

NAVSHIPS 900,590

INSTRUCTION BOOK for

TBS SERIES

TBS TO TBS-8 INCLUSIVE

RADIO TRANSMITTING AND RECEIVING EQUIPMENT

NOMINAL POWER OUTPUT

Transmitter 50 Watts
Receiver 2 Watts

TYPE OF EMISSION

Voice
MCW

FREQUENCY RANGE

60 to 80
Megacycles



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RCA VICTOR DIVISION

of

RADIO CORPORATION of AMERICA

Camden, New Jersey, U. S. A.

NAVY DEPARTMENT

BUREAU OF SHIPS

CONTRACTS NOs-60613

CONTRACTS NOs-70095

CONTRACTS NOs-70095 Sup. B

CONTRACTS NXs-1736

CONTRACTS NXss-17599

CONTRACTS NXss-18747

CONTRACTS NXsr-36725

CONTRACTS NXsr-36725 LOI

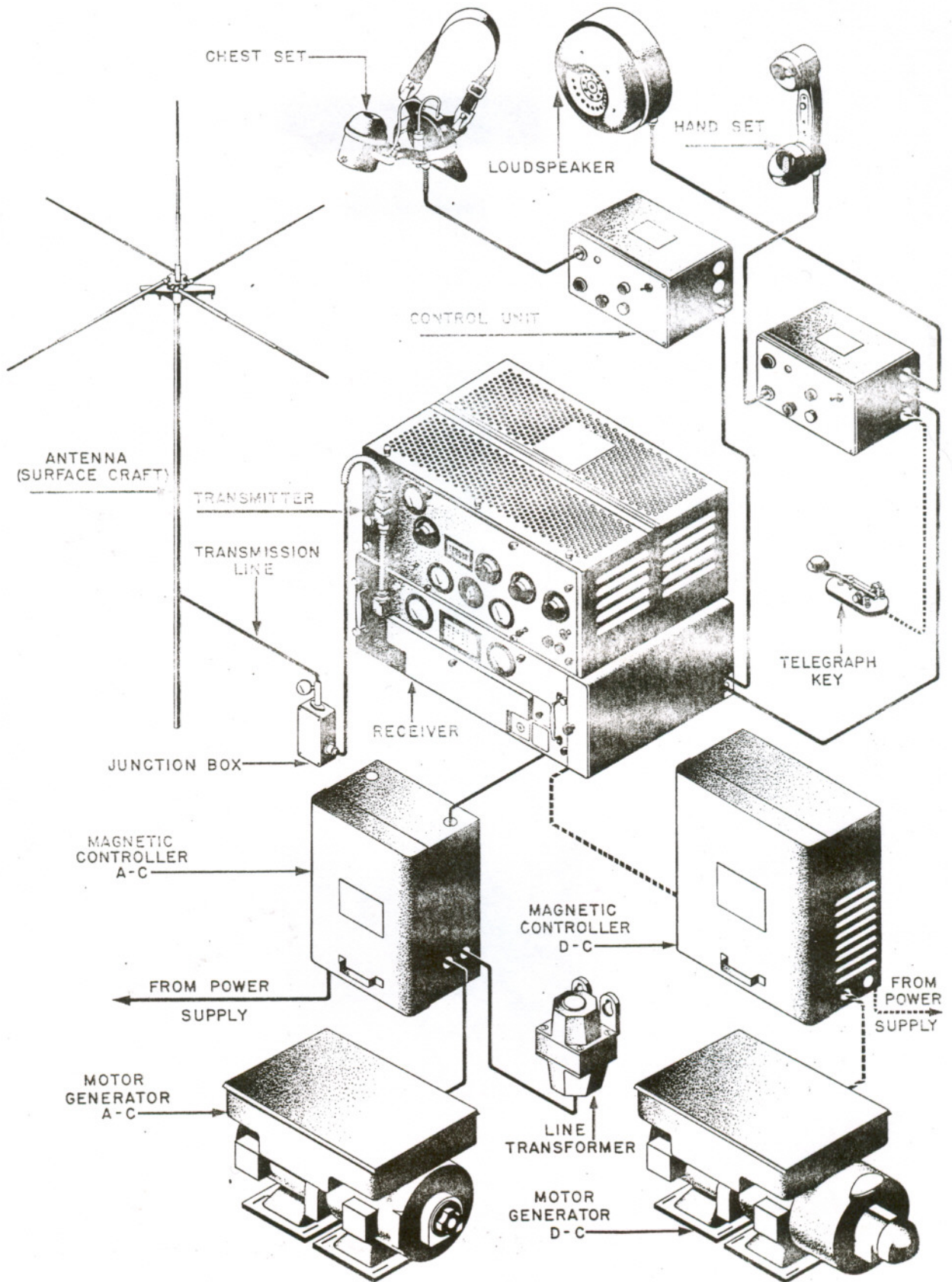
CONTRACTS NXsr-38310

CONTRACTS NXsr-51552 LOI

1B-38370

Approved 13 February 1945

RELATIONSHIP OF TBS UNITS



COMPONENT PARTS OF THE TBS SERIES OF RADIO COMMUNICATION SYSTEMS

The Navy Model TBS Series of Radio Transmitting and Receiving equipment comprising Models TBS, TBS-1, TBS-2, TBS-3, TBS-4, TBS-5, TBS-6 TBS-7 and TBS-8 employed the components pictured on the opposite page to provide reliable radio communication between small surface craft for a distance of approximately ten miles. Communication by voice over this range or telegraphed signals by Modulated Continuous Wave to cover greater distances are available as desired.

The equipment throughout the series has varied but little between the different models except for the motor generators and magnetic controllers. The apparatus may be tuned to operate on any frequency in the 60 to 80 Megacycle range, being fixed tuned and crystal controlled. Full control of transmitter operation is possible from two control units that may be located as desired in the vessel. A chart showing the Navy Model numbers of the components is given on Page 8.

DIMENSIONS OF MAJOR UNITS (UNCRATED)

QUANTITY	NAME OF UNIT	HEIGHT	WIDTH	DEPTH	DIAM.	WEIGHT
1	Radio Transmitter	10 $\frac{1}{2}$	23 $\frac{1}{2}$	17 $\frac{3}{4}$		75
