NAVSHIPS 900,810

RESTRICTED

PRELIMINARY INSTRUCTION BOOK

for

RADIO TRANSMITTING EQUIPMENT
NAVY MODEL TCZ-2

★

COLLINS RADIO COMPANY
CEDAR RAPIDS, IOWA

NAVY DEPARTMENT

BUREAU OF SHIPS

Contract NXsr-95063

APPROVED ____________________

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RECORD OF CORRECTIONS MADE

CHANGE NO.	DATE	SIGNATURE OF OFFICER MAKING CORRECTIONS

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CONTRACTUAL GUARANTEE

The Contractor guarantees that at the time of delivery thereof the articles provided for under this contract will be free from any defects in material or workmanship and will conform to the requirements of this contract. Except as to vacuum tubes, batteries, rubber and material normally consumed in operation, the equipment, including all spare parts, is guaranteed for a period of one (1) year from the date of its delivery to and acceptance by the Government, with the understanding that all 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 shall not obligate the Contractor to repair or replace 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 unless the defect is hot the result of normal expected shelf life deterioration. This guarantee shall then continue as to corrected or replacing articles or, if only parts of such articles are corrected or replaced, to such corrected or replacing parts, until one year after the date of redelivery.

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

All defective items will be subject to ultimate return to the Contractor except that the exigencies of the naval service may necessitate expeditious repair of certain items in order to prevent extended interruption of communications and in such cases the return of the defective items for examination by the Contractor prior to repair or replacement shall 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.

If the Government does not require correction or replacement of a defective or nonconforming article, the Contractor, if required by the contracting officer within a reasonable time after the notice of defect or nonconformance, shall repay such portion of the contract price as is equitable in the circumstances. Equitable in the circumstances is to be determined by mutual agreement between the Contractor and the contracting officer. Failure to agree to such adjustment shall be a dispute concerning a question of fact within the meaning of the section of this contract entitled "Disputes".

INSTALLATION RECORD

Contract Number NXsr-95063 Date of Contract: 14 April 1945

Serial Number of Equipment ______________________

Date of Acceptance by the Navy ______________________

Date of Delivery to Contract Destination ______________________

Date of Completion of Installation ______________________

Date Placed in Service ______________________

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

REPORT OF FAILURE

Report of failure of any part of this equipment, during its service life, shall be made to the Bureau of Ships in accordance with current instructions. The report shall cover all details of the failure and give the date of installation of the equipment. For procedure in reporting failures see Chapter 67 of the "Bureau of Ships Manual," or superseding instructions.

ORDERING PARTS

All requests or requisitions for replacement material should include the following data:

1. Navy stock number or, when ordering from an Army Supply depot, the Army stock number.

2. Name of part.

If the Navy stock number has not been assigned, the requisitions should specify the following:

1. Equipment model designation.

2. Name of part and complete description.

3. Manufacturer's designation.

4. Contractor's drawing and part number.

5. AWS, JAN, or Navy type designation

WARNING

The attention of officers and operating personnel is directed to CHAPTER 67 of BUREAU of SHIPS MANUAL or superseding instructions on the subject of "RADIO-SAFETY PRECAUTIONS TO BE OBSERVED."

While every practicable safety precaution has been incorporated in this equipment, the following rules must be strictly observed:

KEEP AWAY FROM LIVE CIRCUITS

Operating personnel must at all times observe all safety regulations. Do not change tubes or make adjustments inside equipment with high voltage supply on. Under certain conditions 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 and discharge and ground circuits prior to touching them.

DON'T 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.

DON'T TAMPER WITH INTERLOCKS

Do not depend upon door switches or interlocks for protection but always shut down motor generators or other power equipment. Under no circumstances should any access gate, door or safety interlock switch be removed, short circuited, or tampered with in any way, by other than authorized maintenance personnel, nor should reliance be placed upon the interlock switches for removing voltages from the equipment.

RESUSCITATION

AN APPROVED POSTER ILLUSTRATING THE RULES FOR RESUSCITATION BY THE PRONE PRESSURE METHOD SHALL BE PROMINENTLY DISPLAYED IN EACH RADIO, RADAR OR SONAR ENCLOSURE. POSTERS MAY BE OBTAINED UPON REQUEST TO THE BUREAU OF MEDICINE AND SURGERY.

SECTION I

GENERAL DESCRIPTION

1. EQUIPMENT.

The Model TCZ-2 Radio Transmitting Equipment covered by this Instruction Book consists of a Transmitter, an Antenna Load Coil Unit, a Remote Control Unit, an Antenna Shunt Capacitor, a Power Supply Unit and the necessary Interconnecting Cables.

2. DESCRIPTIVE DATA.

a. Nomenclature: Navy Model TCZ-2 Radio Transmitting Equipment.

b. Contract Number: NXsr-95063 Dated 14 April, 1945.

c. Contractor: Collins Radio Company, Cedar Rapids, Iowa.

d. Frequency Range 200 to 1500 kc and 2000 to 18,100 kc.

e. Frequency Control: Master oscillator continuously variable.

f. Emission: Voice, CW, MCW.

Modulation Capability: At least 90%.

g. Nominal Carrier Output for each type of Emission: Varies with frequency. See Output Table, Paragraph 1-4e.

Ø h. Characteristics of power supply required for operation.

(1) 115 volts DC

(2) Current:

(a) Starting:

(b) Stand-by:

(c) Normal Operation:

(d) Maximum:

i. Number of packages involved per complete shipment of equipments: 6.

Ø Inclusion of this sign indicates information not available for Preliminary Instruction Books. This information will be included in the Final Instruction Book.

Ø i. Total cubical contents packed for shipment:

Ø k. Total weight packed for shipment:

l. Crystal complement: One Type CR-2-B/U (200 kc).

m. Vacuum tube complement:

QUANTITY	TYPE NUMBER
2	6V6GT
2	811
1	813
1	837
1	12SJ7
2	12SL7GT
1	12SA7/GT
3	1625

3. GENERAL.

The Model TCZ-2 Series Radio Transmitting Equipment has been designed for installation aboard ship. Particular care has been taken in the design to insure mechanical construction that will withstand the vibration and shock incident to normal service. All materials used in the construction of the equipment are, insofar as practicable, resistant to corrosion resulting from the chemical action of a moist saline atmosphere.

A standard Navy Type-52286-A Transmitter is mounted on top of the Navy Type Col-211624 Dynamotor Assembly Power Unit. The Navy Type COL-47505 Antenna Lead Coil is a separate unit designed to extend the frequency range of the transmitter to include the frequencies from 200 to 1500 kc. The Navy Type COL-23410 Remote Control Box is furnished to facilitate operation of the Model TCZ-2 equipment from a convenient operating position. A shunt capacitor, Navy Type COL-481628, is furnished to assist in loading the transmitter in the 2000 kc region while using a short antenna.

Sub-assembly type of construction has been used extensively in the Type -52286-A Transmitter. This type of construction facilitates the removal of component parts without major disassembly of the unit. The MCW-CFI, the Audio Amplifier, and the LF Oscillator Units are connected by multi-terminal plugs to facilitate removal for servicing. An effort has been made to make all components that may require replacement easily accessible.

The Collins Autotune System has been incorporated in the Model TCZ-2 Series Equipment to permit rapid frequency change. The Autotune system is an electrically controlled means of mechanically repositioning adjustable elements such as switches, variable inductors and variable capacitors. The accuracy of repositioning is of a very high order and is not seriously affected by wear, humidity or temperature changes. No tools are necessary for the changing of the position of any of the controls. Eleven Autotune positions are available, permitting transmission on any one of eleven preset frequencies. Ten of the frequencies are in the frequency range 2000 kc to 18,100 kc, and one is in the frequency range 200 kc to 1500 kc.

Table 1-1 EQUIPMENT SUPPLIED

Name of Unit	Quant.	Numerical Series of Reference Symbols	Navy Type Designation	Collins Part Number	Overall Dimensions (Inches) Crated	Overall Dimensions (Inches) Uncrated	Volume (Cu. Ft.) Crated	Volume (Cu. Ft.) Uncrated	Weight (lbs.) Crated	Weight (lbs.) Uncrated
					HxWxD	HxWxD				
Radio Transmitter	1	101-199 201-299 401-499 2201-2299	-52286-A	17H-2		10-3/4 x 23-9/16x 13-1/4		2.5		66
Dynamotor Assembly Power Unit	1	1901-1999	COL-211624	413D-4		29-7/16 x 23-7/16 x 20-1/8		8.5		——
Remote Control Unit	1	901-999	COL-23410	314N-2		4-3/4 x 9-31/32 x 6-1/2		.175		8
200 kc Quartz Crystal	1	Y-2201	CR-2-B/U (200 kc)	——		——		——		——
Antenna Load Coil	1	3001-3099	COL-47505	180H-4		19-3/4 x 18-5/8 x 15-1/2		3.3		48
Antenna Shunt Capacitor	1	1101-1199	COL-481628	195D-1		3-7/8 x 5 x 4-1/8		.045		1.56
Control Cable (Power Unit to Transmitter)	1	1501-1599	——	65X-7		11-11/32 Long		——		——
Power Cable (Power Unit to Transmitter)	1	1601-1699	——	65X-8		11-9/16 Long		——		——
Power Cable (Transmitter to Load Coil)	1	1701-1799	——	65X-9		120 Long		——		——
Control Cable (Power Unit to Control Box)	1	2301-2399	——	65X-10		120 Long		——		——
Spare Parts	1 Set	——	——	——		——		——		——
Instruction Book	2	——	——	——		——		——		——

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Table 1-2 EQUIPMENT REQUIRED BUT NOT SUPPLIED

Quantity	Name of Unit	Navy Type Designations	Required Characteristics
1	Microphone		40 ohm carbon or 200 ohm Dynamic for RED coded circuit per Navy Specifications RE 8944A Cord: Three Conductor shielded Cord Plug: 3 circuit, Tip 3/16" Dia. 1-3/16" long
1	Telegraph Key		Any Type. Cord: 2 conductor Cord Plug: 2 circuit, Tip 3/16" Dia. 1-3/16" long.
1	Headphone		500 ohm impedance. Cord Plug: 2 circuit, Tip 1/4" Dia. and 1-5/32" long.

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Figure 1-2 Navy Type COL-52286-A Transmitter Unit

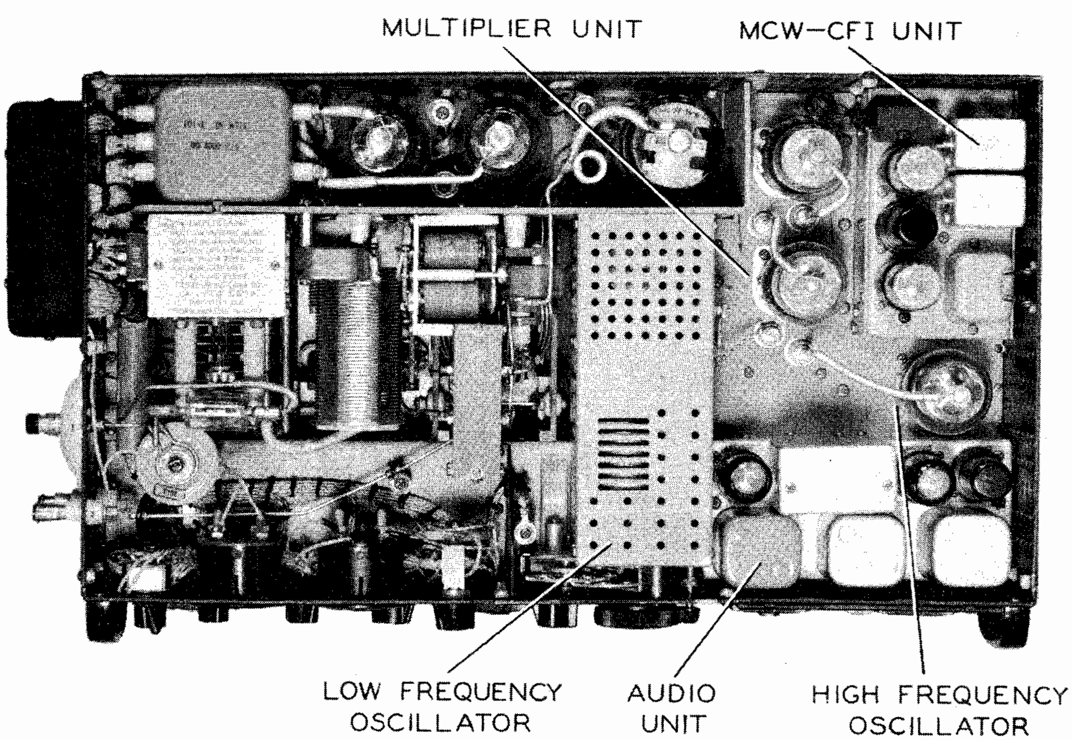


Figure 1-3 Navy Type COL-52286-A Transmitter Unit - Top Open View - Units in place

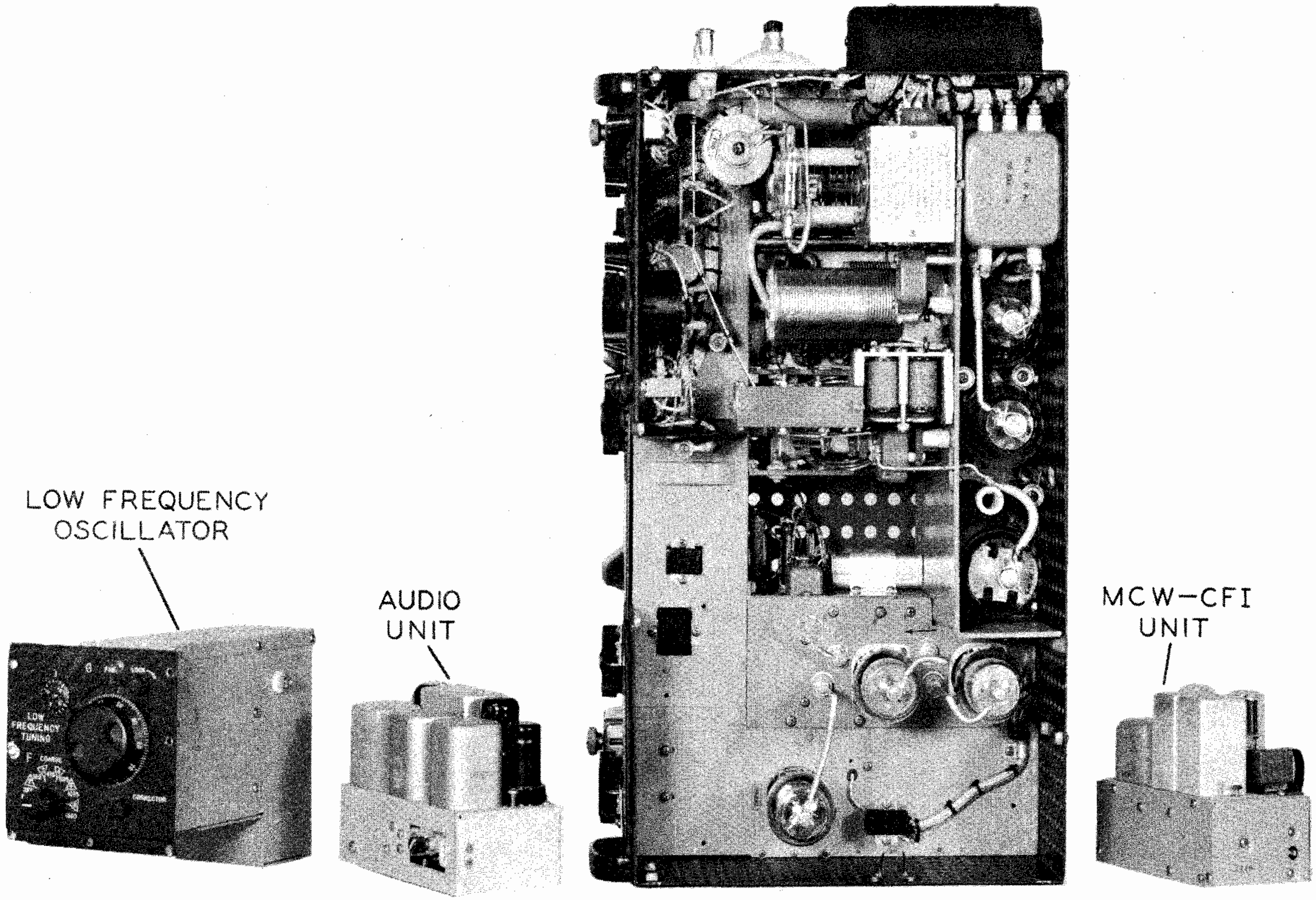


Figure 1-4 Navy Type COL-52286-A Transmitter Unit - Top Open View - Units Removed

4. TRANSMITTER

The transmitter employed by this TCZ-2 equipment is a standard Navy Type -52286-A Aircraft transmitter. This unit employs a slide-track shock-mount system of mounting which makes possible the removal of the transmitter from the top of the power supply in a few seconds time. Since the transmitter was designed primarily for aircraft use, the material used in the structural parts is of aluminum or other light materials. Plug-in type of construction is used where practicable for ease in servicing and replacing parts.

a. TYPES OF EMISSION. - CW, MCW and VOICE types of emission are available with the TCZ-2 equipment. The audio system is capable of modulating the carrier (100 watts nominal) at least 90%. Keying speeds up to 30 words per minute may be used when operating with CW and MCW emission without objectionable chirp or distortion of the length of the keyed characters.

b. AUDIO INPUT. - Either of two types of microphone may be used with this equipment. An input circuit has been incorporated in the equipment to permit the use of either a carbon or dynamic type of microphone. When the microphone switch, S201, is in DYNAMIC position, an audio input of 16 millivolts to the MICROPHONE jack, J102, is required for 90% modulation. When the microphone switch is in the CARBON position 1.45 volt audio input at J102 is required for 90% modulation. The audio frequency response is uniform within 3 db between 300 cps and 4000 cps. The audio frequency distortion is less than 15% rms at 1000 cps and with 90% modulation of the carrier (100 watts nominal).

c. FREQUENCY RANGE. - Two bands of transmission frequencies are available with the TCZ-2 equipment. Output may be obtained in the low frequency range of 200 kc to 1500 kc and in the high frequency range of 2000 kc to 18,100 kc.

When operating in the frequency range 200 kc to 1500 kc an external power amplifier plate tank and antenna loading circuit must be used. The necessary circuit is incorporated in the Navy Type COL-47505 Antenna Loading Coil Unit. Selecting low frequency output automatically makes the proper connections from the power amplifier plate to the external tank circuit.

The output circuits of the transmitter have been designed to match antennas from 25 feet to 35 feet in length in the frequency range 200 kc to 1500 kc and 20 feet to 35 feet in length in the range 2000 kc to 18,100 kc.

d. FREQUENCY CHANGE SYSTEM. - The Autotune frequency system employed in the TCZ-2 equipment is an electrically controlled mechanical system of positioning the transmitter tuning elements. The positioning elements are driven by a single motor. The system will operate to change the frequency of transmission in less than 25 seconds at normal room temperature and with normal operating voltage. A detailed description of both the mechanical and electrical portions of the Autotune is given in the THEORY OF OPERATION section of this Instruction Book.

Manual frequency change and tuning adjustments may be made without disturbing the Autotune stop ring adjustments if the CHANNEL selector switch is placed in the MANUAL position and the Autotune mechanism allowed to operate.

e. POWER OUTPUT. - The power delivered to the antenna varies with frequency and antenna characteristics.

The following table shows the power output obtainable within the two bands of frequencies, 200 kc to 1500 kc and 2000 kc to 18,100 kc, with normal supply voltage and antennas having the characteristics listed under Antenna Resistance and Antenna Reactance:

Table 1-3 POWER OUTPUT

Frequency Kilocycles	Antenna Reactance Ohms	Antenna Resistance Ohms	Power Output Watts	See Note
200	-j6800	71.5	19	(1)a.
300	-j4330	41.0	35	(1)a.
400	-J3250	40.5	47	(1)a.
575	-j2600	40.5	60	(1)a.
575	-j2750	28.0	18	(1)b.
700	-j2000	28.0	24	(1)b.
800	-j1750	28.0	28	(1)b.
1000	-j1350	28.0	40	(1)b.
1300	-j1030	28.0	44	(1)b.
1500	-j 900	28.0	36	(1)b.
2000	-j 450	2.1	31	(2)
3000	-j 200	3.1	60	(2)
4000	0	6.1	80	(2)
5500	+j 380	25.0	90	(2)
7000	0	3500.0	90	(2)
9000	-j 350	50.0	90	(2)
11500	0	50.0	90	(2)
13500	+j 350	100.0	90	(2)
15500	0	1500.0	75	(2)
18000	-j 350	200.0	65	(2)

NOTE

(1) Measurements were made using the Navy Type COL-47505 Antenna Loading Coil.

(a) Low frequency section.

(b) High frequency section.

(2) Measurements were made while operating into a fixed antenna without a loading coil.

f. CONTROL. - The emission of the transmitter may be controlled from the Type COL-52286-A Transmitter panel, the Type COL-23410 Remote Control Unit, or a standard Navy Radiophone Unit. The type of emission and the frequency channel may be selected from the transmitter panel or the remote control unit only.

The Type -52286-A Transmitter controls consist of a TEST switch, a LOCAL-REMOTE switch, a CHANNEL selector switch, a metered circuit selector switch, a power level switch, an EMISSION selector switch, LOW FREQUENCY oscillator TUNING, HIGH FREQUENCY oscillator TUNING, ANTENNA TUNING-COARSE, ANTENNA TUNING-FINE, and ANTENNA LOADING controls, KEY, MICROPHONE and Throttle Switch jacks for control of emission and two jacks, when properly connected, for SIDETONE monitoring.

gives 2.4. Adding 2.4 to 636, which is the dial setting for the next lower frequency, gives 638.4 as the dial setting for 9653 kilocycles.

9. TUNING INSTRUCTIONS FOR LOW FREQUENCY OPERATION (200-1500 kc).

a. Knobs "F" and "G" are coarse and fine frequency controls. Knob "A" MUST be set at 13. Knobs "B", "D", and "E" have no effect on low frequency tuning. They will rotate when automatically shifting to low frequency, but their final position is unimportant. Knob "C" should be set to number 8 since this position allows the least power to be dissipated in the high frequency output circuits. All antenna tuning controls are located on the external loading coil.

b. The following procedure is recommended for tuning the equipment on a desired low frequency:

(1) Set transmitter to desired frequency using Knobs "F" and "G". See instructions paragraph III-8b in this book, and calibration table 3-1.

(2) Place BATTERY-PA GRID-PA PLATE switch in PA PLATE position.

Place CALIBRATE-TUNE OPERATE switch in TUNE position.

Place EMISSION switch in CW position.

See that Knob "A" is in Position 13.

(3) Set the tap switches (Knobs "R" and "T" or "Q") on the loading coil to the desired frequency, using the rough frequency calibration by the knob as a guide.

(4) Press key. Rotate the fine tuning control (Knob "S" or "P" depending on the frequency), for minimum PA plate meter reading. If no sharp dip is found, move the tap switch on the loading coil one position and return the fine tuning control. If no dip is found, move the tap switch one position the other way and try again. Set and lock Knobs "S" or "P" at the position of minimum PA plate meter reading. Release key.

NOTE

The resonant point lowest in frequency must be found to prevent doubling of frequency in the output circuit.

(5) Place CALIBRATE-TUNE-OPERATE switch in OPERATE position. The transmitter is now ready for use.

NOTE

The correct tuning point is at minimum PA plate meter reading. The actual value of PA plate meter reading is of little importance, and will vary between 70 and 130 on the numbered scale, depending on frequency. DO NOT detune any of the knobs to make the meter read in the CW area on the scale. The transmitter is operated below maximum loading on some low frequencies.

(10) The low frequency oscillator is now set on the desired frequency. If it is desired to tune the output and antenna circuits of the transmitter into an antenna, proceed as described in paragraph III-9.

c. FOR FREQUENCIES BETWEEN 2000 AND 18,100 kc.

(1) Turn CHANNEL switch to desired channel.

(2) Turn EMISSION switch to VOICE.

(3) After motor stops, loosen locking bar on Knob "A". Set this knob to the position shown in the table for the desired frequency, approaching the setting clockwise through at least one eighth turn, and tighten the locking bar.

(4) Turn CALIBRATE-TUNE-OPERATE switch to CALIBRATE.

(5) Loosen locking bar in Knob "B". Turn Knob "B" to the dial setting of the nearest crystal check point, shown in heavy type in the group of frequencies in the table containing the desired frequency. Adjust Knob "B" accurately for zero beat in the headphones.

(6) Leave Knob "B" at zero beat and adjust the CORRECTOR which moves the indicating mark over "B" until the dial reading at the mark is correct for the check point.

(7) Turn CALIBRATE-TUNE-OPERATE switch to TUNE.

(8) Turn Knob "B" one eighth each side of the given dial setting and advance clockwise to the final position. Hold knob on setting and tighten locking bar.

(9) The high frequency oscillator is now set on desired frequency. If it is desired to tune the output and antenna circuits to an antenna, proceed as described in paragraph III-10.

d. SELECTION OF FREQUENCIES BETWEEN THOSE GIVEN IN THE CALIBRATION TABLES. - The calibration tables give dial settings at 2 kc intervals from 200 to 500 kilocycles: 5 kc intervals from 500 to 8000 kilocycles; and 10 kc intervals from 8000 to 18,100 kilocycles. The transmitter can also be set to frequencies between those given in the table by the following simple method:

(1) Find the difference between the desired frequency and the next lower frequency given in the table.

(2) Multiply this difference by the number given in parenthesis at the right of the column of figures containing the next lower frequency.

(3) Add the product thus obtained to the dial setting given in the table for the next lower frequency. The result is the dial setting for the desired frequency.

(4) Example: It is desired to work on 9653 kilocycles. The next lower frequency given in the table is 9650, and the difference is 3. The number in parenthesis at the right of the column is 0.8. Multiplying 3 by 0.8

(3) The SPEAKER-PHONES switch is an SPDT switch employed to switch the receiver audio from the speaker to the head phones jack.

(4) The VOLUME CONTROL knob operates a bridged T pad control placed in the receiver audio leads to control receiver volume.

8. ADJUSTMENT OF TRANSMITTER ON DESIRED FREQUENCY USING INTERNAL CRYSTAL FREQUENCY CALIBRATOR (CFI).

a. GENERAL. - Place the equipment in operation using instructions in paragraph III—2 LOCAL OPERATION - 6 WIRE, or paragraph III-3 LOCAL OPERATION - 4 WIRE.

(1) Plug a pair of headphones into the No. 1 sidetone jack on the transmitter. Sidetone No. 2 cannot be used unless proper external connections have been made through remote jack J-106 or terminal board J-1903.

(2) Turn LOCAL-REMOTE switch to LOCAL.

(3) Find desired frequency in calibration table, Table 3-1 or 3-2.

(4) The main frequency controls ("B" for the high frequency range and "G" for the low frequency range) each rotate 20 turns to cover a tuning range. The dial reading given in the table is the number of turns indicated on the small turn counter followed by the dial setting of the large knob. Thus, the dial reading shown in Figure 3-3 is 1447.

b. FOR FREQUENCIES BETWEEN 200 AND 1500 kc.

(1) Turn CHANNEL switch to L. FREQ.

(2) Turn EMISSION switch to VOICE.

(3) After motor stops, see that Knob "A" is at Position 13. If not, loosen locking bar, rotate Knob "A" to 13, approaching the setting clockwise through at least one eighth turn, and tighten locking bar.

(4) Set switch F to the position given in the table for the desired frequency.

(5) Turn CALIBRATE-TUNE-OPERATE switch to CALIBRATE.

(6) Loosen dial lock and turn Knob "G" to the dial setting of the nearest crystal check point, shown in heavy type in the group of frequencies containing the desired frequency. Adjust Knob "G" accurately for zero beat in the headphones.

(7) Leave Knob "G" at zero beat and adjust the CORRECTOR which moves the indicating mark until the dial reading at the mark is correct for the check point.

(8) Turn CALIBRATE-TUNE-OPERATE switch to TUNE.

(9) Turn Knob "G" to the dial setting given in the table for the desired frequency. Tighten dial lock.

(10) The BATTERY - PA GRID - PA PLATE switch transfers the right-hand ·ter to the circuits named. For tuning and normal operation, leave this switch in the PA PLATE position.

(11) The CALIBRATE-TUNE-OPERATE switch turns on the calibrating oscillator and disables the power amplifier in the CALIBRATE position. In TUNE position the equipment is operative at reduced power to prevent damage to the PA tube during preliminary tuning. In OPERATE position the equipment operates at full power. This switch will normally be left in the OPERATE position except during tuning.

(12) The EMISSION switch controls type of emission.

(13) A test key in the upper left-hand corner of the front panel can be used to operate the keying relay for tuning, etc.

(14) The CARBON-DYNAMIC microphone switch and the sidetone output control are located behind the calibration chart, and are accessible by releasing the snap-slides on the chart and swinging it outward and upward. (Refer to Figure 3-2) The sidetone OUTPUT control varies the sidetone output from one-half to 18 volts in 6 steps. Minimum output is at Position 1, and maximum output at Position 6.

c. ANTENNA LOADING COIL UNIT. - When the CHANNEL selector switch, S-108, is rotated to the LF position controls A, B, C, D and E are ignored and controls G and F are used on the transmitter unit panel. Tuning of the power amplifier and antenna is transferred to the following controls on the antenna loading coil unit.

(1) Knob "R" is the frequency range selector switch. In the counter-clockwise position, tuning is possible in the 200-575 kc band, if knob "R" is turned to the clockwise position, tuning is possible in the 575-1500 kc band.

(2) Knob "T" is the COARSE tuning control in the 200-575 kc range.

(3) Knob "S" controls a variometer used for FINE tuning in the 200-575 kc range.

(4) Knob "Q" controls a tap switch and is employed in the 575-1500 kc range for COARSE tuning.

(5) Knob "P", used for FINE tuning in the 575-1500 kc range, controls a variometer.

d. NAVY TYPE COL-23410 REMOTE CONTROL UNIT. - Control of emission selection, channel selection and of the carrier is transferred to the Remote Control Unit when transmitter unit LOCAL-REMOTE switch S-107 is placed in the REMOTE position.

(1) The TRANSMITTER knob controls a tap switch which selects the type of emission desired (MCW, CW, or VOICE).

(2) The CHANNEL knob also controls a tap switch. All eleven transmitting channels can be selected by this knob.

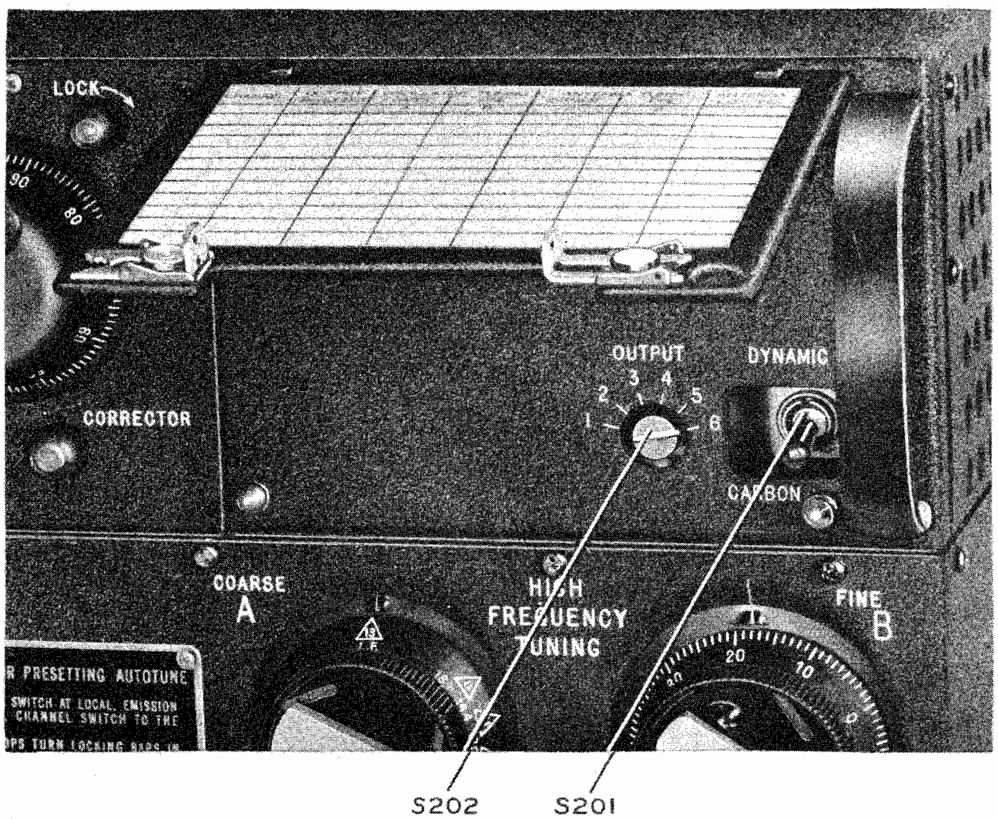


Figure 3-2 Microphone Switch and Sidetone Amp. Gain Control

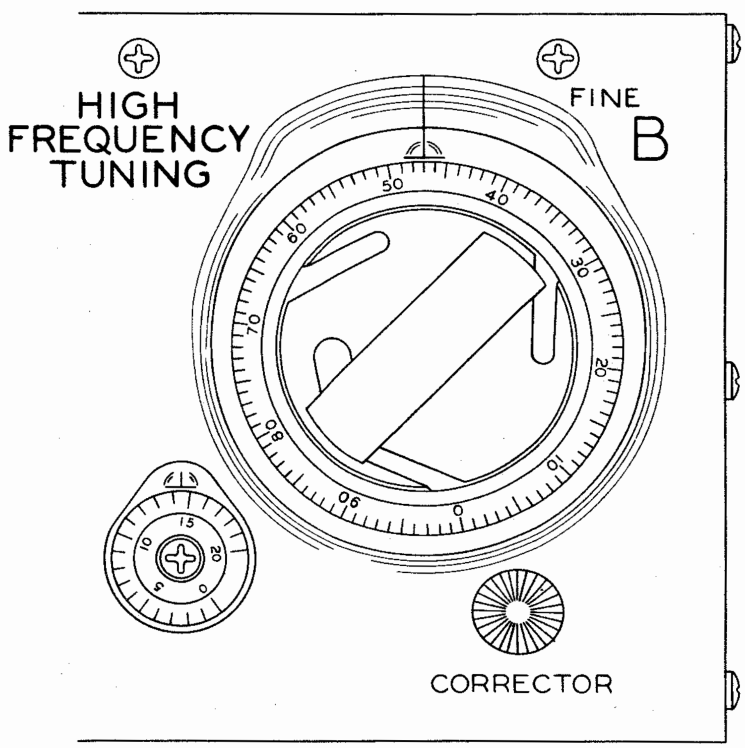


Figure 3-3 High Frequency Tuning Control

the keying relay to reduce arcs as the arm on the tap switch moves between points. It is necessary to set this knob accurately to position to permit the relay to operate.

(4) Knob "D" controls fine tuning of the inductive portion of the antenna tuning network. Its scale is graduated 0-100 with maximum inductance occurring at 0 and minimum inductance at 100.

(5) Knob "E" controls the capacitive portion of the antenna tuning network. This knob has two scales, graduated 0-100 and 100-200.

Scale on Knob "E"	Capacity	Maximum Capacity at	Minimum Capacity at
100-200	Variable capacitor alone.	100	200
0-100	Variable capacitor plus fixed section to extend range.	0	100

WARNING

Do not leave Knob "E" set in the blank space between scales or move the Knob between the blank spaces between the two scales with the key closed as an internal switch may become damaged.

(6) Knob "F" is the coarse frequency control for the low frequency oscillator. Its six positions are marked directly in frequency coverage.

(7) Knob "G" is the fine frequency control for the low frequency oscillator. It rotates 20 turns to cover each range. The dial reading is the reading of the small turn counter, followed by the reading of the large knob. For example, if the turn counter is between 8 and 9, and the large knob is at 32, the dial reading for "G" is 832.

NOTE

It is necessary for Knob "A" to be set at 13 for low frequency operation.

(8) The transmitter unit LOCAL-REMOTE switch transfers control of frequency and emission to the panel switches in LOCAL, or to the NAVY Type Col-23410 Remote Control Unit in REMOTE position.

(9) The CHANNEL switch permits selection of the 10 high frequency and 1 low frequency preset channels. In addition, a position marked MANUAL is provided whereby if the AUTOTUNE system is allowed to operate, the knobs can be rotated freely without disturbing preset positions.

CAUTION

See that locking bars in Knobs "A", "B", "C", "D" and "E" are tight before changing channels.

NOTE

It is possible to control the power from the panel when the power unit LOCAL-REMOTE switch is in the REMOTE position but impossible to control the power from the Navy control circuits when the power unit LOCAL-REMOTE switch is in the LOCAL position.

(6) The 4 WIRE-6 WIRE selector switch located behind the bottom front panel on the right hand side of the cabinet is a toggle switch employed to arrange the power unit control circuits for either NAVY 4 WIRE control circuits or NAVY 6 WIRE control circuits.

WARNING

The terminal board at the bottom of the Power Unit carries in excess of 1100 v DC. Do not remove any front panels without first opening the main power line switch and placing the EMERGENCY switch in the OFF position.

b. TRANSMITTER UNIT. - The high frequency control knobs are marked "A", "B", "C", "D", and "E", and are located along the lower part of the front panel. These controls are preset for one channel by loosening locking bar in center of knob, rotating control either direction to desired setting, (but approaching final setting clockwise), then tightening the locking bar. The CHANNEL switch can then be turned to another channel, and after motor stops, all controls can be preset on another frequency, etc.

The Autotune controls are set up most satisfactorily by turning the dials approximately one eighth turn each side of the chosen dial setting and advancing clockwise to the final position.

CAUTION

Always tighten locking bars before changing channels. Failure to do so will result in loss of dial settings.

(1) Knob "A" is the coarse control of the high frequency oscillator. There are 12 high frequency positions, each marked with its frequency coverage in megacycles. Knob "A" also serves in Position 13 as a transfer switch to disconnect the high frequency oscillator and to connect the low frequency oscillator.

(2) Knob "B" is the fine tuning control for high frequency operation. It consists of a main tuning knob, calibrated 0-100 which rotates 20 turns for each tuning range, and a small counter dial which counts turns of the large knob. The dial reading is the reading of the counter dial followed by the reading of the large knob. For example, if the counter dial is between 16 and 17, and the large knob is at 43, the dial would be read as 1643.

(3) Knob "C" is a coarse antenna tuning control, operating a tap switch. This tap switch changes inductance and capacity in various combinations for different frequencies, and to tune different antennas. In general, the dial settings increase with frequency. An interlock on this switch opens

b. TO STOP THE EQUIPMENT.

(1) Remove the carrier from the air (release the telegraph key or Push-to-Talk button.)

(2) Operate the NAVY 4 WIRE CONTROL switch to the OFF position.

(3) The equipment can also be stopped by operating the 4 WIRE POWER switch on the front panel of the power unit to the OFF position.

6. REMOTE CONTROL - NAVY TYPE COL-23410 REMOTE CONTROL UNIT.

Emission selection, Channel selection and Carrier control is possible from the NAVY TYPE COL-23410 Remote Control Unit. However, the power unit must be placed in operation from the front panel or by the use of either the NAVY 4 WIRE or 6 WIRE control circuits. If the NAVY CONTROL circuits are not used, place transmitter unit LOCAL-REMOTE switch S-107 on the transmitter unit panel in the REMOTE position and use the instructions in paragraph III-2 or III-3 to set the equipment in operation, after which the emission can be controlled by Emission selection switch S-903, the channel selection can be made by CHANNEL selector switch S-902 and the carrier controlled by a telegraph key plugged into KEY jack J-904 or by a Push-to-Talk button on a microphone plugged into MIKE jack J-903.

If the Remote Control Unit is used with NAVY CONTROL circuits, the equipment should be started and adjusted using instructions in paragraph III-4 for NAVY 6 WIRE circuits or paragraph III-5 for NAVY 4 WIRE circuits after which emission selection, channel selection, and carrier control can be had as described above. In this instance, however, it is best that the carrier be controlled by the NAVY CONTROL keying circuits since the receiver interlock relay is inoperative when carrier control is attempted from the front panel or the Remote Control Unit when the power unit LOCAL-REMOTE switch is in the REMOTE position.

7. FUNCTION OF CONTROLS.

a. POWER UNIT.

(1) The ON push button is used to apply primary power to the low voltage dynamotor when 6-WIRE control is employed.

(2) The OFF push button, when pressed, completely stops the equipment by removing all primary power from the power components in 6 WIRE operation.

(3) The 4 WIRE POWER switch is a toggle switch connected to apply primary power to the low voltage dynamotor when the 4 WIRE-6 WIRE switch is in the 4 WIRE position. Opening the 4 WIRE POWER removes all power from the power components.

(4) The EMERGENCY switch is a DPST switch connected in the power line which will, when opened, remove primary power from all components except line fuses.

(5) The power unit LOCAL-REMOTE switch is a multi-contact key switch which is employed to transfer the power control circuits and carrier control circuits from the equipment panel to NAVY 4 WIRE or 6 WIRE circuits.

a. TO START THE EQUIPMENT.

(1) Place the power unit LOCAL-REMOTE switch in the REMOTE position.

(2) Place the transmitter unit LOCAL-REMOTE switch in the LOCAL position.

(3) Place the 4 WIRE-6 WIRE selector switch in the 6 WIRE position.

(4) Place the 4 WIRE POWER switch in the OFF position.

(5) Operate the EMERGENCY switch to the NORMAL position.

(6) Press the NAVY CONTROL ON push button. Allow 30 seconds for the tubes to heat.

(7) The carrier can now be controlled by telegraph key or Push-to-Talk button.

b. TO STOP THE EQUIPMENT.

(1) Open carrier control device (key, push button,etc.)

(2) Press NAVY CONTROL OFF button.

(3) The equipment may also be stopped by pressing OFF button on the front panel of the power unit.

5. REMOTE CONTROL - NAVY 4 WIRE. (Refer to Figure 3-1)

Power control and carrier control are the only operations possible with this type of control, therefore, the tuning adjustments and emission selection must have been made previous to the following steps. Follow instructions in paragraph III-3.

a. TO START THE EQUIPMENT.

(1) Place the power unit LOCAL-REMOTE switch in the REMOTE POSITION.

(2) Place the transmitter unit LOCAL-REMOTE switch in the LOCAL position.

(3) Place the 4 WIRE-6WIRE switch in the 4 WIRE position.

(4) Place the power unit 4 WIRE POWER switch in the ON position.

(5) Operate the EMERGENCY switch to the NORMAL position.

(6) Operate the NAVY 4 WIRE CONTROL switch to the ON position. Allow 30 seconds for the tubes to heat.

(7) The carrier can now be controlled by telegraph key or Push-to-Talk button.

d. TO STOP THE EQUIPMENT.

(1) Open carrier control device (Key, Push-to-Talk button,etc.)

(2) Press the OFF push button.

3. LOCAL OPERATION - 4 WIRE. (Refer to Figure 3-1)

CAUTION

Be certain that the 4 WIRE POWER switch is in the OFF position.

a. TO START THE EQUIPMENT.

(1) Place the power unit LOCAL-REMOTE switch in the LOCAL position.

(2) Place the 4 WIRE-6 WIRE selector switch in the 4 WIRE position.

(3) Operate the EMERGENCY switch to the NORMAL position.

(4) Operate the 4 WIRE POWER switch to the ON position. Allow 30 seconds for the tubes to heat.

(5) Proceed to tune and adjust the equipment as outlined in paragraphs III-8,a, (1) to III-10.

b. TO SELECT EMISSION.

(1) Open carrier control device (Key, Push-to-Talk button, etc.)

(2) Operate the EMISSION selector switch to the desired type of emission.

(3) Control carrier as desired.

c. TO SHIFT FREQUENCY.

(1) Open carrier control device (Key, Push-to-Talk button, etc.)

(2) Operate the channel selector switch to the desired frequency, allow the Autotune to operate.

(3) Control carrier as desired.

d. TO STOP THE EQUIPMENT.

(1) Open carrier control device (Key, push button,etc.)

(2) Operate the 4 WIRE POWER switch to OFF.

4. REMOTE CONTROL - NAVY 6 WIRE. (Refer to Figure 3-1)

Power control and carrier control are the only operations possible with this type of control, therefore, the tuning adjustments and emission selection must have been made previous to the following steps. Follow instructions in paragraph 2 of this section for tuning and emission selection.

SECTION III

OPERATION

1. EMERGENCY SHUT DOWN.

a. OPERATE EMERGENCY SWITCH TO OFF POSITION.

b. LOCATE LINE SWITCH TO RADIO EQUIPMENT AND OPERATE TO OPEN POSITION.

WARNING

THIS EQUIPMENT EMPLOYS VOLTAGES WHICH ARE DANGEROUS AND MAY BE FATAL IF CONTACTED BY OPERATING PERSONNEL. EXTREME CAUTION SHOULD BE EXERCISED WHEN WORKING WITH THE EQUIPMENT

2. LOCAL OPERATION - 6 WIRE. (Refer to Figure 3-1)

a. TO START THE EQUIPMENT.

(1) Place the power unit LOCAL-REMOTE switch in the LOCAL position.

(2) Place the 4 WIRE-6 WIRE selector switch in the 6 WIRE position.

(3) Place the 4 WIRE POWER switch in the Off position.

(4) Operate the EMERGENCY switch to the NORMAL position.

(5) Press the ON push button. Allow 30 seconds for the tubes to heat.

(6) Proceed to tune and adjust the equipment as outlined in paragraphs III-8, a, (1) to III-10.

b. TO SELECT EMISSION.

(1) Open carrier control device (Key, Push-to-Talk button, etc.)

(2) Operate the EMISSION selector switch to desired type of emission.

(3) Control Carrier as desired.

c. TO SHIFT FREQUENCY.

(1) Open carrier control device (Key, Push-to-Talk button, etc.)

(2) Operate the CHANNEL selector switch to desired frequency, allow autotune to operate.

(3) Control carrier as desired.

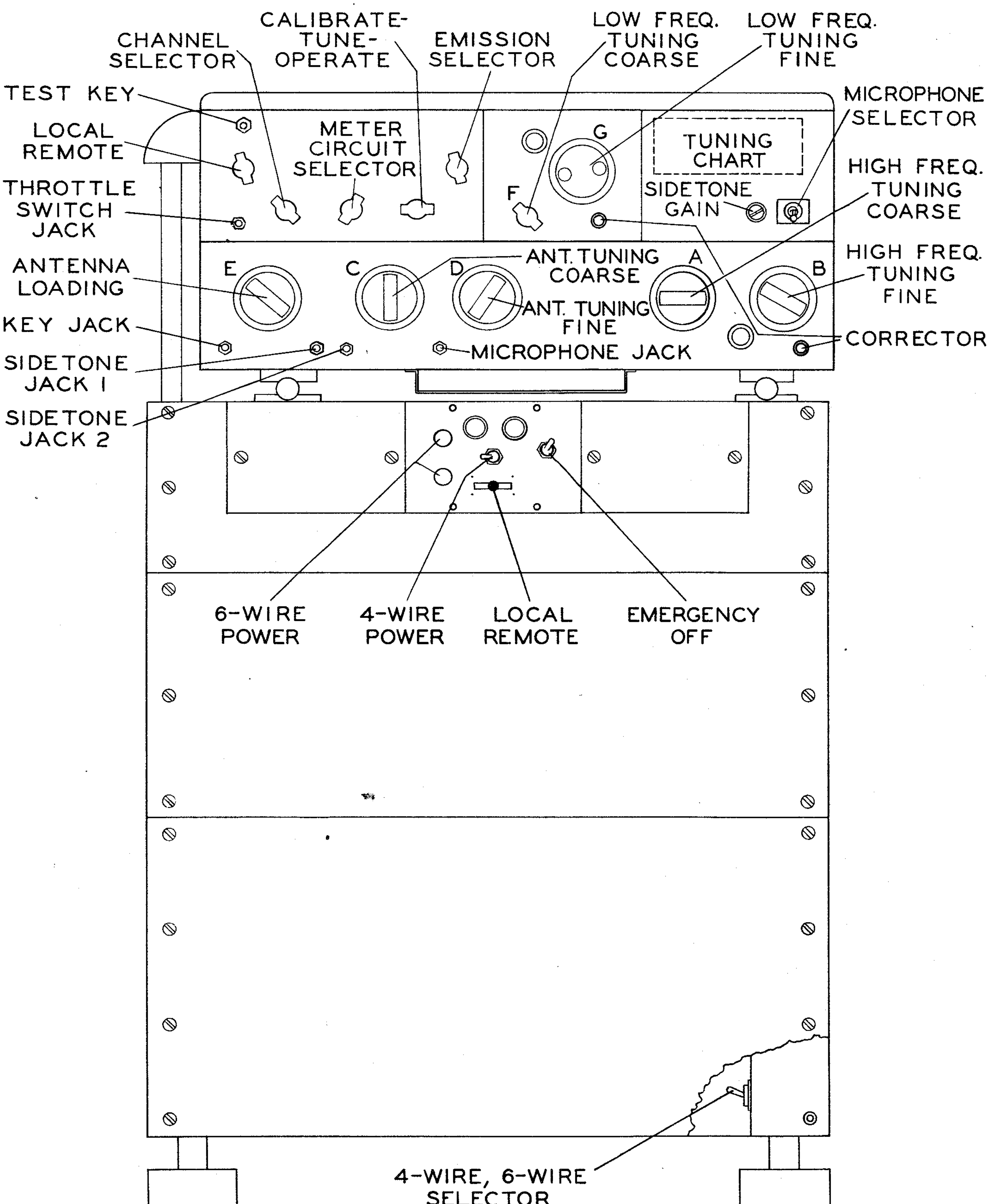


Figure 3-1 Navy Model TCZ-2 Operating Controls

After Control "A" has been set up, Control "B" and Controls "F" and "G", the oscillator tuning controls may be set to exact frequency with the aid of the CFI unit and calibration tables.

Next in order, Controls "C", "D", and "E" may be set up in the high frequency ranges, also Controls "P","Q,""R""S" and "T" on the Antenna Load Coil for the single low frequency position. It is suggested that Control "C" be set at position 8 when the transmitter is being used in the LF range as this position provides the least reaction of the HF network to operation within this range.

After all AUTOTUNE Elements have been set to the desired positions, the CHANNEL selector switch, S-108, may be switched to the various channels and accuracy of reset of AUTOTUNE Elements observed.

It is important that personnel engaged in pre-operation adjustments read the sections of this book on OPERATION and MAINTENANCE. Other checks may suggest themselves from these sections on both pre-installation and pre-operation performance.

(d) Example: It is desired to work on 9653 kilocycles. The next lower frequency given in the table is 9650, and the difference is 3. The number in parenthesis at the right of the column is 0.8. Multiplying 3 by 0.8 gives 2.4. Adding 2.4 to 636, which is the dial setting for the next lower frequency, gives 638.4 as the dial setting for 9653 kilocycles.

d. AUTOTUNE CHECKS.

(1) While checking the AUTOTUNE operation and setting, the EMISSION selector switch, S-110, should be placed in the VOICE position. With S-110 in the VOICE position, the AUTOTUNE system may be operated without starting the high voltage dynamotor. Placing S-110 in the VOICE position operates the voice relay, K-104.

(2) Make certain that the MICROPHONE, KEY and Throttle switch jack circuits are open.

(3) Rotate the CHANNEL selector switch, S-108, to Position 1.

NOTE

If the AUTOTUNE system begins to run, allow it to complete the cycle of operation before proceeding.

(4) Turn the locking bar on the AUTOTUNE Control one-quarter revolution in the counterclockwise direction or until the two red spots appear completely on the dial.

(5) Rotate the Control one eighth turn each side of the desired setting and approach the final setting in a clockwise direction.

NOTE

To prevent displacement of the AUTOTUNE stop rings, and to take out all slack in the mechanism, the controls should be rotated until the desired readings are obtained and the readings noted; then the controls should be rotated one eighth turn each side of the desired setting. The final setting should then be approached in a clockwise rotation.

(6) Lock the AUTOTUNE stop rings in position by holding the dial in the correct position and by turning the locking bar in a clockwise direction until tight. When the dial has been locked, check the position by operating the Control in a clockwise direction until the stop ring prevents any further rotation of the control. Check the position of the control against the indicator mark on the transmitter panel. The settings of controls "A" and "C" are critical. The transmitter will not operate if these Controls are not set properly.

(7) A complete check of the AUTOTUNE System would be to set the transmitter up on all eleven channels. In doing so, Control "A" should be set up for all ten high frequency positions first, setting the lowest frequency on position 1 of Control "A". The LF position would then be set up on Control "A" making sure that the control stops exactly on position 13.

(h) Turn CALIBRATE-TUNE-OPERATE switch to TUNE.

(i) Turn Knob "G" to the dial setting given in the table for the desired frequency. Tighten dial lock.

(j) The low frequency oscillator is now set on the desired frequency. If it is desired to tune the output and antenna circuits of the transmitter into an antenna, proceed as described in Paragraph III-9.

(3) FOR FREQUENCIES BETWEEN 2000 AND 18,100 kc.

(a) Turn CHANNEL switch to desired channel.

(b) After motor stops, loosen locking bar on Knob "A". Set this knob to the position shown in the table for the desired frequency, approaching the setting clockwise through at least one eighth turn and tighten the locking bar.

(c) Turn CALIBRATE-TUNE-OPERATE switch to CALIBRATE.

(d) Loosen locking bar in Knob "B". Turn Knob "B" to the dial setting of the nearest crystal check point, shown in heavy type in the group of frequencies in the table containing the desired frequency. Adjust Knob "B" accurately for zero beat in the headphones.

(e) Leave Knob "B" at zero beat and adjust the CORRECTOR which moves the indicating mark over "B" until the dial reading at the mark is correct for the check point.

(f) Turn CALIBRATE-TUNE-OPERATE switch to TUNE.

(g) Turn Knob "B" one eighth turn each side of the dial setting given in the table for the desired frequency. Approach the given dial setting clockwise through at least one eighth turn. Hold knob on setting and tighten locking bar.

(h) The high frequency oscillator is now set on desired frequency. If it is desired to tune the output and antenna circuits to an antenna, proceed as described in Paragraph III-10.

(4) The calibration tables give dial settings at 2 kc intervals from 200 to 500 kilocycles; 5 kc intervals from 500 to 8000 kilocycles; and 10 kc intervals from 8000 to 18,100 kilocycles. The transmitter can also be set to frequencies between those given in the table by the following simple method:

(a) Find the difference between the desired frequency and the next lower frequency given in the table.

(b) Multiply this difference by the number given in parenthesis at the right of the column of figures containing the next lower frequency.

(c) Add the product thus obtained to the dial setting given in the table for the next lower frequency. The result is the dial setting for the desired frequency.

If resonance cannot be established with Control "T" in position 1, try other positions of Control "T" until the point of resonance is found. The plate current reading will vary between 70 and 130 on the plate current meter.

NOTE

Since it is possible to double the frequency in the PA stage, the resonance point lowest in frequency will be the correct point.

Check each position of Control "F" in like manner.

c. ADJUSTMENT OF TRANSMITTER ON DESIRED FREQUENCY USING INTERNAL CRYSTAL FREQUENCY CALIBRATOR.

(1) GENERAL.

(a) Plug a pair of headphones into the No. 1 sidetone jack on the transmitter. Sidetone No. 2 cannot be used unless proper external connections have been made through remote jack J-106 or terminal board J-1903. See paragraph II-8d.

(b) Turn LOCAL-REMOTE switch to LOCAL.

(c) Find desired frequency in calibration table, Table 3-1 or Table 3-2.

(d) The main frequency controls ("B" for the high frequency range and "G" for the low frequency range) each rotate 20 turns to cover a tuning range. The dial reading given in the table is the number of turns indicated on the small turn counter followed by the dial setting of the large knob. Thus, the dial reading shown in figure 3-3 is 1447.

(2) FOR FREQUENCIES BETWEEN 200 AND 1500 kc.

(a) Turn CHANNEL switch to L.FREQ.

(b) Turn EMISSION switch to VOICE.

(c) After motor stops, see that Knob "A" is at Position 13. If not, loosen locking bar, rotate Knob "A" to 13, approaching the setting clockwise through at least one eighth turn and tighten locking bar.

(d) Set switch "F" to the position given in the table for the desired frequency.

(e) Turn CALIBRATE-TUNE-OPERATE switch to CALIBRATE.

(f) Loosen dial lock and turn Knob "G" to the dial setting of the nearest crystal check point, shown in heavy type in the group of frequencies containing the desired frequency. Adjust Knob "G" accurately for zero beat in the headphones.

(g) Leave Knob "G" at zero beat and adjust the CORRECTOR which moves the indicating mark until the dial reading at the mark is correct for the check point.

(21) Place the EMERGENCY switch in the OFF position.

(22) After rotation of the high voltage dynamotor has stopped, insert the 1150 volt supply fuse F-1908 and replace the fuse cover.

(23) Turn the EMERGENCY switch to NORMAL and press the ON button.
(The low voltage dynamotor should start and all the filaments should light.)

(24) Place the meter switch in the PA PLATE position.

(25) After the filaments have warmed up at least thirty seconds, press the TEST key.
(An indication of plate current should be seen on the voltage-current indicating meter.)

(26) Release the TEST key and press the OFF button.

(27) Place the 4 WIRE-6 WIRE switch in the 4 WIRE position.

(28) Turn the 4 WIRE POWER switch to ON.
(The low voltage dynamotor should start and the transmitter tubes should light.)

(29) After the filaments have warmed up at least thirty seconds, press the TEST switch.
(An indication of plate current should be observed on the voltage-current indicating meter.)

(30) Release the TEST key and turn the 4 WIRE POWER switch to the OFF position.
(All of the above operating circuits should turn off.)

(31) Make certain that the Navy remote control circuits are turned off.

(32) Place the power unit LOCAL-REMOTE switch in the REMOTE position.

(33) Turn the 4 WIRE-6 WIRE switch to the proper position for the Navy remote control circuits which are to be used and check the operation of these controls.

b. RF CIRCUITS.

(1) Place the equipment in LOCAL control and check the transmitter for each position of the Control "A". (By placing CHANNEL selector switch S-108 in the MANUAL position the dials can be turned without unlocking the locking bars.) Position 13 of Control "A" is for the LF range 200 kc to 1500 kc.

(2) Check the LF circuits by placing CHANNEL selector switch S-108 in the L. FREQ. position. After the AUTOTUNE has operated, Control "A" should be exactly on position 13. If Control "A" is not on position 13, the locking bar should be released and the dial turned to position 13 after which the locking bar should be tightened again. Place Control "F" COARSE tuning in position 1. Place Control "R" on the load coil in the 200 to 575 kc position and Control "T" in position 1. Press TEST key S-104 and seek resonance with Control "S".

(4) Close the line switch to the radio equipment, place the EMERGENCY switch in the NORMAL position and press the ON button.
(The low voltage dynamotor should start.)

(5) Press the OFF button.
(The low voltage dynamotor should stop)

(6) Insert the 28 volt supply fuse F-1905 and the 14 volt supply fuse F-1906.

(7) Press the ON button.
(The low voltage dynamotor should start and the transmitter tubes should light. If the AUTOTUNE motor starts allow it to complete operation)

(8) Press the OFF button.
(The low voltage dynamotor should stop and all filaments should go out)

(9) Turn the EMERGENCY switch to OFF.

(10) Insert the high voltage dynamotor primary fuse F-1904.
(Be sure that both fuse covers are in place.)

(11) Turn the EMERGENCY switch to NORMAL and press the ON button.
(The low voltage dynamotor should start and the transmitter tubes should light.)

(12) Press the TEST switch.
(The high voltage dynamotor should start.)

(13) Release the TEST switch and press the OFF button.
(Both dynamotors should stop and the filaments should go out.)

(14) Turn the emergency switch to OFF.

(15) Be certain that the high voltage dynamotor has ceased to rotate, so that there is no voltage on the 400 volt and 1150 volt supply fuse clips, and then insert the 400 volt supply fuse F-1907 and replace the fuse cover.

(16) Turn the EMERGENCY switch to NORMAL and press the ON button.
(The low voltage dynamotor should start and all tubes should light.)

(17) Turn the meter switch to PA GRID.

(18) Check the position of controls "A" and "C", and if they are not set accurately on numbers unlock the locking bars and set them.

(19) After the filaments have warmed up at least thirty seconds, press the TEST switch.
(An indication of PA grid current should be observed on the voltage-current indicating meter.)

(20) Release the TEST switch and press the OFF button.
(All of the above operating circuits should turn off.)

The fuses should be examined and their ratings checked against the table provided. It is good practice to insert each fuse as required during the initial adjustment procedure in order that any faults which may be due to errors in the interconnecting of the units or unintentional grounding of terminals may be quickly determined and also to check and clear each individual circuit in the proper sequence. Refer to paragraph II—11a for detailed instructions. The fuses used in this equipment with the Symbol Designation of the fuses and the circuit in which these are located are tabulated below:

TABLE 2-1 TABLE OF FUSES

Symbol Designation	Rating Amps.	Circuit
F-1901	30	Power Line
F-1902	30	Power Line
F-1903	15	Low Voltage Dynamotor Primary
F-1904	15	High Voltage Dynamotor Primary
F-1905	15	28 v Supply
F-1906	3	14 v Supply
F-1907	1	400 v Supply
F-1908	1	1150 v Supply

11. PRE-OPERATION ADJUSTMENT.

Before placing the equipment in routine service a complete check of all controls should be made. The following steps will prepare the equipment for final adjustment and operation.

a. POWER UNIT.

(1) Be certain that the line switch to the radio equipment is open.
Remove all fuses from the fuse holders and check their ratings with table 2-1. (The line switch to the radio equipment must always be open when removing or inserting the line fuses F-1901 and F-1902 as these fuses are on the line side of all the power unit switches.)

(2) Place the EMERGENCY switch in the OFF position.
Place the power unit LOCAL-REMOTE switch in the LOCAL position.
Place the 4 WIRE-6 WIRE selector switch in the 6 WIRE position.
Place the 4 WIRE POWER switch in the OFF position.
Make sure that all local key and microphone circuits and all remote key and microphone circuits are open.
Turn the transmitter power level switch to TUNE.
Turn the EMISSION selector switch to VOICE.
Rotate the CHANNEL selector switch to position 1.
Place the transmitter LOCAL-REMOTE switch in the LOCAL position.

(3) Insert the line fuses F-1901 and F-1902 and the low voltage dynamotor primary fuse F-1903.

WARNING

Be sure that all panels, covers and enclosures are in place. The high voltages present are dangerous to life.

posible and the leads should be kept short and direct.

The Type COL-481628 Antenna Shunt Capacitor should be connected between terminal, J-118, engraved COND., and ground. A heavy, stranded conductor should be used to make the connections and the lead between J-118 and the capacitor should be formed to clear all metal objects by at least an inch and a half.

A good ground connection to the frame of the ship should be made to the terminal designated as GROUND, J-113, using heavy bus or a heavy stranded conductor and keeping the lead as short as practicable.

To complete the installation connections, connect a jumper between the antenna terminal on the receiver and the RECEIVER terminal, J-110, on the transmitter.

d. SIDETONE CONNECTIONS. - A connection for keying of double sidetone, utilizing auxiliary jack J-105 in connection with SIDETONE jack J-104, can be made by connecting jumper wires from terminals number 26 to 27 of remote jack J-106.

Connection for the purposes described can be made in a dummy plug used in remote jack J-106 if REMOTE control of the transmitter is not desired. In case REMOTE control of the transmitter is desired it will be necessary to jumper terminals 26 and 27 on terminal board J-1903.

9. CONNECTIONS TO NAVY CIRCUITS.

This radio transmitting equipment is designed to operate as a unit controlled by controls contained completely within the equipment or controlled by Standard Navy 4 WIRE-6 WIRE and Telephone Control Circuits (Spec. RE 13A 592B)

a. 4 WIRE-6 WIRE TRANSMITTER CONTROL. - The transmitting equipment can be started, stopped and keyed using either 4 WIRE or 6 WIRE circuits by connecting the 4 WIRE or 6 WIRE circuits through the ship's distribution board to terminals 1 to 6 inclusive on J-1905 in the base of the Power Unit. See figure 4-12 for applicable circuits.

b. TELEPHONE CIRCUITS. - The TCZ-2 equipment is arranged for carrier control and carrier modulation when connected to the ship's distribution board. The equipment also provides a suitable low voltage DC for microphone circuits. Connections for these circuits are provided on J-1905 terminals 7, 8, 9, 10, 11 and 12. Refer to figures 4-12 and 4-13.

c. RECEIVER PROTECTING RELAY. - A set of SPDT contacts have been provided on the keying relay which may be used to turn the receiver off when the transmitter carrier is turned on. The set of SPDT contacts are brought out to terminals 17, 18, and 19 of terminal board J-1905. Refer to the Power Unit schematic figure 7-47.

10. FUSES.

All fuses for the TCZ-2 equipment are located on either side of the power unit control panel. The fuses are protected by covers which may be removed by loosening the four thumb-nuts.

these cables. The type cable using part number 424 0007 00 wire has wires coded by color and various numbers of ridges on the insulation while the type using part number 424 2710 00 wire has wires coded by multi color insulation. The table has information for connecting either type of cable.

J-1903 TERM. NO.	424 0007 00 CABLE DATA CONDUCTOR COLOR	NUMBER OF RIDGES	424 2710 00 CABLE DATA CONDUCTOR BODY COLOR	FIRST TRACER	SECOND TRACER
1	GRAY	0	GREEN	WHITE	
2	BROWN	0	RED	WHITE	
3	BROWN	1	ORANGE	WHITE	BLACK
4	GRAY	1	BLUE	WHITE	
5	WHITE	1	BLACK		
6	WHITE	2	GREEN	BLACK	
7	BROWN	2	RED	BLACK	
8	GREEN	2	WHITE		
9	WHITE	0	ORANGE	BLACK	
10	BLACK	0	BLACK	WHITE	
11	YELLOW	0	WHITE	BLACK	
12	YELLOW	1	GREEN	BLACK	WHITE
13	GREEN	1	BLACK	RED	
14	RED	0	RED		
15	RED	1	BLUE	BLACK	
16	BLACK	2	BLUE		
17	BLACK	1	WHITE	RED	BLACK
18	YELLOW	2	RED	WHITE	BLACK
19	ORANGE	2	WHITE	RED	
20	WH. & BLACK IN SHIELD		BLUE (SHIELDED)	WHITE	BLACK
21	GREEN	0	GREEN		
22	RED	2	ORANGE		
23	BLUE	0	BLACK	WHITE	RED
24	ORANGE	1	ORANGE	RED	
25	ORANGE	0	BLUE	RED	
26	BLUE	2	RED	GREEN	
27	BLUE	1	ORANGE	GREEN	

The locking rings on the plugs should be tightened.

NOTE

Safety wires should be inserted in the locking rings to prevent them from loosening under conditions of vibration.

c. ANTENNA CONNECTIONS. - Five terminals on the left hand end of the transmitter cabinet provide terminals for connecting the antenna shunt capacitor, the load coil, the receiver antenna terminal and a ground.

A connection should be made from J-3002 on the load box to the LOADING COIL terminal J-117 on the transmitter and a good ground from the frame of the ship should be made to GROUND terminal J-3003 on the load box. Connect terminal J-3004 on the load box to FIXED ANTENNA terminal J-109 on the transmitter. The antenna is connected to ANTENNA terminal J-3005 on the load coil box. Heavy stranded conductors should be used for all connections where

7. CABLES.

The external cables used with this equipment are furnished completely assembled. The construction of the 65X-7 and 65X-8 cables is shown in figures 7-41 and 7-42 respectively while the construction of the 65X-9 cable which furnishes relay power to the load box is shown in figure 7-43. Refer to figure 7-44 for details of the 65X-10 remote control cable. The cables should be installed allowing sufficient length for free action of the shock mounts. Bends in the cables should be made with a radius of not less than eight inches.

8. CONNECTIONS.

After all units have been mounted, the installation may be completed by making the power, inter-unit and antenna connections. Refer to the installation diagram, figure 2-1.

a. POWER CONNECTIONS. - Connections from the power unit to the power source should be made using two heavy cables. Two #12 AWG wires in parallel for each lead are recommended.

Connections to the terminals provided in the base of the power unit should be clean and firm as there is considerable power drawn from the power source.

b. INTER-UNIT CONNECTIONS. - Connections from the transmitter to the power unit are made by pre-assembled cables, see figures 7-41 and 7-42. The 65X-7 cable is a 27 wire cable used to transfer the control circuits from the transmitter to the base terminals of the power unit for use with the remote control box. The 65X-8 cable is a 10 wire cable used to convey the filament and plate power from the power unit to the transmitter. Each of the above cables is approximately 10-1/2" long including the connectors.

The 65X-7 and 65X-8 cable connectors should be inserted in their respective sockets and the locking rings tightened.

The 65X-9 cable is used to connect the relay power to the Antenna Load Coil. While this cable, as supplied, is ten feet long, it may be cut to the proper length for the installation by using instructions shown on figure 7-43. The right angle connector is inserted in J-3006 on the load coil and the straight connector is inserted in J-107 on the transmitter. Receptacle J-107 may be equipped with a dust cap which must be removed by turning counter-clockwise before the cable connector plug can be inserted.

The Remote Control Unit is connected to the base of the Power Unit by the 65X-10, 27 conductor cable. The end of the cable terminated by a plug is connected to the Remote Control Unit. The opposite end which is terminated by spade-type lugs is connected to J-1903 in the base of the Power Unit. Figure 7-44 shows the construction of the 65X-10. Note that the ends of the wires containing the spade-lugs are color coded. The numbers adjacent to the lugs on the illustration represent the terminal numbers on terminal board J-1903.

The following table contains information necessary for connecting the Collins 65X-10 Remote-to-Power Unit cable to connector strip J-1903 in the base of the Power Unit. Two different types of wire were used in making up ing foot has 2 holes, which are 13/32" in diameter, for bolting the unit to the deck. 3/8" bolts may be used for this purpose.

Sufficient space should be left between the sides of the cabinet and surrounding objects to permit free circulation of air around and through the cabinet.

The external cable connections are made through the bottom of the power unit near the front edge, to a terminal board that is accessible by removing the bottom front panel.

c. DYNAMOTORS. - Each dynamotor of the power unit is mounted on a removable chassis. All power connections are made to plugs at the rear of the chassis which engage socket terminals as the chassis is inserted into the power unit. The chassis should be shoved straight into their respective positions with the high voltage dynamotor on the right, viewed from the front, and the low voltage dynamotor on the left. The thumb-nut locks should be rotated as far as they will go in the counterclockwise direction and then rotated in the clockwise direction until they secure the units into place.

d. PANELS. - The removable panels and covers on the power unit are equipped with thumb-nuts that may be secured in position by a locking wire. In installations where severe vibration is encountered, locking wires should be inserted through the thumb-nuts and through the tabs on the panels after which the ends of the wires should be twisted.

e. ANTENNA LOADING COIL. - Installation drawing, figure 7-39, shows the outline dimensions and the distances between centers of the mounting holes for the Antenna Loading Coil.

The loading coil cabinet may be mounted on either the bottom or rear. The unit should be mounted within easy reach of the transmitter unit to facilitate the adjustment of the controls on the panel when making tuning adjustments for low-frequency operation.

The mounting centers are 9-1/2" x 14-3/4" on the bottom and 15-5/8" x 14-3/4" on the rear. All mounting holes are drilled for 1/4" screws.

f. REMOTE CONTROL UNIT. - The Type COL-23410 Control Unit should be mounted in a position convenient to the operator. Figure 7-38 shows the outline dimensions and mounting details of the unit.

g. ANTENNA CAPACITOR. - If operation in the frequency range of 2000 kc to 3000 kc is contemplated and the antenna does not have sufficient capacity to permit the tuning of the output circuit within this frequency range, the Type -481628 Antenna Shunt Capacitor should be connected between the COND. terminal, just below the ANT. terminal on the left-hand end of the transmitter, and ground.

Figure 7-40 shows the outline dimensions and mounting details of the Type -481628 Antenna Shunt Capacitor.

The capacitor should be mounted as close as possible to the left end of the transmitter cabinet so that the lead between the COND. terminal and the capacitor unit will be as short as possible. The length of lead must not exceed 12 inches.

Plug the crystal unit into the two prong socket in the extreme rear right-hand corner of the transmitter as illustrated in figure 2-2.

Replace the cabinet cover and fasten securely in position with the clamping screws.

5. OPERATIONAL CHECK.

It is recommended that the complete equipment be given an operational check before installing the units in the ship. Considerable time and labor may be saved if all units are in working order before installation. Where numerous installations are to be made, it is recommended that a test bench be set up so that each equipment may be given a careful electrical check prior to installation for operation.

In addition to the regular units supplied with the TCZ-2 Series Equipment, it will be necessary to have available a DC source of power of approximately 115 volts potential, a set of test cables with plugs and cabling of the same type as supplied with the equipment, a set of earphones (500 ohm impedance), a single button carbon or dynamic microphone similar to the microphone that is to be used in actual operation of the equipment, a telegraph key and a dummy antenna load consisting of from 3 to 5 ohms of resistance in series with approximately 100 mmf of capacity.

NOTE

Make certain that the microphone circuit switch, S-201, is in the correct position for the type of microphone that is being used.

Using the above mentioned accessories, carefully check the operation of the transmitter unit, the power unit, and the remote control unit. Check the equipment with all types of emission and both remote and panel control. Refer to paragraph II-11 for instructions. If any trouble is found, it will be much less difficult on the work bench than after the installation has been completed. When the equipment has been carefully checked, the installation on shipboard may be made.

