Type -23453 1 Canvas Carrying Case Type -10375 6 -1.5 Volt "A" Battery Type -19031 ADAPTER UNIT Type -632246 SET OF BASIC EQUIPMENT SPARE PARTS consisting of: 2/L-SA-1670 Cover Fasteners (for TRANS.-REC. Unit Type -43060 or ACCESSORY BOX Type -10039) B-PP-10006-1 Black Jack Covers B-P-10006-2 Red Jack Covers 2 L-SA-10074 Binding Post Assemblies Set of Brushes for -21263B D.C. Generator (4-B-BR-1004 L.V.) (4-B-BR-1005 H.V.) B-SP-10005 Crankshaft Grounding Brush B-SP-10006 Armature Shaft Grounding Spring -22130-A Ammeter -22291-D Multimeter Resistor Part No. B-RE-919, 1.43 ohms Part of -22291-D Multimeter Resistor Part No. B-RE-920, 140,000 ohms Part of -22291-D Multimeter Resistor Part No. B-RE-921, 0.4 ohms Part of -22291-D Multimeter -30334 Receiver Output Transformer -301276 Microphone Transformer -301278 Modulation Reactor 1 L-SA-1677 R.F. Choke B-CL-10001 R.F. Choke C-CL-10012 R.F. Choke -1N5GT/G Vacuum Tubes -1A7GT/G Vacuum Tubes -1A5GT/G Vacuum Tube 1 -2E22 Vacuum Tube 1 2 -3A4 Vacuum Tubes 1 -991 Vacuum Tube -66024 Ground Stake 1 -61244A Insulators CM 50B 103K Capacitor .01 mfd. 48487-B10 Capacitor .01 mfd. 1 -48645-B10 Capacitor .001 mfd. 1 -48666-B2 Capacitor .0001 mfd. 1 CM 458 A111J Capacitor .00011 mfd. 3 -48770-B10 Capacitors .006 mfd. 1 -481043-B10 Capacitors .0005 mfd. 1 -481016-D1 Capacitor .0007 mfd. 1 -48674-B10 Capacitor .0001 mfd. 1 -48690-B10 Capacitor .00025 mfd. -48771-B10 Capacitor 5 mmfd. -481015-D1 Capacitor .0004 mfd. -481014-D1 Capacitor .0003 mfd. 1 1 -48840-D10 Capacitor 15 mmfd. 1 -48675 Capacitor .0002 mfd. CC 26-CK 250K Capacitor 25 mmfd. 1 -482068 Capacitor .02 mfd. 1 -481002-20 Capacitor .5 mfd. 1

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-481998-10 Capacitor 1 mfd.

-482184-20 Dual .5 mfd.

-482928 Capacitor 15 mfd.

-482180 Capacitor 50 mfd.

-482434-10 Capacitor 2 mfd. CM 30B 302K Capacitor .003 mfd. -63360 Resistor 1 megohm -63360 Resistor ½ megohm -63360 Resistor 50,000 ohms -63360 Resistor 2 megohms -63360 Resistor 200,000 ohms -63360 Resistor 30,000 ohms -63360 Resistor 6,800 ohms -63360 Resistor 150,000 ohms -63355 Resistors 10,000 ohms -63355 Resistor 100,000 ohms -63360 Resistor 68,000 ohms -63288 Resistor 11,000 ohms -63291-5 Resistor 240 ohms -63555B Resistor 42 ohms -63288 Resistor 22 ohms -63703-5 Resistor 30 ohms 1 -63705-5 Resistor 100 ohms 1 -63705-5 Resistor 68 ohms -63705-5 Resistor 390 ohms -63288 Resistor 3,300 ohms -63689E-10 Resistor 20,000 ohms -63634-10 Resistor 5,000 ohms -632093-5 Resistor 4 ohms -63360 Resistor 2,500 ohms -63360 Resistor 1,000 ohms Antenna Relay Part No. C-RL-10000 Line Relay Part No. C-RL-10001 L-SA-10080 Accessory Box Cable -631987-10 Potentiometer 100,000 ohms -631414-10 Potentiometer 20,000 ohms (d) Auxiliary Equipment Spare Parts: Set of Equipment Spares for Crystal Calibrator and Monitor Type -60133 consisting of:
1 RC 21 BF 224K Resistor 220,000 ohms CC 21 CK 100 F Ceramicon 10 mmfd. CC 21 CK 150 K Ceramicon 15 mmfd. Vacuum Tube Type -3A4 L-CL-10014 R.F. Choke L-SA-10151 Waterproof Jack Cover assem-1 L-SA-10093 Binding Post Assembly B-TE-1003 Binding Post Set of Equipment Spares for Remote Control Unit, Type -23453 consisting of: -63360 Resistor 1 megohm -63705-10 Resistor 18 ohms -481998-10 Capacitor 1 mfd. -481721 Capacitor 25 mfd. -301437 Line Matching Transformer 1 L-SA-10154 Red Waterproof Jack Cover Assembly L-SA-10151 Black Waterproof Jack Cover Assembly L-SA-10074 Binding Post Assemblies B-PP-10027 Latch Fasteners Set of Equipment Spares for Adapter Unit Type -632246 consisting of: -63703-5 Resistor 6 ohms -63703-5 Resistor 27 ohms 1 RC-21-BF-333J Resistor 33,000 ohms 1

> RC-21-BF-822J Resistor 8,200 ohms RC-41-BF-203J Resistor 20,000 ohms

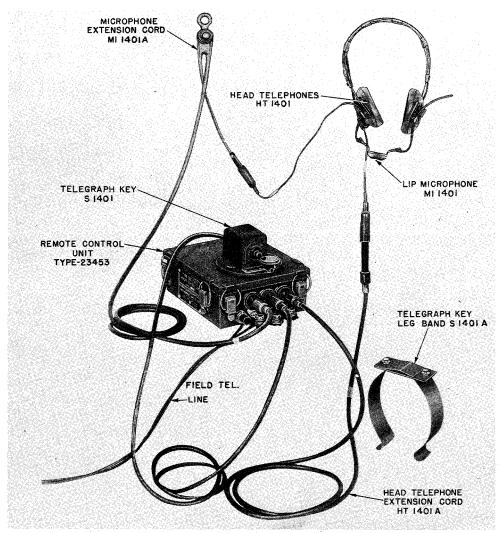


Fig. 3. Remote Control Unit Type -23453 Set up for C.W. or Voice Operation

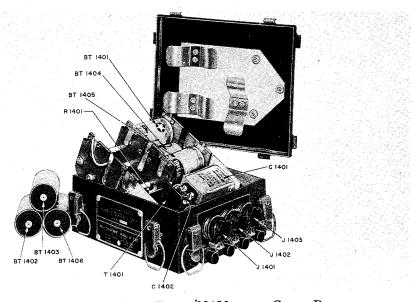


Fig. 3A. Remote Control Unit Type -23453 with Cover Removed

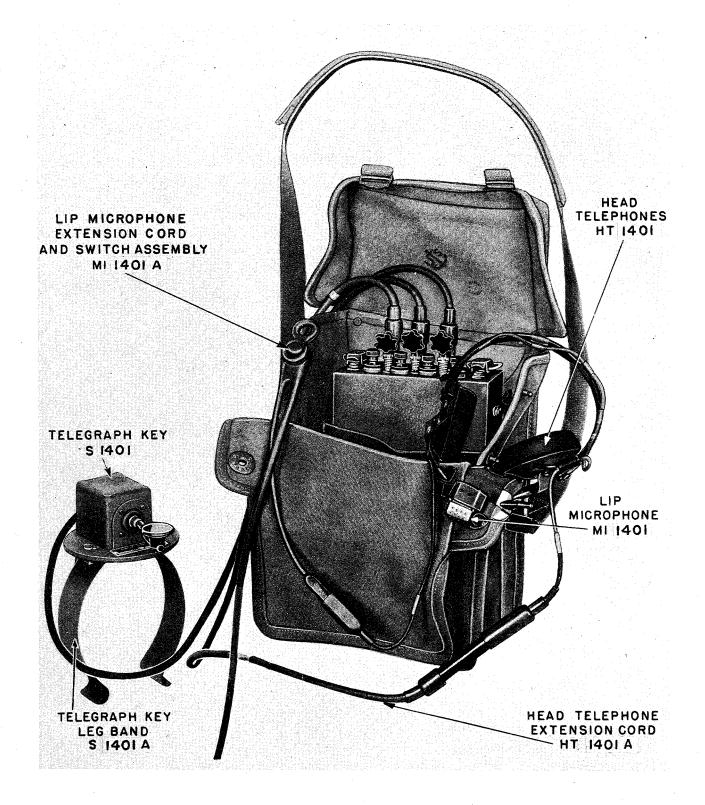


FIG. 3B. REMOTE CONTROL UNIT TYPE-23453 SHOWING UNIT INSTALLED IN CARRYING CASE

IV. FIELD EQUIPMENT

A. BASIC FIELD EQUIPMENT

The units of the Model TBX-8 Basic Portable Radio Equipment which are intended to be removed from shipping chest type -10017B for use in the field comprises the following:

- (a) Type -43060 Transmitter-Receiver unit complete with carrying case type -10027A.
- (b) Type -10339 Accessory Box complete with carrying case type -10027A.
- (c) Type -21263B D-C Hand Generator complete with carrying case type -10028A.
- (d) Antenna Assembly complete with carrying case type 10029A.

B. AUXILIARY EQUIPMENT

The units of the model TBX-8 Basic Portable Radio Equipment designated as "auxiliary equipment" which are intended for use in the field with the basic equipment are the following:

(a) Type -60133 Crystal Calibrator and Monitor. This unit is carried in the accessory box.

(b) Type -10480 Rain Shield. This unit is packed with type -43060 Transmitter-Receiver unit and is intended for use with the Transmitter-Receiver unit in rainy weather.

(c) Type -632246 Receiver Adapter Unit. This unit carried in the shipping chest need not be removed for use with the TBX-8 basic equipment.

V. REMOTE CONTROL UNIT

The Model -23453 Remote Control Unit permits operation of the Basic Equipment at a distance (up to one mile).

This consists of a Canvas Carrying Case Type -10375 containing:

1—Remote Control Unit Type -23453

1—Head Set Type -49507

1—Headphone Extension Cord Type -49534

1—Microphone Type -51071

1—Microphone Extension Cord and Switch

Assembly Type -49588 1--Telegraph Key Assembly with Leg Band Type -26022

6—1.5 volt "A" Battery Type -19031

The remote control unit contains 6 Type 19031 batteries. These batteries are readily accessible for replacement by unlatching the cover. See Fig. 3B.

NOTE: THE BATTERIES MUST BE RE-MOVED FROM THE REMOTE UNIT WHEN-EVER THE EQUIPMENT IS STORED OR DURING SHIPMENT.

VI. POWER SUPPLY

BASIC POWER SUPPLY

1. Radio Transmitter

The radio transmitter of the Model TBX-8 Portable Radio Equipment is designed to operate from the following power supply which is furnished with each Basic Equipment:

Hand-driven D-C Generator Type -21263B rated 12.6/500-550 volts, 2.0/0.085 amp. max. d-c.

2. Radio Receiver

Battery Supply contained in Accessory Box Type -10339 comprising:

"A" Battery, 1.5 volts, consisting of two Batteries Type -19010 in parallel.

"B" Battery, 90 volts, consisting of two Bat-

teries Type -19005 in series. "C" Battery, 7.5 volts, Type -19001 (6 volt tap

only utilized).

CAUTION: NEVER LEAVE BATTERIES IN THE ACCESSORY BOX WHEN THE EQUIP-MENT IS STORED OR DURING SHIPMENT.

B. AUXILIARY POWER EQUIPMENTS

Transmitter [Reference is made to Cording Diagram Fig. 27]

Instead of Hand-driven D-C Generator Type -21263B, power supply for the radio transmitter may be obtained from one of the following Auxiliary Power Equipments when available:

1. Model EF Series, Gas Engine-driven Generator Equipments—self contained.

Model EG Series, A-C Motor-Generator

Equipments—115 volts, 60 cycle, single phase.
3. Model EH Series, D-C Motor-Generator Equipments—115 volts d-c line.

Model EJ Series, Dynamotor Equipments—12 volt storage battery.

2. Receiver [Reference is made to Cording Diagram Fig. 27]

The Model EAO and EAP Receiver Power Equipments are capable of supplying adequately filtered, polarized and isolated filament, plate, screen and bias voltages of 1.5, 3, 135, 90, 15 and 6 volts respectively. 1.5, 90 and 6 volts are required for proper operation of the TBX-8 Radio Receiver without the use of the Type -632246 Adapter Unit. Use of the Type -632246 Adapter Unit and Type

-49574 3 foot cable is required for correct operation of the Receiver of the TBX-8 from the Receiver Power Equipments described below:

The Model EL Series are rectifier operated a-c

equipments. These equipments are designed for operation from power sources having the following characteristics:

Model EL Series—115 volt $(\pm 10\%)$ 60 cycle $(\pm 2\%)$ a-c line.

The Models EM, EN, EO, EP and EQ Series of

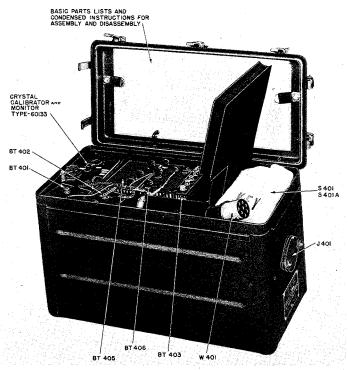


Fig. 4. Accessory Box Type -10339: Cover Open

the Receiver Power Equipments are all dynamotoroperated d-c equipments, and are similar to the Model EAP except for filtering against R.F. "Hash" and dynamotor ratings.

Model EM Series—6 volt (±15%) storage bat-

tery, approximately 25 watts.

Model EN Series—12 volt (±15%) storage battery, approximately 25 watts.

Model EO Series—24 volt ($\pm 15\%$) storage battery, approximately 25 watts.

Model EP Series—32 volt (±15% storage battery, approximately 25 watts.

Model EQ Series—110 volt (±10%) d-c line, approximately 25 watts.

VII. ANTENNAS

Two types of antennas are provided.

A. SMALL ANTENNA

This is a vertical rod antenna, approximately 24 feet in height, which is used for installations when space and time are limited. It may be used with, or without, the counterpoise wires, depending on the nature and conductivity of the soil over which it is erected. Short distance communication is possible using the three Type -66022 lower sections only.

B. LARGE ANTENNA

This antenna is of the single wire "L" type and is designed to be erected when space and time permit. It may be operated with or without the counterpoise wires, depending on the nature and conductivity of the soil over which it is erected; the ground post and mast (less the three top sections) are also required when the "large" antenna is used.

VIII. VACUUM TUBES

The Model TBX-8 Basic Portable Radio Equipment employs a total of nine vacuum tubes as follows:

Radio Transmitter:

One Type 3A4 as Master Oscillator

One Type 2E22 as Power Amplifier One Type 3A4 as Speech Amplifier (Modu-

lator)

One Type 991 neon tube as Side Tone Oscillator for "C.W."

Radio Receiver:

One Type 1A7GT/G as Frequency Converter —(1st Detector-Oscillator)

One Type 1N5GT/G as I-F Amplifier

One Type 1N5GT/ as Beat Frequency Oscil-

One Type 1N5GT/G as 2nd Detector One Type 1A5GT/G as Audio Amplifier

Spaces are provided, in Accessory Box Type -10339, which include each of the above types

as mobile spares as follows:

One Type 2E22

Two Type 3A4
One Type 991
One Type 1A7GT/G
One Type 1N5GT/G
One Type 1A5GT/G

In addition, one complete set of tubes as listed

above is carried as part of the Set of Equipment Spare Parts contained in Shipping Chest Type -10017B.

The Model -60133 Auxiliary Crystal Calibrator and Monitor employs one type 3A4 vacuum tube as a crystal controlled oscillator. An additional 3A4 vacnum tube is furnished as part of the equipment spare parts contained in Shipping Chest type -10017B.

TRANSMITTER

Type	Description	Fil. Poten- tial Volts	Fil. Cur. Amp.	Function	Remarks
3A4	Minature Pentode	2.8	0.1	R.F. Osc.	Triode Connected
3A4	Minature Pentode	2.8	0.1	Speech Amplifier (Modulator)	
2E22	R.F. Low Power Pentode	6.3	1.5	Power Amplifier	Suppressor Modulated
991	Glow Discharge Voltage Tube			Side Tone Osc. on "C.W."	Double contact bayonet candelabra base.

RECEIVER

Type	Description	Fil. Potential Volts	Fil. Cur. Amp.	Function	Remarks
1A7GT/G	Pentagrid Converter	1.4	0.05	Converter 1st Detector (Oscillator)	
1N5GT/G	R.F. Amplifier Pentode	1.4	0.05	I.F. Amplifier	
1N5GT/G	R.F. Pentode	1.4	0.05	2nd Detector	
1N5GT/G	R.F. Amplifier Pentode	1.4	0.05	Beat Freq. Osc.	
1A5GT/G	Power Amplifier Pentode	1.4	0.05	Audio Amplifier	

IX. INSTALLATION

A. GENERAL

The complete TBX-8 Basic Equipment is normally transported and stowed in Shipping Chest Type -10017B. Refer to Outline Diagram Fig. 28. Care should be taken to check parts against the list given on the contents name plate whenever the equipment is replaced after field use. Requisition replacement promptly when any item is lost, damaged beyond repair, or is utilized in effecting repairs. The completeness of the equipment, including all listed Equipment Spare Parts, must be maintained intact.

Batteries, when removed from Accessory Box Type -10339, should be stowed in the spaces provided in Shipping Chest Type -10017B. Connection Diagram Fig. 23 shows the proper connections for the batteries as used in Accessory Box Type -10339. This diagram also appears in the cover of the accessory box for ready reference.

CAUTION: THE BATTERIES MUST BE REMOVED FROM THE ACCESSORY BOX WHENEVER THE EQUIPMENT IS STORED OR SHIPPED.

No particular problems should be encountered in the installation of the Receiver Power Units. They must be placed within three feet of the radio-receiver power receptacle in a position where the power switch is readily accessible and the indicator lamp visible (EAO or EL only). They can usually be installed in the space formerly occupied by Accessory Box Type -10339.

Before installation of any one of the Model EAO or EL Series of Receiver Power Equipments, be sure that the vacuum tube, filter capacitors, and indicator lamp bulb are firmly inserted in their proper sockets.

Any of the line-operated Receiver Power Equipments should be connected, by means of the attachment plugs provided, to suitable fused outlet receptacles.

The battery-operated Model EAP or EN series of Receiver Power Equipments should be connected to the battery panel board, where available, by means of the clips provided.

Battery Cable Type -49574, provided in Accessory Box Type -10339, is to be used for connection from the power unit to the radio receiver.

CAUTION: WHEN USING A UNIT OF THE "EL" OR "EN" SERIES OTHER THAN MODELS EAO OR EAP ADAPTER TYPE -632246 MUST BE USED, TOGETHER WITH 3 FT. CABLE TYPE -49574.

When installing the Basic Field Equipment, the instructions for assembly and disassembly (which are also contained in the Condensed Instructions, carried in the cover of the Accessory Box Type -10339) should be followed.

When it is desired to use any one of the Model TBX Series of Portable Radio Equipments in an

open boat or in motor vehicles, a suitable wooden mounting rack can be constructed by the activities personnel for mounting and holding Radio Transmitter-receiver Unit Type -43060, Accessory Box Type -10339, and the "Small" antenna-mast base support.

Figs. 12 and 12A shows a suitable design for the mounting rack with the relative components of any of the Model TBX Series of Portable Radio Equipments mounted thereon. Radio Transmitter-Receiver Type -43060 is mounted on the top shelf with Accessory Box Type -10339 directly under it. Provision is made at the left for mounting the ground stake of the "Small" antenna. A space is provided, at the left of Accessory Box Type -10339, in which the microphone, headphones, and writing materials may be stowed when not in use. The rack has an extension at each end of the bottom to permit fastening to a bench, seat or other structural members as available. The rack can be fastened to its support by lashing, nailing, by the use of wood screws or machine bolts and nuts.

The rack illustrated is made of white-pine lumber and is fastened together with common nails. Almost any kind of wood can be used; the design is such as to be readily adapted to the available material.

Outline Diagram Fig. 29 shows the constructional details of the rack. Dimensions on this drawing indicate possible variations which can be made, depending on the material used. If desired, wood screws can be used to hold the parts together. The only tools required to build this rack, in its simplest form, are a saw and hammer. The hole, in the top shelf, for the ground stake is made by sawing off one corner of the shelf. The bottom support for this stake is a triangular block of wood nailed in position.

B. ASSEMBLY AND DISASSEMBLY INSTRUCTIONS

1. General

- (a) Always check equipment against the Basic Parts List prior to taking into the field, and also upon disassembly.
- (b) Keep all parts free of dirt and moisture.
- (c) Set up equipment so that maximum possible antenna clearance is provided.
- (d) The batteries must be removed from Accessory Box Type -10339, whenever the equipment is to be out of use for periods exceeding three days.

2. To Install "Small" Antenna

- (a) Locate and drive the ground stake. Drive guy stakes 120 degrees apart, about 12 feet from the ground stake.
- (b) Assemble antenna by screwing sections together in the order listed under the Basic Parts List and lay it on a line with one of the

- guy stakes, with the base adjacent to the ground stake. To assist in rapid assembly, all screw fittings with corresponding threads have been coded with the same color (Red or Yellow).
- (c) Unwind and separate all guy lines. Adjust guys to approximate lengths required.
- (d) Screw the insulated base section into the bottom section of the mast assembly. Erect this assembly to a vertical position and screw the ground stake to the bottom section.
- (e) Fasten the guys to the guy stakes with sufficient tension to prevent bowing of the antenna.
- (f) Connect the Transmitter-Receiver ground post to the ground stake, using the stub sections of the counterpoise. The five-foot insulated section should be connected to the equipment and the two-foot section connected to the ground stake by means of the clip provided.
- (g) Connect the Transmitter-Receiver antenna post to the post on the insulated base section, using the antenna lead-in. Keep this lead clear of the ground by moving Transmitter-Receiver Unit Type -43060 to take up the slack.
- (h) When the counterpoise is used, it should be spread out under the antenna.
- (i) Reverse the procedure to disassemble. Wrap the guy lines neatly between the hooks provided on the mast section:

NOTE: For short range communication it is only necessary to use the three lower sections of the "Small" antenna.

3. To Install "Large" Antenna

- (a) Assemble the "Small" antenna as previously described, omitting the three top sections and inserting the connecting ring of the end of the "Large" antenna wire between the 4th and 5th mast sections from the top. Erect and guy the antenna mast so formed.
- (b) Unroll the antenna; attach a heavy object to the end of the antenna line, and toss the end of the line across a suitable object, in such a manner that the antenna can be pulled up tightly. The far end of the antenna should be from 20 to 30 feet above the ground, and have a total span of from 40 to 70 feet.
- (c) The counterpoise, if used, should be spread out under the antenna with the stub lead connected to the ground stake of the mast.
- (d) To disassemble, reverse the above procedure. When winding the antenna, take care neither to snarl nor twist the wire. When winding the couterpoise, bring the far ends together at the reel and wind carefully and with sufficient tension to equalize the winding of the parallel wires. Separating the wire slightly, by allowing them to run between the fingers, will prevent twisting.

4. To Install D-c Hand Generator Type 21263B with Clamping Attachment

- (a) Remove the generator from its carrying case and unfasten the gasketed covers over the plug and hand crank holes.
- (b) Attach, with socket down, about shoulder high, to a suitable vertical object which is approximately 1½ inches to 12 inches in diameter. See that the thumbscrew is loose, then take up all extra slack in the chain around the object in the notch provided. Clamp by operating the thumbscrew.
- (c) Insert generator cranks so that they form a 180-degree angle, and connect Transmitter-Receiver Unit Type -43060 and the generator by means of the generator cable Type -49044A.
- (d) Retighten clamp after several minutes operation.
- (e) Reverse the procedure to disassemble, taking care to fasten the gasketed covers evenly and tightly.

To Unpack and Install Transmitter-Receiver Unit Type-43060 Accessories

- (a) Remove Transmitter-Receiver Unit Type -43060 and Accessory Box Type -10339 from their canvas carrying cases and open by disengaging the clamps. Open the gasketed cover of the accessory box socket.
- (b) Remove the lids and locate them conveniently near the Transmitter-Receiver unit. The leadin should approach the set from the left rear of the operator as he faces the panel.
- (c) Remove the head telephone set, key, microphone, and extension cords from the accessory box. Attach the key to the buttons on top of the transmitter-receiver unit so that the top of the set forms an arm rest. Connect the Head Phone Set and Microphone to their respective extension cords. Plug in the key, microphone and head telephone set. If a head-set with cord tips instead of plugs is available, it may be connected to the binding posts adjacent to the phone jack.
- (d) The Transmitter-Receiver unit may be set on top of the accessory box for operation. Two sponge rubber pads are provided for this purpose and are to be placed between the Transmitter-Receiver unit and the top of the Accessory Box.
- (e) Attach the 3 Ft. battery cable Type -49574 to the Accessory Box and Transmitter-Receiver unit.
- (f) See that the antenna, ground (or counterpoise), and power cable connections are properly made.
- (g) The equipment is now ready for operation.
- (h) Provision is made for the use of an auxiliary receiving antenna. The binding post for this is located to the left of the R. F. Ammeter.

To Disassemble and Pack Transmitterreceiver Unit Type-43060 Accessories

- (a) Reverse the foregoing procedure.
- (b) The accessory box should be repacked as follows:

Roll the cables together and place them on the bottom.

Pack in the antenna lead-in.

Wrap the key, head telephone set, and microphone separately in packing material, place in their respective bags and pack on top of the other units.

(c) Tighten all covers down tightly and evenly, and return the equipment to the respective canvas carrying cases.

AUXILIARY EQUIPMENT

C. REMOTE CONTROL UNIT TYPE-23453

- (a) Remove the Remote Control Unit type -23453 from its Canvas Carrying Case.
- (b) Remove the cover by loosening the eight latches located at each side of the box.
- (c) Install six Navy type -19031 or equivalent, 1½ volt flashlight cells as shown in Fig. 3A. The batteries are inserted between the bakelite uprights, so that the cap (positive terminal) slides into the groove in the bakelite supports.
- (d) When properly installed as described above, the batteries are all connected in series for a total supply of 9 volts. Care should be taken that none of the batteries are forced or reversed into the holder, as improper or no operation will result.

CAUTION: REMOVE THE SIX TYPE -19031 BATTERIES WHENEVER THE EQUIPMENT IS TO BE OUT OF USE FOR PERIODS EXCEEDING THREE DAYS.

These batteries should have a useful life of approximately 80 hours (based upon an intermittent use of 4 hours per day). When the voltage drops below 7 volts the cells should be replaced.