1	Radio Receiver	8 $\frac{3}{4}$	25 $\frac{13}{16}$	16 $\frac{7}{8}$		45
1	Magnetic Controller d-c	17 $\frac{1}{4}$	14 $\frac{1}{2}$	7 $\frac{3}{4}$		45
	Magnetic Controller a-c	15 $\frac{1}{8}$	10 $\frac{5}{8}$	7 $\frac{1}{4}$		34
2	Control Unit	5 $\frac{15}{16}$	10 $\frac{7}{16}$	7 $\frac{1}{4}$		9
1	Loudspeaker	5			11 $\frac{1}{8}$	21
2	Handset					1 $\frac{1}{2}$
1	Chest Set					1 $\frac{1}{4}$
1	Antenna	104				46
1	Transmission Line	1440			3 $\frac{3}{8}$	
1	Line Transformer	7 $\frac{3}{8}$	4 $\frac{1}{2}$	4		16 $\frac{1}{4}$

TECHNICAL SUMMARY OF TRANSMITTER & RECEIVER

FUNCTIONAL FACTORS	RADIO TRANSMITTER	RADIO RECEIVER
Frequency Range	60 to 80 MC	60 to 80 MC
Frequency Control	Crystal	Crystal
Frequency Stability	0.025 percent	
Tuning Bands	No. of Crystals furnished and bands covered varies with different models.	
	Inspect nameplates of crystal holders for channel frequencies.	
Output Impedance		600 Ohms
Power Input	1000 watts	110 watts
Power Output	50 watts	2 watts
Type of Modulation	Amplitude	
Method of Modulation	Plate	
Modulation Capability	100%	
Sensitivity (Minimum R-F input for 6 MW output)		5 Microvolts
Crystals	Quartz	Quartz
A-F Input Impedance	600 Ohms	
R-F Input Impedance		70 Ohms
Intermediate Frequency		5.3 MC

ANTENNA

Vertical Type Quarter Wave
Concentric Grounded Stub

Radiation Impedance.....70 ohms
4 Ground plane rods in Destroyer type
2 Ground plane rods in Submarine type

FREQUENCY RANGE—3 BANDS 60 TO 80 MC

Coverage MC	Destroyer	Rod Length	Submarine
60.0-65.0	44	inches	41 $\frac{7}{8}$
64.5-71.5	38 $\frac{3}{8}$	inches	34 $\frac{3}{4}$
71.0-80.0	33	inches	28 $\frac{1}{4}$

TRANSMISSION LINE

Gas filled Concentric type
5-20 lbs. nitrogen

Line Impedance.....70 ohms
Destroyer type.....120 ft. long
Submarine.....80 ft. long

THE CONTROL UNIT

Two furnished with each installation

Provides full control of transmitter from any two desired points in the vessel.