6. MOUNTING OF UNITS.

a. TYPE -52286-A TRANSMITTER UNIT. - The transmitter unit is equipped with detachable sliding mounting tracks. Rubber shock mounts incorporated in the mounting tracks reduce the effect of the vibration and shock encountered in normal service to a minimum.

When the power unit is securely bolted in position, the transmitter may be slid into position from the front of the track slide or may be lowered into the slots and then slid backward approximately two inches. When the unit has been placed, the locking knob on the front edge of the track should be rotated in a clockwise direction to the locked position.

b. POWER UNIT. - The overal dimensions for the power unit with the mounting feet positioned as furnished are: 29-7/16" high, 23-7/16" wide, and 20-1/8" deep. Note that the height is 39-5/8" for the power unit and transmitter combined. The dimensions change slightly if the mounting feet are rotated 90 degrees. Refer to figure 7-37 for mounting layout and dimensions. Each mount-

SECTION II

INSTALLATION AND ADJUSTMENT

1. UNCRATING.

Open packing crates with care. When crates are marked with arrows to indicate upright position, remove crate covers only and lift units out carefully. Search all packing material for small packages. Inspect cables and wiring and be sure that all terminal connections are tight. Inspect each unit for loose screws and bolts. Be sure that all controls such as switches, dials, etc., work properly. All claims for damage should be filed promptly with the transportation company. If a claim for damage is to be filed, the original packing case and packing material must be preserved.

2. GENERAL.

Figure 2-1 shows a complete TCZ-2 installation with all the accessories necessary for transmission on any frequency within the frequency range of the transmitter and with transmitter control from either the transmitter panel or from a remote position. If the fixed antenna has sufficient capacity the Type -481628 Antenna Shunt Capacitor Unit may be omitted from the installation.

The first step in preparing the transmitter for installation is to check the vacuum tubes and calibration crystal for placement in the proper sockets. The transmitting tubes and the crystal unit can be installed from the top of the transmitter unit. To remove the transmitter cabinet cover, loosen the cover hold-down screws and lift the cover upward. To remove the shield cover from the low-frequency oscillator unit remove the six screws and lift the cover off.

3. TUBES.

The tube and fuse placement diagram, figure 2-2, includes an outline drawing of the top view of the transmitter unit with cover removed. This drawing shows the proper location of the transmitting tubes and illustrates the operation of the tube clamps. Also refer to figure 7-2.

Place all plate lead connectors firmly on the plate caps of the 811, 813, 837, and 1625 tubes and lock tube clamps.

Fasten the oscillator shield cover securely in position with the securing screws.

4. CRYSTALS.

The quartz crystal has been carefully calibrated, checked and sealed in the holder at the factory.

The Type CR-2-B/U (200 kc) Crystal Unit is designed to mount in a two terminal crystal socket.

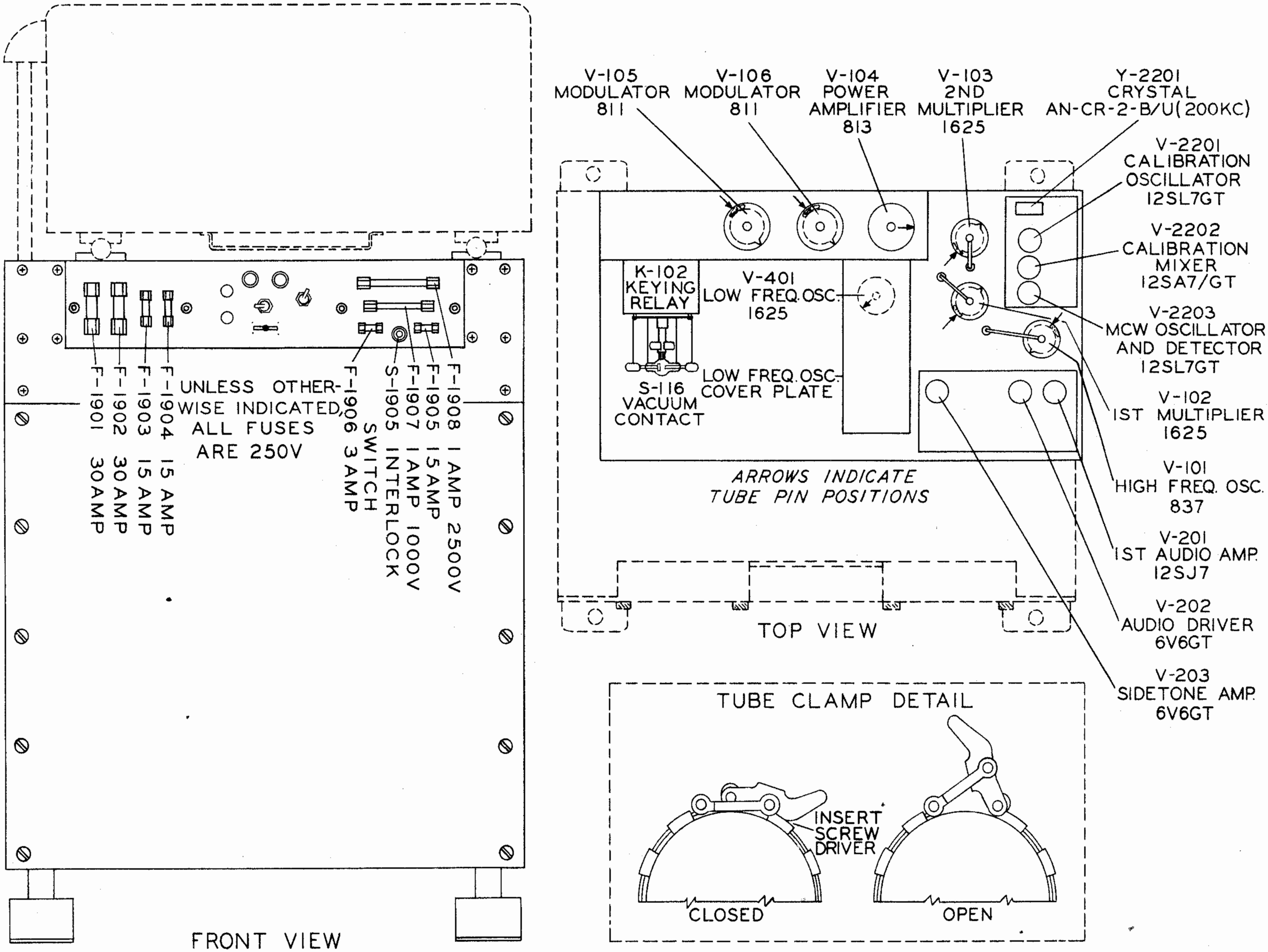
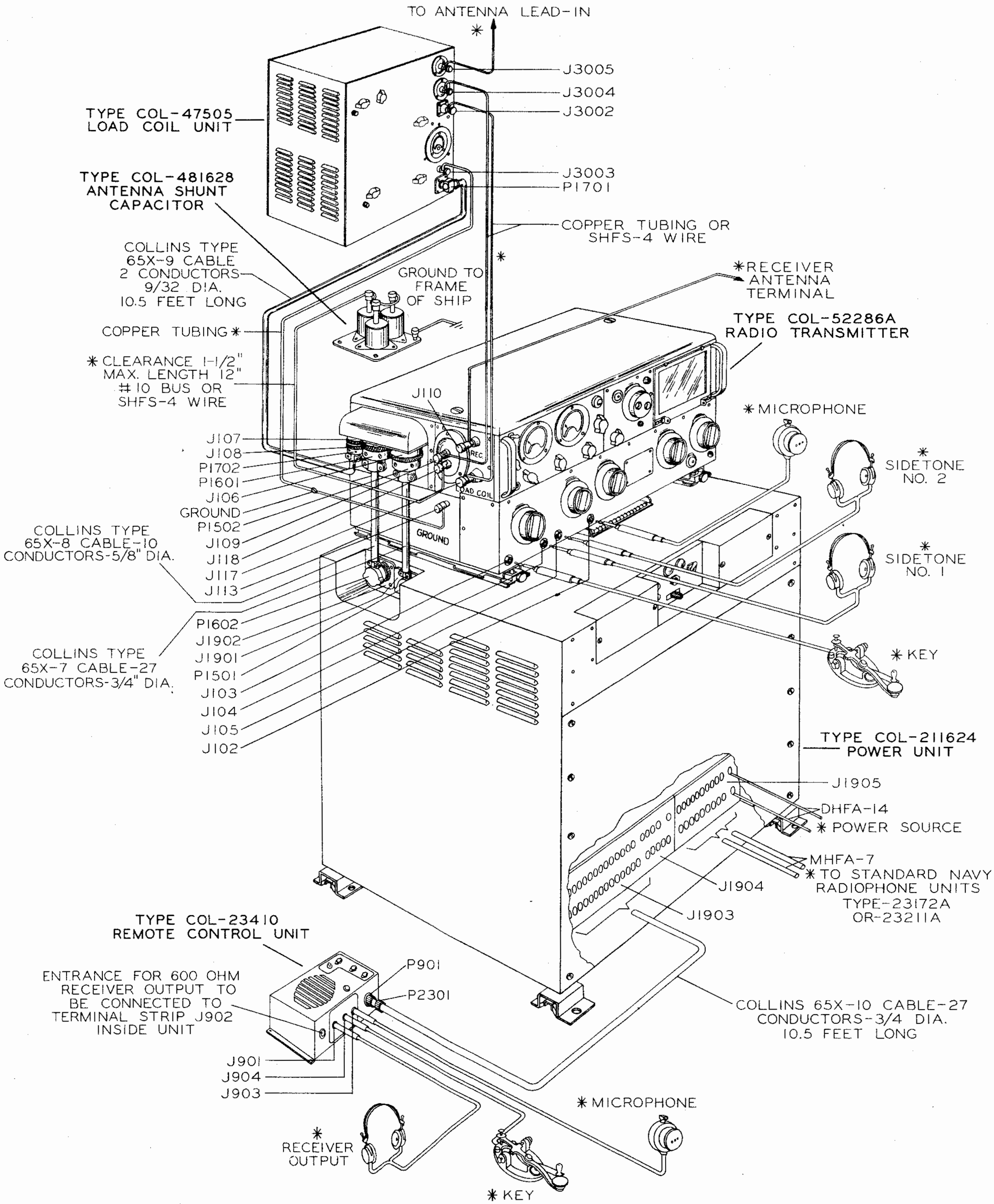


Figure 2-2 Navy Model TCZ-2 Tube and Fuse Placement Diagram



* THESE UNITS AND CABLES NOT SUPPLIED ON CONTRACT. BENDING RADIUS OF COLLINS TYPE 65X-9 AND 65X-10 CABLES, NOT LESS THAN 8 INCHES.

Figure 2-1 Complete Navy Model TCZ-2 Installation Diagram internal resistance. When the circuit selector switch is in the DYNAMIC position the input circuit will match a dynamic microphone of approximately 200 ohms internal resistance.

The audio input to the equipment from Standard Navy Control Circuits (Spec. RE 13A 592B) is through an impedance matching transformer. The primary is tapped at 200, 400, and 600 ohms impedance while the secondary is tapped at 42, 60, 82, and 106 ohms impedance. These taps can be changed to suit the existing conditions.

k. ELECTRICAL CHARACTERISTICS OF RECOMMENDED ANTENNAS. - 25 foot (117 mmf) to 35 foot (135 mmf) whip antenna having a 6 foot lead-in.

l. TUBE DESIGNATION AND FUNCTION.

Symbol Designation	Type Number	Quantity	Circuit Function
V101	837	1	High Frequency Oscillator
V102	1625	1	1st Multiplier
V103	1625	1	2nd Multiplier
V104	813	1	Power Amplifier
V105	811	1	Modulator
V106	811	1	Modulator
V201	12SJ7	1	1st Audio Amplifier
V202	6V6GT	1	Audio Driver
V203	6V6GT	1	Sidetone Amplifier
V401	1625	1	Low Frequency Oscillator
V2201	12SL7GT	1	Osc-Tripler
V2202	12SA7/GT	1	Mixer
V2203	12SL7GT	1	Detector-Audio Osc

Ø m. CHARACTERISTICS OF POWER SUPPLY

(1) Voltage: 115 volts DC

(2) Current required at 115 supply volts for:

(a) Maximum starting:

(b) Standby:

(c) Normal Operation:

1. With filaments on:

2. Locked key CW:

3. Locked key (Voice):

g. AUDIO FREQUENCY RESPONSE.

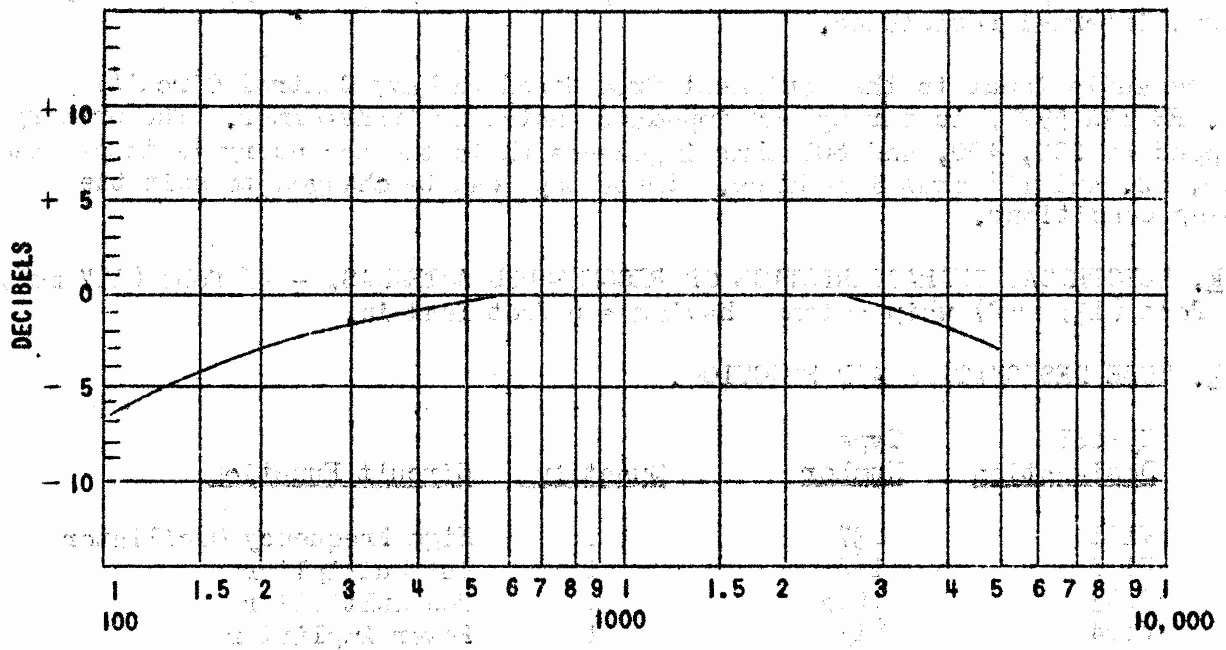


Figure 1-10 Overall Frequency Response Curve

h. CRYSTAL. - One CR-2-B/U (200 kc). CFI unit crystal, 200 kc output.

i. FREQUENCY STABILITY DATA.

(1) Frequency Variation with Temperature Change:

Temp. Change	% Frequency Deviation			
	2.0 mc	2.4 mc	3.0 mc	6.0 mc
-10°C (14°F) to 0°C (32°F)	0.0006	0.0027	0.0011	0.0116
0°C (32°F) to 10°C (50°F)	0.0014	0.0027	0.0004	0.0147
10°C (50°F) to 20°C (68°F)	0.0009	0.0044	0.0008	0.0123
20°C (68°F) to 30°C (86°F)	0.0030	0.0018	0.0027	0.0124
30°C (86°F) to 40°C (104°F)	0.0000	0.0042	0.0015	0.0109
40°C (104°F) to 50°C (122°F)	0.0042	0.0040	0.0015	0.0126

(2) Frequency Variation with Change in Humidity:

Humidity Change	% Frequency Deviation			
	2.0 mc	2.4 mc	3.0 mc	6.0 mc
30% to 95%	0.0073	0.0058	0.0097	0.0153
95% to 30%	0.0046	0.0000	0.0050	0.0153

j. INPUT IMPEDANCE. - The audio input circuit of the equipment is designed to match the output of either a carbon or dynamic microphone. A switch selects the proper input circuit to correspond to the type of microphone that is to be used. When the microphone circuit selector switch is in the CARBON position the input circuit will match a carbon microphone of approximately 40 ohms

2000 kc to 18,100 kc in the High Frequency Range. The frequency is continuously variable within the two ranges. The transmitter can be pre-set on ten HF positions and one LF position by Local Control only. However, these pre-set positions can be selected by either Local Control or by Remote Control using the Navy Type COL-23410 Remote Control Unit.

b. TUNING BANDS.

Band	Frequency Range
1	2.0 to 2.4 mc
2	2.4 to 3.0 mc
3	3.0 to 3.6 mc
4	3.6 to 4.0 mc
5	4.0 to 4.8 mc
6	4.8 to 6.0 mc
7	6.0 to 7.2 mc
8	7.2 to 9.0 mc
9	9.0 to 10.8 mc
10	10.8 to 12.0 mc
11	12.0 to 14.4 mc
12	14.4 to 18.1 mc
13	200 to 1500 kc

c. NUMBER OF PRE-SET FREQUENCIES. - Ten High Frequencies and one Low Frequency

d. TYPE OF MODULATION.- Amplitude.

e. METHOD OF MODULATION. - Class B modulation to the plate and screen of the PA tube.

f. MODULATION CAPABILITY. - 90 to 100% on all frequencies with nominal power input.

Short, heavy power leads and good connections are desirable to minimize voltage drops. Two #12 AWG wires in parallel for each lead are recommended.

IMPORTANT

Before connecting to a power source check it carefully to make sure that it is a DC source of approximately 115 volts potential.

12. OVERLOAD PROTECTION.

The input circuit of the power unit and the input circuits of both dynamotors are protected by fuses. The 28 volt and 14 volt output circuits of the low voltage dynamotor and the 400 volt and the 1150 volt output circuits of the high voltage dynamotor also are fused to protect circuit components from being damaged by an overload.

13. ABBREVIATIONS.

Throughout the Instruction Book abbreviations are used in place of some of the more common radio terms and phrases. The terms and definitions listed below should help in the understanding of the sections of this book that follow.

PA	- Power Amplifier
CW	- Continuous-Wave
MCW	- Modulated Continuous-Wave
VOICE	- Voice modulated radio-frequency
HF OSCILLATOR	- High-Frequency Oscillator (1000 kc to 1510 kc output)
LF OSCILLATOR	- Low-Frequency Oscillator (200 kc to 1500 kc output)
CFI	- Calibration Frequency Indicator
1st MULTIPLIER	- First radio-frequency multiplier stage
2nd MULTIPLIER	- Second radio-frequency multiplier stage
LOCAL	- Control of the power and emission from the the transmitter panel
REMOTE	- Control of the transmitter power and emission from the Remote Control Unit
RF	- Radio Frequency
AF	- Audio Frequency

14. SYMBOL DESIGNATIONS.

The Symbol Designations used throughout this book refer to the symbols used on the schematic diagrams and photographs. These designations are also used in the Parts List and Spare Parts Lists to identify circuit components with component part numbers and description.

15. TECHNICAL SUMMARY.

a. FREQUENCY RANGE. - 200 kc to 1500 kc in the Low Frequency Range.

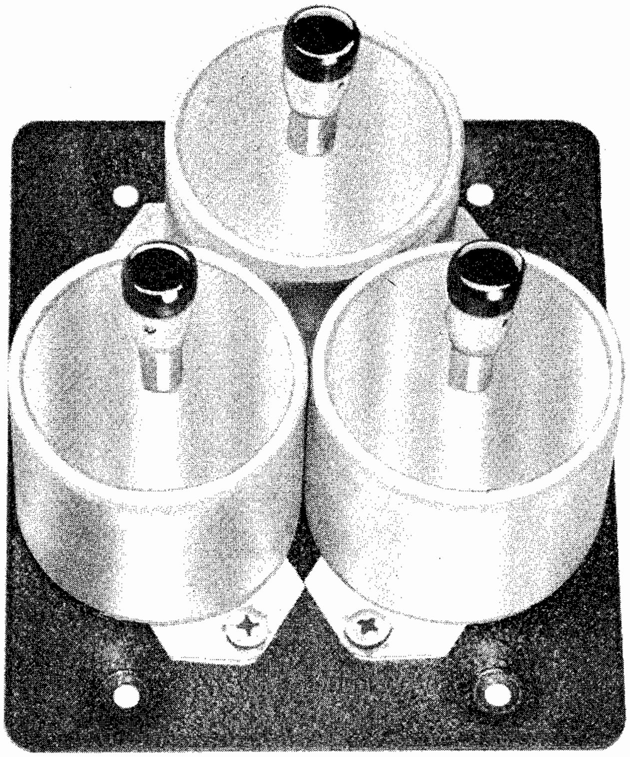


Figure 1-8 Navy Type COL-481628 Antenna Shunt Capacitor

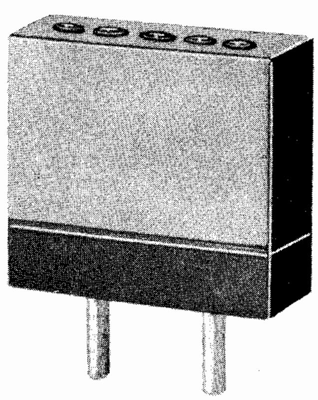


Figure 1-9 Type CR-2-B/U (200 kc) Crystal Unit

mounts and may be installed on a bulk-head near the transmitter unit.

8. ANTENNA SHUNT CAPACITOR.

The Type COL-481628 Antenna Shunt Capacitor is furnished to permit operation in the range 2000 to 3000 kc using a short whip-type antenna.

9. ACCESSORIES.

a. The Type CR-2-B/U (200 kc) Crystal Unit is mounted in a plug-in holder for convenience in mounting in the crystal oscillator calibration unit.

b. Power, control and unit-interconnecting cables are furnished complete with the fittings and plug connectors necessary to complete the installation.

c. Complete sets of Phillips and Bristo wrenches are fastened on the left side of the transmitter unit.

10. INTERCHANGEABILITY OF UNITS.

Table 1-4 INTERCHANGEABILITY OF UNITS.

Unit Description	Navy Type Designation	Collins Type No.	Model TCZ	Model TCZ-1	Model TCZ-2
Radio Transmitter	-52286	17H-2	X		
Radio Transmitter	-52286-A	17H-2		X	X
Remote Control Unit	COL-23410	314N-2	X	X	X
Antenna Loading Coil (300 kc to 600 kc)	COL-47370	180H-3	X		
Antenna Loading Coil (200 kc to 1500 kc)	COL-47505	180H-4		X	X
Antenna Shunt Capacitor	-481628	195D-1	X	X	X
Quartz Crystal Assembly (200 kc)	-40127		X		
Quartz Crystal Assembly (200 kc)	CR-2-B/U (200 kc)			X	X
AC Power Unit	COL-211101	413D-1	X		
AC Power Unit	COL-211322	413D-3		X	
DC Power Unit	COL-211102	413D-2	X		
DC Power Unit	COL-211624	413D-4			X
27 Conductor Cable		65X-7	X	X	X
10 Conductor Cable		65X-8	X	X	X
2 Conductor Cable		65X-9	X	X	X
27 Conductor Cable		65X-10	X	X	X

This Instruction Book may not be used for installation, operation or maintenance of any units except those supplied on this contract.

11. POWER SOURCE.

The equipment described by this Instruction Book requires approximately 1200 watts of 115 volt DC current. To take care of starting surges and overloads a power source with adequate capacity should be employed.

The controls on the Type COL-23410 Remote Control Unit consist of a CHANNEL selector switch, an EMISSION selector switch, a MICROPHONE jack, and a TELEGRAPH KEY jack.

5. POWER UNIT.

Power for the transmitter unit is furnished by a Navy Type COL-211624 Dynamotor Assembly Power Unit , requiring approximately 1200 watts of power at 115 v DC at rated load.

Channel type of construction is employed in the power unit, therefore, most of the components may be serviced by removing either of the two side plates. Shock mounts are provided for deck mounting.

The power unit employs two dynamotors to generate operating voltages for all the circuits of the installation except the 115 v DC keying circuits. One dynamotor furnishes 28 v DC for tube filaments and relays, and 14 v DC for Navy Control Circuits. Plate voltage for the transmitter unit is obtained from the second dynamotor which has two output voltages, one of which is used for the tubes requiring 400 volts while both voltages are combined for the tubes requiring 1150 v.

Output of the power unit is as follows:

14 v DC at 1.2 amp for Navy Control Circuits.
28 v DC at 15 amp for transmitter filaments and relays.
400 v DC at 0.4 amp for LV transmitter tubes plates.
1150 v DC at 0.35 amp for HV transmitter tubes plates.
115 v DC line voltage is used for the power unit keying relay.

6. REMOTE CONTROL UNIT.

The Type COL-23410 Remote Control Unit permits the control of power, the selection of the type of emission, the control of the emission and the selection of the frequency channel from a remote position. The unit also contains a loudspeaker, a headphones cord plug receptacle and an audio level control. The input circuits of the speaker and phones jack are brought out to a terminal strip so that the output of the installation receiver may be easily connected to the unit. Either speaker or headphones reception may be selected by the operation of a toggle switch. This unit has mounting holes for mounting the unit in a position convenient to the operator.

7. ANTENNA LOAD COIL.

The external load coil is used only when low frequency operation (200 kc to 1500 kc) is selected. The antenna should by connected to the ANT LEAD IN terminal on the load coil and connections made from the load coil terminals to the transmitter. A relay located in the Type COL-47505 Antenna Load Coil Unit, operated by the telegraph key, TEST switch or the push-to-talk switch on the microphone, connects the tank circuit that is located in the load coil unit to the antenna when operating in the low frequency range. During operation in the frequency range 2000 kc to 18,100 kc the relay remains unoperated and the normally closed contacts connect the output of the transmitter directly to the antenna. The Load Coil unit is equipped with shock-

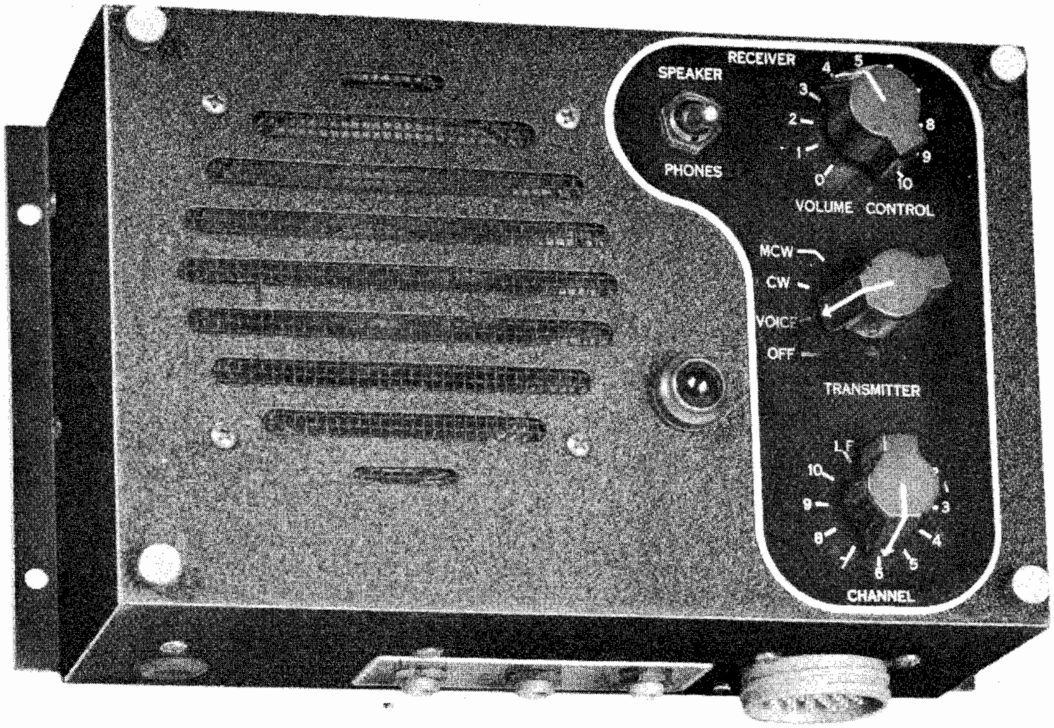


Figure 1-6 Navy Type COL-23410 Remote Control Unit

Figure 1-7 Navy Type COL-47505 Antenna Loading Coil Unit

10. TUNING INSTRUCTIONS FOR HIGH FREQUENCY OPERATION (2000 to 18,100 kc).

a. Knobs "A" and "B" are coarse and fine frequency controls. Knobs "C", "D" and "E" tune the antenna circuit. Knobs "F" and "G" and all knobs on external loading coils have no effect during high frequency operation.

b. The following procedure is recommended for tuning the equipment to any desired high frequency:

(1) One of the tables of dial settings for "C", "D" and "E" in table 3-3 or 3-4 will be found to be approximately correct for any antenna installation. To determine which table to use, measure the length of the antenna taking the total length of wire from the antenna terminal of the Antenna Loading Coil to the extreme end of the antenna. (Include the length of lead inside the radio room.) If the antenna is a "T" disregard the length of wire in the shorter branch at the top of the "T", or, if the two branches are equal, include the length of only one of them.

(2) To check the choice of table, tune up the set on one of the frequencies given in the table for the antenna length nearest that measured above. Choose a frequency which tunes on Position 7 on the "C" dial. Compare the actual dial settings obtained with the dial settings given in this table and also in the tables for the next shorter and the next longer antenna lengths. Of these tables the one showing dial settings closest to the actual dial settings is the table to use for this particular installation. The above procedure need only be followed once for a given type of antenna installation. Once the particular table which applies is known, it can be used thereafter.

(3) Set transmitter to desired frequency with Knobs "A" and "B". See instructions paragraph III-8c in this book, and calibration table 3-2.

(4) Set knobs "C", "D", and "E" to the dial settings given in the table chosen above for the frequency nearest to the desired frequency. Some of the tables give two sets of dial settings for the same frequency. Use the dial settings which give most nearly correct PA plate meter reading when tuned as described below.

(5) Place BATTERY-PA GRID-PA PLATE switch in PA PLATE position.

Place CALIBRATE-TUNE-OPERATE switch in TUNE position.

Place EMISSION switch in CW position.

(6) Press key. Turn Knob "D" for minimum PA plate meter reading.

(7) Place CALIBRATE-TUNE-OPERATE switch in OPERATE position. The pointer of the meter reading PA plate should be in the white area marked CW. If the needle does not read in the area marked CW, detune Knob "E" a few degrees and retune Knob "D" to minimum PA plate meter reading. If the new meter reading is more nearly correct, detune Knob "E" a few more degrees the same direction and retune with Knob "D". If the new meter reading is farther from correct value, detune Knob "E" a few degrees the other way and find dip in PA plate meter reading with Knob "D". Continue until the dip in PA plate meter reading falls within the area marked CW. Release key.

The object is to make the meter reading at the dip, fall within the white CW area on the meter scale. Knob "E" controls loading while Knob "D" controls fine antenna tuning, but their effects are interlocking. If one knob is turned, it is necessary to readjust the other.

WARNING

The correct tuning is at the minimum dip in PA plate meter reading. If meter reading is too low, follow the procedure described above. Do not detune from dip to get the "correct" meter reading. Always tune to the dip in PA plate meter reading as the final step.

NOTE

Set Knob "C" accurately to mark.

(8) In the tuning process the knobs have been moved either direction as required. It is now necessary to set and lock these knobs so the Autotune quick-shift mechanism will retune them automatically to the correct position. Note the setting of Knob "C". Move it one position counterclockwise (to next lower number), then back clockwise to the original setting, stopping exactly on the mark. Hold knob and tighten locking bar.

Note the setting of Knob "D". Move it one eighth turn counterclockwise, then return it clockwise exactly to the original setting. Hold knob and tighten locking bar.

Turn Knob "E" one eighth turn counterclockwise. Press key. Retune Knob "E" slowly clockwise and stop at minimum PA plate meter reading. If you turn past the point of minimum PA plate meter reading, back up one eighth turn and try again. Set Knob "E" at the point of dip in PA plate meter reading, hold knob, and tighten locking bar, Release key. The equipment is now tuned and ready for use.

(9) A useful check on accuracy of setup is, after all locking bars are tightened, to turn each knob by hand clockwise against its stop, then press key momentarily and note if the set is correctly tuned. If so, the Autotune quick-shift mechanism will repeat the settings thereafter.

(10) The transmitter can be tuned and loaded with low line voltage if proper allowance is made so that the loading will not be too high with normal line voltage. Obtain a power line voltage meter reading and proceed to tune the antenna as described in paragraph(7) above, but adjust minimum PA plate meter reading proportional to the line voltage meter reading obtained above rather than to the area marked CW. Thus when the line voltage is low, the transmitter is loaded proportionately low, and the loading will be correct when line voltage is normal.

(11) All antenna tuning and loading should be done in the CW position. Upon switching to VOICE position the reading of the righthand meter will increase slightly without modulation, and will kick upwards to about 150 on the scale during normal talking. In the MCW position the meter will read in or near the area marked MCW.

NOTE

Under no circumstances should the transmitter be actually operating (key down or microphone push-button closed) when the EMISSION selector switch is operated. Such operation can cause a sustained arc to occur between the contacts of the CW relay.

(12) Antenna tuning data for antennas of various lengths are given in the following tables. Use the data in table 3-3 where the lowest desired frequency can be tuned with the particular antenna in use.

(13) If it is necessary to tune to a lower frequency than is possible with the given antenna alone, the NAVY Type COL-481628 shunt capacitors may be connected between the terminals on the transmitter marked COND and GROUND. This additional capacity will extend the tuning range. Antenna tuning data in table 3-4 shows the amount of shunt capacity to use with each antenna to reach 2000 kc.

IMPORTANT

Use table 3-3 whenever possible. Use table 3-4 only when shunt capacity must be added to extend antenna tuning range.

TABLE 3-1 L-F OSCILLATOR CALIBRATION DATA (200 Kc. to 1500 Kc.)

Freq.	A	F	G	
200	**13**	**1**	**393**	
202	13	1	469	
204	13	1	540	
206	13	1	609	(31 divisions per kc)
208	13	1	676	
210	13	1	739	
212	13	1	801	
214	13	1	861	
216	13	1	919	
218	13	1	976	
220	13	1	1030	
222	13	1	1084	
224	13	1	1136	
226	13	1	1187	
228	13	1	1237	(23 divisions per kc)
230	13	1	1286	
232	13	1	1334	
234	13	1	1381	
236	13	1	1426	
238	13	1	1472	
240	13	1	1515	
242	13	1	1560	
244	13	1	1603	
246	13	1	1646	
248	13	1	1688	(20 divisions per kc)
250	**13**	**1**	**1729**	
252	13	1	1770	
254	13	1	1810	
256	13	1	1851	
258	13	1	1890	
260	13	1	1929	
262	13	1	1968	
262	13	2	175	
264	13	2	242	
266	13	2	305	
268	13	2	366	
270	13	2	423	
272	13	2	480	
274	13	2	533	(25 divisions per kc)
276	13	2	585	
278	13	2	635	
280	13	2	684	
282	13	2	731	
284	13	2	778	
286	13	2	823	
288	13	2	868	
290	13	2	911	
292	13	2	953	
294	13	2	995	
296	13	2	1035	
298	13	2	1075	
300	**13**	**2**	**1114**	

Freq.	A	F	G	
300	**13**	**2**	**1114**	
302	13	2	1153	
304	13	2	1192	(18 divisions per kc)
306	13	2	1229	
308	13	2	1266	
310	13	2	1302	
312	13	2	1338	
314	13	2	1373	
316	13	2	1407	
318	13	2	1442	
320	13	2	1476	
322	13	2	1508	
324	13	2	1542	
326	13	2	1574	
328	13	2	1606	
330	13	2	1638	
332	13	2	1670	(18 divisions per kc)
334	13	2	1701	
336	13	2	1732	
338	13	2	1763	
340	13	2	1793	
342	13	2	1823	
344	13	2	1854	
346	13	2	1883	
348	13	2	1912	
350	**13**	**2**	**1942**	
352	13	2	1971	
354	13	2	2000	
356	13	2	2028	
350	**13**	**3**	**154**	
352	13	3	205	(21 divisions per kc)
354	13	3	255	
356	13	3	302	
358	13	3	347	
360	13	3	392	
362	13	3	434	
364	13	3	476	
366	13	3	515	
368	13	3	555	
370	13	3	593	
372	13	3	631	
374	13	3	668	
376	13	3	704	
378	13	3	739	
380	13	3	774	(16 divisions per kc)
382	13	3	808	
384	13	3	841	
386	13	3	874	
388	13	3	906	
390	13	3	938	
392	13	3	970	
394	13	3	1000	
396	13	3	1030	
398	13	3	1061	
400	**13**	**3**	**1090**	

Freq.	A	F	G	
400	**13**	**3**	**1090**	
402	13	3	1120	
404	13	3	1148	(13 divisions per kc)
406	13	3	1177	
408	13	3	1205	
410	13	3	1233	
412	13	3	1260	
414	13	3	1288	
416	13	3	1314	
418	13	3	1341	
420	13	3	1368	
422	13	3	1394	
424	13	3	1419	
426	13	3	1445	
428	13	3	1470	
430	13	3	1495	
432	13	3	1519	
434	13	3	1544	
436	13	3	1569	(12 divisions per kc)
438	13	3	1593	
440	13	3	1616	
442	13	3	1641	
444	13	3	1665	
446	13	3	1688	
448	13	3	1710	
450	**13**	**3**	**1734**	
452	13	3	1757	
454	13	3	1780	
456	13	3	1802	
458	13	3	1825	
460	13	3	1847	
462	13	3	1870	(11 divisions per kc)
464	13	3	1892	
466	13	3	1913	
468	13	3	1936	
470	13	3	1958	
472	13	3	1980	
474	13	3	2001	
476	13	3	2022	
468	13	4	191	
470	13	4	213	
472	13	4	235	
474	13	4	257	
476	13	4	279	(10 divisions per kc)
478	13	4	300	
480	13	4	321	
482	13	4	342	
484	13	4	363	
486	13	4	383	
488	13	4	402	
490	13	4	422	
492	13	4	442	
494	13	4	462	
496	13	4	481	
498	13	3	499	
500	**13**	**4**	**518**	

Freq.	A	F	G	
500	**13**	**4**	**518**	(9 divisions per kc)
505	13	4	565	
510	13	4	609	
515	13	4	654	
520	13	4	697	
525	13	4	739	
530	13	4	781	
535	13	4	821	(8 divisions per kc)
540	13	4	862	
545	13	4	901	
550	**13**	**4**	**940**	
555	13	4	978	
560	13	3	1016	
565	13	4	1053	
570	13	4	1090	
575	13	4	1127	
580	13	4	1163	
585	13	4	1198	(7 divisions per kc)
590	13	4	1234	
595	13	4	1270	
600	**13**	**4**	**1304**	
605	13	4	1340	
610	13	4	1375	
615	13	4	1408	
620	13	4	1444	
625	13	4	1479	
630	13	4	1512	
635	13	4	1548	(7 divisions per kc)
640	13	4	1584	
645	13	4	1618	
650	**13**	**4**	**1655**	
655	13	4	1691	
660	13	4	1728	
665	13	4	1766	
670	13	4	1804	
675	13	4	1845	(9 divisions per kc)
680	13	4	1886	
685	13	4	1928	
690	13	4	1976	
695	13	4	2023	
695	13	5	156	
700	**13**	**5**	**195**	
705	13	5	231	
710	13	5	269	(7 divisions per kc)
715	13	5	303	
720	13	5	338	
725	13	5	373	
730	13	5	406	
735	13	5	438	
740	13	5	471	
745	13	5	502	
750	**13**	**5**	**553**	

Use nearest check point shown in heavy type.

Frequency 750 to 1500 kilocycles

TABLE 3-1 L-F OSCILLATOR CALIBRATION DATA (200 Kc. to 1500 Kc.) (Cont.)

Freq.	A	F	G	
750	**13**	**5**	**533**	(6 div. per kc)
755	13	5	565	
760	13	5	594	
765	13	5	624	
770	13	5	654	
775	13	5	683	(5.4 divisions per kc)
780	13	5	711	
785	13	5	739	
790	13	5	768	
795	13	5	795	
800	**13**	**5**	**821**	
805	13	5	849	
810	13	5	876	
815	13	5	901	
820	13	5	927	
825	13	5	953	
830	13	5	979	(4.9 divisions per kc)
835	13	5	1004	
840	13	5	1029	
845	13	5	1054	
850	**13**	**5**	**1079**	
855	13	5	1103	
860	13	5	1127	
865	13	5	1152	
870	13	5	1176	
875	13	5	1199	
880	13	5	1223	
885	13	5	1247	(4.7 divisions per kc)
890	13	5	1270	
895	13	5	1294	
900	**13**	**5**	**1317**	
905	13	5	1341	
910	13	5	1364	
915	13	5	1387	
920	13	5	1410	
925	13	5	1433	(4.7 divisions per kc)
930	13	5	1457	
935	13	5	1480	
940	13	5	1503	
945	13	5	1526	
950	13	5	1550	
955	13	5	1574	
960	13	5	1597	
965	13	5	1621	
970	13	5	1645	
975	13	5	1670	(5 divisions per kc)
980	13	5	1694	
985	13	5	1718	
990	13	5	1744	
995	13	5	1770	
1000	**13**	**5**	**1795**	

Freq.	A	F	G	
1000	**13**	**5**	**1795**	(5.8 divisions per kc)
1005	13	5	1822	
1010	13	5	1850	
1015	13	5	1878	
1020	13	5	1905	
1025	13	5	1935	
1030	13	5	1966	
1035	13	5	1998	
1035	13	6	145	(4.5 div. per kc)
1040	13	6	171	
1045	13	6	196	
1050	**13**	**6**	**219**	
1055	13	6	244	
1060	13	6	270	
1065	13	6	293	
1070	13	6	315	
1075	13	6	338	(4.3 div. per kc)
1080	13	6	363	
1085	13	6	385	
1090	13	6	407	
1095	13	6	428	
1100	**13**	**6**	**451**	
1105	13	6	473	
1110	13	6	493	
1115	13	6	514	
1120	13	6	534	
1125	13	6	556	(3.9 div. per kc)
1130	13	6	576	
1135	13	6	596	
1140	13	6	615	
1145	13	6	635	
1150	**13**	**6**	**656**	
1155	13	6	675	
1160	13	6	694	
1165	13	6	712	
1170	13	6	731	
1175	13	6	751	
1180	13	6	770	(3.5 div. per kc)
1185	13	6	788	
1190	13	6	806	
1195	13	6	823	
1200	**13**	**6**	**842**	
1205	13	6	860	
1210	13	6	878	
1215	13	6	895	
1220	13	6	913	
1225	13	6	930	
1230	13	6	948	(3.4 div. per kc)
1235	13	6	966	
1240	13	6	983	
1245	13	6	999	
1250	**13**	**6**	1016	

Freq.	A	F	G	
1250	**13**	**6**	**1016**	(3.4 div. per kc)
1255	13	6	1032	
1260	13	6	1050	
1265	13	6	1067	
1267	**13**	**6**	**1073**	
1270	13	6	1084	
1275	13	6	1100	
1280	13	6	1116	(3.2 divisions per kc)
1285	13	6	1132	
1290	13	6	1149	
1295	13	6	1166	
1300	**13**	**6**	**1182**	
1305	13	6	1198	
1310	13	6	1214	
1315	13	6	1230	
1320	13	6	1246	
1325	13	6	1262	
1330	13	6	1278	(3.1 divisions per kc)
1335	13	6	1294	
1340	13	6	1309	
1345	13	6	1325	
1350	**13**	**6**	**1341**	
1355	13	6	1358	
1360	13	6	1374	
1365	13	6	1389	
1370	13	6	1404	
1375	13	6	1419	
1380	13	6	1436	(3.2 divisions per kc)
1385	13	6	1452	
1390	13	6	1468	
1395	13	6	1484	
1400	**13**	**6**	**1499**	
1405	13	6	1514	
1410	13	6	1530	
1415	13	6	1547	
1420	13	6	1563	
1425	13	6	1580	
1430	13	6	1595	(3.3 divisions per kc)
1435	13	6	1611	
1440	13	6	1627	
1445	13	6	1644	
1450	**13**	**6**	**1661**	
1455	13	6	1678	
1460	13	6	1694	
1465	13	6	1710	
1470	13	6	1727	
1475	13	6	1744	
1480	13	6	1763	(3.5 div. per kc)
1485	13	6	1780	
1490	13	6	1797	
1495	13	6	1813	
1500	**13**	**6**	**1832**	

Use nearest check point shown in heavy type.

Frequency 2000 to 3000 kilocycles

TABLE 3-2 H-F OSCILLATOR CALIBRATION DATA (2000 Kc. to 18,100 Kc.)

Freq.	A	B	
2000	**1**	**100**	
2005	1	119	(3.6 divisions per kc)
2010	1	138	
2015	1	156	
2020	1	174	
2025	1	193	
2030	1	211	
2035	1	230	
2040	1	248	
2045	1	267	
2050	1	285	
2055	1	303	
2060	1	322	
2065	1	340	
2070	1	359	
2075	1	377	
2080	1	396	
2085	1	415	(3.6 divisions per kc)
2090	1	433	
2095	1	452	
2100	**1**	**470**	
2105	1	489	
2110	1	508	
2115	1	526	
2120	1	545	
2125	1	564	
2130	1	582	
2135	1	601	
2140	1	620	
2145	1	638	
2150	1	657	
2155	1	675	
2160	1	693	
2165	1	713	
2170	1	732	
2175	1	750	
2180	1	769	(3.6 divisions per kc)
2185	1	787	
2190	1	806	
2195	1	824	
2200	**1**	**843**	
2205	1	862	
2210	1	880	
2215	1	898	
2220	1	917	
2225	1	935	
2230	1	954	
2235	1	972	
2240	1	991	
2245	1	1009	
2250	1	1027	

Freq.	A	B	
2250	1	1027	
2255	1	1046	
2260	1	1064	
2265	1	1083	
2270	1	1101	
2275	1	1119	
2280	1	1138	(3.6 divisions per kc)
2285	1	1156	
2290	1	1174	
2295	1	1193	
2300	**1**	**1211**	
2305	1	1229	
2310	1	1247	
2315	1	1265	
2320	1	1284	
2325	1	1302	
2330	1	1321	
2335	1	1339	
2340	1	1357	
2345	1	1376	
2350	1	1394	
2355	1	1412	
2360	1	1430	(3.6 divisions per kc)
2365	1	1449	
2370	1	1468	
2375	1	1486	
2380	1	1504	
2385	1	1523	
2390	1	1541	
2395	1	1560	
2400	**1**	**1578**	
2400	**2**	**060**	
2405	2	076	
2410	2	091	(3 divisions per kc)
2415	2	106	
2420	2	121	
2425	2	137	
2430	2	152	
2435	2	168	
2440	2	183	
2445	2	198	
2450	2	213	
2455	2	228	
2460	2	243	(3 divisions per kc)
2465	2	259	
2470	2	274	
2475	2	290	
2480	2	305	
2485	2	320	
2490	2	335	
2495	2	351	
2500	**2**	**366**	

Freq.	A	B	
2500	**2**	**366**	
2505	2	381	(3 divisions per kc)
2510	2	397	
2515	2	412	
2520	2	427	
2525	2	443	
2530	2	458	
2535	2	474	
2540	2	489	
2545	2	505	
2550	2	520	
2555	2	535	
2560	2	551	
2565	2	567	
2570	2	590	
2575	2	597	
2580	2	613	
2585	2	628	(3 divisions per kc)
2590	2	644	
2595	2	659	
2600	**2**	**674**	
2605	2	690	
2610	2	705	
2615	2	721	
2620	2	736	
2625	2	756	
2630	2	767	
2635	2	782	
2640	2	797	
2645	2	813	
2650	2	828	
2655	2	844	
2660	2	859	
2665	2	874	
2670	2	890	
2675	2	905	
2680	2	920	
2685	2	935	
2690	2	951	
2695	2	966	(3 divisions per kc)
2700	**2**	**981**	
2705	2	996	
2710	2	1012	
2715	2	1027	
2720	2	1042	
2725	2	1057	
2730	2	1073	
2735	2	1088	
2740	2	1103	
2745	2	1118	
2750	2	1133	

Freq.	A	B	
2750	2	1133	
2755	2	1148	
2760	2	1163	
2765	2	1179	
2770	2	1194	
2775	2	1209	
2780	2	1224	
2785	2	1239	(3 divisions per kc)
2790	2	1254	
2795	2	1270	
2800	**2**	**1285**	
2805	2	1300	
2810	2	1315	
2815	2	1330	
2820	2	1345	
2825	2	1361	
2830	2	1376	
2835	2	1391	
2840	2	1406	
2845	2	1421	
2850	2	1436	
2855	2	1452	
2860	2	1469	
2865	2	1482	
2870	2	1498	
2875	2	1513	
2880	2	1528	
2885	2	1544	
2890	2	1559	
2895	2	1574	(3 divisions per kc)
2900	**2**	**1590**	
2905	2	1605	
2910	2	1621	
2915	2	1636	
2920	2	1653	
2925	2	1668	
2930	2	1683	
2935	2	1699	
2940	2	1715	
2945	2	1731	
2950	2	1749	
2955	2	1763	
2960	2	1779	
2965	2	1795	**(3 divisions per kc)**
2970	2	1811	
2975	2	1827	
2980	2	1843	
2985	2	1860	
2990	2	1877	
2995	2	1893	
3000	**2**	**1910**	

Use nearest check point shown in heavy type.

Frequency 3000 to 4000 kilocycles

TABLE 3-2 H-F OSCILLATOR CALIBRATION DATA (2000 Kc. to 18,100 Kc.) (Cont.)

Freq.	A	B	
3000	**3**	**100**	
3005	3	113	
3010	3	126	
3015	3	138	(2.5 divisions per kc)
3020	3	150	
3025	3	162	
3030	3	174	
3035	3	186	
3040	3	198	
3045	3	211	
3050	3	223	
3055	3	235	
3060	3	248	
3065	3	260	
3070	3	272	
3075	3	285	
3080	3	297	
3085	3	309	
3090	3	322	
3095	3	334	
3100	3	346	
3105	3	359	
3110	3	371	(2.5 divisions per kc)
3115	3	383	
3120	3	396	
3125	3	408	
3130	3	420	
3135	3	433	
3140	3	445	
3145	3	457	
3150	**3**	**470**	
3155	3	483	
3160	3	496	
3165	3	508	
3170	3	520	
3175	3	532	
3180	3	545	
3185	3	557	
3190	3	569	
3195	3	582	
3200	3	594	(2.5 divisions per kc)
3205	3	606	
3210	3	620	
3215	3	632	
3220	3	644	
3225	3	657	
3230	3	669	
3235	3	681	
3240	3	693	
3245	3	706	
3250	3	719	

Freq.	A	B	
3250	3	719	
3255	3	731	
3260	3	743	
3265	3	755	
3270	3	769	
3275	3	781	
3280	3	793	
3285	3	806	(2.5 divisions per kc)
3290	3	818	
3295	3	830	
3300	**3**	**843**	
3305	3	855	
3310	3	867	
3315	3	880	
3320	3	892	
3325	3	904	
3330	3	917	
3335	3	929	
3340	3	941	
3345	3	954	
3350	3	966	
3355	3	978	(2.5 div. per kc)
3360	3	991	
3365	3	1003	
3370	3	1015	
3375	3	1027	
3380	3	1039	
3385	3	1051	
3390	3	1064	
3395	3	1076	
3400	3	1088	
3405	3	1101	
3410	3	1113	
3415	3	1125	
3420	3	1138	(2.5 divisions per kc)
3425	3	1150	
3430	3	1162	
3435	3	1174	
3440	3	1186	
3445	3	1198	
3450	**3**	**1211**	
3455	3	1223	
3460	3	1235	
3465	3	1247	
3470	3	1259	
3475	3	1271	
3480	3	1284	
3485	3	1296	
3490	3	1308	
3495	3	1321	
3500	3	1333	

Freq.	A	B	
3500	3	1333	(2.5 div. per kc)
3505	3	1345	
3510	3	1357	
3515	3	1369	
3520	3	1381	
3525	3	1394	
3530	3	1406	
3535	3	1418	
3540	3	1430	
3545	3	1443	(2.5 divisions per kc)
3550	3	1456	
3555	3	1468	
3560	3	1480	
3565	3	1492	
3570	3	1504	
3575	3	1516	
3580	3	1528	
3585	3	1541	
3590	3	1553	
3595	3	1565	
3600	**3**	**1578**	
3600	**4**	**060**	
3605	4	070	
3610	4	080	
3615	4	091	
3620	4	101	(2 divisions per kc)
3625	4	116	
3630	4	121	
3635	4	131	
3640	4	141	
3645	4	152	
3650	4	162	
3655	4	172	
3660	4	183	
3665	4	193	
3670	4	203	
3675	4	213	
3680	4	223	
3685	4	233	
3690	4	243	
3695	4	253	
3700	4	264	
3705	4	275	
3710	4	285	
3715	4	295	
3720	4	305	(2 divisions per kc)
3725	4	315	
3730	4	325	
3735	4	335	
3740	4	345	
3745	4	355	
3750	**4**	**366**	

Freq.	A	B	
3750	**4**	**366**	
3755	4	376	
3760	4	386	
3765	4	397	
3770	4	407	(2 divisions per kc)
3775	4	417	
3780	4	427	
3785	4	437	
3790	4	447	
3795	4	458	
3800	4	469	
3805	4	479	
3810	4	489	
3815	4	499	
3820	4	509	
3825	4	520	
3830	4	530	
3835	4	540	
3840	4	551	
3845	4	561	
3850	4	571	
3855	4	582	
3860	4	592	
3865	4	602	
3870	4	613	
3875	4	623	(2 divisions per kc)
3880	4	633	
3885	4	644	
3890	4	654	
3895	4	664	
3900	**4**	**674**	
3905	4	684	
3910	4	694	
3915	4	705	
3920	4	715	
3925	4	725	
3930	4	736	
3935	4	746	
3940	4	756	
3945	4	767	
3950	4	777	
3955	4	787	
3960	4	797	
3965	4	807	(2 divisions per kc)
3970	4	817	
3975	4	828	
3980	4	838	
3985	4	848	
3990	4	859	
3995	4	869	
4000	**4**	**879**	

Use nearest check point shown in heavy type.

Frequency 4000 to 5000 kilocycles

TABLE 3-2 H-F OSCILLATOR CALIBRATION DATA (2000 Kc. to 18,100 Kc.) (Cont.)

Freq.	A	B	
4000	**5**	**100**	
4005	5	109	
4010	5	119	
4015	5	128	
4020	5	138	
4025	5	147	
4030	5	156	(1.8 divisions per kc)
4035	6	165	
4040	5	174	
4045	5	183	
4050	5	193	
4055	5	202	
4060	5	211	
4065	5	220	
4070	5	230	
4075	5	239	
4080	5	248	
4085	5	257	
4090	5	267	
4095	5	276	
4100	5	285	
4105	5	293	
4110	5	303	
4115	5	312	
4120	5	322	
4125	5	331	
4130	5	340	
4135	5	349	
4140	5	359	
4145	5	368	
4150	5	377	
4155	5	386	
4160	5	396	(1.8 divisions per kc)
4165	5	405	
4170	5	415	
4175	5	424	
4180	5	433	
4185	5	442	
4190	5	452	
4195	5	461	
4200	**5**	**470**	
4205	5	479	
4210	5	489	
4215	5	498	
4220	5	508	
4225	5	517	
4230	5	526	
4235	5	535	
4240	5	545	
4245	5	554	
4250	5	564	

Freq.	A	B	
4200	**5**	**470**	
4250	5	564	
4255	5	573	(1.8 divisions per kc)
4260	5	582	
4265	5	591	
4270	5	601	
4275	5	610	
4280	5	620	
4285	5	629	
4290	5	638	
4295	5	647	
4300	5	657	
4305	5	666	
4310	5	675	
4315	5	684	
4320	5	693	
4325	5	702	
4330	5	713	
4335	5	722	
4340	5	732	
4345	5	741	
4350	5	750	
4355	5	759	
4360	5	769	
4365	5	778	
4370	5	787	
4375	5	796	
4380	5	806	
4385	5	815	
4390	5	824	(1.8 divisions per kc)
4395	5	833	
4400	**5**	**843**	
4405	5	852	
4410	5	862	
4415	5	871	
4420	5	880	
4425	5	889	
4430	5	898	
4435	5	907	
4440	5	917	
4445	5	926	
4450	5	935	
4455	5	944	
4460	5	954	
4465	5	963	
4470	5	972	
4475	5	981	
4480	5	991	
4485	5	1000	
4490	5	1009	
4495	5	1018	
4500	5	1027	

Freq.	A	B	
4500	5	1027	
4505	5	1036	
4510	5	1046	
4515	5	1055	
4520	5	1064	
4525	5	1073	
4530	5	1083	
4535	5	1092	
4540	5	1101	
4545	5	1110	
4550	5	1119	
4555	5	1128	
4560	5	1138	
4565	5	1147	
4570	5	1156	
4575	5	1165	
4580	5	1174	
4585	5	1183	(1.8 divisions per kc)
4590	5	1193	
4595	5	1202	
4600	**5**	**1211**	
4605	5	1220	
4610	5	1229	
4615	5	1338	
4620	5	1247	
4625	5	1256	
4630	5	1266	
4635	5	1275	
4640	5	1284	
4645	5	1293	
4650	5	1302	
4655	5	1311	
4660	5	1321	
4665	5	1330	
4670	5	1339	
4675	5	1348	
4680	5	1357	
4685	5	1366	
4690	5	1376	
4695	5	1385	
4700	5	1394	
4705	5	1403	
4710	5	1412	
4715	5	1421	(1.8 divisions per kc)
4720	5	1430	
4725	5	1439	
4730	5	1449	
4735	5	1458	
4740	5	1468	
4745	5	1477	
4750	5	1486	
4800	**5**	**1578**	

Freq.	A	B	
4750	5	1486	
4755	5	1495	
4760	5	1504	(1.8 divisions per kc)
4765	5	1513	
4770	5	1523	
4775	5	1532	
4780	5	1541	
4785	5	1550	
4790	5	1560	
4795	5	1569	
4800	**5**	**1578**	
4800	**6**	**060**	
4805	6	068	
4810	6	076	
4815	6	084	
4820	6	091	
4825	6	099	
4830	6	106	
4835	6	114	(1.5 divisions per kc)
4840	6	121	
4845	6	129	
4850	6	137	
4855	6	145	
4860	6	152	
4865	6	160	
4870	6	168	
4875	6	176	
4880	6	183	
4885	6	191	
4890	6	198	
4895	6	206	
4900	6	213	
4905	6	221	
4910	6	228	
4915	6	236	
4920	6	243	
4925	6	251	
4930	6	259	
4935	6	267	
4940	6	274	(1.5 divisions per kc)
4945	6	282	
4950	6	290	
4955	6	298	
4960	6	305	
4965	6	313	
4970	6	320	
4975	6	328	
4980	6	335	
4985	6	343	
4990	6	351	
4995	6	359	
5000	**6**	**366**	

Use nearest check point shown in heavy type.

Frequency 5000 to 6000 kilocycles

TABLE 3-2 H-F OSCILLATOR CALIBRATION DATA (2000 Kc. to 18,100 Kc.) (Cont.)

Freq.	A	B	Note
5000	**6**	**366**	
5005	6	374	
5010	6	381	
5015	6	389	
5020	6	397	
5025	6	405	
5030	6	412	(1.5 divisions per kc)
5035	6	420	
5040	6	427	
5045	6	435	
5050	6	443	
5055	6	451	
5060	6	458	
5065	6	466	
5070	6	474	
5075	6	482	
5080	6	489	
5085	6	497	
5090	6	505	
5095	6	513	
5100	6	520	
5105	6	528	
5110	6	535	
5115	6	543	
5120	6	551	
5125	6	559	
5130	6	567	
5135	6	575	
5140	6	582	
5145	6	590	
5150	6	597	
5155	6	605	
5160	6	613	(1.5 divisions per kc)
5165	6	621	
5170	6	628	
5175	6	636	
5180	6	644	
5185	6	652	
5190	6	659	
5195	6	667	
5200	**6**	**674**	
5205	6	682	
5210	6	690	
5215	6	698	
5220	6	705	
5225	6	713	
5230	6	721	
5235	6	729	
5240	6	736	
5245	6	744	
5250	6	752	

Freq.	A	B	Note
5200	**6**	**674**	
5250	6	752	
5255	6	760	(1.5 divisions per kc)
5260	6	767	
5265	6	775	
5270	6	782	
5275	6	790	
5280	6	797	
5285	6	805	
5290	6	813	
5295	6	821	
5300	6	828	
5305	6	836	
5310	6	844	
5315	6	852	
5320	6	859	
5325	6	867	
5330	6	874	
5335	6	882	
5340	6	890	
5345	6	898	
5350	6	905	
5355	6	913	
5360	6	920	
5365	6	928	
5370	6	935	
5375	6	943	
5380	6	951	(1.5 divisions per kc)
5385	6	959	
5390	6	966	
5395	6	974	
5400	**6**	**981**	
5405	6	989	
5410	6	996	
5415	6	1004	
5420	6	1012	
5425	6	1020	
5430	6	1027	
5435	6	1035	
5440	6	1042	
5445	6	1050	
5450	6	1057	
5455	6	1065	
5460	6	1073	
5465	6	1081	
5470	6	1088	
5475	6	1096	
5480	6	1103	
5485	6	1111	
5490	6	1118	
5495	6	1126	
5500	6	1133	

Freq.	A	B	Note
5500	6	1133	
5505	6	1141	
5510	6	1148	
5515	6	1156	
5520	6	1163	
5525	6	1171	
5530	6	1179	
5535	6	1187	
5540	6	1194	
5545	6	1202	
5550	6	1209	
5555	6	1217	
5560	6	1224	
5565	6	1232	
5570	6	1239	
5575	6	1247	
5580	6	1254	(1.5 divisions per kc)
5585	6	1262	
5590	6	1270	
5595	6	1278	
5600	**6**	**1285**	
5605	6	1293	
5610	6	1300	
5615	6	1308	
5620	6	1315	
5625	6	1323	
5630	6	1330	
5635	6	1338	
5640	6	1345	
5645	6	1353	
5650	6	1361	
5655	6	1369	
5660	6	1376	
5665	6	1384	
5670	6	1391	
5675	6	1399	
5680	6	1406	
5685	6	1414	
5690	6	1421	
5695	6	1429	
5700	6	1436	
5705	6	1444	
5710	6	1452	(1.5 divisions per kc)
5715	6	1460	
5720	6	1467	
5725	6	1475	
5730	6	1482	
5735	6	1490	
5740	6	1498	
5745	6	1506	
5750	6	1513	
5800	**6**	**1590**	

Freq.	A	B	Note
5750	6	1513	
5755	6	1521	
5760	6	1528	
5765	6	1536	
5770	6	1544	
5775	6	1552	
5780	6	1559	
5785	6	1567	
5790	6	1574	
5795	6	1582	
5800	**6**	**1590**	
5805	6	1598	
5810	6	1605	(1.5 divisions per kc)
5815	6	1613	
5820	6	1621	
5825	6	1629	
5830	6	1636	
5835	6	1644	
5840	6	1653	
5845	6	1661	
5850	6	1668	
5855	6	1676	
5860	6	1683	
5865	6	1691	
5870	6	1699	
5875	6	1707	
5880	6	1715	
5885	6	1723	
5890	6	1731	
5895	6	1739	
5900	6	1747	
5905	6	1755	
5910	6	1763	
5915	6	1771	
5920	6	1779	
5925	6	1787	
5930	6	1795	
5935	6	1803	(1.6 divisions per kc)
5940	6	1811	
5945	6	1819	
5950	6	1827	
5955	6	1835	
5960	6	1844	
5965	6	1852	
5970	6	1860	
5975	6	1868	
5980	6	1877	
5985	6	1885	
5990	6	1893	
5995	6	1901	
6000	**6**	**1910**	

Use nearest check point shown in heavy type.

TABLE 3-2 H-F OSCILLATOR CALIBRATION DATA (2000 Kc. to 18,100 Kc.) (Cont.)

Freq.	A	B	Freq.	A	B	Freq.	A	B	Freq.	A	B
6000	**7**	**100**	6250	7	408	6500	7	719	6750	7	1027
6005	7	106	6255	7	415	6505	7	725	6755	7	1033
6010	7	112	6260	7	421	6510	7	732	6760	7	1039
6015	7	119	6265	7	427	6515	7	738	6765	7	1046
6020	7	125	6270	7	433	6520	7	744	6770	7	1052
6025	7	131	6275	7	439	6525	7	750	6775	7	1058
6030	7	138	6280	7	445	6530	7	756	6780	7	1064
6035	7	144	6285	7	452	6535	7	762	6785	7	1070
6040	7	150	6290	7	458	6540	7	769	6790	7	1076
6045	7	156	6295	7	464	6545	7	775	6795	7	1083
6050	7	162	**6300**	**7**	**470**	6550	7	781 (1.2 divisions per kc)	6800	7	1089 (1.2 divisions per kc)
6055	7	168	6305	7	476	6555	7	787	6805	7	1095
6060	7	174	6310	7	482	6560	7	793	6810	7	1101
6065	7	180	6315	7	489	6565	7	799	6815	7	1107
6070	7	186	6320	7	495	6570	7	806	6820	7	1113
6075	7	193	6325	7	501	6575	7	812	6825	7	1119
6080	7	199 (1.2 divisions per kc)	6330	7	508	6580	7	818	6830	7	1125
6085	7	205	6335	7	514	6585	7	824	6835	7	1131
6090	7	211	6340	7	520	6590	7	830	6840	7	1138
6095	7	217	6345	7	526	6595	7	836	6845	7	1144
6100	7	223	6350	7	532 (1.2 divisions per kc)	**6600**	**7**	**843**	6850	7	1150
6105	7	230	6355	7	538	6605	7	849	6855	7	1156
6110	7	236	6360	7	545	6610	7	855	6860	7	1162
6115	7	242	6365	7	551	6615	7	862	6865	7	1168
6120	7	248	6370	7	557	6620	7	868	6870	7	1174
6125	7	254	6375	7	564	6625	7	874	6875	7	1180
6130	7	260	6380	7	570	6630	7	880	6880	7	1186
6135	7	267	6385	7	576	6635	7	886	6885	7	1193
6140	7	273	6390	7	582	6640	7	892	6890	7	1199
6145	7	279	6395	7	588	6645	7	898	6895	7	1205
6150	7	285	6400	7	595	6650	7	904	**6900**	**7**	**1211**
			6405	7	601	6655	7	910	6905	7	1217
6155	7	291	6410	7	607	6660	7	917	6910	7	1223
6160	7	297	6415	7	613	6665	7	923	6915	7	1229
6165	7	303	6420	7	620	6670	7	929	6920	7	1235
6170	7	309	6425	7	626	6675	7	935	6925	7	1241
6175	7	315	6430	7	632	6680	7	941 (1.2 divisions per kc)	6930	7	1247 (1.2 divisions per kc)
6180	7	322	6435	7	638	6685	7	947	6935	7	1253
6185	7	328	6440	7	644	6690	7	954	6940	7	1259
6190	7	334	6445	7	650	6695	7	960	6945	7	1266
6195	7	340	6450	7	657	6700	7	966	6950	7	1272
6200	7	346				6705	7	972	6955	7	1278
6205	7	352 (1.2 divisions per kc)	6455	7	663	6710	7	978	6960	7	1284
6210	7	359	6460	7	669	6715	7	984	6965	7	1290
6215	7	365	6465	7	675	6720	7	991	6970	7	1296
6220	7	371	6470	7	681	6725	7	997	6975	7	1302
6225	7	377	6475	7	687	6730	7	1003	6980	7	1308
6230	7	383	6480	7	693 (1.2 divisions per kc)	6735	7	1009	6985	7	1314
6235	7	389	6485	7	699	6740	7	1015	6990	7	1321
6240	7	396	6490	7	705	6745	7	1021	6995	7	1327
6245	7	402	6495	7	713	6750	7	1027	7000	7	1333
6250	7	408	6500	7	719						
6300	**7**	**470**	**6600**	**7**	**843**						

Use nearest check point shown in heavy type.

Frequency 7000 to 8000 kilocycles

TABLE 3-2 H-F OSCILLATOR CALIBRATION DATA (2000 Kc. to 18,100 Kc.) (Cont.)

Freq.	A	B	
6900	**7**	**1211**	
7000	7	1333	
7005	7	1339	(1.2 divisions per kc)
7010	7	1345	
7015	7	1351	
7020	7	1357	
7025	7	1363	
7030	7	1369	
7035	7	1376	
7040	7	1382	
7045	7	1388	
7050	7	1394	
7055	7	1400	
7060	7	1406	
7065	7	1412	
7070	7	1418	
7075	7	1424	
7080	7	1430	
7085	7	1436	
7090	7	1442	
7095	7	1449	
7100	7	1455	
7105	7	1461	
7110	7	1468	(1.2 divisions per kc)
7115	7	1474	
7120	7	1480	
7125	7	1486	
7130	7	1492	
7135	7	1498	
7140	7	1504	
7145	7	1510	
7150	7	1516	
7155	7	1523	
7160	7	1529	
7165	7	1535	
7170	7	1541	
7175	7	1547	
7180	7	1553	
7185	7	1560	
7190	7	1566	
7195	7	1572	
7200	**7**	**1578**	
7200	**8**	**060**	
7205	8	065	
7210	8	070	(1 division per kc)
7215	8	076	
7220	8	081	
7225	8	086	
7230	8	091	
7235	8	096	
7240	8	101	
7245	8	106	
7250	8	111	

Freq.	A	B	
7200	**8**	**060**	
7250	8	111	
7255	8	116	
7260	8	121	
7265	8	126	
7270	8	131	
7275	8	137	
7280	8	142	
7285	8	147	
7290	8	152	(1 division per kc)
7295	8	157	
7300	8	162	
7305	8	168	
7310	8	173	
7315	8	178	
7320	8	183	
7325	8	188	
7330	8	193	
7335	8	198	
7340	8	203	
7345	8	208	
7350	8	213	
7355	8	218	
7360	8	223	
7365	8	228	
7370	8	233	
7375	8	238	
7380	8	243	
7385	8	248	
7390	8	253	
7395	8	259	
7400	8	264	
7405	8	269	
7410	8	274	
7415	8	279	
7420	8	284	(1 division per kc)
7425	8	290	
7430	8	295	
7435	8	300	
7440	8	305	
7445	8	310	
7450	8	315	
7455	8	320	
7460	8	325	
7465	8	330	
7470	8	335	
7475	8	340	
7480	8	345	
7485	8	351	
7490	8	356	
7495	8	361	
7500	**8**	**366**	

Freq.	A	B	
7500	**8**	**366**	
7505	8	371	(1 division per kc)
7510	8	376	
7515	8	381	
7520	8	386	
7525	6	391	
7530	8	397	
7535	8	402	
7540	8	407	
7545	8	412	
7550	8	417	
7555	8	422	
7560	8	427	
7565	8	432	
7570	8	437	
7575	8	443	
7580	8	448	
7585	8	453	
7590	8	458	(1 division per kc)
7595	8	463	
7600	8	469	
7605	8	474	
7610	8	479	
7615	8	484	
7620	8	489	
7625	8	494	
7630	8	499	
7635	8	505	
7640	8	510	
7645	8	515	
7650	8	520	
7655	8	525	
7660	8	530	
7665	8	535	
7670	8	540	
7675	8	545	
7680	8	551	
7685	8	556	
7690	8	561	
7695	8	567	(1 division per kc)
7700	8	572	
7705	8	577	
7710	8	582	
7715	8	587	
7720	8	592	
7725	8	597	
7730	8	602	
7735	8	607	
7740	8	613	
7745	8	618	
7750	8	623	
7800	**8**	**674**	

Freq.	A	B	
7750	8	623	
7755	8	628	
7760	8	633	
7765	8	638	
7770	8	644	
7775	8	649	
7780	8	654	
7785	8	659	
7790	8	664	
7795	8	669	
7800	**8**	**674**	
7805	8	679	
7810	8	684	
7815	8	690	
7820	8	695	
7825	8	700	
7830	8	705	
7835	8	710	(1 division per kc)
7840	8	715	
7845	8	721	
7850	8	726	
7855	8	731	
7860	8	736	
7865	8	741	
7870	8	746	
7875	8	752	
7880	8	757	
7885	8	762	
7890	8	767	
7895	8	772	
7900	8	777	
7905	8	782	
7910	8	787	
7915	8	792	
7920	8	797	
7925	8	802	
7930	8	807	
7935	8	813	
7940	8	818	
7945	8	823	
7950	8	828	
7955	8	833	
7960	8	838	
7965	8	844	(1 division per kc)
7970	8	849	
7975	8	854	
7980	8	859	
7985	8	864	
7990	8	869	
7995	8	874	
8000	8	879	
8100	**8**	**981**	

Use nearest check point shown in heavy type.

Frequency 8000 to 10000 kilocycles

TABLE 3-2 H-F OSCILLATOR CALIBRATION DATA (2000 Kc. to 18,100 Kc.) (Cont.)