- (e) Some difficulty may be experienced in removing dead cells. This may be faciliated by partially lifting the complete assembly from the box, so that the batteries may be pushed out of the holder from the underside. See Figure 3A. Any bits of paper, torn from the battery cover, adhering to the contact springs should be removed before a replacement is made.
- (f) Remove the head telephone set, key, microphone, and extension cords from the Canvas Carrying Case. Attach the key to the key studs located on the top cover of the Remote Control Unit. See Fig. 3. Connect the head phone set and lip microphone to their respective extension cords. Plug in the key, lip microphone and head set. Attach headset with cord tips instead of plug if used to bind-

ing posts below the "Phones" jack. Connect the field telephone line to the "LINE" binding posts. It is assumed that the other end of the line has been connected to the "LINE" posts of the Transmitter-Receiver Unit; which has already been set up for operation in the normal manner. The line must be properly polarized for correct operation. This is described in detail under "Operation and Adjustment" Paragraph E.

- (g) For "Voice" operation the Remote Control Unit may be operated from the Canvas Carrying Case, since all jacks and binding posts are accessible when the flaps are open. See Fig. 3B.
- (h) The Remote Control Unit is now ready for operation with the type -43060 Transmitter-Receiver Unit.

7. To Disassemble and Pack Remote Control Unit Type -23453 Accessories

- (a) Reverse the foregoing procedure.
- (b) Repack accessories in compartment provided in the type -10375 Canvas Carrying Case.

D. INSTRUCTIONS FOR ASSEMBLY AND DISASSEMBLLY OF THE TYPE -60133 CRYSTAL CALIBRATOR AND MONITOR.

- (a) Remove the Crystal Calibrator and Monitor from the type -10339 Accessory Box.
- (b) Loosen the two thumb screws located on the top cover of the unit and slide out of box.
- (c) Install the type FT243 Crystal Holders and Crystals in the 10 socket positions and mark channel frequency in space markers opposite each lettered switch position. Install high frequency crystal channels between 5 and 6 megacycles in positions A, B, I and J for best operation.

CAUTION: Only type FT243 Crystal Holders of the front loading type with unungrounded nameplates should be used in the type -60133 Crystal Calibrator and Monitor. Use of type FT-243 Crystal Holders with grounded front nameplates will result in grounding one side of the crystal to the inside retaining channel of the Crystal Calibrator Monitor case and prevent operation.

- (d) Install the Navy Type -19031 or equivalent 1½ volt flashlight cell and the Navy type -19011 or equivalent 7½ Volt "C" Battery in the positions shown by Figs. 13 and 13A. Strip off the insulation from the black lead of the "C" Battery and connect the black lead to the adjacent binding post. Connect the Blue Lead with attached spade lug to the + terminal of the "C" Battery.
- (e) Install the unit into its box and tighten the two thumb screws securely.
- (f) Clamp the Crystal Calibrator Monitor under the thumb nut located at the upper left side

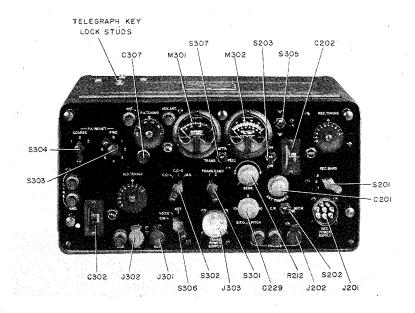


Fig. 5. Radio Transmitter-Receiver Unit Type -43060: Front View of Panel.

- of the type -10339 Accessory Box as shown in Fig. 1.
- (g) Turn the collapsible rod antenna to the vertical position and extend.
- (h) The Crystal Calibrator Monitor is now ready for operation with the Type -43060 Trans.-Rec. Unit.

8. To Disassemble and Pack the Type -60133 Crystal Calibrator Monitor

(a) Reverse the procedure in paragraph (f) and (g) to disassemble and repack the Crystal Calibrator Monitor in the Type -10339 Accessory Box. CAUTION: Remove the Type -19031 Flash-

light cell and the type -19011 "C" Battery or equivalents whenever the Equipment is to be out of use for periods exceeding three days and store in Type -10339 Accessory Box.

E. INSTRUCTIONS FOR ASSEMBLY AND DISASSEMBLY OF THE TYPE -10480 RAIN SHIELD (for use during rainy weather)

- (a) The Type -10480 Rain Shield is normally attached when not in use to the rear bottom case of the Type -43060 Trans.-Rec. Unit by means of a retaining strap which is permanently attached to one side of the shield and is stretched across the bottom of the case to a stud on the other side of the shield. See Fig. 15A.
- (b) In rainy weather remove the Rain Shield from the case by detaching the synthetic rubber strap securing it to the case and mount over

the guides on the front of the Type -43060 Trans.-Rec. Unit set up for operation.

(c) With the Rain Shield in place secure the synthetic rubber strap around the front portion of the Trans-Rec. Unit and attach to the stud on the other side of the Rain Shield as shown in Fig. 15.

To Disassemble and Pack the Type -10480 Rain Shield

(a) Reverse the above procedure to disassemble the Type -10480 Rain Shield and pack with type -43060 Trans.-Rec. Unit.

F. INSTRUCTIONS FOR ASSEMBLY AND DISASSEMBLY OF THE TYPE -632246 ADAPTER UNIT

- (a) Remove the Type -632246 Adapter Unit from the battery compartment of the Shipping Chest.
- (b) Remove the Adapter Unit from its bag and plug into the receptacle of the auxiliary power equipment or Type -10026-A Accessory Box Equipment to be used. See Fig. 27 for models of Auxiliary Equipment to be used with Adapter Unit.

(c) Plug the Type -49574 cable into the Adapter Receptacle Socket and connect the other end of the cable to the Receiver Receptacle Socket of the TBX-8 equipment.

To Disassemble and Pack the Type -632246 Adapter Unit

(d) Reverse the above procedure to disassemble and replace the Adapter Unit in the Shipping Chest battery compartment.

X. OPERATION AND ADJUSTMENT

A. WARNING

OPERATION OF THIS EQUIPMENT INVOLVES THE USE OF VOLTAGES WHICH ARE DANGEROUS TO LIFE. OPERATING PERSONNEL MUST AT ALL TIMES OBSERVE ALL SAFETY REGULATIONS. DO NOT CHANGE TUBES OR MAKE ADJUSTMENTS INSIDE THE EQUIPMENT WITH HIGH-VOLTAGE SUPPLY "ON."

In general, whenever the chassis is removed from the case to replace tubes or make adjustments, the generator and receiver power cables should both be removed from the panel sockets.

If it is desired to run any power unit when not connected to the radio transmitter through the power cable, the socket on the power unit should be closed by its cover to prevent accidental contact with socket terminals.

B. GENERAL

The operation and adjustment of the Model TBX-8 Portable Radio Equipment and Auxiliary Equipment are described in this section. The adjustment of the transmitter is essentially the same whether Hand-driven D-C Generator Type -21263B or the Auxiliary Power Equipments are used.

Assuming that the Basic Field Equipment has been set up and checked in accordance with the Installation Instructions given under Section IX the following procedure should be observed in adjusting the radio transmitter to a particular desired frequency or form of operation. For convenience of the operator, operating instructions in a condensed form appear in the cover of Transmitter-Receiver Unit Type -43060. Typical Transmitter performance data under average operating conditions are given in Fig. 17.

Typical settings for the P.A.-Antenna tuning controls are indicated by this data for both "large" and "small" antennas. In general, the "P.A.IND.FINE" switch setting and the "P.A. TUNING CAP." will vary somewhat from the typical settings between equipments and installations, while the "P.A.IND. COARSE" switch settings will be as shown. For a particular installation and equipment, the settings, to give optimum performance, should be determined for the most commonly used frequencies and recorded in ink in the spaces provided on the "TUNING CHARTS" at the bottom of the proper CALIBRATION CURVE.

Care must be exercised to prevent radiation on the second harmonic instead of the fundamental M-O frequency. This is most likely to occur when operating in the frequency range 2000-3000 kc ("Trans. Band" in No. 1 position), and can be avoided when using the two antennas supplied by referring to the typical performance settings. The typical resonant frequency limits of the P.A.-Ant. circuit, when operated with each of the two antennas for "P.A.IND.COARSE" switch settings and for the

extreme settings of the "P.A.IND.FINE" switch and the "P.A. TUNING CAP.", are given below:

P.A. Ind.	P.A. Ind. Fine	P.A. Tuning	App. P.AAnt. Resonant Freq Kc		
Coarse	rine	Сар	"Large" Ant.	"Small" Ant.	
1	1	0	1620	1750	
. 1	8	100	2356	2487	
2	1	0	2180	2346	
2	8	100	4463	4750	
3	1	0	2800	3058	
3	8	100	6480	7500	

If it is ever necessary or desirable to operate on any antenna other than one of the two for which the equipments were designed (e.g., it might be desirable to operate into a shipboard receiving antenna for emergency use), particular care must be taken to avoid combinations of P.A.-Ant. tuning which would result in emission at the second harmonic of the M-O frequency. In this case, a check with a wavemeter should be made.

Transmitter M-O and receiver tuning calibrations appear on the "TUNING CHARTS" carried in the cover of each transmitter-receiver unit,

Typical meter readings for the radio receiver with fresh batteries and at any frequency of operation are:

Operation	Filament Current (Milliamperes)	Plate Voltage (Volts)	
C.W. or M.C.W.	245	86	

WARNING

Each of the Model TBX Series of Portable Radio Equipments is individually calibrated; therefore, care must be exercised to utilize only the calibration charts which were supplied with the particular equipment involved. The serial number of each Transmitter-Receiver unit is engraved on a Type Plate located on the cabinet. Each calibration chart bears the serial number of the equipment to which it is applicable.

C. RADIO TRANSMITTER

1. C.W.—(Crystal Controlled)

- (a) Turn "C.W.-VOICE-NET" switch to "C.W."
- (b) Turn "C.O.-1, C.O.-2, M.O." switch to "C.O.-1" or "C.O.-2" depending on the desired crystal frequency (see proper TUNING CHART at bottom of the transmitter CALI-BRATION CURVE.)
- (c) Turn the "TRANS. BAND" switch to position "1" or position "2" depending on the assigned crystal frequency (see TUNING CHART at bottom of proper transmitter CALIBRATION CURVE.)
- (d) Turn the milliammeter ("M'T'R.") switch "TRANS.-REC." to "TRANS."
- (e) Refer to the TUNING CHART selected above and set the "M.O. TUNING" dial to the recorded reading for the particular crystal selected. Also turn the "P.A. INDUCT" switches, both "COARSE" and "FINE" and the "P.A. TUNING" dial to the approximate settings recorded for the particular antenna in use.
- (f) Operate the GENERATOR at approx. 65 R.P.M. and press the key. The transmitter current should reach a maximum reading in about 4 seconds.
- (g) With the key depressed, rotate the "P.A. TUNING" dial until maximum antenna current is obtained. The transmitter current should have a value between 50 and 70 milliamperes (lower scale reading).
- (h) Further adjustment of the "P.A. INDUCT-FINE" switch and the "P.A. TUNING" dial may be necessary to obtain maximum radiation.
- (i) In general, the optimum crystal setting is obtained as follows: starting from zero, turn the "M.O. TUNING" dial until crystal oscillation is indicated by a sharp increase in the transmitter current. When this occurs the side tone oscillator will be heard in the earphones. The dial is then rotated 50 to 75 divisions in the same or increase-reading direction.

2. VOICE—(Crystal Controlled)

(a) Proceed as in "1" above. Then turn the "C.W. - VOICE - NET" switch to the "VOICE" position.

3. C.W.—(Self-excited or M.O.)

(a) Procedure is the same as in "1," above, except that the "C.O.-1, C.O.-2, M.O." switch is set to the "M.O." position and the "M.O. TUNING" dial, the "P.A. TUNING" dial, the "P.A. INDUCT-COARSE" switch, and the "P.A. INDUCT-FINE" switch are set in accordance with the proper TUNING CHART for the desired frequency and the particular antenna used. If the desired fre-

quency is not recorded on the TUNING CHART, the "M.O. TUNING" dial setting is obtained from the CALIBRATION CURVE and the transmitter is tuned as described above.

4. VOICE—(Self-excited)

(a) Proceed as in "3". Then throw the "C.W.-VOICE-NET" switch to the "VOICE" position.

5. MODULATION CONTROL

When using the standard lip microphone, Type-51071, supplied with TBX-8 Equipment, the "MODULATION" control should be set at the maximum (or #10 position). This control is located on the left side of the chassis, and is accessible by removing the chassis from the cabinet.

With this maximum adjustment, when speaking in a normal manner, 90-100% modulation should be obtained. This is evidenced by an increase in the reading of the R.F. Ammeter of approximately 12½% over the value obtained without modulation.

If substantially less than 90% modulation is used, a loss in intelligibility when communicating over long distance or under adverse atmospheric conditions will result. Modulation considerably in excess of 100% will cause severe distortion.

Should the type -49007A microphone used in older TBX equipments be used the "Modulation" control should be turned to a lower setting so that at normal speech levels OVER-MODULATION will not result.

D. RADIO RECEIVER

1. C.W. Reception

- (a) Cease operating the GENERATOR, allowing it to come to rest normally
- (b) Set the "C.W.-M.C.W." switch in the "C.W." position.
- (c) Turn the milliammeter ("M'T'R.") switch "TRANS.-REC." to the "REC." position. The meter now reads the "A" or receiver filament current on the *upper* scale. This should be between the limits of the red shaded area.
- (d) Test the "B" battery voltage by holding the "A-B" switch momentarily down and reading the *lower* scale. The scale reading should fall between the limits of the indicated red range on the *lower* or 140 volt scale.
- (e) Refer to the RECEIVER CALIBRATION CURVES or the proper TUNING CHART at the bottom of these curves and set the "REC. BAND" switch and the "REC. TUNING" dial for the desired frequency. Advance the "SENS" control while tuning the dial near this setting and locate the desired signal. Readjust the "SENS." control for optimum signal and retune the "REC. TUNING" dial for maximum volume, adjusting the "ANT. TRIMMER" as necessary. Adjust the "B.F.O. PITCH" control for the desired beat note frequency.

2. PHONE or M.C.W. Reception

(a) Turn the "C.W.-M.C.W." switch to the "M. C.W." position. Readjust the "SENS." control, proceeding as for C. W. reception.

3. NET Operation

- (a) Throw the "C.W.-M.C.W." switch to "C.W." Set the "B.F.O. PITCH" control to zero. Tune in the station with which it is desired to "NET" and by means of the "REC. TUNING" dial adjust to zero beat.
- (b) Turn the "C.W.-VOICE-NET" switch to "NET." From the calibration or recorded tuning data set the "M.O. TUNING" dial to the approximate frequency of the received signal as determined from the receiver calibration. Apply power to the transmitter. Reduce the ssensitivity control so as to bring the signal to a suitable level for headphone reception. Adjust the "M.O. TUNING" dial for zero beat. Tune the antenna circuit for maximum power output as indicated by the R.F. Ammeter. NOW CAREFULLY READJUST the "M.O. TUNING" DIAL FOR ZERO BEAT.
- (c) Turn the "C.W.-VOICE-NET" switch to either "VOICE" or "C.W." as desired.

4. Auxiliary Antenna

The "AUX" binding post permits the use of a separate antenna for the receiver, as discussed in Section X-B (Auxiliary Antenna). Remove chassis from cabinet and slide the link on the terminal board on the rear of the panel to the "AUX" position. A screw driver fastened to the underside of the chassis may be used for this purpose.

AUXILIARY EQUIPMENT

E. REMOTE CONTROL UNIT OPERATION

- (a) Connect the line between the "LINE" binding posts of the Transmitter-Receiver and those on the remote unit. If line polarity is known, connect the plus wire of line from transmitter to L2.
- (b) Plug the headphones, key, and microphone into their respective jacks at the remote unit.
- (c) It is assumed that the Transmitter-Receiver has been set up and tuned for operation on a specific frequency, but with the Transmitter power supply not functioning. The key, microphone and headphones are left connected as for normal operation.
- (d) Depress the microphone switch. The operator or monitor at the Transmitter may now be instructed to start operation of the Transmitter power supply and set the "C.W.-VOICE-NET" switch to "C.W."
- (e) Depress the key. The side tone should now be heard in the headphones. If such is not the case, the line wires should be reversed and the test repeated.
- (f) The "TRANS." and "ANT" meters should now read.

- (g) If required, further adjustments of the Transmitter and Receiver can now be made. The equipment is then ready for operation on C.W.
- (h) If "VOICE" operation is desired, instructions may be transmitted, to the operator at the Transmitter by depressing the microphone switch and talking into the microphone. The voice currents are of sufficient intensity to override the side tone.
- (i) Two-way intercommunication without radiation, over the remote line may be obtained by setting the "C.W.-VOICE-NET" switch to the "NET" position. During such operation power must be supplied to the Transmitter, and remove the antenna lead. Power need not be supplied to the receiver for this type of operation.

CAUTION: CONTINUOUS OPERATION OF THE HAND GENERATOR IS NECESSARY AT THE TRANSMITTER-RECEIVER STA-TION DURING TWO-WAY COMMUNICA-TION WITH REMOTE CONTROL UNIT.

(j) Check modulation by noting change in antenna current and adjust "MODULA-TION" control (in transmitter) if necessary as described under "Modulation Control," Section C. Paragraph 5.

F. CRYSTAL CALIBRATOR AND MONITOR OPERATION

- I. Assuming that the basic field equipment has been set up for field use with the Crystal Calibrator and Monitor as shown in Fig. 1, the following procedure should be followed in adjusting the Transmitter or Receiver to a particular crystal channel frequency in conjunction with the Crystal Calibrator and Monitor.
- 11. Crystal Calibrator and Monitor operation with the Transmitter.
 - (a) C.W. (Self-Excited or M.O.).
 - 1. Select the crystal channel desired on the Calibrator Monitor and set the selector switch to that position. The crystal channel frequencies are pencilled in to correspond to the internal crystals plugged into the respective sockets.
 - 2. Proceed with adjustment of the Transmitter as described in paragraph (C3) except turn the "CW-Voice-Net" switch to the "Net" position.
 - 3. Plug the headphones into the "Phones" jack of the Crystal Calibrator and Monitor.
 - 4. Refer to the Transmitter tabulated "M.O. dial" settings for M.O. Bands 1 and 2 given on the chart located in the lid of the type -43060 Transmitter-Receiver Unit. Select the nearest M.O. dial setting that approximates the crystal channel selected on the Crystal Calibrator and Monitor.
 - 5. Extend the collapsible rod antenna to maximum length for maximum coupling to the antenna lead.
 - 6. Hold the momentary On-Off switch to the On position and at the same time rotate the M.O. tuning dial back and forth until

an audible beat frequency is heard in the Phones. Now carefully by rotating the M.O. tuning dial readjust the audible beat frequency to "Zero Beat" and lock the M.O. tuning dial. Release the Crystal Calibrator and Monitor momentary switch to the "Off" position.

7. Turn the "CW-Voice-Net" switch to "CW" or "Voice" and proceed with normal transmitter operation.

- 8. The Transmitter M.O. dial lock should be released and the initial setting checked for "Zero Beat" against the Crystal Calibrator and Monitor channel being used and the M.O. tuning dial reset at short intervals for initial "Warm-Up" drift. The procedure outlined in paragraph (6) above should be repeated with the "CW-Voice-Net" switch in the "Net" position.
- 9. The above procedure is the same for all other crystal channels selected on the Crystal Calibrator and Monitor. Continuous Monitoring of the Transmitter Signal is thereby made possible at all times that an M.O. frequency corresponding to the selected crystal channel is used. Readjust the rod antenna for optimum coupling dedesired to the Transmitter antenna lead to avoid blocking of the Crystal Calibrator and Monitor signal.

III. Crystal Calibrator and Monitor Operation with the Receiver.

- (a) "CW" Reception.
 - 1. Turn the "CW-Voice-Net" switch to "CW" or "Voice" for proper Receiver operation.
 - 2. Remove the Phones from the "Phones"

- jack of the Crystal Calibrator and Monitor and plug into the Receiver Phones jack.
- 3. Proceed with Receiver adjustments as described in paragraph (D1).
- 4. Select the crystal channel desired on the CRYSTAL CALIBRATOR AND MONITOR by turning the selector switch to the lettered position that bears the pencilled in frequency desired.
- 5. Refer to the receiver tabulated "Tuning Dial" settings for Bands 1, 2 and part of 3 given on the chart located in the lid of the type -43060 Transmitter-Receiver Unit. Select the nearest "Tuning Dial" setting that approximates the crystal channel selected on the CRYSTAL CALIBRATOR AND MONITOR.
- 6. Hold the On-Off momentary switch to the On position and at the same time rotate the "Receiver" Tuning" dial back and forth until an audible beat frequency is heard in the Phones. Now carefully by rotating the "Receiver Tuning" readjust the audible beat frequency to "Zero Beat" and lock the "Receiver Tuning" dial.
- 7. Proceed with normal receiver operation.
- 8. Recheck the receiver frequency with the Crystal Calibrator and Monitor as described above at short intervals for "Warm-Up" drift and monitoring.

 NOTE: Figure 18 and figure 18A are tabulated data for Transmitter and receiver bands for use with the Crystal Calibrator and Monitor. This data appears on the chart that is mounted in the lid of the type -43060 TRANSMITTER RECEIVER UNIT.

XI. ELECTRICAL CIRCUIT DESCRIPTION AND THEORY OF OPERATION

A. RADIO TRANSMITTER: [Reference is made to Schematic Diagram Fig. 19]

The type -43060 Transmitter-Receiver supplied as a unit of TBX-8 equipment, consists of a five tube superheterodyne Receiver and a four tube Transmitter.

This equipment employs "Push-to-Talk" operation on voice and "Break-In" operation on C.W., thereby eliminating the "Send-Receive" switch.

Provision is made, by means of the Type -23453 Remote Control unit for remote voice or C. W. operation over a W-110 (or equivalent) field telephone line up to one mile in length.

The transmitter consists of a 3A4 master oscillator, 2E22 Power amplifier and a 3A4 speech amplifier (Modulator). A 991 neon tube is employed as a tone oscillator to permit the operator to monitor his keying

The oscillator consists of vacuum tube V302 together with inductor L301, variable capacitor C302 and padding capacitor C303. For Master Oscillator (Self-Excited) operation, the frequency is deter-

mined by the setting of variable capacitor C302 and band switch S301. Capacitor C303 is used to set the high frequency coverage to a predetermined limit.

Switch S302 selects either of two fixed crystal frequencies or operation as a continuously tuned Self-Excited Oscillator. With Switch S302 in position "C.O.-1" or "C.O.-2" the corresponding crystal is connected to the grid of V302; padding capacitor (C302 and L301) is switched to the plate circuit of V302 to form a tuned anode crystal oscillator.

The voltage for V302 is dropped to the proper operating potential by means of series resistors R313 and R316. The potential for the screen of the Power Amplifier Tube (V301) is also obtained from R313.

Bias for the oscillator is developed in the grid leak consisting of resistors R301 and R302 in series. R.F. choke L302 in series with this grid leak provides a high impedance while maintaing the correct D.C. resistance for proper operation of V301 and also serves to prevent the entry of R.F. into the suppressor and modulation circuits. On self-excited operation the grid leak (R301 and R302) is common to

the power amplifier and oscillator grid circuits.

On crystal operation, since the grid of the oscillator, V302 is no longer connected to the grid of the power amplifier V301, separate grid leaks R317 and R318, are provided, which are connected across the individual crystals.

The plate of the 2E22 (V301) power amplifier is shunt fed thru R.F. choke L304 from the 550 volt supply which is by-passed for R.F. by capacitors C309 and C314. V301 is coupled by means of capacitor C308 to the output tank and Antenna loading circuits. Static drain resistor R315 prevents shock from the discharge of blocking capacitor C308.

The antenna and power amplifier plate circuits are common and are tuned to the desired frequency by the antenna coil L303, variable capacitor C307 and fixed capacitor C313. Coarse circuit adjustment of L303, and selection of fixed capacitor C313 are accomplished by switch S304. Fine adjustment of L303 is achieved by means of taps selected by switch S303. By this arrangement, a multiplicity of resonant combinations is obtained for any frequency in the Transmitter range to insure maximum output with either long or short antenna under various conditions of installation.

Resistor R323 inserted between L304 and the plate cap of V301 functions as a parasitic suppressor when the key is up while the voltage is applied to the Transmitter.

Switch S306 provides selection of C.W. or Phone. The third or "NET" position will be described elsewhere, in connection with the Receiver.

In the "C.W." position of S306, oscillator plate voltage is keyed through relay K301. This keyed voltage also feeds Neon tube V305 which functions as an oscillator to provide an audible side tone which is heard in the head phones. The suppressor of V301 is brought to ground potential in order to obtain maximum power output.

On "Phone" the suppressor is connected to the junction of R301 and R302. This provides a negative potential to limit the amplitude of the R.F. carrier to a value suitable for 90% phone modulation, with minimum distortion. Modulation choke L305 with grid swamping resistor R322 connected in parallel is inserted between the suppressor, which is bypassed for R.F. by capacitor C306 and this bias point. The voice currents from the microphone are fed through transformer T301 to the grid of modulator tube V303. The output of this tube is fed to the suppressor through coupling capacitor C317 and appears across modulation choke L305.

Modulator tube V303 operates as a Class A Pentode audio amplifier and provides sufficient gain to obtain 90% modulation at normal speech levels with a Navy type -51071 lip microphone.

Modulation control R321 is provided to reduce the output of higher level microphones to a suitable value, to prevent overmodulation.

Changeover from "Send" to "Receive" is accomplished automatically by means of relay K301. On "C.W." the relay is actuated when the key is depressed; on "Phone" when the microphone button is pressed. When this is done, the antenna is trans-

ferred from "Receive" to "Send," voltage is applied to the R.F. Oscillator V302 and the tone oscillator V305 (on C.W. only), and the B+ potential is removed from the receiver output tube, thereby rendering it inoperative. Since the plate voltage is always applied to the 2E22 while the transmitter power supply is functioning, it is necessary in the "key-up" position to limit the plate dissipation of tube V301 (2E22). This is accomplished by bleeder resistor R303 which limits the screen grid voltage, resulting in low plate current hence low plate dissipation. On remote operation this is accomplished by the use of an auxiliary relay RL302, the action of which will be described later.

When Switch S307 is thrown to the "TRANS" position, shunt resistor R310 is connected across the multimeter M302, which then reads the total "B+" current of the oscillator and amplifier tubes. The meter is by-passed for R.F. by capacitor C311.

Power for microphone excitation is obtained from the 12.6 V. microphone supply (Pin 66) which is filtered within the generator. Capacitor C310 provides additional filtering.

The filament of the modulator tube V303 is fed from this same source and is dropped through series resistors R307 and R308. R308 also provides a negative bias for the proper operation of V303 as an amplifier. R309 shunts one half of the filament (Pin 5 to Pin 7) to equalize the voltage across each half. Without this shunt, excessive voltage would develop across this half, with resultant decreased life. Capacitor C315 in conjunction with resistor R307 further filters the supply.