THE LOUDSPEAKER

Input Impedance.....600 ohms
Power Capability2 watts

THE HANDSET

Two furnished with each installation

Earpiece600 ohms
Carbon Button Microphone.....40 ohms
Press to Talk Switch

THE CHEST SET

Provides chest support for microphone

Carbon Button Microphone.....40 ohms
Press to Talk Switch

LINE TRANSFORMER

Furnished with 440 V. A-C Equipment

Primary wound for 440 volt.....No taps
Secondary wound for 220 volt.....No taps
Provides proper voltage for filament transformer in transmitter and operating voltage for magnetic controllers.

POWER SUPPLY UNITS

A motor generator unit is employed as the source of power in the TBS series of radio installations to provide the high voltage current required by the transmitter and serves as well to permit the use of the apparatus on any small surface craft or submarine regardless of the characteristics of the primary power available. Since the current requirements of the radio apparatus are fixed, the output side of generator of motor generator units are practically identical in physical as well as electrical characteristics. The input or motor side of the unit must function on the current available and will vary in mechanical and electrical features.

The chief difference between the various models of the TBS Series lies in the type of motor generator employed. In order to indicate clearly the relationship between line current available and the power supply units furnished with the various models of the TBS Series the chart on the opposite page is provided.

The magnetic controller for remote control of the motor generator will also vary in type depending upon the motor employed. For direct current motors two types are provided, the CRV-21319

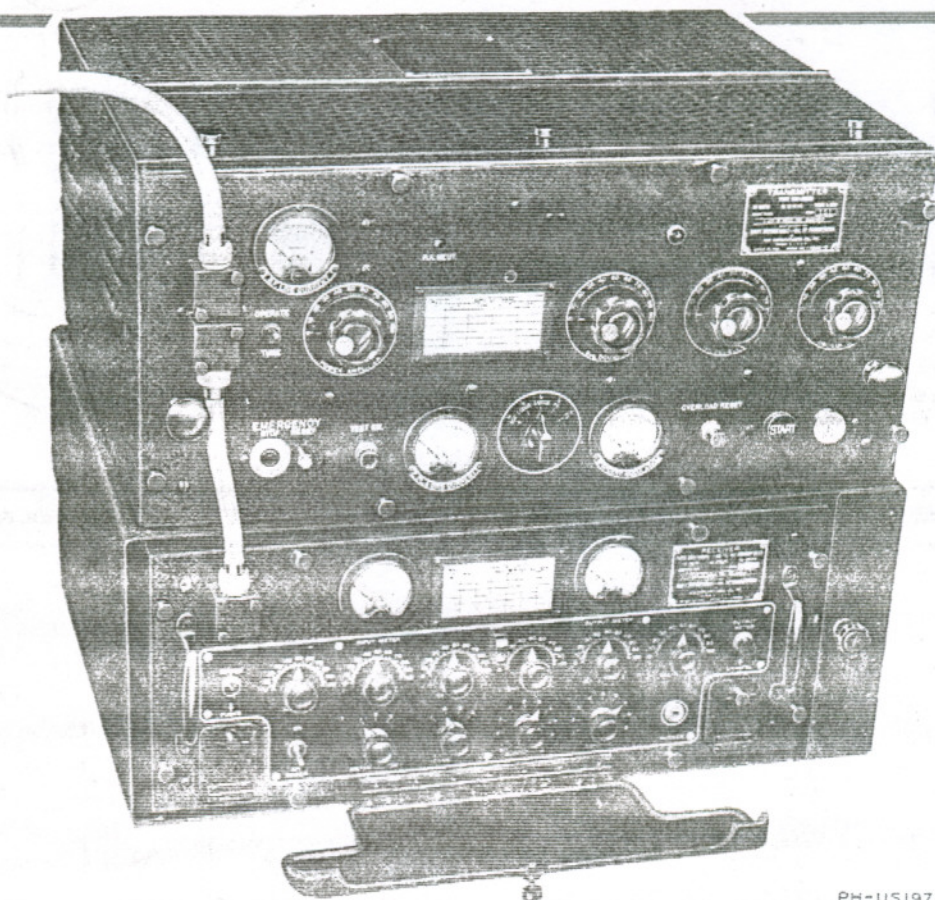
and CG-21319 for use with 120 volt motors and the CRV-21804 and CG-21804 for controlling 230 volt motors. Both these controllers employ three steps of resistance change to bring the motor up to speed in starting. The same type controller, CRV-21320 and CG-21320, is used with all types of a-c motors.