Freq.	A	B	
8000	8	879	
8010	8	890	
8020	8	900	
8030	8	910	
8040	8	920	
8050	8	930	
8060	8	940	
8070	8	951	
8080	8	961	
8090	8	971	
8100	**8**	**981**	(1 division per kc)
8110	8	991	
8120	8	1001	
8130	8	1012	
8140	8	1022	
8150	8	1032	
8160	8	1042	
8170	8	1052	
8180	8	1062	
8190	8	1073	
8200	8	1083	
8210	8	1093	
8220	8	1103	
8230	8	1113	
8240	8	1123	
8250	8	1133	
8260	8	1143	
8270	8	1153	
8280	8	1163	
8290	8	1173	
8300	8	1183	
8310	8	1194	
8320	8	1204	
8330	8	1214	
8340	8	1224	
8350	8	1234	
8360	8	1244	
8370	8	1254	(1 division per kc)
8380	8	1264	
8390	8	1274	
8400	**8**	**1285**	
8410	8	1295	
8420	8	1305	
8430	8	1315	
8440	8	1325	
8450	8	1335	
8460	8	1345	
8470	8	1355	
8480	8	1365	
8490	8	1376	
8500	8	1386	

Freq.	A	B	
8400	**8**	**1285**	(1 division per kc)
8500	8	1386	
8510	8	1396	
8520	8	1406	
8530	8	1416	
8540	8	1426	
8550	8	1436	
8560	8	1446	
8570	8	1456	
8580	8	1467	
8590	8	1477	
8600	8	1487	
8610	8	1498	
8620	8	1508	
8630	8	1518	
8640	8	1528	
8650	8	1538	
8660	8	1548	
8670	8	1559	(1 division per kc)
8680	8	1569	
8690	8	1579	
8700	**8**	**1590**	
8710	8	1600	
8720	8	1610	
8730	8	1621	
8740	8	1631	
8750	8	1641	
8760	8	1653	
8770	8	1663	
8780	8	1673	
8790	8	1683	
8800	8	1694	
8810	8	1704	
8820	8	1715	
8830	8	1725	
8840	8	1736	
8850	8	1747	
8860	8	1757	
8870	8	1768	
8880	8	1779	
8890	8	1789	
8900	8	1799	(1 division per kc)
8910	8	1811	
8920	8	1821	
8930	8	1832	
8940	8	1843	
8950	8	1854	
8960	8	1865	
8970	8	1877	
8980	8	1888	
8990	8	1899	
9000	**8**	**1910**	

Freq.	A	B	
9000	**9**	**100**	
9010	9	108	
9020	9	116	
9030	9	124	
9040	9	132	
9050	9	140	
9060	9	148	
9070	9	156	(0.8 divisions per kc)
9080	9	165	
9090	9	174	
9100	9	182	
9110	9	190	
9120	9	198	
9130	9	206	
9140	9	214	
9150	9	222	
9160	9	230	
9170	9	239	
9180	9	248	
9190	9	256	
9200	9	264	
9210	9	272	
9220	9	280	
9230	9	288	
9240	9	296	
9250	9	304	
9260	9	313	
9270	9	322	
9280	9	330	
9290	9	338	
9300	9	346	
9310	9	354	
9320	9	362	
9330	9	370	(0.8 divisions per kc)
9340	9	378	
9350	9	387	
9360	9	396	
9370	9	404	
9380	9	412	
9390	9	420	
9400	9	428	
9410	9	436	
9420	9	444	
9430	9	452	
9440	9	461	
9450	**9**	**470**	
9460	9	478	
9470	9	486	
9480	9	494	
9490	9	502	
9500	9	510	

Freq.	A	B	
9450	**9**	**470**	
9500	9	510	
9510	9	518	
9520	9	527	
9530	9	536	
9540	9	545	
9550	9	553	
9560	9	561	(0.8 divisions per kc)
9570	9	570	
9580	9	578	
9590	9	586	
9600	9	595	
9610	9	601	
9620	9	610	
9630	9	620	
9640	9	628	
9650	9	636	
9660	9	644	
9670	9	652	
9680	9	660	
9690	9	668	
9700	9	676	
9710	9	684	
9720	9	693	
9730	9	701	
9740	9	709	
9750	9	717	
9760	9	725	
9770	9	733	
9780	9	742	
9790	9	751	
9800	9	760	
9810	9	769	
9820	9	777	(0.8 divisions per kc)
9830	9	785	
9840	9	793	
9850	9	801	
9860	9	809	
9870	9	817	
9880	9	825	
9890	9	834	
9900	**9**	**843**	
9910	9	851	
9920	9	859	
9930	9	867	
9940	9	875	
9950	9	883	
9960	9	891	
9970	9	899	
9980	9	908	
9990	9	917	
10000	9	925	

Use nearest check point shown in heavy type.

Frequency 10000 to 12000 kilocycles

TABLE 3-2 H-F OSCILLATOR CALIBRATION DATA (2000 Kc. to 18,100 Kc.) (Cont.)

Freq.	A	B	
9900	**9**	**843**	
10000	9	925	
10010	9	933	
10020	9	941	(0.8 divisions per kc)
10030	9	949	
10040	9	957	
10050	9	965	
10060	9	973	
10070	9	982	
10080	9	991	
10090	9	999	
10100	9	1007	
10110	9	1015	
10120	9	1023	
10130	9	1031	
10140	9	1039	
10150	9	1047	
10160	9	1055	
10170	9	1064	
10180	9	1072	
10190	9	1080	
10200	9	1089	
10210	9	1097	
10220	9	1105	
10230	9	1113	
10240	9	1121	
10250	9	1129	
10260	9	1138	
10270	9	1146	
10280	9	1154	
10290	9	1162	(0.8 divisions per kc)
10300	9	1170	
10310	9	1178	
10320	9	1186	
10330	9	1194	
10340	9	1202	
10350	**9**	**1211**	
10360	9	1219	
10370	9	1227	
10380	9	1235	
10390	9	1243	
10400	9	1251	
10410	9	1259	
10420	9	1267	
10430	9	1275	
10440	9	1284	
10450	9	1292	
10460	9	1300	
10470	9	1308	
10480	9	1316	
10490	9	1324	
10500	9	1333	

Freq.	A	B	
10350	**9**	**1211**	(0.8 divisions per kc)
10500	9	1333	
10510	9	1341	
10520	9	1349	
10530	9	1357	
10540	9	1365	
10550	9	1373	
10560	9	1381	
10570	9	1389	
10580	9	1397	
10590	9	1405	
10600	9	1413	
10610	9	1421	
10620	9	1430	
10630	9	1438	
10640	9	1446	
10650	9	1454	
10660	9	1462	(0.8 divisions per kc)
10670	9	1470	
10680	9	1478	
10690	9	1486	
10700	9	1494	
10710	9	1504	
10720	9	1512	
10730	9	1520	
10740	9	1528	
10750	9	1536	
10760	9	1544	
10770	9	1552	
10780	9	1560	
10790	9	1569	
10800	**9**	**1578**	
10800	**10**	**060**	
10810	10	066	
10820	10	072	
10830	10	079	
10840	10	086	
10850	10	093	
10860	10	100	
10870	10	107	(0.68 divisions per kc)
10880	10	114	
10890	10	121	
10900	10	127	
10910	10	134	
10920	10	141	
10930	10	148	
10940	10	155	
10950	10	162	
10960	10	169	
10970	10	176	
10980	10	183	
10990	10	189	
11000	10	195	

Freq.	A	B	
10800	**10**	**060**	
11000	10	195	
11010	10	202	
11020	10	209	
11030	10	216	
11040	10	223	
11050	10	230	
11060	10	237	
11070	10	243	
11080	10	249	
11090	10	256	
11100	10	264	
11110	10	270	
11120	10	277	
11130	10	284	
11140	10	291	
11150	10	297	
11160	10	305	(0.68 divisions per kc)
11170	10	311	
11180	10	317	
11190	10	324	
11200	10	331	
11210	10	338	
11220	10	345	
11230	10	352	
11240	10	359	
11250	**10**	**366**	
11260	10	372	
11270	10	378	
11280	10	385	
11290	10	392	
11300	10	399	
11310	10	406	
11320	10	413	
11330	10	420	
11340	10	427	
11350	10	433	
11360	10	440	
11370	10	447	
11380	10	454	
11390	10	462	
11400	10	469	
11410	10	475	
11420	10	482	
11430	10	489	
11440	10	495	(0.68 divisions per kc)
11450	10	503	
11460	10	510	
11470	10	517	
11480	10	524	
11490	10	531	
11500	10	538	
11700	**10**	**674**	

Freq.	A	B	
11500	10	538	
11510	10	545	
11520	10	551	
11530	10	557	
11540	10	563	
11550	10	570	
11560	10	577	
11570	10	584	
11580	10	591	
11590	10	598	
11600	10	605	
11610	10	613	
11620	10	619	
11630	10	625	
11640	10	632	(0.68 divisions per kc)
11650	10	639	
11660	10	646	
11670	10	653	
11680	10	660	
11690	10	667	
11700	**10**	**674**	
11710	10	680	
11720	10	687	
11730	10	694	
11740	10	701	
11750	10	708	
11760	10	715	
11770	10	722	
11780	10	729	
11790	10	736	
11800	10	742	
11810	10	748	
11820	10	755	
11830	10	762	
11840	10	769	
11850	10	776	
11860	10	783	
11870	10	790	
11880	10	797	
11890	10	803	(0.66 divisions per kc)
11900	10	810	
11910	10	817	
11920	10	824	
11930	10	831	
11940	10	838	
11950	10	845	
11960	10	852	
11970	10	859	
11980	10	866	
11990	10	873	
12000	**10**	**879**	

Use nearest check point shown in heavy type.

TABLE 3-2 H-F OSCILLATOR CALIBRATION DATA (2000 Kc. to 18,100 Kc.) (Cont.)

Freq.	A	B	Freq.	A	B	Freq.	A	B	Freq.	A	B
12000	**11**	**100**	12500	11	408	13000	11	719	13500	11	1027
12010	11	106	12510	11	415	13010	11	725	10510	11	1033
12020	11	112	12520	11	421	13020	11	732	13520	11	1039
12030	11	119	12530	11	427	13030	11	738	13530	11	1046
12040	11	125	12540	11	433	13040	11	744	13540	11	1052
12050	11	131	12550	11	439	13050	11	750	13550	11	1058
12060	11	138	12560	11	445	13060	11	756	13560	11	1064
12070	11	144	12570	11	452	13070	11	762	13570	11	1070
12080	11	150	12580	11	458	13080	11	769	13580	11	1076
12090	11	156	12590	11	464	13090	11	775	13590	11	1083
12100	11	162	**12600**	**11**	**470**	13100	11	781	13600	11	1089 (0.6 divisions per kc)
12110	11	168	12610	11	476	13110	11	787	13610	11	1095
12120	11	174	12620	11	482	13120	11	793	13620	11	1101
12130	11	180	12630	11	489	13130	11	799	13630	11	1107
12140	11	187	12640	11	495	13140	11	806	13640	11	1113
12150	11	193 (0.6 divisions per kc)	12650	11	501	13150	11	812	13650	11	1119
12160	11	199	12660	11	508	13160	11	818	13660	11	1125
12170	11	205	12670	11	514	13170	11	824	13670	11	1131
12180	11	211	12680	11	520	13180	11	830	13680	11	1138
12190	11	217	12690	11	526	13190	11	836 (0.6 divisions per kc)	13690	11	1144
12200	11	223	12700	11	532 (0.6 divisions per kc)	**13200**	**11**	**843**	13700	11	1150
12210	11	230	12710	11	538	13210	11	849	13710	11	1156
12220	11	236	12720	11	545	13220	11	855	13720	11	1162
12230	11	242	12730	11	551	13230	11	862	13730	11	1168
12240	11	248	12740	11	557	13240	11	868	13740	11	1174
12250	11	254	12750	11	564	13250	11	874	13750	11	1180
12260	11	260	12760	11	570	13260	11	880	13760	11	1186
12270	11	267	12770	11	576	13270	11	886	13770	11	1193
12280	11	273	12780	11	582	13280	11	892	13780	11	1199
12290	11	279	12790	11	590	13290	11	898	13790	11	1205
			12800	11	595	13300	11	904	**13800**	**11**	**1211**
12300	11	285	12810	11	601	13310	11	910	13810	11	1217
12310	11	291	12820	11	607	13320	11	917	13820	11	1223
12320	11	297	12830	11	613	13330	11	923	13830	11	1229
12330	11	303	12840	11	620	13340	11	929	13840	11	1235
12340	11	309	12850	11	626	13350	11	935	13850	11	1241
12350	11	315	12860	11	632	13360	11	941	13860	11	1247
12360	11	322	12870	11	638	13370	11	947	13870	11	1253
12370	11	328	12880	11	644	13380	11	954	13880	11	1259
12380	11	334	12890	11	650	13390	11	960	13890	11	1266
12390	11	340	12900	11	657	13400	11	966	13900	11	1272 (0.6 divisions per kc)
12400	11	346 (0.6 divisions per kc)							13910	11	1278
12410	11	352	12910	11	663	13410	11	972	13920	11	1284
12420	11	359	12920	11	669	13420	11	980	13930	11	1290
12430	11	365	12930	11	675	13430	11	986	13940	11	1296
12440	11	371	12940	11	681	13440	11	991	13950	11	1302
12450	11	377	12950	11	687 (0.6 divisions per kc)	13450	11	997	13960	11	1308
12460	11	383	12960	11	693	13460	11	1003 (0.6 divisions per kc)	13970	11	1314
12470	11	389	12970	11	699	13470	11	1009	13980	11	1321
12480	11	396	12980	11	706	13480	11	1015	13990	11	1327
12490	11	402	12990	11	713	13490	11	1021	14000	11	1333
12500	11	408	13000	11	719	13500	11	1027			
12600	**11**	**470**	**13200**	**11**	**843**						

Use nearest check point shown in heavy type.

Frequency 14000 to 16000 kilocycles

TABLE 3-2 H-F OSCILLATOR CALIBRATION DATA (2000 Kc. to 18,100 Kc.) (Cont.)

Freq.	A	B	
13800	**11**	**1211**	
14000	11	1333	
14010	11	1339	
14020	11	1345	
14030	11	1351	
14040	11	1357	
14050	11	1363	(0.6 divisions per kc)
14060	11	1369	
14070	11	1376	
14080	11	1382	
14090	11	1388	
14100	11	1394	
14110	11	1400	
14120	11	1406	
14130	11	1412	
14140	11	1418	
14150	11	1424	
14160	11	1430	
14170	11	1436	
14180	11	1442	
14190	11	1449	
14200	11	1455	
14210	11	1461	
14220	11	1468	
14230	11	1474	
14240	11	1480	
14250	11	1486	(0.6 divisions per kc)
14260	11	1492	
14270	11	1498	
14280	11	1504	
14290	11	1510	
14300	11	1516	
14310	11	1523	
14320	11	1529	
14330	11	1535	
14340	11	1541	
14350	11	1547	
14360	11	1553	
14370	11	1560	
14380	11	1566	
14390	11	1572	
14400	**11**	**1578**	
14400	**12**	**060**	
14410	12	065	
14420	12	070	
14430	12	076	
14440	12	081	
14450	12	086	(0.5 divisions per kc)
14460	12	091	
14470	12	096	
14480	12	101	
14490	12	106	
14500	12	111	

Freq.	A	B	
14400	**12**	**060**	
14500	12	111	
14510	12	116	
14520	12	121	
14530	12	126	
14540	12	131	
14550	12	137	
14560	12	142	
14570	12	147	
14580	12	152	
14590	12	157	(0.5 divisions per kc)
14600	12	162	
14610	12	168	
14620	12	173	
14630	12	178	
14640	12	183	
14650	12	188	
14660	12	193	
14670	12	198	
14680	12	203	
14690	12	208	
14700	12	213	
14710	12	218	
14720	12	223	
14730	12	228	
14740	12	233	
14750	12	238	
14760	12	243	
14770	12	248	
14780	12	253	
14790	12	259	
14800	12	264	
14810	12	269	
14820	12	274	
14830	12	279	
14840	12	284	
14850	12	290	(0.5 divisions per kc)
14860	12	295	
14870	12	300	
14880	12	305	
14890	12	310	
14900	12	315	
14910	12	320	
14920	12	325	
14930	12	330	
14940	12	335	
14950	12	340	
14960	12	345	
14970	12	351	
14980	12	356	
14990	12	361	
15000	**12**	**366**	

Freq.	A	B	
15000	**12**	**366**	
15010	12	371	
15020	12	376	
15030	12	381	
15040	12	386	
15050	12	391	(0.5 divisions per kc)
15060	12	397	
15070	12	402	
15080	12	407	
15090	12	412	
15100	12	417	
15110	12	422	
15120	12	427	
15130	12	432	
15140	12	437	
15150	12	443	
15160	12	448	
15170	12	453	
15180	12	458	
15190	12	463	
15200	12	469	(0.5 divisions per kc)
15210	12	474	
15220	12	479	
15230	12	484	
15240	12	489	
15250	12	494	
15260	12	499	
15270	12	505	
15280	12	510	
15290	12	515	
15300	12	520	
15310	12	525	
15320	12	530	
15330	12	535	
15340	12	540	
15350	12	545	
15360	12	551	
15370	12	556	
15380	12	561	
15390	12	567	
15400	12	572	(0.5 divisions per kc)
15410	12	577	
15420	12	582	
15430	12	587	
15440	12	592	
15450	12	597	
15460	12	602	
15470	12	607	
15480	12	613	
15490	12	618	
15500	12	623	
15600	**12**	**674**	

Freq.	A	B	
15500	12	623	
15510	12	628	
15520	12	633	
15530	12	638	
15540	12	644	
15550	12	649	
15560	12	654	
15570	12	659	
15580	12	664	
15590	12	699	
15600	**12**	**674**	
15610	12	679	
15620	12	684	
15630	12	689	
15640	12	694	(0.5 divisions per kc)
15650	12	699	
15660	12	705	
15670	12	710	
15680	12	715	
15690	12	721	
15700	12	726	
15710	12	731	
15720	12	736	
15730	12	741	
15740	12	746	
15750	12	752	
15760	12	757	
15770	12	762	
15780	12	767	
15790	12	772	
15800	12	777	
15810	12	782	
15820	12	787	
15830	12	792	
15840	12	797	
15850	12	802	(0.5 divisions per kc)
15860	12	807	
15870	12	813	
15880	12	818	
15890	12	823	
15900	12	828	
15910	12	833	
15920	12	838	
15930	12	844	
15940	12	849	
15950	12	854	(0.5 divisions per kc)
15960	12	859	
15970	12	864	
15980	12	869	
15990	12	874	
16000	12	879	
16200	**12**	**981**	

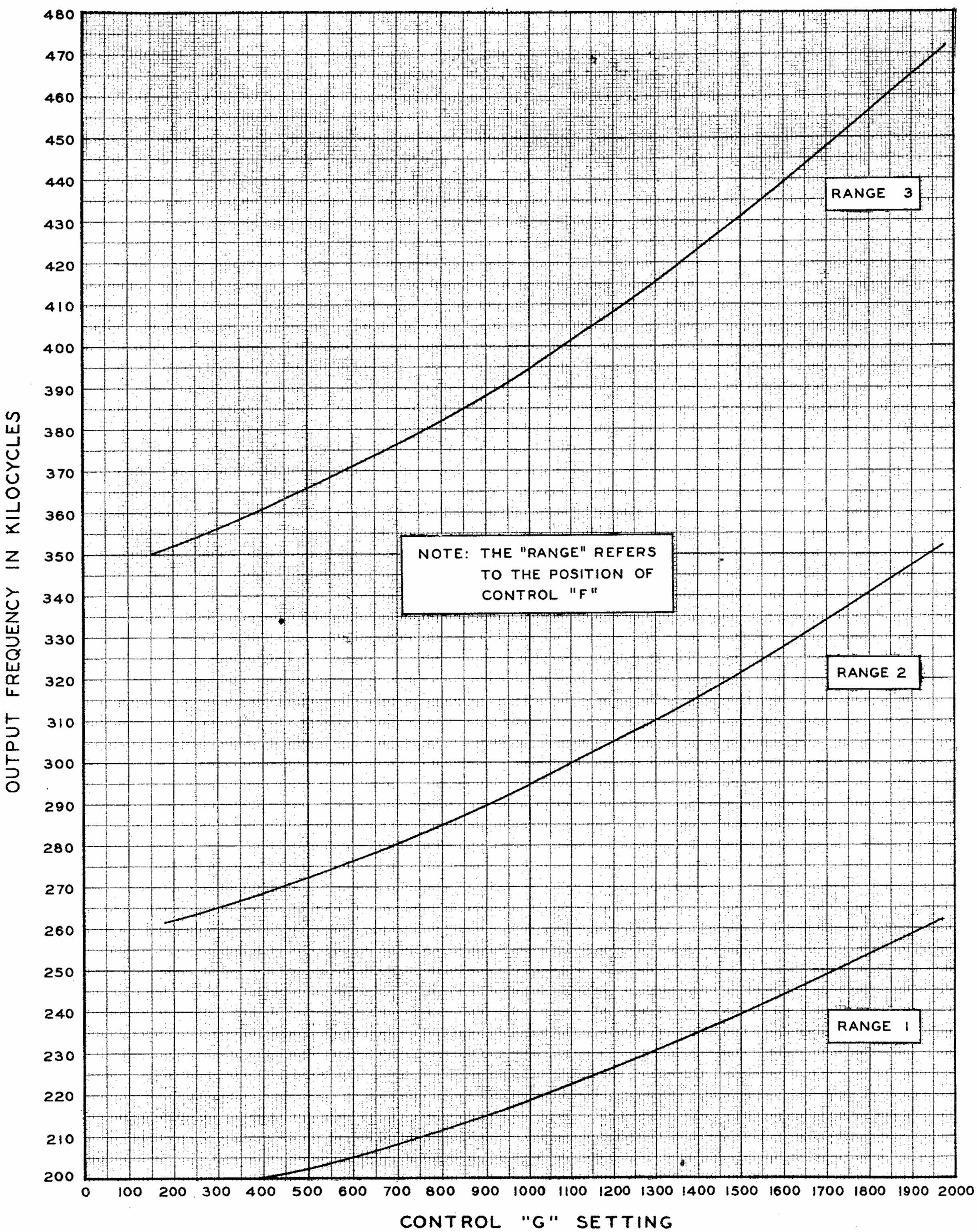
Use nearest check point shown in heavy type.

TABLE 3-2 H-F OSCILLATOR CALIBRATION DATA (2000 Kc. to 18,100 Kc.) (Cont.)

Freq.	A	B		Freq.	A	B	
16000	12	879		16500	12	1133	
16010	12	884		16510	12	1138	
16020	12	890		16520	12	1143	
16030	12	895		16530	12	1148	
16040	12	900		16540	12	1153	
16050	12	905		16550	12	1158	
16060	12	910		16560	12	1163	
16070	12	915		16570	12	1168	
16080	12	920		16580	12	1173	(0.51 divisions per kc)
16090	12	925	(0.5 divisions per kc)	16590	12	1179	
16100	12	930		16600	12	1184	
16110	12	935		16610	12	1189	
16120	12	940		16620	12	1194	
16130	12	945		16630	12	1199	
16140	12	951		16640	12	1204	
16150	12	956		16650	12	1209	
16160	12	961		16660	12	1214	
16170	12	966		16670	12	1219	
16180	12	971		16680	12	1224	
16190	12	976		16690	12	1229	
16200	**12**	**981**		16700	12	1234	
16210	12	986		16710	12	1239	
16220	12	991		16720	12	1244	
16230	12	996		16730	12	1249	
16240	12	1001		16740	12	1254	
16250	12	1006		16750	12	1259	
16260	12	1012		16760	12	1264	
16270	12	1017		16770	12	1270	
16280	12	1022		16780	12	1275	
16290	12	1027		16790	12	1280	
16300	12	1032		**16800**	**12**	**1285**	
16310	12	1037		16810	12	1290	
16320	12	1042		16820	12	1295	
16330	12	1047		16830	12	1300	
16340	12	1052		16840	12	1305	
16350	12	1057		16850	12	1310	
16360	12	1062	(0.5 divisions per kc)	16860	12	1315	(0.51 divisions per kc)
16370	12	1067		16870	12	1320	
16380	12	1073		16880	12	1325	
16390	12	1078		16890	12	1330	
16400	12	1083		16900	12	1335	
16410	12	1088		16910	12	1340	
16420	12	1093		16920	12	1345	
16430	12	1098		16930	12	1350	
16440	12	1103		16940	12	1355	
16450	12	1108		16950	12	1361	
16460	12	1113		16960	12	1366	
16470	12	1118		16970	12	1371	
16480	12	1123		16980	12	1376	
16490	12	1128		16990	12	1381	
16500	12	1133		17000	12	1386	

Freq.	A	B		Freq.	A	B	
16800	**12**	**1285**		**17400**	**12**	**1590**	
17000	12	1386	(0.52 divisions per kc)	17550	12	1668	
17010	12	1391		17560	12	1673	
17020	12	1396		17570	12	1678	
17030	12	1401		17580	12	1683	(0.54 divisions per kc)
17040	12	1406		17590	12	1688	
17050	12	1411		17600	12	1694	
17060	12	1416		17610	12	1699	
17070	12	1421		17620	12	1704	
17080	12	1426		17630	12	1709	
17090	12	1431		17640	12	1715	
17100	12	1436		17650	12	1720	
				17660	12	1725	
17110	12	1441		17670	12	1731	
17120	12	1446		17680	12	1736	
17130	12	1452		17690	12	1742	
17140	12	1457		17700	12	1747	
17150	12	1462					
17160	12	1467		17710	12	1752	
17170	12	1472		17720	12	1757	
17180	12	1477		17730	12	1763	
17190	12	1482		17740	12	1768	
17200	12	1487		17750	12	1773	
17210	12	1492		17760	12	1779	
17220	12	1498		17770	12	1784	
17230	12	1503		17780	12	1789	
17240	12	1508		17790	12	1795	
17250	12	1513		17800	12	1800	
17260	12	1518		17810	12	1805	
17270	12	1523		17820	12	1811	
17280	12	1528		17830	12	1816	
17290	12	1533	(0.53 divisions per kc)	17840	12	1821	
17300	12	1538		17850	12	1827	
17310	12	1544		17860	12	1832	
17320	12	1549		17870	12	1837	(0.58 divisions per kc)
17330	12	1554		17880	12	1843	
17340	12	1559		17890	12	1848	
17350	12	1564		17900	12	1854	
17360	12	1569		17910	12	1860	
17370	12	1574		17920	12	1865	
17380	12	1579		17930	12	1871	
17390	12	1584		17940	12	1877	
17400	**12**	**1590**		17950	12	1882	
17410	12	1595		17960	12	1888	
17420	12	1600		17970	12	1893	
17430	12	1605		17980	12	1898	
17440	12	1610		17990	12	1904	
17450	12	1615		**18000**	**12**	**1910**	
17460	12	1621		18010	12	1915	
17470	12	1626		18020	12	1921	
17480	12	1631		18030	12	1927	
17490	12	1636		18040	12	1933	
17500	12	1641		18050	12	1939	
17510	12	1647		18060	12	1944	
17520	12	1653		18070	12	1949	
17530	12	1658		18080	12	1955	
17540	12	1663		18090	12	1961	
17550	12	1668		18100	12	1966	

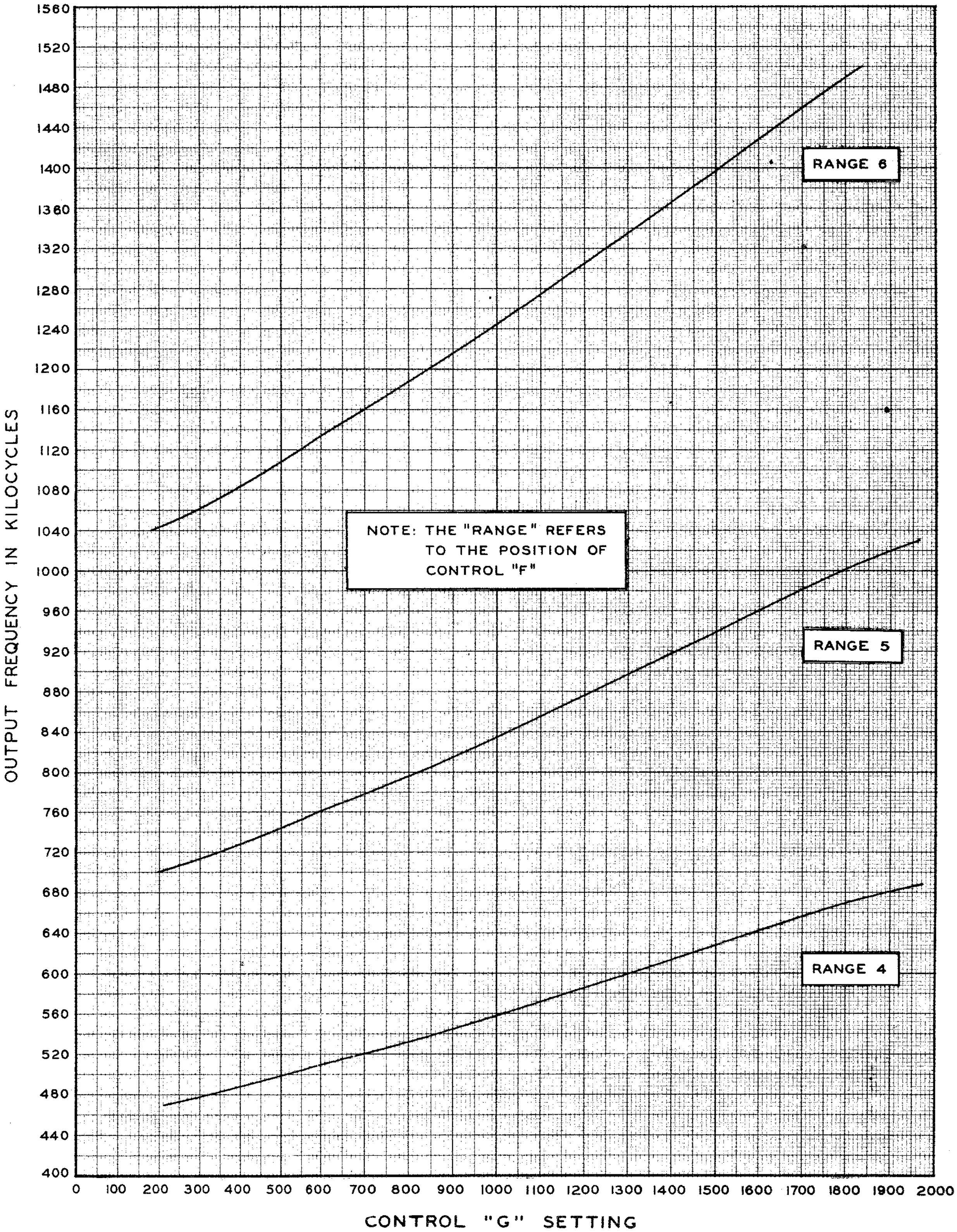
Use nearest check point shown in heavy type.



LOW FREQUENCY TUNING CHART

200KC TO 475KC

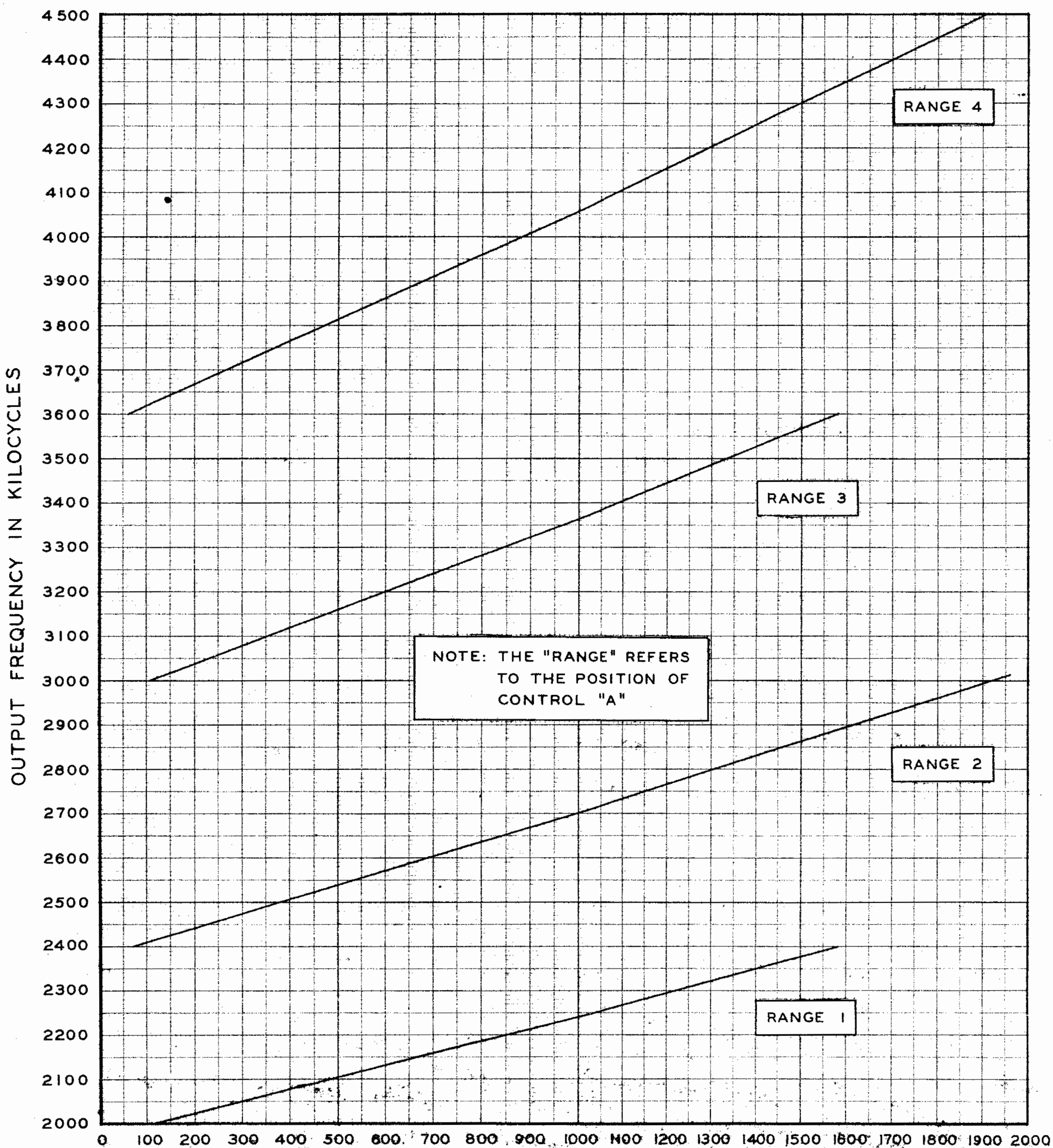
D420A



LOW FREQUENCY TUNING CHART

475KC TO 1500KC

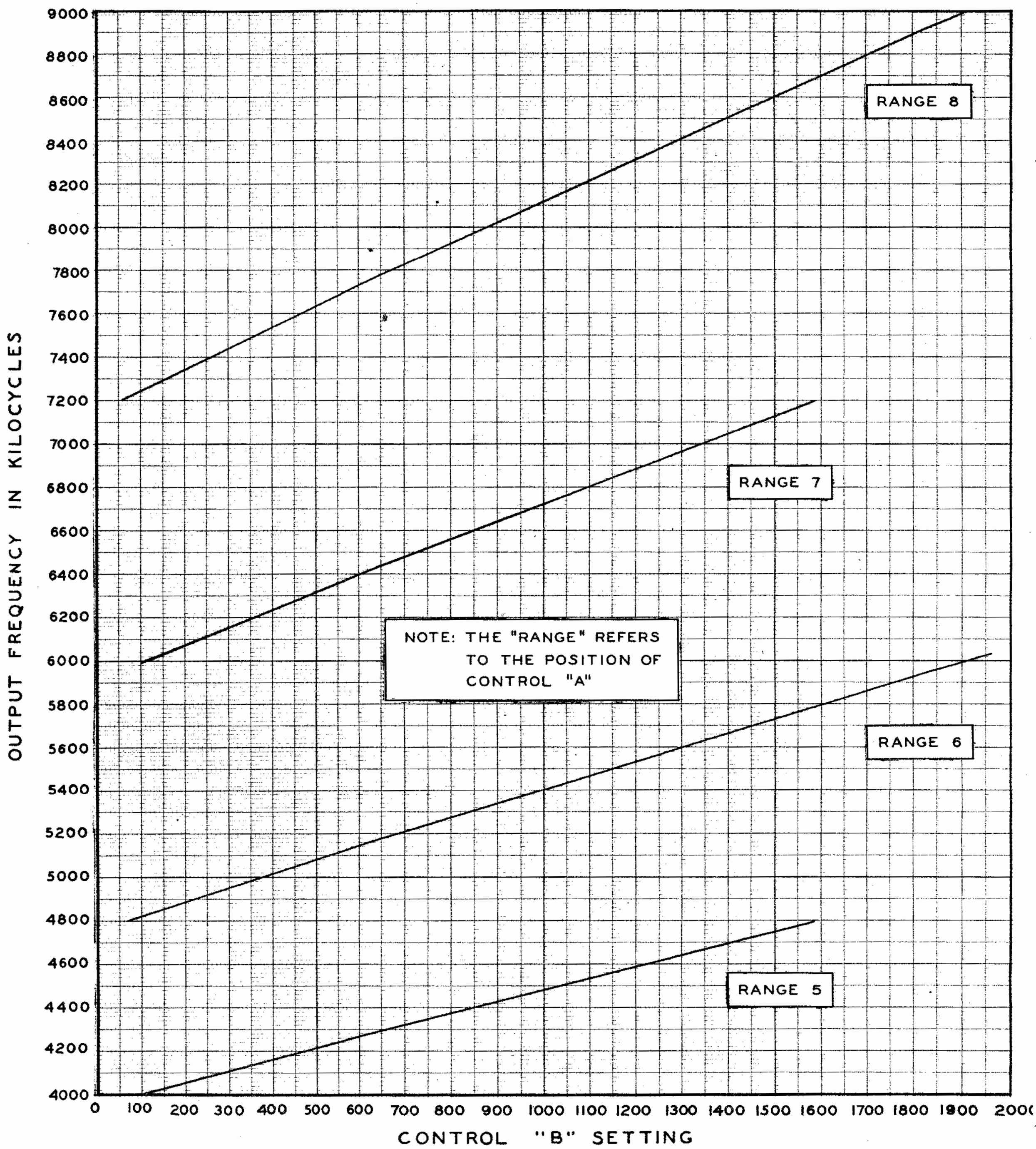
D421A



HIGH FREQUENCY TUNING CHART

2000KC TO 4000KC

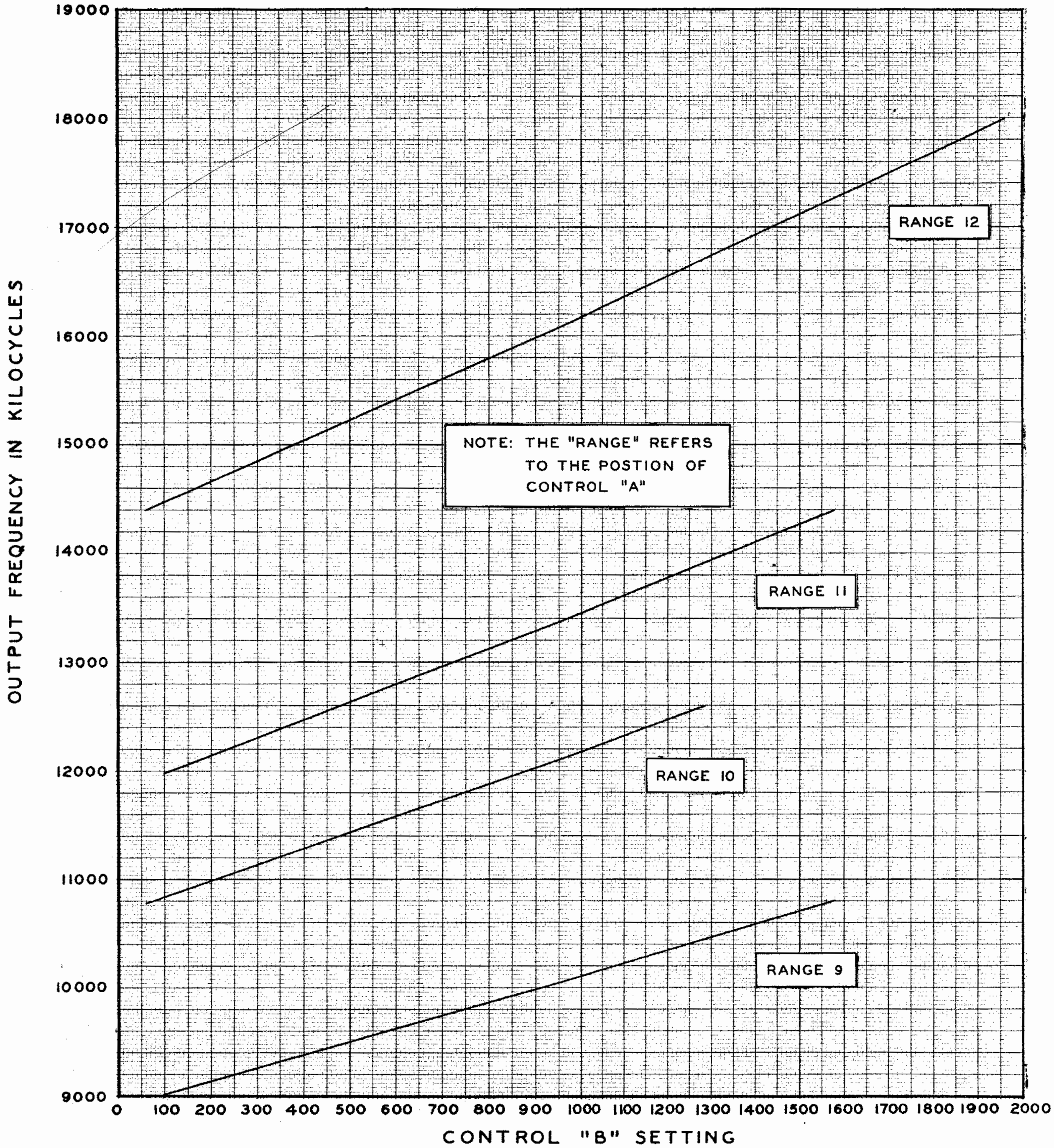
D542A



HIGH FREQUENCY TUNING CHART

4000 KC TO 9000 KC

D418A



HIGH FREQUENCY TUNING CHART

9000 KC TO 18,000 KC

D419A

TABLE 3-3 TYPICAL ANTENNA TUNING DATA (Without Capacitor)

DO NOT USE ANTENNA CAPACITOR

20 Ft. Antenna

KC	C	D	E
3000	1-2	...	70
3500	2-3	...	115
4000	3-4	...	130
5000	4-5	70	150
6000	5-6	45	170
8000	6-7	30	185
10000	7	75	190
11000	7	90	200
11300	7	100	200
10500	11	67	200
11000	11	75	200
11500	11	85	200
12000	11	100	200
12000	11	75	30
13000	11	75	140
14000	11	80	164
15000	11	85	170
11500	12	60	10
12000	12	55	60
13000	12	55	155
14000	12	60	180
16000	12	75	190
18000	12	85	200
16000	13	60	150
17000	13	65	170
18000	13	65	180

22.5 Ft. Antenna

KC	C	D	E
2800	1-2	...	70
3000	1-2	...	70
3500	2-3	...	120
4000	3-4	...	130
5000	4-5	90	150
6000	5-6	60	160
8000	6-7	40	185
10000	7	80	200
9500	11	60	200
10000	11	65	200
10500	11	77	200
11000	11	94	200
11000	11	64	66
12000	11	65	150
13000	11	68	165
14000	11	75	180
15000	11	80	180
11500	12	38	145
12000	12	40	170
13000	12	45	190
14000	12	65	200
16000	12	75	200
16000	13	40	170
17000	13	60	175
18000	13	65	185

25 Ft. Antenna

KC	C	D	E
2700	1-2	...	10
3000	2-3	...	60
3500	3-4	...	100
4000	4-5	...	125
5000	5-6	...	150
6000	6	80	160
8000	6-7	70	180
9800	7	100	200
9000	10	75	200
9500	10	85	200
9500	10	65	0
10000	10	65	55
11000	10	65	150
12000	10	70	170
14000	10	85	180
15000	10	95	190
11000	11	53	160
12000	11	55	180
14000	11	70	200
15000	11	80	200
16000	11	95	200
15000	13	0	155
16000	13	0	180
17000	13	35	190
18000	13	55	195

27.5 Ft. Antenna

KC	C	D	E
2600	1	...	0
3000	2	...	75
3500	3-4	...	110
4000	4-5	...	130
5000	6	...	150
6000	6-7	...	165
8000	7	70	190
9100	7	100	200
9000	10	59	10
9500	10	57	80
10000	10	55	110
11000	10	60	175
12000	10	65	185
14000	10	80	195
15500	10	100	195
9000	11	45	40
10000	11	40	140
12000	11	55	195
14000	11	75	200
16500	11	95	200
16000	13	0	180
17000	13	45	190
18000	13	60	195

TABLE 3-3 TYPICAL ANTENNA TUNING DATA (Without Capacitor) (Cont.)

DO NOT USE ANTENNA CAPACITOR

27.5 Ft. Antenna

KC	C	D	E
2600	1	...	0
3000	2	...	75
3500	3-4	...	110
4000	4-5	...	130
5000	6	...	150
6000	6-7	...	165
8000	7	70	190
9100	7	100	200
9000	10	59	10
9500	10	57	80
10000	10	55	110
11000	10	60	175
12000	10	65	185
14000	10	80	195
15500	10	100	195
9000	11	45	40
10000	11	40	140
12000	11	55	195
14000	11	75	200
16500	11	95	200
16000	13	0	180
17000	13	45	190
18000	13	60	195

30 Ft. Antenna

KC	C	D	E
2500	1-2	...	20
3000	3-4	...	70
3500	4	...	95
4000	4-5	...	120
5000	5-6	...	145
6000	6-7	...	165
8000	7	95	180
8500	7	100	200
8200	10	48	0
9000	10	48	130
10000	10	50	170
11000	10	55	200
12000	10	63	200
14000	10	82	200
15000	10	92	200
15600	10	98	200
8000	11	62	110
10000	11	32	180
12000	11	45	200
14000	11	65	200
16000	11	90	200
16600	11	98	200
16000	13	0	184
17000	13	45	188
18000	13	70	188

32.5 Ft. Antenna

KC	C	D	E
2450	1-2	...	26
3000	3	...	65
3500	4-5	...	100
4000	5	...	120
5000	5-6	...	150
6000	6-7	...	165
8000	7	100	200
7600	10	36	0
8000	10	37	90
9000	10	42	160
10000	10	46	185
11000	10	54	200
12000	10	65	200
13000	10	75	200
14000	10	82	200
14600	10	88	200
8000	11	0	113
9000	11	22	168
10000	11	35	188
11000	11	47	200
12000	11	60	200
14000	11	78	200
16000	11	100	188
16200	11	100	200
16000	13	52	165
16500	13	69	160
17000	13	70	170
18000	13	75	180

35 Ft. Antenna

KC	C	D	E
2400	1-2	...	0
3000	3-4	...	70
3500	4-5	...	100
4000	5-6	...	120
5000	6-7	...	145
6000	7	...	160
7000	7	...	180
7600	7	100	200
7500	8	70	0
8000	8	75	40
9000	8	85	62
10000	8	100	100
10400	8	100	126
8700	11	0	175
9000	11	8	180
10000	11	28	200
11000	11	52	200
12000	11	62	200
14000	11	77	200
15000	11	86	200
15700	11	100	190
15000	13	0	166
16000	13	66	152
17000	13	84	142
18000	13	100	154

TABLE 3-3 TYPICAL ANTENNA TUNING DATA (Without Capacitor) (Cont.)

DO NOT USE ANTENNA CAPACITOR

35 Ft. Antenna

KC	C	D	E
2400	1-2	...	0
3000	3-4	...	70
3500	4-5	...	100
4000	5-6	...	120
5000	6-7	...	145
6000	7	...	160
7000	7	...	180
7600	7	100	200
7500	8	70	0
8000	8	75	40
9000	8	85	62
10000	8	100	100
10400	8	100	126
8700	11	0	175
9000	11	8	180
10000	11	28	200
11000	11	52	200
12000	11	62	200
14000	11	77	200
15000	11	86	200
15700	11	100	190
15000	13	0	166
16000	13	66	152
17000	13	84	142
18000	13	100	154

40 Ft. Antenna

KC	C	D	E
2300	1-2	...	3
2500	2-3	...	10
3000	3-4	...	60
3500	4-5	...	95
4000	5-6	...	120
5000	6-7	...	150
6000	7	...	170
6800	7	100	200
6600	8	57	0
7000	8	60	50
8000	8	70	121
9000	8	83	111
10000	8	97	121
10500	8	100	140
8400	10	0	188
9000	10	25	196
10000	10	47	200
11000	10	60	200
12000	10	70	200
14000	10	88	200
14500	10	100	200
14500	12	71	200
15000	12	76	200
16000	12	84	200
17000	12	100	141
18000	12	100	146

45 Ft. Antenna

KC	C	D	E
2200	1-2	...	0
2500	2-3	...	20
3000	4-5	...	62
3500	5-6	...	90
4000	6	...	120
5000	7	...	155
6000	7	100	175
6100	7	100	185
6000	8	49	0
7000	8	59	106
8000	8	69	129
9000	8	85	106
9800	8	100	90
7500	10	0	171
8000	10	0	185
9000	10	38	193
10000	10	53	200
11000	10	64	200
12000	10	73	200
13000	10	83	200
13740	10	100	182
13500	12	66	200
14000	12	70	200
15000	12	82	92
16000	12	85	125
17000	12	87	164
18000	12	86	195

50 Ft. Antenna

KC	C	D	E
2100	1-2	...	0
2500	3-4	...	19
3000	4-5	...	55
3500	5-6	...	95
4000	6-7	...	120
5000	7	...	160
5500	7	100	180
5400	8	32	0
6000	8	38	90
7000	8	48	148
8000	8	65	152
9000	8	85	148
10000	8	92	142
9000	11	29	200
10000	11	40	200
11000	11	53	200
12000	11	72	200
13000	11	82	200
14000	11	100	0
15000	11	98	135
13500	13	37	28
14000	13	45	52
15000	13	52	125
16000	13	69	136
17000	13	71	164
18000	13	68	184

TABLE 3-3 TYPICAL ANTENNA TUNING DATA (Without Capacitor) (Cont.)

DO NOT USE ANTENNA CAPACITOR

50 Ft. Antenna

KC	C	D	E
2100	1-2	...	0
2500	3-4	...	19
3000	4-5	...	55
3500	5-6	...	95
4000	6-7	...	120
5000	7	...	160
5500	7	...	100
5400	8	32	0
6000	8	38	90
7000	8	48	148
8000	8	65	152
9000	8	85	143
10000	8	92	142
9000	11	29	200
10000	11	40	200
11000	11	53	200
12000	11	72	200
13000	11	82	200
14000	11	100	0
15000	11	98	135
13500	13	37	28
14000	13	45	52
15000	13	52	125
16000	13	69	136
17000	13	71	164
18000	13	68	184

55 Ft. Antenna

KC	C	D	E
2000	1-2	...	0
2500	3-4	...	15
3000	4-5	...	45
3500	5-6	...	100
4000	6-7	...	130
5000	7	100	168
5170	7	100	181
5000	8	15	0
6000	8	35	126
7000	8	51	152
8000	8	64	160
9000	8	81	136
9700	8	100	106
9500	9	62	198
10000	9	68	195
11000	9	87	171
11500	9	100	165
11200	10	73	200
12000	10	90	161
12200	10	100	82
12100	12	60	200
13000	12	62	133
14000	12	63	183
15000	12	68	200
14800	13	0	155
15000	13	0	160
16000	13	45	169
17000	13	62	177
18000	13	72	185

60 Ft. Antenna

KC	C	D	E
2000	1-2	...	0
2500	3-4	...	15
3000	5-6	...	55
3500	6-7	...	90
4000	7	...	125
4800	7	100	178
4750	8	0	0
5000	8	4	60
6000	8	22	155
7000	8	44	170
8000	8	63	164
9000	8	80	150
9700	8	100	120
8000	9	39	200
9000	9	58	200
10000	9	74	186
10880	9	100	123
10500	10	65	200
11000	10	78	181
11350	10	89	0
11290	11	74	200
12000	11	75	190
11600	12	59	30
12000	12	50	141
13000	12	49	197
15000	12	71	200
17000	12	85	200
18000	12	94	200

TABLE 3-4 TYPICAL ANTENNA TUNING DATA (With Capacitor)

20 Ft. Antenna

Use 75 mmfd capacitor (3 sections)

Freq.	C	D	E
2100	1	---	0
2500	3-4	---	0
3000	4-5	---	30
3500	5-6	---	52
4000	6	---	65
5000	6-7	---	102
6000	7	50	118
8000	7	72	146
10000	7	90	168
10500	7	100	174
10000	10	75	200
10500	10	85	200
11000	10	94	200
11300	10	100	200
11100	11	76	200
11600	11	95	200
11600	11	75	0
12000	11	75	80
13000	11	80	142
14000	11	86	180
15000	11	92	200
14500	13	0	164
15000	13	0	180
16000	13	66	185
17000	13	84	190
17700	13	100	200

22.5 Ft. Antenna

Use 75 mmfd capacitor (3 sections)

Freq.	C	D	E
2100	1	---	0
2500	2-3	---	20
3000	4-5	---	45
3500	5-6	---	62
4000	6	---	80
5000	6-7	---	108
6000	7	48	120
7000	7	65	132
8000	7	76	149
10000	7	94	184
10400	7	100	200
10000	10	81	200
10450	10	100	200
10450	10	73	0
11000	10	76	75
12000	10	82	160
13000	19	88	178
14000	10	96	195
14100	10	100	200
14000	13	0	140
14500	13	0	175
15000	13	30	200
16000	13	67	200
17000	13	85	200
17600	13	100	200

USE THESE DATA ONLY IF ONE OR MORE CHANNELS IS BETWEEN 2000 AND 3000 KCS.

25 Ft. Antenna

Use 75 mmfd capacitor (3 sections)

Freq.	C	D	E
2160	1-2	---	0
2500	2-3	---	28
3000	4-5	---	50
3500	5-6	---	65
4000	6-7	---	80
5000	6-7	---	106
6000	7	44	125
7000	7	64	140
9000	7	80	184
9500	7	90	200
9500	10	65	0
10000	10	66	92
11000	10	68	166
12000	10	74	184
13000	10	82	192
14000	10	90	200
14500	10	100	200
14400	13	0	162
14500	13	0	164
15000	13	0	181
16000	13	51	200
17000	13	73	200
18000	13	89	200

27.5 Ft. Antenna

Use 75 mmfd capacitor (3 sections)

Freq.	C	D	E
2130	1-2	---	0
2500	2-3	---	20
3000	4-5	---	44
3500	5-6	---	65
4000	6	---	85
5000	6-7	---	116
6000	7	52	138
7000	7	65	154
8000	7	75	174
8800	7	86	200
8800	10	58	0
9000	10	59	40
10000	10	62	156
11000	10	63	191
12000	10	75	200
13000	10	84	200
14000	10	92	200
14400	10	100	200
13000	11	76	200
14000	11	85	200
15000	11	94	200
15600	11	100	200
14400	13	0	161
15000	13	0	186
16000	13	56	200
17000	13	76	200
18000	13	90	200

USE THESE DATA ONLY IF ONE OR MORE CHANNELS IS BETWEEN 2000 AND 2700 KCS.

TABLE 3-4 TYPICAL ANTENNA TUNING DATA (With Capacitor) (Cont.)

27.5 Ft. Antenna

Use 75 mmfd capacitor (3 sections)

Freq.	C	D	E
2130	1-2	—	0
2500	2-3	—	20
3000	4-5	—	44
3500	5-6	—	65
4000	6	—	85
5000	6-7	—	116
6000	7	52	138
7000	7	65	154
8000	7	75	174
8800	7	86	200
8800	10	58	0
9000	10	59	40
10000	10	62	156
11000	10	63	191
12000	10	75	200
13000	10	84	200
14000	10	92	200
14400	10	100	200
13000	11	76	200
14000	11	85	200
15000	11	94	200
15600	11	100	200
14400	13	0	161
15000	13	0	186
16000	13	56	200
17000	13	76	200
18000	13	90	200

30 Ft. Antenna

Use 75 mmfd capacitor (3 sections)

Freq.	C	D	E
2100	1	—	0
2500	2-3	—	30
3000	4-5	—	48
3500	5-6	—	64
4000	6	—	80
5000	6-7	—	121
6000	7	54	138
7000	7	71	152
8000	7	81	186
8350	7	100	200
8100	10	50	0
8500	10	50	88
9000	10	52	138
10000	10	55	165
11000	10	66	200
12000	10	76	200
13000	10	85	200
13500	10	89	200
14000	10	93	200
13500	11	81	200
14000	11	85	200
14500	11	89	200
15000	11	93	200
14800	13	0	180
15000	13	0	188
15500	13	41	200
16000	13	58	200
17000	13	76	200
18000	13	91	200

USE THESE DATA ONLY IF ONE OR MORE CHANNELS IS BETWEEN 2000 AND 2600 KCS.

32.5 Ft. Antenna

Use 50 mmfd capacitor (2 sections)

Freq.	C	D	E
2100	1-2	—	0
2500	3-4	—	10
3000	4-5	—	44
3500	5-6	—	70
4000	6-7	—	90
5000	7	—	124
6000	7	55	144
7000	7	70	173
7790	7	90	200
7650	9	60	0
8000	9	64	60
9000	9	69	112
10000	9	74	169
11000	9	81	179
12000	9	90	179
12500	9	100	180
11000	10	69	200
12000	10	78	200
13000	10	86	200
14000	10	95	200
14100	10	100	200
13000	11	79	200
14000	11	86	200
15000	11	94	200
15300	11	100	200
15000	13	5	200
16000	13	60	200
17000	13	86	164
18000	13	100	185

35 Ft. Antenna

Use 50 mmfd capacitor (2 sections)

Freq.	C	D	E
2150	1	—	0
2500	2-3	—	22
3000	4-5	—	60
3500	5-6	—	85
4000	6-7	—	110
5000	7	32	128
6000	7	56	156
7000	7	75	184
7435	7	95	200
7200	9	54	0
7500	9	58	49
8000	9	60	112
9000	9	67	142
10000	9	72	160
11000	9	80	176
12000	9	88	178
13000	9	100	181
10000	10	53	200
11000	10	65	200
12000	10	74	200
13000	10	82	200
14000	10	90	200
14600	10	100	200
14500	13	0	160
15000	13	0	178
16000	13	70	156
17000	13	90	130
17700	13	100	146

USE THESE DATA ONLY IF ONE OR MORE CHANNELS IS BETWEEN 2000 AND 2400 KCS.

TABLE 3-4 TYPICAL ANTENNA TUNING DATA (With Capacitor) (Cont.)

35 Ft. Antenna

Use 50 mmfd capacitor (2 sections)

Freq.	C	D	E
2150	1	—	0
2500	2-3	—	22
3000	4-5	—	60
3500	5-6	—	85
4000	6-7	—	110
5000	7	32	128
6000	7	56	156
7000	7	75	184
7435	7	95	200
7200	9	54	0
7500	9	58	49
8000	9	60	112
9000	9	67	142
10000	9	72	160
11000	9	80	176
12000	9	88	178
13000	9	100	181
10000	10	53	200
11000	10	65	200
12000	10	74	200
13000	10	82	200
14000	10	90	200
14600	10	100	200
14500	13	0	160
15000	13	0	178
16000	13	70	156
17000	13	90	130
17700	13	100	146

40 Ft. Antenna

Use 50 mmfd capacitor (2 sections)

Freq.	C	D	E
2100	1-2	—	0
2500	3-4	—	25
3000	4-5	—	66
3500	5-6	—	100
4000	6-7	—	120
5000	7	38	144
6000	7	60	179
6500	7	71	200
6330	9	40	0
7000	9	47	94
8000	9	56	148
9000	9	66	162
10000	9	72	174
11000	9	80	177
12000	9	91	178
12600	9	100	179
11000	10	68	200
12000	10	76	200
13000	10	85	200
14000	10	100	180
14190	10	100	192
14000	12	71	200
14500	12	75	200
15000	12	80	200
16000	12	88	150
17000	12	94	108
18000	12	100	157

USE THESE DATA ONLY IF ONE OR MORE CHANNELS IS BETWEEN 2000 AND 2400 KCS.

45 Ft. Antenna

Use 25 mmfd capacitor (1 section)

Freq.	C	D	E
2050	1-2	—	0
2500	3-4	—	33
3000	4-5	—	70
3500	5-6	—	111
4000	6	—	132
5000	7	43	160
5500	7	54	180
5900	7	60	200
5800	9	27	0
6000	9	30	42
7000	9	42	138
8000	9	55	158
9000	9	67	165
10000	9	74	170
11000	9	83	173
12000	9	100	150
12200	9	100	173
12000	11	70	200
13000	11	80	200
14000	11	91	158
14400	11	100	110
14000	12	75	200
15000	12	82	75
16000	12	85	143
17000	12	89	174
18000	12	92	200

50 Ft. Antenna

Use 25 mmfd capacitor (1 section)

USE THESE DATA ONLY IF ONE OR MORE CHANNELS IS BETWEEN 2000 AND 2200 KCS.

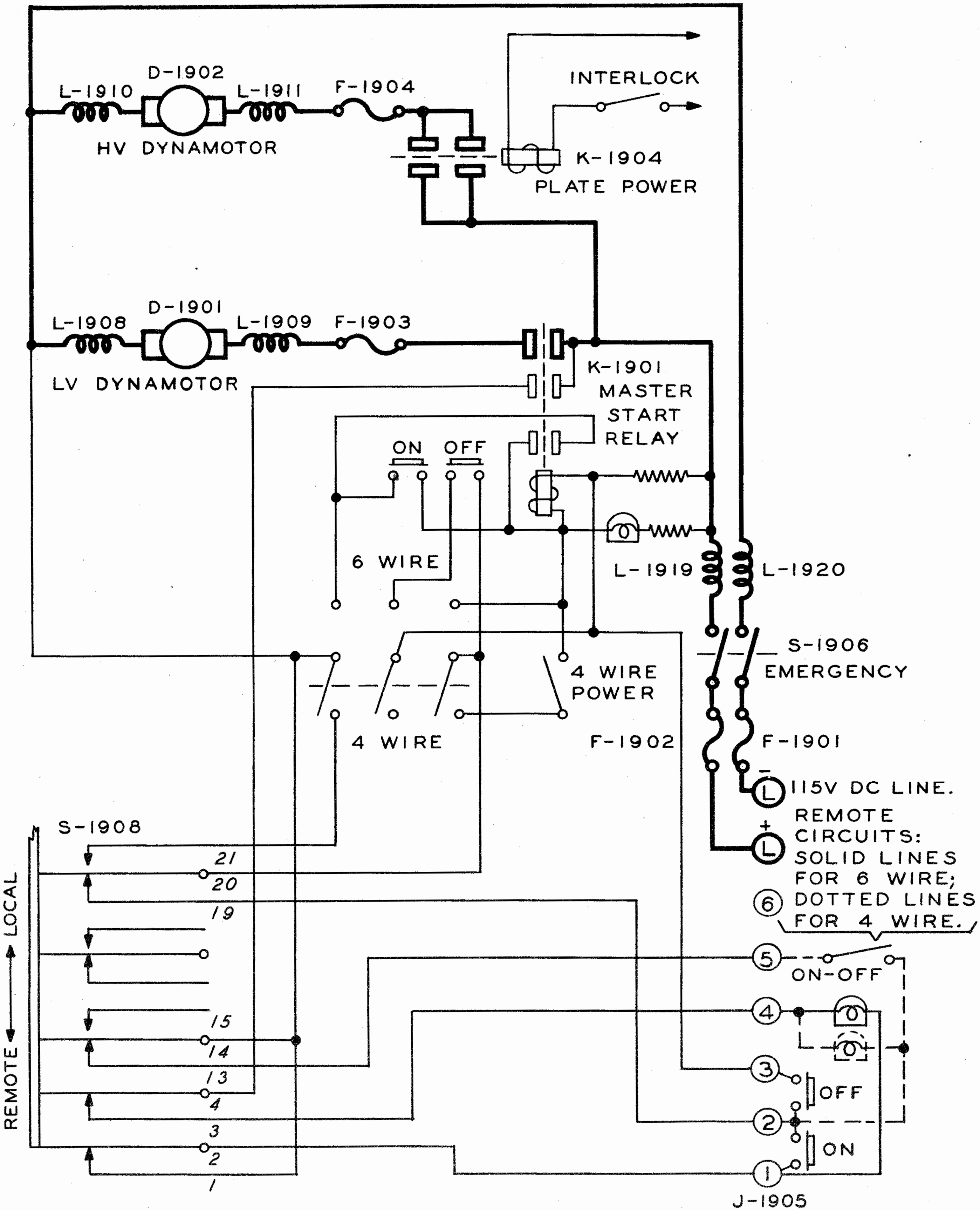


Figure 4-1 Primary Power Circuits

SECTION IV

THEORY OF OPERATION

1. POWER CONTROL CIRCUITS - NAVY TYPE COL-211624 POWER UNIT.

The Navy Type COL-211624 Power Unit is a complete DC operated power unit capable of supplying all necessary power for operation of a Navy Type -52286-A Radio Transmitter Unit as well as power necessary for operation of Standard Navy Control and Telephone Circuits. The object of the power control circuits is to get the master start relay K-1901 operated which will apply primary power to the low voltage dynamotor. The 28 v output of the low voltage dynamotor supplies power to operate plate power relay K-1904; therefore, as soon as the low voltage dynamotor is up to full output the plate power relay can be operated applying primary power to the high voltage dynamotor.

a. PRIMARY POWER CIRCUITS. (See figure 4-1) - The primary power circuits are the circuits necessary for excitation of the two dynamotors which furnish all plate, filament and relay power for the Navy Type -52286-A Radio Transmitter Unit as well as 14 v DC for Standard Navy Telephone Circuits.

The power source is connected to the "L" terminals on terminal board J-1905. The circuit for exciting the low voltage dynamotor D-1901 is from the positive "L" terminal through LINE fuse F-1902, EMERGENCY switch S-1906, line filter choke L-1919, the contacts of master start relay K-1901, fuse F-1903, noise filter choke L-1909, LV dynamotor D-1901, noise filter choke L-1908, line filter choke L-1920, EMERGENCY switch S-1906, LINE fuse F-1901 to the negative "L" terminal on terminal board J-1905.

The circuit for exciting the high voltage dynamotor D-1902 is from the positive "L" terminal on terminal board J-1905 through LINE fuse F-1902, EMERGENCY switch S-1906, line filter choke L-1919, the contacts of plate power relay K-1904, fuse F-1904, noise filter choke L-1911, HV dynamotor D-1902, noise filter choke L-1910, line filter choke L-1920, EMERGENCY switch S-1906, LINE fuse F-1901 to the negative "L" terminal on terminal board J-1905. Plate power relay K-1904 cannot be operated unless the LV dynamotor is operating and generating 28 v DC operating voltage for the coil of plate power relay K-1904.

b. LOCAL POWER CONTROL - 6 WIRE NAVY CIRCUIT. (See figure 4-2) - For local power control using 6 WIRE Navy Control the 4 WIRE-6 WIRE selector switch S-1907 should be in the 6 WIRE position, the LOCAL-REMOTE switch S-1908 in the LOCAL position and the 4 WIRE POWER switch S-1902 in the OFF position. To operate the master start relay K-1901, the energizing current follows the path from the positive "L" terminal on terminal board J-1905 through LINE fuse F-1902, EMERGENCY switch, S-1906, line filter choke L-1919, limiting resistor R-1901, the coil of master start relay K-1901, the contacts of ON push button S-1909, contacts 1 and 4 of 4 WIRE-6 WIRE switch S-1907, line filter choke L-1920, EMERGENCY switch S-1906, LINE fuse F-1901 to the negative "L" terminal on terminal board J-1905. A hold-in circuit is necessary to maintain master start relay K-1901 in the operated position, therefore, a set of normally open contacts on the master start relay are connected across the contacts of the ON push button S-1909 in such a manner as to hold the relay operated when the ON push button is released. The hold-in circuit is from one contact on the ON push button S-1909, through the hold-in contacts on master start relay K-1901 and to the other contact on the ON push button S-1909.

Operation of master start relay K-1901 completes the circuit necessary to start the low voltage dynamotor. Part of the 28 v output of the LV dynamotor is utilized for operation of plate power relay K-1904. Operation of plate power relay K-1904 completes the primary circuit of the HV dynamotor which generates plate voltage for the transmitter unit. See figure 4-6 for the circuits used in operating the plate power relay K-1904.