The filament current for the oscillator tube (V302) is obtained from the unfiltered 12.6 volt supply (Pin 64) through series dropping resistor R305. Here again, as in the case of the modulator tube V303, half the filament is shunted by resistor R306.

Resistor R304 is connected in series with the unfiltered 12.6 volt supply (Pin 64) to feed the filament of the 2E22 (V301).

The excitation for relay K301 is furnished by the unfiltered 12.6 volt supply (Pin 64). The auxiliary (remote control) relay is energized from the 12.6 volt filtered source (Pin 66) in addition to the batteries in the remote control unit. This will be described more fully, in connection with the remote control.

The plate of the modulator tube (V303) is fed through plate load resistor R320 and the screen through series resistor R319. Capacitor C316 bypasses the screen.

The high "B+" voltage is reduced through the common series dropping resistor R314 and bypassed by capacitor C318.

In order to facilitate keying, side tone has been incorporated to provide an audible note in the headphones. Neon tube V305 in conjunction with capacitor C322 and feed resistor R324 constitute the tone oscillator. This tone is coupled through capacitor C321 to the grid of V303. Note that this tube is now operating solely as an amplifier and is not functioning as a modulator. The plate of this tube is coupled

through isolating resistor R326 and capacitor C323 to the primary of the receiver output transformer (T201)

On voice operation, speech side tone is provided in the same manner. The tone oscillator is disconnected and no longer functions when Switch S306 is set to "Voice" operation.

Series limiting resistor R325, connected at the low end of the modulation control maintains sufficient resistance in the grid circuit of V303 to provide a satisfactory degree of side tone under all settings of the modulation control.

The following additions shown in Fig. 19 were made to the Transmitter section of the TBX-8 on all equipments above serial #295:

- (a) In order to eliminate a spurious parasitic oscillation when the transmitter is set for CO-1 or CO-2 operation, M.O. dial between 100 and 600 (either crystal not oscillating) "Trans. Band 1", and "Coarse" setting 1 capacitor (C324) was added. This capacitor is connected between pin 5 and pin 1 (ground) of V301.
- (b) A condition of high plate current exists (M302 pointer swings off scale) when the transmitter is adjusted for VOICE operation of CO-1 or CO-2 (either crystal not oscillating). With these settings the suppressor of P.A. tube V301 has no bias. When the microphone switch (MI401A) is depressed lightly a positive charge is applied to the suppressor of V301 causing excessive plate current to flow. Resistor (R327) has been added and connected between the suppressor pin #4 of V301 and ground to minimize this effect.

Equipments below serial No. 295 do not contain the changes outlined above. Should similar conditions exist the additional parts C324 and R327 should be added. A supplement describing the changes was added to Instruction Book IBT-8.

B. RADIO RECEIVER [Reference is made to Schematic Diagram Fig. 19]

The receiver is of the superheterodyne type employing a total of five tubes; one type 1A7GT/G, three type IN5GT/G and one type 1A5GT/G all of which are of the 1.4 volt low drain (0.05 ampere) series.

When the relay K301 is in its normal or deënergized position, the radio frequency energy which is picked up in the antenna is connected through the relay contacts to capacitor C234. This in turn couples to the control grid (Grid #4) of the converter tube V201 and the input tuned circuit.

The input circuit is tuned by variable capacitor C202-A (antenna section of the two gang tuning capacitor), antenna trimmer C201, and either L201, L203, or L205, which are selected by "Band Selector" Switch S201, together with their respective trimmer capacitors C206, C205 and C204. These capacitors limit the high frequency range of each band.

Antenna trimmer C201, which is manually operated from the front panel permits accurate alignment

of the input circuit with respect to the oscillator.

The band selector switch selects the proper oscillator inductor and shunt trimmer capacitor combination (L202, C216, C239), (L204, C215, C238), (L206, C214, C237) and the corresponding series padding capacitors (C213, C210), (C212, C209), (C211, C208).

This switch also short circuits the antenna and oscillator inductors not in use. Capacitor C207 serves to maintain the low potential side of the antenna circuits at radio frequency ground potential.

The oscillator tuned circuit is coupled to the No. 1 grid of converter tube V201 by means of coupling capacitor C203 and grid leak resistor R201.

The feedback winding is coupled to the anode or No. 2 grid by means of coupling capacitor C217 and series feed resistor R202. Capacitors C213, C210; C212, C209 and C211, C208 in addition to their padding function provide additional coupling for feedback and serve to maintain uniform oscillation throughout the range.

Screen grids (No. 3 and No. 5) of the converter tube are internally conected and are maintained at proper potential by means of series resistor R203 and by-passed to ground by capacitor C218.

The plate of the converter tube is coupled to the control grid of the intermediate frequency amplifier tube V202 through transformer T202 in which the plate and grid circuits are both tuned. The supply voltages fed to transformer T202 are suitably filtered by capacitors C219 and C220 and resistors R204 and R216 (which are located within the transformer shield).

The screen grid of intermediate-frequency-amplifier tube V202 is maintained at proper potential by series resistor R214 and by-passed with capacitor C222. Capacitor C221A serves to by-pass radio-frequency currents in the filament supply leads to this tube.

The plate of the intermediate-frequency-amplifier tube V202 is coupled to the grid of the second detector tube IN5GT/G (V203) by means of the coupling unit T203. In order to further reduce "Microphonics" the second detector socket is shock mounted.

Coupling unit T203 consists of a plate coil tuned to the intermediate frequency by means of its shunt trimmer and filtered from the plate supply by capacitor C223 and decoupling resistor R205. Coupling to the second detector grid is provided by C224 and the grid leak R206. The screen grid of this tube is maintained at proper potential by means of series resistor R207 and by-passed with capacitor C226.

The plate load of the detector consists of the iron core reactor L208 shunted by R217 and C235 in series. The RF component is by-passed by capacitor C228. Coupling to the audio amplifier tube V204 is provided by coupling capacitor C227 and grid leak resistor R208. Additional RF filtering is provided by series grid resistor R213 and by-pass capacitor C240.

Negative grid bias is obtained by returning R208 to the —6 volt connection of C Battery BT 403.

The audio amplifier functions as a pentode, the

output of which is coupled to the phones by means of the impedance matching transformer T201. Capacitor C221B in conjunction with resistor R218

serves as audio plate filter.

The "Phones" Binding Posts are connected in parallel with Jack J202, so that headphones terminating either in cord tips or in a standard plug may be used. Two pairs of phones may thereby be utilized simultaneously. In this case, the resultant impedance mismatch does not seriously affect the Receiver operation.

The beat frequency oscillator tank circuit consists of permeability tuned inductor L207, fixed capacitor C233 and variable capacitor C229. Capacitor C232 provides an RF ground return. The control grid is coupled by means of capacitor C231 and grid leak resistor R210, while the screen grid, serving as the oscillator anode, is directly connected to the other side of this tank circuit. Screen voltage is supplied through series resistor R211. The plate of V205 is fed from the B+ supply through series resistor R209. Capacitor C230 prevents undesired coupling through the supply leads. The beat frequency oscillator operates at one-half the intermediate frequency; the second harmonic of which is fed through coupling capacitor C225 to the plate of IF amplifier tube (V202) to produce an audio frequency beat note in the second detector. The pitch of this note can be varied by "B.F.O. PITCH" control capacitor C229 located on the front panel. The initial setting (mean frequency) is obtained by the adjustment of the iron core in L207

Batteries BT 405 and BT 406 in series, supply 90 volts to the plates and screens of all tubes in the

Variable grid bias for sensitivity control is supplied to the converter and intermediate frequency amplifier tubes through potentiometer R212 located on the

The filaments of all tubes are supplied directly from 1.5 Volt "A" Batteries BT 401 and BT 402 connected in parallel. Switch S203, the "ON-OFF" switch located on the front panel controls all batteries.

When switch S307 is set to the "REC" position, meter M302 is shunted by resistor R312 and reads the filament current.

The "CW-MCW" switch S202 located on the front panel turns the beat frequency oscillator off in the MCW position by removing the potential from the screen. Note that the filament of this tube is on at all time when the Receiver is in operation.

Receiver "B" battery voltage may be read on meter M302 by holding switch S305 in the "B" or momentary position, which conects R311 in series with the multimeter. Note that the battery voltage can be read only when switch S307 is in the "REC" position.

AUXILIARY ANTENNA

An additional antenna binding post (AUX. ANT.) is provided on the front panel so that a separate receiving antenna may be used. This may be desirable in order to utilize the Transmitter of this equipment as a frequency source or driver to operate a higher powered amplifier. The auxiliary antenna remains permanently connected to the Receiver. In this case the Transmitter is connected through the main antenna post to the power amplifier. The transmitting antenna is now connected to the output of the power amplifier and is in no way directly connected to the TBX basic equipment. A terminal board fitted with a sliding link is located on the rear of the front panel behind the "AUX. ANT." post. This permits either type of connection.

NETTING

In the description of the Transmitter, reference was made to the "NET" or third position of switch S306. This enables the operator to tune his Transmitter to the same frequency (zero beat) as an incoming re-

ceived signal for "netting" operation.

In this position the relay K301 is energized (without the necessity of depressing the key) thereby supplying voltage to the oscillator tube V302, the screen grid of power amplifier tube (V301) and simultaneously connecting the "B+" voltage of the output tube V204 into the circuit for Receiver operation. After the preliminary netting adjustments have been made, it is necessary to turn switch S306 to either "C.W." or "Voice" position as desired. In the "NET" position plate voltage from the Receiver converter tube V201 is removed rendering it insensitive. The plate voltage is removed from V201 so that in the "NET" position of switch S306, the Transmitter does not block the Receiver and cause it to emit spurious beat notes. (Filament voltage is supplied to all tubes in the receiver as long as switch S203 is "ON").

Should it be necessary, it is possible to check the calibration of the Transmitter against the Receiver or vice-versa by utilizing the beat frequency oscillator instead of the incoming signal. This will be discussed under "MAINTENANCE."

BREAK-IN OPERATION (C.W.) [Reference is made to Schematic Diagram Fig. 19] "Break-in" operation enables the operator at either

station to break-in or interrupt during periods of transmission.

When the key is depressed relay K301 is energized and the following occurs:

1. The antenna is switched from its normal or receiver connection to the output of the Transmitter.

2. Voltage is applied to the oscillator tube V302, side tone oscillator tube V305 and the screen of V301. (The plate potential of V301 is continuously maintained as long as the transmitting power supply is functioning.)

3. The "B" supply is removed from the Receiver

thereby rendering it inoperative.

Conversely, with the key up, the antenna is reconnected to the Receiver, the plate voltage is removed from the oscillator tube V302, side tone oscillator V305 and the screen of V301 and "B" voltage is restored to the Receiver.

The operator is therefore able to hear any trans-

mission during this key-up period.

D. PUSH-TO-TALK (Voice Operation) [Reference is made to Schematic Diagram Fig. 19]

Similarly, when the microphone button is held down, relay K301 is closed, the antenna is switched, voltage is applied to the oscillator tube and the screen of the P.A. tube and the Receiver becomes inoperative. However, S306 in the "Voice" position has interrupted the voltage to the Side Tone Oscillator, so that it no longer functions. Releasing the button, reverses the above procedure.

E. HAND-DRIVEN D-C GENERATOR TYPE-21263B [Reference is made to Schematic Diagram Fig. 19]

CAUTION: ONLY TYPE *CBF-21263-B* HAND DRIVEN GENERATOR IS TO BE USED WITH TBX-8 EQUIPMENTS, OTHERWISE EXCESSIVE INTERFERENCE WITH RECEIVER RECEPTION WILL RESULT.

This is a double commutator generator which obtains its field excitation from the low-voltage commutator through regulator resistor R501. Vibrator VR501 varies the amount of field resistance in the circuit between two values above and below the normal resistance value, in such a manner as to maintain a constant voltage across the low-voltage output, thus also maitaining the high voltage substantially constant. The actual value of output voltage is dependent upon the rate at which the vibrator operates, depending in turn upon the spring tension of the vibrator armature. In this manner, substantially constant output voltages are maintained despite changes in speed or loading of the generator.

The high voltage supply is filtered by means of capacitor C502, bypassed for R.F. with capacitor C501, R.F. choke L502 and capacitors C503 and

C504 in parallel.

The low-voltage supply is bypassed for R.F. by capacitor C505 and is filtered by R.F. choke L503 and capacitor C506. The microphone supply is further filtered by means of Audio Reactor L501 and capacitor C507.

Radiation of R.F. disturbance or "Hash" from the crank handles has been eliminated by means of grounding wipers at each end of the crank shaft. An additional wiper mounted in the gear housing grounds

the armature shaft.

Auxiliary Equipment

F: REMOTE CONTROL UNIT [Reference is made to Schematic Diagram Fig. 19 and 20]

An auxiliary relay K302 has been included in the transmitter section of the TBX-8 equipment to permit operation over a field telephone line (W-110

or equivalent) up to one mile in length.

With the addition of Remote Control unit type -23453 the Transmitter may be keyed for "C.W." or modulated for "Voice". "Break-In" and "Push To Talk" operation as described previously are still maintained. It is assumed that the Transmitter and Receiver have already been set up for normal operation on a specific frequency for either "Voice" or

"C.W.". No control of these functions is possible over the remote line.

The remote control consists of an impedance matching transformer, batteries for operation of microphone and the remote control relay (in the Transmitter), together with associated jacks for headphone microphone and key, as well as the headphone blocking condenser, key click filter and binding posts for connection to the remote line.

When either the key or the microphone button (at the remote station) is depressed, excitation for remote control relay K-302 is furnished by the filtered 12.6 V supply (Pin 66) in series with batteries in the Remote Control unit. Operation is as follows:

When the key at the remote position is depressed, current flows from this 12.6 Volt source, through the coil of relay K302, through line L2, through transformer T1401, then through the batteries (BT-1401 to BT1406) to ground and returns through line L1 to the generator. This activates this relay (K302) and closes the contacts which supply energy to the main relay K301. This, in turn, performs the functions of break-in keying, as described previously.

For "Voice" operation, the microphone button is depressed and activates two circuits, as follows. The talking circuit supplies microphone current through winding 2-1 of transformer T1401, then through batteries BT1401 to BT1404, and returns to the microphone through resistor R1401. The other or control circuit of the microphone switch grounds the battery through resistor R1401. This, as in the case of CW operation, in series with the 12.6 V filtered supply (Pin 66) energizes relay K302 which in turn controls relay K301. The audio component of the voice currents in winding 2-1 of transformer T1401 induces a voltage across the entire transformer 6-1, which is carried through the line L1-L2 and transferred by relay contacts 3-4 of relay K302 through C319 and is thereby impressed across the primary of the microphone input transformer T301, where it is amplified to modulate the carrier.

With the key up or microphone button not pressed relay K302 is in its normal position allowing the audio voltages of the Receiver to be fed from the ungrounded side of the Receiver output transformer T201, through capacitor C320 and contacts 4-5 (relay K302) into line (L2), through winding 6-5 of transformer T1401 into capacitor C1401, through this capacitor into the headphones through jack J1403.

Should the microphone button and the key be depressed simultaneously batteries BT1405 and BT-1406 would be short circuited through the microphone switch contacts. In order to avoid injury to the contacts, current limiting resistor R1401 is inserted between the microphone control circuit and the batteries. Capacitor C1402 and resistor R1402 connected across the key reduce key clicks.

With the Transmitter power supply inoperative, it is possible for the operator at the Remote unit to talk to the operator at the basic equipment in order to issue instructions as regards adjustments or operation of the equipment or for any other purpose. Microphone excitation is supplied by the batteries in the Remote Control unit.

The voice currents are carried by line L1 and L2 as in normal operation. However since the Transmitter power supply, which in conjunction with the batteries activates relay K302, is not functioning, insufficient current is supplied for relay operation. The line therefore remains connected through contacts 4-5 (K302) to the headphones.

In order to reply, the operator at the basic equipment must utilize the Transmitter power supply.

G. CRYSTAL CALIBRATOR AND MON-ITOR Type -60133 [Reference is made to Schematic Diagram Fig. 21]

With the addition of the Crystal Calibrator and Monitor type -60133 it is possible to obtain crystal controlled accuracy and stability of the transmitter during self-excited transmission over the entire frequency range at any one of the ten pre-selected crystal channels, incorporating type FT243 crystal holders and crystals. This also applies to the receiver section of the TBX-8 between the frequency limits of two to six megacycles.

The Transmitter and Receiver operating frequencies can be continuously checked during operations against the selected crystal channels of the Crystal Calibrator and Monitor. Any deviation in frequency of the Transmitter or Receiver due to initial "Warmup" drift can be immediately checked and corrected from the initial setting by "Zero Beating" with the selected crystal channel in use of the Crystal Calibrator and Monitor. The Transmitter and Receiver can also be continuously monitored at the crystal channel chosen for operation.

The type -60133 Crystal Calibrator and Monitor comprises a crystal controlled Pierce Oscillator employing a 3A4 tube running at 1.5 volts (nominal) filament and 7.5 volts (nominal) plate. The unit includes a momentary type On-Off switch which breaks both "A" and "B" voltage. A ten point selector switch selects any one of the ten type FT243 crystal holders and crystals plugged into their respective sockets. A closed circuit jack permits use of a Navy type 49507-A headset for transmitter operation. A telescoping three section type rod antenna is attached to

the antenna binding post of the Crystal Calibrator and Monitor for coupling to the Transmitter-Receiver antenna.

When momentary switch S1701 is depressed filament voltage is supplied the triode connected 3A4 (V1701) tube. At the same time plate voltage is supplied through radio frequency choke L1701 bypassed by capacitor C1702.

The crystal (Y1701-Y1710) is placed in the network that couples the output plate (pin #2-6) of the 3A4 (V1701) to the input grid (pin #4) thereby creating feedback for self-oscillation of the crystal. Grid leak resistor completes the circuit and is connected between pin #4 of the 3A4 (V1701) tube and returned to + filament. The Pierce crystal-controlled oscillator circuit thus formed causes the crystal to vibrate at a frequency determined primarily by the frequency of mechanical resonance of the crystal.

Output amplitude of the Crystal Calibrator and Monitor is dependent on three factors. These are operating frequency of the crystal in use, Gm of the 3A4 (V1701) tubes, and plate voltage supply to the 3A4 (V1701) tube. The amount of radio frequency energy supplied to the antenna terminal through coupling capacitor C1701 is therefore determined by the above factors.

The radio frequency energy produced is radiated by a telescoping three section rod antenna (A1701) that is connected to the antenna terminal of the Crystal Calibrator Monitor. Coupling to the antenna terminal of the Transmitter-Receiver unit may be varied by simply raising or lowering the sections of the telescoping rod antenna.

The closed circuit phone jack (J1701) connected to the output of the Crystal Calibrator Monitor permits detection of the signal during Transmitter operation.

Releasing momentary switch S1701 to the Off position makes the Crystal Calibrator and Monitor inoperative disconnecting both the "A" and "C" batteries. In order to preserve the life of the internal batteries momentary switch S1701 should always be returned to the Off position.

XII. MAINTENANCE

A. GENERAL

- (a) This equipment is designed to minimize maintenance requirements. However, with any such intricate electrical mechanical device, certain precautions and periodic inspections will assure good performance and reduce probabilities of failure.
- (b) The units of the TBX-8 basic equipment, auxiliary equipment, except auxiliary power equipments have all been "Tropicalized" to eliminate the effects of moisture and fungus growth encountered when in use in tropical climates. Wax impregnated wire has been replaced in all units except the type CBF-21263B Hand Generator by a vinylite coated, fungus resistant wire.

CAUTION: When replacing any part in

the equipment or making any repairs clear the connecting leads of all coating material before soldering. Each unit of the TBX-8 equipment is stamped or has a label affixed to it bearing the above information together with the date of tropicalization. The repaired units should be recoated with a moisture and fungus resistant material upon completion.

B. VACUUM TUBES

Vacuum tubes, especially in the Radio Receiver Crystal Calibrator and Monitor and Transmitter should be replaced at stated intervals rather than as failures occur in each tube. An optimum replacement interval may usually be obtained after some experience under actual operating conditions. If tube testing equipment is available, periodical checks of all tubes should be made.

Tubes should be discarded when the end of useful life is indicated, in a Standard Navy Tube Testing Equipment such as the Model OD-1, by the following, in accordance with Navy Specifications JAN-1A for radio electron tubes.

When changing tubes in the radio Receiver, it is suggested that the Receiver power cable be removed from the power supply or turn the Receiver switch to the "off" position.

C. BATTERIES

(a) The Receiver batteries are designed to give at least 100 hours of service, based on intermittent use of four hours per day, with Fresh batteries. Batteries should be put in service prior to the expiration date stamped thereon. After this date the battery characteristics can be no longer predicted or guaranteed.

The "A" battery may be operated until the voltage falls to 1.1 volts before the operation of the

equipment is appreciably affected.

The "C" battery should be replaced, in general, whenever the "B" batteries are replaced. In any case replacement should be made whenever its voltage falls below 4.5 volts.

The condition of the "A" and "B" batteries may be readily checked by means of the meter provided on the front panel of Transmitter-Receiver Unit

Туре-43060.

Operating ranges for "A" and "B" batteries are indicated respectively by the upper and lower red shaded areas. When the pointer indicates a reading below 200 MA, the "A" batteries should be replaced. The "B" batteries should be replaced when a reading below 67 volts is obtained.

CAUTION: THE BATTERIES MUST BE REMOVED FROM THE ACCESSORY BOX WHENEVER THE EQUIPMENT IS STORED OR DURING SHIPMENT.

(b) The Crystal Calibrator and Monitor batteries are designed to give at least 50 hours of service, based on intermittent use of two hours per day with fresh batteries.

The type -19031 1.5 volt "A" battery should be replaced when the voltage falls below 1.1

volts.

The type -19011 7.5 volt "C" battery should be replaced when the voltage falls below 6.0 volts.

CAUTION: The batteries must be removed from the Crystal Calibrator Monitor whenever the unit is out of use for periods exceeding three days and store in type -10339 Accessory box.

D. HAND-DRIVEN D-C GENERATOR TYPE-21263B

The generator should be checked occasionally for brush wear and brushes replaced when duly worn.

The generator should be checked on the bench periodically for voltage-regulator adjustment. A 1000-ohm-per-volt voltmeter should give full load readings between terminals 63 and 65 of 550 volts \pm 4%, when the generator crank speed is between 60 and 70 rpm. The voltage indicated in a like manner between terminals 64 and 63 should be 12.6 \pm 5%. If the generator "full load voltage" deviates appreciably from the above values, the cover should be removed and the vibrator tension screw "Ç" of voltage regulator VR501, located near the coil at the bottom, should be turned to the right to raise the voltage or to the left to lower it. It will generally not be necessary nor desirable to disturb the settings of the fixed contacts. When the generator is cold, the voltmeter readings will be near the lower limit.

In the event that the "full load check" indicates a voltage across terminals 63 and 65 of approximately 100 volts, worn or dirty vibrator points are indicated. Clean the contacts with a fine grade of sandpaper and adjust according to the following instructions and use the gauge provided in the cover of the generator. (These instructions also appear in the cover

of the generator.)

Adjust "A" (right-hand contact looking at gear end of generator) to 1/64 in. between vibrator core

and vibrator armature (use gauge).
Adjust "B" to 0.0008 in. between vibrator con-

Adjust "B" to 0.0008 in. between vibrator contact and contact screw (use gauge provided; a "loose" gauge setting, i.e., slightly over 0.0008 in., is preferable to a tight gauge setting).

Adjust "C" to obtain the voltage shown on the

nameplate, full load condition.

DO NOT ATTEMPT THIS ADJUSTMENT UNLESS ABSOLUTELY NECESSARY.

E. RADIO TRANSMITTER-RECEIVER UNIT, TYPE -43060

1. General

Radio-frequency switches S301, S302, S303, S304, S306, and S201 may, after long periods of disuse under unfavorable conditions of storage, show some tendency toward poor contact. In such cases, it is generally not necessary to clean these switches since operating them in all positions several times should effectively clean off the contacts.

Transmitter-receiver Unit Type-43060 should be inspected periodically and kept as clean and dust-free as possible. Collection of dust or dirt on parts, particularly the capacitor plates, may result in poor performance in the radio receiver and "flash-over" in the Transmitter capacitors, besides being a nutrient for fungus growth in tropical areas.

2. Radio Receiver

The radio Receiver is designed to maintain its alignment under the most adverse conditions of operation normally encountered in the service intended. However, for best performance it is good practice after any considerable period of use to check

alignment of the radio Receiver. A signal generator, capable of supplying a 30 per cent modulated 400-cycle r-f output up to about 1000 microvolts at the alignment frequencies given below, and an output meter, scale 0 to 3 volts (approximately) are necessary.

Alignment frequencies

I.f.-1515 kc R.f.-1967.8 kc-3283.6 kc Band No. 1 -3102.0 kc-5182.4 kc Band No. 2 -4903.7 kc-8187.5 kc Band No. 3

The i.f. may be aligned by putting the Receiver tuning controls in "Band No. 1-Dial 0" position, applying a signal of approximately 1000 microvolts between the antenna and ground, and adjusting the i-f transformers for maximum output voltage.

The r-f sections should be aligned in the sequence given above by means of appropriate trimmer capacitor C214, C215, C216, C204, C205, or C206 at the high-frequency end of each band. Padder capacitors C211, C212, and C213 should then be adjusted at the low-frequency end, repeating the process by alternate adjustments of "SERIES PADDER" and "SHUNT TRIMMER" until alignment at the given frequencies is obtained. During adjustment of the r-f sections, antenna trimmer capacitor C201 should be set to mid-position. The beat oscillator should be set to 757.5 kc with the "WOBBLER" control set on zero, or midscale.

CAUTION: NEVER ATTEMPT TO ALIGN THE RADIO RECEIVER UNLESS PROPER TEST EQUIPMENT IS AVAILABLE.

F. ACCESSORY BOX TYPE-10339

Accessory Box Type-10339 requires no special maintenance other than making sure that the batteries are removed during any 3-day period of inactivity, and that the socket is kept clean and free from moisture. After periods of operation in which the equipment has been exposed to rain and moisture, particular care should be taken to see that this socket is wiped clean and dry prior to tightening the cover. The parts contained in the box should be wiped clean and dry after use in the field.

G. "SMALL" ANTENNA

This unit requires no special care other than normal cleaning after field operation. The joints should be wiped with an oily rag after exposure to rain or dust.

H. LUBRICATION

1. Transmitter-receiver Drive Mechanism

Periodically wipe, clean, and oil with one or two drops of Navy Grade 1075 oil.

2. Hand-driven D-c Generator Type 21263B

This equipment is designed to run for long periods of time without lubrication. However, the following procedure is recommended. The generator shafts run on ball bearings, six altogether, which require only enough grease to keep the balls from rusting. Excessive greasing will result in generator trouble as surely as failure to grease the bearings.

Every six months the bearings should be greased with Non-fluid Oil, which corresponds to Navy Department lubricant Specification "Ball Bearings-14L-3."