Other adaptations are also required in the installation when the line source of power is other than 220 volt a-c. Where 440 volt current is encountered it is necessary to install a line transformer as indicated in the chart. This transformer provides the 220 volt a-c current for the filament transformer in the transmitter.

Where a d-c source is encountered the motor is fitted with an extra winding and slip rings to furnish the necessary 220 volt a-c. A speed regulator is built into the d-c motor generators to provide essentially constant output voltages when input voltage varies ± 5 per cent.

Data is also included in the chart to indicate the size and weight of the uncrated units as well as starting and running current required by the different units and their correct speed.

RADIO TRANSMITTER AND RECEIVER UNIT FOR TBS SERIES



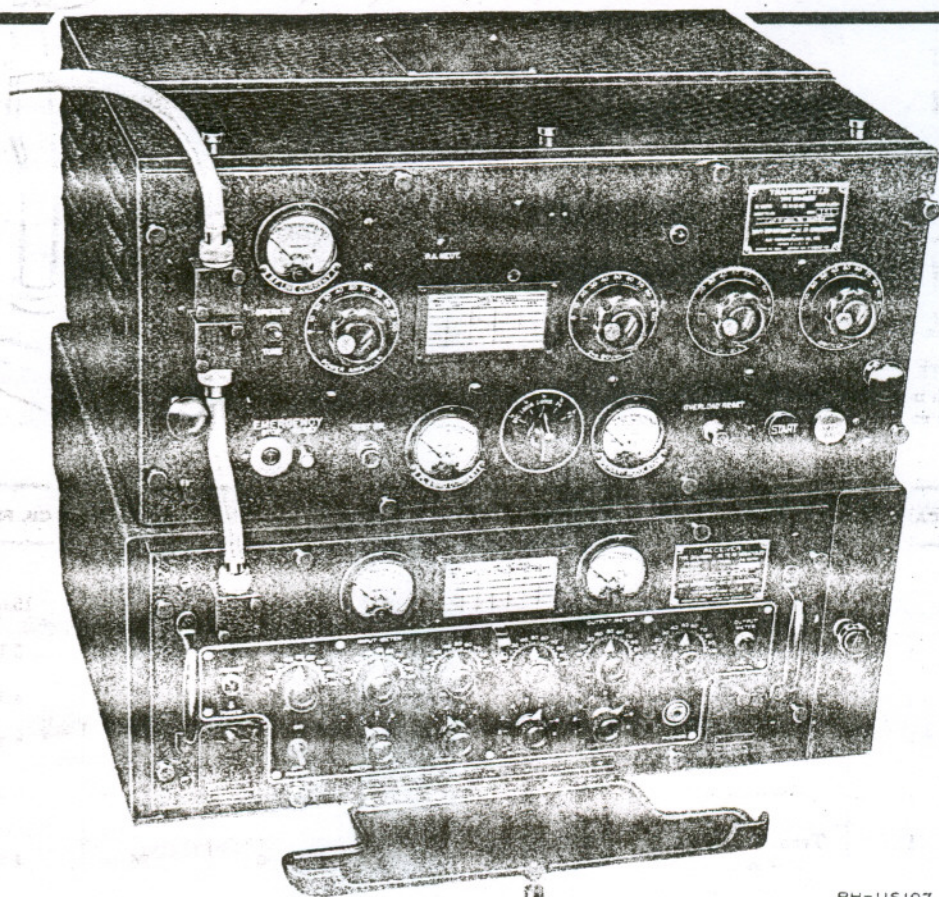
PH-US197

All models of the TBS Series of radio communication equipment employ the transmitter and receiver assembly shown above. Though it is possible to operate these units when mounted apart, the most satisfactory arrangement is that shown. To permit this compact assembly a support stand is provided with the equipment, which encloses the receiver as shown. This stand is of heavy metal with a black crackle finish and provides at the right of the receiver a small closed compartment for the stowage of charts, log books or other operating records. The receiver is shock mounted in this stand and the chassis may be withdrawn

without detaching the receiver cabinet from the stand.

The transmitter is rigidly attached to the top of the support stand and matches it in finish. All connections to the apparatus are made at a terminal board mounted in the rear of the support stand behind the receiver. Leads connect this main terminal board to the connector strip in the rear of the transmitter housing. The receiver requires but two pair of wires, for connection to the terminal strip, the power supply and the audio output leads.