The master start relay is returned to the unoperated position by short circuiting the operating coil to the extent that the armature releases and opens the hold-in contacts. The operating coil is short circuited by the circuit from one terminal of the coil of master start relay K-1901 through contacts 5 and 2 on the 4 WIRE-6 WIRE selector switch S-1907, the contacts of the OFF push button S-1910 contacts 6 and 3 of 4 WIRE-6 WIRE selector switch S-1907 and to the other master start relay coil terminal. A current limiting resistor, R-1901, is connected in series with the short circuiting circuit to limit the amount of current that may flow when the master start relay coil is shorted by the OFF push button.

c. LOCAL POWER CONTROL - 4 WIRE NAVY CIRCUITS. (See figure 4-3) - In 4 WIRE local control operation, the master start relay is controlled by the 4 WIRE POWER switch S-1902. The LOCAL-REMOTE switch S-1908 must be in the LOCAL position, the 4 WIRE-6 WIRE selector switch S-1907 must be in the 4 WIRE position and the 4 WIRE POWER switch S-1902 in the ON position. The coil of the master start relay K-1901 is energized by the circuit from the positive "L" terminal on terminal board J-1905 through LINE fuse F-1902, EMERGENCY switch S-1906, line filter choke L-1919, limiting resistor R-1901, the coil of master start relay K-1901, the contacts of 4 WIRE POWER switch S-1902, contacts 6 and 9 on 4 WIRE-6 WIRE selector switch S-1907, contacts 20 and 21 on LOCAL-REMOTE switch S-1908, contacts 7 and 4 on 4 WIRE-6 WIRE selector switch S-1907, line filter choke L-1920, EMERGENCY switch S-1906, LINE fuse F-1901 to the negative "L" terminal on terminal board J-1905. Since 4 WIRE POWER switch S-1902 is a positive acting switch, no hold-in circuit is necessary, therefore, the master start relay may be returned to the unoperated position merely by opening the 4 WIRE POWER switch. As indicated in figure 4-3, operating 4 WIRE POWER switch S-1902 to the ON position actuates master start relay K-1901 which closes and allows the LV dynamotor to operate. A portion of the 28 v DC output of the LV dynamotor is utilized to operate plate power relay K-1904 which applies primary power to the HV dynamotor.

d. REMOTE POWER CONTROL - 6 WIRE NAVY CIRCUITS. (See figure 4-4) - A set of push buttons are used for ON-OFF power control in standard Navy 6 WIRE control circuits. The DC power unit is designed to operate from Navy 6 WIRE circuits by operating the LOCAL-REMOTE switch S-1908 to the REMOTE position, placing the 4 WIRE-6 WIRE selector switch S-1907 in the 6 WIRE position, and opening the 4 WIRE POWER switch S-1902. Terminals 1, 2 and 3 on terminal

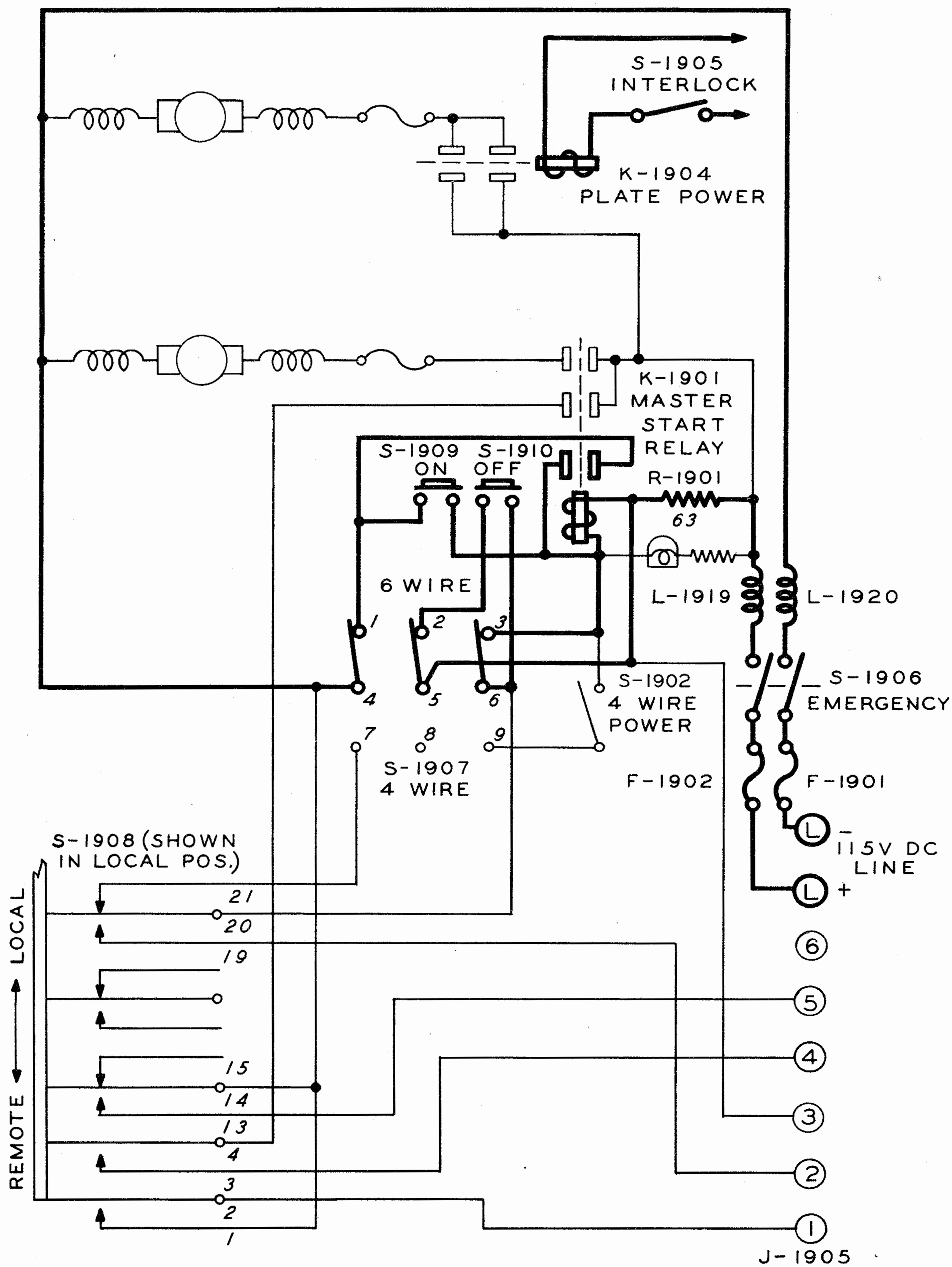


Figure 4-2 Local Power Control - 6 Wire Navy Circuits

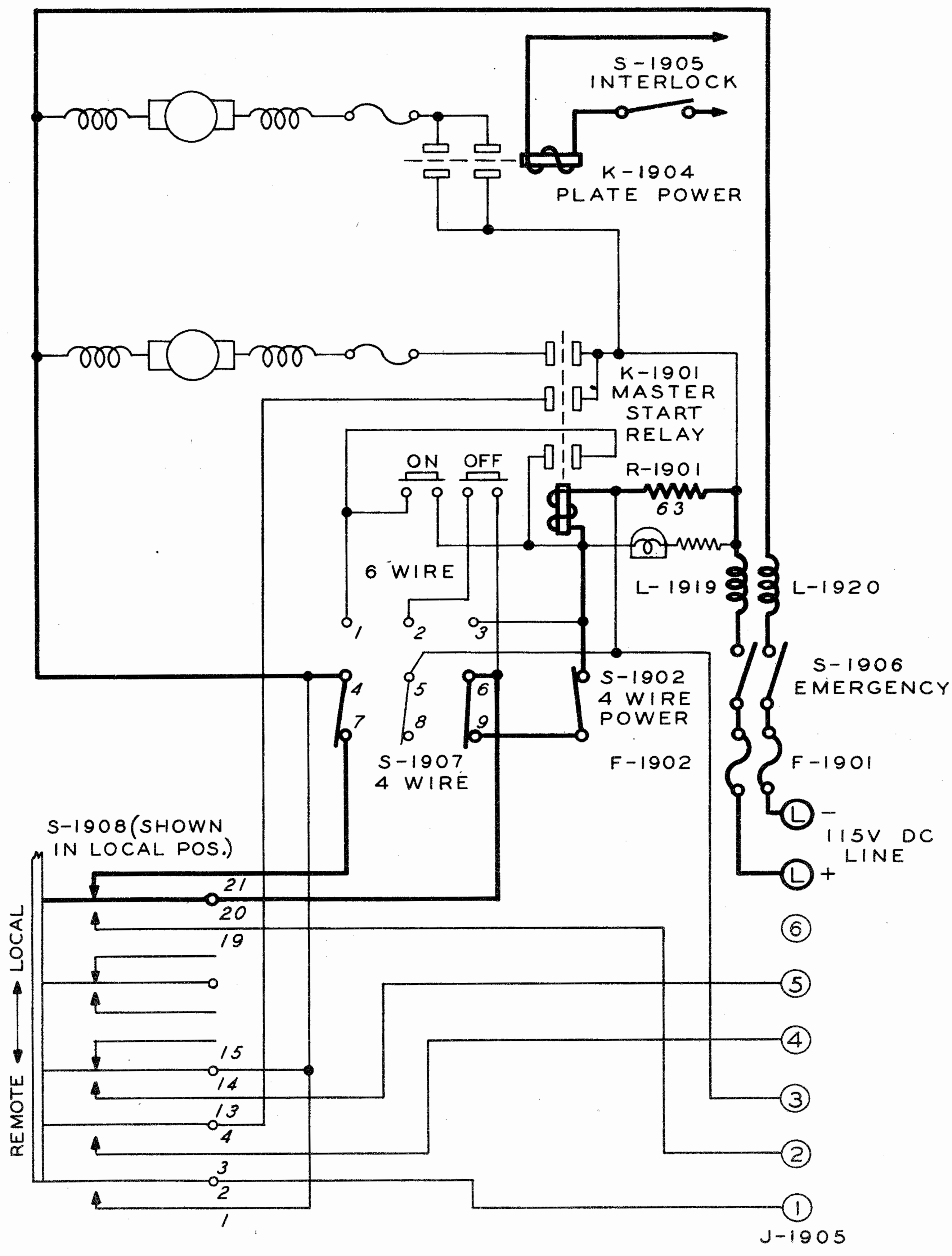


Figure 4-3 Local Power Control - 4 Wire Navy Circuits

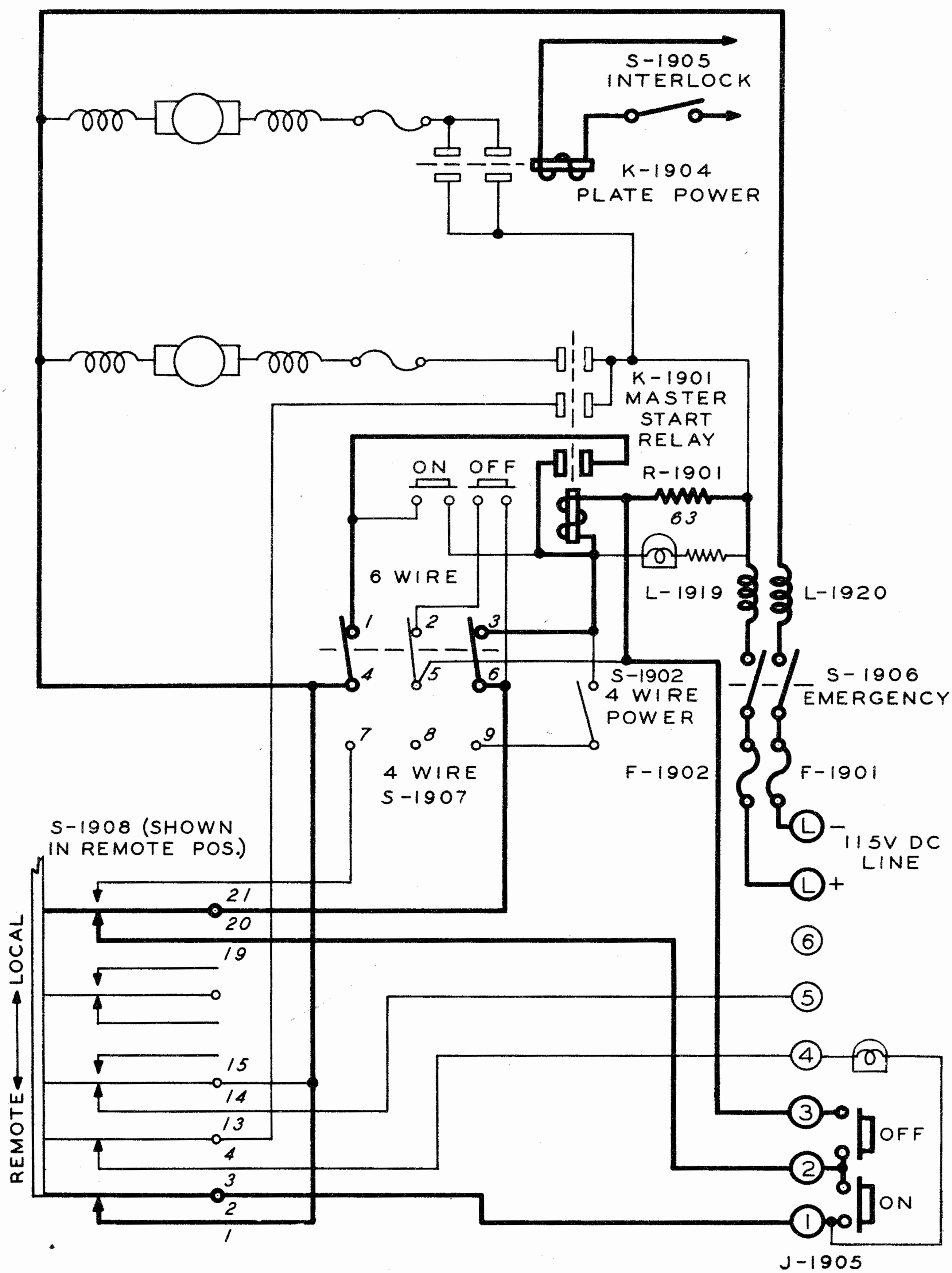


Figure 4-4 Remote Power Control - 6 Wire Navy Circuits

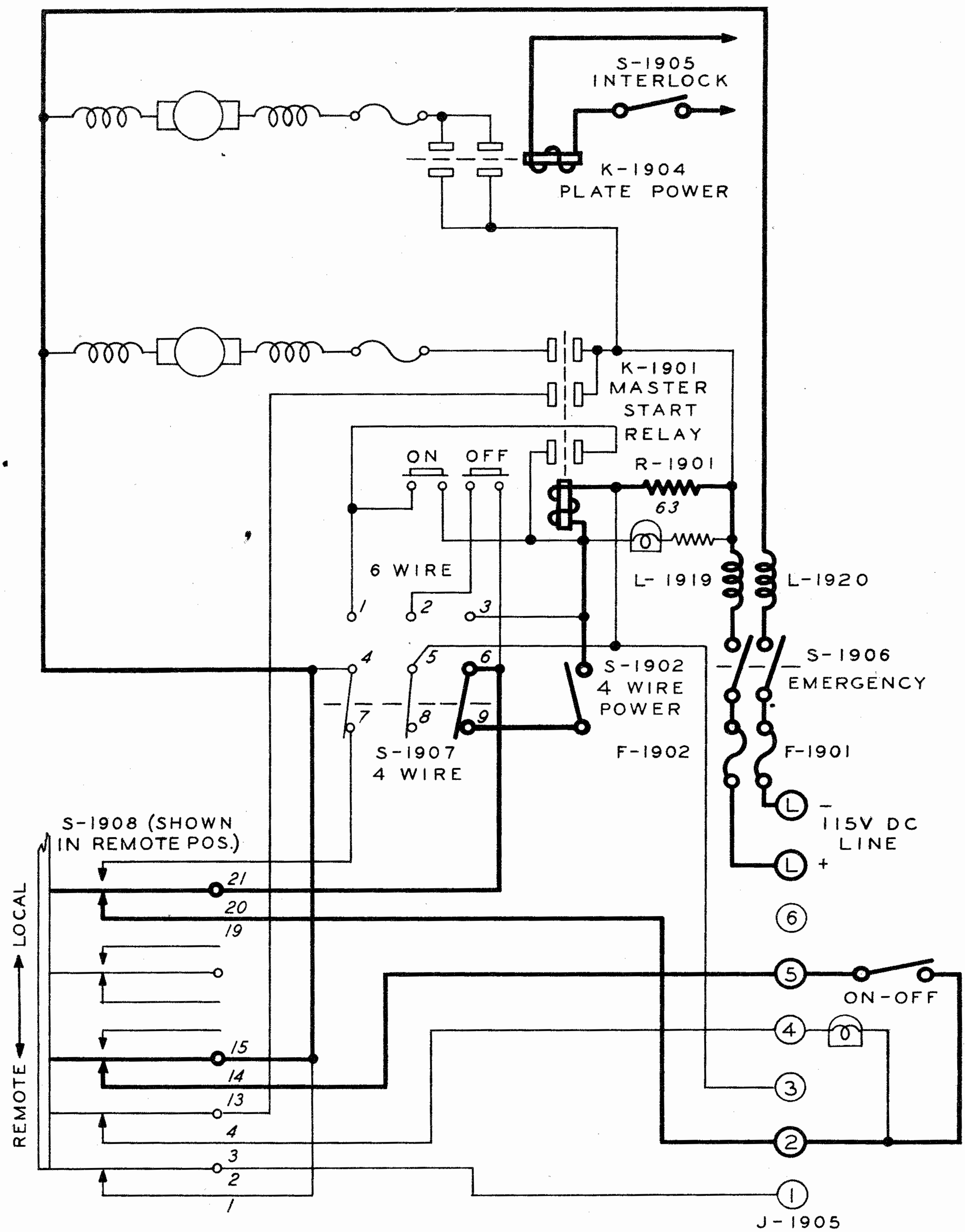


Figure 4-5 Remote Power Control - 4 Wire Navy Circuits

board J-1905 are provided for connecting push button control of the power circuits. The circuit for energizing the master start relay K-1901 is from the positive "L" terminal on terminal board J-1905 through LINE fuse F-1902, EMERGENCY switch S-1906, line filter choke L-1919, limiting resistor R-1901, the coil of master start relay K-1901, contacts 3 and 6 on 4 WIRE-6 WIRE selector switch S-1907, contacts 19 and 20 on LOCAL-REMOTE switch S-1908, the Navy ON push button contacts 2 and 1 on LOCAL-REMOTE switch S-1908, line filter L-1920, EMERGENCY switch S-1906, LINE fuse F-1901 to the negative "L" terminal on terminal board J-1905. Since the Navy control circuit push button is of momentary contact construction, a hold-in circuit is necessary for master start relay K-1901. This hold-in circuit consists of a pair of contacts on the master start relay which parallel the Navy ON push button. Operation of master start relay K-1901 completes the circuit necessary to energize the LV dynamotor primary winding. A portion of the 28 v DC output from the LV dynamotor is employed to energize plate power relay K-1904. The circuits required to energize plate power relay K-1904 are described in paragraph 2 of this section.

Master start relay K-1901 is returned to the unoperated position by short circuiting the operating coil. As shown in figure 4-4, terminals 2 and 3 on terminal board J-1905 are connected across the coil of master start relay K-1901. When the Navy OFF push button is pressed, the coil of master start relay K-1901 is short circuited and the hold-in circuit opens allowing the master start relay to release. Current limiting resistor R-1901 is placed in series with the operating coil of master start relay K-1901 to limit the current that may flow while the coil is short circuited by the OFF push button. A pilot light connected between terminals 1 and 4 on terminal board J-1905 will be energized when the master start relay K-1901 is operated.

e. REMOTE POWER CONTROL - 4 WIRE NAVY CIRCUITS. (See figure 4-5) Power control of 4 WIRE Navy circuits requires the use of a SPST positive action ON-OFF switch connected across terminals 2 and 5 on terminal board J-1905. For this type of control the LOCAL-REMOTE switch S-1908 must be in the REMOTE position, the 4 WIRE-6 WIRE selector switch S-1907 in the 4 WIRE position and the 4 WIRE POWER switch S-1902 in the ON position.

To energize the coil of master start relay K-1901 the circuit employed is from the positive "L" terminal on terminal board J-1905, through LINE fuse F-1902, EMERGENCY switch S-1906, line filter choke L-1919, limiting resistor R-1901, the coil of master start relay K-1901, 4 WIRE POWER switch S-1902, contacts 6 and 9 on 4 WIRE-6 WIRE selector switch S-1907, contacts 19 and 20 on LOCAL-REMOTE switch S-1908, terminals 2 and 5 on terminal board J-1905, contacts 13 and 14 on LOCAL-REMOTE switch S-1908, line filter choke L-1920, EMERGENCY switch S-1906 and LINE fuse F-1901 to the negative "L" terminal on terminal board J-1905. Since the Navy ON-OFF switch is of the positive action type, no hold-in circuit is necessary and master start relay K-1901 is released upon opening the Navy ON-OFF switch. Operating the 4 WIRE POWER switch S-1902 on the power unit to the OFF position will also release the master start relay.

A pilot light connected across terminals 2 and 4 on terminal board J-1905 will be energized when the master start relay is operated.

Operation of master start relay K-1901 completes the primary circuit to LV dynamotor D-1901. Part of the 28 v DC output of the LV dynamotor is utilized in operating plate power relay K-1904 which controls the primary power to HV dynamotor D-1902. An explanation of the circuits involved in the operation of plate power relay K-1904 is given in the following paragraphs.

2. POWER CONTROL CIRCUITS - TRANSMITTER UNIT.

The circuits described thus far were for the purpose of operating the master start relay K-1901. As a result of operating master start relay K-1901 the low voltage dynamotor is started applying filament power to the transmitter tubes and making relay power available for the transmitter unit. Relay and microphone power is also made available for NAVY control circuits.

The circuits described in the following paragraphs are for the purpose of operating the plate power relay K-1904. The operation of this relay applies primary power to the high voltage dynamotor which supplies plate power for the transmitter tubes. See figure 4-1. Plate power relay K-1904 is energized from the 28 v DC output of the low voltage dynamotor by various methods as described in the following paragraphs. See figure 4-6. In this illustration, plate power relay K-1904 is located at the extreme right hand edge of the drawing. The following operations will energize the coil of K-1904:

<u>a</u>. Rotation of EMISSION selection switch S-110 to MCW.

<u>b</u>. Rotation of EMISSION selection switch S-110 to CW.

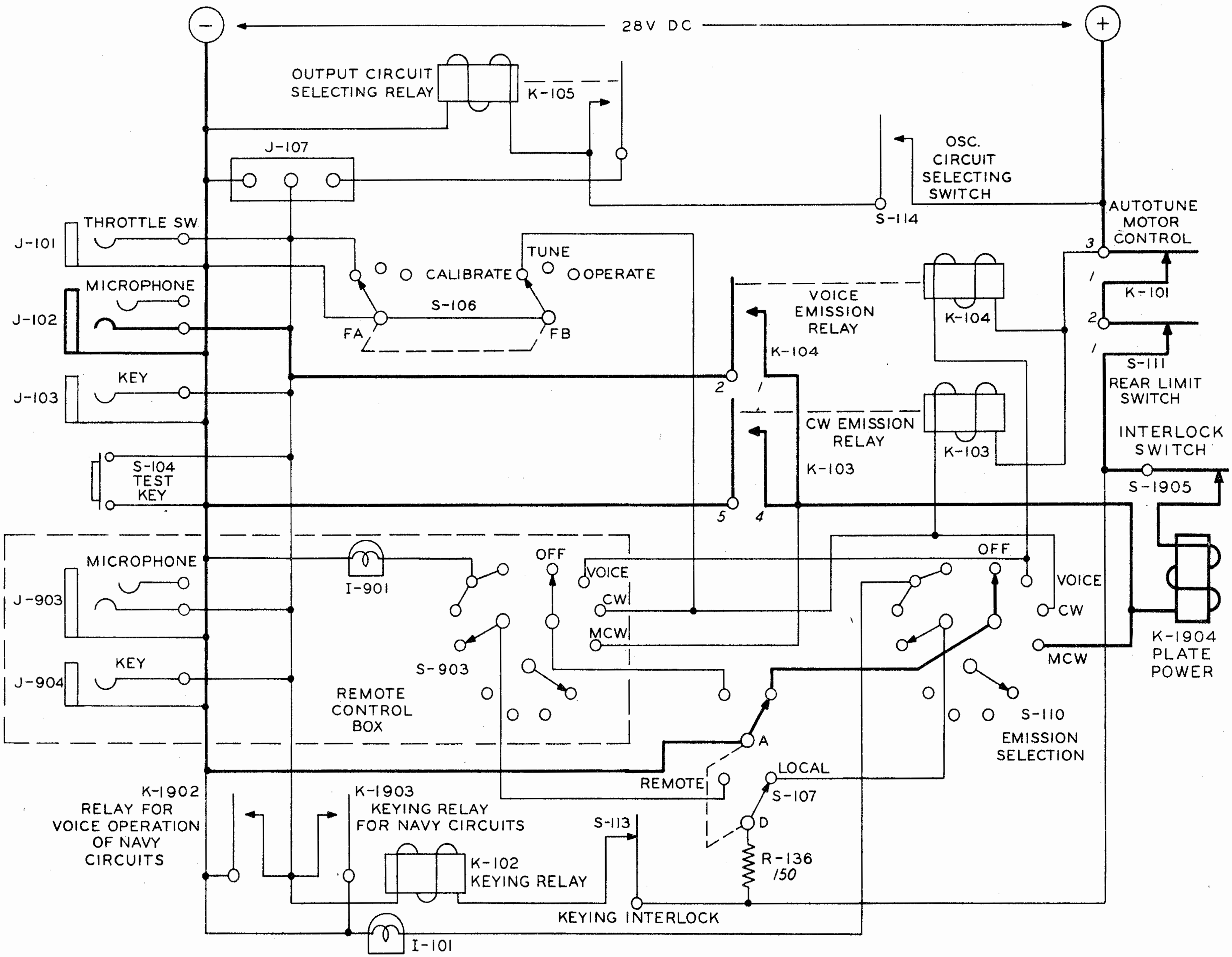
<u>c</u>. Rotation of EMISSION selection switch S-110 to VOICE, providing a keying device (Push-to-Talk switch, Key, Test Key, etc.) is operated.

<u>d</u>. Rotation of power level selector switch S-106 to the CALIBRATE position.

If the EMISSION selector switch, S-110, is operated to the MCW position, plate power relay K-1904 is energized by the circuit through contacts 1 and 3 of Autotune motor control relay K-101, contacts 1 and 2 of the Autotune limit switch, S-111, the contacts of interlock switch S-1905, the coil of plate power relay K-1904, the contacts of EMISSION selector switch S-110, and the contacts of LOCAL-REMOTE switch S-107. Operation of the plate power relay K-1904 applies primary power to the high voltage dynamotor.

If the EMISSION selector switch, S-110 is operated to the CW position, the circuit necessary for the operation of the plate power relay, K-1904, is completed and power is applied to the primary circuit of the high voltage dynamotor Operating the EMISSION selector switch, S-110, to the CW position completes the circuit necessary for the operation of CW relay K-103 through the contacts of LOCAL-REMOTE switch, S-107, the contacts of EMISSION selector switch, S-110, and the coil of CW relay, K-103. When CW relay K-103 has operated, the coil of plate power relay K-1904 is energized through contacts 4 and 5 of CW relay K-103, the coil of plate power relay K-1904, the contacts of interlock switch S-1905, contacts 1 and 2 of the Autotune limit switch, S-111, and contacts 1 and 3 of the Autotune motor control relay K-101.

With the LOCAL-REMOTE switch, S-107, in the LOCAL position, the EMISSION selector switch, S-110, in the VOICE position, the circuit necessary for the



NOTE: UNLESS OTHERWISE INDICATED ALL RESISTANCE VALUES ARE IN OHMS & CAPACITY VALUES ARE IN MICROFARADS

Figure 4-6 Power Control Circuits - Transmitter Unit operation of the "voice" relay, K-104 is completed through the coil of "voice" relay K-104, the contacts of EMISSION selection switch, S-110, and the contacts of LOCAL-REMOTE switch S-107. If power level switch, S-106, is in either the TUNE or OPERATE position, it is necessary to operate the TEST switch, S-104, or to complete the circuit through the throttle switch jack, J-101, the circuit through the MICROPHONE jack, J-102, or the circuit through the KEY jack, J-103, before the plate power relay, will operate.

If the power level switch S-106 is operated to the CALIBRATE position, CW relay K-103 is operated through the coil of CW relay K-103 and the contacts of power level switch S-106. The plate power relay, K-1904 will be operated by the circuit through contacts 1 and 3 of Autotune motor control relay K-101, contacts 1 and 2 of the Autotune limit switch, S-111, the contacts of interlock switch S-1905, the coil of plate power relay K-1904, and contacts 4 and 5 of CW relay K-103.

The transmitter panel pilot lamp, I-101, will be energized when the EMISSION selector switch, S-110, is in any position other than the OFF position. The pilot lamp will be energized through contacts 1 and 3 of Autotune motor control relay K-101, contacts 1 and 2 of the Autotune limit switch S-111, the resistor R-136, the contacts of LOCAL-REMOTE switch S-107, the contacts of EMISSION selector switch S-110, and the pilot lamp I-101.

When the LOCAL-REMOTE switch S-107 is placed in the REMOTE position control of all power circuits is transferred from the transmitter panel controls to the controls located on the Navy Type COL-23410 remote control unit.

To complete the circuit necessary for operation of plate power relay K-1904, when the EMISSION switch S-903 is placed in the VOICE position, the telegraph key must be operated or the microphone jack J-903, circuit must be completed. The "voice" relay K-104 is operated by the circuit through the coil of "voice" relay K-104, the contacts of EMISSION selector switch S-903, and the contacts of LOCAL-REMOTE switch S-107. The plate power relay K-1904 is operated by the circuit through contacts 1 and 3 of Autotune motor control relay K-101, contacts 1 and 2 of Autotune limit switch, S-111, the contacts of interlock switch S-1905, the coil of plate power relay K-1904, contacts 1 and 2 of "voice" relay K-104 and the telegraph key or the microphone jack, J-903.

If the EMISSION selector switch S-903 is operated to the CW position, the CW relay K-103 is operated by the circuit through the coil of K-103, the contacts of EMISSION selector switch S-903 and the contacts of LOCAL-REMOTE switch S-107. The operation of CW relay K-103 completes the circuit necessary for the operation of the plate power relay, K-1904. Plate power relay K-1904 is operated by the circuit through contacts 1 and 3 of Autotune motor control relay K-101, contacts 1 and 2 of Autotune limit switch S-111, the contacts of interlock switch S-1905, the coil of plate power relay K-1904, and contacts 4 and 5 of CW relay K-103. The operation of plate power relay K-1904 applies power to the primary circuit of the high voltage dynamotor.

If the EMISSION selector switch S-903 is operated to the MCW position, plate power relay K-1904 is energized through contacts 1 and 3 of Autotune motor control relay K-101, contacts 1 and 2 of Autotune limit switch S-111, the contacts of interlock switch S-1905, the coil of plate power relay K-1904, the contacts of EMISSION control switch S-903 and the contacts of LOCAL-REMOTE switch S-107.

The pilot lamp I-901 is energized when the EMISSION switch S-903 is in any position other than the OFF position. The pilot lamp I-901 is energized by the circuit through contacts 1 and 3 of Autotune motor control relay K-101, contacts 1 and 2 of Autotune limit switch S-111, resistor R-136, the contacts of LOCAL-REMOTE switch S-107, the contacts of EMISSION selector switch S-903 and the pilot lamp I-901.

3. KEYING CIRCUITS.

Three different relays are used in the Navy Model TCZ-2 equipment for keying purposes. Two relays, K-102 in the transmitter unit and K-1903 in the power supply unit are used during HF transmission while a third relay K-3001 in the LF load coil unit is added during LF operation. The transmitter may be keyed from the front panel, from the Navy Type COL-23410 Remote Control Unit, or from NAVY Control Circuits. When the LOCAL-REMOTE switch S-1908 is in the LOCAL position, keying can be accomplished from the front panel, or the Remote Control Unit. When the LOCAL-REMOTE switch S-1908 is in the REMOTE position, keying can be accomplished from the NAVY Control Circuits, the transmitter front panel and the Remote Control Unit; however, the receiver disabling circuits will be inoperative while keying from the transmitter front panel or the Remote Control Unit.

a. LOCAL KEYING CIRCUITS. (See figure 4-7) - For local keying the LOCAL-REMOTE switch S-1908 must be in the LOCAL position and a telegraph key must be connected to J-103 in the transmitter unit. Closing the circuit through KEY jack J-103 completes the circuit through the coil of keying relay K-102, interlock switch S-113D, Autotune limit switch S-111, and Autotune motor control switch K-101 to energize keying relay K-102. While keying relay K-1903 in the power unit is concerned mostly with remote keying, the receiver disabling contacts are located on this relay and must be operated at all times; therefore, K-1903 is operated by a circuit from the 115 v DC supply through contact numbers 14 and 15 on LOCAL-REMOTE switch S-1908, contacts 1 and 10 on keying relay K-102 back through contact numbers 17 and 18 on LOCAL-REMOTE switch S-1908, through the coil of keying relay K-1903 through a set of contacts on the master start relay K-1901 and to the 115 v DC supply.

b. REMOTE KEYING CIRCUITS.

(1) NAVY CIRCUITS. - The LOCAL-REMOTE switch S-1908 in the power unit must be in the REMOTE position for remote keying using the NAVY circuits. Terminals 5 and 6 on terminal board J-1905 are provided for keying connections. From figure 4-8 it can be seen that keying relay K-102 in the transmitter unit is operated by the action of keying relay K-1903 in the power unit. The circuit for energizing the coil of K-1903 is from terminal number 5 on terminal board J-1905 through contact numbers 13 and 14 on LOCAL-REMOTE switch S-1908, through the 115 v DC supply, a set of contacts on the master start relay K-1901, the coil of keying relay K-1903, contact numbers 16 and 17 on LOCAL-REMOTE switch S-1908, and to terminal number 6 on terminal board J-1905. Operation of K-1903 energizes the coil of keying relay K-102 in the transmitter unit by the circuit from ground through the contacts of keying relay K-1903, contact numbers 9

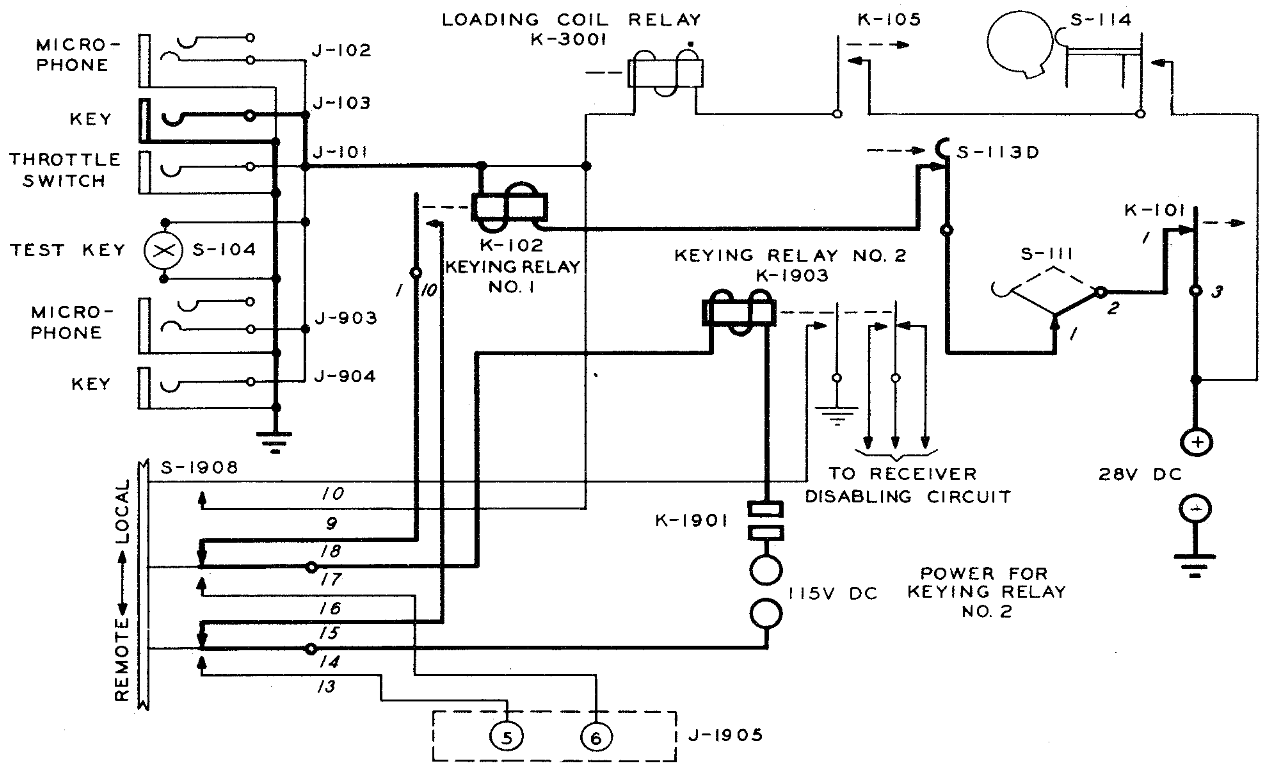


Figure 4-7 Local Keying Circuits

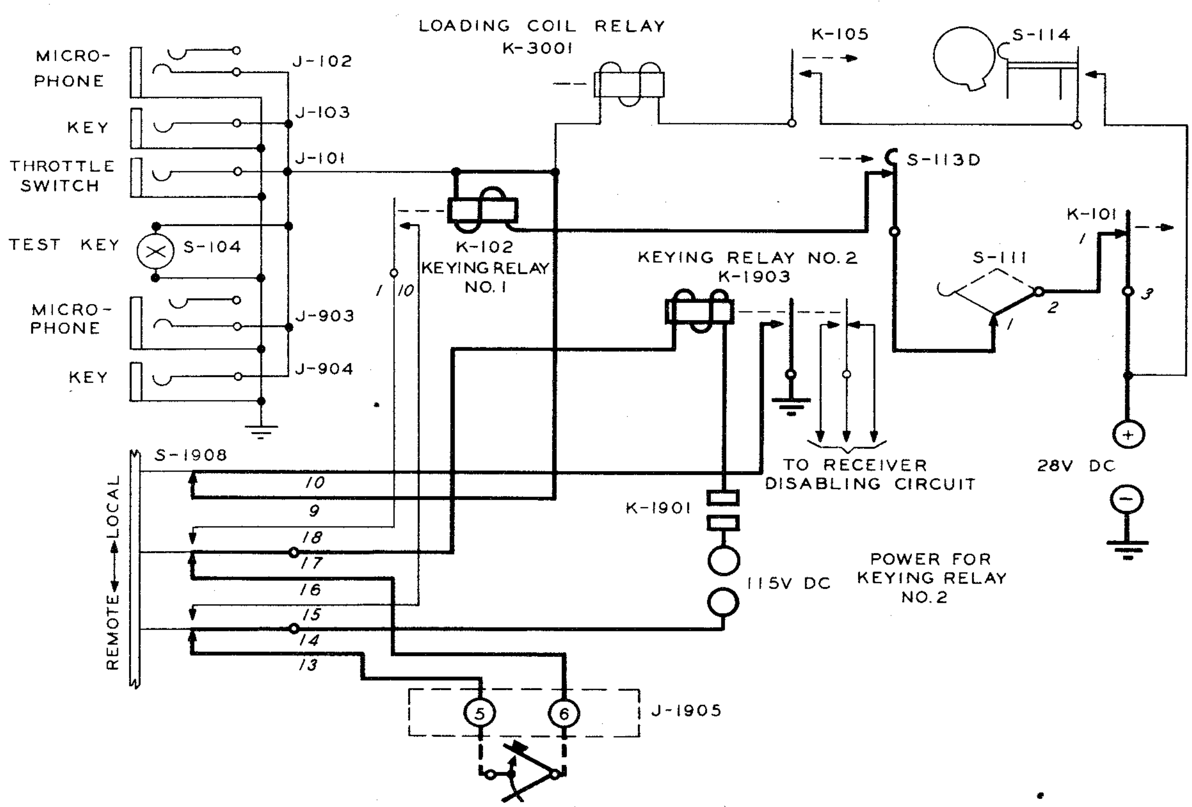
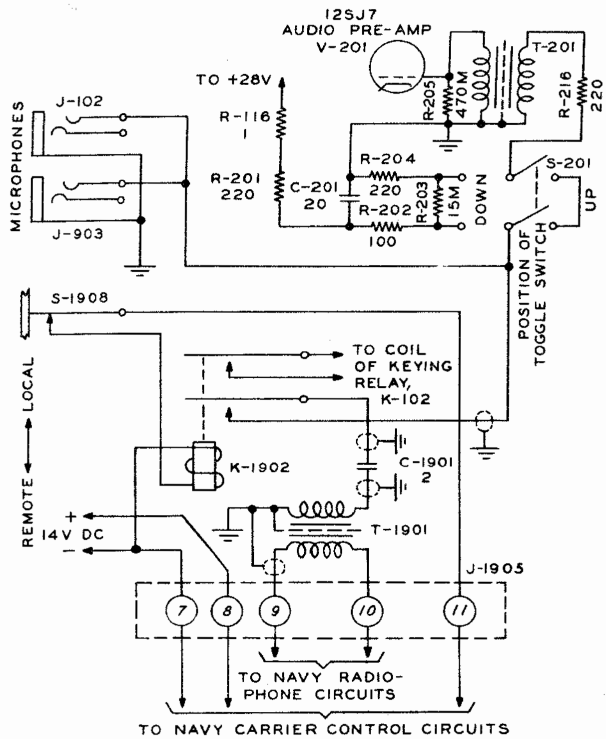
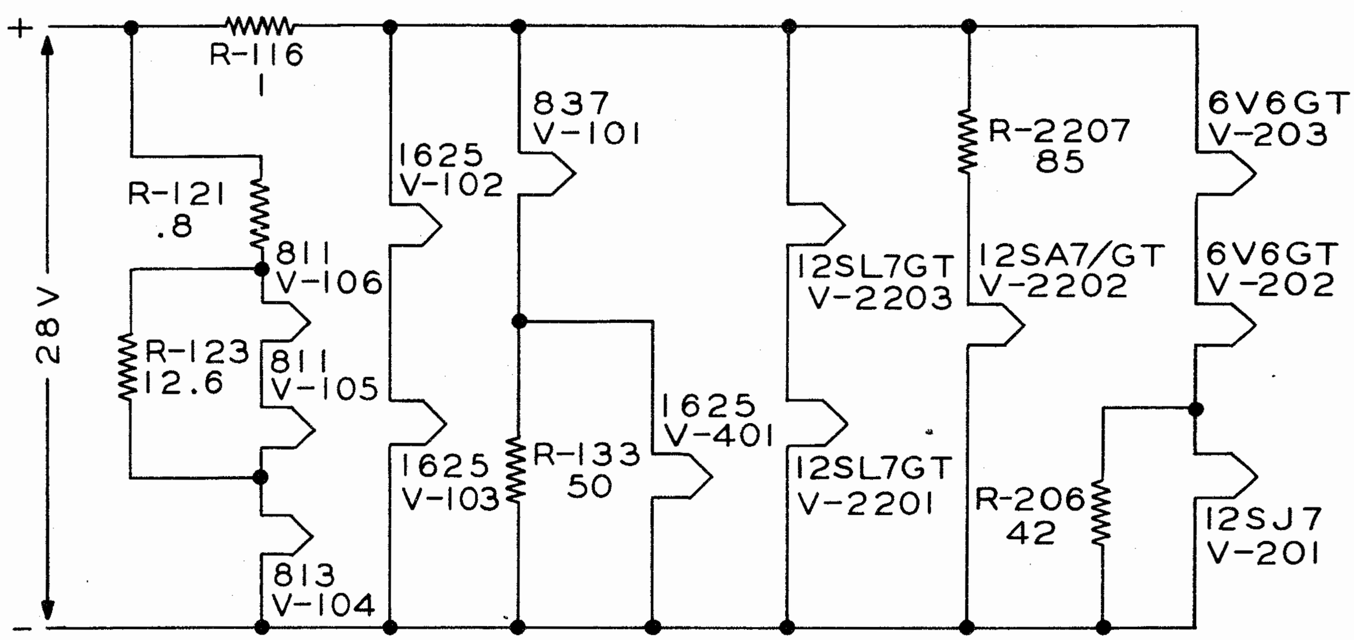


Figure 4-8 Remote Keying Circuits



NOTE: UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS, AND CAPACITY VALUES ARE IN MICROFARADS.

Figure 4-9 Microphone Circuits



NOTE: UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS, AND CAPACITY VALUES ARE IN MICROFARADS.

Figure 4-10 Filament Circuits

and 10 of LOCAL-REMOTE switch S-1908, the coil of keying relay K-102, interlock switch S-113D, motor limit switch S-111, and a set of contacts on motor control relay K-101 to the positive 28 v DC source.

(2) REMOTE CONTROL UNIT NAVY TYPE COL-23410. - The keying circuits for keying the equipment from the Navy Type COL-23410 Remote Control Unit are in parallel with the keying circuits for LOCAL keying from the transmitter panel, therefore, the keying circuits are essentially the same as described in Paragraph 3a of this section.

NOTE

While it is possible to key the transmitter from the front panel while the LOCAL-REMOTE switch S-1908 is in the REMOTE position, keying relay K-1903 will not be energized so the receiver disabling circuits will be inoperative.

4. MICROPHONE CIRCUITS.

A simplified circuit of the microphone circuits is shown in figure 4-9. The transmitter may be voice modulated from the front panel, the NAVY Type COL-23410 Remote Control Unit, or from NAVY telephone circuits. Terminals number 7 and 8 of terminal board J-1905 located in the base of the power unit furnish 14 v DC at 1.2 amp for microphone and relay operation.

A toggle switch S-201 located under the tuning chart is employed in the speech amplifier input circuit to transfer the speech amplifier input from carbon microphone to dynamic microphone input. When this toggle switch is in the CARBON position, button current is supplied to the microphone. If NAVY telephone circuits are used, microphone switch S-201 should be in the CARBON position. A connection between terminals 8 and 11 on terminal board J-1905 (such as a Push-to-Talk button on a microphone) will complete the circuit to energize carrier relay K-1902. The audio input to the transmitter is connected to terminal numbers 9 and 10 of terminal board J-1905. A line matching transformer, T-1901, is provided to match lines of 200, 400, or 600 ohms impedance. The secondary of T-1901 is tapped at 42, 60, 82, and 106 ohms impedance.

5. FILAMENT CIRCUITS.

The filament power circuits of the transmitter are a combination of series and parallel connections. The filaments are supplied with power from the 28 volt DC source. Figure 4-10 shows the filament connections in simplified form. Filament power is applied to the HF oscillator tube, V-101, the frequency multiplier tubes, V-102 and V-103, the audio amplifier tube, V-201, the audio driver tube, V-202, the sidetone amplifier tube, V-203, the calibration frequency oscillator tube, V-2201, the mixer tube, V2202, the detector-audio tube, V-2203, the LF oscillator tube, V-401, the power amplifier tube, V-104, and the modulator tubes, V-105 and V-106, when the low voltage dynamotor is started. The overload fuse, F-1905 breaks the filament circuits when an overload occurs in the transmitter filament or associalted circuits.

6. EMISSION SELECTION AND CARRIER CONTROL.

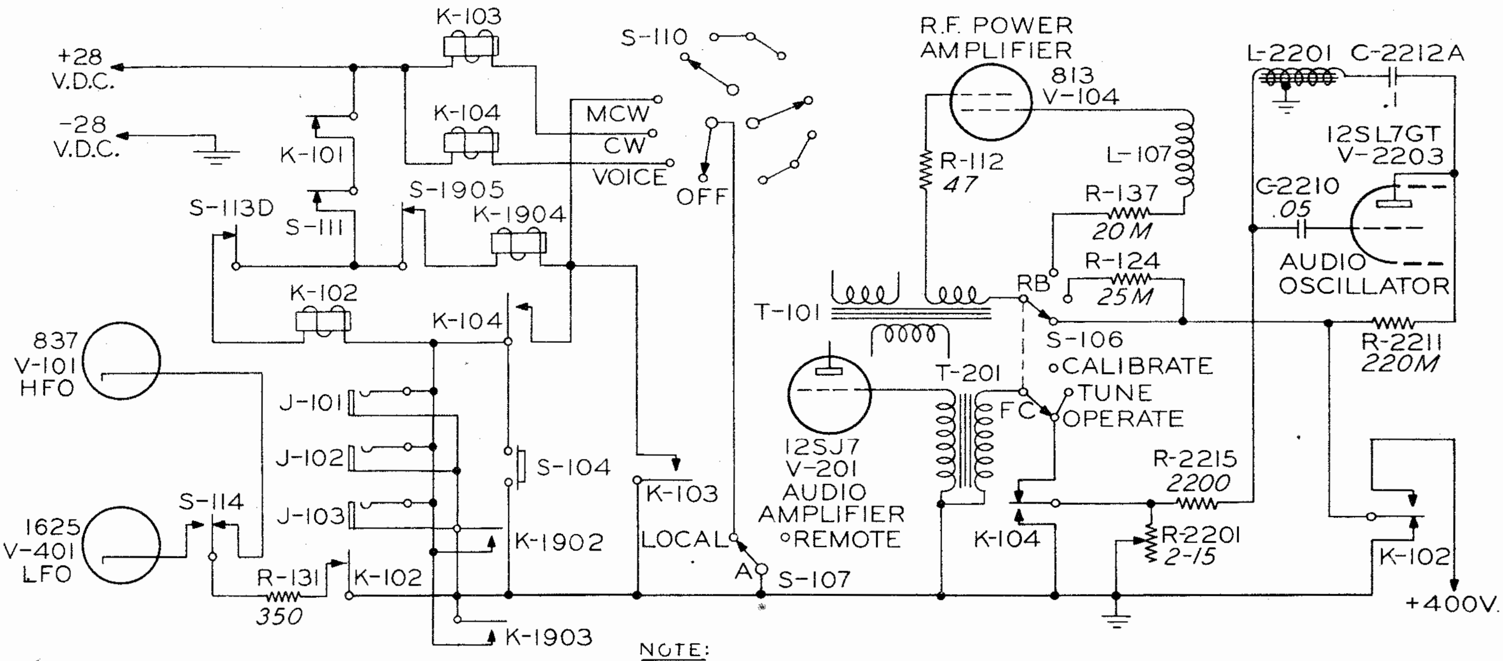
See figure 4-11. The switch S-110 is a combination transmitter ON-OFF switch and EMISSION selector switch. Selecting VOICE emission by the operation of S-110 operates relay K-104. Contacts 5 and 6 on K-104 disconnect the output of the audio oscillator, from the input to the speech amplifier. Contacts 1 and 2 on K-104 connects the coil of relay K-1904 to the emission control circuits of J-101, J-102, J-103, the TEST switch, S-104, and the remote circuits, J-903, J-904, K-1902, and K-1903. Selecting CW emission completes the circuit necessary for the operation of relay K-103. Relay contacts 4 and 5 on K-103 complete the circuit necessary for the operation of K-1904 which, in turn, applies primary power to the high voltage dynamotor. Selecting MCW emission operates relay K-1904, the plate power relay.

The RF carrier is controlled by opening the cathode circuit of the oscillator and removing the screen voltage from the power amplifier. The carrier control relay, K-102, has six sets of contacts. Contacts 3 and 9 on K-102 complete the oscillator cathode circuit by grounding resistor R-131. Contacts 3 and 9 on K-102 and resistor R-131 serve as a cathode return for both the HF oscillator, V-101, and the LF oscillator, V-401. The desired oscillator circuit is, selected by the operation of switch S-114. Switch S-114 operates in conjunction with control A. The audio oscillator, is in operation whenever relay K-102 is in the operated position. The voltage developed across the resistor, R-2201, is applied to the input of the speech amplifier through the relay contacts 5 and 6 on K-104, the power level switch, S-106, and the input transformer T-201. Relay contacts 5 and 13 on K-102 apply plate voltage to V-2203. During periods of CW transmission the output of the audio oscillator is fed through the speech amplifier to the sidetone amplifier and the keying may be monitored by listening to the output of the sidetone amplifier. When switch, S-106, is in the CALBRATE position, the circuit from the output of the audio oscillator to the input of the speech amplifier is broken. The carrier control relay K-102 may be operated by closing the circuits of the Throttle Switch jack, J-101, the MICROPHONE jack J-102, the KEY jack J-103, the TEST switch S-104, the remote microphone jack J-903, the remote key jack J-904, or by operation of relays K-1902 and K-1903. Switch S-113D is operated in conjunction with the output network switch, S-113, and breaks the energizing circuit to the coil of relay K-102 whenever S-113 is operated, thus removing excitation from the RF circuits to prevent arcing at the switch contacts. The Autotune limit switch, S-111, and the Autotune motor relay, K-101, contacts 1 and 3 are also connected in series with K-102 relay coil so that when S-111 or K-101 operates, the holding circuit for K-102 will be broken and arcing at all switch contacts will be prevented.

7. APPLICABLE REMOTE CONTROL CIRCUITS.

Terminals 1 to 12 on J-1905 in the power units are intended for use with external or remote carrier control and microphone circuits. See figure 4-12. Terminals 1 to 5 inclusive are used for primary power control of the power units. while terminals 5 to 12 are used for carrier control and microphone circuits.

Operation of relays K-1902 and K-1903 completes the circuits necessary to operate the carrier control relay K-102. The keying relay K-1903 is energized by closing the circuit between terminals 5 and 6 of J-1905. For phone operation utilizing the remote circuits connected to J-1905, the carrier control relay, K-102, is operated by the operation of K-1902. The coil of K-1902 is energized by a connection from terminal No. 8 to terminal No. 11 which is made



NOTE:
UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS, AND CAPACITY VALUES ARE IN MICRO-FARADS.

Figure 4-11 Emission Selection and Carrier Control Circuits

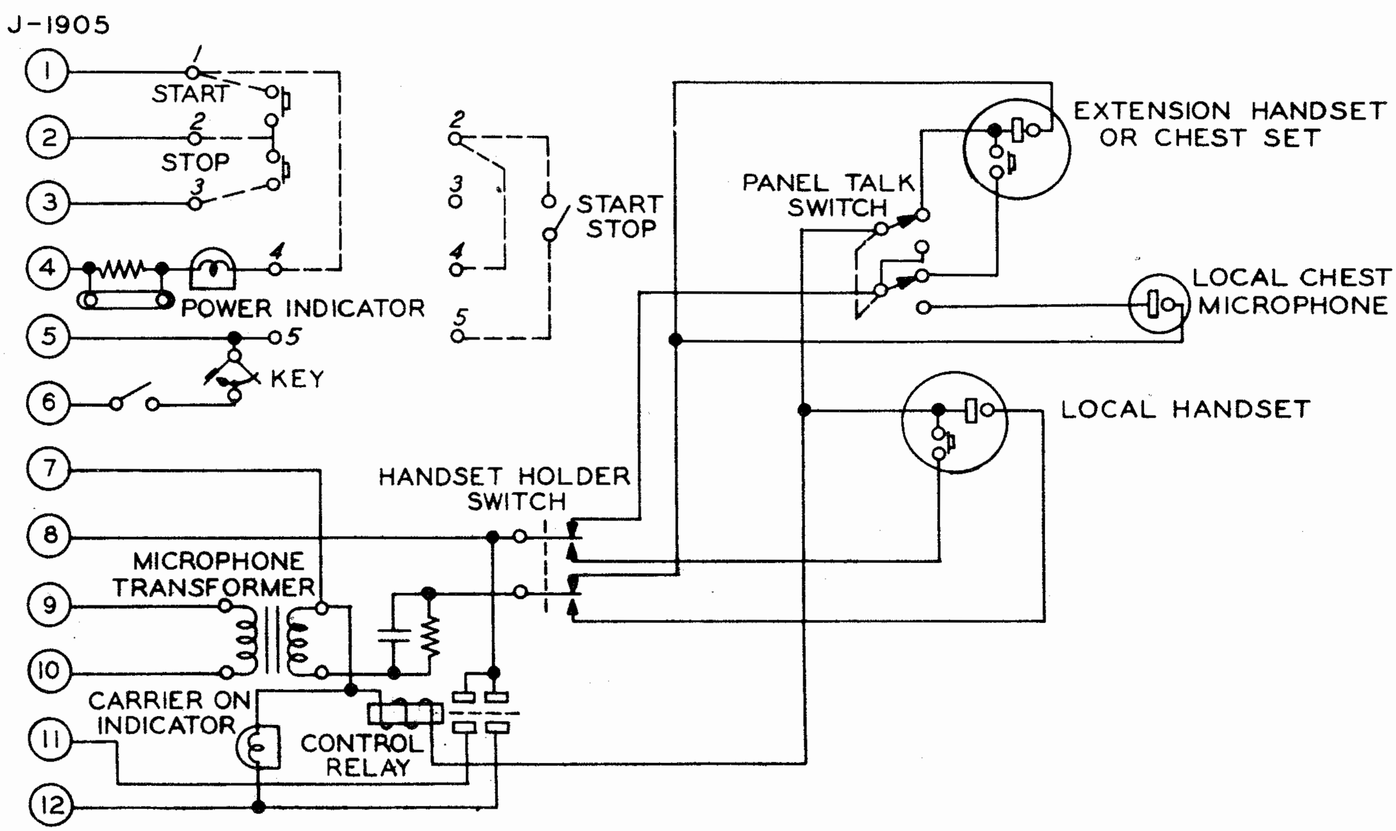


Figure 4-12 Applicable Remote Control Circuits

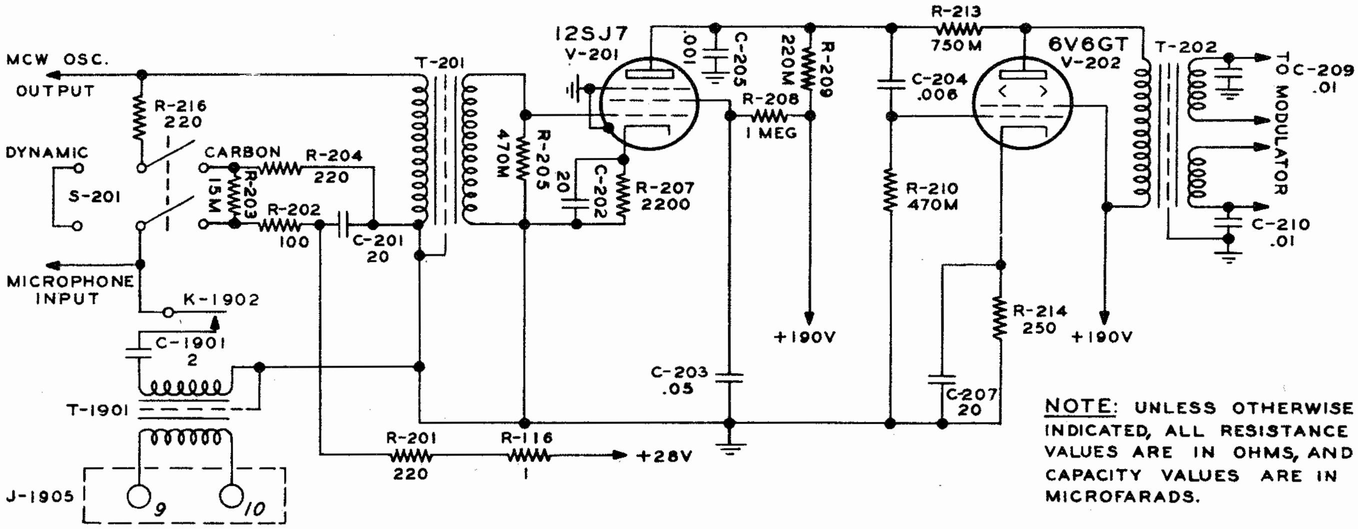
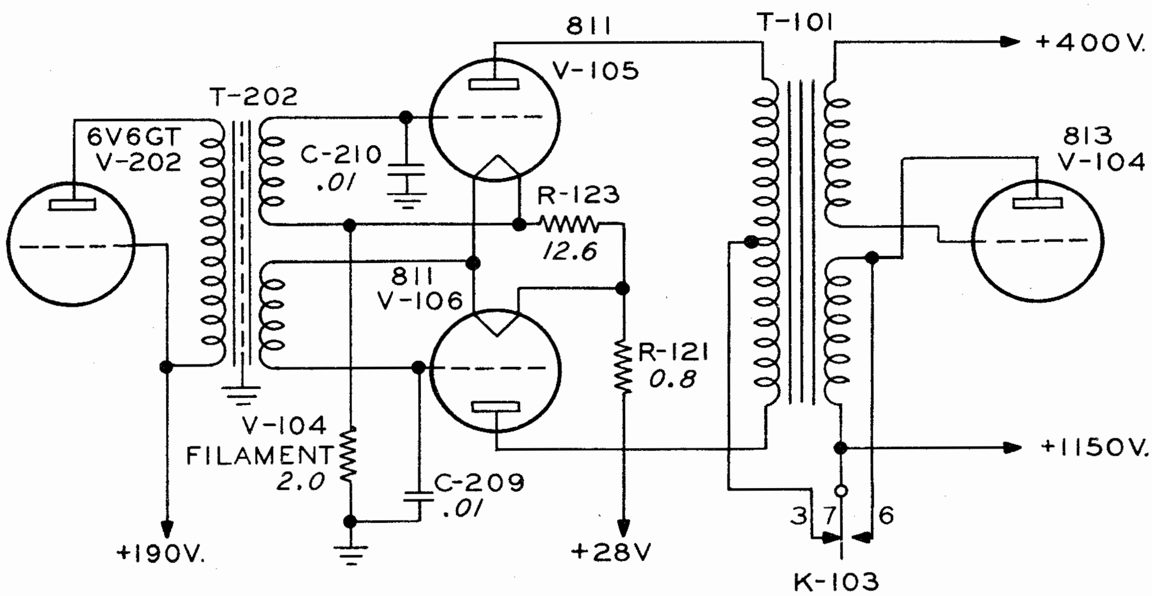


Figure 4-13 Speech Amplifier Circuits



NOTE:

UNLESS OTHERWISE INDICATED ALL RESISTANCE VALUES ARE IN OHMS AND CAPACITY VALUES ARE IN MICROFARADS.

Figure 4-14 Modulator Circuits

through suitable relays controlled by push-buttons on handsets or chestset microphones. Contacts on carrier relay K-1902 also connect the microphone circuit from the transmitter unit to terminals 9 and 10 of terminal board J-1905 through transformer T-1901. Carrier relay K-1902 gets energizing current from a winding on the low voltage dynamotor which supplies 14 volts at 1.2 amps of filtered DC for this purpose. This winding also furnishes button current for remote carbon button microphones and current for other control relays that may be involved.

8. AUDIO CIRCUITS.

The audio system consists of a two stage speech amplifier, push-pull modulators, a sidetone amplifier, and an MCW audio tone oscillator.

a. SPEECH AMPLIFIER. - See figure 4-13. Either of two types of microphone may be used with this equipment. The input to the speech amplifier has been designed so that by operating a switch, proper connections are made to the MICROPHONE jack, J-102, (figure 4-13) to match the output of either a carbon or dynamic type of microphone. The microphone circuit selector switch, S-201, is located beneath the tuning chart on the front panel of the transmitter. If S-201 is placed in the CARBON position, limiting resistors R-201 and R-202 are connected between the positive terminal of the 28 v DC power source and the MICROPHONE jack, J-102, to provide the voltage necessary for the operation of the carbon type of microphone. The operation of S-201 also connects resistor R-203 between J-102 and the input circuit of the speech amplifier to reduce the level of the output of the carbon microphone to the level of the output of a dynamic microphone. Thus, no audio gain control has been proveded because the level of the input to the speech amplifier is the same when using a dynamic microphone as it is when using a carbon microphone. If S-201 is placed in the DYNAMIC position the voltage is removed from the input circuit and the MICROPHONE jack, J-102, is connected in series with resistor R-216 and the primary of the input transformer, T-201. The two stage speech amplifier employs a Type 12SJ7 tube, V-201, as first amplifier, and a Type 6V6GT tube, V-202, as second amplifier. The output of the microphone is coupled by the input transformer, T-201, to the grid of V-201. The output of V-201 is coupled to the grid of V-202 by the capacitor C-204. The output of the audio driver tube, V-202, is coupled to the grids of the molulator tubes V-105 and V-106 by transformer T-202.

b. MODULATOR. - The modulator employs two Type 811 high mu triodes connected in push-pull, and operating Class B. See figure 4-14. The modulators are capable of modulating the carrier (100 watts nominal) at least 90% with full voltage applied to the power amplifier. While the 811 is essentially a zero bias tube when used with plate voltages as high as 1150 volts DC, it becomes necessary to apply some bias to the grid of the tube to keep the static plate current at a safe value. In this application the bias is obtained from the 28 volt DC supply by utilizing the average voltage drop through the filaments of the tubes to obtain equal voltage for application to the grids of both modulator tubes. The output of the modulators is coupled to the RF circuits by modulation transformer T-101. Both the screen and plate of the power amplifier tube, V-104, are modulated. The full output voltage of 1150 volts DC, is applied to the plates of the modulator tubes, V-105 and V-106. Relay contacts 3 and 7 on K-103 remove plate voltage from the modulators when CW emission is selected.

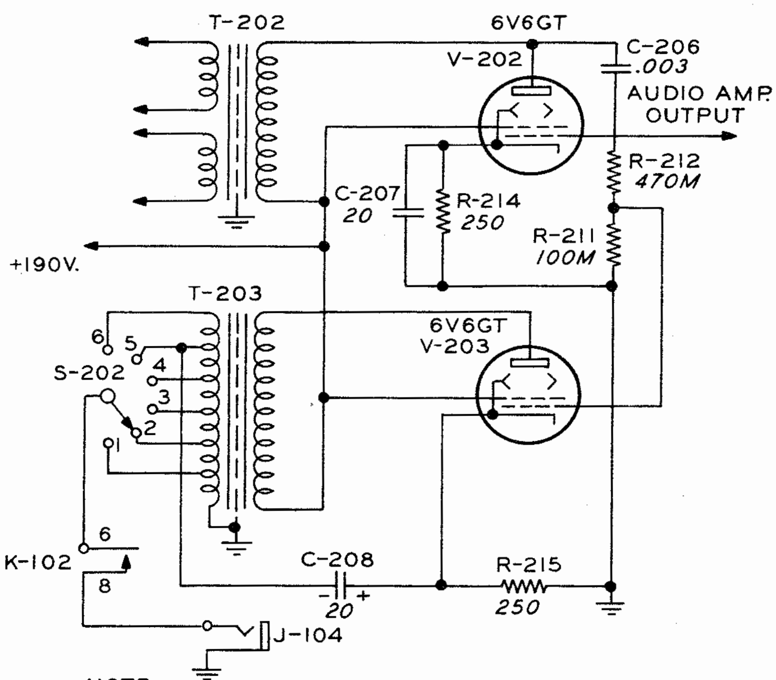
c. SIDETONE AMPLIFIER. - A sidetone amplifier, figure 4-15 is incorporated in the same unit as the two stage speech amplifier. The amplifier employs a Type 6V6GT beam pentode tube V-203. The output of the audio driver V-202 in addition to being applied to the primary of coupling transformer T-202, is applied to a voltage dividing system consisting of C-206, R-211 and R-212. The grid of the sidetone amplifier V-203 is coupled to the junction of R-211 and R-212 and the voltage developed across resistor R-211 drives the grid of V-203 to provide sufficient output from the sidetone amplifier to operate headphones or speaker. The output of V-203 is coupled to the SIDETONE jack, J-104, by the transformer T-203 through the switch S-202 and relay contacts K-102C. The turns-ratio of transformer T-203 may be varied by operating the sidetone OUTPUT switch S-202. The output of the sidetone amplifier is keyed by the operation of the carrier control relay K-102. The SIDETONE jack, J-105, may be connected in parallel with J-104 by connecting a jumper between terminals 26 and 27 of cable connector J-106. The necessary plate and screen voltages for the sidetone amplifier are obtained by tapping the bleeder system of the low voltage output of the power unit.

9. CALIBRATION OSCILLATOR.

a. GENERAL. - The calibration oscillator employs a circuit known as a regenerative frequency divider. The circuit produces a 50 kc fundamental frequency and harmonic output voltages while using a 200 kc crystal as a controlling standard. The 200 kc quartz crystal unit is mounted in a sealed holder which plugs into the two prong receptacle in the rear right-hand corner of the transmitter. Both triode sections of a 12SL7GT tube, V-2201, a 12SA7 pentagrid converter tube, V-2202, and one section of an additional 12SL7GT tube, V-2203, are used in the calibration oscillator circuit. The crystal holder and vacuum tubes plug into sockets on top of the chassis in the order mentioned. The chassis is stamped with the crystal and vacuum tube type designations. The inductor tuning screws that protrude through the sides of the shield cans containing tank circuits Z-2201A, Z-2201B, Z-2202A, and Z-2202B should not be adjusted <u>for any reason</u> unless the alignment procedure is thoroughly understood. The CFI Unit is placed in operation by applying plate voltage to the CFI tubes. The voltage is obtained from the low voltage section of the dynamotor and is applied when power level switch S-106 is operated to the CALIBRATE position. Operating power level switch S-106 to either TUNE or OPERATE position removes high voltage from the CFI tubes thus disabling the oscillator circuit.

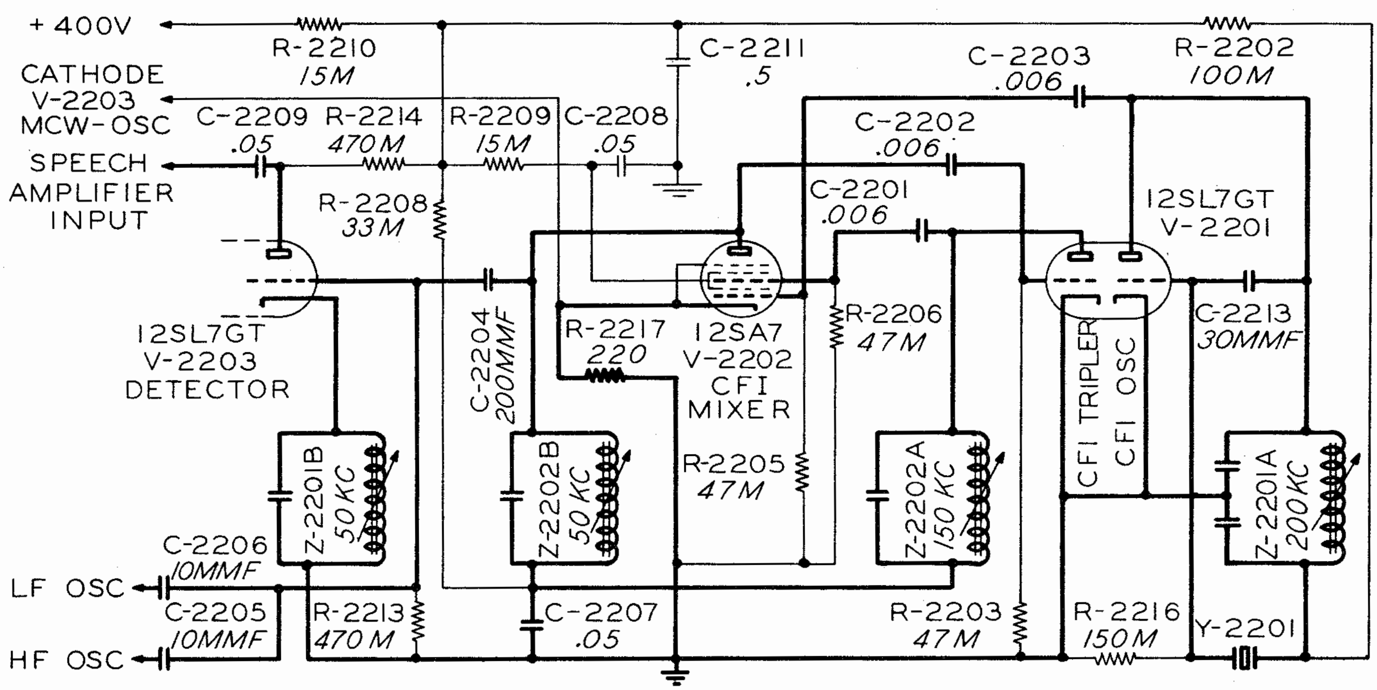
b. CIRCUIT FUNCTION. (Figure 4-16)

(1) The application of plate voltage to the oscillator section of 12SL7GT tube V-2201, starts the 200 kc crystal oscillator. This causes a frequency of 200 kc, plus random tube and circuit noises, to appear on the injection grid of 12SA7 mixer tube V-2202. This random noise appearing on the plate of 12SA7 excites the frequency tripler section of 12SL7GT tube V-2201. Since the plate circuit of this section of 12SL7GT tube V-2201 is tuned to 150 kc, only the 150 kc components of the random noise are amplified. This 150 kc component of the random noise is then impressed on the control grid of the 12SA7 mixer tube. Since the plate circuit of the 12SA7 is tuned to 50 kc; the 50 kc difference frequency, produced by the combination of a 200 kc voltage and a 150 kc voltage appearing in the 12SA7 tube, is the frequency amplified. This 50 kc voltage continues to excite the second triode section of the 12SL7GT, which because of its 150 kc plate circuit, triples the frequency and sustains the 150 kc



NOTE:
UNLESS OTHERWISE INDICATED ALL RESISTANCE VALUES ARE IN OHMS AND CAPACITY VALUES ARE IN MICROFARADS.

Figure 4-15 Sidetone Amplifier Circuits



NOTE: UNLESS OTHERWISE INDICATED ALL RESISTANCE VALUES ARE IN OHMS, AND CAPACITY VALUES ARE IN MICROFARADS.

Figure 4-16 CFI Circuits

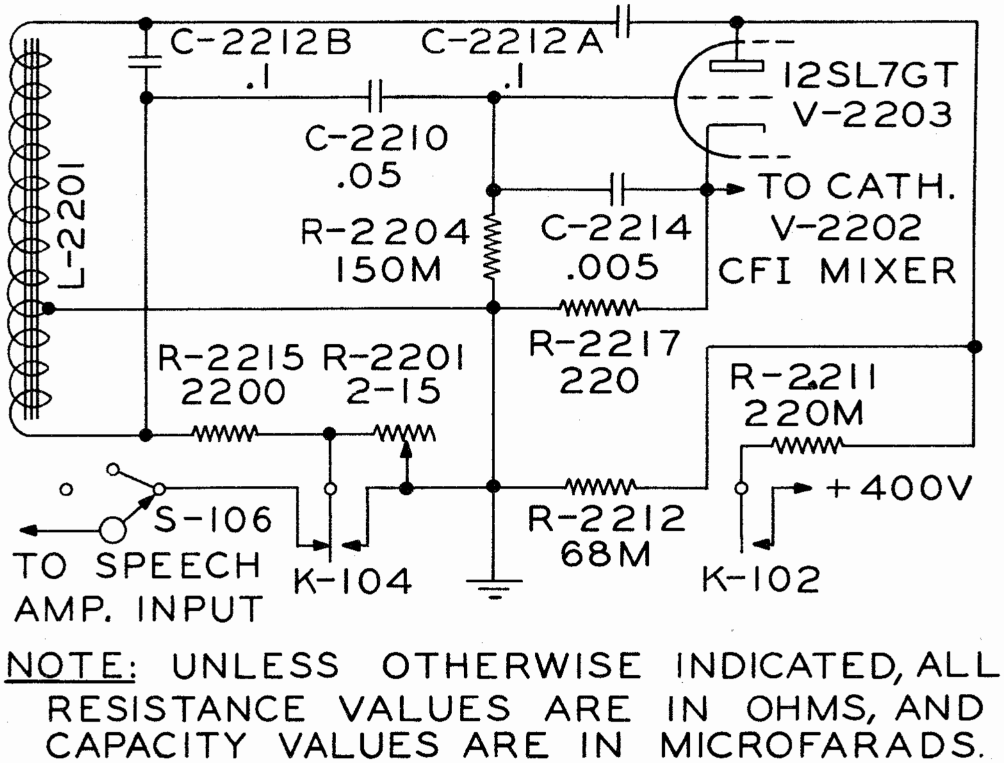


Figure 4-17 MCW Oscillator Circuits

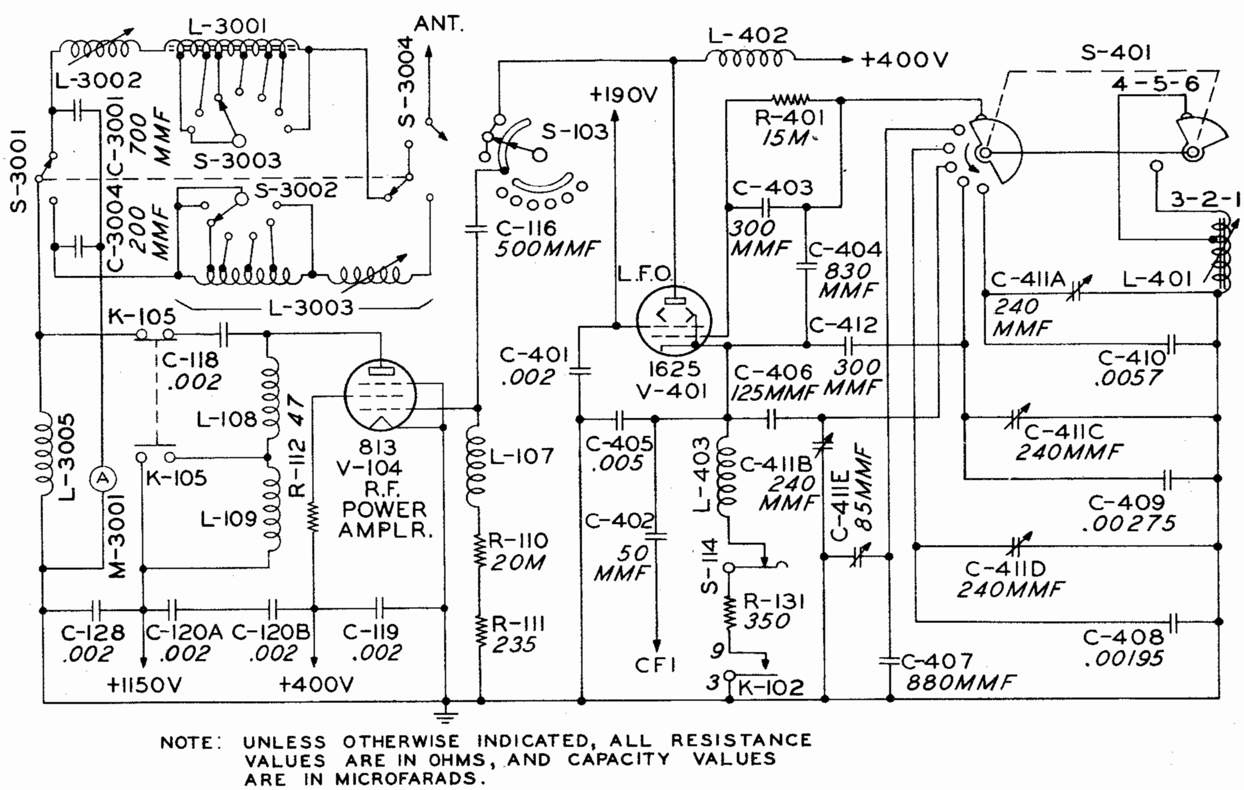


Figure 4-18 Low Frequency Circuits

voltage on the 12SA7 control grid. The 50 kc voltage appearing on the 12SA7 plate becomes the calibration frequency.