CAUTION: ONLY UNPAINTED, CADMI-UM-PLATED SCREWS NEED BE REMOVED AT ANY TIME. ALL SCREWS ARE SEALED WITH "ALUMILASTIC" SEALING COM-POUND TO MAKE THEM WATERTIGHT AND, IF REMOVED, SHOULD BE SEALED AGAIN.

To grease the bearings, remove the gear case held by five screws. This allows access to two ball bearings in the gear case and two in the generator housing. To reach the other two bearings, remove the two plates at the end of the generator opposite the gear case. The upper plate is held by four screws, the lower plate by two screws. Spread grease on the gear teeth, adding new grease if required.

When reassembling, care should be taken that the gaskets and surfaces bearing against them are free from dirt. The screws should be tightened gradually and evenly to insure good contact.

When reassembling the gear case, it is necessary to give a forward and backward rocking motion with the handcrank while pressing on the gear case so as to allow the balls of the bearings to take their seat in the outer race.

3. "Small" Antenna Joints

Use a drop of Navy Grade 1075 oil occasionally.

4. "Large" Antenna Reel

Use a drop of Navy Grade 1075 oil occasionally on the axle joint.

I. MICROPHONE CONNECTIONS

Microphones furnished with TBX-8 equipments are connected per Navy Specification RE-8944A, circuit "A", wherein the microphone plug sleeve is common, microphone connected to ring and control circuit to tip. (RED code marking.)

In the event that microphones are supplied, or that it is desired to use microphones connected per circuit "B" of the above Navy Specification, which is the WHITE connection, it will be necessary to change the microphone leads within the set so that the ring and tip connections are interchanged on jack J302.

If such a change is made in the field, the proper code color should be marked on the jack cover.

XIII. DIMENSIONS AND WEIGHTS

A. MODEL TBX-8 PORTABLE RADIO EQUIPMENT

The dimensions and weights of the components of the Model TBX-8 Portable Radio Equipment, packed for transportation and as assembled for operation are shown on Outline Diagram Fig. 28.

A summary of weights of components of the Equipment complete in carrying cases for field transportation:

1.	Radio Transmitter-Receiver Unit	
	type-43060, with type-10480 Rain	
	Shield	lb.
2.	Accessory box type-1033931.1	lb.
3.	Antenna Assembly11.2	1b.
4.	D.C. Generator type-21263B 27.2	lb.
	Remote control unit type-23453 8.6	
	Adapter unit type-632246	
	Crystal Calibrator and Monitor type	
	-60133	1b.
8.	Shipping chest type-10017B (complete	
	with one set of spare batteries) 209	1b.

XIV. ORDERING OF RENEWAL PARTS

Replacement of defective items during the guarantee period should be made in accordance with the provisions under "guarantee" at the beginning of this book.

When ordering replacement parts, the "Part Designation" and "Navy Type JAN or A.W.S. Number," together with a description of the parts

and the Navy contract number should be given. This information appears in the Parts List which follows.

When ordering replacement crystals, all information given in the Parts List; the Government Contract Number under which the Equipment was furnished; and the CRYSTAL FREQUENCY DESIRED should be given.

XV. SERVICING

A. TYPICAL VOLTMETER READINGS

Troubles due to possible failures of parts such as transformers and resistors can be traced by the following typical voltmeter readings. These were taken with a 20,000 ohms per volt voltmeter. Since these readings must be taken with the case off and power on PRECAUTION MUST BE TAKEN TO PREVENT COMING IN CONTACT WITH PARTS OF THE TRANSMITTER CARRYING HIGH POTENTIALS.

1. Radio Receiver

Operation: CW, Band No. 1, DIAL 0, Sensitivity control at maximum. Tubes in sockets, Average Battery Conditions.

Terminal Designation	Meter Full Scale Volts	20000 ohm-per-volt Meter Readings to Ground
Power Socket J201		
No. 41 No. 52 No. 50 No. 48 No. 40 Converter Socket X2	250 10 10 10 10 10	85 0 .1 -5.9 -1.4
Cap	2.5	-1.22
Pin 3 Pin 4 Pin 5 Pin 6 Pin 7	250 50 10 250 2.5	-1.22 84 45 -3.5 72 -1.4
I-F Socket X202		-
Cap Pin 3 Pin 4 Pin 7	2.5 250 250 2.5	-1.05 85 83 -1.4
Detector Socket X203	3	
Cap Pin 3 Pin 4 Pin 7	2.5 250 250 2.5	55 80 83 -1.4
Audio Amplifier Sock	et X204	
Pin 5 Pin 3 Pin 4 Pin 7	10 250 250 2.5	-6 84 84 -1.4
Beat Freq. Osc. Socke	et X205	
Cap Pin 3 Pin 4 Pin 7	2.5 250 250 2.5	-1.1 1.1 37 -1.4

2. Radio Transmitter

Large Antenna, M.O. Band 1, 2716KC

P.A. IND. COARSE 2

P.A. IND. FINE

P.A. CAP Approx. 12

Power socket terminal voltage held constant at values given below.

Condition of Operation

CW Crystal Control CW Crystal Control
CW Crystal Control Voice Crystal Control CW Self Excited Voice Self Excited
CW Crystal Control
CW Self Excited Voice Self Excited
CW Crystal Control
CW Crystal Control Voice Crystal Control CW Self Excited Voice Self Excited
CW or Voice

B. INCORRECT OPERATION AND SUGGESTED REMEDIES

1. Radio Receiver

Incorrect Operation

- (a) I.F. oscillates with sensitivity control maximum.
- (b) Receiver "DEAD."
- (c) Sensitivity low.

2. Radio Transmitter

- (a) No output, crystal controlled or self excited operation.
- (b) No indicated transmitter current operation otherwise correct.
- (c) Radio transmitter does not key, crystal controlled or self-excited operation.
- (d) Radio transmitter keys, no output on crystal controlled operation.
- (e) No indication of modulation, operation otherwise correct.
- (f) Radio transmitter operates in "C.W." position, no indication of side tone in headphones. Receiver operates.

3. Hand-driven D-c Generator Type 21263B

- (a) Low output voltage.
- (b) No output voltages.
- (c) High ripple in "C.W." or "VOICE" operation.

Suggested Remedy

See that the tube shields are tightly in place. Check voltages, particularly "C" battery. Replace I.F. tube. Realign I.F. (ONLY IF NECESSARY).

Check voltages and headphones. Check battery connections. Check continuity with use of connection diagram Fig. 25.

Check voltages. Change tubes. Realign Receiver (ONLY IF NECESSARY). Check position of "C.W.-VOICE-NET" switch, it should be in "C.W." or "VOICE" position.

See that the antenna is properly erected and connected. See section IX, installation paragraph B2. Check power sources and cable. Check voltages. Check for continuity with use of connection diagram Fig. 24. Replace tubes. Check key and cord, check relay K301. Check antenna ammeter.

See that the "MTR" switch is in the "TRANS" position. Check continuity of meter M302 and connections.

Check relay K301. Check continuity of key and cord. Check continuity of keying circuit.

Be sure that the crystals are in their correct positions (see Calibration Chart). Check setting of M-O. dial in accordance with the calibration chart. If operation is satisfactory under M.O. conditions (same frequency) crystal failure is indicated. Replace crystal.

Check 3A4 Modulator Tube. Check voltages. Check continuity of microphone transformer and modulation reactor. Check microphone and switch cord for continuity. Be sure the "C.W.-VOICE-NET" switch is in the "VOICE" position. Check continuity of this switch. Check setting of modulation control.

Check continuity of side tone circuit. Replace 991 neon tube.

Adjust as described under "MAINTENANCE." Check voltages at generator outlet. Check cable.

Check internal continuity. See Fig. 19. Check brushes and if necessary replace. Check and adjust vibrator as described under "MAINTENANCE."

Indicates failure of filter capacitor C501. Check connections; replace capacitor if necessary.

4. Remote Control Unit

It is assumed that the Transmitter-receiver is functioning normally.

Incorrect Operation

- (a) Voice not heard in headphone when speaking into microphone.
- (b) Side tone not heard at remote position when key is depressed but audible at receiver.
- (c) Transmitter does not key.
- (d) Transmitter does not modulate.
- (e) No incoming signal (Voice or C.W.)

5. Crystal Calibrator and Monitor

- (a) No output.
- (b) Low output.
- (c) Intermittent operation.
- (d) No phone output.

Suggested Remedy

Check battery contact springs, and batteries. If necessary replace batteries. Check headphones and jack. Check microphone. Check continuity of line. Check for and remove any water in microphone jacket J1402.

Check polarity of line as described in Section X paragraph E. Check continuity of headphones. Check continuity of auto transformer T1401. Check relay K302 in transmitter. Check continuity of line. Check key.

Check continuity of key, cord and plug. Check batteries. Check continuity of T1401. Check line. Check relay K302. Check for and remove any water in key Jacket J1403.

Check microphone, switch and connections. Check batteries. Check relay K302.

Check headphones, Transformer T1401, jack J1403, line and remote relay K302 (in transmitter).

Replace crystal, check battery connections. Check selector switch position.

Check condition of "A" and "C" battery. Check or replace 3A4 tube.

Check telescoping ant. connection at ant. post. Tighten if loose. Rotate selector switch to clean contacts.

Check continuity of closed circuit jack (J1701) for open connection inside jacket.

MODEL TBX SERIES OF PORTABLE RADIO EQUIPMENTS

XVI. LIST OF MAJOR UNITS

Navy Design		Name	Symbol Group
Unit	Accessories		Group
-10017B		Shipping Chest for Model TBX Series of Equipments	101-199
	 , · ·	Carrying Cases for Model TBX Series of Equipments	101-199
-43060	, <u> </u>	Receiver Section of Transmitter-receiver Unit.	201-299
-43060		Transmitter Section of Transmitter-receiver Unit.	301-399
	-10339	Accessory Box and Contents	401-499
21263B	·	Hand-driven D-c Generator	501-599
_	<u> </u>	Antenna System for Model TBX Series of Equipments	901-999
-23453		Remote Control Unit	1401-1499
-632246		Receiver Power Supply Adapter	1501-1599
 j	-10480	Rain Shield	1601-1699
-60133		Crystal Calibrator and Monitor	1701-1799

PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL TBX SERIES OF PORTABLE RADIO EQUIPMENTS Receiver Section of Type CGQ-43060 transmitter-receiver unit TABLE 1

Garod Dwg. and Part No.		E-PC-1104	E-SA-1386		E-SA-1401	D-SA-1388						
Special Tolerance, Rating or Modification		•	•	•	•	•	·		1		ž	
Mfr. Desig- nation		•	•	•	•	•,						
.TIM		н	Q	cv3	Q	οù		 				
Navy JAN and/or(A.W.S.) Specification Number	CASE	:	•	•	•	•				•		
Navy Type Designation JAN / or A.W.S. No.	SHIPPING CHEST AND CARRYING	CFU-10017B	CWP-10027A	CWP-10027A	CWP-10028A	CWP-10029A						
Description	SHIPPING	Vulcanized fiber plywood chest with wooden inner partitions for units of basic and auxiliary equipment and station spare parts	Canvas carrying case for Transrec. Type 43060	Same as A101 except for Accessory Box Type 10339.	Canvas Carrying case for Hand-driven Generator Type CBF-21263B	Canvas Carrying Case for antenna system						
Function		Shipping Chest	Carrying Case	Carrying Case	Carrying Case	Carrying Case						
Symbol Desig- nation		A100	A101	A102	A103	A 104						
•												

TABLE I PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL TBX SERIES OF PORTABLE RADIO EQUIPMENTS RECEIVER SECTION OF TYPE CGQ-43060 TRANSMITTER-RECEIVER UNIT

			3.5.					
Symbol Desig- nation	Function	Description	Navy Type Designation JAN / or A.W.S. No.	Navy JAN and/or(A. W.S.) Specification Number	.TIM	Mfr. Desig- nation	Special Tolerance, Rating or Modification	Garod Dwg. and Part No.
			CAPACITORS					
C201	Antenna Trimmer Capacitor	Midget variable; 13.3 mmfd max.	CAIM-482212	•	10	Type H Code 13G	•	C=C0-808
2020	Main Tuning Capacitor	Two section var cap	•	•	4	•	•	D-CO-812
2020	Oscillator Grid Blocking Capacitor	Mica: 0.00025 mfd ± 10% 500 Volts d-c. working	CSL-48690-B10 †(CM 20B 241J)	JAN-C-5	က	•	Tropicalized Wax Imp.	B-C0-728
C204	Band 3 R-F Padding Capacitor	Variable Ceramicon 7-45 MMFD N500 Temp. Coefficient	CER-481623	•	9	TS2A	•	B-C0-10004
C205	Band 2 R-F Padding Capacitor	Same as C204	CER-481623	•	v	TS2A	•	
2806	Band 1 R-F Padding Capacitor	Same as C204	CER-481623	•	ဖ	TS2A	•	
C207	R-F. By-Pass Capacitor	011 Filled .02 Mfd +20% 400 volts working -10%	CSL-482068	RE-13A-488E	က	момтх	•	B-C0-992
0208	Band 3 Fixed Osc. Padding Cap.	Mica: 0.0007 MFD ± 1% 500 Volts D.C. working	CSL-481016-D1	RE-13A-389K	ည	MWSDW-	Tropicalized. Wax Imp.	B-CO-741
6020	Band 2 Fixed Osc.	Mica: 0.0004 MFD ± 1% 500 Volts d.c. working	CSL-481015-D1	RE-13A-389K	тÖ	MOSDW- 1421	Tropicalized. Wax Imp.	B-C0-742
0210	Band 1 Fixed Osc. Padding Cap.	Mica: 0.0003 MFD ± 1% 500 Volts d.c. working	CSL-481014-D1	RE-13A-389K	rO.	MOSDW- 1420	Tropicalized Wax imp.	B-C0-743
C211	Band 3 Variable Osc. Padding Cap.	Same as C204	CER-481623	•	9	•	•	
C212	Band 2 Variable Osc. Padding Cap.	Same as C204	CER-481623	•	60	•	•	
C213	Band 1 Variable Osc. Padding Cap.	Same as C204	CER-481623	•	9	•	•	
		-	,					

† Not exact equivalent, but may be used as an alternate.

TABLE I PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL TBX SERIES OF PORTABLE RADIO EQUIPMENTS RECEIVER SECTION OF TYPE CGQ-43060 TRANSMITTER-RECEIVER UNIT

Garod Dwg. and Part No.		B-CO-10004			B-C0-723					C-CO-10000			B-C0-725	B-C0-732	
P. Q. G.		B-C								0 			Б-Q	B-C	
Special Tolerance, Rating or Modification		•	•	•	Tropicalized Wax Imp.	Tropicalized Wax Imp.	Tropicalized	Tropicalized Wax Tmp.		•	Tropicalized Wax Imp.	Tropicalized Wax Imp.	Tropicalized Wax Imp.	Tropicalized Wax Imp.	
Mfr. Desig- nation		TS2A	•	•	MWBW- 1241	•	•	•	9 YKHRR9 . 5	-1020	•	•	MOBW- 1416	MOBW- 1401	
.TIM		ဖ	9	9	ω	ſΩ	Ŋ	വ		ω 	വ	υ	ω	2	
Navy JAN and/or(A.W.S.) Specification Number		•	•	•	JAN-C-5	JAN-C-5	JAN-C-5	JAN-C-5		RE-13A-488E	JAN-C~5	JAN-C-5	JAN-C-5	JAN-C-5	
Navy Type Designation JAN / or A.W.S. No.	CAPACITORS (Continued)	CER-481623	CER-481623	CER-481623	CSL-48770-B10 (CM 35B 622J)	CSL-48770-B10 (CM 35B 622)	CSL-48770-B10 (CM 35B 622J.)	CSL-48770-B10 (CM 35B 622J)		CSL-482184-20	CSL-48770-B10 (CM 35B 622J)	CSL-48770-B10 (CM 35B 622J)	CSL-48674-B10 (CM 20B 101K)	CSL-48771-B1C (CM 20B 050K)	
Description	CAPAC	Variable Ceramicon 7-45 MMFD N500 Temp. Coeff.	Same as C214	Same as C214	Mica: 0.006 mfd ± 10% 500 Volts d.c. working	Same as C217	Same as C217	Same as C217	Paper, 011 filled:	U.5-U.5 mrd I 20%, 200 Volts d.c. working	Same as C217	Same as C217	Mica: 0.0001 MFD ± 10% 500 Volts d.c. working	Mica: 5MMFD ± 10% 500 Volts d.c. work- ing	
Function		Band 8 Osc. Trimmer Cap.	Band 2 Osc. Trimmer Cap.	Band 1 Osc. Trimmer Cap.	Oscillator Plate Blocking Capacitor	Converter Screen Grid By-pass Capacitor	Converter Plate By-Pass Capacitor	I.F. Grid By- pass Capacitor	Filament By-Pass Capacitor	Audio Amplifier Plate By-pass Cap.	I.F. Screen By- Pass Capacitor	I.F. Plate By- Pass Capacitor	Detector Grid Coupling Capacitor	B-F-O Coupling Capacitor	
Symbol Desig- nation		C214	0215	C216	C217	C218	C219	0220	C221A	C221B	C222	CRR3	C224	C225	

† Not exact equivalent, but may be used as an alternate.

TABLE I PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL TBX SERIES OF PORTABLE RADIO EQUIPMENTS RECEIVER SECTION OF TYPE CGQ-43060 TRANSMITTER-RECEIVER UNIT

Page						Ì			
Detector Gorsen	Symbol Desig- nation	Function	Description	Navy Type Designation JAN or A.W.S. No.	Navy JAN and/or(A.W.S.) Specification Number	.TIM	Mfr. Desig- nation	Special Tolerance, Rating or Modification	Garod Dwg. and Part No.
Paper Oil Filled:	<u></u>		CAPACIT	ORS (Continued)					
Audio Amplifier as a 1.01 MED 1000 MPF 10% (CH 458 103K) Detector Plate from Compling Capacitor fine (CH 458 103K) Detector Plate from Compling Capacitor fine (CH 458 103K) Detector Plate from Compling Capacitor fine (CH 208 101K) Detector Plate from Capacitor fine (CH 208 201J) Detector Lank Cap. Antenna Coupling Cap. Antenna Coupling Son volts d.c. working capacitor fine (CH 208 201J) Antenna Coupling Son volts d.c. working capacitor fine (CH 208 201J) Antenna Coupling Son volts d.c. working capacitor fine (CH 208 201J) Antenna Coupling Son volts d.c. working capacitor fine (CH 208 201J) Detector Audio Capacitor fine Cap. Detector Audio Capacitor fine Capacit	9880	Detector Screen By-Pass Capacitor	011 Filled: 5 MFD ± 20%.	CSL-482184-20	RE-13A-488E		2XKHRB- 5-1020		0-00-10000
Defector Plate CSL-48P74-BIO JAN-C-5 S Troblcalized Max Imp.	C227	Audio Amplifler Coupling Capacitor	1 1.0 MFU 1: .01 MF Volts d.c	CSL-48487-B10 (CM 45B 103K)	JAN-C-5		XQBW6-11	Tropicalized Wax Imp.	B-C0-734
Beat Frequency Osc. Hidget Variable: 13.5 CAIM-482212 CAIM-48221	0228	Detector Plate Filter Capacitor	MFD c. wo	CSL-48674-B10 (CM 20B 101K)	JAN-C-5	rð.	•	Tropicalized Wax Imp.	·
Beat Frequency Osc. Mica: 0.006 MFD ± 10% CSL-48770-B10 JAN-C-5 5 Mush. Tropicalized Wax imp. Plate Filter Capacitor Mica: 0.006 MFD ± 10% CSL-48770-B10 JAN-C-5 5 Mush. Tropicalized Wax imp. Grid Coupling Cap. Same as C230 CSL-48675-D5 JAN-C-5 5 Tropicalized Wax imp. Beat Frequency Osc. Same as C230 CSL-48675-D5 JAN-C-5 5 Tropicalized Wax imp. Antenna Coupling Mica: Dovos Working CSL-48875-D5 JAN-C-5 5 Tropicalized Wax imp. Antenna Coupling Mica: Occoos Working CSL-48840-D10 JAN-C-5 5 Tropicalized Wax imp. Plate Filter Cap. Mica: Occoos MFD ± 10% CSL-48143-B10 JAN-C-5 5 Mush. Tropicalized Wax imp. Plate Filter Cap. Mica: Occoos MFD ± 10% CSL-48143-B10 JAN-C-5 5 Mush. Tropicalized Wax imp. Plate Filter Capacitor Electrolytic: GCC & CK	6880	Beat Frequency Osc. Tuning Capacitor		CAIM-482212	•			•	
Beat Frequency Osc. Mica: 0.0002 MFD ± 5% Only 2002 MFD ± 5% Only 2000 MFD ± 5% Only 3 ane as C230 CSL-48675-D5 ONLO 3 AN-C-5 JAN-C-5 6 HOSW- HAS Imp. HAS Imp. HAS Imp. Tropicalized HAS Imp. HAS Imp. HAS Imp. Tropicalized HAS Imp. HAS Imp. HAS Imp. HAS Imp. CSL-48675-D5 ONLO 3 AN-C-5 JAN-C-5 5 Tropicalized HAS Imp. HAS Imp. HAS Imp. Tropicalized HAS Imp. HAS Imp	0230	Beat Frequency Osc. Plate Filter Capacitor		CSL-48770-B10 † (CM 35B 622J)	JAN-C-5	ഹ	MWBW- 1241	Tropicalized Wax Imp.	B-C0-723
Beat Frequency Osc. Same as C230 CSL-48770-B10 # JAN-C-5 JAN-C-5 5 Tropicalized wax Imp. By-Pass Capacitor Same as C231 CSL-48875-D5 # JAN-C-5 CSL-48875-D5 # JAN-C-5 5 Tropicalized wax Imp. Antenna Coupling Capacitor Mica: 15 MMFD ± 10% working CSL-48840-D10 CM 20B E01J JAN-C-5 5 MOSW Tropicalized Wax Imp. Plate Supply Morking CSL-481043-B10 CM 20B E11K JAN-C-5 5 MWBW- TMD. Tropicalized Wax Imp. Plate Supply Electrolytic: CTD-482928 RE-13A-549 18 ECDR-48 Band 3 Fixed Osc. Ceramicon: CC 26 CK 250K JAN-C-20 6 NPOL Band 2 Fixed Osc. Same as C237 CC 26 CK 250K JAN-C-20 6 NPOL	C231	Frequency Coupling (Mica: 0.0002 MFD ± 5% 500 Volts d.c. working	CSL-48675-D5 CM 20B 201J	JAN-C-5	ഹ	MO SW- 1418	Tropicalized Wax Imp.	B-CO-10002
Beat Frequency Osc. Same as C231 CSL-48675-D5 (CM 208 201J) JAN-C-5 5 Tropicalized Wax Imp. Antenna Coupling Capacitor Mica: 15 MMFD ± 10% CSL-48840-D10 (CM 20B 150K) Working CSL-48840-D10 (CM 20B 150K) (CM 20	0232		Same as C230	CSL-48770-B10 (CM 35B 622J)	JAN-C-5	വ	•	Tropicalized Wax Imp.	
Antenna Coupling	C233	Beat Frequency Osc. Fixed Tank Cap.	25.	CSL-48675-D5 (CM 20B 201J)	JAN-C-5	Ω.	•	Tropicalized Wax Imp.	
Detector Audio Dete	C234	Antenna Coupling Capacitor	MMFD 1.c.	CSL-48840-D10 CM 20B 150K	JAN-C-5	വ	мовм	Tropicalized Wax Imp.	B-C0-971
Plate Supply Electrolytic: CTD-482928 RE-13A-549 18 ECDR-48	0235	Detector Audio Plate Filter Cap.	+1	CSL-481043-B10 CM 30B 511K	JAN-C-5	τĊ	MWBW- 1222	Tropicalized Wax Imp.	B-C0-733
Band 3 Fixed Osc. Cc 26 CK 250K JAN-C-20 6 NPOL Trimmer Cap. Band 2 Fixed Osc. Same as C237 CC 26 CK 250K JAN-C-20 6 NPOL Osc. Trimmer Cap.	0226	Plate Supply Filter Capacitor	Electrolytic: 15 MFD + 75%-10% 150 Volts D.C. Working	CTD-482928	RE-13A-549	18	ECDR-48	•	C-C0-10018
Band 2 Fixed Same as C237 CC 26 CK 250K JAN-C-20 6 NPOL OSC. Trimmer Cap.	C237		Ceramicon: 25MMFD ± 10%	26 CK	JAN-C-20	9	NPOL	•	B-C0-10006
	C238	2 Fixed Trimmer	Same as C237	98	JAN-C-20	ဖ	NPOL	•	

† Not exact equivalent, but may be used as an alternate.

PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL TBX SERIES OF PORTABLE RADIO EQUIPMENTS Receiver Section of Type CGQ-43060 transmitter-receiver unit TABLE 1

Navy Type Designation JAN / or A.W.S. No.	ORS (Continued)	CC-26 CK-25OK JAN-C-20	CSL-48690-B10 †(CM 20B 241J)	CSL-481002-20 CP51B1FF504MM AWS C75.16	RECEPTACLES	CU F-49043	CTC-49025A	ORS AND CHOKE COILS			. :
Description	CAPACITORS	Ceramicon: 25 MMFD ± 10% CC-	Mica: 0.00025 ± 10% CSL 500 Volts d.c. work- ing	011 filled paper 0.5MFD. CSL ± 20%, 600 Volts D.C. CP5 Working	RECE	Eight Circuit CUF	Single Circuit, open, short frame type	R. F. INDUCTORS	Coll: 36 turns of # 30 S. E. copper wire wound 72 turns per inch, 32.85 micro henries adjusted to standard coil # .2% tol. 1 in. diameter by 2 in. long ceramic form.	turns of # 30 S.E. copper wire 11.35 and 15.3 micro henries adjusted to standard coil # .2% tol. 5/8 in. diam by 2 in. long ceramic form.	
Function		Band 1 flxed Osc Trimmer Cap	R.F. Filter Cap.	B+ R. F. By Pass Capacitor		Power Receptacle	Headphone Jack		Band 1 ant. and R.F. coil.	Band 1 Heterodyne Oscillator Coil	
Symbol Desig- nation		C239	C240	C241	,	J 201	J202.		L201	LZOZ	

† Not exact equivalent, but may be used as an alternate.