RADIO TRANSMITTER AND RECEIVER UNIT FOR TBS SERIES



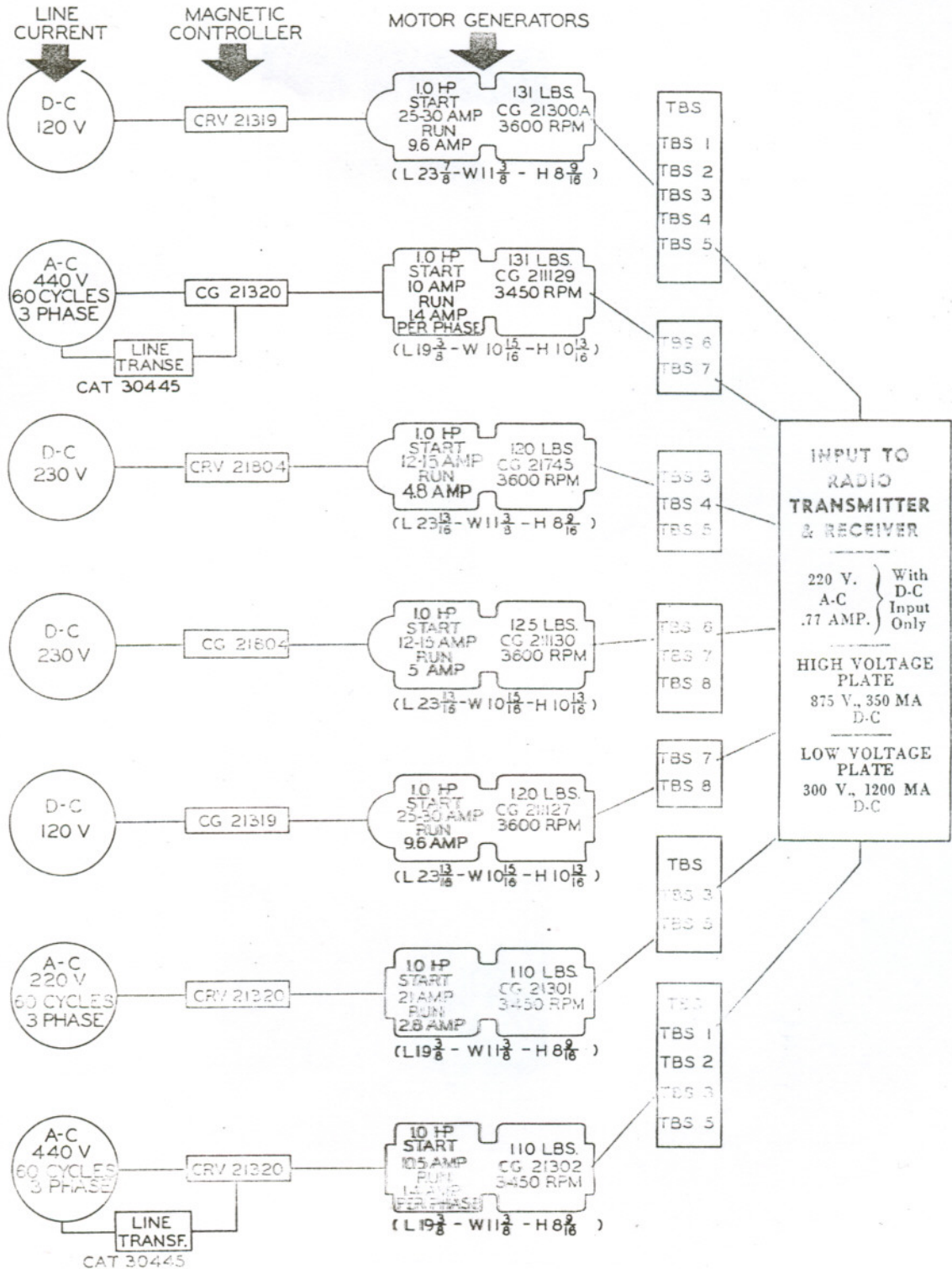
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POWER SUPPLY UNITS