(2) One triode section of the second 12SL7GT tube, V-2203, is employed as a signal detector. A portion of the 50 kc voltage appearing on the plate of 12SA7 tube V-2202 is coupled to the grid of V-2203 by capacitor C-2204. Depending upon the transmitting frequency that is selected, a portion of the output of the LF oscillator or the HF oscillator is coupled to the grid of V-2203 by capacitor C-2206 or capacitor C-2205. The beat note that is generated in the signal detector between the output of the HF of the LF oscillator and the 50 kc CFI standard is coupled to the input of the speech amplifier by capacitor C-2209. When power level switch S-106 is operated to the CALIBRATE position, the circuit is completed and the output of the signal detector is heard in the sidetone circuits of the transmitter. The second triode section of 12SL7GT tube V-2203 is connected as an audio oscillator which supplies a signal for sidetone keying and MCW operation of the transmitter. The 12SA7 CFI mixer tube V-2202 and the audio oscillator section of 12SL7GT tube V-2203 are provided with a common bias resistor, R-2217. When the CFI is turned off, the voltage drop across R-2217 is not sufficient to stop the audio oscillator. However, when the C.I is operating, 12SA7 CFI mixer tube V-2202 draws sufficient current to cause a sharp increase in the voltage drop across R-2217 increasing the bias voltage applied to the cathode of the audio oscillator section of 12SL7GT tube V-2203. This results in overbiasing and stopping the audio oscillator tube which prevents the CFI detector from accepting a portion of the 1000 cycle voltage, generated by the audio oscillator, through capacity coupling between the 12SL7GT tube elements.

10. MCW AUDIO OSCILLATOR. (Figure 4-17.)

Keying relay contacts 5 and 13 on K-102 apply voltage to the plate of the audio oscillator section of 12SL7GT tube V-2203 when keying relay K-102 is operated. The audio frequency output level of this oscillator and consequently the percentage of MCW modulation is controlled by varying resistor R-2201. The screwdriver slot for varying resistor R-2201 is accessible through a hole onthe rear of the MCW-CFI Unit. The voltage developed across resistor R-2201 is coupled through "voice" relay contacts 5 and 6 on K-104 and power level switch S-106 to the speech amplifier input circuit, making the audio oscillator the MCW oscillator when MCW emission is selected. When VOICE emission has been selected, voice relay contacts 5 and 6 on K-104 disconnect the output of the audio oscillator section of vacuum tube V-2203 from the input circuit of the speech amplifier. During periods of CW transmission the audio oscillator is keyed and the output is fed to the input of the speech amplifier and the sidetone amplifier to provide a means of monitoring the keying.

11. RADIO-FREQUENCY CIRCUITS.

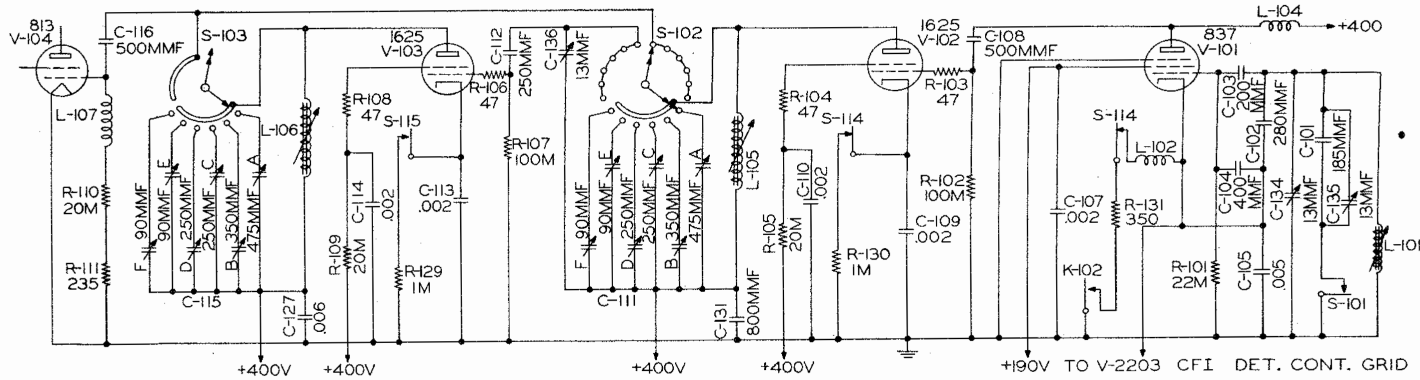
The Type COL-52286-A Transmitter employs two RF systems. One system covers the frequency range 200 kc to 1500 kc and the other system the frequency range 2000 kc to 18,100 kc. Separate oscillator tubes are employed for each frequency range. The same power amplifier tube serves both systems.

a. LOW-FREQUENCY CIRCUITS. (See figure 4-18.) - The LF oscillator, V-401, employs a Type 1625 beam pentode tube. This oscillator operates in the frequency range 200 kc to 1500 kc. This frequency range is covered in six bands.

Refer to the oscillator calibration curves, Section III for the frequency coverage of the individual bands. A combination of capacitive and inductive grid tuning is employed. The COARSE tuning switch S-401 varies the grid circuit capacity by increasing the number of padding capacitors connected in the circuit as S-401 is rotated toward the lowest frequency position. Switch S-401 also changes the tap on the grid inductor L-401 to vary the inductance in the grid circuit. Trimmer capacitors have been connected in parallel with the padding capacitors to provide means of fine adjustment of grid circuit capacity. These trimming capacitors are of the ceramic type and the capacity of each may be varied by rotating one plate with respect to the other. In spite of the small physical size, this type of capacitor provides a means of varying the capacity over a wide range. With the end-points of the frequency band set and the trimmer capacitors adjusted to give some overlap in each position of switch S-401, all fine frequency adjustments within the frequency range of each switch position are made by varying the inductance of the inductor L-401. The inductance of L-401 is altered by adjusting the position of the core, which is actuated by the tuning screw that is accessible through the coil shield. The position of the tuning core within the inductor is determined by Control G. When LF operation is desired and the LF position (13) of control "A" has been selected, the cathode circuit of the oscillator V-401 is coupled through the contacts of switch S-114 and resistor R-131 to relay contacts 3 and 9 of the carrier control relay K-102. Operation of K-102 completes the cathode circuit to ground. Screen voltage for V-401 is obtained by tapping the low voltage output bleeder. The output of the oscillator V-401 is coupled to the grid of the power amplifier tube V-104 by S-103 when Control "A" is operated to the LF position. Selecting LF operation operates relay K-105 which connects the plate circuit of V-104 to the external loading coil. The HF output network is completely removed from the circuit by the operation of K-105. Relay contacts K-105 remove the shorting connection across the plate choke, L-109. Screen voltage for V-104 is obtained from the low voltage output of the power unit. The full voltage of the high voltage section of the power unit is applied to the plate of V-104. The external loading coil in addition to being an antenna loading coil is also the power amplifier plate tank circuit. A tapped inductor and variometer provide means of adjusting the loading and the power amplifier plate tank tuning.

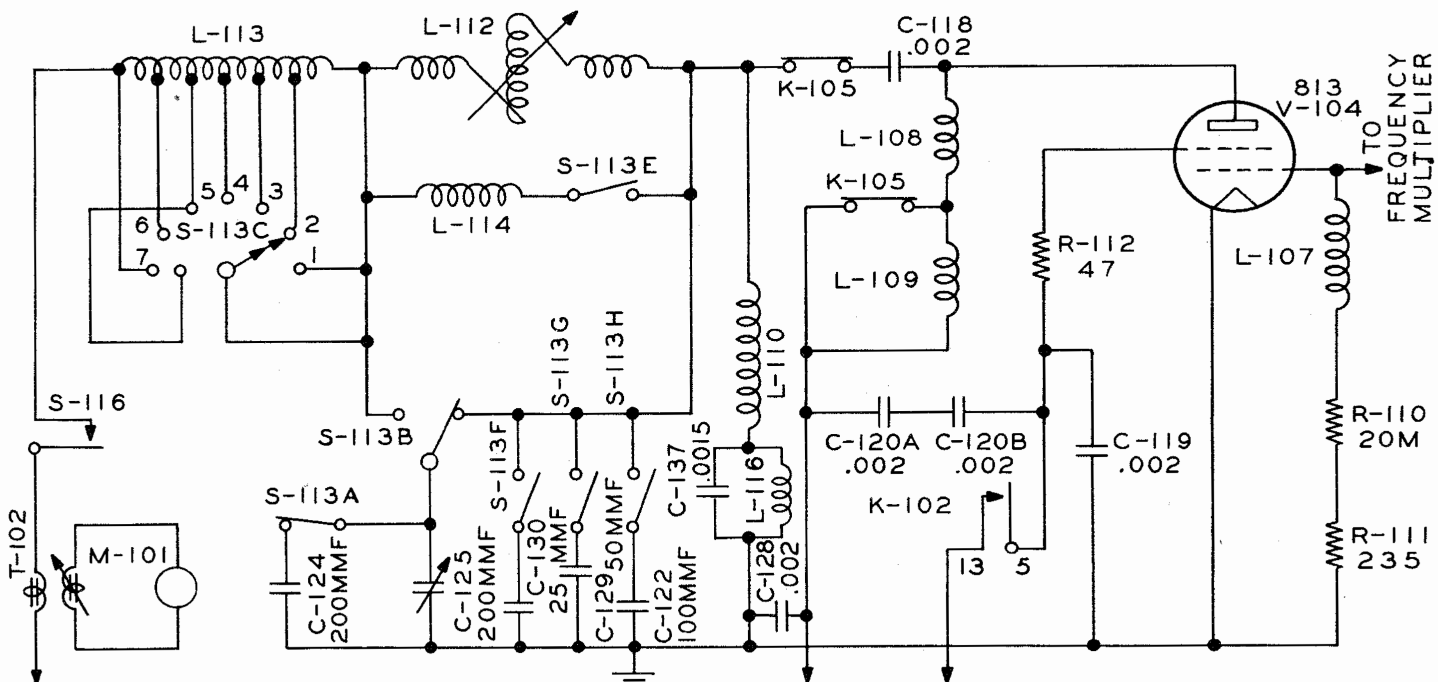
Antenna keying relay K-3001 in the low frequency load coil unit is connected to the keying circuit and is operated in synchronism with carrier relay K-102 when the telegraph key, test key, or microphone switch is operated.

b. HIGH FREQUENCY EXCITER CIRCUITS. - The HF oscillator, figure 4-19, employs a beam pentode Type 837 tube, V-101, in a variable frequency oscillator circuit. The oscillator operates within the frequency range 1000 kc to 1510 kc. This frequency range is covered in two bands, 1000 kc to 1200 kc, and 1200 kc to 1510 kc. The band of frequencies within which output is obtained, is dependent on the position of HF oscillator range switch S-101. Capacitors C-101 and C-135 are connected in the grid circuit of the HF oscillator tube, V-101, by HF oscillator range switch S-101 which is operated by Control "A". Alternate positions of Control "A" add or remove the padding capacitors C-101 and C-135. With Control "A" in the 2.0 mc to 2.4 mc position HF oscillator range switch S-101 is closed, giving the maximum grid circuit capacitance and consequently the lowest frequency output. Therefore, when Control "A" is in the 2.0 mc to 2.4 mc position, oscillator output is obtained in the frequency range 1000 kc to 1200 kc. When Control "A" is rotated to the 2.4 mc to 3.0 mc position, HF oscillator range switch S-101 is opened, removing capacitors C-101 and C-135 from the circuit, and oscillator output is obtained in the frequency range



NOTE:
UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS, AND CAPACITY VALUES ARE IN MICROFARADS.

Figure 4-19 High Frequency Exciter Circuits



NOTE:
UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS, AND CAPACITY VALUES ARE IN MICROFARADS.

Figure 4-20 Power Amplifier and Output Network

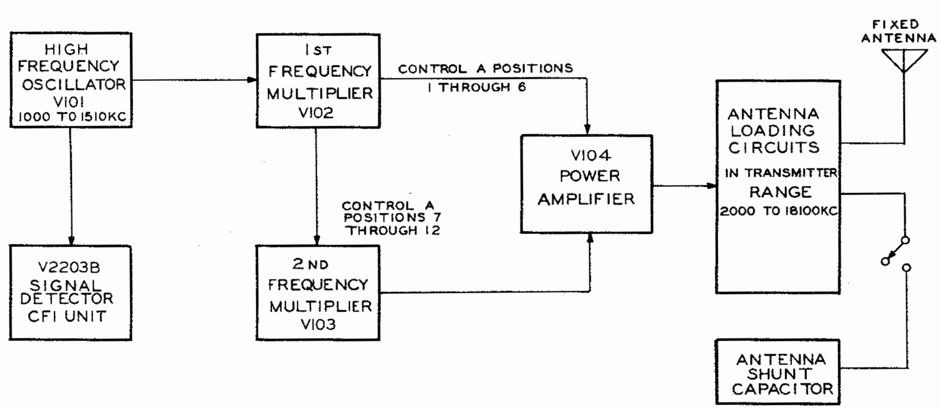


Figure 4-21 High Frequency RF Circuits - Block Diagram

1200 kc to 1510 kc. When Control "A" is operated to the 3.0 mc to 3.6 mc position, HF oscillator range switch S-101 is again operated to the closed position and oscillator output is obtained in the frequency range 1000 kc to 1200 kc. In the remaining nine HF positions of Control "A", HF oscillator range switch S-101 is alternately opened and closed to give oscillator output as indicated above. Trimming capacitors C-134 and C-135 have been provided to aid in setting the end-points of the two frequency bands. When setting the HF end of the 1000 kc to 1200 kc band, the grid capacity is trimmed using variable capacitor C-135. When the HF end of the 1200 kc to 1510 kc band is set, the grid tuning capacity is trimmed by using variable capacitor C-134. Fine frequency adjustment within each band is made by varying the inductance of grid tuning inductor L-101. The inductance of L-101 is varied by adjusting the position of the tuning slug within the coil. The position of the tuning slug is determined by Control "B". Approximately 20 revolutions of Control "B" will cover the entire frequency range of the band upon which the oscillator is operating, with some overlap on both ends of the band. A portion of the output of the HF oscillator V-101 is fed to the grid of the CFI tube, V-2203, to permit the calibration of HF oscillator tube V-101 against the crystal oscillator circuit of CFI unit. When HF operation has been selected, rotating Control "A" to any one of the twelve HF positions will close the cathode circuit of HF oscillator tube V-101 through cathode choke L-102, the contacts of oscillator selecting switch S-114 and the cathode resistor R-131, to keying relay contacts 3 and 9 on K-102. The operation of keying relay K-102 completes the cathode circuit to ground. Screen voltage for HF oscillator tube V-101 is obtained by tapping the bleeder across the low voltage output of the power unit. The full voltage of the low voltage section of the power unit is applied to the plate of HF oscillator tube V-101.

To obtain RF output in the frequency range 2000 kc to 18,100 kc, the output of the HF oscillator must be multiplied from two to twelve times. The frequency multiplier tubes, V-102 and V-103, are inoperative when LF operation has been selected. The frequency multiplier stages employ Type 1625 beam pentode tubes. The first multiplier tube may operate as a frequency doubler, tripler, or quadrupler. The number of times that the frequency of the output of the HF oscillator tube, V-101, is multiplied is dependent upon the position of first multiplier range switch S-102. The position of first multiplier range switch S-102 is determined by Control "A". Twelve HF positions and one LF position of Control "A" are available. The twelve HF positions permit the selection of any output frequency within the frequency range 2000 kc to 18,100 kc.

The 13 positions of Control "A" and the frequency range covered by each are tabulated below:

HIGH FREQUENCY TUNING - COARSE

Control Position "A"	Frequency Range
1	2.0 to 2.4 mc
2	2.4 to 3.0 mc
3	3.0 to 3.6 mc
4	3.6 to 4.0 mc
5	4.0 to 4.8 mc
6	4.8 to 6.0 mc
7	6.0 to 7.2 mc

HIGH FREQUENCY TUNING - COARSE (Cont)

Control Position	Frequency Range
8	7.2 to 9.0 mc
9	9.0 to 10.8 mc
10	10.8 to 12.0 mc
11	12.0 to 14.4 mc
12	14.4 to 18.1 mc
13	200 kc to 1500 kc

In the first six positions of Control "A", only the first frequency multiplier tube, V-102, is in operation. First multiplier range switch S-102 connects the output circuit of the first frequency multiplier tube V-102 to the input circuit of the final amplifier tube V-104. With Control "A" in Position 1 or 2, first multiplier tube V-102 is operating as a frequency doubler. With Control "A" in Position 3 or 4, first multiplier tube V-102 is operating as a frequency tripler. With Control "A" in Position 5 or 6, first multiplier tube V-102 is operating as a frequency quadrupler. First multiplier range switch S-102 is a twelve-position switch and connects padding capacitors across the first multiplier tube V-102 plate tuning inductor L-105. The capacity of the tank circuit is reduced as Control "A" is rotated in a clockwise direction, thus increasing the frequency of the output of first multiplier tube V-102 as Control "A" is rotated through Positions 1 through 6. When Control "A" is rotated to Position 7, the second multiplier tube, V-103 is placed in operation. First multiplier range switch S-102 acts to connect the output circuit of first multiplier tube V-102 to the grid circuit of second multiplier tube V-103 and breaks the circuit from the first multiplier tube V-102 output circuit to the grid circuit of final amplifier tube V-104. The second multiplier tube V-103 operates only as a frequency tripler. Control "A", when in Positions 7 to 12 inclusive, also operates second multiplier operating switch S-115 to connect the cathode of second multiplier tube V-103 through bias resistor R-129 to ground. The first multiplier tube, V-102, operates as a frequency doubler when Control "A" is in Position 7 or 8, as a frequency tripler when Control "A" is in Position 9 or 10, and as a frequency quadrupler when Control "A" is in Position 11 or 12. Second multiplier range switch section S-103 connects the sections of padding capacitor C115 across the second multiplier tube V-103 plate inductor, L-106. Capacitors C-111 and C-115 are of the ceramic type and the capacity of each section may be adjusted by rotating one plate in respect to the other. The frequency multiplier stages are aligned by adjusting the capacity of C-111 and C-115 and the inductance of the plate tank inductors L-105 and L-106. The tuning slugs within inductors L-105 and L-106 are ganged with the tuning slug of L-101, but may be adjusted in respect to each other and with respect to the tuning slug of L-101, to obtain proper tracking within each frequency band. Plate and screen voltages for the frequency multiplier tubes, V-102 and V-103, are furnished by the low voltage section of the power unit. The voltage for application to the tube screens is dropped from the 400 volt output of the power unit to approximately 270 volts by dropping resistors R-105 and R-109.

c. POWER AMPLIFIER AND OUTPUT NETWORK. - The power amplifier stage, figure 4-20, employs a Type 813 beam pentode tube and operates as a straight amplifier at all frequencies. When the transmitter is operating in the frequency range 200 kc to 1500 kc, the output of the RF oscillator is capacitively coupled to the grid of the power amplifier. When the transmitter is operating in the frequency range 2.0 mc to 6.0 mc the output of the first frequency multiplier tube, V-102, is coupled to the grid of the power amplifier tube through first multiplier range switch S-102 contacts and capacitor C-116. When the transmitter is operating in the frequency range 6.0 mc to 18.1 mc the output of the second frequency multiplier tube, V-103 is coupled to the grid of the final amplifier tube, V-104, through second multiplier range switch S-103 contacts and capacitor C-116. When LF operation has been selected, output circuit selecting relay K-105 operates to connect the plate circuit of the final amplifier tube, V-104, to external loading coil terminal J-117. With output circuit selecting relay K-105 in the normal unoperated position, the plate circuit of final amplifier tube V-104 is connected to the output network that is incorporated in the transmitter proper. Screen voltage for the power amplifier is supplied by the low voltage section of the power unit. Screen voltage is applied to final amplifier tube V-104 when the keying relay K-102 is operated through relay contacts 5 and 13 on K-102. The operation of output circuit selecting relay K-105 performs four functions, namely, (1) connects the output of the power amplifier to external loading coil terminal J-117, (2) disconnects the antenna tuning and power amplifier plate tank circuit, (3) adds an additional RF choke, L-109, in series with the power amplifier feed choke L-108, and (4) connects the positive 28 volt DC lead to external relay connector J-107. When output circuit selecting relay K-105 is in the normal or unoperated position, the output of the power amplifier tube is coupled to the plate tank and antenna coupling network in the transmitter proper through the capacitor C-118 and the RF choke, L-109, is shorted out. The full output voltage of the high voltage section of the power unit is applied to the plate of final amplifier tube V-104.

The output network is designed to operate as either a pi or L section. The multi-section output network switch S-113 connects the capacitors and inductors in the proper positions to permit matching the power amplifier plate circuit to most aircraft antennas at any frequency within the frequency range 2000 kc to 18,100 kc.

The following table will help the operator to better understand the operation of the output network switch S-113:

Control "C" Position	S-113A	S-113B	S-113C	S-113E	S-113F	S-113G	S-113H
1	Operated by the rotation of C-125. (Operated when dial E reads in 0-100 range.)	1	1	OPEN	OPEN	OPEN	OPEN
2		1	2	OPEN	OPEN	OPEN	OPEN
3		1	3	OPEN	OPEN	OPEN	OPEN
4		1	4	OPEN	OPEN	OPEN	OPEN
5		1	5	OPEN	OPEN	OPEN	OPEN
6		1	6	OPEN	OPEN	OPEN	OPEN
7		1	7	OPEN	OPEN	OPEN	OPEN
8		2	7	OPEN	CLOSED	CLOSED	CLOSED
9		2	7	OPEN	OPEN	OPEN	CLOSED
10		2	7	OPEN	OPEN	CLOSED	OPEN
11		2	7	OPEN	CLOSED	OPEN	OPEN
12		2	7	OPEN	OPEN	OPEN	OPEN
13		2	7	CLOSED	OPEN	CLOSED	OPEN

The variometer, L-112, is operated by Control "D". The variable capacitor C-125 is operated by Control "E". The above controls are connected to the Autotune system, but may be manually operated without disturbing the positions of the Autotune stop rings if the CHANNEL selector switch S-108 is placed in the MANUAL position and the Autotune system allowed to operate. The network will tune and deliver rated power to antennas 17 feet to 60 feet in length throughout the frequency range 3000 kc to 18,100 kc. If operation in the range 2000 kc to 3000 kc is desired, it may be necessary to connect the Type-481628 Antenna Shunt Capacitor (figure 1-8) across the network output.

12. AUTOTUNE SYSTEM.

The Collins Autotune System is an electrically controlled means of mechanically repositioning adjustable elements such as tap switches, variable inductors, variable capacitors, etc. Any combination of these items such as are used in transmitting equipment can be tuned to any one of eleven preselected frequencies in a period of twenty-five seconds at normal room temperature and with a normal supply voltage, by the use of the Autotune system. Provisions have also been made to permit manual tuning of the radio equipment.

The Autotune assembly consists of a group of positioning mechanisms, one of which is applied to each tuning elementto perform the same function as a manual tuning knob. Each positioning mechanism provides precise angular setting of the tuning control to any one of eleven angular positions, each of which is readily adjustable. The settings for each frequency and for each control are entirely independent.

The positioning accuracy of the Autotune mechanism is of a very high order. Each setting is inherently independent of wear, backlash, alignment, supply voltage, etc. The accuracy of the settings is comparable to that of vernier manual controls. The parts are machined within close limits and although operation is most precise, there are no delicate adjustments or fragile mechanisms. Permanently lubricated bearings are used in many places and the assembly is enclosed and protected from dust and corrosion.

a. MECHANICAL DETAILS. (Refer to figure 4-22.)

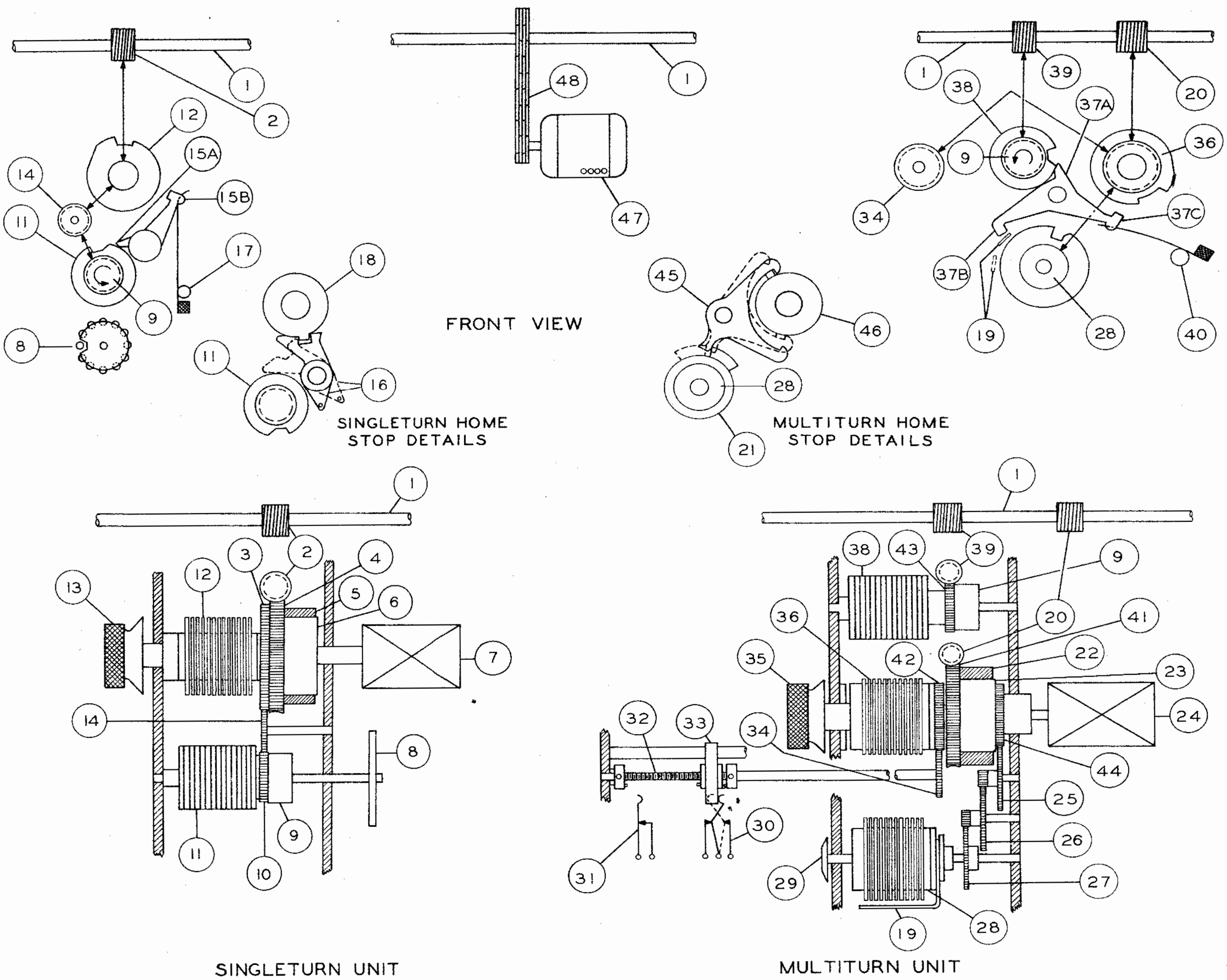
(1) LINE SHAFT. - The line shaft extends the entire length of the Autotune casting and drives all the Autotune units. Power is applied to the shaft from the motor (47) by means of a chain drive (18).

(2) SINGLETURN WORM. - The singleturn unit is driven by one worm on the line shaft (1).

(3) CAM DRUM DRIVE SPUR GEAR. - This gear is fastened directly to the slip clutch worm gear (4) and drives the cam drum spur gear (10) through the idler gear (14).

(4) SLIP CLUTCH WORM GEAR. - This gear is fastened to the cam drum drive spur gear (3) and drives the stop ring drum (12) through the slip clutch (6). This gear is driven by the singleturn worm (2).

(5) SLIP CLUTCH BAND. - This band is driven directly from the slip clutch worm gear (4) and presses against the slip clutch drum (6).



KEY TO SYMBOLS

1-LINE SHAFT
2-SINGLETURN WORM
3-CAM DRUM DRIVE SPUR GEAR
4-SLIP CLUTCH WORM GEAR
5-SLIP CLUTCH BAND

6-SLIP CLUTCH DRUM
7-TUNED ELEMENT
8-CIRCUIT SEEKING TAP SWITCH
9-SINGLE TOOTH RATCHET
10-CAM DRUM SPUR GEAR
11-CAM DRUM
12-STOP RING DRUM
13-SINGLETURN DIAL
14-IDLER GEAR
15-PAWL (15A-PAWL HEEL)(15B-PAWL TOE)
16-SINGLETURN HOME STOP PAWL

17-PAWL SPRING
18-SINGLETURN HOME STOP RING
19-ANVIL
20-MULTITURN WORM #1
21-MULTITURN HOME STOP CAM

22-SLIP CLUTCH BAND
23-SLIP CLUTCH DRUM
24-TUNED ELEMENT
25-IDLER GEAR #1
26-IDLER GEAR #2
27-COUNTER DRUM SPUR GEAR
28-COUNTER DRUM
29-TURN COUNTER DIAL
30-REAR LIMIT SWITCH SECTION
31-FORWARD LIMIT SWITCH SECTION
32-LIMIT SWITCH DRIVE SHAFT

33-SWITCH OPERATING ARM
34-LIMIT SWITCH DRIVE SHAFT SPUR GEAR
35-MULTITURN DIAL
36-STOP RING DRUM
37-PAWL (37A-PAWL HEEL)
(37B-PAWL TAIL) (37C-PAWL TOE)
38-CAM DRUM
39-MULTITURN WORM #2
40-PAWL SPRING
41-STOP RING DRUM WORM GEAR
42-STOP RING DRUM SPUR GEAR
43-CAM DRUM WORM GEAR
44-COUNTER DRUM DRIVE GEAR
45-MULTITURN HOME STOP PAWL
46-MULTITURN HOME STOP RING
47-AUTOTUNE MOTOR
48-CHAIN DRIVE

Figure 4-22 Collins Autotune System - Mechanical Portion

(6) SLIP CLUTCH DRUM. - This slip clutch drum, driven by the slip clutch band (5), is fastened to the stop ring drum shaft.

(7) TUNED ELEMENT. - The tuned element, such as a tap switch, a variable capacitor, or a variometer, is driven directly from the stop ring drum shaft.

(8) CIRCUIT SEEKING TAP SWITCH. - This switch is driven by the cam drum shaft and is phased so that the contacts are in synchronization with the cams of the cam drums (11) and (38).

(9) SINGLE TOOTH RATCHET. - The single tooth ratchet, when engaged, drives the cam drum. These ratchets keep the cam drums of the various units synchronized.

(10) CAM DRUM SPUR GEAR. - The cam drum spur gear is driven from the line shaft through gears (2), (3), and (14). The spur gear drives the cam drum (11) through the single tooth ratchet (9).

(11) CAM DRUM. - The cam drum consists of twelve cams mounted on a shaft with adjacent cam slots staggered 30 degrees. These cams are rigidly fastened to the drum. The single tooth ratchet (9) mounts on the shaft behind the drum and drives the drum.

(12) STOP RING DRUM. - The stop ring drum assembly consists of twelve stop rings mounted on a shaft with spacers between the rings. The stop rings are free to rotate but the spacers are keyed to the shaft such that as one stop ring is rotated, movement of the ring will not affect the adjacent rings which may have been previously adjusted. A locking bar, on the dial, locks the stop rings when adjustment has been completed. The locking mechanism consists of a bar that drives a screw to apply pressure to the stack of stop rings and spacers, thereby, in effect, locking them.

(13) SINGLETURN DIAL. - The singleturn dial is fastened to the stop ring drum (12) and enables the operator to adjust the tuned element (7). The locking bar is located on the front of the dial.

(14) IDLER GEAR. - The idler gear transmits power from the cam drum drive spur gear (3) to the cam drum spur gear (10).

(15A) PAWL HEEL. - The pawl heel is held against the cam brum (11) by the pawl spring (17).

(15B) PAWL TOE. - The pawl toe serves to position the tuned element (7) by dropping into the stop ring slot and stopping the stop ring drum (12) after the motor (47) reverses and the pawl heel (15A) is in a cam drum slot.

(16) SINGLETURN HOME STOP PAW. - This pawl limits the rotation of the singleturn unit to one revolution. The pawl is located on the same shaft as the pawl (15) and is engaged by the singleturn home stop ring (19). Referring to the mechanical portion of the Autotune, the pawl as shown in solid lines limits the rotation of the stop ring drum (12) in the counterclockwise direction. The pawl cannot pivot further because it bears against the stop ring drum (12) at point "B". The pawl as shown in dotted lines limits the rotation of the cam drum (12) in a clockwise direction. The pawl cannot pivot further in this posi-

tion because it bears on the cam drum (11) at point "A".

(17) PAWL SPRING. - The pawl spring presses the pawl heel (15A) against the cam drum (11) and when the pawl heel (15A) drops into the cam drum slot, the pawl spring presses the pawl toe (15B) against the stop ring drum (12).

(18) SINGLETURN HOME STOP RING. - This ring, mounted with the other stop rings on the stop ring drum (12), is rigidly fastened to the drum. The home stop pawl (16) engages with this ring to limit the rotation of the stop ring drum (12) to one revolution.

(19) ANVIL. - The anvil prevents the multiturn pawl tails (37B) from becoming engaged in the counter drum (28) ring slots until after the motor (47) reverses.

(20) MULTITURN WORM #1. - This worm drives the stop ring drum worm gear (41).

(21) MULTITURN HOME STOP CAM. - This cam is mounted with the other cams on the counter drum (28). This cam actuates the home stop pawl (45) to limit the rotation of the stop ring drum (36) to twenty revolutions.

(22) SLIP CLUTCH BAND. - This band, driven by the worm gear (41), drives the stop ring drum (36) through the slip clutch drum (23).

(23) SLIP CLUTCH. - This clutch, similar to (6), is driven by the slip clutch band (22) and is fastened to the stop ring drum shaft.

(24) TUNED ELEMENT. - This frequency determining element is coupled directly to the stop ring drum (36).

(25) IDLER GEAR #1. - This gear and gear (26) link the counter drum (28) to the slip clutch spur gear (44) which is fastened to the stop ring drum (36).

(26) IDLER GEAR #2. - This gear and idler gear #1 (25) link the counter drum (28) to the slip clutch spur gear (44).

(27) COUNTER DRUM SPUR GEAR. - This gear drives the counter drum (28).

(28) COUNTER DRUM. - This drum consists of eleven cams with spacers between them. Like the stop ring drums (12) and (36), the spacers are keyed to the shaft so that movement of one cam will not disturb adjacent cams. A spring on the rear of the counter drum loads the stack of cams axially so that the rings will not turn too easily.

(29) TURN COUNTER DIAL. - This dial, numbered from 0 to 20, indicates the number of turns the Multiturn unit has made.

(30) REAR LIMIT SWITCH SECTION. - This switch, actuated by the operating arm (33), is normally held in the operated position. During the first part of the Autotune cycle, this switch opens, disabling the keying relay. As the Autotune cycle nears completion, the operating arm (33) recloses the switch, turning off the motor (47) and restoring the coil circuit of the keying relay.

(31) FORWARD LIMIT SWITCH SECTION. - This switch, normally closed, provides a holding circuit for the motor control relay. When the operating arm (33) opens the switch, the circuit seeking tap switch reverses the motor, thereby returning the Autotune to the home position, completing the cycle.

(32) LIMIT SWITCH DRIVE SHAFT. - This shaft is driven by the gear (34) from the line shaft (1). The screw thread on the shaft moves the switch operating arm forward or backward between the limit switch sections (30) and (31). On either end of the screw are cams which limit the travel of the switch operating arm (33).

(33) SWITCH OPERATING ARM. - This arm is driven by the threaded drive shaft (32) and controls limit switches (30) and (31).

(34) LIMIT SWITCH DRIVE SHAFT SPUR GEAR. - This gear, driven by the stop ring drum spur gear (42) drives the limit switch drive shaft (32).

(35) MULTITURN DIAL. - This dial with locking bar enables the operator to adjust the stop ring drum (36) to any desired operating frequency within the range of the equipment.

(36) STOP RING DRUM. - See (12).

(37A) PAWL HEEL. - The pawl heel is held against the cam drum (38) by the pawl spring (40).

(37B) PAWL TAIL. - The pawl tail, when allowed to engage the counter drum (28) ring slot by the movement of the anvil (19) selects the revolution in which the tuned element (24) will be positioned.

(37C) PAWL TOE. - The pawl toe serves to position the tuned element (24) by dropping into the stop ring slot and stopping the stop ring drum (36).

(38) CAM DRUM. - See (11).

(39) MULTITURN WORM #2. - This worm drives the cam drum (38) through the singletooth ratchet (9).

(40) PAWL SPRING. - This spring is similar to (16).

(41) STOP RING DRUM WORM GEAR. - This gear, powered from the line shaft (1) by the worm (20), drives the stop ring drum (36) through the slip clutch (23).

(42) STOP RING DRUM SPUR GEAR. - This gear is fastened to the stop ring drum worm gear (41) and drives the limit switch drive shaft (32) through the gear (34).

(43) CAM DRUM WORM GEAR. - This gear, powered from the line shaft (1) by the worm (39), drives the cam drum (38) through the single tooth ratchet (9).

(44) COUNTER DRUM DRIVE GEAR. - This gear, fastened to the slip clutch drum (23) drives the counter drum (28) through the idler gears (25) and (26) and gear (27).

(45) MULTITURN HOME STOP PAWL. - This pawl, actuated to either position shown by the home stop cam (21), engages the projection on the home stop ring (46) to limit the rotation of the stop ring drum (36) to 20 revolutions. This pawl is mounted on the same shaft as the pawl (37).

(46) MULTITURN HOME STOP RING. - This ring is engaged by the pawl (45) and is mounted on the stop ring drum (36). The dotted outlines of the home stop ring (46) and pawl (45) show the stop ring drum (36) in the limit of rotation in the counterclockwise direction. The other position shows limit in the clockwise direction.

(47) AUTOTUNE MOTOR. - The Autotune motor is a DC shunt wound reversible type and applies power to the line shaft (1) through the chain drive (48).

(48) CHAIN DRIVE. - The chain drive transmits the power from the Autotune motor (17) to the line shaft (1) and consists of a driving pinion coupled to a driven sprocket by a chain.

b. ELECTRICAL DETAILS. (See figure 4-23.)

(1) B-101 AUTOTUNE MOTOR. - The Autotune motor operates from the 28 volt direct current power source and is controlled by the limit switches, S-111 and S-112, and motor control relay, K-101.

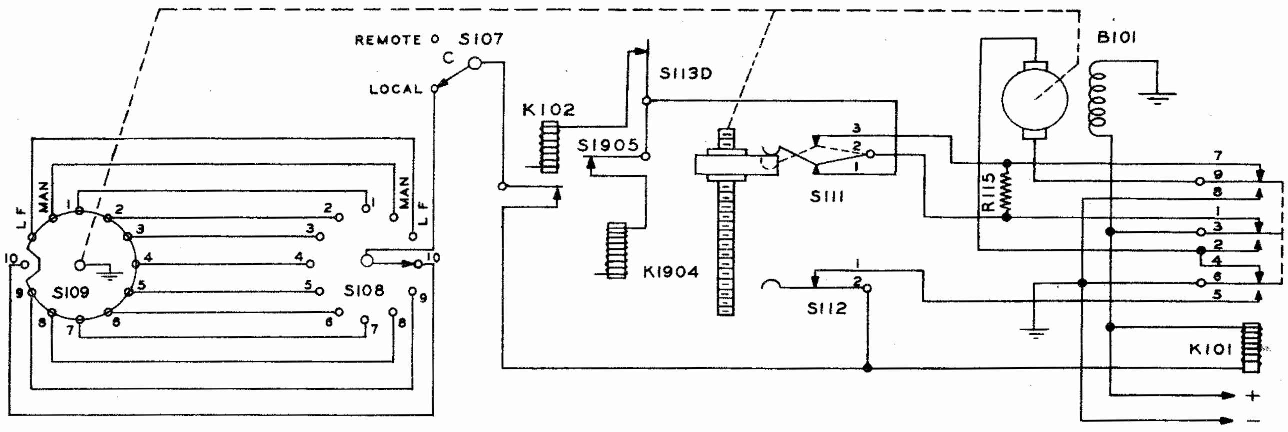
(2) K-101 MOTOR CONTROL RELAY.- K-101 is energized through the contacts of the keying relay, K-102, the LOCAL-REMOTE switch, S-107, the channel selector switch, S-108, and the circuit seeking tap switch, S-109, to ground. The holding circuit for the relay is through contacts 5 and 6 of motor control relay K-101 and the contacts of front limit switch section, S-112. When operated, motor control relay K-101 disables keying relay K-102 and plate power relay K-1904 preparatory to the release of rear limit switch section S-111.

(3) K-102 KEYING RELAY.- K-102, when operated during periods of transmission, prevents false operation of the Autotune system. The energizing circuit is through the emission control circuits, that is the TEST switch, S-104, the Throttle Switch jack, J-101, the MICROPHONE jack, J-102, or the KEY jack, J-103.

(4) S-107 LOCAL-REMOTE SWITCH. - S-107 permits the selection of either the panel channel selecting circuit or the remote channel selecting circuit. This switch is located on the transmitter panel and is designed for manual operation only.

(5) S-108 CHANNEL SELECTING SWITCH. - S-108 permits the selection of any one of eleven Autotune frequency channels and "MANUAL" tuning of the transmitter. The selection of a new channel energizes motor control relay, K-101, by the circuit through CHANNEL selecting switch, S-108, and circuit seeking switch, S-109, to ground.

(6) S-109 CIRCUIT SEEKING TAP SWITCH. - S-109 is driven by the Autotune motor, B-101, through a worm and spur gear arrangement. The circuit seeking tap switch, S-109, completes the circuit necessary for the operation of the motor control relay, K-101. Of the twelve circuits connected to the circuit seeking tap switch, S-109, eleven are grounded at all times. The operation of



B101 - AUTOTUNE MOTOR
K101 - MOTOR CONTROL RELAY
K102 - KEYING RELAY
K1904 - PLATE POWER RELAY

R115 - MOTOR TORQUE RETAINER RESISTOR
S107 - LOCAL-REMOTE SWITCH
S108 - CHANNEL SELECTOR SWITCH
S109 - CIRCUIT SEEKING TAP SWITCH

S111 - REAR LIMIT SWITCH SECTION
S112 - FORWARD LIMIT SWITCH SECTION
S113D - KEYING INTERLOCK SWITCH
S1905 - PANEL INTERLOCK SWITCH

Figure 4-23 Collins Autotune System - Electrical Portion

1
OPERATOR TURNS *CHANNEL* SELECTOR SWITCH S108 TO CHANNEL DESIRED.

2A
GROUND CIRCUIT THRU CONTACTS ON KEYING RELAY K102, THRU CONTACTS ON *LOCAL-REMOTE* S107, *CHANNEL* SELECTOR S108, AUTOTUNE SEEKING SWITCH S109 CLOSES MOTOR CONTROL RELAY K101.

2B
MOTOR CONTROL RELAY K101 REMAINS OPERATED THROUGH THE RELAY HOLDING CONTACTS 5 & 6.

2C
MOTOR CONTROL RELAY K101 WHEN OPERATED DISABLES KEYING RELAY K102 AND PLATE POWER RELAY K1904 PREPARATORY TO RELEASE OF REAR LIMIT SWITCH SECTION S111.

3A
MOTOR B101 STARTS, CAUSING REAR LIMIT SWITCH SECTION S111 TO RETURN TO THE UNOPERATED POSITION.

3B
CONTACTS 1 & 2 OF REAR LIMIT SWITCH SECTION S111 OPEN DISABLING KEYING RELAY K102 & PLATE POWER RELAY K1904 CONTACTS 2 & 3 SHORT MOTOR TORQUE RETAINER RESISTOR R115, PREPARATORY TO RELEASE OF MOTOR CONTROL RELAY K101.

4
LIMIT SWITCH OPERATING ARM OPENS FORWARD LIMIT SWITCH SECTION S112, REMOVING HOLDING CIRCUIT FROM MOTOR CONTROL RELAY K101.

5A
AUTOTUNE SEEKING SW. S109 ROTATES UNTIL IT COMES TO SAME POSITION AS *CHANNEL* SELECTOR SWITCH S108.

5B
MOTOR CONTROL RELAY K101 OPENS REVERSING MOTOR B101.

5C
AUTOTUNE SEEKING SW. S109 REMAINS AT REST FOR DURATION OF AUTOTUNE CYCLE.

6
FORWARD LIMIT SWITCH SECTION S112 RECLOSES AS SWITCH OPERATING ARM MOVES TOWARD REAR LIMIT SWITCH SECTION S111.

7
ALL TUNING ELEMENTS ARE POSITIONED AS SWITCH OPERATING ARM MOVES TOWARD REAR LIMIT SWITCH SECTION S111.

8
REAR LIMIT SWITCH SECTION S111 IS OPERATED PLACING MOTOR TORQUE RETAINER RESISTOR R115 IN CIRCUIT BY OPENING CONTACTS 2 & 3 CAUSING MOTOR B101 TO STOP.

9
CONTACTS 1 & 2 OF REAR LIMIT SWITCH SECTION S111 CLOSE INTERLOCK CIRCUIT OF KEYING RELAY K102 & PLATE POWER RELAY K1904.

10
AUTOTUNE CYCLE IS NOW COMPLETE. MOTOR TORQUE RETAINER RESISTOR R115 ALLOWS JUST ENOUGH CURRENT TO FLOW IN MOTOR B101 TO PROVIDE A POSITION RETAINING TORQUE TO THE AUTOTUNE UNITS.

Figure 4-24 Collins Autotune Operating Sequence motor control relay, K-101, connects front limit switch section, S-112, in the circuit, preventing seeking switch, S-109, from finding the circuit selected by CHANNEL selecting switch, S-108, until after the limit switch operating arm reaches and operates front limit switch section, S-112.

(7) S-111 REAR LIMIT SWITCH SECTION. - S-111 is normally held in the position necessary to complete the circuit for the operation of keying relay, K-102, and plate power relay, K-1904. When released by the limit switch operating arm, contacts 2 and 3 of the rear limit switch section, S-111, short motor torque retainer resistor, R-115, out of the circuit preparatory to the release of motor control relay, K-101. The return of the limit switch operating arm to the original position opens contacts 2 and 3 of rear limit switch section, S-111, placing motor torque retainer resistor, R-115, again in the circuit, thereby stopping Autotune motor, B-101.

(8) S-112 FRONT LIMIT SWITCH SECTION. - The normally closed contacts of S-112 complete the holding circuit for motor control relay, K-101, through contacts 5 and 6 of K-101. When the front limit switch section, S-112, is operated by the switch operating arm, allowing circuit seeking tap switch, S-109, to find the circuit position selected by CHANNEL selecting switch, S-109, the operating circuit for motor control relay, K-101, is broken allowing K-101 to release. De-energizing motor control relay, K-101 reverses the direction of rotation of the Autotune motor, B-101.

(9) S-113D KEYING INTERLOCK SWITCH. - S-113D is operated by the "ANTENNA TUNING - COARSE", Control "C", and prevents the operation of the keying relay, K-102, between settings of Control "C".

c. AUTOTUNE OPERATION. - The Autotune system consists of one Multiturn unit and four Singleturn units (refer to figures 4-22, 5-7, 5-9) which are driven by a reversible motor through a line shaft. The Multiturn unit may be set up to select any dial setting in a continous range of 7200 angular degrees (twenty turns or revolutions) of dial rotation.

NOTE

One revolution of the dial is equal to 360 angular degrees of rotation. The Singleturn units may be set up to select any dial setting from 0 to 360 degrees of rotation (a single turn or revolut on). The drawings of the electrical and mechanical portions of the Autotune, figure 4-22 and figure 4-23, should be referred to in connection with the description of the following operational sequence. The drawings show the Autotune at the completion of the operation cycle

(1) The operator turns the CHANNEL selector switch, S-108, to the channel desired.

(2) This places a ground on the motor control relay, K-101, through the circuit seeking tap switch, S-109, the CHANNEL selector switch, S-108, the LOCAL-REMOTE switch, S-107, and the contacts of the keying relay, K-102. With the keying relay, K-102, in the normal or unenergized position, the motor control relay, K-101, will operate and energize the Autotune motor, B-101. The motor control relay, K-101, is then kept energized by the circuit through contacts 5 and 6 and the limit switch section, S-112. The operation of motor control relay, K-101, disables the keying relay, K-102.

(3) The motor, B-101, drives the line shaft (1) in a forward direction causing all the cam drums and stop-ring drums to rotate in a counterclockwise direction and the multiturn unit counter drum to rotate in a clockwise direction.

(4) The switch operating arm (33) moves out from the rear limit switch section, S-111, amd moves toward the forward limit switch section, S-112. Contacts 1 and 2 of the rear limit switch section, S-111, open, keeping keying relay K-102 and plate power relay, K-1904, disabled when the motor control relay, K-101, opens. Contacts 2 and 3 of the rear limit switch section short motor torque resistor, R-115, out of the circuit preparatory to the release of motor control relay, K-101.

(5) The forward limit switch section, S-112, opens and the motor continues to run until the open segment of the circuit seeking tap switch, S-109, is positioned opposite the contact upon which the channel selector switch has been set by the operator.

(6) As the open segment of the circuit seeking tap switch, S-109, comes to the contact of the channel selected, the synchronized cam drums are at the position where the pawl heels (15A and 37A) of the channel selected have just dropped into their respective slots in the cam drums.

(7) Since the holding circuit has been removed, the motor control relay, K-101, opens, causing the polarity of the voltage on the armature to be reversed which reverses the direction of rotation of the motor.

(8) After the motor reverses, allowing the cam drums to fully engage their respective pawl heels, the switch operating arm moves toward the rear, allowing the forward limit switch section, S-112, to reclose.

(9) As the motor continues to run in the reverse direction, the stop-ring drum (12) of the singleturn unit rotates and when the slot on the stop ring of the channel selected is adjacent to pawl toe (15B) the pawl toe drops into the slot. The pawl toe stops the tuned element (7) at the predetermined position and the clutch slips until the Autotune cycle has been completed.

(10) The counter drum (28) of the multiturn unit reverses direction of rotation thereby rotating the anvil (19) out from under the pawl tail (37B) as the motor reverses, and when the slot of the cam on the counter drum, of the channel selected, is adjacent to the pawl tail (37B), the pawl tail drops into the slot and selects the revolution in which the tuned element (24) will be positioned.

(11) As soon as the slot in the proper stop ring of the stop-ring drum (36) is adjacent to the pawl toe (37C) the pawl toe drops into the slot. This stops the tuned element (24) at the preselected position and the clutch (23) slips until the Autotune cycle has been completed.

(12) As the motor continues in the reverse direction, the switch operating arm moves back against the rear limit switch section, S-111, opening contacts 2 and 3 of S-111.

(13) Contacts 2 and 3 of the rear limit switch section upon opening remove the short across the motor torque retainer resistor, R-115, which stops the motor by allowing just enough current to flow through the armature of motor B-101 to provide a position retaining torque to the Autotune units.

(14) The contacts 1 and 2 of the rear limit switch section, S-111, close, permitting the carrier to be turned on. The Autotune cycle is now complete. The carrier control circuits and Autotune control circuits are interlocked so that the Autotune can not operate when the carrier is on and the carrier cannot be turned on while the Autotune system is in operation.

13. UNIT FUNCTION.

a. The order of the Autotune units from left to right is as follows: "E", "C", "D", "A" and "B".

b. Proceeding in the order of unit function; the choice of oscillator, the high frequency oscillator range, the multiplier range and the Autotune seeking switch, S-109, are controlled by Autotune unit "A"; the high frequency oscillator tuning is controlled by Autotune unit "B"; the coarse selection of inductance and capacity in connection with a given antenna by Autotune unit "C"; the variometer, providing a fine control of inductance , serving as tuning resonator by Autotune unit "D"; and the large variable capacitor, providing a fine control of capacitance, serving as a loading control, by Autotune unit "E".

c. The high frequency oscillator, which is the unit at the extreme right of the transmitter is controlled by Autotune unit "B". The multiplier coil forms are mounted at the back of the casting. The slugs of multiplier coils are attached to the same shaft that controls the oscillator slug. Also mounted in the high frequency oscillator casting is the switch, actuated by a star cam in the adjacent multiplier chassis, which changes the frequency range of the high frequency oscillator.

d. The multiplier chassis, the operation of which is controlled by Autotune unit "A", contains the star cam mentioned above plus a cam operated multi-contact switch which controls the high and the low frequency oscillators. The wafer switch nearest the Autotune unit controls the range of the first multiplier stage, the wafer switch farthest from the Autotune unit controls the range of the second multiplier stage and the remaining cam operates a switch that closes the cathode circuit of the second multiplier stage at the proper time.

e. Autotune unit "D" controls the variometer.

f. The network switch, controlled by Autotune unit "C", varies the tap on the loading inductance and the capacity in the circuit. In the first position all of the inductance is in the circuit and in the seventh position this inductance is completely shorted out. Between ranges seven and eight switch S-113 operates to cut in the ceramic padding capacitor, various combinations of which are used from tanges eight to thirteen. In addition, a small inductance is connected across the variometer on range thirteen by the operation of one of the switch arms. A star cam on the same network switch shaft operates a switch, S-113D, that incapacitates the RF portion of the complete transmitter by preventing the operation of the keying relay, K-102, between the network switch settings.

g. Autotune unit "E" controls the setting of the large variable loading capacitor, plus the operation of a switch in the network switch assembly controlled by a cam attached to the variable capacitor rotor. This switch extends the range of the large variable loading capacitor by connecting three ceramic capacitors located in the network switch assembly as padders.

SECTION V

MAINTENANCE

This radio equipment has been constructed of materials considered to be the best obtainable for the purpose and has been carefully inspected and adjusted at the factory to reduce maintenance to a minimum. However, a certain amount of checking and servicing is necessary to maintain efficient and dependable operation. The following procedures should aid in the checking and servicing of the equipment.

1. DAILY OPERATIONAL CHECK.

The operation of the transmitter should be checked daily or after any appreciable shut-down period. The following operational checks will indicate whether or not the transmitter is operating normally.

a. PROCEDURE.

(1) Turn the Power Supply on and after allowing the tubes sufficient time to warm up, rotate the EMISSION selector switch, S-110, to the CW position (applies 1150 volts DC plate potential) and operate the TEST switch, S-104, to the ON position.

(2) Check the PA PLATE meter reading.

(3) Release the TEST switch and operate S-110 to the VOICE position.

(4) Insert a microphone cord plug into the MICROPHONE jack, J-102, press the Push-to-Talk switch (applies 1150 volts plate potential) and while speaking into the microphone observe the PA PLATE meter needle "kick". Check the position of the microphone switch, S-201, to make certain that it is in the proper position for the type of microphone used.

(5) Check the keying on CW and MCW by listening to the output of the sidetone amplifier and to the keyed signal on an adjacent receiver.

(6) Check keying using LOCAL control and an external key. Also check keying with REMOTE control.

If the above checks indicate normal transmitter operation, no further tests will be necessary.

If transmitter operation does not appear to be normal, check the (1) position of the power level switch, S-106, (2) position of the EMISSION selector switch, S-110, (3) position of the LOCAL-REMOTE switch, S-107, (4) position of the metered circuit selector switch, S-105, (5) fuses, (6) power unit operation, (7) line voltage, (8) cable connector plugs, (9) antenna and ground connections, and (10) position of controls "A" and "B".

If the above checks fail to reveal the cause of erratic operation or transmitter failure, further trouble shooting will be necessary. The trouble shooting procedure together with the symptoms of and cures for some of the more common causes of erratic operation or transmitter failure is outlined in this section of this book under SERVICING.

2. ROUTINE CHECK.

To assure efficient and dependable service, periodic operational checks should be made. The inspection and check should be made at intervals of approximately one month or during the regular port inspection.

The following routine checks are recommended; others may suggest themselves to the maintenance personnel.

a. EQUIPMENT INSPECTION.

(1) Check all interconnecting wires. If necessary hand-tighten all plug locking rings. Inspect for broken and loose wires at the plugs.

(2) Check the connections to the receiver antenna, ground and loading coil, making certain that the spring connector terminals are making good contact with the wires.

(3) Remove the end bells from the dynamotors and, using compressed air, blow out all carbon and copper dust from the commutator and surrounding surfaces. Inspect the brushes for wear and replace them if the carbons are shorter than 1/4 inch.

(4) All relays should be carefully checked at regular intervals. Check the contacts for proper alignment, pitting and corrosion. Use a burnishing tool to clean the contacts - never use sandpaper or emery cloth.

b. OPERATIONAL CHECKS. - To check the operation of the Autotune system, proceed as follows:

(1) Place the power level switch, S-106, in the TUNE position and the EMISSION selector switch, S-110, in the VOICE position.

(2) Beginning with Channel 1 operate the CHANNEL selector switch, S-108, to each of the ten high-frequency channels. As each Autotune cycle is completed, check the positions of the controls against their original settings.

(3) Having checked the positioning of the ten high-frequency channels, operate CHANNEL selector switch, S-108, to the L. FREQ. position.

(4) When the Autotune cycle has been completed, Control "A" should come to rest in Position 13.

(5) After checking that the Autotune positions correctly for the eleven channel positions, operate S-108 to the MANUAL position.

(6) When the Autotune cycle has been completed, check the operation of all controls. Each control should move freely to permit transmitter tuning without

disturbing the positions of the Autotune stop rings.

NOTE

To check the operation of the power control, RF and audio circuits, proceed as follows:

(7) Operate the LOCAL-REMOTE switch, S-107, to the LOCAL position and the EMISSION selector switch, S-110, to the CW position. (Applies 1150 volts DC plate potential.)

(8) Rotate the metered circuit selector switch, S-105, to the PA PLATE position.

(9) Operate the TEST switch, S-104, to the ON position.

(10) Check the power amplifier plate reading on meter M-102. The meter should indicate current within the CW portion of the meter scale.

NOTE

If M-102 does not indicate a PA PLATE meter reading within the CW portion of the scale some adjustment of the output loading may be necessary. Before attempting to readjust the output circuit for proper loading for the particular channel upon which the transmitter is operating, check the operation on the other Autotune channels by operating the CHANNEL selector switch, S-108.

(11) If all meter readings are off in the same direction, that is, if all readings are too high or if all readings are too low, check the line voltage.

NOTE

If the line voltage is much higher or lower than the voltage was at the time that the tuning adjustments were made and the Autotune stop rings locked, the power amplifier plate meter reading will be somewhat different than the original reading. No adjustment of the output tuning controls should be attempted if the tuning adjustments were originally made with normal supply voltage.

(12) Release the TEST switch and insert a key cord plug into the KEY jack, J-103. Check the keying by operating the telegraph key and listening to the keyed signal in a receiver. The transmitter should key cleanly and without noticeable chirp at speeds up to thirty words per minute.

(13) Release the telegraph key and operate the EMISSION selector switch, S-110, to the MCW position. (Applies 1150 volts DC plate potential.)

(14) Operate the TEST switch, S-104, to the ON position.

(15) Check the PA PLATE meter reading on meter M-102. The meter should indicate within the MCW portion of the meter scale.

(16) Release the TEST switch and insert the earphones cord plug into the

SIDETONE jack, J-104.

(17) Insert the key cord plug into the KEY jack, J-103.

(18) With the earphones in position, operate the telegraph key and check the keying by listening first in the earphones and then in an adjacent receiver. The keying should be clean-cut and with little distortion of character at keying speeds up to thirty words per minute.

(19) Release the telegraph key and operate the EMISSION selector switch, S-110, to the VOICE position.

(20) Insert the microphone cord plug into the MICROPHONE jack, J-102.

(21) Press the Push-to-Talk button on the microphone (applies 1150 volts DC plate potential) and check the PA PLATE meter reading.

(22) Check the modulation by pressing the Push-to-Talk button on the microphone (applies 1150 volts DC plate potential) and speaking into the microphone at normal voice level and checking the swing of the needle of meter M-102. The needle should swing up to the MCW portion of the meter scale, or slightly beyond, on voice peaks.

(23) Check the operation of the speech amplifier by listening to the sidetone amplifier output while having someone speak into the microphone

NOTE

When operation from the LOCAL position has been checked, the procedure outlined below should be followed to check remote operation:

(24) Operate the LOCAL-REMOTE switch, S-107, to the REMOTE position.

(25) Operate the EMISSION selector switch, S-903, in the type COL-23410 Remote Control Unit, to the VOICE position.

(26) Following the procedure outlined for checking the Autotune system from the transmitter panel, check the operation and positioning of the dials when using the CHANNEL selector switch, S-902. The position of the controls for a given Autotune channel selected with S-902 should correspond to the position of the controls when the Autotune channel is selected with the panel switch, S-108.

(27) Insert a microphone cord plug into microphone jack J-903 and check the transmitter control by operating the Push-to-Talk button on the microphone (applies 1150 volts DC plate potential). Also check the condition of the audio lines from the Control Unit to the transmitter by speaking into the microphone and checking the kick of the needle of meter M-102. Voice peak readings should correspond to readings obtained when checking the modulation with panel or LOCAL transmitter control.

(28) Operate S-903 to the CW position (applies 1150 volts DC plate potential) and operate the key. Check the keying by listening to the signal on a receiver.

(29) Operate S-903 to the MCW position (applies 1150 volts DC plate potential) and check PA PLATE by observing M-102. Check the keying by listening to the keyed signal on a receiver.

3. SERVICING.

a. GENERAL. - If the above checks reveal erratic or abnormal operation, the tubes should be carefully checked. Tube failure is probably the most common cause of transmitter failure. The most dependable method of checking the tubes and finding the defective tube is to replace the tubes one at a time, with tubes known to be in good condition.

In case of trouble, look for simple causes first. Analyze and isolate the difficulty before attempting to remove or dismantle any part of the equipment.

A few moments of thought and study of the complete schematic circuit diagram, figure 7-45, together with a tabulation of the various possible causes of failure, may save hours of haphazard labor.

Radio equipments are often damaged by needless disassembly and removal of parts, when the real cause of trouble is merely a broken lead or a faulty connection.

In order to gain access to the tubes and other components the transmitter cover must be removed. This can be done by inserting a coin or a screwdriver in the holddown screw, making a half turn counterclockwise and lifting off the cover.

b. VACUUM TUBE REPLACEMENT. - After having made certain that the KEY, MICROPHONE and Throttle Switch circuits are open remove the transmitter cabinet cover.

CAUTION

In the interest of safety, and to protect other filaments and filament resistors that may be in the circuit, the equipment should be completely turned off when tubes are being replace.

(1) The tube clamps used in this equipment are designed to prevent the tube from coming out of the socket under vibration incident to normal service. Refer to the tube placement diagram, figure 2-2, for the exact location of the various tube clamps. The clamp on tube V-101 is readily accessible through the side cover plate. The clamps on V-105 and V-106 are accessible through the rear cover plate. The clamps on V-102 and V-103 can best be reached from the top of the transmitter.

(2) To open or close a clamp in removing or replacing tubes insert a screw driver as shown in the lower left corner illustration of figure 2-2. Gently press the clamp open or closed as required. No undue exertion is necessary in operating this type of clamp. Removal of 813 power amplifier tube, V-104, is facilitated by inserting a screwdriver through a ventilating hole in the rear cover plate so that the screwdriver may be used as a lever between the tube base and the socket.

(3) The 813 tube should be inserted by orienting the base pin with the slot in hole above the socket and pressing down firmly until the tube snaps solidly in the socket.

(4) Study the tube-heater circuits (see figure 4-10) to become familiar with the series-parallel arrangement used. This is important to prevent the needless replacement of tubes.

(5) In most instances, an open filamentin a tube will break the filament circuit of another tube. An open filament circuit in the low frequency oscillator will cause an abnormally low voltage on the high frequency oscillator tube, V-101. Occasionally, the metal tubes contain foreign matter which may be "weld-flash" loosened under prolonged vibration. This causes inter-electrode short circuits which are sometimes difficult to find because of their temporary nature.

(6) The RF ammeter, M-101, is calibrated on 2000 kc at the factory using a "dummy" antenna load comprising 10 ohms and 100 micromicrofarads (mmf). The calibration will hold approximately throughout the range of the transmitter. However, since the reading of this meter is dependent upon the impedance of the antenna being used and the operating frequency, the reading will be high when the antenna presents a low impedance and low when the antenna presents a high impedance.

c. VACUUM TUBE FAILURE SYMPTOMS. - Some of the more common symptoms of tube failure together with the tubes that may need replacement are given in the paragraphs that follow:

(1) NO RF OUTPUT IN THE FREQUENCY RANGE 2.0 mc TO 6.0 mc. - Three RF tubes are in use when the transmitter is operating in the frequency range 2.0 mc to 6.0 mc, namely V-101, V-102, and V-104. To find the particular tube that is defective replace each tube with another tube of the same type that is known to be in good condition, that is, replace one tube at a time. After each tube replacement check transmitter operation. If, after having replaced all three tubes the transmitter is still inoperative or low in output, further trouble shooting will be necessary.

(2) NO RF OUTPUT IN THE FREQUENCY RANGE 6.0 mc TO 18.1 mc. - When operating in the frequency range 6.0 mc to 18.1 mc a fourth RF tube, V-103, is brought into operation. If after having found satisfactory transmitter operation in the frequency range 2.0 mc to 6.0 mc, the output is discovered to be low or nil in the frequency range 6.0 mc to 18.1 mc, the trouble is likely in the 2nd multiplier stage. Replace the type 1625 tube, V-103, with a tube of the same type known to be in good condition and check the operation. If the transmitter is still inoperative or the output low, the trouble is something other than a defective tube.

(3) NO RF OUTPUT L. FREQ. CHANNEL (200 kc TO 1500 kc). - When the transmitter is operating in the low frequency range only two RF tubes are used, the LF oscillator tube, V-401, and the PA tube, V-104. If output in the frequency range 2.0 mc to 18.1 mc is satisfactory but no output is obtained when the low frequency channel is selected, the trouble is probably in the low frequency oscillator stage. Replace V-401 with a tube of the same type known to be in good condition and check transmitter operation. If the stage is still inoperative further tests will be necessary.

(4) SATISFACTORY VOICE OPERATION - NO MODULATION ON MCW. - The same audio amplifier and modulator stages are employed for both VOICE and MCW operation, therefore, if no modulation is obtained on MCW, the MCW Oscillator tube, V-2203, must be inoperative. Replace V-2203 and while listening to the output of the sidetone amplifier or to the signal in a receiver, operate the TEST key and check the modulation. If the signal is still unmodulated it will be necessary to check the oscillator circuit.

(5) SATISFACTORY RF OUTPUT AND SIDETONE AMPLIFIER OUTPUT - NO MODULATION ON EITHER VOICE OR MCW. - The output of the audio driver tube, V-202, is coupled to the input of the sidetone amplifier. Therefore, satisfactory output from the sidetone amplifier indicates that the audio amplifier and audio driver stages are operating satisfactorily. The output of the audio driver is also coupled through a transformer to the grids of the modulator tubes, V-105 and V-106. Replace the modulator tubes with tubes known to be in good condition, one at a time, and check the transmitter output for modulation. If the RF signal is still unmodulated the trouble is other than defective tubes and further trouble shooting will be necessary.

(6) SATISFACTORY RF OUTPUT - NO MODULATION VOICE OR MCW - NO OUTPUT FROM SIDETONE AMPLIFIER. - There being no output from the sidetone amplifier, it is evident that one or more of the following three stages is inoperative, audio amplifier, V-201, audio driver, V-202, or the sidetone amplifier, V-203. Replace V-201, V-202, and V-203 with a tube of the proper type that is known to be in good condition, one at a time, and while listening to the SIDETONE output, operate the TEST switch after each tube is replaced.

(7) SATISFACTORY RF OUTPUT - SATISFACTORY VOICE AND MCW OPERATION WHEN OPERATING IN CALIBRATE POSITION NO BEAT NOTE OBTAINABLE BETWEEN RF OSCILLATOR OUTPUT AND CALIBRATION OSCILLATOR OUTPUT. - Satisfactory VOICE and MCW operation indicates that the RF, audio and MCW oscillator stages are operating properly, therefore, the trouble must be in the calibration oscillator circuit. Remove calibration oscillator tubes, V-2201, V-2202, V-2203, and crystal, Y-2201, one at a time, and replace with others known to be in good condition. If it is still impossible to obtain a beat note between the two signals, the trouble is still likely in the calibration oscillator circuit but is something other than a defective tube.

(8) LOW RF OUTPUT. - If the grid meter reading is satisfactory and the transmitter is otherwise apparently operating satisfactorily, note the extent to which the PA PLATE meter reading soars off resonance with power level switch, S-106, in the OPERATE position. Failure of the PA PLATE meter reading to soar more than 10% usually indicates low emission of the 813 final amplifier tube, V-104. Normal off resonance PA PLATE meter reading will be found to be about 200. If it appears that the off resonance reading is considerably more than 200 the 813 tube will usually be found to be "soft" or "gassy".

(9) HIGH DISTORTION ON VOICE. - Replace the 813 tube if after checking the speech amplifier tubes, the unit itself and the modulator tubes, V-105 and V-106, high distortion exists at full modulation. Since both the screen and the plate of the tube have separate modulation transformer windings it is possible for a condition to exist where the proportion of current drawn by the 813 screen and plate is not normal. This condition can cause a mismatch to

occur in the modulation transformer at high audio levels.

d. TROUBLE SHOOTING. - If replacing vacuum tubes has failed to remedy the trouble and the transmitter is still inoperative or not operating properly, further trouble shooting will be necessary.

A few tools and an indicating instrument are absolutely essential. In addition to the tools ordinarily available (screwdriver, pliers, soldering iron, etc.) a volt-ohmmeter capable of measuring DC voltages up to 1500 volts is necessary. Any voltmeter having high internal resistance (1000 ohms or more per volt) will suffice but a meter of the vacuum tube type is recommended. High voltage circuits should not be checked with a voltmeter unless other means cannot be used. This practice is advocated in the interest of safety.

The following table of typical servicing problems should prove useful in locating common sources of trouble:

(1) TYPICAL SERVICING PROBLEMS OTHER THAN THOSE COMMONLY CAUSED BY VACUUM TUBE, CAPACITOR OR RESISTOR FAILURES.

SYMPTOM	PROBABLE CAUSE
28 volt short	Autotune cover touching a lug on Autotune limit switch section S-111. Autotune limit switch contact arms touching multiturn unit. Terminals of motor control relay K-101 shorted due to cable pressure against relay. Autotune motor B-101 defective. Lug on R-116 touching chassis. Lug on keying interlock switch S-113D touching chassis.
Fuse F-1907 blown.	400 volt short.
400 volt short in Multiplier Unit.	Cable wire caught on an arm of range switch S-103. Cable shield touching lug of C-115. L-105 slug shorting on pin of L-105 internally. L-106 slug shorting on pin of L-106 internally. S-101 cam follower arm not centered on star cam resulting in the arm contacting a mounting screw of a contact spring of range switch S-102.
400 volt short not in multiplier	Ground bus on X-104 socket touching 813 tube V-104 series screen resistor R-112 tie point. Lug on R-113 touching chassis. Lug on R-105 touching chassis. Short in connections to J-111 Wires pinched underneath Modulation transformer, T-101.

High voltage short.	Center grounding lead of CW relay K-103 touching contact springs.
No output from High Frequency Oscillator.	Inproper contact on oscillator selecting switch, S-114. Inproper contact on keying relay, K-102.
Absence of beat notes at sidetone output.	Cable connections on J-111 broken or shorted. Cable connections on J-114 broken or shorted.
No output from first multiplier stage.	First multiplier plate choke, L-115 open. Incorrect adjustment of, or foreign matter on, the contacts of range switch, S-102. A section of padding capacitor, C-111, open or shorted. A broken slug or a shorted or open turn on inductor L-105. Improper contact on oscillator selecting switch, S-114. Control grid or screen suppressor resistors R-103 or R-104 grounded. Dial "A" out of alignment with shaft.
No output from second multiplier stage.	Improper contact on second multiplier cathode switch S-115. Incorrect adjustment of, or foreign matter on, the contacts of range switches, S-102 and/or S-103. A section of padding capacitor C-115 open or shorted. A broken slug or a shorted or open turn on inductor L-106. Control grid or screen suppressor resistors R-106 or R-108 grounded. Dial "A" out of alignment with shaft.
Insufficient or absence of grid current reading on meter M-102.	813 tube V-104 not in the socket properly. 813 tube filament not at full brilliance due to open shunt resistor R-123 or defective filament. Multiplier padding capacitors C-111 and C-115 in need of readjustment due to excessive vibration, humidity or corrosion. Grid choke L-107 open or turns shorted. Defective contact on meter circuit selector switch S-105.
Erratic operation or frequency instability of High Frequency Oscillator.	Incorrect adjustment of oscillator range switch S-101 cam follower. Dial "A" out of alignment with shaft.