TABLE I Parts List by symbol designations for model tbx series of portable radio equipments receiver section of type CGQ-43060 transmitter-receiver unit

						-		
Symbol Desig- nation	Function	Description	Navy Type Designation JAN / or A.W.S. No.	Navy JAN and/or(A.W.S.) Specification Number	.TIH	Mfr. Desig- nation	Special Tolerance, Rating or Modification	Garod Dwg. and Part No.
		R. F. INDUCTORS	RS AND CHOKE COILS	S (Continued)				
L203	Band 2 Antenna and R. F. Coll	Coil: 23 turns of #268.E. copper wire wound at 44 turns per inch, 13.6 micro henries adjusted to standard coil ±,2% tol., 1 in. diam. by 2 in. long ceramic form.	•	•	10	•	Tropicalized Wax Imp.	C-CL-10003
L204	Band & Heterodyne Oscillator Coil	Coll: 184 turns of #30S.E. and 244 turns of #26S.E. copper wire, close wound, 7.25 and 8.35 micro henries adusted to standard coll #0.2% tol., 5/8 in. diam. by 2 in. long ceramic form.	•	•	10	•	Tropicalized Wax imp.	0-cL-10007
1.205	Band 3 Antenna and R. F. Coll	coll: 15 turns of #285.E. copper wire wound at 28 turns per inch, 5.45 micro henries adjusted to standard coll ± 0.2% tol., 1 in. diam. by 2 in. long ceramic form.	•	•	10	•	Tropicalized Wax Imp.	C-CL-10004
1.206	Band 3 Heterodyne Oscillator coils	Coll: 164 turns of #30 S.E. copper wire, 174 turns of #285.E. copper wire close wound. 5.95 and 5.9 micro henries adjusted to standard coll # 0.2% tol., 5/8 in. diam. by 2 in. long ceramic form.	•	•	10	•	Tropicalized Wax Imp.	C-CL-10008

† Not exact equivalent, but may be used as an alternate.

PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL TBX SERIES OF PORTABLE RADIO EQUIPMENTS Receiver Section of Type CGQ-43060 transmitter-receiver unit TABLE 1

•			ארכרוזרא פרכווסא פן וודב	COQ-+3000 INANSMIIIEN-NECEITEN	MILLEN-NEVE!	▼ E R	1 1 10		
	Symbol Desig- nation	Function	Description	Navy Type Designation JAN / or A.W.S. No.	Navy JAN and/or(A.W.S.) Specification Number	alM.	Mfr. Desig- nation	Special Tolerance, Rating or Modification	Garod Dwg. and Part No.
			R. F. INDU	INDUCTORS AND CHOKE CO	COILS (Continued)				
	L207	Beat Frequency Oscillator Coil	Coll: 45 turns of # 32 D.S.E. copper wire, 67 turns of # 32 D.S.E. Copper wire, wound 4 crosses per turn, 37.4	•	•	10	•	Tropicalized Wax Imp.	C-CL-10005
			sted to 5-2% tol	1n.					
	L208	Detector Plate Reactor	Audio Reactor: 325 Henries at 0.0003 amp d.c. 5500 ohms d.c. Resistance	CG-80885		TT .	•	•	C-CL-1025
				RESISTORS					
	R201	Heterodyne Oscillator Grid leak Resistor	Compositon: 200,000 ohms ± 10% ½ Watt	CSA-63360-10 (RC21 BF 204K)	JAN-R-11	23	Z ← WO	wax Dipped	B-RE-10000
	R202	Heterodyne Oscillator Plate Dropping Resistor	Composition: 10,000 ohms i 10% & Watt	CSA-63360-10 (RC21 BF 103K)	JAN-R-11	03 103	CM-2	Wax Dipped	B-RE-897
	R203	Converter Screen Dropping Resistor	Composition: 50,000 ohms ± 10% ± Watt	CSA-63360-10 † (RC21 BF 513J)	JAN-R-11	23	Z-W0	Wax Dipped	B-RE-903
	R204	Converter Plate Resistor	Composition: 2,500 ohms ± 10% ½ Watt	CSA-63360-10 (RC21 BF 242J)	JAN-R-11	63 60	Z-W0	Wax Dipped	B-RE-892
	R205	I.F. Plate Resistor	Composition: 1000 ohms ± 10% ± Watt	CSA-63360-10 (RC21 BF 102K)	JAN-R-11	23.	₹-W0	Wax Dipped	B-RE-893
	R206	Detector Grid Leak Resistor	Composition: 2 megonm ± 10% ½ Watt	CIR-63360-10 † (RC21 BF 205J)	JAN-R-11	123	BT-2	Wax Dipped	B-RE-907
	R207	Detector Screen Dropping Resistor	Same as R202	CSA-63360-10 (RC21 BF 103K)	JAN-R-11	23	•	•	
	R208	Audio Amplifier Grid Leak Resistor	Composition: 1 megohm ± 10% ½ Watt	CIR-63360-10 (RC21 BF 105K)	JAN-R-11	123	BT-2	Wax Dipped	B-RE-898
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† Not exact equivalent, but may be used as an alternate.

TABLE I Parts List by symbol designations for model tbx series of portable radio equipments RECEIVER SECTION OF TYPE CGQ-43060 TRANSMITTER-RECEIVER UNIT

Beat Dropp Beat Leak	Function Beat Frequency Osc. Plate Dropping Resistor Beat Frequency Osc. Grid Leak Resistor	Description Composition: 1 me 10% ½ Watt Composition: 50,0 ± 10% ½ Watt	Dption RESISTORS T megohm # CIR (RCZ 50,000 ohms GSA	Navy Type Designation JAN / or A.W.S. No. CIR-63360-10 (RC21 BF 105K) (RC21 BF 5131)	Navy JAN and/or(A.W.S.) Specification Number JAN-R-11	MIT.	Mfr. Designation nation BT-2	Special Tolerance, Rating or Modification Wax Dipped	Garod Dwg. and Part No. B-RE-898 B-RE-903
Beat Frequency Osc. Screen Dropping Res Sensitivity Control	istor	Composition: ohms ± 10% ½. 20,000 ohms m logarithmic t. 2 Watts, Carb	150,000 Watt max. taper	CIR-63360-10 (RC21 BF 154K) CSA-631414-10	JAN-R-11 RE-13A-492	23 28	BT-1	Wax Dipped Sealed	B-RE-10007 C-PT-1003
R.F. Filter I.F. Screen Resistor	Filter Resistor Screen Dropping tor	Composition: ± 10% ½ Watt Composition: ± 10% ½ Watt	30,000 ohms;	CIR-63360-10 (RC21 BF 303K) CIR-63360-10 (RC21 BF 103K)	J AN-R-11	12	BT 3	Wax Dipped Wax Dipped	B-RE-10001 B-RE-897
Sensitivity Con Series Resistor I.F. Grid Resis	y Control 1stor Resistor	Composition: 10% ½ Watt Same as R214	6800 ohms	CSA-63360-10 †(RC21 BF 682K) CIR-63360-10 (RC21 BF 103K)	JAN-R-11 JAN-R-11	23	CM- <u>+</u>	Wax Dipped	E-RE-10026
Detector Audio Filter Resistor Plate Filter Re	Detector Audio Plate Filter Resistor Plate Filter Resistor	Composition: ohms ± 10% ½ Composition: ± 10% ½ Watt	500,000 Watt 1000 ohms	CSA-63560-10 †(RC21 BF 513J) CSA-63560-10 †(RC21 BF 102K)	JAN-R-11	23 23	CM-2	Wax Dipped Wax Dipped	B-RE-899 B-RE-893
				SWITCHES		_			
Band Change	Switch	Multiple Band Change Switch 4 Banks, 2 Wafers, 3 Positions Position 1-Band 1 (1967.8- 3283.6 K.C.) Position 2- Band 2 (3102.0-5182.4 K.C.) Position 3-Band 3 (4903.7- 8187.5 K.C.)	Band Change 4 Banks, 2 2 Positions 1-Band 1 (1967.8- 5102.0-5182.4 K.C.) 3-Band 3 (4903.7- 5.C.)	•		4	рн	•	C-SW-10000

+ Not exact equivalent, but may be used as an alternate.

TABLE I PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL TBX SERIES OF PORTABLE RADIO EQUIPMENTS RECEIVER SECTION OF TYPE CGQ-43060 TRANSMITTER-RECEIVER UNIT

Symbol Desig- nation	ol g- on	Description	Navy Type Designation JAN / or A.W.S. No.	Navy JAN and/or(A.W.S.) Specification Number	.TIM	Mfr. Desig- nation	Special Tolerance, Rating or Modification	Garod Dwg. and Part No.
		LIMS	SWITCHES (Continued)					
8808	Beat Frequency Osc. On- Off Switch	Double-Pole, Double Throw, Miniature Toggle Switch; 1 AMP 250 Volts, 3 AMP 125 Volts.	06-24033	RE-24AA-118A (C75.15)	11	Cat#49x36 (mod1f1ed)	•	
8203	Filament On-Off Switch	Same as S202	•	•	11	•	•	
		TRAN	TRAN SFO RMERS				,	
T201	Output Transformer	Audio Transformer: Ratio 6.5 to 1 Step Down, 400 to 4000 Cycles, Primary D.C. Resistance 552 ohms, Secondary D.C. Resistance 67 ohms.	CG-30334	RE-13A-653B	런	•	· · · · ·	C-TR-1019
TROS	Ist I.F. Transformer	Transformer for 1515 K.C. Operation. Includes Items C219, C220, R204 and R216	CFW-47401	•	15	•	Tropicalized	D-TR-1017
T203	2nd I.F. Transformer	Transformer for 1515 K.C. Operation. Includes Items C225, C224, R205 and R206	CFW-47 402	•	14	•	Tropicalized	D-TR-1016
		VACUUM	TUBES					
V201	Converter Tube	Pentagrid Converter	CHS-1A7GT/G	JAN-1A	16	•	•	B-TU-10000
V202	I-F Tube	R-F Amplifier Pentode Sharp Cut Off.	CHS-1N5GT/G	JAN-1A	16	• • • • • • • • • • • • • • • • • • • •	•	B-TU-10001
V203	Detector Tube	Same as V202	CHS-1N5GT/G	JAN-1A	16	•	• .	
V204	Audio Amplifier Tube	Power Amplifier Pentode	CHS-1A5GT/G	JAN-1A	16	•	•	
V205	Beat Freq. Osc. Tube	Same as V202	CHS-IN5GT/G	JAN-1A	16	•	•	B-TU-10006

TABLE I Parts List by Symbol Designations for model tbx series of Portable Radio Equipments Receiver Section of Type CQQ-43060 transmitter-receiver unit

Garod Dwg. and Part No.		B-80-10000					. `							
Special Tolerance, Rating or Modification		•	•	•	•	•					,			
Mfr. Des1g- nation		•	•	•	• • . •	•								
.TIM		17	17	17	17	17							 	
Navy JAN and/or(A.W.S.) Specification Number		RE-49A-300B	RE-49A-300B	RE-49A-300B	RE-49A-300B	RE-49A-300B							*	
Navy Type Designation JAN / or A.W.S. No.	SOCKETS	CPH-49373	CPH-49373	CPH-49373	CPH-49373	CPH-49373						100		
Description		Octal Socket Ceramic	Same as X201	Same as X201	Same as X201	Same as X201		-						
Function		Tube Socket for Converter Tube	Tube Socket for I-F Tube	Tube Socket for Detector Tube	Tube Socket for Audio Tube	Tube Socket for B. F. O. Tube								
Symbol Desig- nation		x201	X202	X203	X204	X205								

PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL TBX SERIES OF PORTABLE RADIO EQUIPMENTS Transmitter Section of Type CGQ-43060 transmitter-receiver unit TABLE I

	Garod Dwg. and Part No.	-	B-C0-751	D-CO-813	C-CO-814	B-C0-734		B-C0-740	D-C0-815		B-CO-10015	B-C0-10011			B-C0-10003		
	Special Tolerance, Rating or Modification		Tropicalized F. Wax 1mp.			Tropicalized F	Tropicalized Wax imp.	•		•	Varnish vac- uum impregnation	•			•	Varnish vac- uum imp.	
	Mfr. Desig- nation		XQBW6-31	• • •	•	XQBW6-11	•	XQBW6-21	•	•	ХQВW	LDXDR	MWBW- 1241		хфвм	хфвм	
	.TIM		5	4	છ	വ	വ	က	4	വ	ß	rO	ഥ		ω	ഥ	
	Navy JAN and/or(A.W.S.) Specification Number		JAN-C-5	•	•	JAN-C-5	JAN-C-5	JAN-C-5	•	JAN-C-5	JAN-C-5	RE-13A-549	JAN-C-5		JAN-C-5	JAN-C-5	
	Navy Type Designation JAN / or A.W.S. No.	CAPACITORS	CSL-48668-B2 (CM-45B 101G)	•	CAIM- 482182	CSL-48487-B10 CM 45B 103K	CSL-48487-B10 CM 45B 103K	CSL-48645-B10 (CM 45B 102K)	•	CSL-48645-B10 † (CM 45B 102K)	CM 50B 103K	CSL-482180	CSL-48770-B10 † (CM 35B 622J)		CM 45B 111K	CM 50B 103K	
,	Description		Mica: 0.0001 MFD ± 2% 600 Volts D.C. working	Variable: 171 MMFD max. ± 2%, 10.3 MMFD min. ± 2 MMFD, straight line freq.	Midget Variable 25 MMFD	Mica: .01 MFD. ± 10% 600 Volts d.c. working	Same as C3O4	Mica: 0.001 MFD ± 10% 600 Volts D.C. working	Variable: 193 MMFD max. ± 2% 10.3 MMFD min, ± 2 MMFD straight line freq.	Same as C306	Mica: .01± 10% 1200 Volts d.c. working	Electrolytic: 50 MFD + 75% - 10% 25 Volts D.C. working	Mica: 0.006 MFD ± 10% 500 Volts d.c. working	:	Capacitance Mica: 0.00011 MFD ± 10% 1200 Volts d.c. working	Same as C309	
	Function		M.O. Coupling Capacitor	M.OC.O. Tuning Capacitor Variable: 17 ± 2%, 10.3 MM MMFD, straigh	M.O. Padding Capacitor	Power Amplifier Screen By Pass Capacitor	M.O.C.O. Supply By Pass Sapacitor	P.A. Suppressor By Pass Capacitor	P.A. Tuning Capacitance	Antenna Blocking Capacitor S	P.A. High Voltage By Pass N Capacitor	Microphone supply Filter E	Meter By Pass Capacitor	NOT ASSIGNED	P.A. Fixed Tank Capacitance	Plate Supply By Pass Capacitor	
	Symbol Desig- nation		0301	C302	0303	C304	C205	0308	C307	6208	6020	C310	C311	C312	C313	C3 14	

† Not exact equivalent, but may be used as an alternate.

BY SYMBOL DESIGNATIONS FOR MODEL TBX SERIES OF PORTABLE RADIO EQUIPMENTS TRANSMITTER SECTION OF TYPE CGQ-43060 TRANSMITTER-RECEIVER UNIT TABLE I PARTS LIST

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Symbol Desig- nation	Function	Description	Navy Type Designation JAN or A.W.S. No.	navy JAN and/or(A.W.S.) Specification Number	.TÎM	. Mfr. Desig- nation	Special Tolerance, Rating or Modification	Garod Dwg. and Part No.
-		CAPACI	CAPACITORS (Continued)			:		
C315	Modulator filament by pass capacitor	Electrolytic: 50 MFD. + 75 -10% 25 Volts d.c.	CSL-482180	RE-13A-549	co	LDXDR		B-CO-10011
C316	Modulator screen by pass capacitor	Working 011 filled paper 0.5 MFD. ± 20% 600 Volt d.c. working	CSL-48100-20 CP51B1FF504MM	AWS C75.16	ιΩ	XDMRT 6 5-20		B-C0-10010
C317	Modulator coupling capacitor	Same as C316	CSL-481002-20 CP51B1FF504MM	AWS C75.16	Ω	XDMRT 65-20		•
C318	Modulator supply by pass capacitor	Same as C316	CSL-481002-20 CP51B1FF504MM	AWS C75.16	ω	XDMRT 65-20	•	•
C319	Remote input coupling capacitor	Paper, 011 filled 1 MFD ± 10% 600 Volts D.C. working	CTD-481998-10	AWS C75.16	18	OM-601	•	B-C0-10009
C320	Receiver output coupling	Same as C319	CTD-481998-10	AWS C75.16	18	•		•
C321	Side Tone Osc. Coupling	0.006 1ts d.	CSC-48770-B10 † (CM 35B 622J)	JAN-C-5	ى د	MWBW- 1241	Tropicalized Wax imp	B-CO-723
C322	Side Tone Osc. Tank Cap.	Mica: 0.0001 MFD 10% 500 Volts d.c. working	CSL-48674-B10	JAN-C-5	ω	MOBW 1416	Tropicalized Wax imp	B-C0-725
C323	Side Tone Amp. Coupling Cap.	Same as CS21	CSL-48770-B10 (CM 35B 622J)	JAN-C-5	ശ	•	Tropicalized Wax imp	•
C324	Filament Bypass Cap.	Same as C321	CSL-48770-B10 + (CM 35B 622J)	JAN-C-5	ည	•	Tropicalized Wax 1mp	•
		JACKS	S & RECEPTACLES					
1301	Key Jack	Single Circuit, open,	CTC-49025A	•	7	JK34A	Tropicalized varnish imp.	C-RC-1032
J 302	Microphone Jack	Three Circuit, two spring, short frame type	CTC-49039	•	7	JK33A	Tropicalized varnish imp.	C-RC-1030
1303	Power Input Receptacle	Four Circuit Ceramic Insulation	CUF-49041	•	ω	•		C-RC-1033
	•						,	

† Not exact equivalent, but may be used as an alternate.

PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL TBX SERIES OF PORTABLE RADIO EQUIPMENTS Transmitter Section of Type CGQ-43060 transmitter-receiver unit TABLE I

Garod Dwg. and Part No.		C-RL-10000	C-RL-10001		L-CL-10009	L-CL-1027	L-CL-10011	L-CI-10001
Special Tolerance, Rating or Modification		Tropicalized	Tropicalized		Tropicalized Wax imp.	Tropicalized Wax imp.	Tropicalized Wax imp.	Tropicalized Wax imp.
Mfr. Desig- nation		•	505-20-1					:
.TIM		02	19		10	10		10
Navy JAN and/or(A.W.S.) Specification Number		•	•	KE COILS	•	•	•	•
Navy Type Designation JAN / or A.W.S. No.	RELAYS	•	•	INDUCTORS AND CHOKE		•	•	
Description		50 ohm coil 2 S.P.D.T. circuits and one normally closed single circuit	200 ohm coil one S.P.D.T. Circuit one single pole Circuit normally open.	R.F. I	Coll: 49 turns, with 3 taps: 12 turns, 24 turns from the start of the Winding wound with \$70 D.E. copper wire on \$1\frac{1}{2}\$ in, dia, ceramic form	3 colls in series, each 103 turns of \$ 32 E.D.S. Copper wire, Universal Wound 4 crosses per turn on \$ in. diam ceramic	Coll consisting of 60 turns of # 20 D.E. Copper wire with 9 taps, 3 1/16, 5 15/16, 9 1/16, 11 15/16, 15 1/16, 16 15/16, 19 1/16, 28 and 44 turns from start of winding. Wound on 2* 0.D. Ceramic form.	3 colls in series each 128 turns of #32 E.D.S. copper wire Universal Wound 4 crosses per turn on ½ in. diam ceramic form.
Function	7	Keying Relay	Remote Relay		M.O.C.O. Tank Coll	M.O. P.A. Grid Choke	P.A. Antenna Coll	P.A. Plate Choke
Symbol Desig- nation		K301	K302		L301	1302	1303	1.304

TABLE I PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL TBX SERIES OF PORTABLE RADIO EQUIPMENTS TRANSMITTER SECTION OF TYPE CGQ-43060 TRANSMITTER-RECEIVER UNIT

	Garod Dwg. and Part No.		C-PP-1151-1	C-PP-1152-2		B-RE-10012		B-RE-10028	B-RE-10020	B-RE-10013	B-RE-981	B-RE-100 17	B-RE-10015	B-RE-10016
	Special Tolerance, Rating or Modification		Tropicalized	Tropicalized		Wax Dipped			(C) Coating	Dipp	Dippe	Dipp		wax Dipped
-	Mfr. Desig- nation	·	NY-67352-1	NY-57353- 1A		BT 2	BT ½	ĐŒ	DG	BW-2	CM-1	BW-1	SI-2	SI - 2
	.TIM		23	21		12	128	128	128	128	23	123	40	. 40
	Navy JAN and/or(A.W.S.) Specification Number		JAN-I-6	17-I-12		JAN-R-11	JAN-R-11	RE-13A-372J	RE-13A-372J	RE-13A-372J	RE-13A-372J	RE-13A-372J	RE-13A-372J	RE-13A-372J
•	Navy Type Designation JAN or A.W.S. No.	METERS	CAY-22130A (MR-25-F-001- RF-AA)	CAY-22291-D	RESISTORS	CIR-63355-5 (RC21 BE 103J)	CIR-63355-5 (RC21 BE 103J)	CIR-63634-10	CIR-632093-5	CIR-63705-5	CSA-63291-5	CIR-63703-5	CPQ-63705-5	CPQ-63705-5
	Description		Ammeter 0-1.0 Amp. R.F. 22 In. diam; flush, phenolic case, anti-glare glass	Multimeter with the follow- ing scales: 140 m.a. d-c; 140 volts d-c; 500 ma d-c; 2½ in. diam; flush, phenolic case, anti-glare glass.		Composition: 10,000 ohms ± 5% ½ watt	Same as R301	Wire Wound, 5000 ohms ± 10% 8 watts	Wire Wound, 4 ohms ± 5%, 20 watts	Wire Wound, 100 ohms ± 5%, g watts	Wire Wound: 240 ohms ± 5%, 1 watt	Wire Wound: 30 ohms ± 5%, 1 watt	Wire Wound: 68 ohms ± 5%, 2 watts	Wire Wound: 390 ohms ± 5%, 2 watts
	Punction		Antenna Ammeter	Multimeter		M.O. P.A. Grid Leak Resistor	M.O. P.A. Grid Lead Resistor	n Bleeder	P.A. Filament Resistor	M.O. C.O. Filament Resistor	M.O. C.O. Filament Shunt Resistor	Modulator Filament Resistor	Modulator Filament Resistor	Modulator Filament Shunt Resistor
	Symbol Desig- nation		M301	M30 &		R30 1	R302	R303	R304	R305	R306	R307	R308	R309

TABLE I PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL TBX SERIES OF PORTABLE RADIO EQUIPMENTS TRANSMITTER SECTION OF TYPE CGQ-43060 TRANSMITTER-RECEIVER UNIT

Swahol			Navy Type Navy JAN	Navy JAN	,		Special	
	Function	Description	Designation JAN or A. W. S. No.	and/or(A.W.S.) Specification Number	.TIM	Mfr. Desig- nation	Tolerance, Rating or Modification	Garod Dwg. and Part No.
		RES	RESISTORS (Continued)	(
	Multimeter Shunt Resistor for Transmitter	1.43 ohms ± 5% (75M.A.) Evacuated type. Non Inductive Construction.	•	•	22	ZONI F	•	B-RE-919
	Receiver Voltmeter Multiplier Resistor	140,000 ohms ± 2% (1.0.M.A.) Evacuated type Standard Construction	•		83	20 F	•	B-RE-920
	Receiver Filament Meter Shunt Resistor	0.4 ohms ± 5% (250M.A.) Evacuated type, Standard Construction	•	•	83	20F	•	B-RE-921
	P.A. Screen Dropping Resistor	Wire Wound: 20,000 ohms 10% 8 watts	CIR-63689E-10	RE-13A-372J	128	DG	(C) Coating	B-RE-10010
	Modulator Plate Supply Resistor	Same as R313	CIR-63689E-10	RE-13A-372J	12	DG	(C) Coating	
	Static Drain Resistor	Composition: 2 megohms + 10% ± Watt	CIR-63360-10 (RC21 BE 205J)	JAN-R-11	12	BT ≱	Wax Dipped	B-RE-907
	M.O. Supply Series Resistor	Composition: 3300 ohms ± 10% 1 watt	CSA-63288-10	JAN-R-11	23	CM 1	Wax Dipped	B-RE-10029
	C.O. 1, Grid Leak Resistor	Composition: 100,000 ohms ± 5% ½ watt	CSA-63355-5 (RC21 BE 104J)	JAN-R-11	23	CM ≯	Wax Dipped	B-RE-10014
	C.O. 2, Grid Leak Resistor	Same as R317	CSA-63355-5 (RC21 BE 104J)	JAN-R-11	KS.	CM ≱	Wax Dipped	
	Modulator Screen Series Resistor	Composition: 68000 ohms ± 10% ± watt	CIR-63360-10 (RC21 BE 683K)	JAN-R-11	1 23	BT 2	Wax Dipped	B-RE-10019
	Modulator Plate Series Resistor	Composition: 11,000 ohms ± 10% 1 watt	CSA-63288-10 (RCS1 BE 113K)	JAN-R-11	123	CM 1	Wax Dipped	B-RE-911
	Modulation Control Potentiometer	100,000 ohms ± 10% Linear Taper 2 watts, carbon	CSA- 631987-10	RE-13A-492	233	Type C	Sealed	C-PT-10000
	Modulation Reactor Parallel Resistor	Same as R319	CIR-63360-10 (RC21 BE 683K)	JAN-R-11	₩	BT 2	Wax Dipped	
	P.A. Plate Parasitic Resistor	Composition: 22 ohms ± 10% 1 watt	CER-65288-10.	JAN-R-11	φ	518	•	B-RE-10022
ĺ					1		7	

+ Not exact equivalent, but may be used as an alternate.

PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL TBX SERIES OF PORTABLE RADIO EQUIPMENTS Transmitter Section of Type CGQ-43060 transmitter-receiver unit TABLE 1

R324 R326 R326 R327 S301 S304 S304	Side Tone Oscillator Series Resistor Side Tone Limiting Resistor Side Tone Decoupling Resistor VZOI Supressor Grid Leak Resistor C.O1, C.O2 or M.O. Switch F.A. Inductor Switch (Fine) P.A. Inductor Switch (Fine) Meter Momentary Switch C.W. Voice Net Switch	RESIST Composition: 2 megohm ± 10% ½ Watt Composition: 10,000 ohms ± 5% ½ Watt Composition: 150,000 ohms ± 10% ½ Watt Composition: 68,000 ohms though and the creamic. Rotary Tap Switch: two circuit, two positions; three circuits, ceramic. Rotary Tap Switch: single wafer, three positions; three circuits, ceramic. Rotary tap Switch; single wafer, 8 positions; includes S503 in common mounting, ceramic. Rotary Tap Switch; single wafer, 5 positions; includes S503 in common mounting, ceramic. Double Pole, Double Throw momentary in one position, mounting, ceramic. Spositions, 3 cercuits Tap Switch 2 wafers, Tap Switch 2 wafers, Tap Double Fole, Double Throw momentary in one position, position 3 Amp 125 Volts.	Navy Type Designation JAN / or JAN / or A. W. S. No. CIR-68260-10 CIR-68260-10 CIR-68360-10 CIR-68360-10 CIR-68360-10 CIR-68360-10 RE21 BE 683K SWITCHES SWITCHES CG-24034	Navy Jan and/or(A. W.S.) Specification Number JAN-R-11 JAN-R-11 JAN-R-11	HT. 11 8 8 1 14 14 14 14 14 17.	Hfr. Designation BT-½ BT-½ BT-½ BT-½ C	Special Tolerance, Rating or Max Dipped Wax Dipped Wax Dipped	Garod Dwg. and Part No. B-RE-907 B-RE-10012 B-RE-10009 B-SW-1009 B-SW-10001 C-SW-10000
	Transmitter - Receiver Meter Switch	V ₂	CG-24033	RE-24AA-118A (C75.16)	11	Cat#49x36 Mod1fled		C-SW-1007

† Not exact equivalent, but may be used as an alternate.