NAVY TYPE NUMBERS OF EQUIPMENT FURNISHED WITH TBS SERIES

UNIT	TBS	TBS-1 & TBS-2	TBS-3	TBS-4
Radio Transmitter	CRV-52093	CRV-52093	CRV-52093	CG-52093
Radio Receiver	CRV-46068	CRV-46068	CRV-46068	CG-46068
Motor Generator 120 V. D-C	CG-21300	CG-21300A	CG-21300A	CG-21300A
230 V. D-C			CG-21745	CG-21745
220 V. A-C	CG-21301		CG-21301	CG-21301
440 V. A-C	CG-21302	CG-21302	CG-21302	
Magnetic Controller 120 V. D-C	CRV-21319	CRV-21319	CRV-21319	CG-21319
230 V. D-C			CRV-21804	CG-21804
220-440 V. A-C	CRV-21320	CRV-21320	CRV-21320	
Control Unit	CRV-23135	CRV-23135	CRV-23135	CG-23135
Loudspeaker	CRV-49101	CRV-49101	CRV-49155	CMX-49155
Handset	CRV-51019	CRV-51019	CRV-51019	CYH-51019
Chest Set	CRV-51018	CRV-51018	CRV-51018	CYH-51018
Antenna Surface Type	CRV-66015	CRV-66015	CRV-66015	CPD-66015
Submarine Type	CRV-66016	CRV-66016	CRV-66016	
Line Transformer	CAT-30445	CAT-30445	CAT-30445	
Crystals	*	*	*	*

* No Navy Type Nos. assigned crystals except for nameplate.

QUICK REFERENCE DATA ON TBS SERIES

MODEL	CONTRACT	DATE	CONTRACTOR	INSPECTOR
TBS	NOs-60613	May 16, 1938	RCA	A
TBS-1	NOs-70095	Dec. 18, 1939	RCA	A
TBS-2	NOs-70095 Sup.	Apr. 6, 1941	RCA	A
TBS-3	NOs-1736	Oct. 10, 1942	RCA	A
TBS-4	NXss-18747	Dec. 2, 1942	GE	B

RCA—RCA Victor Division of Radio Corporation of America, Camden, N. J. A —Resident Inspector of Navy Material, RCA, Camden, N. J.
 GE —General Electric Co., Schenectady, N. Y. B —Resident Inspector of Navy Material, GE, Schenectady, N. Y.

NAVY TYPE NUMBERS OF EQUIPMENT FURNISHED WITH TBS SERIES

UNIT	TBS-5	TBS-6	TBS-7	TBS-8
Radio Transmitter	CRV-52093	CRV-52093	CG-52093	CRV-52093A
Radio Receiver	CRV-46068A	CRV-46068A	CG-46068A	CRV-46068B
Motor Generator 120 V. D-C	CG-21300A		CG-211127	CG-211127
230 V. D-C	CG-21745	CG-211130	CG-211130	CG-211130
440 V. A-C	CG-21302	CG-211129	CG-211129	
Magnetic Controller 120 V. D-C	CRV-21319		CG-21319	CRV-21319
230 V. D-C	CRV-21804	CRV-21804	CG-21804	CRV-21804
440 V. A-C	CRV-21320	CRV-21320	CG-21320	
Control Unit	CRV-23135	CRV-23135	CG-23135	CRV-23135
Loudspeaker	CRV-49155	CMX-49155	CMX-49155	CMX-49155
Handset	CRV-51019	CRV-51019	CYH-51019	CRV-51019A
Chest Set	CRV-51018	CRV-51018	CYH-51018	CRV-51018A
Antenna Destroyer	CRV-66015	CRV-66015	CPD-66015	CRV-66015
Line Transformer	CAT-30445	CAT-30445	CAT-30445	
Crystal	CRV-40062	CRV-40062B	*	CRV-40068B

QUICK REFERENCE DATA ON TBS SERIES

MODEL	CONTRACT	DATE	CONTRACTOR	INSPECTOR
TBS-5	NXss-17599	Aug. 1943	RCA	A
TBS-6	NXsr-36725	Aug. 25, 1943	RCA	A
TBS-7	NXsr-38310	June 1944	GE	B
TBS-8	NXsr-51552	Mar. 11, 1944	RCA	A
RCA—RCA Victor Division of Radio Corporation of America, Camden, N. J.		A —Resident Inspector of Navy Material, RCA, Camden, N. J.		
GE —General Electric Co., Schenectady, N. Y.		B —Resident Inspector of Navy Material, GE, Schenectady, N. Y.		

ACCESSORIES AND SPARES

- 1—Junction Box.
- 1—Line Transformer (440 volt to 220 volt) with 440 volt a-c Installations.
- 1—Support Stand for mounting radio transmitter and receiver.
- 2—Stowage Hooks for handset.
- 1—Transmission Line Kit. This includes gas flask with tank fitting, 0-2000 gauge, micrometer

valve and flexible hose. Fitting with gauge for refilling flask from Navy gas cylinders.

Spare tubes for transmitter as ordered.

Spare tubes for receiver as ordered.