	Loose nut on oscillator lead screw at multiplier slug cross-bar (will necessitate recalibration of oscillator). Multiturn unit loose on casting. Baclkash in lead screw bushing. Capacity change of capacitors C-101, C-102, C-103, C-104, or C-105.
Erratic multiplier operation. Inability to adjust unit properly.	Leads connecting multiplier padding capacitors C-111 and C-115 touching each other.
Erratic final amplifier operation. Inability to resonate amplifier properly.	Turns shorting on inductance L-113 (aggravated at operating temperatures). Failure of S-113 network switches to make contact due to foreign matter on contacts or binding of switch arm shafts. Mechanism for the operation of S-113A (operated by Dial "F") out of adjustment. Improper adjustment of vacuum contact S-116. Improper contact adjustment of output circuit selecting relay K-105. Static drain choke L-110 or choke L-116 open (changes tuning characteristics). Misplaced bus wiring in network switch causing shorts or arcing. Open thermocouple in antenna ammeter. Poor contact of rotor contacts of variometer L-112. Dial "C" out of alignment with shaft. Wrong antenna or incorrect use of antenna shunt capacitor.
813 tube draws plate current with key up.	Cathodes of exciter stages grounded regardless of the operation of keying relay K-102. 813 tube V-104 screen contact on keying relay K-102 not grounding the screen when the key is up.
Spurious RF and AF oscillations.	813 tube V-104 beam forming plates not grounded causing self oscillation of the tube. Shield of first audio amplifier tube V-201 not grounded. Defective audio amplifier unit. Shield on wires to voice relay K-104 or J-112 disconnected.

	Defective contact on power level switch S-106. Open capacitor C-209 or C-210.
Abnormal or no modulation	Defective contact on microphone jack J-102. Microphone selecting switch S-201 in wrong position for type of microphone being used. Defective contact jacks in J-112 (a jack pushed up in the housing). Open, shorted or partially shorted winding on modulation transformer T-101. CW relay contact arm in contact with a lug of capacitor C-120A. Lead of R-134 grounded on the frame of power level switch S-106.
Abnormal or no modulation only on MCW	Lead of R-135 grounded on the frame of power level switch S-106. Voice relay K-104 not making contact. Broken wire on J-111 or J-112. Shield on wires to voice relay K-104 touching contact arm terminals of K-104.
Keying relay K-102 energized when key is up.	Shield on wires to voice relay K-104 touching contact arm terminals of this relay.
Sidetone output low or absent entirely. Volume increased by turning sidetone output control S-202 counterclockwise.	A ground in the sidetone circuit (especially in remote control cabling or connections).
Sidetone pitch varied by adjustment of sidetone output control S-202.	Remote connections 23, 24 and 25 shorted in either position of keying relay K-102 (key up or down).
Abnormal operation of output circuit selecting relay K-105.	Faulty operation, or shorting terminals on oscillator selecting switch S-114.
Autotune hesitates at moment of reversal accompanied by clicking of keying relay K-102.	Improper contact or shorting terminals on limit switch section S-111.
Unusual clicking noise during Autotune operation.	Probably a stiffened joint in chain drive.
An Autotune Unit locks when the Autotune system is in the MANUAL position.	Unit is probably out of synchronization.
Autotune channel is selected, but motor does not start.	Foreign matter on contacts of motor control relay K-101.

Autotune system will not reverse.	Improper contact on limit switch section S-112, CHANNEL selector switch S-108 or Seeking switch S-109.
An Autotune unit will not reposition.	Broken pawl spring. Foreign matter in the Autotune system. Anvil inoperative (on multiturn unit).
Erratic channeling of Autotune system.	Probably an intermittent contact on the circuit from CHANNEL selector switch S-108 to J-106 seeking switch S-109.

NOTES

Look for open, shorted or partially shorted chokes and other inductances.

Inspect capacitors for shorts, intermittent shorts or opens.

Inspect resistors for opens or wrong values.

Look for faulty connections or pieces of solder or wire which might cause short circuits.

If the foregoing tests do not reveal the source of trouble, refer to the table of voltages and resistances in this Section of this book.

(2) REMOTE CONTROL UNIT. - To gain access to the components in the Remote Control Unit, remove the mounting plate by removing the four thumb-nuts from the front panel. The contacts on the ganged switch sections may require cleaning or, if the unit has been exposed to an extreme shock, the switch pies may require replacement.

(3) ANTENNA LOADING COIL. - The Antenna Loading Coil should require very little maintenance but components such as switches, capacitors and inductors may require adjustment or replacement if the equipment has been subject to overload or extreme mechanical shock.

To gain access to the components in the Antenna Loading Coil remove the two sides and the top. The bottom and back are permanently attached. The top and sides are removed as a unit by taking out all the screws that are observed on their surface. The switch contacts may require attention due to corrosion. Plug connectors should also be inspected for corrosion and dirt. Capacitors may become shorted or open. The static drain choke may become open. These components can be checked with standard test instruments through the openings at the sides and top.

(4) POWER UNIT

(a) GENERAL. - The circuits and components employed in the power unit are straightforward and can be serviced by ordinary means and methods. Access to most components can be had by removing the two side plates. All screws observed on the two side plates should be removed and the side plates set aside. If necessary, the back plate can be removed also. Refer to the illustration section of this book to become familiar with the parts locations. Check the operation of switches, relays and interlocks. Check all connections including plug connectors and receptacles for effects of corrosion and for loose contact springs.

(b) DYNAMOTORS. - Low filament or relay voltage may be due to a dirty commutator, worn brushes in the low voltage dynamotor or an accumulation of copper dust between some of the commutator bars. Low plate voltage may be due to the same conditions in the high voltage dynamotor. To remove the copper dust use a stream of compressed air. Replace the brushes when they have reached a length of one quarter inch or less. Examine the mica between the commutator segments. If the mica is even with the surface of the commutator, it is likely that arcing and fouling of the commutator surface will occur. No amount of polishing the commutator surface or replacing brushes will cure this condition. The armature must be removed from the dynamotor and the mica undercut. This would be a good time to true up the commutator with a cutting tool. Some common faults of dynamotors are as follows:

1. SPARKING AT THE BRUSHES.

a. Rough or dirty commutator surface.

b. Poor brush fit.

c. Incorrect brush pressure.

d. Overload on the machine.

e. Short-circuited armature coil.

f. Open-circuited armature coil.

2. DYNAMOTOR FAILING TO START.

a. No voltage on the line.

b. Fuses out.

c. Failure of relays to operate.

To clean a dirty commutator use a silken rag that has been dipped in kerosene and thoroughly wrung out. If the commutator is rough or pitted it may be smoothed up by moving a block of wood covered with fine sandpaper (do not use emery cloth or paper) back and forth axially by hand over the surface. After this operation the commutator should be blown out with air and wiped clean with a rag. If the spaces between the commutator bars become clogged with carbon, the remedy is to clean out the spaces with an old hack saw blade taking care not to scratch the commutator surface.

WARNING

The terminal board at the bottom of the power unit carries in excess of 1100 volts DC. If possible, remove the dynamotors from the cabinet for servicing.

Each dynamotor is mounted on a chassis which slides out of the front of the cabinet. Rotate the two thumb-nuts in a counterclockwise direction as far as they will go and then pull the dynamotor forward out of the cabinet.

(c) RELAYS. - Relay failures have become one of the most common sources of equipment trouble. Reports indicate that many of these failures occur as a result of the rough handling of relays or the improper treatment of contacts.

A Relay is a delicate piece of equipment and its adjustments are usually made with great precision. Handle it as you would an expensive watch or a fine meter.

When it is necessary to clean and readjust relays, do it carefully. To clean flat surface contacts, use only a crocus cloth or a burnishing tool. Make sure all pits and burns are removed from contact points and that contact surfaces are parallel. Extreme care must be exercised when cleaning telephone type relays. Abrasives will flatten the points and lead to further trouble. Use only a crocus cloth and apply this gently. On both telephone type relays and flat surface contact relays be sure that the contact arms have not been bent or their movements jammed in any way.

If new adjustments are to be made, make them carefully and correctly. Check and recheck until spacings are exactly what they are supposed to be. After the relay has been in operation again for a short time, check the spacings once more and readjust if necessary.

Some extra care will go a long way towards eliminating this frequent source of trouble.

Failure of the power unit to deliver power might be traced directly to the relays employed.

(5) TRANSMITTER UNIT. - Three of the sub-units in the Navy Type -52286-A Transmitter Unit, the LF unit, the MCW-CFI Unit and the Audio Amplifier Unit, may be readily removed for checking and the replacement of parts. The three units have been equipped with multi-terminal connector plugs to permit the removal of the sub-units from the transmitter without the use of a soldering iron. The following procedure is recommended for the removal of the above named units:

(a) LF OSCILLATOR UNIT.

1. Remove the connector wire from the right-hand side of the unit.

2. Remove the seven screws that hold the low-frequency panel in place.

3. Loosen all screws along the top edge of the Autotune front cover plate.

4. Remove the plate lead from the 813 power amplifier tube, V-104, and remove the tube from the socket by inserting a screwdriver through a ventilating hole in the back of the transmitter, using it as a lever between the tube base and the socket. Lift the tube out.

5. Insert a screwdriver through the ventilating holes at the back of the transmitter and remove the screws that hold the back of the unit.

6. The unit is now free of all retaining screws and wires and may be removed from the transmitter by raising the rear edge of the oscillator unit to free the front panel from the Autotune cover plate and then raising the unit until the connector plug is free.

(b) MCW-CFI UNIT.

1. Loosen the two large screws that hold the unit to the main transmitter chassis.

2. Raise the unit until the connector plug is disengaged.

3. Tip the unit toward the frequency multiplier tubes, V-102 and V-103, until the transformer clears the cabinet cover clamping bracket.

4. Remove the screws holding the sides of the MCW-CFI Unit chassis and pull the sides out as far as the connecting wires will permit.

5. All circuit components are accessible from the bottom of the unit.

(c) AUDIO AMPLIFIER UNIT.

1. Loosen the two large screws that hold the unit to the main transmitter chassis.

2. Remove the plate cap from the high-frequency oscillator, V-101, and remove the tube from the socket.

3. Raise the unit until the multi-terminal plug becomes disengaged from the receptacle.

4. Slide the unit backward until the cabinet studs are cleared and raise the audio amplifier unit upward.

(d) HIGH-FREQUENCY OSCILLATOR. - The frequency multiplier plate tank inductors are readily accessible if the cabinet wrap-around plate is removed from the right-hand end of the transmitter cabinet. Four screws in the rear and ten screws on the side hold the plate in position. An additional shield covers the section of the casting that houses the high-frequency oscillator circuit components. If this inner shield is removed all oscillator circuit components will be exposed and available for checking and replacement.

NOTICE

Removal of this inner shield will necessitate oscillator recalibration.

Do not remove this inner shield or make any adjustments of the HF oscillator condensers or slug unless the calibration of this oscillator is thoroughly understood.

(e) FREQUENCY MULTIPLIER. - Some of the frequency multiplier circuit components are accessible from the bottom of the transmitter when the bottom cover plate is removed. To gain access to the remaining frequency multiplier circuit components, the multiplier unit must be removed from the assembly. The following procedure is recommended for the removal of the multiplier unit from the transmitter:

1. Remove the plate caps from the frequency multiplier tubes, V-102 and V-103, unlock the tube base clamps and remove the tubes from the sockets. Disconnect the low-frequency oscillator plate lead at the oscillator end.

2. Remove the transmitter bottom cover plate and the Autotune cover plate.

3. Remove Autotune Unit "A" in the following manner: Turn the dial locking bar to the unlocked position and loosen the two #10 Bristo set screws in the dial. Turn the dial and locking bar counterclockwise together until the bar comes free. Remove both the dial and the locking bar. Remove the dial back plate, loosen the two long screws on the top end of the unit and the short screw on the bottom end of the unit. Carefully lift the unit out.

CAUTION

Care must be exercised not to move any of the Autotune mechanisms from the time the unit is loosened until the unit is again securely in place, otherwise the unit may be thrown out of synchronization.

4. When the Autotune Singleturn Unit has been removed, remove the screws holding the seeking switch, S-109, to the Autotune casting and swing the switch out.

5. Unsolder and remove the wires leading to the multiplier coils at the rear of the high-frequency oscillator unit. Unsolder and remove the bus wire connected to coupling capacitor C-116.

6. The cam follower arm of high-frequency oscillator range switch S-101 must be removed from the oscillator casting if the multiplier unit is removed. Two Phillips head screws hold this arm on the oscillator casting. Removal of these screws will allow the arm to drop away from the star cam upon which it operates, after which it can be removed from the transmitter.

7. Remove the two crews just behind the second multiplier tube clamp shell and the two screws just in front of the first multiplier tube clamp shell.

8. The multiplier unit can now be pulled out sufficiently to remove the nut holding the ground wire lug on the side of the unit adjacent to the fire wall assembly. Remove cable connector J-115 from P-101 in the multiplier unit.

9. The multiplier unit may now be lifted out of the transmitter.

10. In reassembling the transmitter it is essential that the shaft of seeking switch S-109 be carefully centered with the cam drum shaft that drives it. This may be checked by referring to Paragraph V-7d except that the position of the switch and not the driving arm should be adjusted.

11. In replacing the cam follower arm of high-frequency oscillator range switch S-101, care must be exercised to make certain the end of the arm is centered in the hole provided in the contact arm of the switch. The cam follower arm mounting screws may then be inserted, but not tightened. Because of the fine thread in the aluminum casting, care must be exercised not to cross-thread these screws. The arm should then be centered on the star cam mounted on the multiplier switch shaft and the arm mounting screws tightened just enough to hold the arm in place.

12. In order to time the operation of oscillator range switch S-101, the following procedure should be followed:

a. Remove the warning plate covering the adjustment holes for C-134 and C-135. (Figure 5-3.)

b. Connect a continuity indicator from the shaft of C-135 (nearest the multiturn unit) to the oscillator casting.

c. Adjust the cam follower until switch S-101 indicates continuity on the odd numbered contacts of multiplier range switches S-102 and S-103 (check with Dial "A"). This should be done in such a manner that continuity is maintained during the fraction of a revolution necessary for the contact arms of multiplier range switches S-102 and S-103 to travel completely across the flat portion of every odd numbered contact, but not to extend more than the dividing line between the even and the odd numbered contacts.

d. Tighten the cam follower arm mounting screws securely enough to hold the arm in permanent adjustment.

e. If the above conditions cannot be met, the multiplier mounting screws should be loosened and the multiplier moved enough to make the adjustment outlined possible. Retighten the multiplier mounting screws.

NOTE

Care should be exercised to replace the dial exactly as it was before disassembly. Range No. 1 on the dial should correspond exactly with the centering of the contact arms of range switches S-102 and S-103 on contact 1. In addition, the dial must clear the dial back plate throughout the rotation range of Control "A".

(f) OSCILLATOR CASTING. - The following procedure is recommended for the removal of the oscillator casting from the transmitter:

NOTICE

The removal of the high-frequency oscillator is not recommended unless it is absolutely necessary.

1. Remove the plate cap from the high-frequency oscillator tube, V-101, unlock the tube base clamp and remove the tube from the socket.

2. Remove the MCW-CFI and the Audio Amplifier Units as outlined in the preceding section.

3. Remove the two screws that hold J-111, the MCW-CFI Unit Connector plug receptacle, to the standoffs and unsolder the single wire that connects the high-frequency oscillator tube V-101 cathode to terminal 1 on J-111.

4. Remove the Autotune cover plate and wrap-around section of the transmitter cabinet.

5. Remove the locking bar and dial from Control "A" by turning the dial locking bar to the unlocked position, loosening the two number 10 Bristo set screws in the dial, and turning both locking bar and dial counterclockwise until free. Remove the dial back plate.

6. The Autotune Singleturn Unit adjacent to the high-frequency oscillator Multiturn Unit must be removed so that the screws holding the oscillator casting to the Autotune casting may be loosened. To remove this unit loosen the short screw that holds the lower edge of the unit to the Autotune casting and the two long screws that hold the upper edge of the unit to the casting and lift the unit carefully out of position.

CAUTION

Care must be exercised not to move any of the Autotune mechanisms from the time the unit is loosened until the unit is again securely in place, otherwise the unit may be thrown out of synchronization.

7. When the Autotune Singleturn Unit has been removed, loosen the screws that hold the castings together in the front and top of the chassis.

8. To complete disconnecting the HF oscillator, move the casting slightly to the right and unsolder the connections to the terminal strip on the inner side of the casting and the wires leading to the frequency multiplier plate tank inductors.

9. The HF oscillator casting assembly may now be removed from the transmitter.

CAUTION

Care must be exercised not to damage the cam follower arm of S-101. This arm is attached to the left side of the oscillator casting.

NOTE

All components not included in units that may not be removed from the main assembly of the transmitter have been mounted in positions so as to be as accessible as possible in the limited space available. The cabinet cover, bottom plate and Autotune cover plate are all removable from the main assembly. The location of the part to be checked or replaced will determine the section of the cabinet that is to be removed.

4. RADIO-FREQUENCY CIRCUIT ALIGNMENT.

a. LOW-FREQUENCY OSCILLATOR ALIGNMENT.

(1) If low-frequency oscillator circuit components have been damaged or replaced, the grid circuit may require realignment. For realignemt of the circuit the following procedure should be followed:

(a) Operate Control "F" to Position 6 (1035 kc to 1500 kc).

(b) Rotate the CHANNEL selector switch, S-108, to the L.-FREQ. position.

(c) Operate the EMISSION selector switch, S-110, to the VOICE position.

(d) When the Autotune cycle has been completed check the position of Control "A".

The control should stop in Position 13. If the control stops in any position other than number 13, loosen the locking bar and manually operate Control "A" to Position 13.

(e) Refer to Table 3-1 in Section III of this book and select a dial setting under column G that is near the middle of the tuning range. If there is a dial setting listed on each side of the midpoint of the tuning range, select the dial setting on the high-frequency side.

For example 1079 in the column under G is very near the midpoint of the tuning range of the control. (The exact midpoint is 1000.)

(f) Rotate Control "G" to the dial setting that has been chosen from the calibration table.

(g) Operate the power level switch, S-106, to the CALIBRATE position. (Applies 1150 volts DC to plates of V-104, V-105, and V-106.)

(h) Insert an earphones cord plug into the SIDETONE output jack, J-104.

(i) While listening to the SIDETONE amplifier output, rotate Control "G" about the setting obtained from the calibration table until exact zero beat is obtained between the output of the low-frequency oscillator and the output of the calibration oscillator.

(j) Check the dial setting and lock the dial.

(k) Loosen the two set screws that hold the knob to the shaft of Control "G" and without detuning the circuit, rotate the knob on the shaft until the dial setting corresponds to the setting given in the calibration table and tighten the set screws.

(l) Rotate Control "G" to home stop position near zero. Loosen the two set screws on the counter dial mechanism collar attached to the main oscillator shaft and holding the mechanism at zero, rotate Control "G" to zero. Tighten the set screws.

(m) Operate Control "F" to Position 5.

(n) As explained in steps (e) and (f), select a dial setting from Table 3-1 near the middle of the tuning range.

(o) Note the numbered slots on the oscillator shield cover exposing the trimming capacitor, C-411. Also refer to figure 5-1.

(p) While listening to the SIDETONE output, adjust capacitor section E (5) of C-411 with any narrow tool until zero beat is obtained between the low-frequency oscillator output and the output of the calibration oscillator.

(q) Operate Control "F" to Position 4 and repeat steps (n) and (p) adjusting section D (4) of C-411 instead of section E.

(r) Repeat steps (n) and (p) adjusting capacitor trimmer sections C (3), B (2) and A (1), for Control "F" Positions 3, 2 and 1, respectively.

(s) Check the excitation over the entire range of each position of Control "F" by rotating Control "G" through twenty revolutions for each position of Control "F".

b. HIGH-FREQUENCY OSCILLATOR ALIGNMENT USING CFI.

(1) If the high-frequency RF circuits are to be realigned in the field, where no frequency measuring equipment is available, the calibration oscillator may be used to check the band end-point frequencies. However, if coils, transformer cores, capacitors, etc., in the oscillator circuit require replacement, an accurate means of measuring frequency must be used together with a portable frequency meter to check the harmonic output of the frequency multiplier.

(2) For realignment when a frequency standard is not available, the following procedure should be followed:

(a) With the EMISSION selector switch, S-110, in the OFF position, remove the cover plate from the right-hand end of the transmitter cabinet. Remove the small plate on the bottom of the oscillator casting. This plate covers the holes provided for the adjustment of trimmer capacitors C-134 and C-135. The HF oscillator grid trimmer capacitors, C-134 and C-135, the HF oscillator grid inductor, L-101, tuning slug adjustment and the frequency multiplier plate inductor, L-105 and L-106, tuning slug adjustments are thus exposed.

(b) Rotate the CHANNEL selector switch, S-108, to the MANUAL position.

(c) Operate the EMISSION selector switch, S-110 to the VOICE position.

(d) When the Autotune cycle has been completed, operate Control "A" to Position 2.

(e) Set the indicator mark, over Control "B", to mid-scale using the CORRECTOR knob.

(f) Refer to Table 3-2 in Section III of this book and obtain the dial setting of Control "B" for output on 2400 kc with Control "A" in position 2.

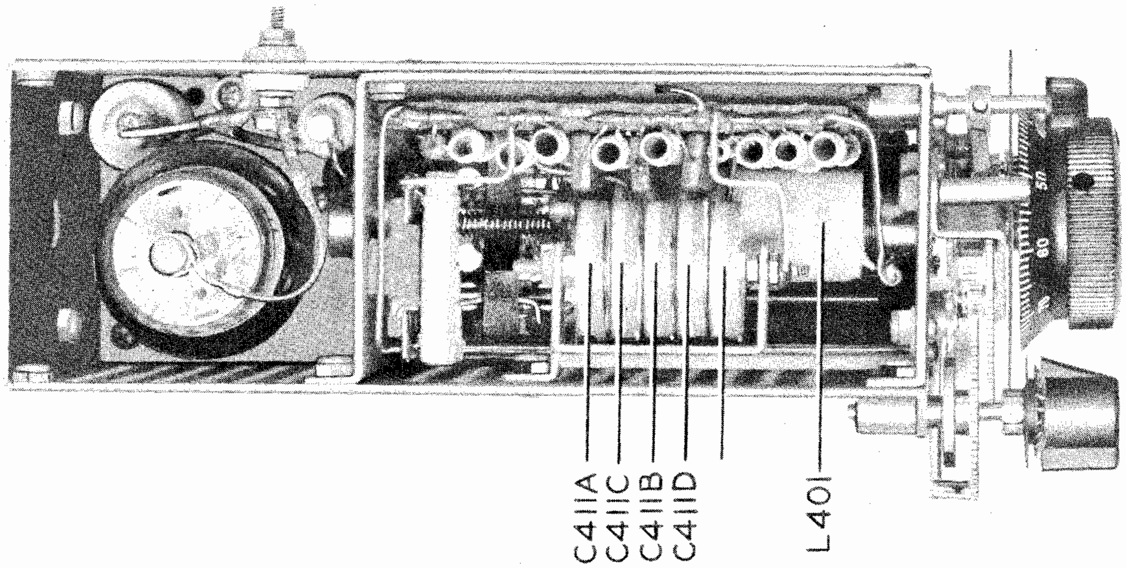


Figure 5-1 Low Frequency Oscillator

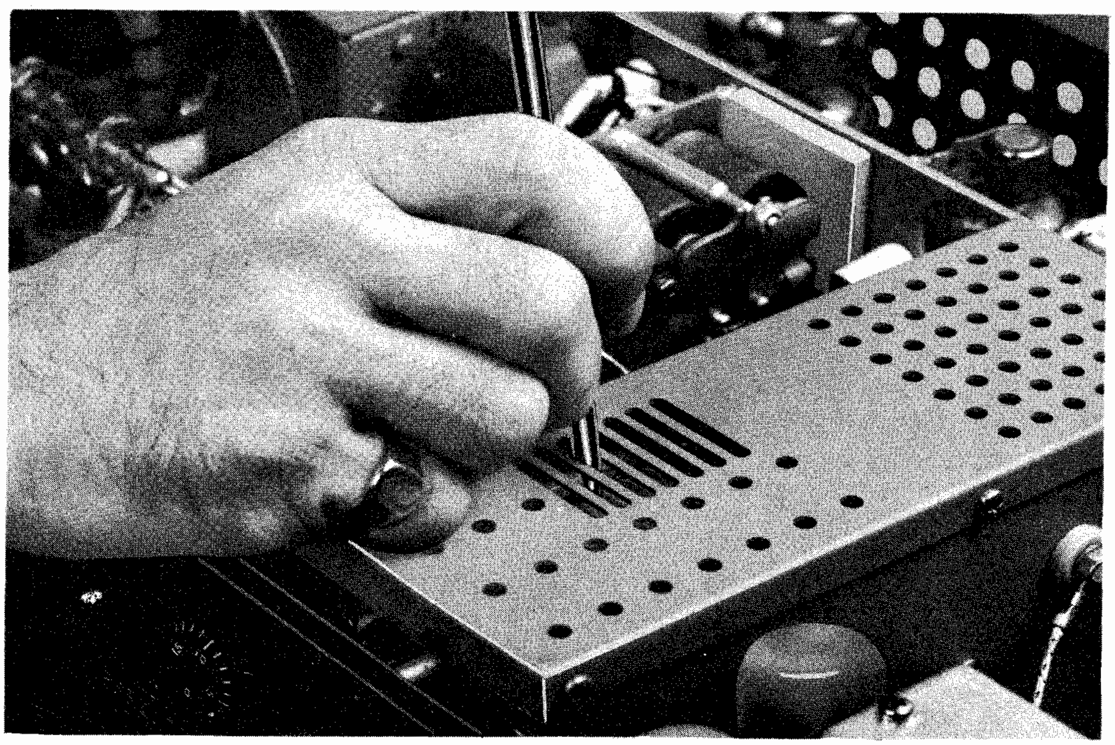


Figure 5-2 Low Frequency Oscillator Adjustment

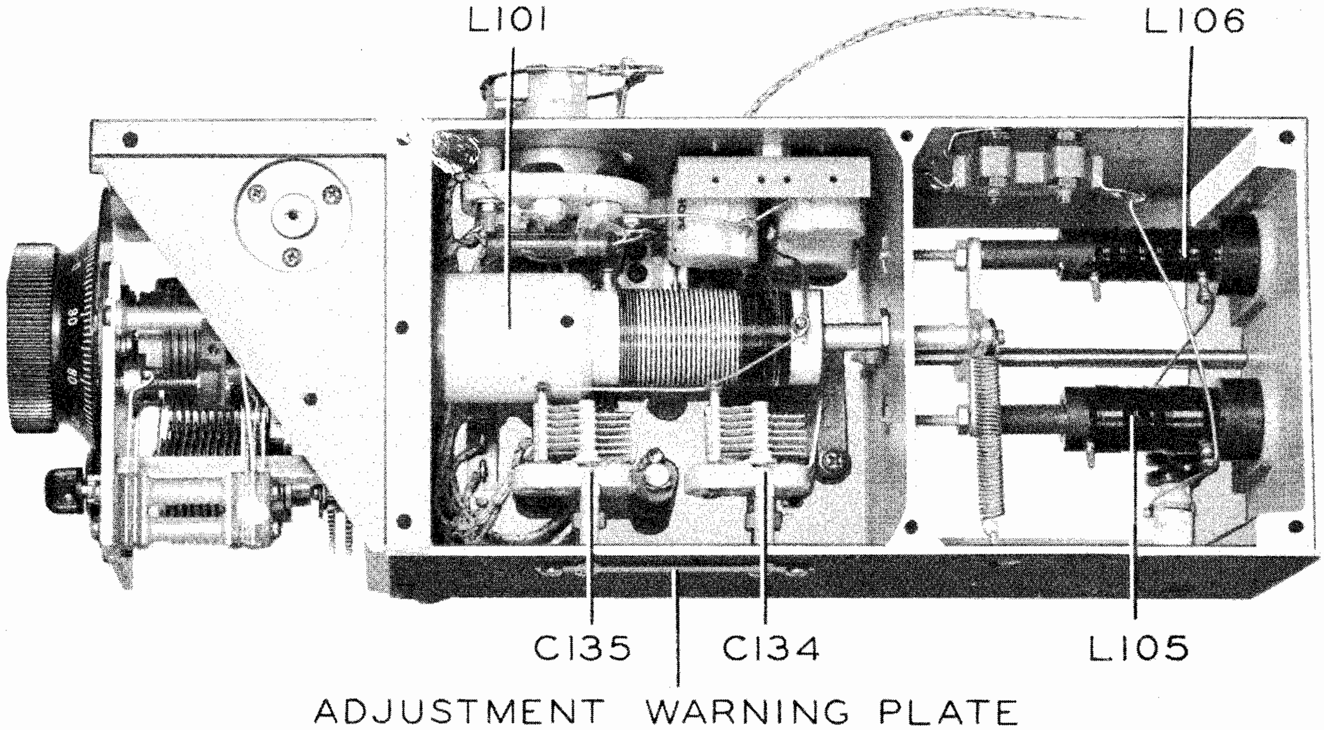


Figure 5-3 High Frequency Oscillator

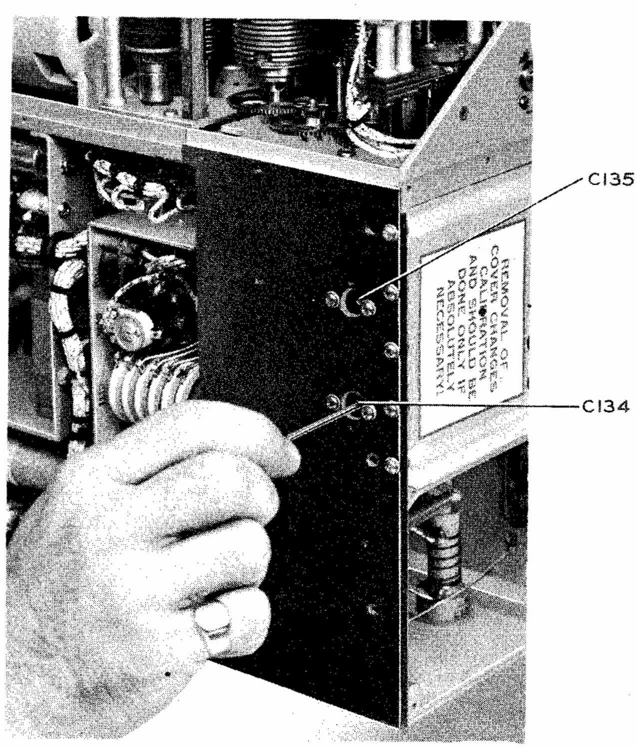


Figure 5-4 High Frequency Oscillator Adjustment

(Oscillator output on 1200 kc.)

(g) Rotate Control "B" to the setting obtained from the table. Approach the setting in a clockwise direction.

(h) Loosen the nut on the rear of the lead screw that holds the multiplier tuning slug yoke to the screw.

(i) Insert an earphones cord plug into the SIDETONE output jack, J-104.

(j) Operate the power level switch, S-106, to the CALIBRATE position. (Applies 1150 volts DC to plate of V-104.)

(k) While listening to the SIDETONE output in the earphones, and keeping Control "B" set at the position obtained from the table, adjust the position of the HF oscillator grid inductor tuning slug by rotating the tuning slug screw with pliers, the jaws of which are padded to prevent marring the shaft, until zero beat is obtained between the output of the calibration oscillator and the output of the high-frequency oscillator.

NOTE

Caution should be exercised in the adjustment of the position of the tuning slug when no frequency standard is available. A fraction of a revolution in one direction or the other should realign the circuit.

(l) When zero beat has been obtained, carefully tighten the nut on the end of the slug screw to prevent further displacement of tuning slug.

(m) Refer to Table 3-2 in Section III and obtain the correct position of Control "B" for output on 3000 kc with Control "A" in Position 2. (Oscillator output on 1500 kc)

(n) Rotate Control "B" to the setting obtained from the table. Approach the setting in a clockwise direction.

(o) Adjust trimming capacitor C-134, (figure 5-3) until zero beat is obtained between the output of the HF oscillator and the output of the calibration oscillator.

(p) Check several points in the band by obtaining Control "B" settings from Table 3-2 and listening to the beat note output of the SIDETONE amplifier.

(q) If the setting of Control "B" necessary to obtain exact zero beat deviates more than 4 or 5 dial divisions from the setting given in the calibration table, repeat steps (f) through (p) of the above procedure until the dial settings necessary to obtain a given frequency correspond very closely to those given in the calibration table.

(r) When alignment adjustments have been completed with Control "A" in Position 2, operate the control to Position 1.

(s) Refer to Table 3-2 opposite 2000 kc (Control "A" in Position 1) and obtain the dial setting for Control "B". (Oscillator output on 1000 kc.)

(t) While listening to the SIDETONE output, adjust trimming capacitor C-135 (figure 5-3) until zero beat between the high-frequency oscillator output and the calibration oscillator output is obtained.

NOTE

Do not make any further adjustments of trimmer C-134.

(u) Check several points within the frequency range 2000 kc to 2400 kc by obtaining the dial setting of Control "B" from the table, listening to the SIDETONE output and operating Control "B" about the setting obtained from the calibration table. The settings should check with those given in the table within 4 or 5 dial divisions.

NOTE

No adjustment of the high-frequency oscillator grid inductor slug should be made with Control "A" in Position 1.

(v) Return the EMISSION selector switch, S-110, to the OFF position.

c. HIGH-FREQUENCY OSCILLATOR ALIGNMENT USING EXTERNAL FREQUENCY STANDARD (NAVY TYPE LM).

(1) If oscillator circuit components have been replaced and an accurate frequency standard is available the following procedure should be followed for the alignment of the high-frequency oscillator circuit:

(a) With the EMISSION selector switch, S-110, in the OFF position remove the cover plates from the right-hand end and bottom of the transmitter cabinet. The HF oscillator grid trimmer capacitors, C-134 and C-135, the HF oscillator grid inductor, L-101, tuning slug adjustment and the frequency multiplier plate inductor, L-105 and L-106, tuning slug adjustments are exposed.

(b) Rotate the CHANNEL selector switch, S-108, to the MANUAL position.

(c) Operate the EMISSION selector switch, S-110, to the VOICE position.

(d) When the Autotune cycle has been completed, operate Control "A" to Position 2.

(e) Set the indicator mark, over Control "B", to mid-scale using the CORRECTOR knob.

(f) Refer to Table 3-2 and obtain the dial setting for an output frequency of 2400 kc with Control "A" in Position 2. (Oscillator output on 1200 kc.)

(g) Rotate Control "B" to the setting obtained from the table.

(h) Loosen the nut on the rear of the lead screw that holds the multiplier tuning slug yoke to the screw.

(i) Operate the power level switch, S-106, to the CALIBRATE position. (Applies 1150 volts DC to plate of V-104.)

(j) Measure the output frequency of the oscillator and adjust the position of the tuning slug in L-101 until the oscillator frequency is exactly 1200 kc.

(k) When the correct position of the tuning slug has been found tighten the locking nut to prevent any further displacement of the slug.

(l) Refer to Table 3-2 and obtain the setting of Control "B" necessary to obtain an output frequency of 3000 kc with Control "A" in Position 2. (Oscillator output on 1500 kc.)

(m) Rotate Control "B" to the setting obtained from the table.

(n) Measure the output frequency of the oscillator and adjust capacitor trimmer C-134 (figure 5-3) until the frequency of the oscillator output is exactly 1500 kc.

(o) Check several points within the band by obtaining dial settings from the calibration tables, rotating Control "B" to these settings and measuring the frequencies.

NOTE

Always keep in mind that with Control "A" in Positions 1 or 2 the frequencies given in the calibration tables are always twice the output frequency of the oscillator. With the power level switch in the CALIBRATE position only the oscillator is operating, therefore, the output frequency to be measured will always be one-half the frequency that is given in the calibration tables.

(p) If the dial setting of Control "B" which is necessary to obtain output on a selected frequency deviates more than 4 or 5 dial divisions from the dial setting given in the calibration tables, repeat steps (f) through (o) until the actual dial setting of Control "B" corresponds very closely to the setting given in the table.

(q) When alignment has been completed with Control "A" in Position 2, operate the control to Position 1.

(r) Refer to Table 3-2 and obtain the dial setting of Control "B" to obtain an output frequency of 2000 kc with Control "A" in Position 1. (Oscillator output on 1000 kc.)

(s) Adjust trimming capacitor C-135 (figure 5-3) until the oscillator output frequency is exactly 1200 kc.

NOTE

Do not make any adjustment of C-134 or the core in inductor L-101 with Control "A" in Position 1.

(t) Check several points within the band by comparing the actual dial settings necessary to obtain a given frequency with the dial settings given in the calibration tables for the same frequency. The settings should check within 4 or 5 dial divisions.

(u) Return the EMISSION selector switch, S-110, to the OFF position.

d. FREQUENCY MULTIPLIER ALIGNMENT.

(1) Having completed the alignment of the high-frequency oscillator circuit, complete the RF circuit alignment by following the procedure outlined below for the adjustment of the frequency multiplier circuits:

(a) With the transmitter tipped up on the rear edge and the bottom cover removed, the frequency multiplier plate tank capacitors are exposed.

NOTE

The multiplier plate tank capacitors are located beneath the multiplier chassis. (Stacks of ceramic capacitor sections.) Capacitor section A of each capacitor, C-111 and C-115, is located nearest the right-hand side of the transmitter, as the transmitter is viewed from the bottom, with sections B, C, D, E and F in order in the stack. (Figure 5-5.)

(b) Operate Control "A" to Position 6.

(c) Rotate the metered circuit selector switch, S-105, to the PA GRID position.

(d) Rotate Control "B" until the dial reading is 1100.

(e) Operate the power level switch to the TUNE position.

(f) Operate the EMISSION selector switch, S-110, to the CW position. (Applies 1150 volts DC plate potential.)

CAUTION

Use an insulated tool to adjust the capacitors. When the key is operated the capacitor is at a potential of 400 volts above ground.

(g) Insert a shorted plug in KEY jack J-103 and adjust section F (bottom of stack) of first multiplier padding capacitor C-111 to the position that will give the maximum PA GRID meter reading on M-102.

NOTE

To vary the capacity of sections of C-111 or C-115 rotate the metal lip that protrudes between capacitor section.

(h) Using a portable frequency meter check the output frequency of the first frequency multiplier stage to be sure that the plate circuit is tuned to the correct harmonic. The output should be on approximately 5400 kc with Control "A" in Position 6 and Control "B" tuned to a dial reading of 1100.

(i) When it has been ascertained that the multiplier output is on the correct harmonic rotate Control "B" over the entire range, observe the grid reading on meter M-102.

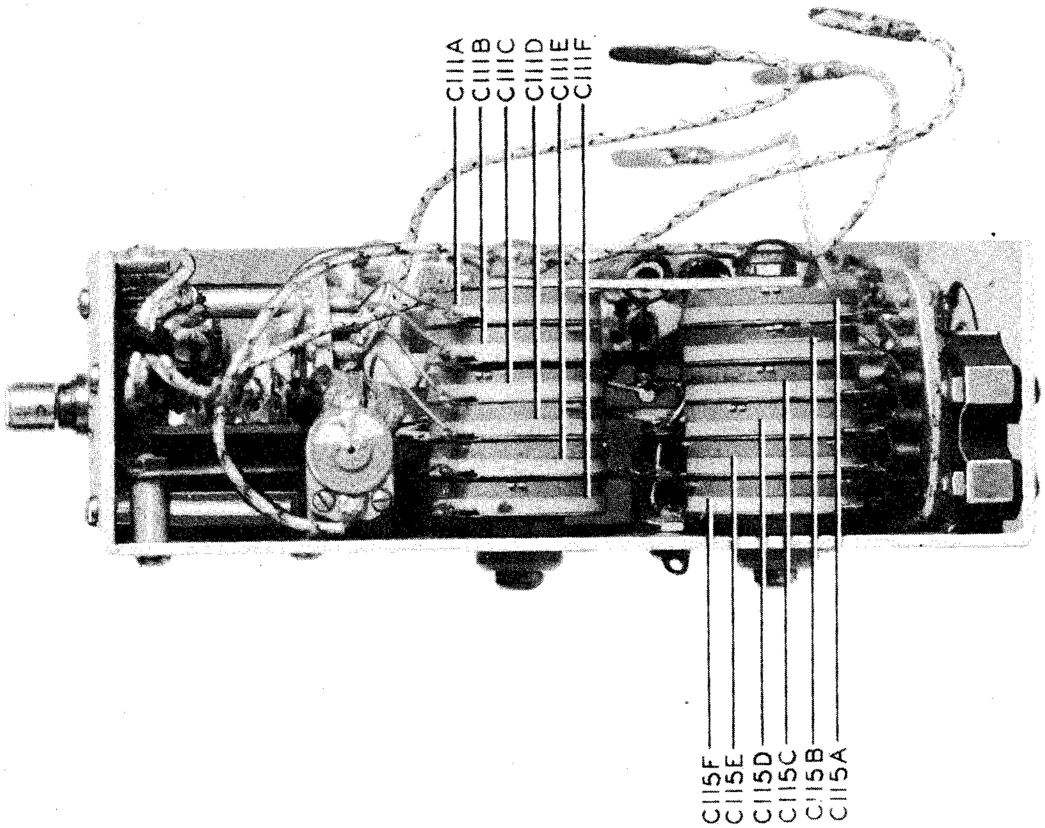


Figure 5-5 Frequency Multiplier

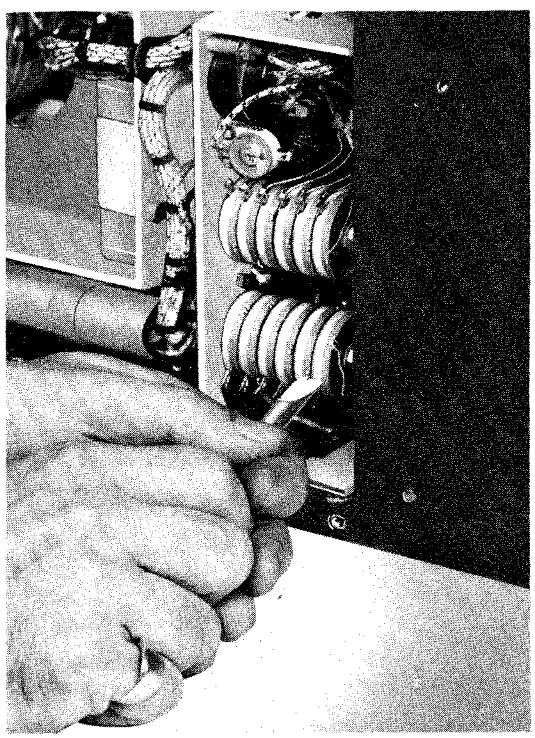


Figure 5-6 Frequency Multiplier Adjustment

CAUTION

When the key is operated the inductors L-105 and L-106 are at a potential of 400 volts above ground.

(j) Take out dips in the meter reading by adjusting section F of first multiplier padding capacitor C-111 for an average reading of the meter.

CAUTION

When the key is operated the inductors L-105 and L-106 are at a potential of 400 volts above ground.

(k) A drop at the extreme ends of the range is permissible but if the meter needle still dips sharply at any other point, rotate Control "B" to a dial reading of 1100, loosen the first multiplier inductance L-105 tuning slug locking nut and change slightly the position of the tuning slug. Tighten the slug locking nut.

(l) Rotate Control "B" over the entire range and check the PA GRID current. Meter M-102 should indicate a consistent value of grid current over the entire range. If the meter needle dips sharply at any point repeat steps (j) and (k).

(m) Having completed the adjustment of the inductor slug and section F of C-111, remove the key shorting plug and rotate Control "A" to Position 5.

(n) Rotate Control "B" to a dial reading of 1100.

(o) Replace the key shorting plug, adjust section E of capacitor C-111 to give a maximum PA GRID meter reading and check with a frequency meter for the correct harmonic.

NOTE

Do not make any further adjustments of the position of the tuning slug in L-105.

(p) Rotate Control "B" through the entire range and check the excitation. If dips occur in the meter reading readjust padding capacitor C-111E.

(q) Remove the key shorting plug and operate Control "A" to Position 4.

(r) Replace the key shorting plug and adjust section D of C-111 for maximum PA GRID meter reading.

(s) Check the excitation over the band by operating Control "B" over the entire range. If dips in the meter reading occur repeat step (j).

(t) Repeat steps (r) and (s) for Positions 4, 3, 2 and 1 of Control "A". Adjust capacitor sections D, C, B and A, for Control "A" Positions 4, 3, 2 and 1 respectively.

(u) Having completed the alignment of the 1st frequency multiplier stage, remove the key shorting plug and operate Control "A" to Position 12.

(v) Rotate Control "B" to a dial reading of 1100.

(w) Replace the key shorting plug and adjust section F of second multiplier padding capacitor C-115 for maximum PA GRID meter reading.

(x) Using an insulated screwdriver to reduce body capacity adjust trimmer capacity C-136 for maximum PA GRID meter reading.

(y) Check the output frequency of the second multiplier with a frequency meter. With Control "A" in Position 12 and Control "B" tuned to a dial reading of 1100 the frequency meter should indicate approximately 16,430 kc. A materially different reading indicates that a wrong harmonic has been chosen necessitating a readjustment of padding capacitor C-115F and trimmer capacitor C-136.

(z) Take out dips in the meter reading by adjusting section F of padding capacitor C-115.

(aa) A drop at the extreme ends of the range is permissible but if the meter needle still dips sharply at any other point, rotate Control "B" to a dial reading of 1100, loosen the second multiplier inductance L-106 tuning slug locking nut and change the position of the tuning slug slightly. Tighten the slug locking nut.

(bb) Again rotate Control "B" over the entire range and check the excitation. If the meter dips sharply at any point repeat steps (x) through (bb)

(cc) Having completed the adjustment of the inductor slug and section F of C-115, remove the key shorting plug and rotate Control "A" to Position 11.

(dd) Rotate Control "B" to a dial reading of 1100.

(ee) Replace the key shorting plug, adjust section E of capacitor C-115 to the capacity which gives the maximum PA GRID meter reading and check with a frequency meter for the correct harmonic.

NOTE

Do not make any further adjustment of the tuning slug in L-106 or trimmer capacitor C-136.

(ff) Rotate Control "B" through the entire range and check the excitation. If dips occur in the meter reading readjust padding capacitor C-115E.

(gg) Repeat steps (ee) and (ff) with Control "A" in positions 10, 9, 8 and 7. Adjust capacitor sections D, C, B and A for Control "A" Positions 10, 9, 8 and 7 respectively.

The above procedure completes the alignment of the high-frequency RF circuits of the transmitter.

5. MCW-CFI ADJUSTMENT

NOTE

If at any time erratic or abnormal operation is observed, or the unit fails to function entirely, the tubes and crystal should be carefully checked. Tube failure is probably the most common cause of the failure of any electronic device. The most dependable method of checking and finding the defective tube or crystal is to replace each tube one at a time with tubes known to be in good condition and to insert another crystal known to be active and correct in frequency.

IMPORTANT

Realignment or servicing other than tube or crystal replacement should not be attempted until the tubes and crystal have been carefully checked and unless the alignment procedure of the unit is thoroughly understood.

WARNING

Because the inductor tuning adjustment screws are in a difficult position to reach when the unit is in place in the transmitter, and because of the proximity of exposed leads carrying potentials of more than 400 volts, a short extension cable allowing the MCW-CFI Unit to be on the bench beside the transmitter is recommended.

NOTE

Because of the small space, adjustment of the unit is most conveniently made with a very small "jewelers" type screwdriver having a shank at least 1-1/4 inches long. Such a screwdriver is included in the equipment spares.

a. CFI ALIGNMENT USING TRANSMITTER SIDETONE CIRCUITS.

(1) Make sure that EMISSION selector switch S-110 is in the OFF position.

(2) Insert a coin or a screwdriver in the slot of the transmitter cover hold-down screws, rotate the screws one-half revolution counterclockwise and lift off the cover.

(3) Loosen the two large screws that hold the unit to the main transmitter chassis.

(4) Raise the unit until the connector plug is disengaged and lift the unit out.

(5) Connect an extension cable to MCW-CFI jack J-111 in the transmitter and to unit plug P-2201.

(6) Turn LOCAL-REMOTE switch S-107 to the LOCAL position.

(7) Connect earphones to the sidetone circuits by inserting the earphones cord plug into SIDETONE jack J-104.

(8) Rotate CHANNEL selector switch S-108 to the MANUAL position.

(9) Turn EMISSION selector switch S-110 to the VOICE position.

(10) When the Autotune cycle has been completed, rotate Control "C" to any dial reading, taking care to approach the chosen setting clockwise through at least one eight turn and to set the dial accurately.

(11) Rotate Control "A" to Position 1.

(12) Turn power level switch S-106 to the CALIBRATE position. (Applies 1150 volts DC to plates of V-104, V-105 and V-106.)

(13) Adjust SIDETONE gain control switch S-202 to Position 2 and search for calibration beat signals by rotating Control "B".

(14) If beat signals are not found, insert a small screwdriver in the slot of inductor Z-2201A tuning adjustment screw, adjacent to which is stamped the number "200". Rotate this screw, while continuing to rotate Control "B", until a beat signal is heard, indicating operation of the crystal oscillator.

(15) If a loud squeaking rush noise appears as soon as the crystal oscillator functions, adjust inductor Z-2202A tuning adjustment screw, adjacent to which is stamped the number "150", until this noise disappears. Absence of such noises is one indication of correct unit operation.

(16) Vary the pitch of the beat signal arrived at, by adjusting Control "B" to a pitch easy to listen to. Adjust SIDETONE gain control switch S-202 to a position giving comfortable volume level.

(17) Adjust inductor Z-2201A tuning adjustment screw for the midpoint of the maximum volume range.

(18) Tune the HF oscillator by rotating Control "B" until two loud signals of approximately equal volume are heard.

(19) Compare the zero beat signal dial settings of the two selected beat points with the calibration table check points to determine if the interval between the points is 100 kc (oscillator frequency is doubled on range 1 causing 50 kc interval with oscillator to be recorded as 100 kc.)

(20) If the interval is correct and the dial readings correspond reasonably (within 25 dial divisions) with the calibration table tune Z-2201B (farthest from crystal) marked "50", tune Z-2202B (nearest crystal) marked "50", and tune Z-2202A (marked "150") for maximum sidetone output. Recheck tuning in the same order.

(21) Turn the transmitter on and off several times, noting whether the crystal oscillates positively as soon as the transmitter is turned on. Detune Z-2201A (marked "200") slightly to improve cyrstal starting if necessary.

(22) If less than a 50 kc interval (recorded 100 kc on Band 1) is obtained, rotate mixer tank Z-2202B adjustment screw clockwise three turns, then rotate

tripler tank Z-2202A adjustment screw counterclockwise until harsh noises occur and disappear. Repeat Steps 18 to 20 inclusive.

(23) If more than a 50 kc interval (recorded 100 kc on Band 1) is obtained, rotate mixer tank Z-2202B adjustment screw counterclockwise three turns, then rotate tripler tank Z-2202A adjustment screw clockwise until harsh noises occur and disappear. Repeat Steps 18 to 20 inclusive.

(24) The unit can now be considered to be aligned and the calibration frequency accurate to within very close limits. Replacement in the transmitter completes the operation.

NOTE

It is possible for the unit to be adjusted in the transmitter by removing the multiplier tubes, since the 400 volt plate potential is removed from the multiplier tube plate cap leads by the operation of power level switch S-106 to the CALIBRATE position. However, in the interests of safety, this procedure is not recommended, since the exposed plate cap lead of the HF oscillator and the exposed LF oscillator plate lead terminals are at a potential of more than 400 volts above ground.

b. MCW ADJUSTMENT. - The frequency of the audio tone oscillator is fixed at approximately 1000 cps but the output level may be varied by means of a variable resistor R-2201.

To adjust the audio tone oscillator follow the procedure outlined in Steps (1) to (5) inclusive in the section devoted to CFI adjustment preparations and then proceed as follows:

(1) Adjust the transmitter for MCW operation on any frequency and place it in operation.

(2) By means of an oscilloscope or other modulation level measuring device measure the percentage of modulation.

(3) Insert a screwdriver through the hole provided in the back side of the MCW-CFI Unit and engage the exposed slot.

(4) Rotate the screwdriver until the desired percentage of modulation is attained. An adjustment providing 70% modulation at full power is recommended.

c. CFI ALIGNMENT USING VACUUM TUBE VOLTMETERS. - If multi-scale reversible polarity DC vacuum tube voltmeters are available, the following alignment procedure should be followed. Although it is possible to follow this procedure using only one such meter, it is recommended that wherever possible three meters be employed as described.

(1) Follow steps 1 to 8 inclusive in the preceding adjustment procedure.

(2) Connect the normally negative or grounded lead of meter number 1 to a ground in the unit. Connect the normally positive or above ground lead through a 1 megohm resistor to terminal No. 4 of X-2201 (V-2201 oscillator control grid). Adjust meter to read 0 to -30 volts.

(3) Connect and adjust meter number 2 in the same manner as in step (2) except to select terminal number 1 of X-2201 (V-2201 tripler control grid).

(4) Connect meter number 3 in the same manner as in step (2) except to select terminal number 8 of X-2202 (V-2202 mixer control grid). Adjust meter to read 0 to -10 volts.

(5) Follow steps (9) to (12) inclusive outlined in the preceding adjustment procedure.

(6) Insert a small screwdriver in the slot of inductor Z-2201A tuning adjustment screw, adjacent to which is stamped the number "200". Rotate this screw for maximum voltage as indicated on meter number 1 (step 2).

(7) Rotate inductor Z-2202A, tuning adjustment screw, adjacent to which is stamped the number "150" until maximum negative voltage is indicated on meter number 2. (Several voltage peaks may be found, possibly even a positive one. The correct position of the adjustment screw is that which gives the highest negative meter reading.)

(8) Rotate inductor Z-2202B tuning adjustment screw adjacent to which is stamped the number "50" (nearest crystal) until the maximum voltage peak is indicated on meter number 3.

(9) Repeat steps (7) and (8) until meter number 2 and meter number 3 indicate maximum reading simultaneously.

(10) Turn power level switch S-106 to the TUNE position.

(11) Disconnect meters and reconnect a meter to terminal number 1 of X-2203 (detector section of V-2203 control grid).

(12) Adjust SIDETONE gain control switch S-202 to Position 2 and turn power level switch S-106 to the CALIBRATE position. (Applies 1150 volts DC to plate of V-104.)

(13) Using headphones, adjust Control "B" until a beat signal is heard on an HF oscillator frequency ending in 50 (consult calibration tables in data section). Vary the pitch of the beat signal arrived at by adjusting Control "B" to a pitch easy to listen to. Adjust SIDETONE gain control switch S-202 to a position giving comfortable volume level.

(14) Rotate inductor Z-2201A tuning adjustment screw, adjacent to which is stamped the number "50" (farthest from crystal) until the meter indicates minimum voltage. The beat note heard in the headphones varies in volume as this point is approached. The adjustment screw should be adjusted in the vicinity of minimum voltage meter reading at the point which produces a maximum audio level beat note located between two weaker points.

6. PRECISION CALIBRATION OF MCW-CFI UNIT CRYSTAL OSCILLATOR. - The 200 kc crystal used in the MCW-CFI Unit is accurate to within ± .01% 32-158°F (0-70°C). Variations in the tuning of the crystal tank circuit through the range in which the crystal will stay in oscillation averages about 25 cycles off crystal frequency. It can be seen therefore that the CFI can be considered accurate for all practical purposes.

The alignment procedure previously outlined presupposes a Navy Type -52286-A Transmitter oscillator in good working condition and reference to the oscillator calibration tables for determining the 50 kc interval CFI output.

The remote possibility of obtaining other than a 50 kc interval during alignment can be checked by listening on a nearby calibrated receiver, especially if the receiver is provided with a beat frequency oscillator, and observing that a 50 kc interval exists between harmonics of the CFI output as the receiver is tuned over a range of about 300 kc. For this purpose, a well shielded receiver should be used.

a. PROCEDURE.

(1) Obtain a length of stranded, insulated wire about 6 feet long. Connect one end of the wire to the antenna terminal on the receiver and the other end to the ground terminal on the receiver. Twist the two leads together and make a loop in the extreme end of the "twisted pair".

(2) Place the loop over the detector and audio oscillator tube V-2203 which is located farthest from the crystal unit in the MCW-CFI Unit.

(3) Place transmitter LOCAL-REMOTE switch S-107 in the LOCAL position.

(4) Place EMISSION selector switch S-110 in the VOICE position.

(5) Operate power level switch S-106 to the CALIBRATE position. (Applies 1150 volts DC to plates of V-104, V-105 and V-106.)

(6) Place the receiver in operation and turn on the receiver beat frequency oscillator.

(7) Listen to the receiver as it is tuned over a range of about 300 kc and observe whether a 50 kc interval exists between the beat notes observed. If other than a 50 kc interval is observed, refer to the CFI alignment procedure outlined in Paragraph V-5a, step (1) to (8) inclusive, and step (22) or (23).

(8) Again tune the receiver repeating the procedure outlined until the interval is correctly 50 kc.

Since a slight variation in the output frequency of the crystal oscillator is possible by detuning the crystal oscillator tank circuit, this factor can be used to adjust the CFI output frequency to exact zero beat with another highly accurate frequency standard by feeding the output of such a standard into the receiver while it is connected in the manner described in Paragraph V-6 except that the receiver beat frequency oscillator must be turned off. Any such standard to be of value must be constantly checked against the U.S. Bureau of Standards or similar transmissions. If such a transmission can be received directly, the ultimate in accurate adjustment of CFI frequency can be obtained by attaching the antenna to the receiver, in addition to the "twisted pair" connection to the receiver, and obtaining a zero beat between the standard transmission and the CFI output. Any standard used in the manner outlined must be a multiple of 50 kc.

7. MAINTENANCE OF AUTOTUNE MECHANISM.

a. LUBRICATION.

(1) The four types of lubricants required are: (1) Texaco Capella A lubricating oil manufactured by the Texas Company, 135 E. 42 St., New York City, (2) Socony-Vacuum PD-535A lubricating grease manufactured by the Socony Vacuum Oil Co., 26 Broadway, New York City, (3) Cities Service North Star 000 oil manufactured by The Cities Service Oil Company, 500 Roberts St., Saint Paul, Minnesota. The replaceable Autotune lubrication wicks (see Parts List, Section VI) are obtainable from Collins Radio Company, Cedar Rapids, Iowa. In locations where severe dust is encountered, it may be necessary to thoroughly clean all parts before application of any lubricants. A soft brush and a jet of compressed air will be suitable for cleaning the Autotune mechanism.

(2) The Texaco Capella A oil is to be used for all lubrication points except the open gears and pawls. The points to be lubricated with this oil include:

(a) All line shaft bearings.

(b) Autotune motor bearings.

(c) Front and rear cam drum bearings on each of the Autotune units.

(d) All idler gear bearings.

(e) Counter drum bearings.

(f) Limit switch drive shaft bearings.

(3) The Socony-Vacuum PD-535A grease should be used on all gears. These gears include:

(a) Spur and idler gears on all Autotune units.

(b) The screw on the limit switch drive shaft.

(4) Cities Service North Star 000 oil should be used for lubricating the pawl stacks on each of the Autotune units.

(5) Replaceable wick lubricators are used in the following positions:

(a) All line shaft worms.

(b) Autotune chain drive.

(6) The Autotune lubrication chart, figure 5-11, shows the proper points for the application of each type of lubricant. The letters inside the dotted circles denote the type of lubricant to be used at each point. The letters A, B, and C are identified with the lubricants they represent at the bottom of figure 5-11.

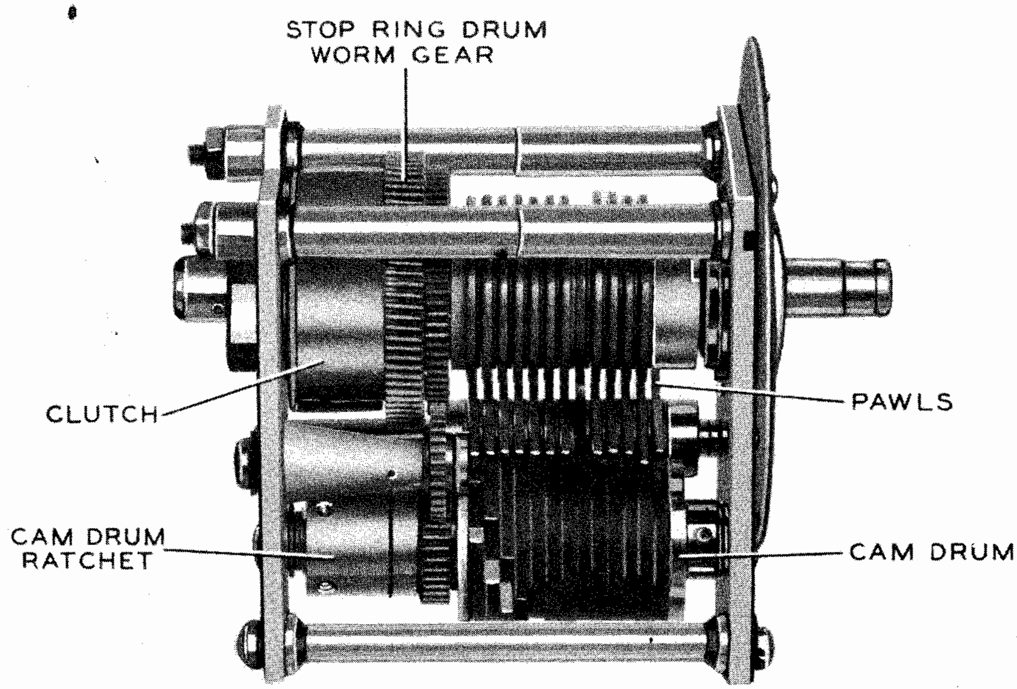


Figure 5-7 Autotune Singleturn Unit - Left Side

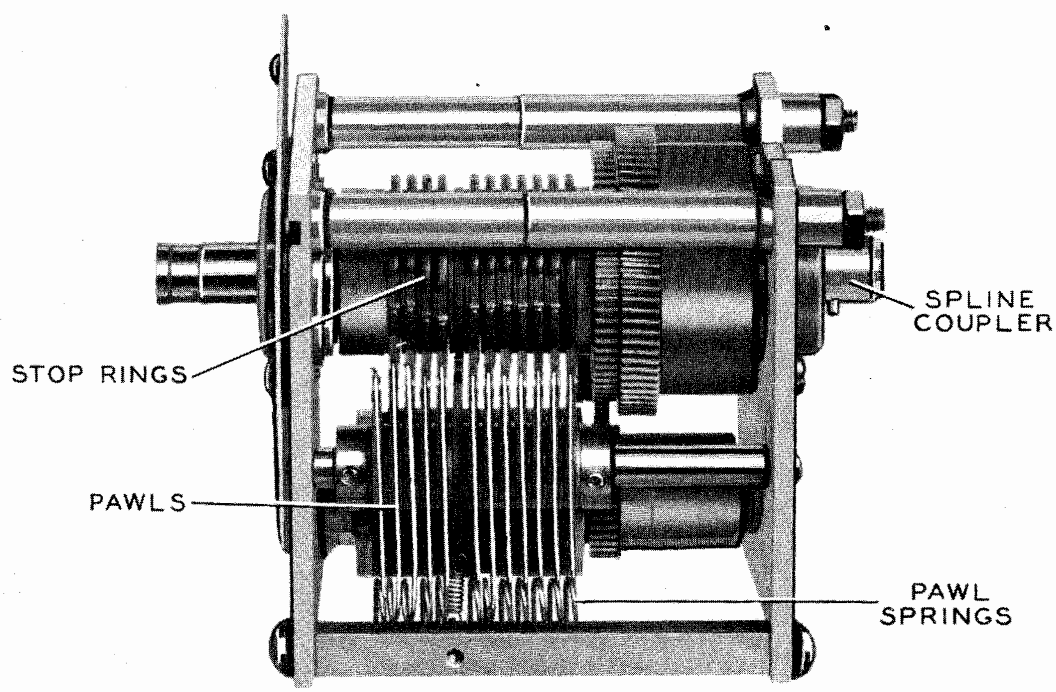


Figure 5-8 Autotune Singleturn Unit - Right Side

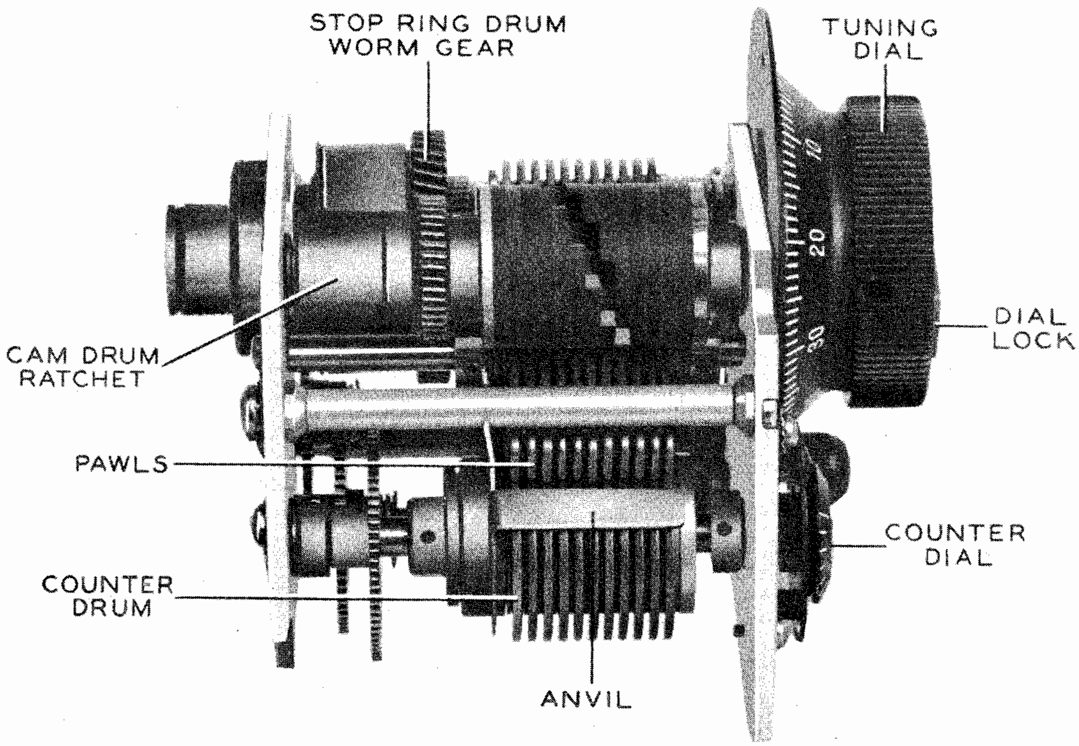


Figure 5-9 Autotune Multiturn Unit - Left Side

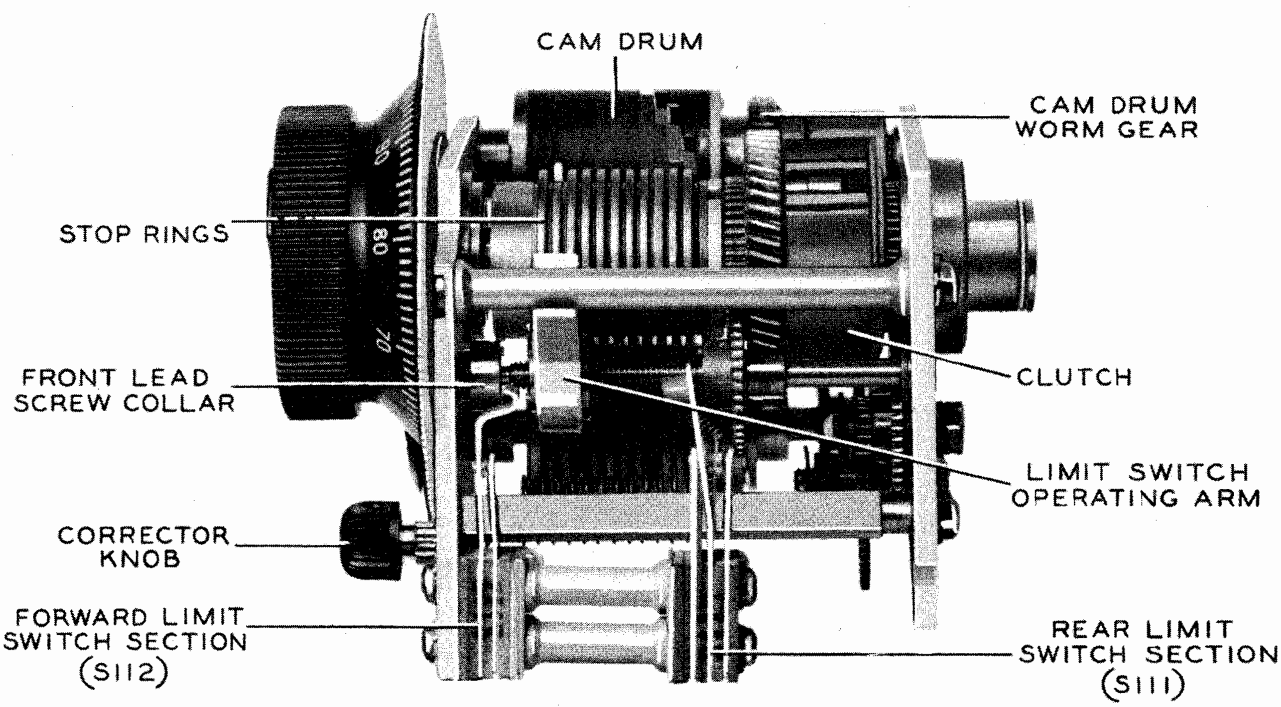
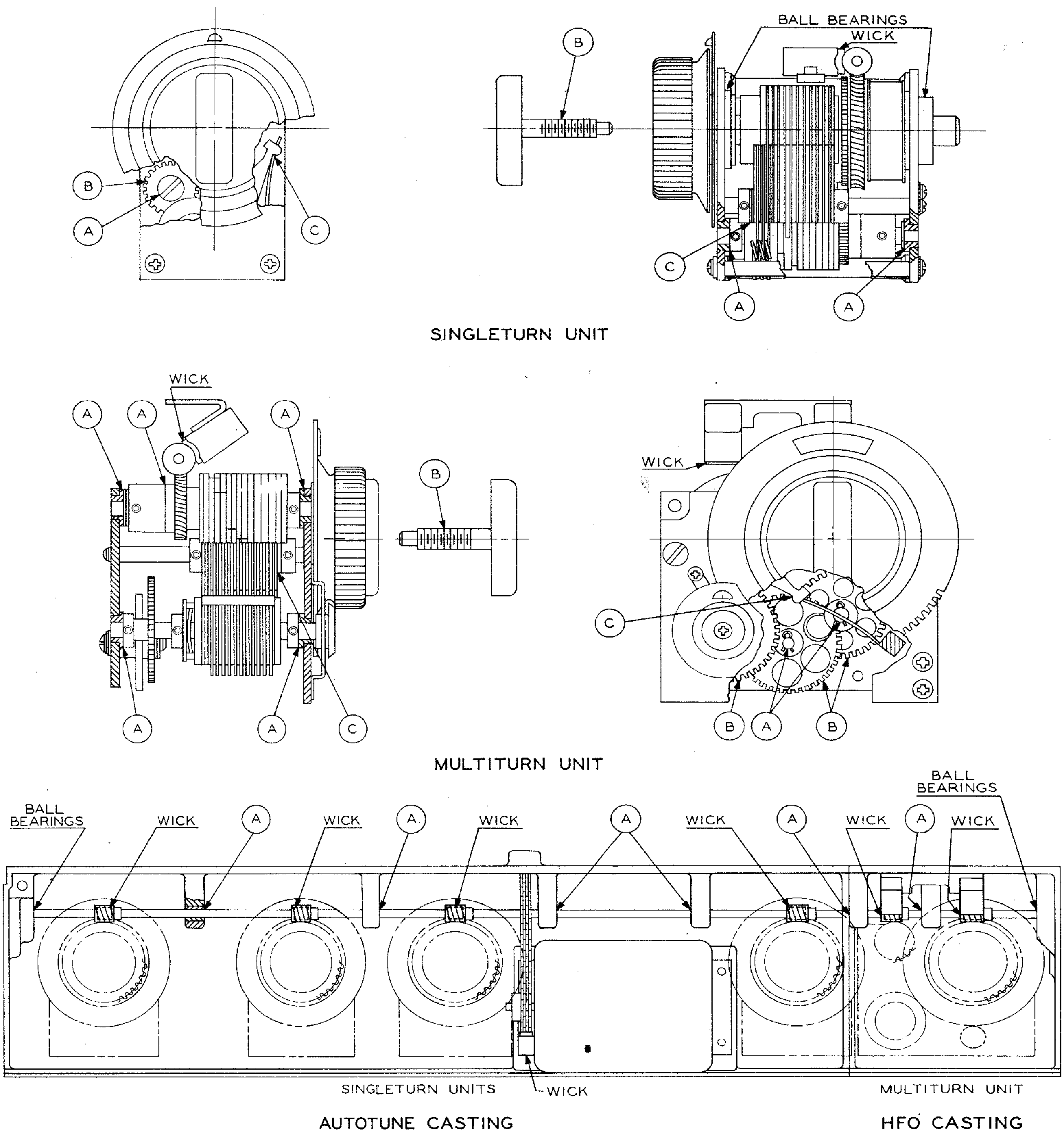


Figure 5-10 Autotune Multiturn Unit - Right Side



SEMI-ANNUALLY

EACH ARROW INDICATES A POINT OF LUBRICATION. LETTERS WITHIN BALLOONS CORRESPOND TO LUBRICANTS LISTED BELOW. APPLY SPARINGLY WITH CAMEL HAIR BRUSH. REMOVE EXCESS LUBRICANT.