TABLE I PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL TBX SERIES OF PORTABLE RADIO EQUIPMENTS TRANSMITTER SECTION OF TYPE CGQ-43060 TRANSMITTER-RECEIVER UNIT

Symbol Desig- nation	Function	Description	Navy Type Designation JAN / or A. W. S. No.	Navy JAN and/or(A.W.S.) Specification Number	.TIM	Mfr. Desig- nation	Special Tolerance, Rating or Modification	Garod Dwg. and Part No.
		IRON CORE TRA	TRANSFORMERS AND RE	REACTORS				
L305	Modulation Reactor	Total Inductance 40 Henries with 12.5 M.A. DC tested at 60 cycles, 20 volts	CUT-301278	•	24	81749		D-TR-10002
T301	Microphone Transformer	Ratio 1-10 step up ± 2 DB of 1000 cycles 200 to 3000 cycles	CUT-301276	•	24	81748	•	D-TR-10001
			TUBES					
V301	P. A. Tube	R.F. Power Amplifier Pentode	CTL-2E22	JAN-1A	25	•	•	B-TU-10004
V302	M.OC.O. Tube	R.F. Amplifier Pentode	CTL-3A4	JAN-1A	25	•	•	B-TU-10003
V303	Modulator Tube	Same as V302	CTL-3A4	JAN-1A	25	•		
V304	Side Tone Oscillator Tube	Glow Discharge Tube (neon lamp)	CG-991	JAN-1A	11	•		B-TU-10005
			CRYSTALS					
Y301	Quartz Crystal and Holder	At cut, quartz crystal and holder	CG-40024A	•	11	•	•	B-SA-1409
Y302	Quartz Crystal and Holder	Same as Y301	CG-40024A	•	11	•	•	B-SA-1409
			SOCKETS					
X301	P.A. Tube Socket	5 prong ceramic	CNA-49328	RE-13A-524A	27	•		B-S0-10002
X302	M.OC.O. Tube Socket	7 prong midget ceramic	CMG-49571	•	82	9834	•	B-S0-10001
X303	Modulator Tube Socket	Same as X302	CMG-49571	•	82	•	•	
X304	Side Tone Osc. Tube Socket	Double Candelabra	•	•	68	NE991 Flush	•	B-S0-10003

TABLE I
PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL TBX SERIES OF PORTABLE RADIO EQUIPMENTS
ACCESSORY BOX TYPE CGQ-10339 AND ACCESSORIES

Garod Dwg. and Part No.		L-SA-10036		B-BT-1000		B-BT-1001	C-BT-1002			E-PP-10024	C-PP- 100 25
Special Tolerance, Rating or Modification		•		•	•	•	•			Tropicalized	•
Mfr. Desig- nation		•		•	•	•	•	•		:	•
.TIM		10		•	•	•	•	•		38	38
Navy JAN and/or(A.W.S.) Specification Number		•		J AN-B-18	JAN-B-18	J AN-B-18	J AN-B-18	JAN-B-18		RE13 A 980	: : :
Navy Type Designation JAN / or A. W. S. No.	ACCESSORY BOX	CGQ-10339	BATTERIES	-19010	-19010	-19011	-19005	-19005	HEAD TELEPHONES	CW-49507A	CW-49534
Description	AC	16 in. by 8 in. to the outside of the cover, 10 in. high	-	Dry Battery: Rated 1.5 Volts	Same as BT401	Dry Battery Rated 7.5 Volts. Terminals on each Cell with Black Flexible Negative Lead	Dry Battery Rated 45 Volts	Same as BT405		Consists of Navy Type CW-49504 Head Band, cord and plug, 2 Navy Type CW-49505 Headphones, and 2 Navy Type CW-49506 Synthetic Rubber Molded Ear Cushions.	6 Foot Extension Cord With 1-Type PL-55 Plug and 1-Type JK-48 Receptacle.
Function		Accessory Box		"A" Battery	"A" Battery	"C" Battery	"B" Battery	"B" Battery		Head Telephone Receiver Set	Head Telephone Extension Cord
Symbol Desig- nation		A400		BT401	· BT402	BT403	BT405	BT406		HT400	HT400A

TABLE I PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL TBX SERIES OF PORTABLE RADIO EQUIPMENTS ACCESSORY BOX TYPE CGQ-10339 AND ACCESSORIES

1	Symbol Desig- nation	Function	Description	Navy Type Designation JAN / or A.W.S. No.	Navy JAN and/or(A.W.S.) Specification Number	.TIM	Mfr. Desig- nation	Special Tolerance, Rating or Modification	Garod Dwg. and Part No.
				RECEPTACLES					-
	J401	Power Receptacle Socket	Eight Circuit Receptacle	CUF-49043	•	8	•	•	C-RC-1034
				MICROPHONES				T THE TE MAN AND MANAGEMENT AND	
	MI40.1	Microphone	Lip Microphone Assembly Consisting of Navy Type CW-51066 Microphone, Cord and Plug Assembly Navy Type 10312	CW-51071	RE-9340	28	• • •	Tropicalized	C-MK-10000
	MI401A	Microphone Extension Cord and Switch Assembly	Consists of Waterproof Switch, 5 foot Cable With Type PL-68 three circuit Plug, 8 inch cable With Type JK-48 receptacle.	CTE-49588 † (CD 318A)		39.0	•	•	D-PP-10020
			11	TELEGRAPH KEYS					
	8401	Telegraph Key	Consists of Enclosed Water proof key on Special base with two mounting holes.	CAQZ-26022	16K1(RE)	13	Model 288	Tropicalized	D-SA-10137
	S401A	Telegraph Key Leg Band	Leg band with two studs for Mounting to key base.	Part of CAQZ-26022	16K1(RE)	13			
				VACUUM TUBES					
	V401	Spare Tube Mobile	R.F. Power Amplifier Pentode	CTL-2E22	JAN-1A	25	•		B-TU-10004
	V402	Spare Tube Mobile	R.F. Amplifier Pentode	CTL-3A4	JAN-1A	25		•	B-TU-10003
	V403	Spare Tube Mobile	R.F. Amplifier Pentode	CTL-3A4	JAN-1A	35			B-TU-10003
	V404	Spare Tube Mobile	Power Amplifier Pentode	CTL-1A5 GT/G	JAN-1A	16	•		B-TU-10006

† Not exact equivalent, but may be used as an alternate.

PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL TBX SERIES OF PORTABLE RADIO EQUIPMENTS ACCESSORY BOX TYPE CGQ-10339 AND ACCESSORIES TABLE 1

	Mfr. Special Garod Desig-Rating or Part No.		B-TU-10005	B-TU-10000	B-TU-10001		L~SA-10058			C-SA-1531	L-SA-1688	B-CA-1061	L-SA-10078	
	.TIM		11	16	16		10	10	11	10	10	11	01	_
	Navy JAN and/or(A.W.S.) Specification Number	(Continued)	JAN-1A	JAN-1A	JAN-1A	S		•	•	•	•	•	•	
•	Navy Type Designation JAN / or A.W.S. No.	VACUUM TUBES (Cont	CG-991	CHS-1A7GT/G	CHS-1N5GT/G	WIRES AND CABLES	CGA-49574	CGQ-49042	CG-49048	CGQ-49044A	CGQ-49040	CG-49049	•	
	Description	\	Glow Discharge (Neon Lamp)	Pentagrid Converter	R. F. Amplifier Pentode		Consists of 2 Navy Type CGQ 49042 Eight-Circuit Plugs and 3 Feet of Navy Type CG 49048 Seven Conductor Cordage.	Eight circuit Plug	3 Feet Seven Conductor Cordage	Consists of 2 Navy Type CGQ-49040 Four Circuit Plugs and 20 Feet of Navy Type CG-49047 Four Conductor Cordage	Four Circuit Plug	20 Feet Four Conductor Cordage	5 ft. of # 16 A.W.G. Stranded, Packard # 344 ighition wire with terminals	
	Function		Spare Tube Mobile	Spare Tube Mobile	Spare Tube Mobile		Battery Cable	Battery Cable Plug	Battery cable Cordage	Generator Cable	Generator Cable Plug	Generator Cable Cordage	Antenna Lead	
	Symbol Desig- nation		V405	V406	V407		W401	W401A	W401B	W402	W402A	W402B	W403	

TABLE I Parts List by Symbol designations for model tbx series of portable radio equipments hand driven generator - Type CBF-21263B

Symbol Desig- nation	Function	Description	Navy Type Designation JAN / or A.W.S. No.	Navy JAN and/or(A.W.S.) Specification Number	Hir.	Mfr. Desig- nation	Special Tolerance, Rating or Modification	Garod Dwg. and Part No.
			HAND CRANKS					
A-501~	Hand Cranks	Hand Cranks for operation of Type CBF-21263B	CBF-21263B	• c	31	8-15974	•	C-PP-1132
			CAPACITORS					
C50 1	H-V R.F. Filter Capacitor	Mica: .01 MFD ± 10% 1200 volts D.C. Working	CM 50B 103K	J AN-C-5	- 2	Х'QВМ	Varnish Vacuum Impregnation	B-CO-10015
C.50 2	H-V Filter Capacitor	Paper, oil filled 1 MFD ± 10% 600 volts D.C. working	CTD-481998-10	AWS-C75.16	18	0%-601	•	B- CO- 10009
C50 3	H-V Filter Capacitor	Paper 011 Filled 2 MFD ± 10% 600 Volts D.C. Working	CTD-482434-10	RE-13A-488E	18	OM-602		B-C0-10013
C50 4	H-V Filter Capacitor	Same as C503	CTD-482434-10	RE-13A-488E	18	0M-602	•	•
C505	L-V R.F. Filter Capacitor	Mica: .003 MFD ± 10% 500 Volts D.C. Working	CM SOB SORK	JAN-C-5	വ		Varnish Vacuum Impregnation	B-CO-10016
0208	L-V Filter Capacitor	Same as C503	CTD-482434-10	RE-13A-488E	18	0M-602	•	•, • •
C507	Microphone Filter Capacitor	Same as C50.2	CTD-481998-10	AWS-C75.16		OM-601	•	•
			GENERATORS					
9500	Hand Driven Generator	12.6/500-550 Volts ± 5% 2.0/0.08 Amp. D.C. Crank Speed 60 to 70 R.P.M.	CBF-21263B	•	31	•		E-SA-1413
			RECEPTACLES					
J501	Power Receptacle	Four Circuit Ceramic Insulation	CUF-49041	•	80	•	:	C-RC-1033
								/

TABLE I Parts List by Symbol Designations for model tbx series of Portable Radio Equipments Hand Driven Generator Type CBF-21263B

Garod Dwg. and Part No.		B-CL-1024	L-CL-10012	•		B-RE-956		Part of E-SA-1413	
Special Tolerance, Rating or Modification		•	•	:		•		•	
Mfr. Desig- nation		•	•	•		•		S-15737-A	
.TIM		11	10	10		31		31	
Navy JAN and/or(A.W.S.) Specification: Number	LS	•	•	•				• • •	
Navy Type Designation JAN / or A. W. S. No.	ORS AND CHOKE COILS	06-30336	•	•	RESISTORS	CBF-63555B	GE REGULATOR	•	
Description	R. F. INDUCTORS	0.5 Henries, 0.1 amps., 32 ohms D.C. Res.	Consists of Approximately 90T of #16 "Formex" Wire Approximate IND=36	Microhenries on 1/2 Diam. Form. Same as L502	RE	42 Ohms ± 5% Tapped at 52 Ohms Wound With No. 52 "Double Advance" Wire	VOLTAGE	No Load to Full Load Regulation Not to Exceed 5% on the H.V. and 5% on the L.V. Windings	
Function		Microphone Supply Filter Reactor	H-V R.F. Filter Choke Coll	L-V R.F. Filter Choke Coil		Regulator Resistor		Voltage Regulator	
Symbol Desig- nation	r	L501	T208	L503		R501		VR501	

TABLE I Parts List by Symbol designations for model tbx series of portable radio equipments antenna system

Garod Dwg. and Part No.			D-MA-1067	B-SA-1734			C-SA-1735		B-SA-1737		B-SA-1736	
Special Tolerance, Rating or Modification				•			• .		•	•	•	
Mfr. Desig- nation				•	:	•	•		•	•	•	
.TIM		-	30	30	30	30	30		30	30	30	
Navy JAN and/or(A.W.S.) Specification Number	A		•	:			•		•		:	
Navy Type Designation JAN / or A.W.S. No.	FLAGELLIFORM ANTENNA		•	CFM-66022	CFM-66022	CFM-66022	CFM-66021A		CFM-66020	CFM-66020	CM-66019	-
Description	FLAGE		Seven Section Chrome molybdenum steel tube mast	Seamless chrome molyb- denum steel tubing 3 ft. 7-1/4 in. long with screw fittings on both ends for screwing into adjacent mast sections	Same as A904	Same as A904	Seamless chrome molyb- denum steel tubing 3 ft. 7-1/4 in. long with	ends and 4 sets of guy	Seamless chrome molybdenum steel tubing 3ft. 7-1/4 in. long with screw fittings on both ends for screwing into adjacent mast sections	Same as A908	Geamless chrome molyb- denum steel tubing 3 ft. 7-1/4 in. long with screw fittings on one end and other end plugged.	
Function			Flagelliform Antenna	Mast Section No. 1	Mast Section No. 2	Mast Section No. 3	Mast Section No. 4		Mast Section' No. 5	Mast Section No. 8	Mast Section No. 7	
Symbol Desig- nation			A903	A904	A905	A906	A907		A908	606A	A910	

TABLE I PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL TBX SERIES OF PORTABLE RADIO EQUIPMENTS ANTENNA SYSTEM

Garod Dwg. and Part No.		C-SA-1739	B-SA-1738	B-SA-1402		B-SA-1499	B-MP-1038	C-SA-1500
Special Tolerance, Rating or Modification		•	•				•	•
Mfr. Desig- nation	,		•	•		•	•	•
.TîM		30	30	34		10	35	
Navy JAN and/or(A.W.S.) Specification Number	(Cont' d)	•	•				RE-13A-317F	•
Navy Type Designation JAN / or A.W.S. No.	FLAGELLI FORM ANTENNA (CON	CFM-66023B	CFM-66024	CCR-66013	WIRES, CABLES Etc.	•	CCJ-61244A	•
Description	FLAGELLIF	Mycalex with dural cap on one end, stainless steel screw fittings on both ends, overall length 8-1/4 in.	Body of Stake chrome molybdenum steel tubing, with inserted head and point of stainless steel, overall length 15-1/8 in.	Sheet Steel 9 in. long	ANTENNA WI	Consists of 30 ft. of Model J Antenna wire, insulator Navy Type 612444, approximately 60 ft. oi waterproof nonstretch braided linen line 0.090 in. diam. and	connector. Ceramic Strain Insulator	Consists of four 20 ft. length of Model J Antenna wire, with ground clamps on one end of 2 ft. section. One 5 ft. section of 5 ft. section of 5 ft. section of able with terminal on one end
Function		Mast Base Support	Ground Stake	Guy Stake		"Large" Antenna	Insulator for "Large" Antenna	Counterpoise
Symbol Desig- nation		A911	A912	A913		W901	W901A	M90 &

TABLE I PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL TBX SERIES OF PORTABLE RADIO EQUIPMENTS ANTENNA SYSTEM

Garod Dwg. and Part No.		В-ср-1000	B-MP-1038 D-SA-1492	
Special Tolerance, Rating or Modification			· · · · · · · · · · · · · · · · · · ·	
Mfr. Desig- nation		•	• •	
Mîr.		36	32	
Navy JAN and/or(A.W.S.) Specification Number	(Cont'd)	•	RE-13A-317F	
Navy Type Designation JAN / or A. W. S. No.	CABLES Etc.	•	CCJ-61244A -71007	
Description	ANTENNA WIRES,	Waterproof non-stretch braided linen line not over .090 in. diam. by 20 ft. in length.	Ceramic strain insulator Reel for "Large" Antenna and counterpoise	
Punction		Guy lines for Flagelliform Antenna (3)	Insulator for Guy line Antenna Reel	
Symbol Desig- nation		W903	W903A W904	

TABLE I PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL TBX SERIES OF PORTABLE RADIO EQUIPMENTS REMOTE CONTROL UNIT NAVY TYPE CGQ-23453

			outh which	NA L. WV CN			Special	
Symbol Desig- nation	Function	Description	Designation JAN / or A.W. S. No.	and/or(A.W.S.) Specification Number	Mîr.	Mfr. Desig- nation	Tolerance, Rating or Modification	Garod Dwg. and Part No.
			CARRYING CASE				•	
A105	Carrying Case	Canvas Carrying Case for remote Control Unit Type-23453	CAQF-10375	•	41	• • •	•	E-SA-10084
			BATTERI ES					
BT1401	Dry Cell	1½ Volt Flashlight Cell	-19031	JAN-B-18	•			B-BT-10000
BT1402	Dry Cell	Same as BT1401	-19031	JAN-B-18	•	•	•	
BT1403	Dry Cell	Same as BT1401	-19031	JAN-B-18		•	•	
BT1404	Dry Cell	Same as BT1401	-19031	JAN-B-18	•	•	•	
BT1405	Dry Cell	Same as BT1401	-19031	JAN-B-18	•	•	•	
BT1406	Dry Cell	Same as BT1401	-19031	JAN-B-18	.• ,	•	•	
			CAPACITORS					
C1401	Series Blocking Capacitor	Paper, oil filled 1 MFD ± 10% 600 volts D. C. working.	CTD-481998-10	AWS C75.16	18	OM-601	•	B-CO-10009
C1402	Click Suppression Capacitor	Electrolytic: 25 MFD + 100 -10% 25 volts D.C. working.	CTD-481721	RE-13A-549	18 E	ECDR-45		B-C0-703
			HEAD TELEPHONES					
HT1401	Head Telephones	Consists of Navy Type CW-49504 Head band, cord and plug, 2 Navy type CW-49505 headphones, and 2 Navy type CW-49506 Synthetic rubber molded ear cushions.	CW-49507A	RE-13A-980		•	Tropicalized	E-PP-10024
								•

† Not exact equivalent, but may be used as an alternate.

TABLE I PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL TBX SERIES OF PORTABLE RADIO EQUIPMENTS REMOTE CONTROL UNIT NAVY TYPE CGQ-23453

Symbol Desig- nation	Function	Description	Navy Type Designation JAN or A.W. S. No.	Navy JAN and/or(A.W.S.) Specification Number	.alh	Mfr. Desig- nation	Special Tolerance, Rating or Modification	Garod Dwg. and Part No.
		HEAD	TELEPHONES (Cont'd)	(P ₁		-		,
HT1401A	Head Telephones Extension Cord	6 Foot extension cord with 1-type PL-E5 plug and 1- type JK-48 Receptacle	with CW-49534	•	38	•	•	C-PP-10025
		PΛ	JACKS AND RECEPTACLES	ES				
J1401	кеу Јаск	Single circuit, open, short frame type	CTC-49025A	•	7	JK 34A	Tropicalized Varnish Imp.	C-RC-1032
J1402	Microphone Jack	Three Circuit, two spring short frame type	CTC-49039	•	<u>r</u>	JK 33A	Tropicalized Varnish Imp.	C-RC-1030
J1403	Headphone Jack	Single circuit, open, short frame type	CTC-49025A	•	7	JK 34A	Tropicalized Varnish Imp.	C-RC-1032
,			MICROPHONES		,			
M11401	Lip Microphone	Lip Microphone Assembly consisting of Navy type CW-51066 microphone, cord and plug assembly Navy type-10312	CW-51071	RE-9340	38	•	Tropicalized	С-МК-10000
MI1401A	Microphone Extension cord and switch assembly	Consists of waterproof switch, 5 foot cable with type PL-68 three circuit plug, 8 inch cable with type JK-48 receptacle	CTE-49588	•	Ō	•	:	D-PP-10020
			RESISTORS					
R1401	Current Limiting Resistor	Wire Wound 18 ohms ± 10% 2 Watt	CIR-63705-10	RE-13A372J	23	BW-2	Wax Dipped	B-RE-10025
R1402	Click suppression resistor	Composition: 1 megohm ± 10% 1/2 watt	CIR-63660-10 (RC21 BF 105K)	JAN-R-11	128	BT-1/2	Wax Dipped	B-RE-698
		Laboratoria de la companya de la com			+	-		

† Not exact equivalent, but may be used as an alternate.

TABLE I PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL TBX SERIES OF PORTABLE RADIO EQUIPMENTS REMOTE CONTROL UNIT NAVY TYPE CGQ-23453

	and No.		.0137			0010		•					
	Garod Dwg. a Part		D-SA-10137			C-CL-10010					 		·
	Special Tolerance, Rating or Modification		Trop1cal1zed			Tropicalized			,				,
	Mfr. Desig- nation		Model 288			D-13729						2	
	.TIM		13	13		19							
	Navy JAN and/or(A.W.S.) Specification Number		16K1 (RE)	16Ķ1 (RE)	8	•	:	· · · · · · · · · · · · · · · · · · ·		,		,	
	Navy Type Designation JAN or A.W.S. No.	TELEGRAPH KEYS	CAQZ-26022	Part of CAQZ-26022	DRMERS AND REACTORS	CCT-301437			,				
, 102-200 1-0212	Description		Consists of enclosed waterproof key on special base with two mounting holes.	Flexible leg band with two studs for mounting to key base.	TRANSFORMERS	Tapped Autotransformer for Microphone and Phones							
	Function		Telegraph Key	Telegraph Key Leg Band		Line Matching Auto Transformer.							
	Symbol Desig- nation		81401	S1401A		T1401					•		

† Not exact equivalent, but may be used as an alternate.

TABLE I PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL TBX SERIES OF PORTABLE RADIO EQUIPMENTS RECEIVER POWER SUPPLY ADAPTER NAVY TYPE CGQ-632246

							1					 	 		
Garod Dwg. and Part No.		C-RC-1034		L-SA-1690		B-RE- 100 27	B-RE-10034	B-RE-10032	B-RE-10033	B-RE-10031					
Special Tolerance, Rating or Modification				•		Wax Dipped	Wax Dipped	Wax Dipped	Wax Dipped	Wax Dipped					
Mfr. Desig- nation				•		SI -1	SI=1	CM-1	CM-1	S IS	•				
Hfr.		8		10		40	40	23	23	94					
Navy JAN and/or(A.W.S.) Specification Number		•		•		RE-13A-372J	RE- 13A-372J	JAN-R-11	J AN-R-11	Jan-R-11					
Navy Type Designation JAN / or A. W. S. No.	RECEPTACLES	CUF-49043	PLUGS	CGQ-49042	RESISTORS	CPQ-63703-5	CPQ-63703-5	RC-31-BF-333-J	RC-31-BF-822-J	RC-41-BF-203-J					
ptlon		Receptacle		Plug		6 ohms ± 5%	27 ohms ±	33,000 ohms	8,200 ohms	20,000 onms			-		
Description		Eight Circuit		Elght Circuit		Wire Wound: 1 Watt	Wire Wound: 5% 1 Watt	Composition: ± 5% 1 Watt	Composition: ± 5% 1 Watt	Composition: ± 5% 2 Watts					
Function		Power Receptacle Socket		Battery Cable Plug		Filament Series Dropping Resistor	Filament Load Resistor	Blas Series Dropping Resistor	H.V. Series Dropping Resistor	H.V. Load Resistor					
Symbol Desig- nation		J1501		P1501		R1501	R1502	R1503	R1504	R1505					:

TABLE I PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL TBX SERIES OF PORTABLE RADIO EQUIPMENTS RAIN SHIELD TYPE CAUQ-10480

	Garod Dwg. and Part No.		.E-SA-10141		C-SA-10147	
	Special Tolerance, Rating or Modification		•		•	
	Mfr. Desig- nation		500			
	.TIM		37		27	
	Navy JAN and/or(A.W.S.) Specification Number				•	
	Navy Type Designation JAN / or A. W. S. No.	RAIN SHIELD	CAUQ-10480	STRAPS	•	
•	Description		Shield: Consisting of Transparent plastic material formed to fit over Front of Trans-Rec. unit with synthetic rubber strap for attaching to Case.		Synthetic rubber strap, one side of which is permanently fastened to one side Rain shield and equipped with a clip on other side for attachment to shield when in place.	
	Function		Trans Rec. Rain Shield		Synthetic rubber strap	
	Symbol Desig- nation		A1600		A1601	

† Not exact equivalent, but may be used as an alternate.

PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL TBX SERIES OF PORTABLE RADIO EQUIPMENTS CRYSTAL CALIBRATOR AND MONITOR TYPE CGQ-60133 TABLE

Garod Dwg. and Part No.		C-SA-10157	,	B-BT-10000	B-BT-1001		B-CO-10020	B-CO-10019		C-RC-10000		L-CL-10014	
Special Tolerance, Rating or Modification		0		- H									
Mfr. Desig- nation		•		•	•		•			1J-102			
Mfr.		42]	•	•		9	9		43		10	
Navy JAN and/or(A.W.S.) Specification Number		•		J AN - B-18	JAN-B-18		JAN-C-20	JAN-C-80		•		•	
Navy Type Designation JAN / or A.W.S. No.	D TYPE ANTENNA		BATTERI ES	-19031	-19011	CAPACITORS	CC 21CK 150K	CQ 21CK 100F	JACKS	•	R. F. INDUCTORS	•	
Description	ROD	3 section Telescoping type antenna		1 ± Volt flashlight cell	Dry Battery: Rated 7 ½ Volts. Terminals on each cell with black flexible negative lead.		Capacitor Ceramicon: 15 MMFD. ±10%	Ceramicon: 10 MMFD. ±10%		Single, closed circuit short frame type	R,	Coll consisting of 3 colls in series, each 103 turns #52 E.D.S. copper wire universal wound 4 crosses per turn on ½" ceramic form.	
Function		Rod Antenna	ā	Dry Cell	"C" Battery		Antenna Coupling Capacitor	R.F. Choke Shunt Capacitor		Headphone Jack		R. F. Plate choke	
Symbol Desig- nation		A1701		B1701	\$170 <i>2</i>		C1701	C1702		11701		L1701	

† Not exact equivalent, but may be used as an alternate.