- 1—Box of Spare Parts for radio transmitter, control units, magnetic controller and radio receiver.

- 1—Box of Spare Parts for power supply unit.

TUBE COMPLEMENT

TRANSMITTER

TUBE	QUANTITY	TYPE No.
Modulation Limiter	1	-84
R-F Oscillator	1	-807
1st Doubler	1	-807
2nd Doubler	1	-808
Power Amplifier	1	-808
Modulator	2	-808
A-F Driver	2	-2A3
A-F Oscillator	1	-6A6
Speech Amplifier	2	-6D6

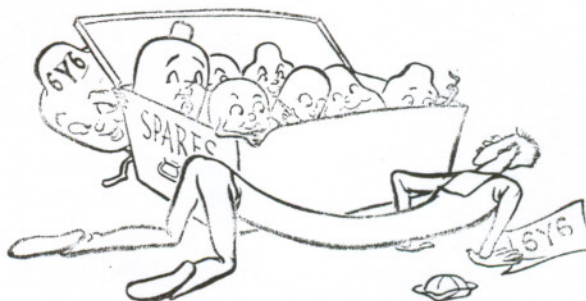
RECEIVER

TUBE	QUANTITY	TYPE No.
R-F Amplifier	1	-956
First Detector	1	-6C6
I-F Amplifier	3	-6D6
Second Detector and Noise Suppressor	1	-75
Automatic Volume Control	1	-6F7
Oscillator and First Doubler	1	-6F8-C
Second Doubler	1	-6J5
TBS-5, TBS-6, and TBS-8 may use	-6J5-G or -6J5-GT	
Output Amplifier	1	-6Y6-G
Rectifier	1	-5Z3
First A-F Amplifier	1	-6C6

EXTRA EQUIPMENT

The following equipment is necessary to make the installation operative but is not furnished.

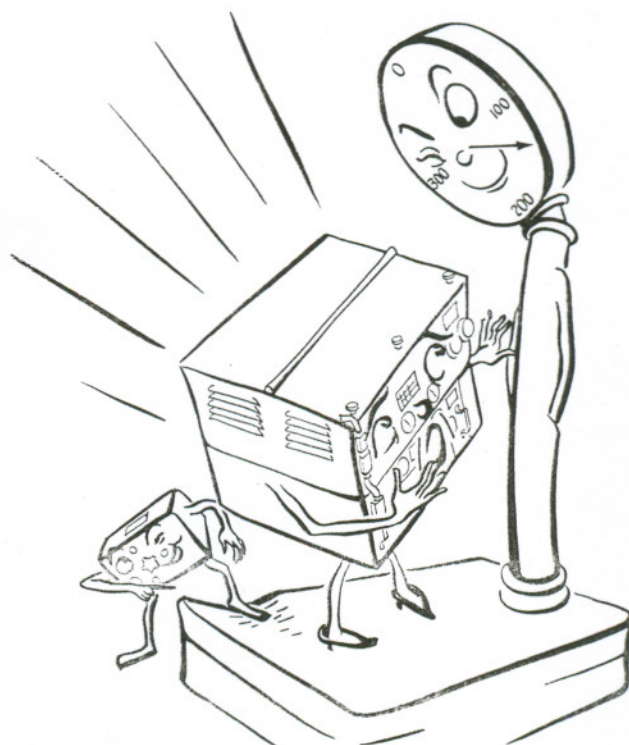
QUANTITY	ITEM
2	Cable for connection between transmitter and control units. (Navy Type MHFA-14.)
1	Cable for connection between transmitter and magnetic controller. (Navy Type MHFA.)
1	Cable for connection between magnetic controller and power supply unit.
1	Set of wiring to line transformer when used. (Navy Type MCS2.)
1	Cable to Loudspeaker. (Navy Type TTHFA-1.)



The following items are necessary or desirable depending upon operating requirements.