(A) TEXACO CAPELLA A OIL (OR EQUAL)

(B) SOCONY VACUUM PD5 35A GREASE (OR EQUAL)

(C) CITIES SERVICE NORTH STAR 000 (OR EQUAL)

BALL BEARINGS SHOWN ABOVE DO NOT REQUIRE LUBRICATION.

ANNUALLY

REPLACE 7 WICKS WITH A COMPLETE NEW SET. DO NOT RE-USE WICKS.

Figure 5-11 Autotune Lubrication Chart

(7) Each of the three lubricants may be applied with a camel's hair brush to the various lubrication points. Only very small amounts of oil or grease are required at most points. Be sure to remove any excess oil or grease after lubricating the Autotune system.

(8) It will not be necessary to remove the individual Autotune units in order to lubricate the mechanism properly. The transmitter should be turned on the back and the Autotune front panel removed for maximum access to the lubrication points.

(9) The wick lubricator on the singleturn Autotune units can be most easily replaced by loosening the screws clamping the wick holder to the unit and sliding the holder forward. The wick lubricator holders on the multiturn Autotune unit and the Autotune chain drive must be removed in order to replace the wicks.

b. SYNCHRONIZATION CHECK.

(1) In order for the Autotune system to function properly, the five individual units must be carefully synchronized. If there is any reason to doubt the accuracy of the synchronization, it should be immediately checked. This may be done as follows:

(2) Turn the equipment on the back so as to have maximum access to the units and remove the Autotune front panel.

NOTE

If the counter drum rings in the multiturn unit "B" have been moved for any reason so that a pawl cannot fall in the slot of a given ring within the range of the counter drum rotation, the ring must be moved manually a quarter turn in either direction.

(3) Place the crank (which is included in the spare parts) on the right end of the Autotune line shaft, orient the crank hub in the slot and fasten it with a 4-40 x 1/2" screw.

(4) By means of the crank turn the line shaft counterclockwise until all the cam drums are being driven. Continue to turn the crank counterclockwise until the stop-ring drum on the Multiturn unit has reached home stop and has ceased to turn.

(5) After the stop-ring drum on the Multiturn unit has ceased to turn and only the cam drums are turning, pull the fork of the anvil (figure 4-22) in a counterclockwise direction away from under the tails of the pawls so that they are free to fall to the surface of the counter drum. If at any time the line shaft should be turned clockwise, it will first be necessary to turn the line shaft again in the counterclockwise direction far enough to reach home stop before pulling the anvil out from under the tails of the pawls; otherwise, as soon as the line shaft is turned counterclockwise, the anvil will be rotated up under the tails of the pawls.

(6) Continue to rotate the crank slowly until the No. 5 pawl on one of the units, just drops into its cam slot.

NOTE

Count from the front of the Autotune unit to the back, omitting the first or manual pawl, to arrive at pawl No. 5.

(7) Note the position of the crank arm by marking a line on the casting and then slowly turn the crank, noting the points at which the No. 5 pawls on all of the other units drop into the cam slots. All of the pawls should drop into place within a quarter turn ahead or behind the point where the number 5 pawl or unit "A" engaged with its cam. All pawls should drop sharply with a "click".

(8) Continue to rotate the crank counterclockwise until the number 6 pawl on one of the units, just drops into its cam slot.

(9) Note the position of the crank arm by marking a line on the casting and then slowly turn the crank, noting the points at which the number 6 pawls on all of the other units drop into the cam slots and repeat the procedure outlined in Step (7).

(10) Repeat Steps (8) and (9) checking the operation in turn of pawls number 7, 8, 9, 10, 11, 12 (LF), manual, 1, 2, 3, and 4.

c. SYNCHRONIZATION.

(1) If the Autotune system is found to be out of synchronism, the following procedure should be used to restore it:

(2) Determine which units are not in synchronism with the multiturn unit by use of the foregoing procedure. No adjustment is possible on the multiturn unit, therefore all other units should be synchronized with this unit.

(3) Repeat the procedure outlined in paragraph V-7b, (4) and (5).

(4) If it has been found by means of the Synchronization Check that Autotune unit "A" is not synchronized with Autotune unit "B", it may be synchronized as follows:

(a) Turn the line shaft counterclockwise until pawl number 5 on unit "B" just drops into its slot in the cam drum. At this point the cam drum on unit "A" should be in a position so that the set screws in the collar below the gear are accessible. In case one of the set screws is inaccessible, tighten the accessible set screw with a number 6 Bristo wrench and continue to turn the line shaft counterclockwise until the inaccessible set screw can be reached and loosened with the number 6 Bristo wrench, after which it will be necessary to continue to turn the line shaft in a counterclockwise direction until pawl number 5 on unit "B" again just drops into its slot in the cam drum. When this point is reached the remaining set screw in the collar on the cam drum shaft in unit "A" should be loosened. In case the above conditions cannot be met, it will be necessary to choose some other pawl that will allow these conditions.

(b) The cam drum in unit "A" is now free to be turned with the fingers until number 5 pawl just drops into its slot in the cam drum.

(c) Insert a 0.005 inch feeler gauge between the cam drum washer, which is adjacent to the cam drum and the gear on the cam drum shaft in unit "A".

Now insert a number 6 wrench in the accessible set screw, force the collar tight against the gear and around clockwise so that all play is taken up before tightening the screw. Care must be used not to move the cam drum during this step.

(d) Turn the line shaft counterclockwise noting the sequence in which the pawls on unit "A" fall with respect to the corresponding pawls on unit "B". If all the corresponding pawls on the two units fall within one-quarter turn of the line shaft, the two units are synchronized. The second set screw in the collar on unit "A" cam drum shaft should now be tightened.

(5) It is entirely possible, due to slight irregularities in the structure of the cam drums, that one or more corresponding pairs of pawls on the two units will not fall within the prescribed one-quarter turn tolerance or that the synchronizing was not done with sufficient care, causing even number 5 pawl on unit "A" to drop ahead or behind number 5 pawl on unit "B" by more than one-quart turn.

(a) If is is found necessary to correct the synchronization, turn the line shaft counterclockwise noting the sequence in which the pawls fall. If some or all of the corresponding pawls fall farther apart from each other than the prescribed tolerance, pick out the pair that drops farthest apart and note which pawl drops first.

(b) If the pawl on unit "A" drops first, note what part of a revolution the line shaft must be turned through before the corresponding pawl on unit "B" falls. Continue to crank the line shaft counterclockwise until the two set screws on the collar below the cam drum on unit "A" are easily accessible. After loosening the set screws, turn the line shaft counterclockwise through the required part of a turn deemed necessary to correct the error and tighten the set screws. Repeat with more care if the pawls upon rechecking do not yet fall within the prescribed limits.

(c) If the pawl on unit "B" drops first, note what part of a revolution the line shaft must be turned through before the corresponding pawl on unit "A" falls. Continue to crank the line shaft counterclockwise until the two set screws on the collar below the cam drum on unit "A" are easily accessible. After loosening the set screws, rest the hand on the frame of unit "A" and, placing the thumb firmly on the cam drum, rotate the cam drum slightly counterclockwise by the amount judged necessary to correct the error, then tighten the set screws. Repeat with more care if the pawls upon rechecking do not yet fall within the prescribed limits.

(d) Check to make sure that both set screws in the collar on unit "A" cam drum shaft are tight.

(6) If it has been found by means of the Synchronization Check that Autotune unit "D", "C" or "E" is not synchronized with unit "A", causing corresponding pawls on units "A", "D", "C" and "E" to drop more than one-quarter turn of the line shaft apart, it will be necessary to re-synchronize the unit or units with unit "A" which are not within the one-quarter turn tolerance by the same procedure given for synchronizing unit "A" with unit "B" as outlined in Steps (4) and (5).

(7) It should be noted that when the Autotune System has been synchronized correctly, corresponding pawls on units "A" and "B" drop within one-quarter turn of each other and the corresponding pawls on units "C", "D" and "E" drop within one-quarter turn of those on unit "A".

d. AUTOTUNE POSITIONING MECHANISM.

(1) The Autotune positioning control mechanism consists of the Autotune seeking switch, S-109, which is of the open segment type, driven by an arm attached to the shaft of the cam drum on the singleturn Autotune unit "A", and the CHANNEL selector switch, S-108.

(2) The seeking switch driving arm must be so adjusted that when, for instance position number 5 is selected by the CHANNEL selector switch S-108, the number 5 pawl will drop on all Autotune units and be in this position at the end of the Autotune cycle. In addition, the driving arm pin must engage the driven arm completely, but the pin must not touch the frame of the seeking switch, S-109, at any point of the 360 degree rotation. Finally, a "back-up" distance of roughly from 5/64" ±1/64" must be maintained between the pin of the driving arm and its place of contact on the driven arm after the cam drum, to which the driving arm is attached, is rotated by hand clockwise as far as it will go.

(3) If there is reason to believe that the seeking switch driving arm is out of adjustment, the following procedure should be followed to check it:

(a) Turn the CHANNEL selector switch, S-108, to any position.

(b) Turn the EMISSION selector switch, S-110, to the VOICE position. If the Autotune motor starts running allow it to run until the Autotune cycle is complete and the motor stops.

NOTE

If the motor continues to run more than 30 seconds without coming to a stop, observe whether, due to misalignment of the seeking switch driving arm, the seeking switch, S-109, is not being driven before turning the EMISSION selector switch, S-110, to the OFF position. If the adjustment of the seeking switch driving arm appears to be correct, the trouble is probably misalignment of or foreign matter in the motor control relay, K-101, or limit switch, S-111 and S-112. A short in the seeking switch itself can cause this trouble as can a short in the wiring.

(c) Turn the EMISSION selector switch, S-110, to the OFF position.

(d) Connect a continuity indicator from the number 1 contact of remote cable jack J-106 to the gnd connector on the transmitter. Operate the LOCAL-REMOTE switch, S-107, to the REMOTE position.

(e) Repeat Steps V-7b (2) to V-7b (4) inclusive.

(f) Continue to rotate the crank slowly until the last pawl corresponding to the contact selected has just dropped into its cam slot.

(g) Note the position of the crank arm by marking a line on the casting and then slowly turn the crank until the continuity is broken.

(h) Observe the fraction of a revolution that the crank has turned. It should be within the limits of one-eight to one full turn of the crank.

(i) If the continuity is not broken within the limits of one-eighth to one full turn of the crank, the seeking switch driving arm must be adjusted.

(j) Repeat Steps (f), (g), and (h) for each contact of remote cable jack J-106 up to and including number 11.

(4) If it is determined in checking by the procedure outlined in paragraph V-7c (3) that the driving arm of the seeking switch, S-109, is out of adjustment, it may be readjusted as follows:

(a) If the switch shaft is not centered exactly with the cam drum shaft in front of it or if the mounting screws are loose, correct these conditions by re-centering the switch shaft and tightening the screws.

(b) Select a position by turning the line shaft crank counterclockwise that will place the set screws in the hub of the seeking switch driving arm in an accessible position.

(c) Loosen the set screws with a number 6 Bristo wrench.

(d) Turn the seeking switch driving arm clockwise if the switch as checked in Step (3) opened early, and counterclockwise if it opened late. The amount to turn the arm must be determined by trial and error, but will be very slight unless it has become loose enough to cause an entirely different pawl number to drop on the Autotune units.

(e) Tighten the set screws, taking care that the pin completely engages the driven arm but does not come so close to the frame of the seeking switch as to permit it to touch at any point of the 360 degree rotation.

(f) Recheck as outlined in Steps (3),(f), (g), (h) and repeat procedure until the Autotune seeking switch, S-109, is correctly adjusted.

e. AUTOTUNE LIMIT SWITCH.

(1) The limit switch is composed of a front section, S-112, and a rear section, S-111, and is located on the right side of the Multiturn or "B" Autotune unit.

(2) The rear limit switch section, S-111, should be adjusted so that it snaps between the limits of 3-1/4 to 9-1/4 turns of the line shaft crank counting clockwise from the time the switch snaps until the collar pin on the switch operating arm is engaged by the rear lead screw collar.

(3) Add or remove shims from the rear end of the front switch section, S-112, insulator stack until the foregoing conditions Step V-7e (2) can be met.

NOTE

Do not attempt to bend the arms of the rear switch sections as such a procedure may destroy the snap action of the switch.

(4) The front limit switch section should be adjusted so that it closes between the limits of 3-1/4 to 9-1/4 turns of the line shaft crank in a clockwise direction from the reference point. This reference point is arrived at by turning the line shaft crank counterclockwise, until the collar pin on the switch operating arm is engaged by the front lead screw collar. A continuity indicator connected across the switch contacts will facilitate noting the exact moment the switch makes the contact.

(5) The main arm of the front switch section should follow the short arm for slightly less than 1/32 inch as the short arm is bent back until contact is broken. This assures adequate contact pressure necessary for reliable operation of the switch.

(6) Using an ordinary telephone relay spring bender, bend the head of the long switch contact arm and the heel end of the short contact leaf until the foregoing conditions Steps (4) and (5) are met.

(7) Make sure that the leaves of the front and rear switch sections are in the clear and are not in danger of shorting on any part of the mechanism.

8. REPLACEMENT OF PARTS.

The following Autotune parts may be replaced in the field if adequate shop facilities are available. Since the Autotune mechanism is necessarily complicated, it is recommended that only skilled and experienced personnel be permitted to repair it.

REPLACEABLE AUTOTUNE PARTS

Item	Quan.	Part Description	Used With	Part Number
1	1	Multiturn Autotune Unit "B"		520 0361 40 or 96K-1
		Includes Wick Lubricator		500 4644 001
2	1	Singleturn Autotune Unit "A"		571 0738 30 or 96J-4
		Includes Wick Lubricator		500 4630 001
3	1	Singleturn Autotune Unit "C"		572 0737 30 or 96J-2
		Includes Wick Lubricator		500 4630 001
4	1	Singleturn Autotune Unit "D"		571 0737 30 or 96J-1
		Includes Wick Lubricator		500 4630 001

Item	Quan.	Part Description	Used With	Part Number
5	1	Singleturn Autotune Unit "E"		573 0737 30 or 96J-3
		Includes Wick Lubricator		500 4630 001
6	1	Dial for Unit A	2	508 1069 20 or NY-1069B
7	1	Dial for Unit B	1	507 5524 00 or X-5524
8	1	Dial for Unit C	3	508 1072 20 or NY-1072B
9	1	Dial for Unit D	4	507 5586 00 or NX-5586
10	1	Dial for Unit E	5	507 5796 00 or NX-5796
11	5	Dial Locking Bar	6,7,8, 9,10	507 5525 00 or NX-5525
12	5	Bar Stop Disc	11	507 5620 00 or X-5620
13	1	Main Line Shaft	17	507 5512 00 or NX-5512
14	4	Singleturn Worm	13	507 5513 00 or NX-5513
15	1	Small Multiturn Worm	17	Same as (14)
16	1	Large Multiturn Worm	17	507 5519 00 or NX-5519
17	1	Multiturn Line Shaft	13	507 5517 00 or NX-5517
18	1	Main Line Shaft Thrust Bearing	13	309 1320 00 or 309N132
19	1	Multiturn Line Shaft Thrust Bearing	17	309 1360 00 or 309N136
20	6	Line Shaft Bearing	13,17	507 5724 00 or NX-5724
21	1	Line Shaft Crank	17	571 1149 10 or GA-1149A
22	1	Counter Drum Dial	1	507 5527 00 or X-5527

Item	Quan.	Part Description	Used With	Part Number
23	1	Positioning Switch Drive Arm	2	571 0881 10 or 881A
24	1	Chain Drive	13,25, 26	507 5603 00 or NX-5603
		Includes Wick Lubricator		500 4635 001
25	1	Motor Sprocket	24	507 56 02 00 or NX-5602
26	1	Line Shaft Sprocket	13,25, 26	507 5514 00 or NX-5514

a. REMOVING COMPONENT PARTS.

(1) COVER. - Remove 16 screws and lift off. (Cover must be removed before any other units or parts are removed.)

(2) MOTOR. - Remove 3 mounting screws and unsolder four wires to motor. Pivot motor as it is lifted out so as to free it from chain drive.

(3) AUTOTUNE UNIT "A". - Turn dial locking bar to unlocked position and loosen the two number 10 Bristo set screws in the dial. Turn dial and locking bar counterclockwise together until bar comes free. Remove both dial and locking bar. Remove the dial back plate, loosen the two long screws on the top end of the unit and the short screw on the bottom end of the unit. Lift the unit out.

(4) AUTOTUNE UNIT "C", "D", OR "E". - Remove 4 screws, one on each of Autotune units "C", "D", and "E" and one on the end of the jack strip. Pull the strip out as far as the wires will permit. Turn locking screw on Autotune unit "C", "D", or "E" to unlocked position and loosen the two number 10 Bristo set screws in the dial. Remove dial, remove dial back plate, loosen the two long screws on the top end of the unit and the short screw on the bottom of the rear plate. Lift the unit out.

NOTE

Autotune units "C", "D", and "E" differ only in that the clutches are designed to exert a different torque on each of these units. Each unit is stamped at the bottom of the front plate with the control letter "C", "D" or "E". Care must be exercised not to interchange these units. Note that the control dials are not interchangeable because of the dial engraving.

(5) AUTOTUNE UNIT "B". - Remove the right end cover plate and the dial and back plate from Unit "A". Next remove the number 10 nut on the back end of the main tuning slug leadscrew which is attached to the multiplier slug coupling yoke. Then remove the two mounting screws along the upper edge of the backplate of the multiturn unit; also remove the single screw along the lower edge. Remove the two screws which hold the limit switch and carefully

pull the switch away from the assembly. Pull the assembly out of the casting carefully so as not to damage the tuning slug on the leadscrew.

NOTE

If the leadscrew is turned even slightly the high frequency oscillator must be recalibrated and realigned.

(6) LINE SHAFT. - Remove all Autotune singleturn units and four screws of the thrust bearing on left end of shaft. Remove taper Groov-pins on worms for heads A, C, and D and on sprocket. Pull shaft assembly out of the left end of Autotune casting.

CAUTION

Be very careful not to spring the line shaft when driving out the taper Groov-pins. Support the shaft adjacent to the gears when removing or replacing the taper Groov-pins. Keep the gears separate and in order so each may be replaced in the same location from which it was removed.

(7) REPLACING CONTROL DIALS "A", "B","C", "D" AND "E". - Care must be exercised to replace the dials exactly as they were before disassembly. Each dial must clear the dial back plate throughout the range of the Autotune unit to which it is attached.

(a) Dial "A" should indicate range number 1 when the contact arm of range switch S-102 is centered on contact number 1. The setting must be approached clockwise from the counterclockwise rotation limit.

(b) Dial "B" should indicate "O" when the multiturn unit is at the counterclockwise home stop position when the reference marker is in a vertical position.

(c) Dial "C" should read between 1 and 13 when the unit is rotated against the counterclockwise rotation limit. Rotating the dial to position number 1 should cause a tooth of the star cam to seat squarely on the roller of Autotune interlock switch S-113D during the interval that the contact arm of S-113C rests squarely on contact number 1. Contact number 1 is located farthest from the transmitter front panel.

(d) Dial "D" should indicate "O" when the crosswise half-turn in the rotor winding of variometer L-112 is at the top of the unit and the windings of the unit are in alignment. This setting must be approached clockwise from the counterclockwise limit of rotation.

(e) Dial "E" should be adjusted so that switch S-113A is completely closed when the dial reads 100 and completely open when the dial reads 200. The switch must operate in the blank space between the dial reading of 100 and 200.

b. SERVICING THE MAIN LINE SHAFT ASSEMBLY.

(1) The following replaceable parts are associated with the main line shaft assembly:

Item	Description
13	Main Line Shaft
14	Singleturn Worm (4)
18	Main Line Shaft Thrust Bearing
20	Line Shaft Bearing (4)
24	Chain Drive
25	Line Shaft Sprocket

(2) In order to replace these parts it will be necessary to remove the entire line shaft assembly. Care must be exercised to keep each gear in the proper order when disassembling the line shaft. None of the gears are interchangeable.

(3) The following procedure is recommended for removing the line shaft assembly.

CAUTION

When driving out the taper Groov-pins be very careful not to spring the line shaft.

(a) Remove all singleturn Autotune heads (Heads A, C, D and E).

(b) Remove the taper Groov-pin from each of the worms and the sprocket. Before driving out a taper Groov-pin, be sure that the line shaft is well supported adjacent to the taper Groov-pin.

(c) Remove the four screws from the thrust bearing retainer plate on the left end of the casting.

(d) Slowly work the shaft off the left end of the casting removing each worm or the sprocket as it nears the end of the shaft. Be sure each gear is properly identified so as to be replaced in its original position. These gears are not interchangeable because each gear is drilled while on the line shaft.

c. REPLACING A SINGLETURN WORM.-- The replacement singleturn worm is furnished undrilled. The following procedure is recommended for replacing a singleturn worm:

(1) Center-punch the sleeve of the worm in the spot corresponding to the center of the hole on the old worm.

(2) Using a 1/16" drill, drill through one side of the worm sleeve.

(3) Slide the worm on the shaft with the sleeve end away from the thrust bearing assembly.

(4) Drill through to the other side of the worm sleeve with the 1/16" drill.

(5) Proceed to reassemble the line shaft in the reverse order of the foregoing disassembling procedure using new 1/16" x 3/8" taper Groov-pins on the worms and a new 5/64" x 1/2" taper Groov-pin on the sprocket.

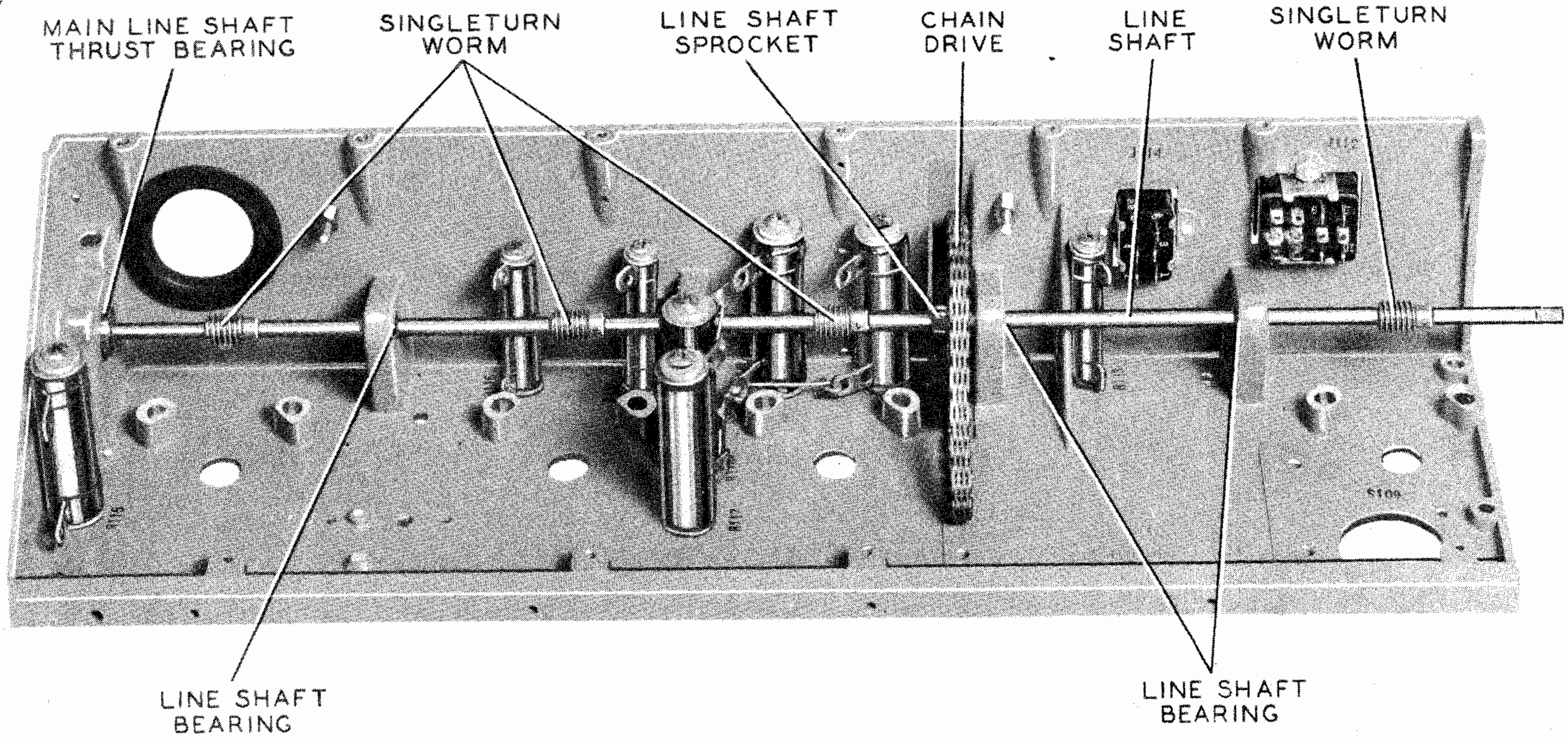


Figure 5-12 Autotune Casting

d. REPLACING A LINE SHAFT SPROCKET. - Follow the same procedure as used for replacing the singleurn worm except use a number 47 drill.

e. REPLACING THE CHAIN DRIVE. - As the line shaft is being pulled out the left end of the casting, slip off the old chain and sprocket. Put the new chain on the sprocket and push the line shaft back into place, slipping the shaft through the sprocket. Slip the singleturn worm on the end of the shaft and then replace with new taper Groov-pins.

f. REPLACING A LINE SHAFT BEARING. - The oilite type line shaft bearings are held in place by means of a press fit. A thin steel sleeve fits over these bearings. After removing the line shaft the defective bearing should be driven out gently by using a mallet and a rod or blunt end punch. The new bearing should then be gently driven into place. Be careful not to deform the bearing.

g. REPLACING THE MAIN LINE SHAFT THRUST BEARING. - In replacing this bearing, it will not be necessary to remove the entire line shaft assembly. The following procedure is recommended:

(1) Remove the four screws from the bearing retainer plate on the left end of the casting.

(2) Remove the taper Groov-pin from the line shaft sprocket.

(3) Work the shaft end bearing out about an inch or more from the end of the casting.

(4) Carefully block up the outside bearing collar and drive out the taper Groov-pin from the inside bearing collar.

CAUTION

Be careful not to spring the line shaft when driving the taper Groov-pin out.

(5) Replace the inside collar on the shaft, slide the new bearing on the shaft and then slide the outside collar through the bearing into the inside collar.

(6) Insert a taper Groov-pin and gently drive it home.

CAUTION

Be sure the outside collar is blocked up properly so that the line shaft will not be sprung.

(7) Slide the shaft back to its original position and replace the bearing plate. Use a new taper Groov-pin in the line shaft sprocket.

h. REPLACING THE MAIN LINE SHAFT. - The task of installing a new line shaft is difficult and lengthy and should only be attempted by an experienced mechanic who has adequate tools available. The following procedure is recommended for replacing the main line shaft:

(1) Remove the line shaft as previously prescribed.

(2) Reassemble the gears on the shaft and drive the taper Groov-pins in lightly.

(3) Carefully measure the distance from the milled end of the shaft to one end of each worm, the sprocket and the thrust bearing.

(4) Completely disassemble the line shaft.

(5) Centerpunch each gear and the sprocket at a point which is at a right angle to the previously used taper Groov-pin hole and the same distance from the end.

(6) Drill each gear with a 1/16" drill and the sprocket with a number 47 drill through on one side only.

(7) Put one of the worms on the shaft, in its predetermined position, block the shaft well, and, using a 1/16" drill, drill through the new hole in the gear into the line shaft through the other side of the gear.

(8) Suitably mark the new hole on the sleeve of the gear.

(9) Repeat Steps (7) and (8) for the remaining worms and sprocket. Use a number 47 drill for the sprocket.

(10) Assemble the bearing and slide it on the end of the shaft.

(11) Clamp the bearing, block the shaft and drill through the two sleeves and the shaft at a point at right angles to the old hole. Use a 1/16" drill.

(12) Suitably mark the new hole on both sleeves.

(13) Using new taper Groov-pins (five 1/16" x 3/8" and one 5/64" x 1/2") assemble the shaft in the casting as previously described.

NOTE

Be sure to place the gears in their proper order on the shaft.

i. SERVICING THE MULTITURN LINE SHAFT ASSEMBLY.

(1) The following replaceable parts are associated with the Multiturn line shaft assembly:

Item	Description
15	Small Multiturn Worm
16	Large Multiturn Worm
17	Multiturn Line Shaft
19	Multiturn Line Shaft Thrust Bearing
20	Line Shaft Bearing

(2) This shaft assembly may be serviced in the same general way as the main line shaft. The multiturn head must be removed before any work may be done on the shaft. The large worm requires a 5/64" x 1/2" taper Groov-pin and the small worm and thrust bearing require 1/16" x 3/8" taper Groov-pins.

9. PERFORMANCE STANDARDS.

Table 5-1 POWER INPUT REQUIREMENTS

Ø

Type of Emission	Power Input
CW	
CW (Stand-by)	
MCW	
MCW (Stand-by)	
VOICE (No Modulation)	
VOICE (90% Modulation)	
VOICE (Stand-by)	

NOTE

All of the above power input measurements were made with 115 volts input to the power unit and with power amplifier loaded to rated PA PLATE meter reading.

Table 5-2 TYPICAL AUDIO-FREQUENCY DATA

a. OVERALL AUDIO-FREQUENCY RESPONSE (EITHER CARBON OR DYNAMIC INPUT).

Frequency	50% Mod.	90% Mod.
100 cps	-7.6 db	-7.0 db
200 cps	-3.4 db	-2.8 db
300 cps	-2.2 db	-1.7 db
500 cps	-0.7 db	-0.4 db
1000 cps	0.0 db	0.0 db
2000 cps	-0.2 db	-0.3 db
3000 cps	-0.7 db	-0.9 db
4000 cps	-1.6 db	-1.8 db
5000 cps	-2.7 db	-3.2 db

NOTE

All of the above measurements made with input to microphone jack J-102.

b. AUDIO INPUT. - Input required for 90% Modulation at 1000 cps.

CARBON Input - 1.52 v required.

DYNAMIC Input - 16.0 mv required.

Ø Inclusion of this sign indicates information not available for the Preliminary Instruction Book. This information will be included in the Final Instruction Book.

c. NOISE LEVEL. - Below 100% Modulation with input at 1000 cps.

CARBON Input - -44 db.

DYNAMIC Input - -45 db.

d. AUDIO DISTORTION. - Distortion with 90% Modulation at 1000 cps.

CARBON Input - 4.5% Distortion.

DYNAMIC Input - -4.7% Distortion.

e. SIDETONE DISTORTION. - Distortion measured on output of SIDETONE at Position 5 with 90% Modulation at 1000 cps.

CARBON Input - -8.8% Distortion.

DYNAMIC Input - -8.9% Distortion.

f. SIDETONE OUTPUT.

Switch Position	Output CW	Output MCW	Load Impedance
1	0.6 volt	0.75 volt	125 ohms
2	1.3 volt	1.6 volt	125 ohms
3	2.5 volts	3.0 volts	125 ohms
4	5.0 volts	6.0 volts	125 ohms
5	8.8 volts	10.5 volts	125 ohms
6	19.5 volts	23.5 volts	2000 ohms

NOTE

All of the above audio-frequency measurements were made with Control "A" in Position 2 at an RF output frequency of 3.0 mc, with 115 v input to the power unit and with power amplifier loaded to rated PA PLATE meter reading.

Table 5-3 MCW-CFI UNIT OUTPUT LEVEL

DB at SIDETONE jack J-104 of -52286-A Transmitter with MCW-CFI UNIT installed using 500 ohm 6 MW "Zero" Ref. Type Meter across 125 ohms.

Sidetone OUTPUT Level switch on Position 5.

Freq. kc	Dial "G"	db
	Band 1	
200	393	+9.5
	936	Usable
225	1159	Usable
	1363	Usable
250	1729	+14
	1959	Usable
	Band 2	
275	559	+0
	762	Usable
300	1114	+15
	1418	Usable

Freq. kc	Dial "G"	db
	Band 2 (Cont.)	
325	1557	+1
	1690	Usable
350	1941	+16
	Band 3	
350	160	+16
	532	Usable
375	688	+3
	832	Usable
400	1091	+15
	1322	Usable
433-1/3	1534	Usable

Freq. kc	Dial "G"	db
	Band 3 (Cont.)	
450	1732	+15
466-2/3	1909	Usable
	Band 4	
450	00	+15
475	272.5	
500	522	+16
525	742	
550	942	+13.5
575	1127	
600	1305	+11
625	1479	

RESTRICTED

RESTRICTED

Table 5-3 (Cont.)

Freq. kc	Dial "G"	db
	Band 4 (Cont.)	
650	1656	+11
675	1848	
700	2084	+10
	Band 5	
675	00	
700	199	+15
725	376	
750	537	+11
775	685	
800	823	+9
825	954	
850	1079	+9
875	1199	
900	1316	+6
925	1433	

Freq. kc	Dial "G"	db
	Band 5 (Cont.)	
950	1550	+4.5
975	1670	
1000	1797	+7
1025	1939	
	Band 6	
1025	095	
1050	222	+10-1/2
1075	340	
1100	450	+9
1125	555	
1150	654	+9
1175	749	
1200	841	+9
1225	929	
1250	1014	+8

Freq. kc	Dial "G"	db
	Band 6 (Cont.)	
1275	1097	
1300	1179	+6-1/2
1325	1259	
1350	1339	+6
1375	1417	
1400	1494	+6
1450	1658	
1500	1832	+3-1/2

RESTRICTED

Table 5-3 (Cont.)

Freq. kc	Dial "B"	db	Freq. kc	Dial "B"	db	Freq. kc	Dial "B"	db
2000	100	+10	2366-2/3	1455	Usable	2633-1/3	775	Usable
2023	223	Usable	2400	1578	+9	2650	826	Usable
2050	284			1704	Usable	2666-2/3	878	Usable
2066-2/3	346	Usable		1767	Usable	2700	979	+6.5
2100	469	+10.5		1832	Usable	2733-1/3	1081	Usable
2133-1/3	591	Usable	2500	1967	+8	2750	1132	Usable
2150	655	Usable	2400	60	+10	2766-2/3	1183	Not Good
2166-2/3	717	Usable	2433-1/3	162	Usable	2800	1284	+6.5
2200	841	+9	2450	213	Usable	2833-1/3	1385	Usable
2233-1/3	965	Usable	2466-2/3	263	Usable	2850	1436	Usable
2250	1026	Usable	2500	365.5	+9.5	2900	1589	+5.5
2267	1087	Usable	2533-1/3	468	Usable	2933-1/3	1694	Usable
2300	1209	+8.5	2550	518	Usable	2950	1746	Usable
2333-1/3	1332	Usable	2566-2/3	570	Usable	3000	1910	+4
2350	1393	Usable	2600	673	+7.0			

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RESTRICTED

Table 5-4

RESISTANCE MEASUREMENTS FROM VACUUM TUBE TERMINALS TO

GROUND AND

TYPICAL OPERATING VOLTAGES AND CURRENTS

All voltage readings taken at full power level with a supply voltage of 115 volts.

All voltage and resistance measured to ground.

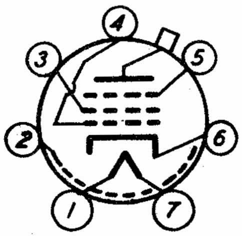
Voltage readings in Column A taken with a 1000 ohm per volt voltmeter. Voltage readings in Column B taken with a 20,000 ohm per volt voltmeter.

For voltage measurements, unless otherwise noted, transmitter is adjusted for VOICE operation in the range 6000 kc to 7200 kc, key closed, no modulation.

For resistance measurements, allow one half hour to elapse with transmitter turned off. Keying relay, Audio, LFO, MCW-CFI, Remote Control and Power Unit disconnected. Tubes in place. EMISSION selector switch is in the MCW position, Control "A" on Position 7 and power level switch on OPERATE, unless otherwise noted. Key closed.

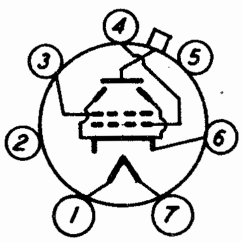
	PIN	VOLTAGE A	VOLTAGE B	MA	RESISTANCE

V-101 837



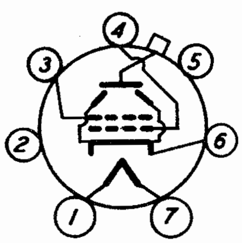
	PIN	A	B	MA	RESISTANCE
Filament	1	12	12		5.5
Filament	7	24	24		3
Cathode	6	14	14		inf
Grid 1	4	6.5**	8**		22,000
Grid 2	3	190	190	10	5000
Grid 3	5	0	0		0
Plate	C	395	400	30	6750
Shield	2	0	0		0

V-102 1625



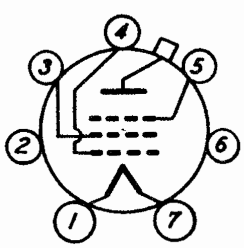
	PIN	A	B	MA	RESISTANCE
Filament	1	12	12		4.5
Filament	7	24	24		3
Cathode	6	42	43		1000
Grid 1	4	-55**	-65**		100,050
Grid 2	3	300	320	6	26,750
Plate	C	395	400	35	6750
-----	2	0	0		inf
-----	5	-55**	-65**		100,000

V-103 1625



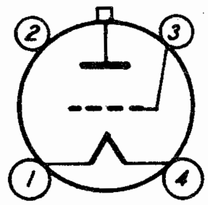
	PIN	A	B	MA	RESISTANCE
Filament	1	0	0		0
Filament	7	12	12		4.5
Cathode	6	63	65		1000
Grid 1	4	-165**	-175**		100,050
Grid 2	3	300	320	3.2	26,750
Plate	C	395	400	40	6750
-----	2	0	0		inf
-----	5	-165**	-175**		100,000

V-104 813



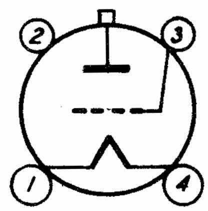
	PIN	A	B	MA	RESISTANCE
Filament	1	10	10		.5
Filament	7	0	0		0
Grid 1	4	-180**	-185**		20,300
Grid 2	3	395	400	40	inf
Grid 3	5	0	0		0
Plate	C	1285	1285	150	inf
-----	2	395	400		inf
-----	6	0	0		0

V-105 811



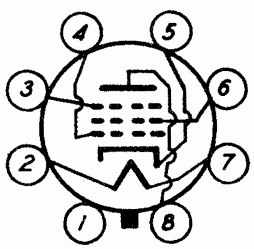
	PIN	VOLTAGE A	VOLTAGE B	MA	RESISTANCE
Filament	1	10	10		.5
Filament	4	16	16		1
Grid	3	10*	10*		inf
Plate	C	1285	1285	16.5	inf
-----	2	0	0		inf

V-106 811



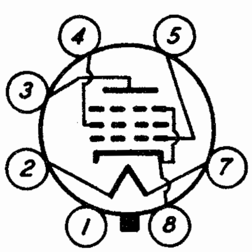
	PIN	VOLTAGE A	VOLTAGE B	MA	RESISTANCE
Filament	1	22	22		1.5
Filament	4	16	16		1
Grid	3	16*	16*		inf
Plate	C	1285	1285	16.5	inf
-----	2	0	0		inf

V-201 12SJ7 #



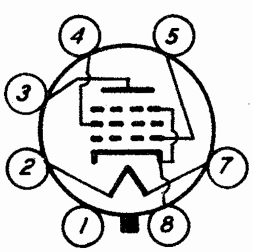
	PIN	VOLTAGE A	VOLTAGE B	MA	RESISTANCE
Filament	2	0	0		0
Filament	7	12	12		5
Cathode	5	7	9		2200
Grid 1	4	0**	0**		4000
Grid 2	6	35	35	.2	inf
Grid 3	3	0	0		0
Plate	8	70	115	.6	inf
-----	1	0	0		0

V-202 6V6GT



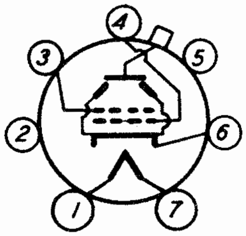
	PIN	VOLTAGE A	VOLTAGE B	MA	RESISTANCE
Filament	2	18	18		5.5
Filament	7	12	12		5
Cathode	8	9.5	9.5		250
Grid 1	5	0**	0**		500,000
Grid 2	4	200	210	3	inf
Plate	3	190	195	30	inf

V-203 6V6GT



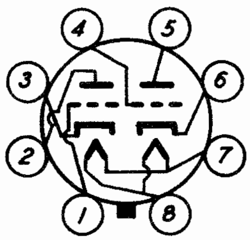
	PIN	VOLTAGE A	VOLTAGE B	MA	RESISTANCE
Filament	2	24	24		5.5
Filament	7	18	18		6
Cathode	8	10	10.5		250
Grid 1	5	0**	0**		100,000
Grid 2	4	200	210	3.5	inf
Plate	3	190	195	30	inf

V-401 1625 ##



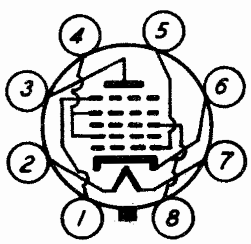
	PIN	VOLTAGE A	VOLTAGE B	MA	RESISTANCE
Filament	1	0	0		0
Filament	7	12	12		inf
Cathode	6	19	19		inf
Grid 1	4	-15	-16		15,000
Grid 2	3	190	190	2	inf
Plate	C	395	400	50	inf
------	2	0	0		inf
------	5	19	19		inf

V-2201 12SL7GT



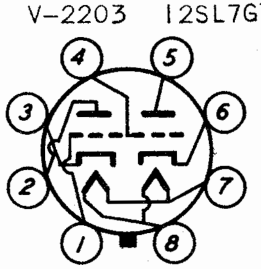
	PIN	VOLTAGE A	VOLTAGE B	MA	RESISTANCE
Filament	7	0	0		0
Filament	8	12	12		15
CFI CRYSTAL OSCILLATOR SECTION					
Cathode	6	0	0		0
Grid	4	-6**	-6**		150,000
Plate	5	90	115	2.5	inf
CFI TRIPLER SECTION					
Cathode	3	0	0		0
Grid	1	-10**	-17**		50,000
Plate	2	80	90	1.3	inf

V-2202 12SA7



	PIN	VOLTAGE A	VOLTAGE B	MA	RESISTANCE
Filament	2	12	12		15
Filament	7	0	0		0
Cathode	6	2	2		220
Grid 1	5	-2**	-4**		50,000
Grid 2 & 4	4	90	95	9	0
Grid 3	8	-6**	-10**		50,000
Grid 5	1	2	2		0
Plate	3	90	90	2.5	0

V-2203 12SL7GT



	PIN	VOLTAGE A	VOLTAGE B	MA	RESISTANCE
Filament	7	12	12		15
Filament	8	20	24		27
CFI DETECTOR SECTION					
Cathode	3	0	0		28
Grid	1	-1.5**	-2**		500,000
Plate	2	55	75	.25	inf
AUDIO OSCILLATOR SECTION					
Cathode	6	.1**	.1**		220
Grid	4	-1**	-1.5**		150,000
Plate	5	65	75	.5	67,000

Place power level switch in the CALIBRATE position and microphone selecting switch in the CARBON position.

* Since modulator Grid bias is obtained by utilizing the average voltage drop through the filaments of the modulator tubes, it is impractical to measure this value directly. Value shown is actually a filament voltage measurement. The effective value may be considered to be half the filament voltage actually supplied the filament of the tube.

Voltage and current measurements made with transmitter adjusted for 1000 kc with final amplifier at resonance under load. Resistance measurements made with Control "A" on 13 (LF).

** 100 mh RF choke used to isolate meter.

Table 5-5 VOLTAGE AND RESISTANCE TO GROUND FROM CONNECTOR TERMINALS

All voltage readings taken at full power level with a supply voltage of 115 volts.

Voltage readings in Column A taken with a 1000 ohm per volt voltmeter. Voltage readings in Column B taken with a 20,000 ohm per volt voltmeter.

For voltage measurements, unless otherwise noted, transmitter is adjusted for MCW operation, LOCAL control, in the range 6000 kc to 7200 kc, key closed.

For resistance measurements, allow one half hour to elapse with transmitter turned off. Keying relay, Audio, LFO, MCW-CFI, Remote Control and Power units disconnected. Tubes in place. EMISSION selector switch is in the MCW position, Control "A" on Position 1, Autotune positioned on CHANNEL 1, LOCAL-REMOTE switch on LOCAL position and power level switch on OPERATE unless otherwise noted. Microphone circuit selecting switch S-201 in the CARBON position. Key Closed.

Connector	Term	Voltage A	Voltage B	Meter Scale	Resistance
HFO TERM STRIP					
	1	190	190	250	5000
	2	24	24	50	3
	3	12	12	50	5.5
	4	14	14	50	inf

Connector	Term	Voltage A	Voltage B	Meter Scale	Resistance Local	Resistance Remote #
J-106						
	1	0	0		180	inf
	2	0	0		0	0
	3	0	0		0	0
	4	0	0		0	0
	5	0	0		0	0
	6	0	0		0	0
	7	0	0		0	0
	8	0	0		0	0
	9	0	0		0	0
	10	0	0		0	0
	11	0	0		0	0
	12	0	0		inf	180
	13	0	0		inf	0
	14	28	28		150	150
	15	0	0		inf	inf
	16				120	120
	17	0	0		inf	150
	18	0	0		0	0
	19	0	0		0	0
	20	23.5	23.5		inf	inf
	21	0	0		0	inf
	22	0	0		inf	0

Connector	Term	Voltage A	Voltage B	Meter Scale	Resistance Local	Resistance Remote #
	23	0	0		inf	inf
	24	0	0		inf	inf
	25	0	0		inf	inf
	26	0##			inf	inf
	27	10.5##			inf	inf

Connector	Term	Voltage A	Voltage B	Meter Scale	Resistance		
J-107							
	1	0	0		0		
	2	0	0		0		
	3	0	0		inf		
J-108							
	1	395	400		6750		
	2	395	400		inf		
	3	28	28		3		
	4	28	28		3		
	5	0	0		0		
	6	28	28		1.5		
	7	0	0		0		
	8	0	0		0		
	9	395	400		inf		
	10	1285	1285		inf		
J-111							
	1	13.5	13.5	50	0	T*	C**
		15**	15**	50	inf	inf	inf
	2	0	0		inf	inf	inf
	3	-.1	-.5	5	inf	inf	inf
		400**	415**	1000			
	4	0	0		inf	inf	inf
	5	390	400	1000	inf	inf	inf
		400**	415**	1000			
	6	0	0		0	0	0
	7	0	0		inf	4	inf
	8				3	3	3
J-112							
	1	10	10	50	inf		
	2	10	10	50	.5		
	3	16	16	50	.5		
	4	16	16	50	inf		
	5	10.5##			inf		
	6	190	195	250	5000		
	7	24	24		3		
	8	0	0		0		
	9	0	0		0		
	10	23.5	23.5		inf		
	11	0	0		0		
	12	0	0		inf		

Connector	Term	Voltage A	Voltage B	Meter Scale	Resistance
J-114					
	1	0	0		0
	2	12	12		5.5
	3	395	400		6750
	4	190	190		5000
	5	19	19		inf
	6	0	0		inf
J-115					
	1	300	320		26,750
	2	395	400		6750
	3	0	0		----
	4	28	28		3
	5	0	0		inf
	6	14	14		inf
	7	0	0		125
	8	14	14		inf
	9	24	24		3
	10	0	0		----
	11	395	400		6750
	12	300	320		26,750
J-116					
	1	0	0		inf
	2	28	28		153
	3	0	0		0
	4	0	0		0
	5	395	400		inf
	6	10.5##			inf
	7	0	0		inf
	8	10.5##			inf
	9	0	0		inf
	10	0	0		inf
	11	0	0		inf
	12	0	0		inf
	13	395	400		6750
	14	0	0		0
	15	28	28		3
P-101					
	1	300	320		inf
	2	395	400		inf
	3	0	0		----
	4	28	28		inf
	5	0	0		inf
	6	14	14		inf
	7	0	0		inf
	8	14	14		inf
	9	24	24		inf
	10	0	0		----
	11	395	400		inf
	12	300	320		inf

Connector	Term	Voltage A	Voltage B	Meter Scale	Resistance
P-102					
	1	0	0		inf
	2	28	28		inf
	3	0	0		inf
	4	0	0		inf
	5	395	400		inf
	6	10.5##			inf
	7	0	0		inf
	8	10.5##			inf
	9	0	0		inf
	10	0	0		
	11	0	0		inf
	12	0	0		inf
	13	395	400		inf
	14	0	0		inf
	15	28	28		inf
P-201					
	1	10	10	50	inf
	2	10	10	50	inf
	3	16	16	50	inf
	4	16	16	50	inf
	5	10.5##			2 to 16
	6	190	195	250	inf
	7	24	24		24
	8	0	0		0
	9	0	0		0
	10	23.5	23.5		325
	11	0	0		0
	12	0	0		6.5
P-401					
	1	0	0		0
	2	12	12		28
	3	395	400		inf
	4	190	190		inf
	5	19	19		inf
	6	0	0		inf

LOCAL-REMOTE switch on REMOTE position for these readings.

Use 1,000 ohm per volt AC voltmeter sidetone switch on #5 (output of audio sidetone).

If receiver disabling circuit is used terminals 26 and 27 are equal.

* Turn power level switch to TUNE position for these readings.

** Turn power level switch to CALIBRATE position for these readings.

Table 5-6 RESISTANCE MEASUREMENTS ON ROTATING MACHINES

All resistance readings were made will all brushes removed from the machines.

a. AUTOTUNE MOTOR. - Fractional Type NY-818C-C direct current shunt wound motor 3.1 amps, 28 volts, 1/20 hp, 3900 rpm. Part No. 508 0818 33.

Resistance between commutator segments diametrically opposed = .83 ohms.

Resistance between adjacent commutator segments = .16 ohms (24 commutator segments).

Field resistance, F1 to F2 = 27.0 ohm (F1 grounded to motor frame).

b. LOW VOLTAGE DYNAMOTOR PART NO. 231 0028 00

(1) Resistance from any of the commutators to the dynamotor frame = infinite ohms.

Ø(2) Average resistance between adjacent segments on the 115 v commutator =

Ø(3) Average resistance between adjacent segments on the 28 v commutator =

Ø(4) Average resistance between adjacent segments on the 14 v commutator =

Ø(5) Field winding resistance =

c. HIGH VOLTAGE DYNAMOTOR PART NO. 231 0029 00

(1) Resistance from any of the commutators to the dynamotor frame = infinite ohms.

Ø(2) Average resistance between adjacent segments on the 115 v commutator =

Ø(3) Average resistance between adjacent segments on the 400 v commutator =

Ø(4) Average resistance between adjacent segments on the 750 v commutator =

Ø(5) Resistance of the field winding =

NOTE

A short or low resistance to ground from either terminal A1 or A2, with brushes removed and external wires disconnected, indicates a defective capacitor or brush holder.

A variation in resistance between adjacent commutator segments, with brushes removed indicates a defective armature.

Ø Inclusion of this sign indicates information not available for the Preliminary Book. This information will be included in the Final Instruction Book.

A low resistance or short to ground from the commutator, indicates a defective armature.

A large discrepancy in field resistance or a short from F2 to ground indicates a defective field winding.

A low resistance or short to ground from the input or output wires, with brushes removed, indicates a defective capacitor or brush holder.

A variation in resistance between adjacent segments on any commutator, with brushes removed, indicates a defective armature.

A low resistance or short to ground from any commutator, with brushes removed, indicates a defective armature.

A large discrepancy in shunt field resistance indicates a defective or shorted field winding.

10. TUBE COMPLEMENT.

Table 5-7 TUBE COMPLEMENT

Tube Type	Quan.	Function
837	1	HF Oscillator
1625	1	1st Frequency Multiplier
1625	1	2nd Frequency Multiplier
813	1	Power Amplifier
811	2	Modulators
12SJ7	1	Audio Amplifier
6V6GT	1	Audio Driver
6V6GT	1	Sidetone Amplifier
12SL7GT	1	Crystal Oscillator-Tripler
12SA7	1	Mixer
12SL7GT	1	Detector-Audio osc.

NOTE

Tube pin connections and typical operating voltages and currents may be found in Table 5-4.

WARNING

In order to obtain satisfactory tube life the following precautions must be taken:

Operate all tube filaments within ±5% of rated voltage.

Do not exceed rated plate current in any of the tubes during normal operation of the equipment.

When tuning, do not exceed rated plate current except for periods of short duration.

Failure to observe the above precautions may result in the destruction of the tubes.

ALL TUBES SUPPLIED WITH THE EQUIPMENT OR AS SPARES ON THE EQUIPMENT CONTRACT SHALL BE USED IN THE EQUIPMENT PRIOR TO EMPLOYMENT OF TUBES FROM GENERAL STOCK.

11. THE ADJUSTMENT AND THE REPLACEMENT OF PARTS OF COMMERCIAL ASSEMBLIES.

The following drawings and parts lists cover standard commercial assemblies for which replacement parts are obtainable. Ordering information is given such as to permit identification of any part which is subject to failure as a result of normal wear in service.

Because of special design the manufacturers of relays other than those listed below, consider it impractical to replace parts of these assemblies. If any of these units fail, a complete assembly should be ordered.

Adjustment data on the following items is included:

Part Number (Symbol Desig.)		Function
405 0009 00	(K-101)	Autotune Motor Control Relay
(Alternate)	405 2201 10	
410 0008 00	(K-102)	Keying Relay
410 1700 00	(K-103)	CW Emission Control Relay
410 1600 00	(K-104)	Voice Emission Control Relay
410 0010 00	(K-105)	Output Circuit Selecting Relay

a. GENERAL REQUIREMENTS FOR SATISFACTORY OPERATION.

(1) All screws and nuts should be tight.

(2) All relay assemblies should be securely mounted.

(3) When replacing parts such as coils or contacts, the wires should have a little slack, but not enough to interfere with moving parts. All unnecessary solder should be removed and bare wire should be bent in such a manner that it will not touch adjacent metal parts.

(4) When replacing armatures or contacts, the bushings and springs should be carefully aligned and checked for free operation.

(5) When adjusting contact springs, the bends in the springs should be gradual rather than sharp bends or kinks.

(6) Contacts should be carefully aligned and under no condition should the contacts be more than one-fourth of the diameter of the contacts out of alignment with respect to each other as gauged by eye.

(7) The coils should measure within ±5% of the specified DC resistance.

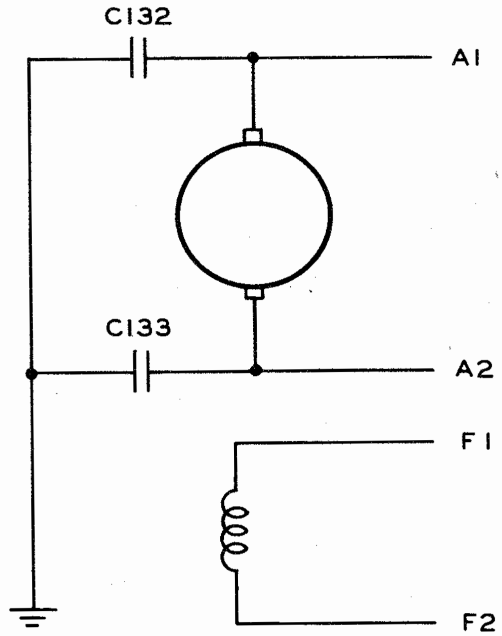
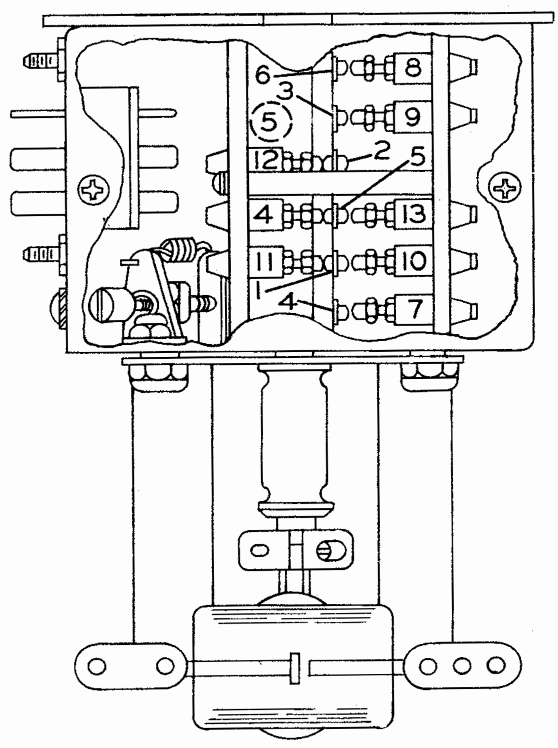


Figure 5-13 NY-818C-C Autotune Motor Schematic



NOTE:
ALTERNATE CONTACT ARRANGEMENT
NORMALLY CLOSED STATIONARY CONTACT 4 MAY BE FOUND LOCATED IN POSITION (5) IN WHICH CASE IT WILL BE CONNECTED TO P102 TERMINAL NO. 5.

Figure 5-14 Keying Relay (K-102) Contact Arrangement

NOTE

The resistance values of the windings are based upon a normal temperature of +20°C (+68°F). If the resistance is measured at a temperature other than this, corrections should be made for the difference in temperature.

(8) It is important that the relay contacts be kept free from corrosion and pits. The relays should be inspected regularly and if the contacts have become corroded a burnishing tool should be used to remove the corrosion.

(9) The armature should not make contact with the core.

b. RELAY ADJUSTMENT.

(1) 405 2201 00 (Alternate) (K-101)

The contact should be adjusted so that when the relay is in the unoperated position the spacing between the movable contact and the stationary contact is between .040 inch and .050 inch. The armature should be adjusted so that the spacing between the armature and the top edge of the field pole is .040 inch. The tension of the armature spring should be adjusted so that the armature back tension is 7 ounces. This relay should operate with a minimum of 18 volts DC and a maximum of 32 volts DC. The DC resistance of the coil, measured at +20°C (+68°F), should be 150 ohms.

(2) 410 0008 00 (K-102)

This relay has been provided with three adjusting screws. The two adjusting screws located on the side of the relay opposite the multi-terminal connector plugs, Item 20, figure 5-15 control the position and tension of the relay armature when the relay is unoperated. The lower adjusting screw determines the position of the armature and the upper screw determines the tension of the armature return spring. The tension of the armature return spring, as measured at the top of the bakelite strip should be between 23 ounces and 24 ounces.

To set the armature position, leave the relay in the unoperated condition and rotate the lower adjusting screw in a clockwise direction until the movable contacts just begin to lift from the fixed contacts. Then rotate the adjusting screw approximately one-half revolution in a counterclockwise direction. The movable contacts should rest firmly against the fixed contacts. The position of each fixed contact is adjustable and may be set by loosening the locking nut and rotating the contact. Contacts are numbered according to the terminal number of the plug to which they are connected. See figure 5-14. The contacts operate in the following sequence when the coil is energized: 2 and 12 open, 5 and 4 (or 3 and 5) open, vacuum contact S-116 open, Vacuum contact S-116 close, 4 and 7 close, 6 and 8 close, 3 and 9 close, and 5 and 13 close. The contacts operate in a reverse order when the coil is deenergized. Check the adjustment of the remaining fixed contacts by applying between 22 volts DC and 28 volts DC to the relay coil (terminals 14 and 15 on the multi-terminal connector plug, Item 20, figure 5-15) and observing the position of the movable contacts. The movable contacts should rest firmly against the corresponding fixed contact.

The contacts of the relay should be adjusted so that the gap between the movable contacts and the fixed contacts, when the relay is unoperated, is .035 inch. The relay will operate with a minimum of 18 volts DC applied to the coil but will only follow keying of eight impulses per second with this voltage. With 24 volts DC applied to the relay coil the armature will follow keying at 16 impulses per second. With 28 volts DC applied to the relay coil, the armature will follow keying of 35 words per minute. The maximum voltage that should be applied to the relay coil is 28 volts DC.

(3) 260 6010 00 (S-116)

This vacuum contact is mounted on relay 410 0008 00. The vacuum contact must be adjusted to operate properly when the relay 410 0008 00 is adjusted as described in the preceding paragraphs. A single adjusting screw near the multi-terminal connector plug permits the adjustment of the mounting yoke so that the movable contact operating arm will operate the arm to close the contact but will not apply enough pressure to dammage the vacuum tube. To adjust the mounting yoke, loosen the studs, Item 17, figure 5-15, and with relay unoperated, rotate the adjusting screw, Item 16, in a direction that allows the movable contact within the vacuum tube to rest firmly against the fixed contact that is ordinarily connected to the RECEIVER terminal of the transmitter, that is, Item 10 on the relay drawing. When this adjustment has been completed, tighten the studs, Item 17, and apply voltage to the relay coil (Terminals 14 and 15 on the multi-terminal connector plug, Item 20) and, with the relay operated; check the position of the movable contact within the vacuum tube. The movable contact arm should rest firmly against the fixed contact that is ordinarily connected to the COND. terminal on the transmitter. The contact should be firm but the movable arm should not apply enough pressure to the fixed arm to endanger the vacuum seal. The contact pressure must not exceed 665 grams (23.4 oz.) measured at a point 3/4" from the diaphram. If the movable contact is applying too much pressure to the fixed contact when the relay is operated, readjust the lower adjusting screw on the side of relay 410 0008 00, opposite the connector plug, to reduce the pressure.

(4) 410 1700 00 (K-103)

The contacts of this relay should be adjusted so that when the relay is unoperated the gap between the fixed contact and the movable contact, Item 17, figure 5-17, is between .045 inch and .050 inch. The gap between the armature and the front edge of the field piece should be 3/32 inch. The armature return spring, Item 8, should be adjusted so that the pressure against the top contacts when the relay is unoperated is beteen 75 and 80 grams. The pressure between the movable contacts and the fixed contacts when the relay is operated should be between 50 and 55 grams. The DC resistance of the coil is 125 ohms. The minimum voltage required for satisfactory operation is 18 volts DC. The voltage applied to the coil should never exceed 32 volts DC.

(5) 410 1600 00 (K-104)

The contacts should be adjusted so that the air gap between the movable contacts, Item 3, figure 5-16, and the fixed contacts, Item 9, is .030 inch. The armature return spring, Item 6, should be adjusted so that the pressure between the movable contacts and the upper fixed contacts is 50 grams. When the relay is operated the pressure between the movable contacts and the lower fixed contacts should be 70 grams. The air gap between the field piece and the armature, as measured at the front edge of the field piece, should be .035 inch. The DC resistance of the coil measured at 68 degrees F. is 150 ohms. The relay should operate with a minimum of 18 volts DC and the voltage applied to the coil should never exceed 32 volts DC.

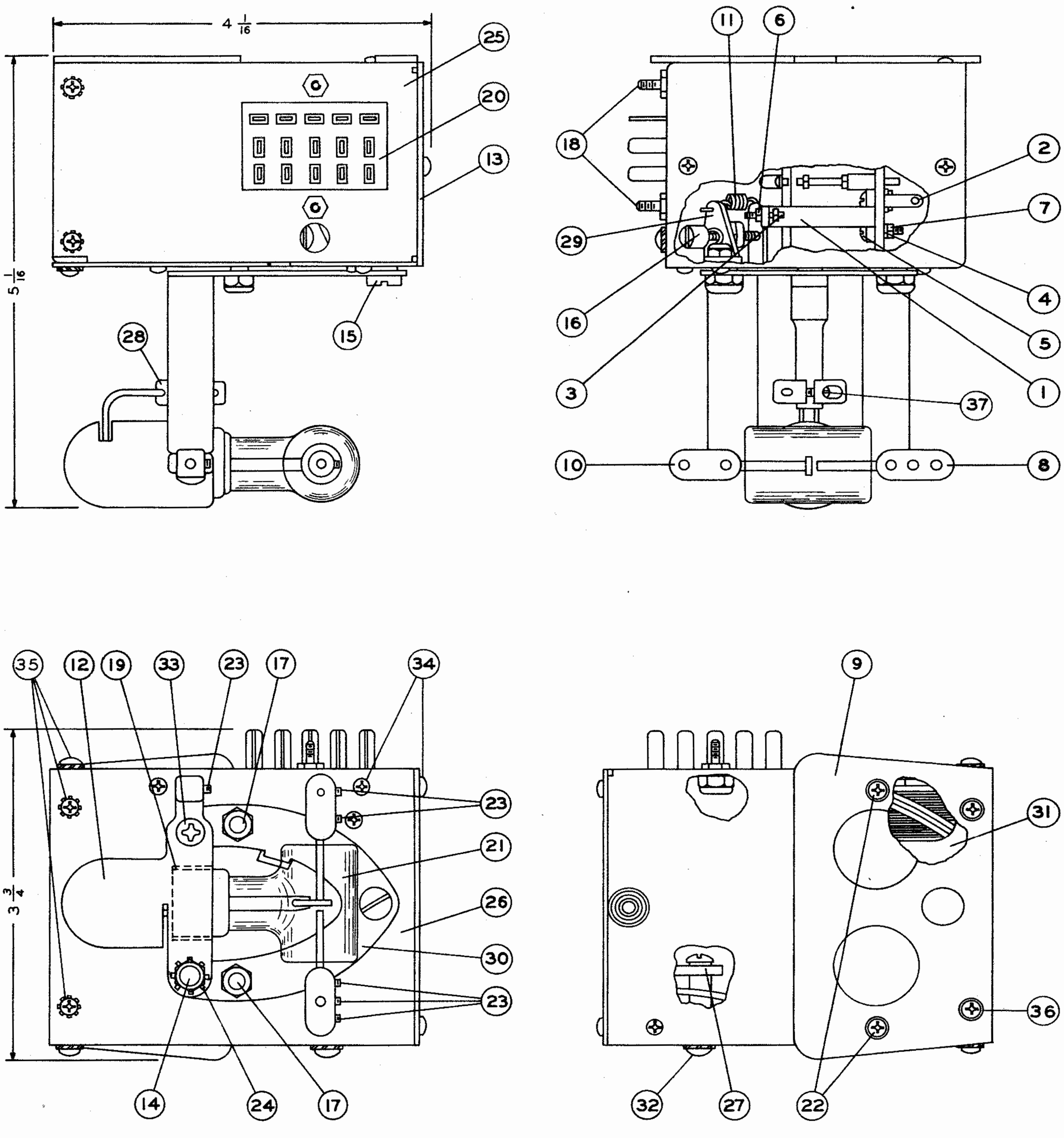
(6) 410 0010 (K-105)

The air gap between the armature contacts and the fixed contacts should be adjusted to .110 inch. The DC resistance of the coil is 60 ohms. The minimum voltage necessary for satisfactory operation is 22 volts DC. The maximum voltage that should be applied to the relay coil is 30 volts DC continuous operation.