TABLE I Parts List by Symbol Designations for model tbx series of Portable Radio Equipments Crystal Calibrator and Monitor Type CGQ-60133

					-			
Symbol Designation	Function	Description	Navy Type Designation JAN / or A.W.S. No.	Navy JAN and/or(A.W.S.) Specification Number	.TIM	Mfr. Desig- nation	Special Tolerance, Rating or Modification	Garod Dwg. and Part No.
			RESISTORS					
R1701	Grid leak resistor	Composition: 220,000 ohms ±10% ½ watt	RC21BF224K RC21BF224K	JAN-R-11	23	CM ½	•	B-RE-10040
			SWI TCHES					
81701	Momentary on-off switch	Double pole, double throw momentary in one position, normally closed in other positions 3 AMP 125 Volts.	CG 24034	A. W. S. C75.15	1,	1GA4C12 Modified	•	C-SW-1006
81702	Crystal channel selector switch	switc posit	• •	•	14	•	•	C-SW-10003
			TUBES					
V1701	Oscillatofr tube	R. F. amplifier pentode	CTL-SA4	JAN-1A	25	•		B-TU-10003
			SOCKETS					
X1701	Oscillator tube socket	7 prong Midget Ceramic	CMG-49571A	JAN-S-28	28	•	•	B-S0-10001
			CRYSTALS					
Y1701 thru Y1710	Quartz Crystal and holder	At cut quartz crystal and holder	Signal Corps Type FT243 holder	•		•		
						•		-

† Not exact equivalent, but may be used as an alternate.

Code	Mfr.		
	Prefix	N	411.
No.	rreilx	Name Name	Address
1	CFU	Tillitson Furniture Co.	Jamestown, N.Y.
2	CWP	Winship Co., Inc.	Utica, N.Y.
3	CAIM	American Steel Package Co.	Defiance, Ohio
4	CHC	Hammurland Mfg. Co., Inc.	New York, N.Y.
5 .	CSL	Solar Mfg. Co.	New York, N.Y.
			, , , , , , , , , , , , , , , , , , , ,
6	CER	Erie Resistor Corp.	Erie, Pa.
7	CTC	Chicago Telephone Supply Co.	Elkhart, Ind.
8	CUF	The Ucinite Mfg. Co.	Newtonville, Mass.
9	CTE	Telephonics Corp.	New York, N.Y.
10	CGQ	Garod Radio Corp.	Brooklyn, N.Y.
11	CG	General Electric Co.	Schenectady, N.Y.
12	CIR	International Resistance Co.	Philadelphia, Pa.
13	CAQZ	Brelco Corp.	New York, N.Y.
14	COC	Oak Mfg. Co.	Chicago, Ill.
15	CFW	F.W. Sickles Co.	Springfield, Mass.
		,	
16	CHS,	Hygrade Sylvania Corp.	Salem, Mass.
17	СРН	American Phenolic Corp.	Chicago, I11.
18	CTD	Tobe-Deutschmann	Canton, Mass.
19	CCT	Stromberg Carlson Tel. & Mfg. Co.	Rochester, N.Y.
. 20	CGE	Guardian Electric Mfg. Co.	Chicago, I11.
21	CAY	Westinghouse Electric & Mfg. Co.	Bloomfield, N.J.
22	CSF	Sprague Specialties Co.	North Adams, Mass.
23	CSA	Stackpole Carbon Co.	St. Mary's, Pa.
24	CUT	United Transformer Co.	New York, N.Y.
25	CTL	Tung-Sol Lamp Works Inc.	Baltimore, Md.
	CITY	, ,	
26	CHY	Hytron Corp.	Salem, Mass.
27	CNA	National Company Inc.	Malden, Mass.
28	CMG	Cinch Mfg. Co.	Chicago, Ill.
29	an.	Dial Light Co. of America	New York, N.Y.
30	CFM	Froiland Mfg. Co.	Springfield, Mass.
91	CBF	Busha Flasts: Co	Paris Da
31 32	CDF	Burke Electric Co. Dahlstrom Metallic Door Co.	Erie, Pa. Jamestown, N.Y.
33	CALJ	The Archwin Co.	Brooklyn, N.Y.
34	CCR	Chisholm-Ryder Co.	Niagara Falls, N.Y.
35	CCJ	Henry L. Crowley Co.	West Orange, N.J.
•0	000	nearly L. Orowiey Co.	west Ofange, M. J.
36		Ashaway Line & Twine Co.	Ashaway, R. I.
37 -	CAUQ	Design Center	New York, N.Y.
38	CW	Western Electric Co.	Kearny, N.Y.
39	CAGY	Walter L. Schott Co.	Beverly Hills, Calif.
40	CPQ"	Speer Resistor Corp.	St. Mary's, Pa.
	OT V	obeer restraint onth	One many de ga
41	CAQF	Hamilco	Port Chester, N.Y.
42		Spirling Products Co.	New York, N.Y.
43	1 (1) (1) (1) (1) (1) (1) (1) (1) (1) (1	Utau Products Co.	Chicago, III.

APPLICABLE COLOR CODES RMA 6 COLOR CODE SYSTEM FOR CAPACITORS

COLOR	SIGNIFICANT FIGURE	DECIMAL MULTIPLYER	TOLERANCE	VOLTAGE RATING
Black Brown	0 1 2 3 4 5 6 7 8 9	1 10 100 1000 10000 100000 10000000 1000000	123.3.5.5.5.5.5.5.5.5.5.5.5.5.5.5.5.5.5.5	100 200 300 400 500 600 700 800 900 1000 2000 500

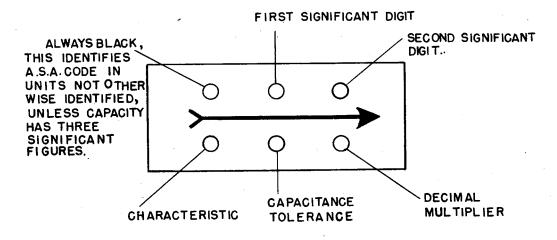
Dot A, indicates the first significant figure of the capacitance. Dot B, indicates the second significant figure of the capacitance. Dot C, indicates the third significant figure of the capacitance. Dot D, indicates the decimal multiplyer. Dot E, indicates the tolerance of the capacitor. Dot F, indicates the voltage rating of the capacitor.

RMA COLOR CODE FOR RESISTORS

COLOR	"A" 1st DIGIT	"B" 2nd DIGIT	MULTIPLYING VALUE	"D" TOLERANCE
Black Brown Red Orange . Yellow . Green Blue . Violet . Gray . White . Gold . Silver . No Color	0 1 2 3 4 5 6 7 8 9 -	0 1 2 3 4 5 6 7 8 9 -	1 10 100 1000 10000 100000 1000000 1000000	±5% ±10% ±20%
	A B	C D		

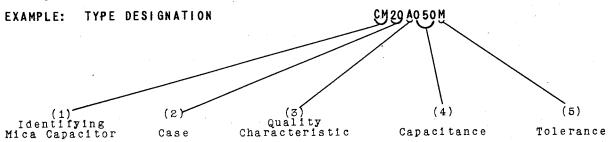
BAND A indicates the first significant figure of the resistance. BAND B indicates the second significant figure of the resistance. BAND C indicates the multiplier. BAND D if any indicates the tolerance limits.

APPLICABLE COLOR CODE FOR JAN-C-5 JOINT ARMY-NAVY SPECIFICATION



Color	Significant Figure	Decimal Multiplier	Designation Letter & Tolerance	Characteristic
Black	0	10	20% (M)	A B
Brown Red Orange Yellow	1234 5678	100 1000	2 % (G)	B C D E F G
White Gold Silver	9 -	0.1	5% (J) 10% (K)	
	c	Temperature Coefficient parts/million/°C		Capacitance Drift
A	- • • • •	Not Specified Not Specified -200 to +200 -100 to +100 -20 to +100 0 to +70 0 to -70		Not Specified Not Specified ±0.5% ±0.3% ± (0.1% +0.1MMF) ± (0.05% +0.1 MMF) ± (0.05% +0.1 MMF)

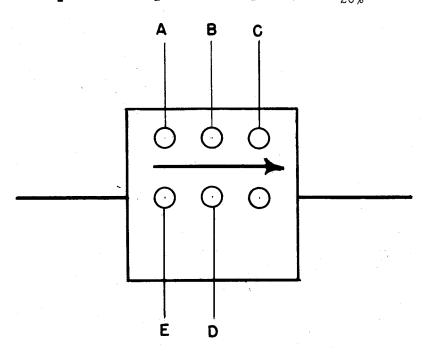
The reverse side of this condenser contains a method of identifying by a comprehensive letter and number system comprised of five elements.



The above designation, for example identifies a 5 micromicrofarad mica capacitor of $\pm 20\%$ tolerance having an unspecified quality characteristic.

RMA (MODIFIED) 3 COLOR CODE SYSTEM FOR CAPACITORS

Color	1st Digit	and Digit	Ciphers	D Tolerance	E Voltage Rating
Black	0	0	. 0		
Brown	ĭ	ĭ	0	1%	100
Red	2	. 2	00		200
	₹	ž	ŏŏo	2% 3%	300
Orange	3	ž	0000	4%	400
Yellow	*	-	00000	5%	500
Green	Đ	5			
Blue	6	6	000000	6%	600
Violet	7	7	000000	7%	700
Gray	8	. в	0000000	8%	800
White	ă	9	00000000	9%	900
Gold	Ľ	<u> </u>	-	5%	100
		_	_ ′	10%	200
Silver	_	_	-	20%	500



```
Dot A, indicates the first significant figure of the Capacitance.

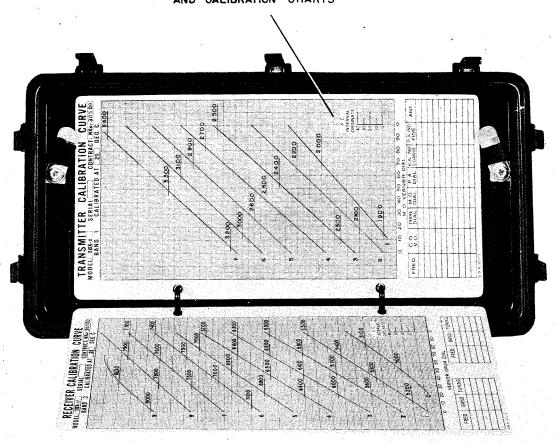
Dot B, indicates the second significant figure of the Capacitance.

Dot C, indicates the number of ciphers (zero following two significant figures).

Dot D, indicates the Tolerance.

Dot E, indicates the voltage rating.
```

CONDENSED OPERATING INSTRUCTIONS AND CALIBRATION CHARTS



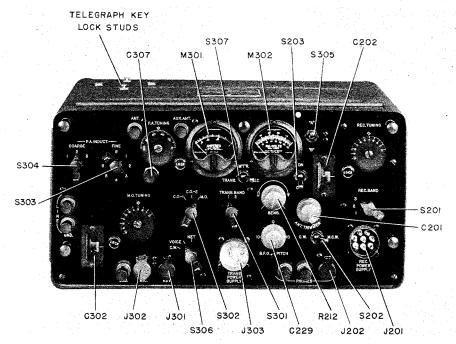


Fig. 6. Radio Transmitter-Receiver Unit Type -43060: Front View, Cover Removed

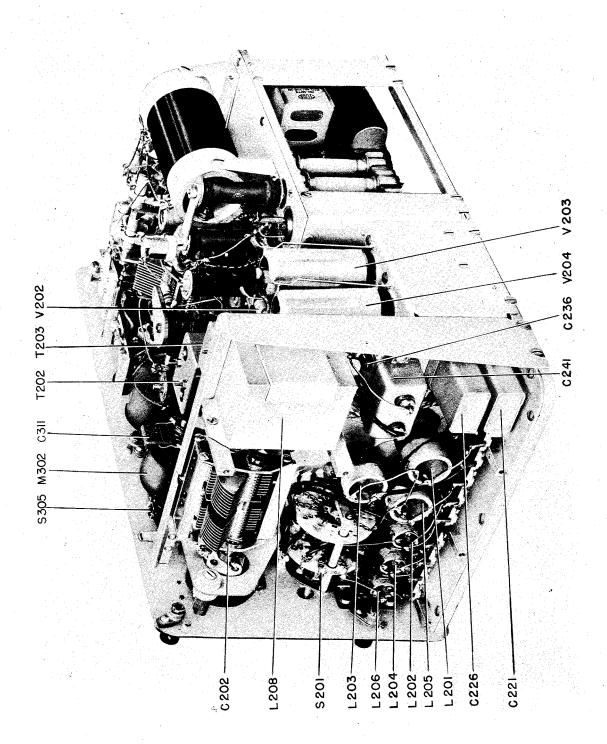


Fig. 7. Radio Transmitter-Receiver Unit Type -43060: Right Rear Oblique View of Chassis

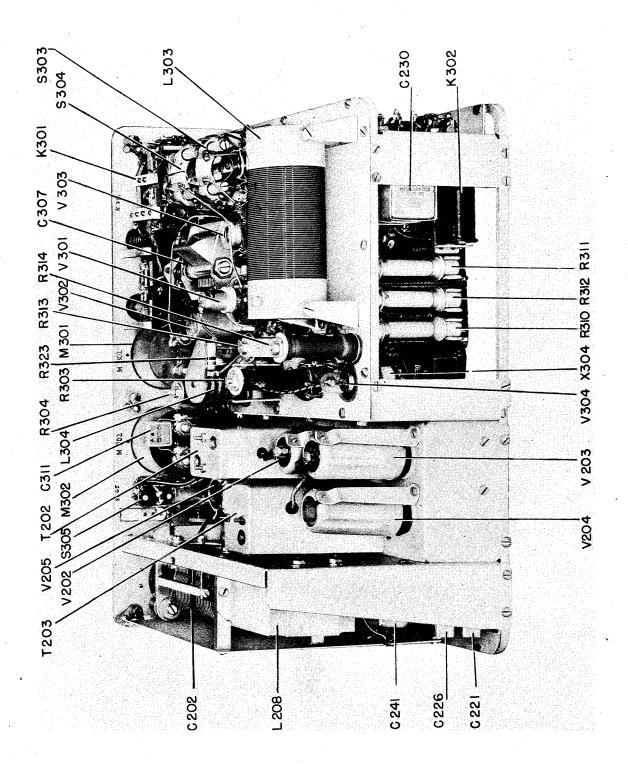


Fig. 8. Radio Transmitter-Receiver Unit Type -43060: Top Rear View of Chassis

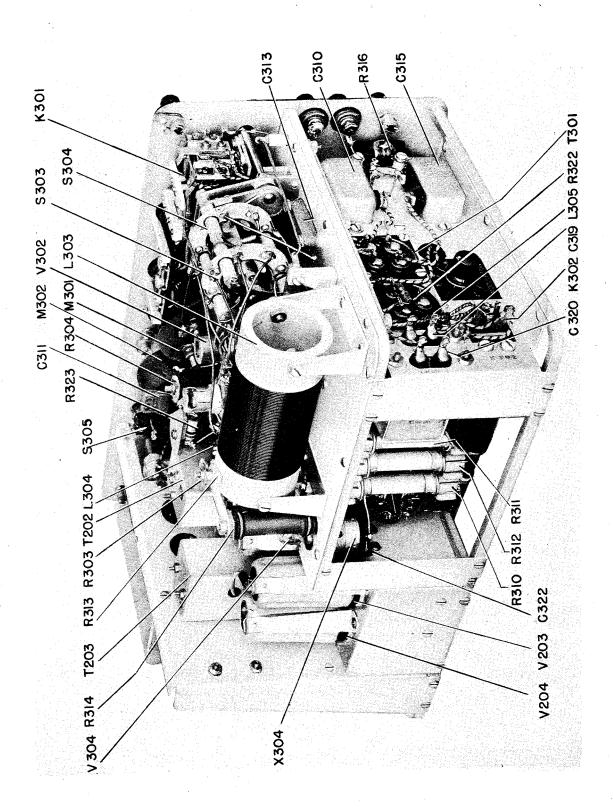


Fig. 9. Radio Transmitter-Receiver Unit Type -43060: Rear Left Obligue View of Chassis

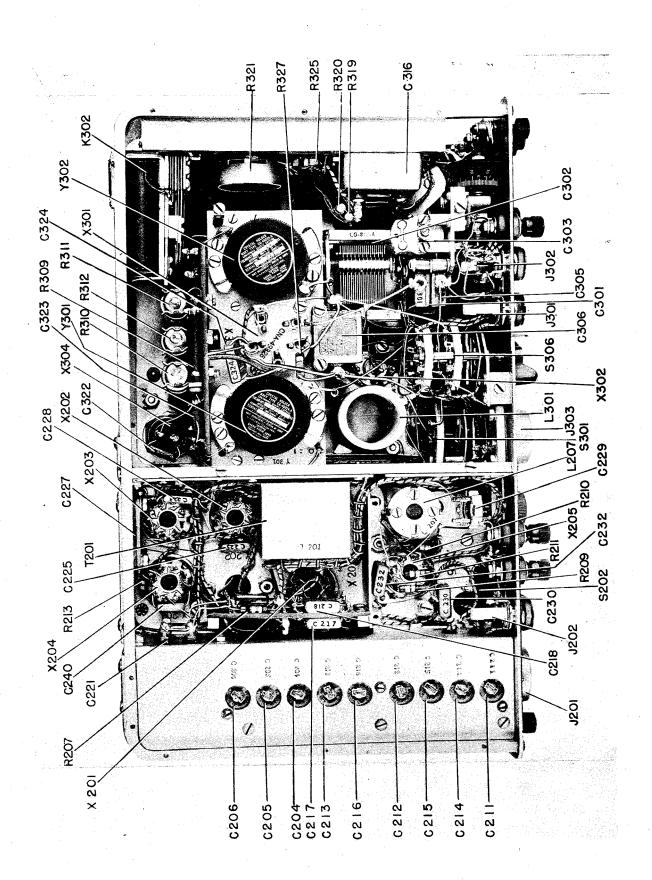


Fig. 10, Radio Transmitter-Receiver Unit Type -43060; Bottom View of Chassis

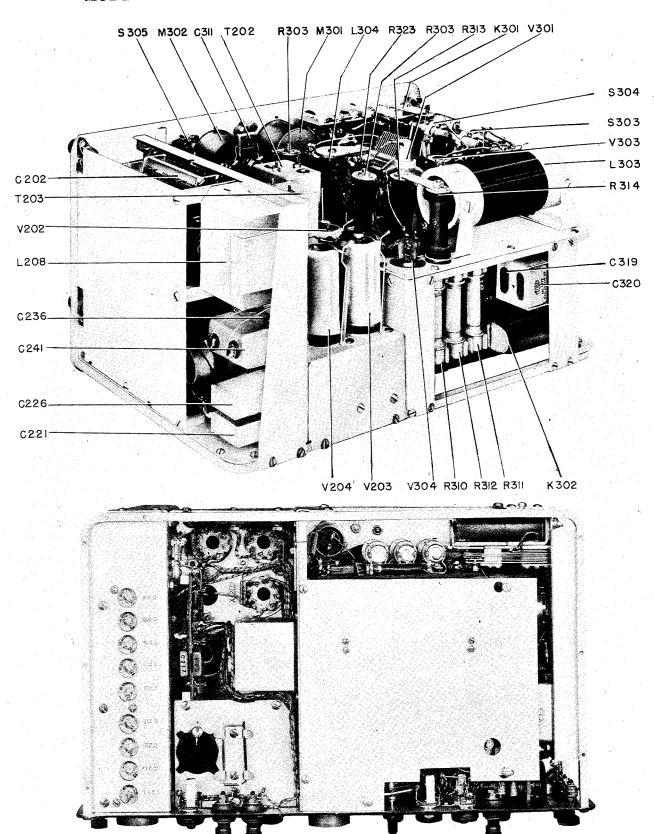


Fig. 11. Radio Transmitter-Receiver Unit Type -43060: Right Rear Oblique and Bottom Views with Shield Plates Attached

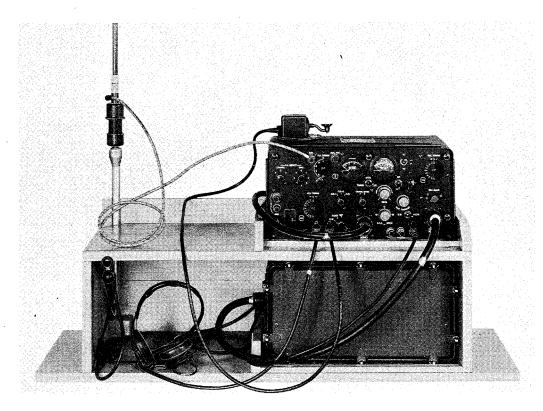


Fig. 12. Model TBX-8 Portable Radio Equipment: An Equipment Mounted on Typical Wooden Mounting Rack

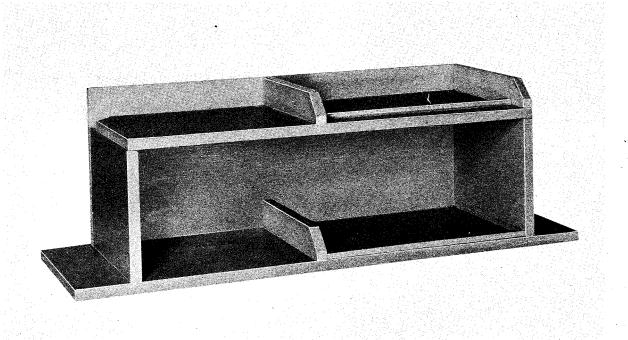


Fig. 12-A. Typical Wooden Mounting Rack

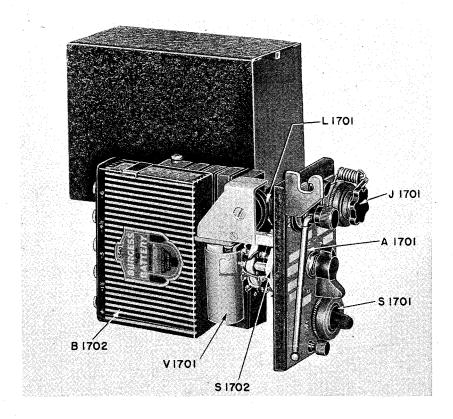


Fig. 13. Crystal Calibrator and Monitor, Type -60133: Left Oblique View

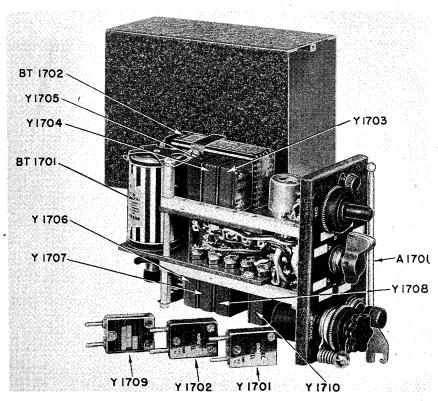


Fig. 13-A. Crystal Calibrator and Monitor, Type -60133: Right Oblique View

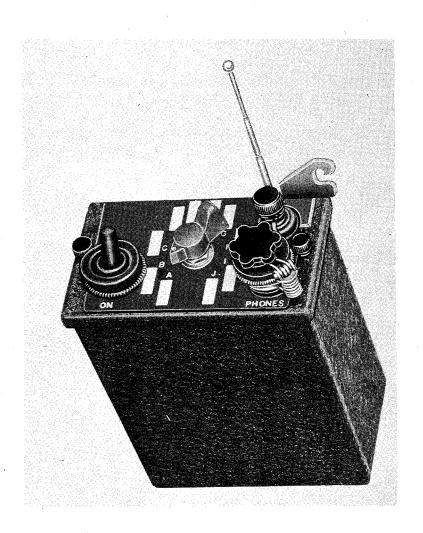


Fig. 14. Crystal Calibrator and Monitor, Type -60133: With Extended Antenna

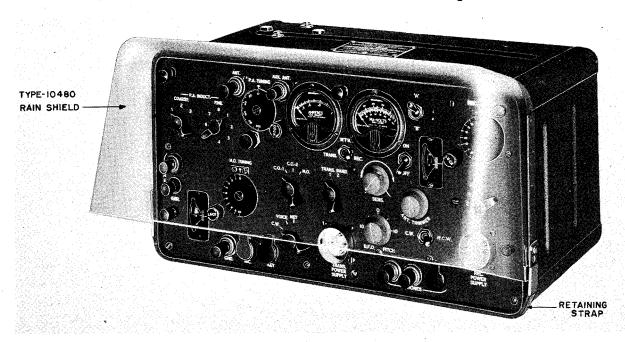


Fig. 15. Rain Shield, Type -10480: Mounted on Type -43060 Transmitter-Receiver Unit



Fig. 15-A. Rain Shield, Type -10480: Assembled for Transmission in Carrying Case, Type 10023A

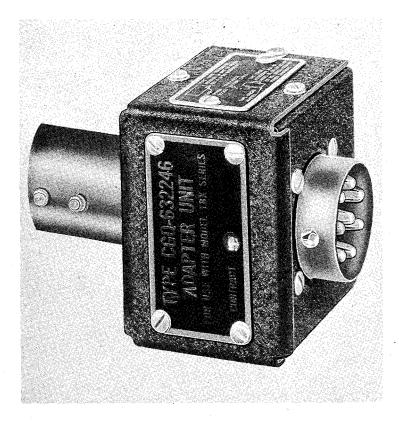


Fig. 16. Adapter Unit, Type -632246: Completely Assembled

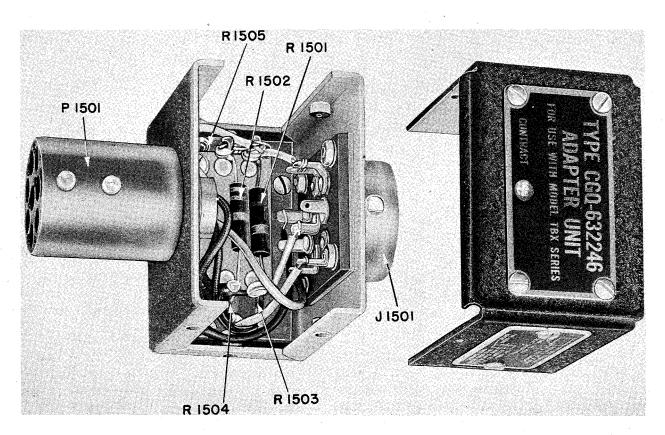


Fig. 16-A. Adapter Unit, Type -632246: With Cover Removed

TYPICAL TRANSMITTER PERFORMANCE

Ep = 525 Volts.

Ef = 12.6 Volts.

Large Ant. 26 ohms.