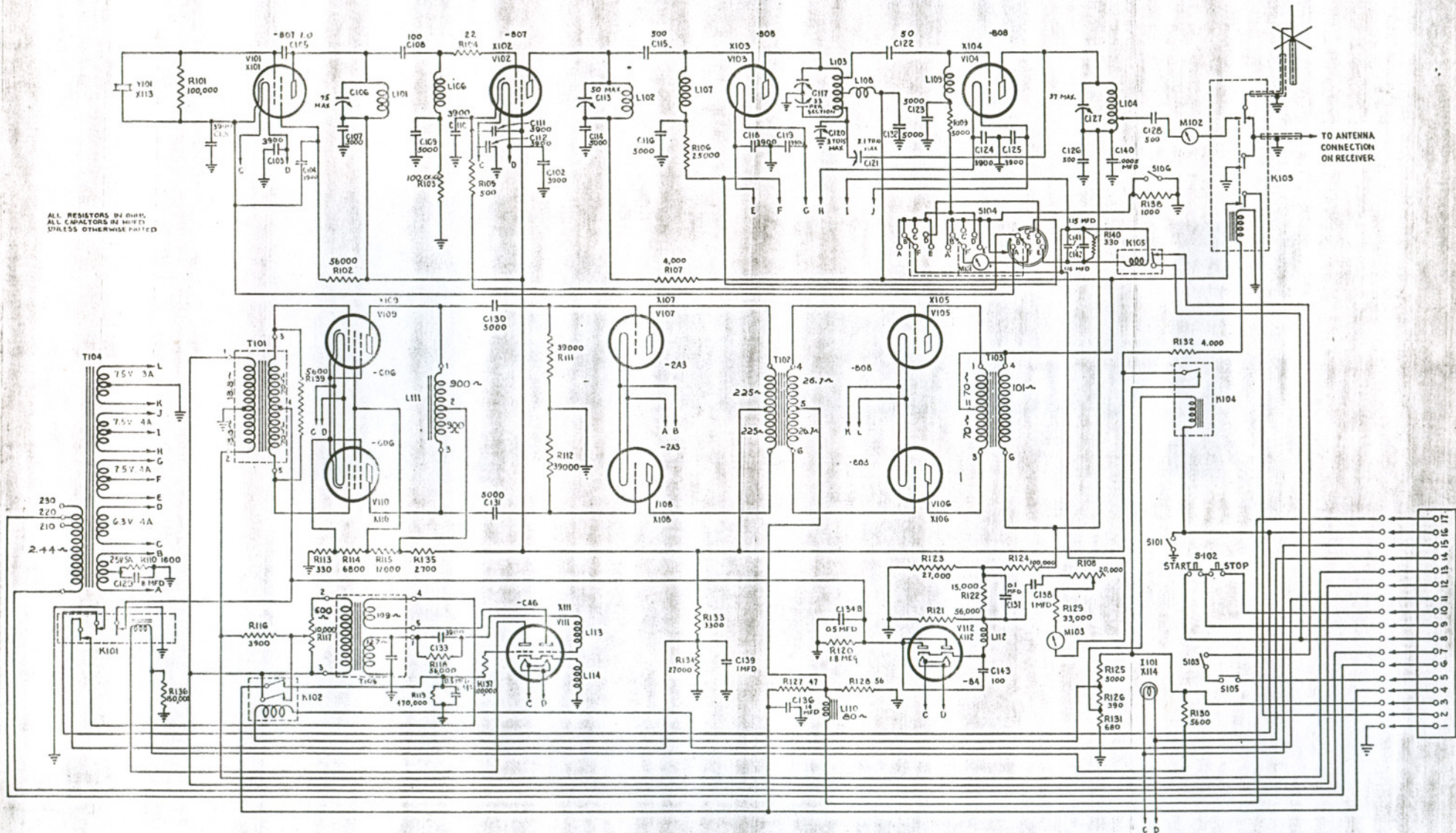
- 1 Telegraph key and flexible leads. (MHFA-2.)
- 1 Telephone headset (600 ohms).

**DATA ON
TYPICAL
SHIPMENT
OF TBS
EQUIPMENT**



NOTE: Dimensions and weights may vary slightly with mode of packing, type of Power Unit supplied and extra equipment specified.

CASES		DIMENSIONS	NET (LBS.)	GROSS	CU. FT.
1	Transmitter, Receiver and stand	33 x 27 x 30	186	300	15.6
1	Motor Generator	24 x 13 x 12	153	190	3.1
1	Accessories	34½ x 18 x 13	50	82	4.6
2	Tubes	34 x 13½ x 12	8	57	3.9
1	Antenna	67 x 27 x 9	46	120	6.6
1	Transmission Line and Kit	43 x 37 x 7	29	86	4.4
1	Equipment Spares	28 x 29½ x 18	152	212	7.2
1	M. G. Spares	23 x 13 x 12	68	93	2.7
9	TOTALS		692	1140	48.1



ALL RESISTORS IN OHMS,
ALL CAPACITORS IN MICROFARADS
UNLESS OTHERWISE NOTED

THEORY OF OPERATION

NAVSHIPS 900,590

SECTION 2