Small Ant. 10.4 ohms

		1			i i			
Operation	Ant. Large or Small	M.O. Dial	M.O. Band	P.A. Coarse	INDUCT. Fine	P.A. Dial	Trans. Curr. MA.	Ant. Cur. Amp.
CW MCW CW MCW	L L S S	190 190 190 190	1 1 1	1 1 1	4 4 4 4	54 54 18 18	58 48 60 48	.6 .4 .86 .59
CW MCW CW MCW	L L S S	414 414 414 414	1 1 1 1	2 2 2 2	3 3 2 2	14 14 6 6	64 48 56 44	.63 .4 .83 .53
CW MCW CW MCW	L L S	635 635 635 635	1 1 1 1	2 2 2 2	6 6 5 5	22 22 18 18	62 45 52 40	.6 .34 .78 .48
CW MCW CW MCW	L L S S	238 238 238 238	2 2 2 2 2	3 3 3 3	2 2 2 2	42 42 23 23	57 45 55 45	.46 .3 .77 .53
CW MCW CW MCW	L L S S	382 382 382 382	2 2 2 2 2	3 3 3 3	3 3 3 3	58 58 40 40	57 46 56 44	.36 .25 .63 .46
CW MCW CW MCW	L L S S	519 519 519 519	2 2 2 2 2	3 3 3 3	5 5 5 5	50 50 24 24	64 49 63 48	.42 .24 .81 .51
CW MCW CW MCW	L L S S	657 657 657 657	2 2 2 2 2	3 3 3 3	6 6 6	54 54 25 25	65 49 66 52	.34 .2 .73 .48
CW MCW CW MCW	L L S S	881 881 881 881	2 2 2 2	3 3 3 3	7 7 7 7	78 78 44 44	62 47 60 46	.2 .05 .66 .41
	CW MCW CW	Operation Large or Small CW L MCW L CW S MCW S MCW S CW L MCW L CW S MCW S CW L MCW S MCW S	Operation Large or Small M.O. Dial CW L 190 MCW L 190 CW S 190 MCW S 190 CW L 414 MCW L 414 CW S 414 MCW S 635 MCW L 635 MCW S 635 MCW S 635 CW L 238 MCW L 238 CW S 238 MCW S 238 CW L 382 MCW S 382 CW S 382 CW L 519 MCW S 519 MCW S 657 MCW S 657 CW L 657 MCW S 657 CW	Operation Large or Small M.O. Dial M.O. Band CW L 190 1 MCW L 190 1 CW S 190 1 MCW S 190 1 CW L 414 1 MCW L 414 1 CW L 635 1 MCW L 635 1 CW S 635 1 MCW S 635 1 CW L 238 2 CW S 238 2 MCW S 238 2 CW S 382 2 MCW S 382 2 CW S 382 2 CW S 519 2 MCW S 519 2 CW S 657 2 MCW	Operation Large or Small M.O. Dial M.O. Band P.A. Coarse CW L 190 1 1 MCW L 190 1 1 CW S 190 1 1 MCW S 190 1 1 MCW L 414 1 2 MCW L 414 1 2 CW S 414 1 2 MCW L 635 1 2 CW S 238 2 3 MCW S 238 2 3 MCW S 382 2 3 CW S 382 2 3 CW S 519 2 3	Operation Large or Small M.O. Dial M.O. Band P.A. Coarse INDUCT. Fine CW L 190 1 1 4 MCW L 190 1 1 4 CW S 190 1 1 4 MCW L 414 1 2 3 MCW L 414 1 2 3 MCW S 414 1 2 2 MCW L 635 1 2 6 CW S 635 1 2 5 MCW S 635 1 2 5 CW L 238 2 3 2 MCW S 238	Operation Large or Small M.O. Dial M.O. Band P.A. Coarse INDUCT. Fine P.A. Dial CW L 190 1 1 4 54 MCW L 190 1 1 4 54 CW S 190 1 1 4 18 MCW S 190 1 1 4 18 CW L 414 1 2 3 14 MCW L 414 1 2 3 14 CW S 414 1 2 2 6 MCW S 414 1 2 2 6 CW S 635 1 2 6 22 MCW S 635 1 2 6 22 MCW S 238 2 3 2 42 CW S 238 2 3	Operation Large or Small M.O. Dial M.O. Band P.A. Coarse INDUCT. Fine P.A. Dial Curr. MA. CW L 190 1 1 4 54 48 MCW L 190 1 1 4 54 48 CW S 190 1 1 4 18 60 MCW S 190 1 1 4 18 60 MCW S 190 1 1 4 18 48 CW L 414 1 2 3 14 64 MCW L 414 1 2 3 14 48 CW L 635 1 2 6 22 6 56 MCW S 635 1 2 6 22 45 CW S 635 1 2 5 18 40

Fig. 17. Typical Transmitter Performance

TABIILATED	TRANSMITTER	AND	RECEIVER	DATA

Freq. Kc.	M. O. Band	M. O. Dial (Approx.)	Freq. Kc.	M. O. Band	M. O. Dial (Approx.)
2000 2100 2200 2300 2400	1 1 1 1	180 231 279 326 371	3200 3400 3600 3800 4000	2 2 2 2 2 2	145 212 275 334 389
2500 2600 2700 2800 2900	1 1 1 1 1	415 459 502 547 590	4200 4400 4600 4800 5000	2 2 2 2 2 2 2	444 498 553 607 663
3000, 3100 3200 3300 3400	1 1 1 1 1	635 680 725 773 817	5200 5400 5600 5800 6000	2 2 2 2 2 2	719 775 830 884 940

Fig. 18. Tabulated Transmitter Bands 1 and 2, Calibration Data for Use With Type -60133 Crystal Calibrator and Monitor.

Bar	nd 1	Ba	nd 2	Band 3		
Freq.	Dial (Approx.)	Freq.	Dial	Freq.	Dial	
Kc.		Kc.	(Approx.)	Kc.	(Approx.)	
2000	32	3100	0	5000	39	
2100	108	3200	59	5100	69	
2200	175	3300	107	5200	98	
2300	239	3400	151	5300	126	
2400	301	3500	193	5400	152	
2500	363	3600	233	5500	178	
2600	426	3700	274	5600	204	
2700	492	3800	313	5700	229	
2800	562	3900	352	5800	254	
2900	636	4000	392	5900	278	
3000 3100 3200	716 802 891	4100 4200 4300 4400 4500	432 473 516 560 606	6000 (6100	303 327	
		4600 4700 4800 4900 5000 5100	653 703 754 808 862 917			

Fig. 18-A. Tabulated Receiver Bands 1, 2, and Part of 3, Calibration Data for Use with Type -60133 Crystal Calibrator and Monitor.

TYPE-43060 TRANSMITTER-RECEIVER UNIT

RESISTOR-CAPACITOR PARTS LIST BY SYMBOL NUMBER FOR SCHEMATIC DIAGRAM FIG. 19

Refer to Table I for Complete Description of All Components

RECEIVER RESISTORS

			RECEIVER RESISTORS		
Symbol R201 R202 R203 R204 R205 R206	Value 200k $\pm 10\%$ $\frac{1}{2}$ w $10k \pm 10\%$ $\frac{1}{2}$ w $50k \pm 10\%$ $\frac{1}{2}$ w $2.5k \pm 10\%$ $\frac{1}{2}$ w $1k \pm 10\%$ $\frac{1}{2}$ w 2 Meg. $\pm 10\%$ $\frac{1}{2}$ w	R208 R209	Value 10k $\pm 10\%$ ½w 1 Meg. $\pm 10\%$ ½w 1 Meg. $\pm 10\%$ ½w 50k $\pm 10\%$ ½w 150k $\pm 10\%$ ½w 20k $\pm 10\%$ ½p Potentiometer	R213 R214 R215 R216 R217 R218	Value $30k \pm 10\% \frac{1}{2}w$ $10k \pm 10\% \frac{1}{2}w$ $6.8k \pm 10\% \frac{1}{2}w$ $10k \pm 10\% \frac{1}{2}w$ $10k \pm 10\% \frac{1}{2}w$ $10k \pm 10\% \frac{1}{2}w$ $1k \pm 10\% \frac{1}{2}w$
			RECEIVER CAPACITORS		
C202 C203 C204 C205 C206 C207 C208 C209 C210 C211 C212 C213	$\begin{array}{c} \text{Value} \\ 13.3 \text{ mmfd Var.} \\ 139.4 \text{ mmfd Var.} \\ 250 \text{ mmfd } \pm 10\% 500\text{v} \\ 7\text{-}45 \text{ mmfd Var.} \\ 7\text{-}45 \text{ mmfd Var.} \\ 7\text{-}45 \text{ mmfd Var.} \\ 0.02 \text{ mfd } \pm 10\% 400\text{v} \\ 700 \text{ mmfd } \pm 1\% 500\text{v} \\ 400 \text{ mmfd } \pm 1\% 500\text{v} \\ 400 \text{ mmfd } \pm 1\% 500\text{v} \\ 300 \text{ mmfd } \pm 1\% 500\text{v} \\ 7\text{-}45 \text{ mmfd Var.} \\ 7$	C216 C217 C218 C219 C220 C221 C222 C223 C224 C225	Value 7-45 mmfd Var. 7-45 mmfd Var. 0.006 mfd ±10% 500v 100 mmfd ±10% 500v 5 mmfd ±10% 500v 2x.5 mfd ±10% 200v 0.01 mfd ±10% 600v 100 mmfd ±10% 500v	C230 C231 C232 C233 C234 C235	Value 13.3 mmfd Var. $0.006 \text{ mfd} \pm 10\% 500\text{v}$ 200 mmfd $\pm 5\% 500\text{v}$ 0.006 mfd $\pm 10\% 500\text{v}$ 200 mmfd $\pm 5\% 500\text{v}$ 15 mmfd $\pm 10\% 500\text{v}$ 15 mmfd $\pm 10\% 500\text{v}$ 10 mfd Elec. 150v 25 mmfd $\pm 10\% \text{ Ceramic}$ 250 mmfd $\pm 10\% \text{ Ceramic}$ 250 mmfd $\pm 10\% \text{ 500v}$ 0.5 mfd $\pm 20\% 600\text{v}$
			TRANSMITTED BESISTADS		
			TRANSMITTER RESISTORS		
R301 R302 R303 R304 R305 R306 R307 R308 R309	Value $10k \pm 5\% \frac{1}{2}w$ $10k \pm 5\% \frac{1}{2}w$ $5k \pm 10\% 8w$ $4.0 \text{ Ohms} \pm 5\% 20w$ $100 \text{ Ohms} \pm 5\% 2w$ $240 \text{ Ohms} \pm 5\% 1w$ $30 \text{ Ohms} \pm 5\% 1w$ $68 \text{ Ohms} \pm 5\% 2w$ $390 \text{ Ohms} \pm 5\% 2w$	R311 R312 R313 R314 R315 R316 R317	1.43 Ohms—Evac. 140k—Evac. 0.4 Ohms—Evac. 20k ±10% 8w 20k ±10% 8w	Symbol R319 R320 R321 R322 R323 R324 R325 R326 R327	Value $68k \pm 10\% \frac{1}{2}w$ $11k \pm 10\% 1w$ $100k \pm 10\%$ Potentiometer $68k \pm 10\% \frac{1}{2}w$ $22 \text{ Ohms} \pm 10\% 1w$ $2 \text{ Meg.} \pm 10\% \frac{1}{2}w$ $10k \pm 5\% \frac{1}{2}w$ $150k \pm 10\% \frac{1}{2}w$ $68k \pm 10\% \frac{1}{2}w$
			RANSMITTER CAPACITORS		•
			RANSMITTER CAPACITORS		
C302 C303	100 mmfd $\pm 2\%$ 600v	C310 C311 C313 C314 C315	0.01 mfd $\pm 10\%$ 1200v 50 mfd Elec. 25v 0.006 mfd $\pm 10\%$ 500v 110 mmfd $\pm 10\%$ 1200v 0.01 mfd $\pm 10\%$ 1200v 50 mfd Elec. 25v 0.5 mfd $\pm 20\%$ 600v	C319 C320 C321 C322	Value 0.5 mfd ±20% 600v 1 mfd ±10% 600v 1 mfd ±10% 600v 0.006 mfd ±10% 500v

k=Kilohms

Meg = Megohms

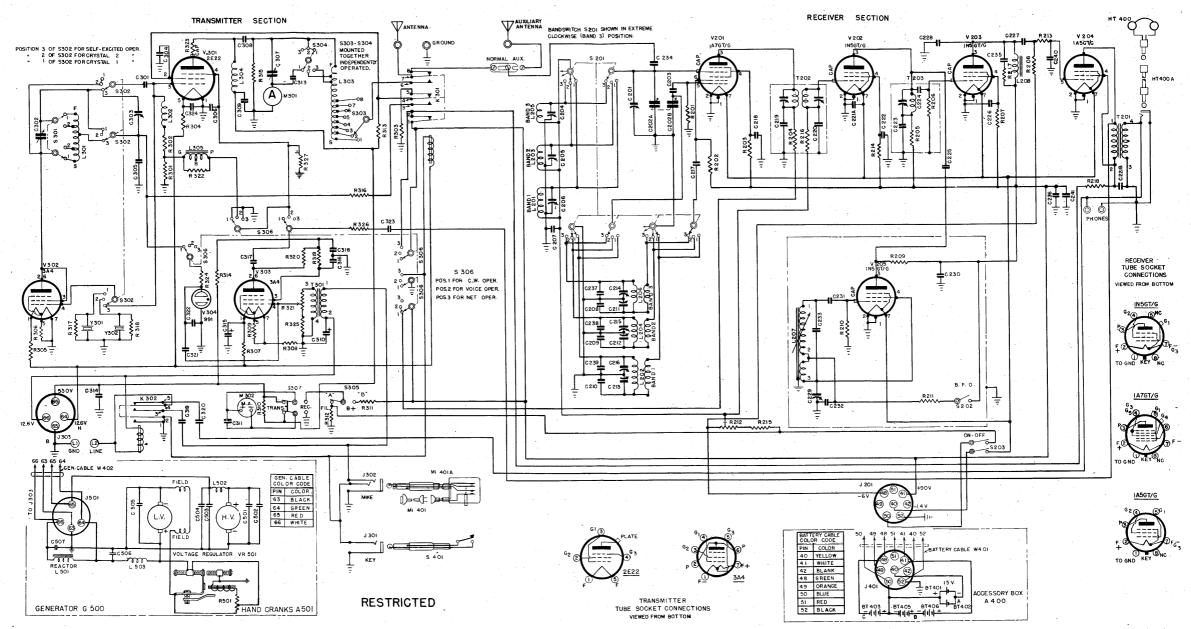
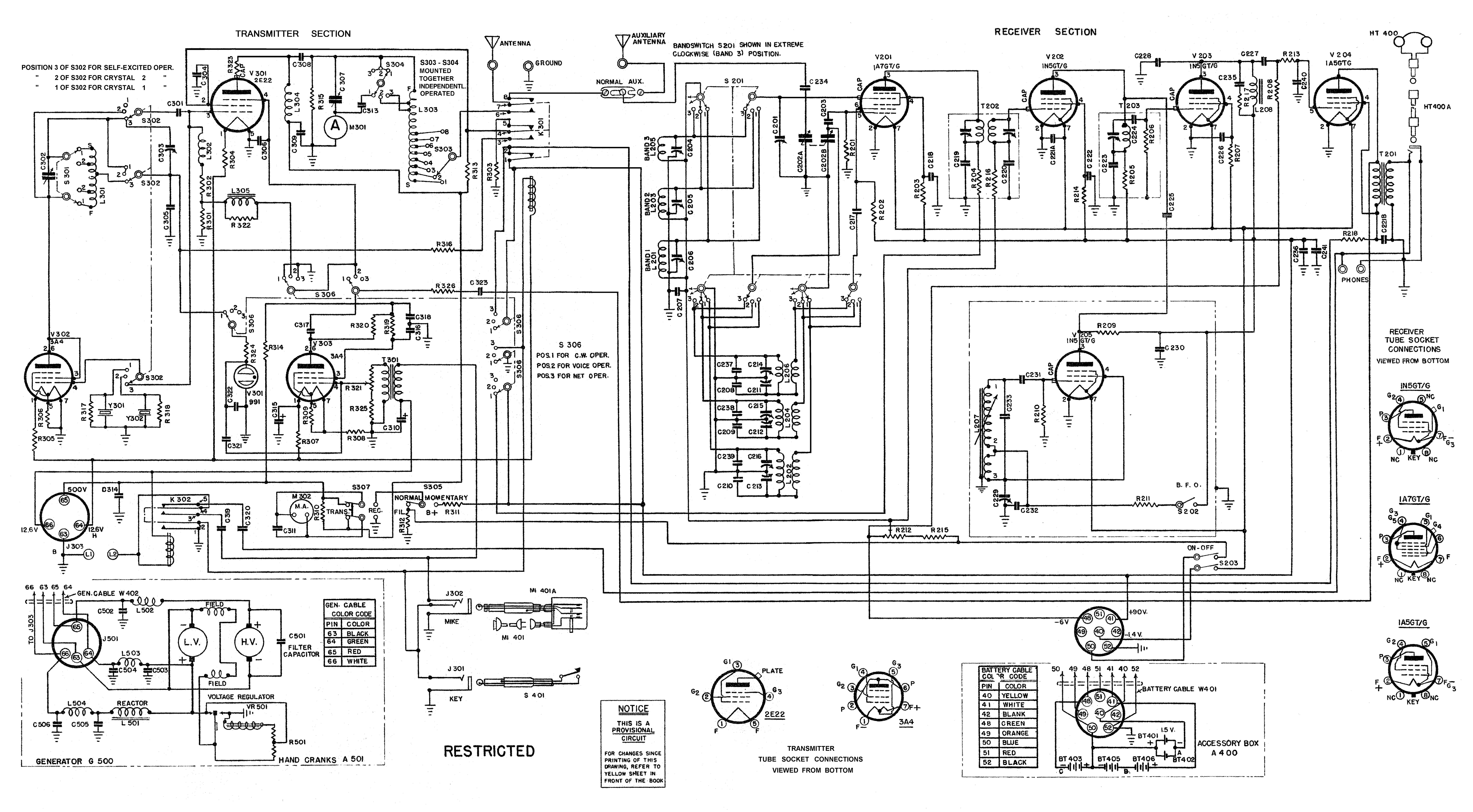


Fig. 19. Schematic Diagrams Type -43060 Radio Transmitter-Receiver Unit; Type -21263B Hand Driven Generator and Type -10339 Accessory Box.

RESTRICTED Fig. 19



RESTRICTED

Fig. 14

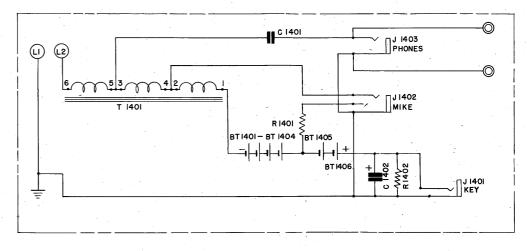


Fig. 20. Schematic Diagram, Remote Control Unit Navy Type -23453

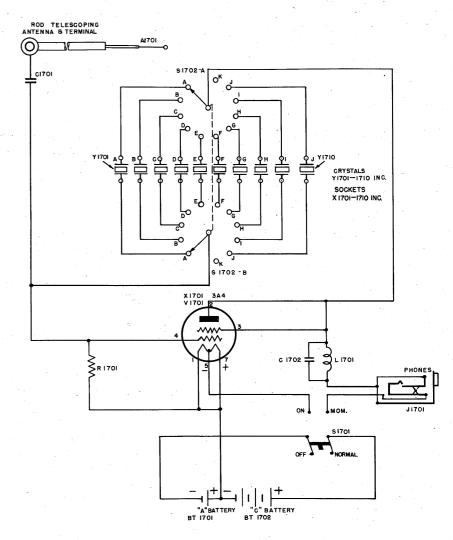


Fig. 21. Schematic Diagram, Crystal Calibrator and Monitor, Type -60133

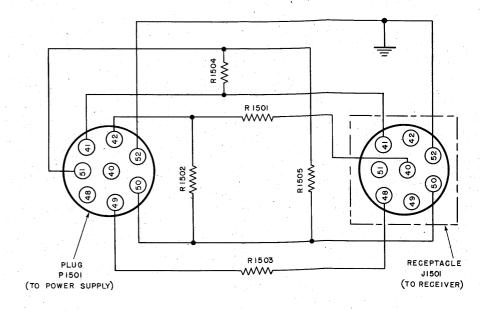
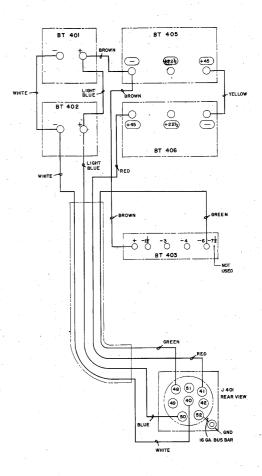


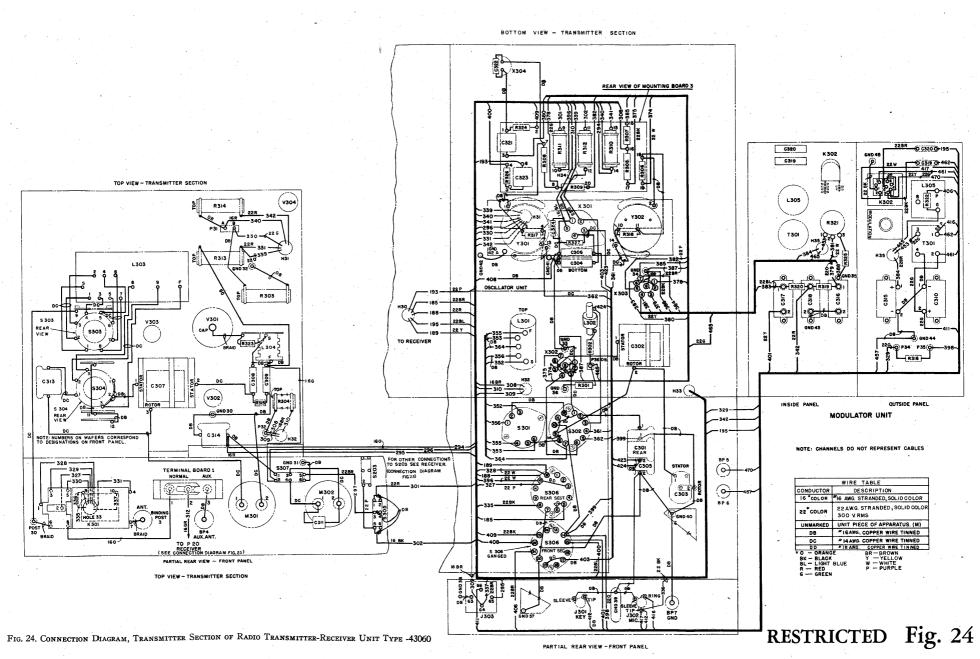
Fig. 22. Schematic Diagram, Receiver Power Supply Adapter Navy Type -632246

ACCESSORY BOX CONNECTION DIAGRAM FOR TBX-8



CAUTION THE BATTERIES MUST BE REMOVED FROM
ACCESSORY BOX WHENEVER THE EQUIPMENT
IS STORED OR DURING SHIPMENT.

Fig. 23. Connection Diagram, Accessory Box Navy Type -10339



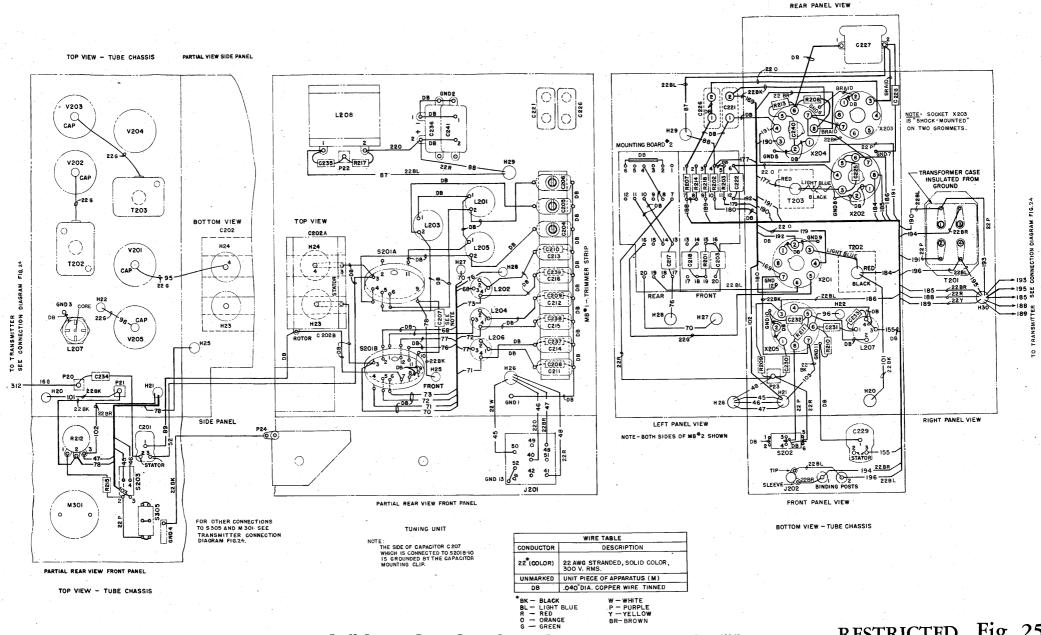


FIG. 25. CONNECTION DIAGRAM, RECEIVER SECTION OF RADIO TRANSMITTER-RECEIVER UNIT TYPE -43060

RESTRICTED Fig. 25

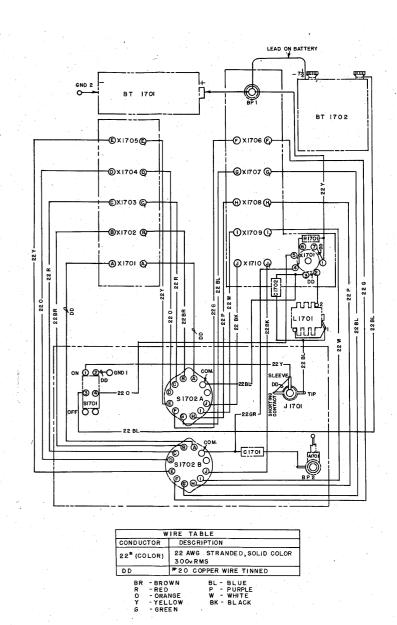


Fig. 26. Connection Diagram, Crystal Calibrator and Monitor, Type -60133

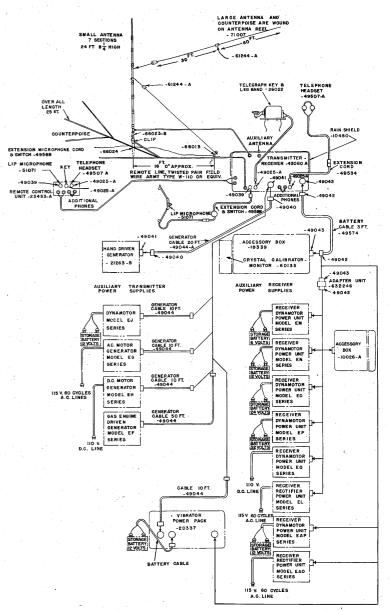


Fig. 27. Cording Diagram, Type -43060 Transmitter-Receiver Unit, Showing Possible Selection of the Various Power Supplies