PARTS LIST FOR 410 0008 00 KEYING RELAY (K-102)

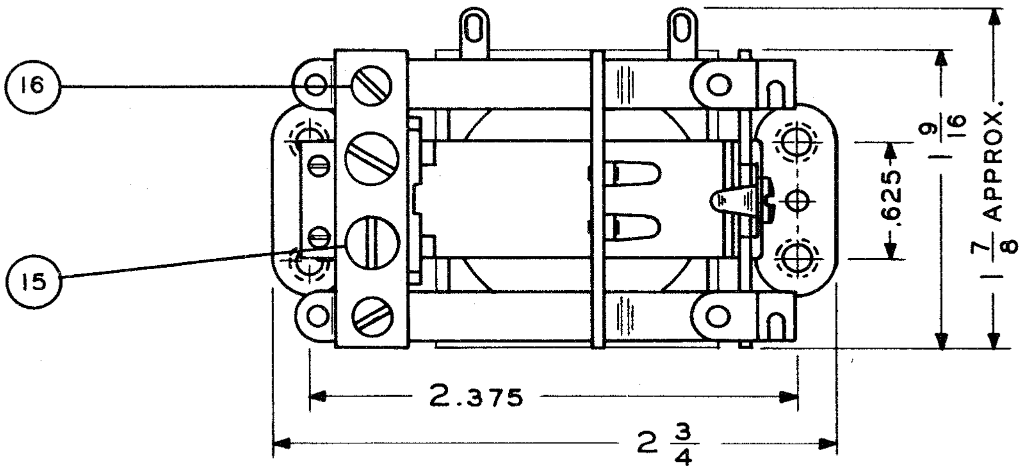
(Guardian Type G-36427)

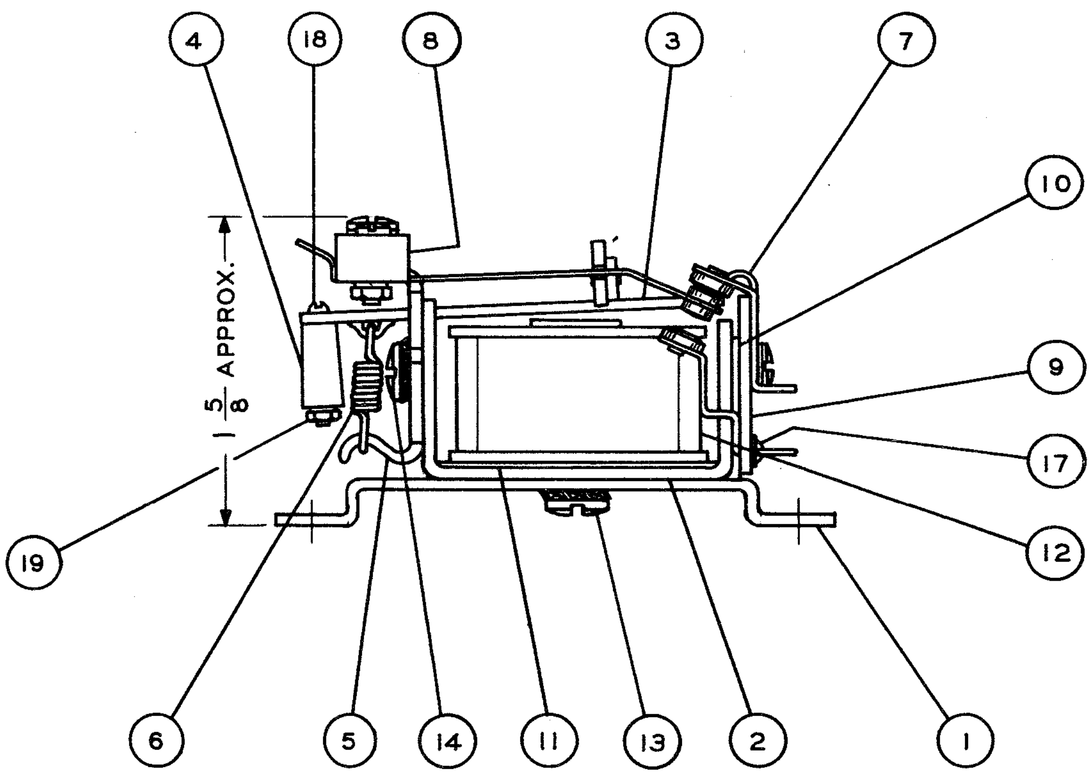
Item	Qty.	Guardian Part No.	Description
1	1	BR-599-A	Contact Mounting Bracket
2	1	2522-4	Solder Lug
3	1	SW-57-A	Adj. Contact Screw
4	2		#4 Split Lock Washers
5	2		4-40 x 3/8 Binder Head Mch. Screw
6	1		4-48 x 3/16 Hex. Nuts
7	2		4-40 x 3/16 Hex. Nuts
8	1	BU-110	Vacuum Tube Terminal
9	1	BM-161	Mounting Plate
10	1	BU-102	Vacuum Tube Terminal
11	1	CS-142	Adjusting Bracket Spring
12	1	CV-81	Tube End Cover
13	1	CV-94	Cover (Top)
14	1	N-19	Hex. Cap Nut
15	1	ST-157	Lever Rearing Stud
16	1	SW-54	Tube Adjusting Screw
17	2	SW-56	Adjustment Screw
18	2	SW-60	Insert Screw
19	1	X-380	Rubber Cushion
20	1	X-382	Contact Plug
21	1	X-399	Vacuum Switch
22	6		4-40 x 3/8 Flat Head Mach. Screw
23	6		4-48 x 1/16 Bristol Head
24	1		#8 External Shakeproof Washer
25	1	CVA-20	Side Cover Assembly
26	1	CVA-21	Side Cover Assembly
27	1	X-386	Terminal Block Assembly
28	1	X-381	Collar & Arm Assembly
29	1	BRA-97	Stop Bracket Assembly
30	1	BRA-98	Tube Adjusting Bracket Assembly
31	1	FIA-85	Coil & Armature Assembly
32	2		6-32 x 1/4" Binder Head Mach. Screw
33	1		8-32 x 5/8" Binder Head Mach. Screw
34	6		4-40 x 5/16" Binder Head Mach. Screw
35	6		4-40 x 3/16" Binder Head Mach. Screw
36	2		4-40 x 3/16" Flat Head Mach. Screw
37	1		2-56 x 3/8" Round Head Mach. Screw



GUARDIAN ELECTRIC MFG. CO. CHICAGO ILLINOIS	COLLINS RADIO COMPANY CEDAR RAPIDS IOWA
GUARDIAN ELEC. CO. PART NUMBER: G-32877	COLLINS PART NO: 410N19A

Figure 5-15 Keying Relay (K-102) Assembly





GUARDIAN ELECTRIC COMPANY CHICAGO, ILLINOIS		COLLINS RADIO COMPANY CEDAR RAPIDS, IOWA	
GUARDIAN ELECT. NUMBER:	G-32734	COLLINS PART NO:	410N16

Figure 5-16 Voice Relay (K-104) Assembly

PARTS LIST FOR 410 1600 00 VOICE EMISSION CONTROL RELAY (K-104)

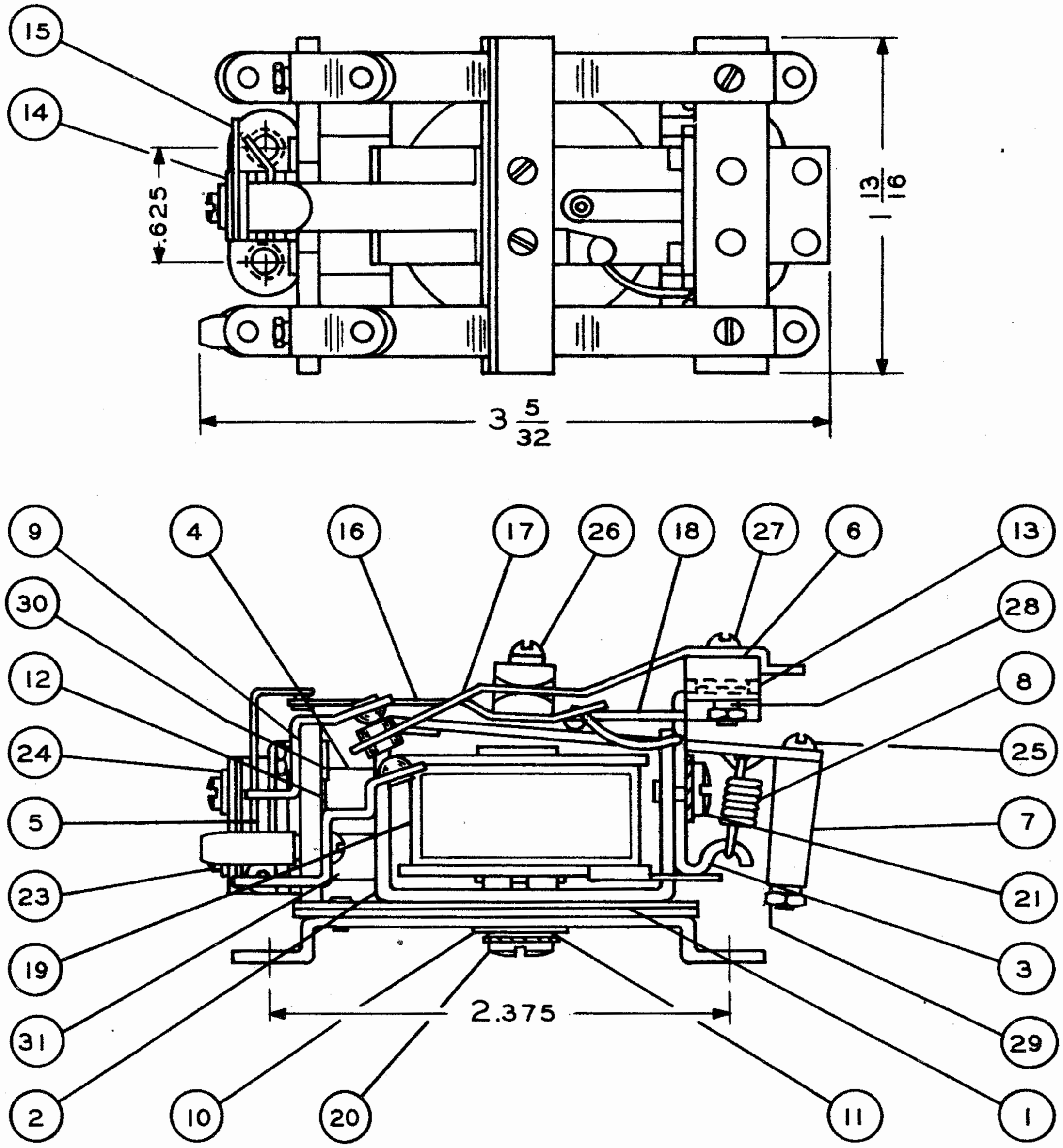
(Guardian Type G-32734)

Item	Qty.	Guardian Part No.	Description
1	1	BR-611-B	Relay Mounting Bracket
2	1	FI-48	Field Piece
3	1	ARA-319	Armature Assembly
4	1	X-241	Counterweight
5	1	BR-487	Armature Retainer Bracket
6	1	CS-120	Armature Spring
7	1	US-128-C	Armature Stop Bracket
8	1	BBA-74	Contact Block & Spring Assem
9	1	BBA-61	Contact Bracket & Block Assem
10	1	BB-141	Spacer Block
11	1	FP-23	Coil Insulator
12	1	SP-220-W	Coil Assembly
13	1		8-32 x 3/8 Binder Head Screw
14	1		8-32 x 3/16 Binder Head Screw
15	2		6-32 x 3/8 Binder Head Screw
16	2		6-32 x 7/16 Binder Head Screw
17	1		2-56 x 3/16 Round Head Screw
18	2		2-56 x 5/8 Round Head Screw
19	2		2-56 x 3/16 Hex Nuts

PARTS LIST FOR 410 1700 00 CW EMISSION CONTROL RELAY (K-103)

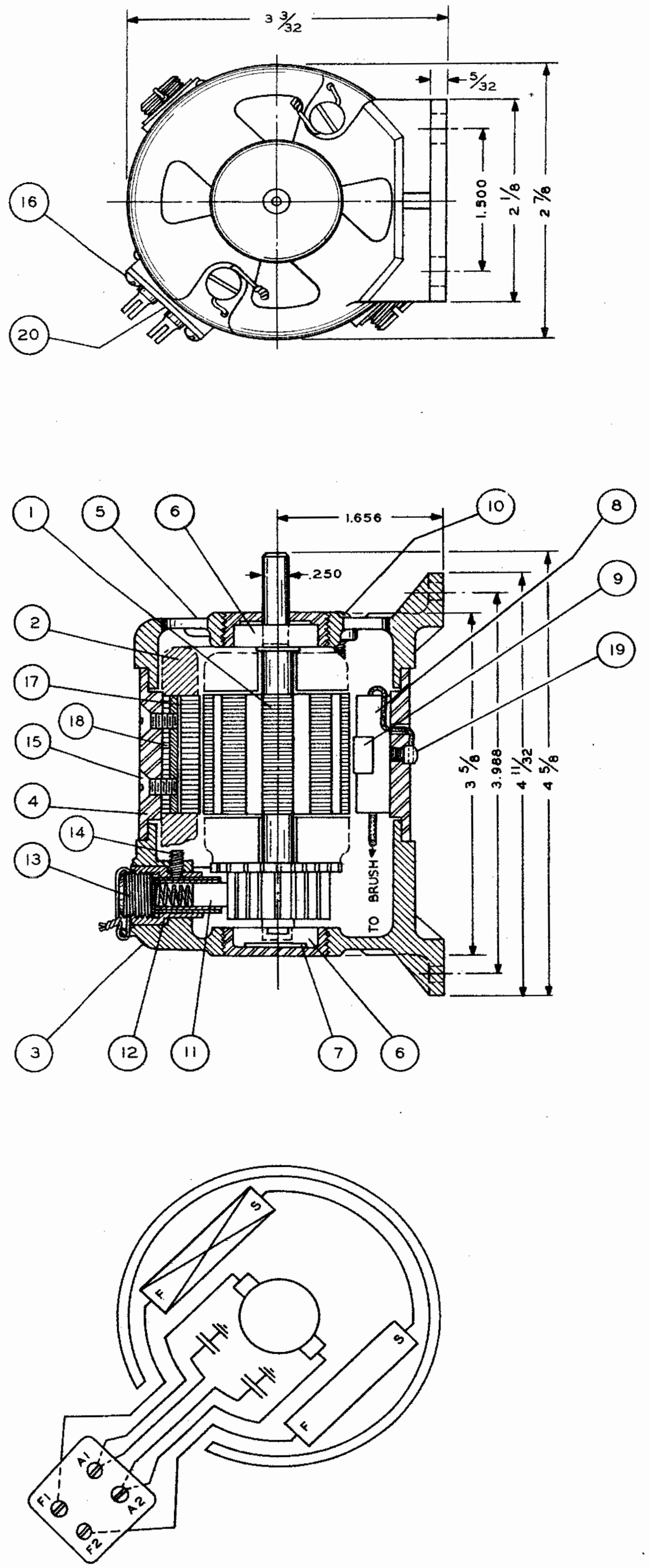
(Guardian Type G-32811)

Item	Qty.	Guardian Part No.	Description
1	1	BRA-101	Mounting Bracket Assembly
2	1	FI-64	Field Piece
3	1	BR-487A	Armature Retainer Bracket
4	2	SPA-85	Spacers
5	1	CXA-829	A-2 Contact Assembly
6	1	B-179	Contact Spring Mounting Bar
7	1	X-389	Counterweight
8	1	CS-122	Armature Spring
9	1	BBA-76	Contact Bracket & Block Assem
10	1	FW-16	Bakelite Washer
11	1	MW-47-D	Plain Brass Washer
12	2	FW-90	Cushion Washers
13	4	FW-91	Cushion Washers
14	1	CS-18-J	Separator Plate
15	1	CS-21	Lug Adapter
16	1	ARA-424	Armature Assembly
17	2	CX-350	Contact Spring Assembly
18	1	BRA-99-A	Armature Bracket Assembly
19	1	SP-222-W	Coil Assembly
20	1		8-32 x 1/2 Binder Head Screw
21	1		8-32 x 3/16 Binder Head Screw
22	2		#8 Shakeproof
23	2		5-40 x 5/8 Fillister Head Screw
24	2		#5 Split Lock Washers
25	2		2-56 x 7/8 Round Head Screw
26	2		2-56 x 3/8 Round Head Screw
27	2		2-56 x 7/16 Round Head Screw
28	6		#2 Split Lock Washers
29	4		2-56 x 3/16 Hex. Nuts
30	2		2-56 x 1/4 Special Mach. Screw
31	2		2-56 x 1/4 Round Head Screw



GUARDIAN ELECTRIC COMPANY CHICAGO, ILLINOIS	COLLINS RADIO COMPANY CEDAR RAPIDS, IOWA
GUARDIAN ELECT. NUMBER: G-32811	COLLINS PART NO: 410 1700 00

Figure 5-17 CW Relay (K-103) Assembly



FRACTIONAL MOTORS COMPANY CHICAGO, ILLINOIS	COLLINS RADIO COMPANY CEDAR RAPIDS, IOWA
FRACTIONAL NUMBER: F-800	COLLINS PART NO. NY-818C-C

Figure 5-18 Autotune Motor Assembly

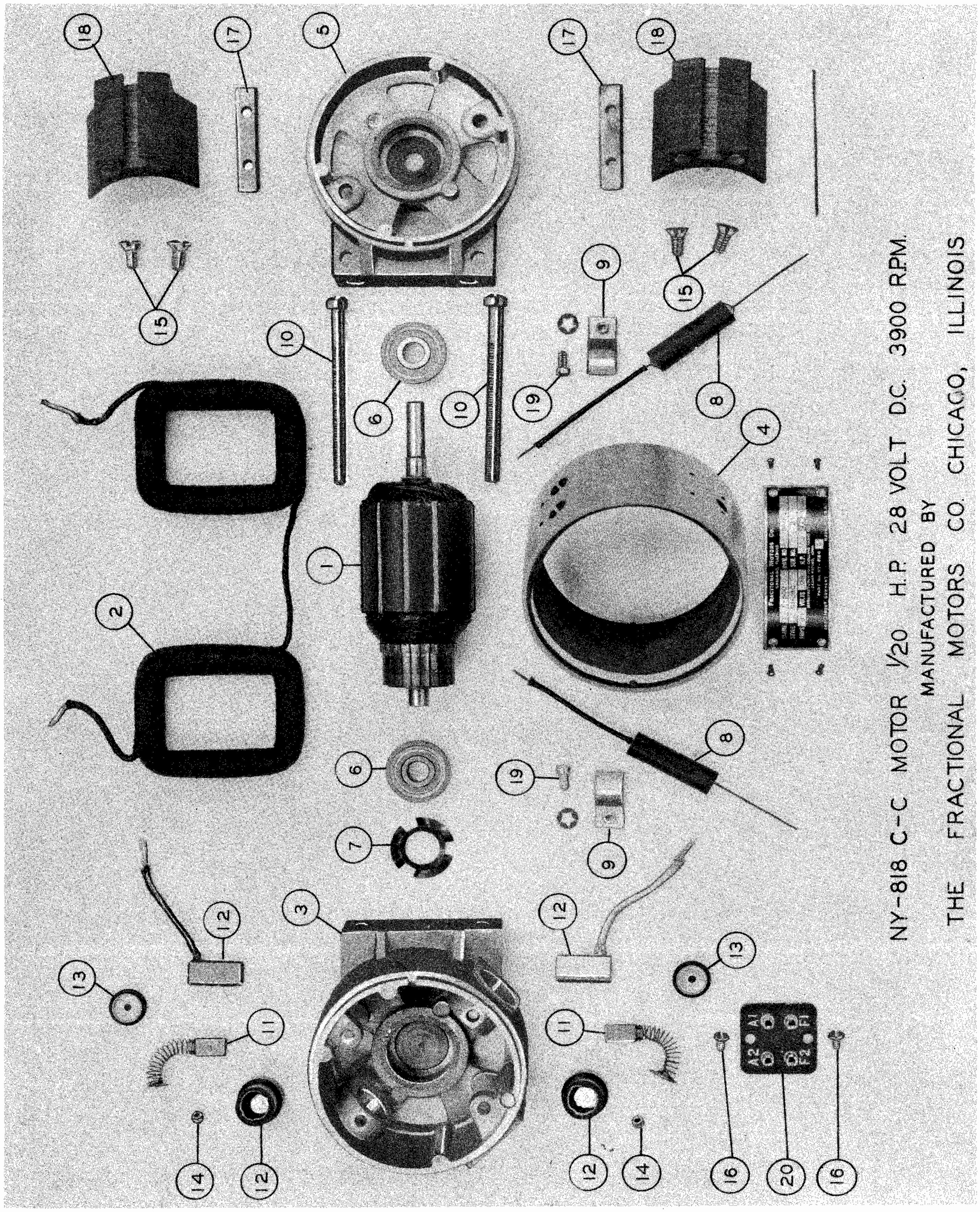


Figure 5-19 Autotune Motor Photograph

PARTS LIST FOR 508 0818 33 AUTOTUNE MOTOR (E-101)

(Fractional Type NY-818C-C)

Item	Quantity	Fractional Part Number	Description
1	1	F-860	Armature Assembly (without bearing)
2	1	F-875	Field Coil
3	1	F-801	Brush Holder End Bracket
4	1	F-803	Motor Yoke
5	1	F-802	End Bracket
6	2	N.D.77037	Ball Bearing
7	1	S-102	Bearing Load Spring
8	2	F-840	Capacitor
9	2	F-812	Capacitor Bracket
10	2	F-815	Motor Stud
11	2	F-811	Brush Assembly
12	2	F-830	Brush Holder
13	2	F-825	Brush Holder Cap
14	2	SCR-209	Brush Holder Screw
15	4	SCR-206	Pole Screw
16	2	SCR-210	Terminal Screws
17	2	F-805	Pole Key
18	2	F-870	Pole Piece Assembly
19	2	SCR-208	Capacitor Bracket Screw
20	1	F-821	Terminal Base
	4	F-820	Terminals

SECTION VI

PARTS AND SPARE PARTS LISTS

1. INTRODUCTION.

Component parts of the equipment are identified by means of symbol designations. Wherever it is required to reference a component, the same symbol designation is used. Thus, a part appearing on a simplified schematic, a complete circuit diagram, a wiring diagram, photograph or layout drawing, will always be identified by means of the same symbol designation. In addition, each component part is stamped with its corresponding symbol designation. These symbol designations identify the various component parts which appear in the following parts lists.

Only one Symbol Designation is assigned to cover component parts with multitple electrical or mechanical characteristics. However, since at times it is desirable to identify certain electrical or mechanical sections of these component parts, suffix letters are added when necessary. Thus, C-121A, C-121B, and C-121C identify each section of triple capacitor C-121.

The alphabetical portion of symbol designations have been selected from the following list in accordance with the classification of the component parts concerned.

(A) Structural parts, panels, frames, castings, etc.

(B) Motors and other prime movers, self-synchronous motors, etc.

(C) Capacitors of all types.

(CR) Dry disc rectifiers.

(D) Dynamotors.

(E) Miscellaneous electrical parts: Insulators, knobs, brushes, etc.

(F) Fuses.

(G) Generators, exciters, etc.

(H) Hardware, screws, bolts, studs, pins, snapslides, etc.

(I) Indicating devices (except meters and thermometers), pilot lamps, etc.

(J) Jacks and receptacles (stationary).

(K) Contactors, relays, circuit breakers, etc.

(L) Inductors, RF, and AF.

(M) Meters of all types, gauges, thermometers, etc.

(N) Nameplates, dials, charts, etc.

(O) Mechanical parts, bearings, shafts, couplings, gears, ferrules, flexible shafts, housings, etc.

(P) Plugs.

(Q) Diaphragms, (microphone, telephone, projector, etc.).

(R) Resistors, fixed and variable, potentiometers, etc.

(S) Switches, interlocks, thermostats.

(T) Transformers, RF, nad AF, and power.

(U) Hydraulic parts.

(V) Vacuum and gaseous discharge tubes.

(W) Wires, interconnecting cables, without plugs.

(X) Sockets.

(Y) Mechanical oscillators, cyrstals, magnetestriction tubes, etc.

(Z) Filters, IF transformers, compound tuned circuit assemblies, etc., in a common container.

The numerical portion of the symbol designation has been assigned to identify the component part with a particular major unit assembly. The numerical portion of symbol designations begin with 101 for the first component part in each class (i.e., component part in each alphabetical class as described above) and run consecutively for the remaining component parts in a particular class. A different munerical series of numbers is used for each major unit of the equipment. The series 101 to 199 is reserved for the first major unit. The series 201 to 299 is reserved for the second major unit. The series 301 to 399 is reserved for the third major unit. In this manner, each major unit of the entire equipment is identified with a series of numerals to be used for the designation of component parts.

The List of Major Units, Table 6-1, gives a complete list of symbol designation numbers in correlation with the major units.

Table 6-1 LIST OF MAJOR UNITS

Quan.	Symbol Group	Navy Type Designation	Collins Type Number	Name of Major Unit	Assembly Dwg. No.
1	101-199 201-299 401-499 2201-2299	-52286-A	17H-2	Radio Transmitter	K351E
1	901-999	COL-23410	314N-2	Remote Control Unit	K1104C
1	Y-2201	CR-2-B/U (200 KC)	------	200 KC Quartz Crystal	--------
1	3001-3099	COL-47505	180H-4	Antenna Load Coil	
1	1101-1199	COL-481628	195D-1	Antenna Shunt Capacitor	1370B
1	1501-1599	--------	65X-7	Control Cable (Power Unit to Transmitter)	500 1496 00D
1	1601-1699	-------	65X-8	Power Cable (Power Unit Transmitter)	500 1497 00D
1	1701-1799	--------	65X-9	Power Cable (Transmitter to Load Coil)	500 1498 00C
1	1901-1999	COL-211624	413D-4	Dynamotor Assembly Power Unit	502 3869 005
1	2301-2399	--------	65X-10	Control Cable (Power Unit to Control Box)	500 4474 00D

TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION
FOR NAVY MODEL TCZ-2 TRANSMITTING EQUIPMENT

RADIO TRANSMITTER ASSEMBLY

Symbol Desig-nation	Funtion	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Desig-nation	Spcl. Tol. or Mod.	Contractor's Drawing and Part Number
101-199 201-299 401-499 2201-2299		NAVY MODEL -52286-A RADIO TRANSMITTER, Includes one complete set of tubes; Low Frequency Oscillator, Audio Unit and MCW-CFI Unit.			830	17H-2		500 9366 00E
		MOTORS						
B-101	Autotune Motor	MOTOR, 1/20 hp 28 v DC Nominal 20 v Min 32 v Max			1740	NY-818C-C		508 0818 33
B-101	Brush for Autotune motor B-101	BRUSH, + & - Motor Brush			1740	F-811		234 1302 00
B-101	Brush holder for Autotune motor B-101	HOLDER, brush			1740	-		234 0066 00
B-101	Brush holder cap for Autotune motor B-101	CAP, brush holder			1740	F-825		234 0060 00
B-101	Bearing for Autotune motor B-101	BEARING			3330	77037		309 1220 00
		CAPACITORS						
C-101	HFO Grid Padding	CAPACITOR, .000185 mf ±1% 1000 TV	-481677-1		700	841-001		)
C-102) C-103) C-104)	Temperature Compensating	CAPACITOR, Set of three matched ceramic capacitors packaged as a set. To be connected in the equipment in accordance with the circuit at the left to provide 413 mmf ±1% 1000 TV, Temperature Coefficient minus 48 Parts per Million per °C ±5%	-481678-1		700	Type 841		)571 1433 30

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TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION (Cont.)

Symbol Designation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing and Part Number
		CAPACITORS (Cont.)						
C-105	HFO Cathode Bypass	CAPACITOR, .005 mf ±5% 2500 TV	-482938-B5		911 4030	4LST HLST		925 2502 10
*C-106	HFO Filament Bypass	CAPACITOR, .006 mf ±20% 1000 TV	-48410-B20		911 4030	4LS HLS-10		910 2603 40
*C-107	HFO Screen Bypass	CAPACITOR, .002 mf ±20% 1000 TV	-48789-B20		911 4030	4LS HLS-10		910 2203 40
C-108	1st Mult Grid	CAPACITOR, .0005 mf ±10% 1500 TV	-481409-B10		4030	BE-15		915 3505 20
C-109	1st Mult Cathode Bypass	CAPACITOR, .002 mf ±20% 1500 TV	-482111-B20		4030	BE-15		915 2205 40
C-110	1st Mult Screen Supply Filter	CAPACITOR, .002 mf ±20% 1500 TV	-482111-B20		4030	BE-15		915 2205 40
C-111	1st Mult Pl Tuning	CAPACITOR, 6 Section Variable Ceramic	-481679		700	828-003		917 6130 00
C-112	2nd Mult Grid Coupling	CAPACITOR, .00025 mf ±10% 1500 TV	-482947-10		4030	BE-15		915 3255 20
C-113	2nd Mult Cathode Bypass	CAPACITOR, .002 mf ±20% 1500 TV	-482111-B20		4030	BE-15		915 2205 40
C-114	2nd Mult Scr. Supply Filt	CAPACITOR, .002 mf ±20% 1500 TV	-482111-B20		4030	BE-15		915 2205 40
C-115	2nd Mult Pl Tuning	CAPACITOR, 6 Section Variable Ceramic	-481679		700	828-003		917 6130 00
C-116	Power Amplr Grid Coupling	CAPACITOR, .0005 mf ±10% 1500 TV	-481409-B10		4030	BE-15		915 3505 20
*C-117	Power Amplr Filament Bypass	CAPACITOR, .006 mf ±20% 1000 TV	-48410-B20		911 4030	4LS HLS-10		910 2603 40
C-118	Power Amplr Pl Blocking	CAPACITOR, .002 mf ±20% 7500 TV			911 4030	 A2LS		975 2201 40
*C-119	Power Amplr Screen Supply Filter	CAPACITOR, .002 mf ±20% 2500 TV	-48789-B20		911 4030	4LS HLS-25		925 2203 40
C-120A	Power Amplr Pl Supply Filter	CAPACITOR, .002 mf ±20% 5000 TV	-48789-B20		911 4030	4LS HLS-50		950 2203 40
C-120B	Power Amplr Pl Supply Filter	CAPACITOR, .002 mf ±20% 5000 TV	-48789-B20		911 4030	4LS HLS-50		950 2203 40

TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION (Cont.)

Symbol Designation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing and Part Number
		CAPACITORS (Cont.)						
C-121	C121A,C121B,C121C	CAPACITOR, 3-0.1 mf ±20% 600 WV	-48713-B20		911 4210	DYRT-6111 3XDRTW6-.1		956 0001 00
C-121A	Transient Suppressing	CAPACITOR, Section of C-121						
C-121B	Transient Suppressing	CAPACITOR, Section of C-121						
C-121C	Transient Suppressing	CAPACITOR, Section of C-121						
C-122	C-122A, C-122B							
C-122A	Power Amplr Pl Tank Padding	CAPACITOR, .00005 mf ±10% Ceramic	-481690-10		700	850-002		913 4503 20
C-122B	Power Amplr Pl Tank Padding	CAPACITOR, .00005 mf ±10% Ceramic	-481690-10		700	850-002		913 4503 20
C-124	C-124A, C-124B, C-124C							
C-124A	PA Pl Tank Padding	CAPACITOR, .000067 mf ±5% Ceramic	-481691-5		700	850-003		913 4673 10
C-124B	PA Pl Tank Padding	CAPACITOR, .000067 mf ±5% Ceramic	-481691-5		700	850-003		913 4673 10
C-124C	PA Pl Tank Padding	CAPACITOR, .000067 mf ±5% Ceramic	-481691-5		700	850-003		913 4673 10
C-125	PA Pl Tuning	CAPACITOR, Rotor Assembly Stator Assembly			830 830	GA-1342B GA-1308A		571 1342 20 571 1308 10
C-126	Low Voltage Supply Filter	CAPACITOR, 2.0 mf ±20% 600 WV	-48777-20		911 1640 1881	KG-3020 A7649 67X2		930 7824 00
C-127	2nd Mult Pl Supply Filter	CAPACITOR, .006 mf ±20% 1500 TV	-481411-B20		4030	BE-15		915 2605 40
C-128	Pl Filter	CAPACITOR, .002 mf ±20% 7500 TV			911			975 2201 40
C-129	PA Pl Tank Padding	CAPACITOR, .00005 mf ±10% Ceramic	-481690-10		700	850-002		913 4503 20
C-130	PA Pl Tank Padding	CAPACITOR, .000025 mf ±10% Ceramic	-481689-10		700	850-001		913 4253 20
C-131	1st Mult Pl Supply Filter	CAPACITOR, .0008 mf ±5% 1000 TV	-482948-5		4030	BE-10		910 3805 10
C-132	Motor B-101 Spark Suppr	CAPACITOR, .004 mf ±20% 1200 TV	-482939-B20		911	3WS		909 2406 40

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TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION (Cont.)

Symbol Designation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Designation	Spcl. Tol or Mod.	Contractor's Drawing and Part Number
		CAPACITORS (Cont.)						
C-133	Motor B-101 Spark Suppr	CAPACITOR, .004 mf ±20% 1200 TV	-482939-B20		911	3WS		909 2406 40
C-134	HFO Grid Trimming	CAPACITOR, Midget Variable	-483869		3410			922 5100 00
C-135	HFO Grid Trimming	CAPACITOR, Midget Variable	-483869		3410			922 5100 00
C-136	PA Grid Trimming	CAPACITOR, 13 mmf Variable Ceramic	-481681		700	822-009		917 1010 00
C-137	HF Noise Filter	CAPACITOR, .0015 mf ±10% 900 TV	-482940-B10		830 4030 911			909 2156 20
C-138	Low Voltage Filter	CAPACITOR, 0.1 mf ±10% 600 WV	-482937-20		1640 3030			930 0006 00
		MISCELLANEOUS ELECTRICAL PARTS						
E-102	For I-101	RECEPTACLE, Mtg Bracket for Bayonet Base Lamp, Type 80			1200	80		262 1270 00
E-103A	Insulating Feedthru Receptacle	RECEPTACLE, 3/8" x 5/8" Ceramic Bushing	-61511		2410	979A		190 2919 00
E-103A	Alternate							190 0006 00
E-103B	Insulating Feedthru Plug	PLUG, 3/8" x 5/8" Ceramic Bushing			2410			190 2925 00
E-104	Insulating Standoff	STANDOFF, 3/4" Conical	-61503		2410	GS-10		190 2570 00
E-105	Insulating Standoff	STANDOFF, 1/2" x 1" Cyl	-61170		2410	397-L1		190 2327 00
E-106A	LOAD COIL Terminal Feedthru	RECEPTACLE, 1/2" x 7/8" Ceramic Bushing	-61512		2410			190 2921 00
E-106B	LOAD COIL Terminal Feedthru	PLUG, 1/2" x 7/8" Ceramic Bushing			2410			190 2926 00
E-107	Insulating Feedthru	INSERT, 3/16" x 5/8" Bushing	-61513		2410			190 2932 00
E-108	Antenna Feedthru	BOWL, 2-1/2" x 3-1/8"			2410	GA-1741B		571 1741 20
E-109B	Insulating Feedthru	PLUG, 3/8" x 5/8" Ceramic Bushing	NS3W4102		2410			190 2920 00

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TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION (Cont.)

Symbol Desig-nation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Desig-nation	Spcl. Tol. or Mod.	Contractor's Drawing and Part Number
		PILOT LAMPS						
I-101	Transmitter Power Pilot Lamp	INDICATOR, 28 v Clear Bulb Miniature Bayonet Base			1881	T3-1/4		262 3270 00
		JACKS AND RECEPTACLES						
J-101	THROTTLE SWITCH Cord Plug Receptacle	RECEPTACLE, 1 Circuit Jack for plugs with 1/4" Barrel	-49025A		3030 3240	SC1A		358 1040 00
J-102	MICROPHONE Cord Plug Receptacle	RECEPTACLE, 3 Circuit Jack	-49039		3030 3240	SCA2B		358 1050 00
J-103	KEY Cord Plug Receptacle	RECEPTACLE, Same as J-101	-49025A		3030	SC1A		358 1040 00
J-104	Sidetone #1 Receiver Cord Plug Receptacle	RECEPTACLE, 1 Circuit Jack for plugs with 1/4" Barrel	-49025A		3030 3240	SC1A		358 1040 00
J-105	Sidetone #2 Receiver Cord Plug Receptacle	RECEPTACLE, 1 Circuit Jack for plugs with 1/4" Barrel	-49025A		3030 3240	SC1A		358 1040 00
J-106	Control Box Cable Connector Plug Receptacle	RECEPTACLE, 27 Term Wall Mtg Receptacle Female Connector	-49932		630	RNK-27-31SL		371 4039 00
J-107	Relay Supply Connector Plug Receptacle	RECEPTACLE, 3 Term Wall Mtg Receptacle Female Connector	-49933		630	RWK-C3-31SL		371 1059 00
J-108	Dynamotor Conn Plug Receptacle	RECEPTACLE, 10 Term Wall Mtg Receptacle Male Connector	-49934		630	FK-10-32S		371 5130 00
J-109	ANTENNA Connector	RECEPTACLE, 5/8" Push Type Binding Post			1320			372 2210 00
J-110	RECEIVER Connector	RECEPTACLE, 5/8" Push Type Binding Post			1320			372 2410 00
J-111	CFI Unit Connector Plug Receptacle	RECEPTACLE, 8 Terminal Conn Socket	-49566		2580	300		366 2080 00
J-112	Audio Unit Connector Plug Receptacle	RECEPTACLE, 12 Terminal Socket Chassis Mtg	-49663		2580	300		366 2120 00
J-113	GROUND Connector	RECEPTACLE, 5/8" Push Type			1320			372 1410 00
J-114	LFO Connector Plug Receptacle	RECEPTACLE, 6 Terminal Socket Chassis Mtg			2580	300		366 2060 00

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TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION (Cont.)

Symbol Designation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing and Part Number
		JACKS AND RECEPTACLES (Cont.)						
J-115	Multiplier Unit Conn Plug Receptacle	RECEPTACLE, 12 Terminal Octal Style Cable Plug Connector	-49935		200	70-12		369 1700 00
J-116	K-102 & S-116 Connector Strip	RECEPTACLE, 15 Terminal Chassis Mtg Connector	-49936		2580	300		366 2150 00
J-117	LOAD COIL Connector	RECEPTACLE, 1/2" Push Type			1320			372 2110 00
J-118	ANT CAPACITOR Connector	RECEPTACLE, 5/8" Push Type Binding Post			1320			372 2210 00
		RELAYS						
K-101	Relay, Autotune Motor Control	RELAY, 3 Pole Double Throw Circuit Control Relay	-29513		2050	G-33177		405 2201 10
	Alternate		-29604		1820			405 0009 00
K-102	Relay, Keying	RELAY, DT Multi-contact	-29605		2050			410 0008 00
	Alternate		-29606		4310			410 0011 00
K-103	Relay, CW Emission	RELAY, 2 PDT 1 PST Circuit Control Relay	-29607		2050	G-32811		410 1700 00
K-104	Relay, VOICE emission	RELAY, 2 PDT Circuit Control Relay	-29609		2050	G-32734		410 1600 00
K-104	Alternate		-29610		284	R-22-B		410 0013 00
K-105	Relay, Output Circuit Selecting	RELAY, 1 PDT, 1 PNO & 1 PNC with Mycalex Insulation 18-32 v DC	-29519		2050	G-36427		410 0010 00
		INDUCTORS AND REACTORS						
L-101	HFO Tuning Ind	INDUCTOR, Special precision wound Ind			830	GA-671D		571 0671 40
L-102	HFO Cathode RF Choke	CHOKE, Multi-section 2.5 uh 0.125 amp 50 ohm	-47903		3220 70	R100-U		240 5300 00
L-103	HFO Screen RF Choke	CHOKE, Multi-section 2.5 uh 0.125 amp 50 ohm	-47903		3220 70	R100-U		240 5300 00
L-104	HFO Pl Feed Choke	CHOKE, 2 Section 208 mh ± 1% 2 ohm duo-lateral wound	-47904		4335			240 6000 00

TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION (Cont.)

Symbol Designation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Designation	Spcl.Tol. or Mod.	Contractor's Drawing and Part Number
		INDUCTORS AND REACTORS (Cont.)						
L-105	1st Mult Pl Tuning Ind	INDUCTOR, Special precision wound Ind			830	GA-1687B		571 1687 20
L-106	2nd Mult Pl Tuning Ind	INDUCTOR, Special precision wound Ind			830	GA-1686B		571 1686 20
L-107	PA Grid Feed Choke	CHOKE, Multi-section duo-lateral wound 2.5 mh 0.125 amp 35 to 50 ohm	-47905		3220	R100		240 2100 00
L-108	PA Pl Feed Choke	CHOKE, 175 turns, close wound, single layer	-47906		830	GA-1404C		571 1404 30
L-109	PA Pl Feed Choke	CHOKE, Multi-section 6 mh 21 ohm	-47907		950 3090			240 5900 00
L-110	Output Network Static Drain Choke	CHOKE, Close Wound, Single Layer Type	-47909		830	GA-1395C		571 1395 30
L-112	PA Pl Tank Ind	INDUCTOR, Variometer			830	GA-479D		571 0479 40
L-113	Antenna Loading Ind	INDUCTOR, 43 turns, space wound, #14 tinned			830	GA-1258C		571 1258 30
L-114	PA Pl Tank Padding Ind	INDUCTOR, 16 turns, space wound, #16 tinned			830	GA-1114A		571 1114 10
L-115	1st Mult Pl Feed Choke	CHOKE, multi-section 2.5 uh 0.125 amp 50 ohm	-47903		3220	R100-U		240 5300 00
L-116	HF Noise Filter Choke	CHOKE, Multi-section duo-lateral wound 1.0 mh, 0.3 amp 10 ohm	-47895		3220 3090	R300U		240 5800 00
L-117	Mult Filter Choke	CHOKE, Same as L-116	-47895		3220	R-300U		240 5800 00
		METERS						
M-101	Antenna Current Ammeter	METER, 0-0.25 amp RF Meter	-22499 -22500		1881 4900	DW44 NT-33		451 0001 00
M-102	Voltage-Current Indicating Meter	METER, 0-1 ma DC Meter 2% Accuracy	-22501 -22502		1881 4900	DW41 NX-33		450 4125 00

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TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION (Cont.)

Symbol Designation	Funtion	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing and Part Number
		PLUGS						
P-101	Multiplier Unit Connector Plug Mtg.	PLUG, 12 Term Octal Style Female Connector Chassis	-49944		200	MIP		369 1600 00
P-102	K-102 & S-116 Connector Plug	PLUG, Part of K-102						
		RESISTORS						
R-101	HFO Grid	RESISTOR, 22,000 ohm ±10% 1 w	-63288-223		2360	BT1-Navy		729 7224 20
R-102	1st Mult Grid	RESISTOR, 100,000 ohm ±10% 1 w	-63288-104		2360	BT1-Navy		729 7100 42
*R-103	1st Mult Grid Parasitic Suppressor	RESISTOR, 47 ohm ±20% 1 w	-63288-470		4230			729 7474 00
*R-104	1st Mult Screen Parsistic Suppressor	RESISTOR, 47 ohm ±20% 1 w	-63288-470		4230			729 7474 00
R-105	1st Mult Screen	RESISTOR, 20,000 ohm ±10% 25 w	-633240-10		3450	0218		710 0078 00
*R-106	2nd Mult Grid Parasitic Suppressor	RESISTOR, 47 ohm ±20% 1 w	-63288-470		4230			729 7474 00
R-107	2nd Mult Grid	RESISTOR, 100,000 ohm ±10% 1 w	-63288-104		2360	BT1-Navy		729 7100 42
*R-108	2nd Mult Screen Parasitic Suppressor	RESISTOR, 47 ohm ±20% 1 w	-63288-470		4230			729 7474 00
R-109	2nd Mult Screen	RESISTOR, 20,000 ohm ±10% 25 w	-633240-10		3450	0218		710 0078 00
R-110	PA Grid	RESISTOR, 20,000 ohm ±10% 25 w	-633240-10		3450	0218		710 0078 00
R-111	PA Grid Metering	RESISTOR, 235 ohm ±2% 1 w	-633245-2		2360	WW3		721 3235 70
*R-112	PA Screen Parasitic Suppressor	RESISTOR, 47 ohm ±20% 1 w	-63288-470		4230			729 7474 00
R-113	Transient Suppressor	RESISTOR, 150 ohm ±20% 10 W			3450	BD		710 0019 00
R-114	Transient Suppressor	RESISTOR, 150 ohm ±20% 10 w			3450	BD		710 0019 00
R-115	Motor Torque Retainer resistor	RESISTOR, 100 ohm ±10% 25 w	-633230-10		3450			710 0048 00
R-116	Filament Voltage Dropping	RESISTOR, 1 ohm ±10% 10 w	-633227-10		3450	BD		710 1112 00
R-117	LV Supply Bleeder	RESISTOR, 5000 ohm ±10% 25 w	-633242-10		3450	0212		710 3541 20

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TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION (Cont.)

Symbol Designation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing and Part Number
		RESISTORS (Cont.)						
R-118	LV Supply Bleeder	RESISTOR, 5000 ohm ±10% 25 w	-633242-10		3450	0212		710 3541 20
R-119	LV Supply Bleeder	RESISTOR, 5000 ohm ±10% 25 w	-633242-10		3450	0212		710 3541 20
R-120	LV Supply Bleeder	RESISTOR, 5000 ohm ±10% 25 w	-633242-10		3450	0212		710 3541 20
R-121	Filament Voltage Dropping	RESISTOR, 0.8 ohm ±10% 50 w	-633239-10		3450			710 0013 00
R-123	Filament Dropping	RESISTOR, 12.6 ohm ±10% 25 w	-633229-10		3450			710 0045 00
R-124	TUNE-PA Screen Voltage Dropping	RESISTOR, 25,000 ohm ±10% 25 w	-633241-10		3450	0219		710 0081 00
R-128	M-102 Meter Mult	RESISTOR, 4000 ohm ±2% 1 w	-633243-2		2360	WW3		721 3447 00
R-129	2nd Mult Cath	RESISTOR, 1000 ohm ±10% 10w	-633157-10		3450	BD		710 1141 20
R-130	1st Mult Cath	RESISTOR, 1000 ohm ±10% 10 w	-633157-10		3450	BD		710 1141 20
R-131	HFO Cathode	RESISTOR, 350 ohm ±10% 10 w	-633226-10		3450	BD		710 0021 00
R-132	M-102 Meter Mult	RESISTOR, 50,000 ohm ±2% 1 w	-633244-2		2360	WW3		721 3504 70
R-133	Filament Voltage Dropping	RESISTOR, 50 ohm ±10% 10 w	-63535-10		3450	BD		710 1501 20
R-134	Audio Amplr Input terminating	RESISTOR, 75 ohm ±10% 1/2 w	-63678-750		2360	BW1/2		707 7552 00
R-135	MCW Oscillator Cathode	RESISTOR, 10 ohm ±10% 1/2 w	-63678-100		2360	BW1/2		707 1052 00
R-136	I-101 Voltage Dropping	RESISTOR, 150 ohm ±20% 10 w			3450	BD		710 0019 00
R-137	Oscillation Suppressor	RESISTOR, 22,000 ohm ±20% 1 w			2360	BT1-Navy		729 7224 40
		SWITCHES						
S-101A	HFO Grid Tank Padding	SWITCH, Moving Sw Arm			830	GA-1445A		571 1445 10
S-101B	Cap Connector	SWITCH, Stationary Sw Arm			830	GA-2002A		571 2002 10
S-102	1st Mult Pl Tank Cap Selector	SWITCH, 18 contact single pie			830			500 0085 002
S-103	2nd Mult Pl Tank Cap Selector	SWITCH, 7 contact single pie			830			500 0206 002
S-104	TEST	SWITCH, Single pole NO 20 amp 24 v DC	-24560		1010	8817		260 1100 00

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TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION (Cont.)

Symbol Designation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Designation	Spcl.Tol or Mod.	Contractor's Drawing and Part Number
		SWITCHES (Cont.)						
S-105	Metered Circuit Selector	SWITCH, 2 circuit 3 position non-shorting			3410			259 1391 00
S-106	Power Level Selector	SWITCH, 5 circuit 3 position shorting			3410			259 0004 00
S-107	LOCAL-REMOTE	SWITCH, 4 circuit 2 position shorting			3410			259 1411 00
S-108	Autotune CHANNEL Selecting	SWITCH, 1 circuit 12 position non-shorting			3410			259 1401 00
S-109	Autotune Circuit Seeking	SWITCH, 1 circuit 12 position shorting			3410	25851 DH-1		259 1371 00
S-110	EMISSION SELECTOR	SWITCH, 3 circuit 4 position shorting			3410			259 1362 00
S-111	Rear Limit section	SWITCH, SP 1 NC 1 NO Contact Leaf	-24573		830	GA-1557B		571 1557 20
S-112	Forward Limit section	SWITCH, SP 1 NC Contact Leaf	-24569		830	Y-983A		508 0983 10
S-113	S-113A, S-113B, S-113C, S-113D, S-113E, S-113F, S-113G, S-113H	SWITCH, Mult Section sw Assembly			830	186P-1		571 0085 30
S-113A	PA Tank Padding Cap Connector	SWITCH, Single Contact sw Arm Assembly			830	GA-1105A		571 1105 10
S-113B	PA Tuning Cap Connector	SWITCH, Double Contact sw Arm Assembly			830	GA-1083A		571 1083 10
S-113C	PA Tank Ind Tap Selecting	SWITCH, Single Contact sw Arm Assembly			830	GA-1109A		571 1074 10
S-113D	Keying Interlock	SWITCH, Single Pole, 1 NO Contact Leaf	-24571		830	Y-1048A		508 1048 10
S-113E	Padding Ind Connector	SWITCH, Single Contact sw Arm Assembly			830	GA-1082A		571 1082 10
S-113F	Padding Cap Connector	SWITCH, Single Contact Arm Assembly			830	GA-1079A		571 1079 10
S-113G	Padding Cap Connector	SWITCH, Single Contact Arm Assembly			830	GA-1079A		571 1079 10

TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION (Cont.)

Symbol Desig-nation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Desig-nation	Spcl.Tol. or Mod.	Contractor's Drawing and Part Number
		SWITCHES (Cont.)						
S-113H	Padding Cap Connector	SWITCH, Single Contact Arm Assembly			830	GA-1079A		571 1079 10
S-114	Oscillator Circuit Selecting	SWITCH, 1 SPST 1 NO 1 NC Contact Leaf	-24572		830	Y-1136B		508 1136 20
S-115	2nd Mult Cath Grounding	SWITCH, Single Pole NO Contact Leaf	-24570		830	Y-981A		508 0981 10
S-116	Antenna Changeover	SWITCH, 8 amp 250 v AC SPDT Vacuum Contact	CG24163		1881 4240	GL-1S21 GL34		260 6010 00
		TRANSFORMERS						
T-101	Modulation	TRANSFORMER, Pri: 15000 ohm CT, 150 MA Secd #1: 7300 ohm 4000 TV Secd #2: 970 ohm 2500 TV 300-4000 cps ±2 db	-302035		780	7950		677 0002 00
T-102	Antenna Ammeter Coupling	TRANSFORMER, Variable RF Coupling	-47912		830	GA-1716B		571 1716 20
		VACUUM TUBES						
V-101	HFO	TUBE, Type 837 Beam Pentode	837		* *	837		254 0406 00
V-102	1st Freq Mult	TUBE, Type 1625 Beam Pentode	1625		* *	1625		254 0458 00
V-103	2nd Freq Mult	TUBE, Type 1625 Beam Pentode	1625		* *	1625		254 0458 00
V-104	Power Amplr	TUBE, Type 813, Beam Pentode	813		* *	813		254 0397 00
V-105	Modulator	TUBE, Transmitting Tube, Type 811	811		* *	811		254 0395 00
V-106	Modulator	TUBE, Transmitting Tube, Type 811	811		* *	811		254 0395 00

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TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION (Cont.)

Symbol Designation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Designation	Spcl. Tol or Mod.	Contractor's Drawing and Part Number
		SOCKETS						
X-101	For V-101	SOCKET, 7 terminal base Iso	-49366		2570	227		220 5730 00
X-102	For V-102	SOCKET, 7 terminal base Iso	-49366		2570	227		220 5730 00
X-103	For V-103	SOCKET, 7 terminal base Iso	-49366		2570	227		220 5730 00
X-104	For V-104	SOCKET, 7 terminal "Jumbo" Wafer	-49384		2570	237		220 5711 00
	Alternate				2570	237		220 5710 00
X-105	For V-105	SOCKET, 4 prong low loss Ceramic	-49362		2570	224		220 5450 00
X-106	For V-106	SOCKET, 4 prong low loss Ceramic	-49362		2570	224		220 5450 00

TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION
FOR NAVY MODEL TCZ-2 TRANSMITTING EQUIPMENT

AUDIO AMPLIFIER UNIT

Symbol Desig-nation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Desig-nation	Spcl. Tol. Rqd.	Contrator's Drawing and Part Number
		CAPACITORS						
C-201	Microphone Supply Filter	CAPACITOR, 20 mf +100% -10% 100 WV	-482956		911 3030	RVL-10051-1 SPO-38482		183 3310 00
C-202	Audio Amplr Cathode Bypass	CAPACITOR, 20 mf +100% -10% 100 WV	-482956		911 3030	RVL-10051-1 SPO-38482		183 3310 00
*C-203	Audio Amplr Screen Bypass	CAPACITOR, .05 mf +20% -10% 600 WV	-482936-10		1640 3030			930 0010 00
C-204	Audio Driver Grid Coupling	CAPACITOR, .006 mf ±10% 1500 TV	-481411-B10		4030	BE-15		915 2605 20
C-205	Audio Amplr Pl Decoupling	CAPACITOR, .001 mf ±10% 1500 TV	-481410-B10		4030	BE-15		915 2105 20
C-206	Audio Driver Output Coupling	CAPACITOR, .003 mf ±10% 1500 TV	-482949-10		4030	BE-15		915 2305 20
C-207	Audio Driver Cathode Bypass	CAPACITOR, 20 mf +100% -10% 100 WV	-482956		911 3030	RVL-10051-1 SPO-38482		183 3310 00
C-208	Sidetone Amplr Cathode Coupling	CAPACITOR, 20 mf +100% -10% 100 WV	-482956		911 3030	RVL-10051-1 SPO-38482		183 3310 00
C-209	Mod Grid RF Bypass	CAPACITOR, .01 mf +60% -20% 400 WV				ASA: CN35A103		934 0003 00
	Alternate		-481506-B20 or CM-35B-103M		911	1WL		909 0002 00
C-210	Mod Grid RF Bypass	CAPACITOR, .01 mf +60% -20% 400 WV				ASA: CN35A103		934 0003 00
	Alternate		-481506-B20 or CM-35B-103M		911	1WL		909 0002 00

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TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION (Cont.)

Symbol Designation	Function	Description	Navy or JAN JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing and Part Number
		PLUGS						
P-201	Audio Amplr Unit Connector	PLUG, 12 terminal Connector Chassis Mtg.	-49662		2580	P-312-AB		365 2120 00
		RESISTORS						
R-201	Microphone Current Limiting	RESISTOR, 220 ohm ±5% 1 w	-63291-221		90			703 1220 10
R-202	Microphone Current Limiting	RESISTOR, 100 ohm ±5% 1 w	-63291-101		90			703 1100 10
R-203	Microphone Output Coupl Alternate	RESISTOR, 15,000 ohm ±5% ½w	-63355-153		2360	BT1/2-Navy		729 5154 10 745 1134 00
R-204	T-201 Pri Terminating	RESISTOR, 220 ohm ±5% 1 w	-63291-221		90			703 1220 10
R-205	Audio Amplr Grid	RESISTOR, 470,000 ohm ±10% 1/2 w	-63360-474		2360	BT1/2-Navy		729 5470 42
R-206	Audio Amplr Filament Current Dividing	RESISTOR, 42 ohm ±10% 10 w	-633225-10		3450	BD		710 1422 20
R-207	Audio Amplr Cath	RESISTOR, 2200 ohm ±10% 1 w	-63288-222		2360	BW1-Navy		708 0002 00
R-208	Audio Amplr Screen Decoupling	RESISTOR, 1 meg ±10% 1/2 w	-63360-105		2360	BT1/2-Navy		729 0008 00
R-209	Audio Amplr Pl Decoupling	RESISTOR, 220,000 ohm ±10% 1/2 w	-63360-224		2360	BT1/2-Navy		729 5220 42
R-210	Audio Driver Grid	RESISTOR, 470,000 ohm ±10% 1/2 w	-63360-474		2360	BT1/2-Navy		729 5470 42
R-211	Sidetone Amplr Grid	RESISTOR, 100,000 ohm ±5% 1/2 w	-63355-104		2360	BT1/2-Navy		729 5100 41
R-212	Sidetone Amplr Grid Coupling	RESISTOR, 470,000 ohm ±5% 1/2 w	-63355-474		2360	BT1/2-Navy		729 5470 41
R-213	Audio Driver Pl Decoupling	RESISTOR, 750,000 ohm ±5% 1/2 w	-63355-754		2360	BT1/2-Navy		729 5750 41
R-214	Audio Driver Cathode	RESISTOR, 250 ohm ±10% 1 w	-63703-251		2360	BW1-Navy		708 2505 12
R-215	Sidetone Amplr Cathode	RESISTOR, 250 ohm ±10% 1 w	-63703-251		2360	BW1-Navy		708 2505-12
R-216	T-201 Primary Terminal	RESISTOR, 220 ohm ±10% 1/2 w	-63678-221		2360	BW1/2		707 2205 20

TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION (Cont.)

Symbol Designation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Designation	Spcl. Tol or Mod.	Contractor's Drawing and Part Number
		SWITCHES						
S-201	Microphone Circuit Selector Switch	SWITCH, DPDT Toggle 1 amp 250 v DC or 3 amp 125 v DC	-24003-A		2160	24003		266 0004 00
S-202	Sidetone Amplr Output Control switch	SWITCH, 1 P 6 Position 1 Section Shorting			3030			259 1490 00
		TRANSFORMERS						
T-201	Audio Amplr Input Coupling	TRANSFORMER, Pri: 75 ohm Secd: 125,000 ohm 100-5000 cps 1000 TV	-302036		780	7823		677 2590 00
T-202	Audio Driver Output Coupling	TRANSFORMER, Pri: 5000 ohm 30 ma 300-4000 cps Secd: 2000 ohm 1500 TV	-302037		780	7821		677 2530 00
T-203	Sidetone Amplr Output Coupling	TRANSFORMER, Pri: 4000 ohm 30 ma 1500 TV 300-4000 cps Secd: Tapped 200 ohm 50 ohm 12.5 ohm 3.12 ohm 0.78 ohm 0.195 ohm 1500 TV	-302038		780	10082		677 2540 00
		VACUUM TUBES						
V-201	Audio Amplr	TUBE, Triple-Grid Amplr	12SJ7		* *	12SJ7		254 0254 00
V-202	Audio Driver	TUBE, Beam Pentode	6V6GT		* *	6V6GT		254 0200 00
V-203	Sidetone Amplr	TUBE, Beam Pentode	6V6GT		* *	6V6GT		254 0200 00
		SOCKETS						
X-201	For V-201	SOCKET, 8 terminal octal tube	-49423		200	88-8		220 1850 00
X-202	For V-202	SOCKET, 8 terminal octal tube	-49423		200	88-8		220 1850 00
X-203	For V-203	SOCKET, 8 terminal octal tube	-49423		200	88-8		220 1850 00

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TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION
FOR NAVY MODEL TCZ-2 TRANSMITTING EQUIPMENT

LOW FREQUENCY OSCILLATOR UNIT

Symbol Designation	Function6	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Designation	Spcl. Tol or Mod.	Contractor's Drawing and Part Number
401-499		LOW FREQUENCY OSCILLATOR: Includes tube. Frequency range 200 kc to 1500 kc.			830	33W-1		520 0219 00
		CAPACITORS						
C-401	LFO Screen Bypass	CAPACITOR, .002 mf ±20% 1500 TV	-482111-B20		4030	BE-15		915 2205 40
C-402	LFO Cathode Coupling	CAPACITOR, .00005 mf ±20% 900 TV	-481279-B20		4030 911	Type "C" 1 WL		909 4503 40
C-403	LFO Feedback Coupling	CAPACITOR, .0003 mf ±2% 1000 TV	-481685-2		700	816-035		913 3307 00
C-404	LFO Feedback Coupling	CAPACITOR, Set of three matched ceramic capacitors packaged as a set. To be connected in parallel to provide 0.00083 mf ±1/2% temp compensation neg., 150 parts per million per degree C +15 -87 PPM/°C 500 WV	-481688-1/2		700	816-044		913 1100 00
C-405A	LFO Cathode Bypass	CAPACITOR, .002 mf ±1% 500 TV	-482951-F10		4170			912 2208 60
C-405B	LFO Cathode Bypass	CAPACITOR, .002 mf ±1% 500 TV	-482951-F10		4170			912 2208 60
*C-405C	LFO Cathode Bypass	CAPACITOR, .01 mf ±1% 500 TV	-481385-F1		4170			912 2108 60
C-406	LFO Cathode Coupling	CAPACITOR, .000125 mf ±2% 1000 TV	-481684-2		700	814-106		913 0001 00
C-407	LFO Grid Padding	CAPACITOR, Set of three matched capacitors packaged as a set. To be connected in parallel to provide 0.00088 mf ±1% temp compensation neg., 32 parts per million per degrees C +15 -61 PPM/°C 500 WV	-481687-1		700	816-043		913 1200 00
C-408A	LFO Grid Padding	CAPACITOR, .0015 mf ±1% 1000 TV	-482952-F1		4170			912 2158 60

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TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION (Cont.)

Symbol Designation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing and Part Number
		CAPACITORS (Cont.)						
C-408B	LFO Grid Padding	CAPACITOR, .00015 mf ±2% 1000 TV	-481682		700	810-250		913 0017 00
C-408C	LFO Grid Padding	CAPACITOR, .0003 mf ±2% 1000 TV	-481685-2		700	816-035		913 3307 00
C-409A	LFO Grid Padding	CAPACITOR, .002 mf ±1% 500 TV	-482951-F10		4170			912 2208 60
*C-409B	LFO Grid Padding	CAPACITOR, .0004 mf ±1% 500 TV	-481319-F1		4170			912 3408 60
C-409C	LFO Grid Padding	CAPACITOR, .00035 mf ±2% 1000 TV	-481686-2		700	816-041		913 0014 00
C-410A	LFO Grid Padding	CAPACITOR, .00025 mf ±2% 1000 TV	-481683-2		700	810-290		913 0024 00
C-410B	LFO Grid Padding	CAPACITOR, .002 mf ±1% 500 TV	-482951-F10		4170			912 2208 60
C-410C	LFO Grid Padding	CAPACITOR, .002 mf ±1% 500 TV	-482951-F10		4170			912 2208 60
C-410D	LFO Grid Padding	CAPACITOR, .0015 mf ±1% 1000 TV	-482952-F1		4170			912 2158 60
C-411	C-411A, C-411B, C-411C, C-411D, C-411E	CAPACITOR, 5 Section Variable Ceramic	-481680		700	826-003		917 5110 00
C-411A	C-410 Trimmer	CAPACITOR, Section of C-411						
C-411B	C-406 Trimmer	CAPACITOR, Section of C-411						
C-411C	C-409 Trimmer	CAPACITOR, Section of C-411						
C-411D	C-408 Trimmer	CAPACITOR, Section of C-411						
C-411E	C-407 Trimmer	CAPACITOR, Section of C-411						
C-412	LFO Grid Coupling	CAPACITOR, .0003 mf ± 2% 1000 TV	-481685-2		700	816-035		913 3307 00
		MISCELLANEOUS ELECTRICAL PARTS						
E-401	LFO HV Feedthru	BUSHING INSERT, 3/16" x 5/8"	-61152		700			190 2932 00
E-402	LFO Pl Lead Standoff	CYL STANDOFF, 3/8" x 1/2"	-61415		2410	395-L-1/2		190 2329 00
		INDUCTORS AND REACTORS						
L-401	LFO Grid Tuning Inductor	INDUCTOR, 45 turns close wound 48-38 litz wire			830	GA-1259C		571 1259 30
L-402	LFO Pl Feed Choke	CHOKE, 8 mh 0.125 amp 70 ohm	-47908		3090			240 4100 00
L-403	LFO Cathode Choke	CHOKE, Multi-section 2.5 uh 0.125 amp 50 ohm	-47903		3220 70	R100-U		240 5300 00

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TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION (Cont.)

Symbol Designation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing and Part Number
		PLUGS						
P-401	LFO Connector Plug	PLUG, 6 Terminal Connector Chassis Mtg.			2580	Type 300		365 2060 00
		RESISTORS						
R-401	LFO Grid	RESISTOR, 15,000 ohm ±10% 1 w			2360	BT1-Navy		729 7154 20
		SWITCHES						
S-401	LFO Freq Range SW	SWITCH, Rotor Assembly			830	GA-1021A		571 1021 10
S-401		SWITCH, Stator Assembly			830	GA-1544B		571 1544 20
		VACUUM TUBES						
V-401	LFO	TUBE, Type 1625 Beam Pentode	1625		* *	1625		254 0458 00
		SOCKETS						
X-401	For V-401	SOCKET, 7 Term base Iso	CEJ-49366		2570	227		220 5730 00

* * Standard Vacuum Tubes are supplied by numerous well known manufacturers.

TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION
FOR NAVY MODEL TCZ-2 TRANSMITTING EQUIPMENT

MCW-CFI UNIT

Symbol Designation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Designation	Spcl.Tol or Mod.	Contractor's Drawing and Part Number
		CAPACITORS						
C-2201	Calibration Oscillator Tripler Pl Coupling	CAPACITOR, .006 mf +60% -20% 600 WV			911	ASA: CN35A602		934 0002 00
C-2202	Calibration Oscillator Tripler Grid Coupling	CAPACITOR, .006 mf +60% -20% 600 WV			911	ASA: CN35A602		934 0002 00
C-2203	Calibration Oscillator Mixer Grid Coupling	CAPACITOR, .006 mf +60% -20% 600 WV			911	ASA: CN35A602		934 0002 00
C-2204	Calibration Oscillator Detector Grid Coupling	CAPACITOR, 200 mmf ±5% ~~1000 TV~~			4170	ASA: CM20B201-J		935 0118 00
C-2205	Calibration Oscillator Input HFO	CAPACITOR, 10 mmf ±10% 1000 TV	-48710-B10		911 4030 4210 30	5WS KS MO 1468		909 4107 52
C-2206	Calibration Oscillator Input LFO	CAPACITOR, 10 mmf ±10% 1000 TV	-48710-B10		911 4030 4210 30	5WS KS MO 1468		909 4107 52
*C-2207	Calibration Oscillator Pl Decoupling	CAPACITOR, .05 mf +10% -10% 600 WV	-482936-10		1640			930 0010 00
*C-2208	Calibration Oscillator Mixer Screen Decoupling	CAPACITOR, .05 mf +10% -10% 600 WV	-482936-10		1640			930 0010 00
*C-2209	Calibration Oscillator Output Coupling	CAPACITOR, .05 mf +10% -10% 600 WV	-482936-10		1640			930 0010 00
*C-2210	Audio Oscillator Grid Tank	CAPACITOR, .05 mf +10% -10% 600 WV	-482936-10		1640			930 0010 00
C-2211	HV Supply Filter	CAPACITOR, .5 mf ±20% 600 WV	-481223-20		911 4210 1640	DYR-6050 XDMR6-.5 A7178		956 0006 00

TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION (Cont.)

Symbol Designation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing and Part Number
		CAPACITORS (Cont.)						
C-2212	C-2212A, C-2212B	CAPACITOR, 2-.1 mf ±20% 600 WV	-48312-B		911	DYRT		956 4016 40
C-2212A	Audio Oscillator Blocking	CAPACITOR, Section of C-2212	*CP50B1-F104KK					
C-2212B	Audio Oscillator Tank Tuning	CAPACITOR, Section of C-2212						
C-2212	Alternate							961 5036 40
C-2213	Oscillator Feedback	CAPACITOR, 30 mmf ±5% 500 WV	CM 20C300-M			ASA: CM20C300		935 0144 00
C-2213	Alternate		-481327-C5 *CM20C300J		911	5R		912 4303 10
C-2214	RF Bypass	CAPACITOR, .005 mf ±5% 1000 TV				ASA: CM35B512		935 2105 00
	Alternate					ASA: CM40B512		935 3035 00
		INDUCTORS						
L-2201	Audio Oscillator Grid Tank Inductor	INDUCTOR, .25 hy 1000 cps & .1 mf cap	-302095		780	7822		678 2470 00
		PLUGS						
P-2201	MCW-CFI Unit Connector Plug	PLUG, 8 term connector			2580	300		365 0002 00
		RESISTORS						
R-2201	Audio Oscillator Output Control	RESISTOR, 2-15 ohm WW Rheostat	-633249		4975			381 9010 00
R-2202	Calibration Oscillator P1 Decoupling	RESISTOR, 100,000 ohm ±10% 1/2 w	-63360-104		2360	BT1/2-Navy		729 5100 42

TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION (Cont.)

Symbol Designation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing and Part Number
		RESISTORS (Cont.)						
R-2203	Calibration Oscillator Tripler Grid	RESISTOR, 47,000 ohm ±10% 1/2 w	-63360-473		2360	BT1/2-Navy		729 5474 20
R-2203	Alternate							745 1156 00
R-2204	Audio Oscillator Grid Coupling	RESISTOR, 150,000 ohm ±10% 1/2 w	-63360-154		2360	BT1/2-Navy		729 5150 42
R-2204	Alternate							745 1171 00
R-2205	Calibration Oscillator Mixer Injection Grid	RESISTOR, 47,000 ohm ±10% 1/2 w	-63360-473		2360	BT1/2-Navy		729 5474 20
R-2205	Alternate							745 1156 00
R-2206	Calibration Oscillator Mixer Control Grid	RESISTOR, 47,000 ohm ±10% 1/2 w	-63360-473		2360	BT1/2-Navy		729 5474 20
R-2206	Alternate							745 1156 00
R-2207	Calibration Oscillator Mixer Filament Dropping	RESISTOR, 85 ohm ±2-1/2% 10 w	-632958-2-1/2		3450			710 0003 00
R-2208	Calibration Oscillator Pl Decoupling	RESISTOR, 33,000 ohm ±10% 1/2 w	-63360-333		2360	BT1/2-Navy		729 5334 20
R-2208	Alternate							745 1149 00
R-2209	Calibration Oscillator Screen Dropping	RESISTOR, 15,000 ohm ±10% 1 w	-63288-153		2360	BT1-Navy		729 7154 20
R-2209	Alternate							745 3135 00
R-2210	Calibration Oscillator HV Dropping	RESISTOR, 15,000 ohm ±10% 10 w	-633182-10		3450			710 0010 00
R-2211	Audio Oscillator HV Dropping	RESISTOR, 220,000 ohm ±10% 1 w	-63288-224		2360	BT1-Navy		729 7220 42
R-2211	Alternate							745 3184 00
R-2212A	Audio Oscillator HV Bleeder	RESISTOR, 100,000 ohm ±10% 1/2 w	-63360-104		2360	BT1/2-Navy		729 5100 42
R-2212A	Alternate							745 1170 00
R-2212B	Audio Oscillator HV Bleeder	RESISTOR, 220,000 ohm ±10% 1/2 w	-63360-224		2360	BT1/2-Navy		729 5220 42
R-2212B	Alternate							745 1184 00

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TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION (Cont.)

Symbol Designation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing and Part Number
		RESISTORS (Cont.)						
R-2213	Calibration Oscillator Detector Grid	RESISTOR, 470,000 ohm ±10% 1/2 w	-63360-474		2360	BT1/2-Navy		729 5470 42
R-2213	Alternate							745 1198 00
R-2214	Calibration Oscillator Detector Pl Decoupling	RESISTOR, 470,000 ohm ±10% 1/2 w	-63360-474		2360	BT1/2-Navy		729 5470 42
R-2214	Alternate							745 1198 00
R-2215	Audio Oscillator Output Loading	RESISTOR, 2200 ohm ±5% 1/2 w	-63355-222		2360	BT1/2-Navy		729 5220 01
R-2215	Alternate							745 1099 00
R-2216	Calibration Oscillator Grid	RESISTOR, 150,000 ohm ±10% 1/2 w	-63360-154		2360	BT1/2-Navy		729 5150 42
*R-2217	Calibration Oscillator Mixer Cathode	RESISTOR, 220 ohm ±20% 1/2 w	-63678-221		2360	BW1/2		707 2205 40
	Alternate		-63288-221					729 0001 00
	Alternate							708 2205 40
		VACUUM TUBES						
V-2201	Calibration Oscillator Crystal Oscillator-Tripler	TUBE, Dual Triode 12SL7GT			* *	12SL7GT		254 0258 00
V-2202	Calibration Oscillator Mixer	TUBE, Pent Convert 12SA7, 12SA7GT/G			* *	12SA7 12SA7GT/G		254 0248 00
V-2203	Calibration Oscillator Detector-Audio Osc.	TUBE, Dual Triode 12SL7GT			* *	12SL7GT		254 0258 00
		SOCKETS						
X-2201	For V-2201	SOCKET, 8 Terminal Octal Tube	-49423		200	88-8		220 1850 00
X-2202	For V-2202	SOCKET, 8 Terminal Octal Tube	-49423		200	88-8		220 1850 00

TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION (Cont.)

Symbol Desig-nation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Desig-nation	Spcl. Tol. or Mod.	Contractor's Drawing and Part Number
		SOCKETS (Cont.)						
X-2203	For V-2203	SOCKET, 8 Terminal Octal Tube	-49423		200	88-8		220 1850 00
X-2204	For Y-2201	SOCKET, 2 Terminal Crystal	-49951			9816		292 0012 00
		QUARTZ CRYSTALS						
Y-2201	Calibration Oscillator Quartz Crystal	QUARTZ CRYSTAL, Mounted in Holder	CR-2-B/U (200 kc)		4870			291 0002 00
		TUNED CIRCUIT ASSEMBLIES						
Z-2201	Z-2201A, Z-2201B	TUNED CIRCUIT, Coil Assembly	-47923		70			278 0001 00
Z-2201A	Calibration Oscillator Crystal Oscillator	TUNED CIRCUIT, Section of Z-2201						
Z-2201B	Calibration Oscillator Detector Cathode Tank	TUNED CIRCUIT, Section of Z-2201						
Z-2202	Z-2202A, Z-2202B	TUNED CIRCUIT, Assembly Coil	-47911		70			278 0002 00
Z-2202A	Calibration Oscillator Tripler Pl Tank	TUNED CIRCUIT, Section of Z-2202						
Z-2202B	Calibration Oscillator Mixer Tank	TUNED CIRCUIT, Section of Z-2202						

TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION
FOR NAVY MODEL TCZ-2 TRANSMITTING EQUIPMENT

Symbol Designation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Designation	Spcl. Tol or Mod.	Contractor's Drawing and Part Number
		COMPLETE UNIT ASSEMBLIES						
		ASSEMBLY, MCW-CFI Unit			830	8Q-2		500 4587 005
		ASSEMBLY, Audio Unit			830	26S-1		500 7620 005
		ASSEMBLY, Multiplier Unit			830	318E-1		500 3149 004
		ASSEMBLY, HFO Unit ***			830	33X-1		500 4473 005
		ASSEMBLY, Singleturn Autotune Unit "D" (Includes Wick Lubricator Assem)			830	96J-1		571 0737 30
		ASSEMBLY, Singleturn Autotune Unit "C" (Includes Wick Lubricator Assem)			830	96J-2		572 0737 30
		ASSEMBLY, Singleturn Autotune Unit "E" (Includes Wick Lubricator Assem)			830	96J-3		573 0737 30
		ASSEMBLY, Singleturn Autotune Unit "A" (Includes Wick Lubricator Assem.)			830	96J-4		571 0738 30
		MISCELLANEOUS						
		MANUAL, Operating (Calibration Book)			830			520 9111 00
		FERRULE, Conduit			200			019 2034 00
		COUPLING, Conduit			630			019 2050 00
		CAP, Protective			630	RWK-59A1		371 1069 00
		KNOB, HFO Dial			830			507 5524 00
		DIAL, HFO Counter			830			507 5527 00
		KNOB, Dial Lock and Fiducial			830			507 5531 00
		KNOB, Variometer Dial			830			507 5586 00
		SLUG, HFO Tuning			830			507 5719 00

Symbol Designation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing and Part Number
		MISCELLANEOUS (Cont.)						
		KNOB, Capacitor Dial			830			507 5796 00
		SLUG, Multiplier Tuning			830			507 6192 00
		KNOBS, Bar			830			571 1765 20
		KNOB, Multiplier Dial			830			508 1069 20
		KNOB, Network Switch Dial			830			508 1072 20
		SCREW, 6-40 x 1/8 set			500			328 0019 00
	Alternate							328 0002 00
		SCREW, 4-48 x 1/8 set			500			328 0001 00
		SCREW, 8-36 x 1/8 set			500			328 0020 00
	Alternate							328 0003 00
		SCREW, 8-36 x 1/4 set			500			328 0022 00
	Alternate							328 0004 00
		SCREW, 4-40 x 1/2" Long			3580			343 0137 00
		SPACER, 3/4" x 3/8" Switch			830			500 0019 00A
		SPACER, 3/4" x 3/8" Switch			830			500 0020 00A
		SPACER, 3/4" x 3/8" Switch			830			500 0021 00A
		SCREW, Special			830			507 5762 00
		SCREW, Special			830			500 2704 001
		SCREW, 8-32 thd 2-3/8" Special			3580			330 4210 00
		SCREW, 8-32 thd 2-1/2" Special						344 0105 00
		COUPLER, 1/2" Spline			830			500 2729 001
		COUPLER, 1-1/32" Spline			830			500 2730 001
		GROMMET, 1-9/16" Neoprene			880	4757		201 1250 00
		GROMMET, 3/8" Neoprene			2850	905		201 1060 00
		GROMMET, 9/16" Neoprene			2850	913		201 1090 00
		GROMMET, 1/4" Neoprene			2850	901		201 1040 00
		CLIP, Grid			3220	12		301 1001 00
		CLIP, Grid			3220	24		301 6000 00
		KNOB, SIDETONE SW			830			507 5866 00
		WRENCH, External Spanner			830			507 5733 00
		WRENCH, Internal Spanner			830			507 5734 00

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TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION (Cont.)

Symbol Designation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Designation	Spcl. Tol or Mod.	Contractor's Drawing and Part Number
		MISCELLANEOUS (Cont.)						
		WRENCH, #10 Bristo						024 9710 00
		WRENCH, #8 Bristo						024 0019 00
		WRENCH, #6 Bristo						024 9730 00
		WRENCH, #4 Bristo						024 2900 00
		SCREW DRIVER, #1 Phillips						024 3000 00
		SCREW DRIVER, #2 Phillips						024 3100 00
		SCREW DRIVER, .070" shank Jewelers			4296	555C		024 0015 00
		GAUGE, FEELER .005"			830			500 9135 001
		RIGHT TRACK, Shock Mounting						500 4279 00B
		LEFT TRACK, Shock Mounting						500 4278 00B
		MISCELLANEOUS AUTOTUNE PARTS						
		CRANK, Autotune			830			571 1149 10
		SHAFT, Main Line			830			507 5512 00
		WORM, Small			830			500 6679 001
		WORM, Large			830			507 5519 00
		BEARING, Line Shaft			830			507 5724 00
		ARM, Positioning Switch Drive			830			571 0881 10
		CHAIN, Autotune Drive (Includes Wick Lubricator Assem)			830			507 5603 00
		SPROCKET, Motor			830			507 5602 00
		SPROCKET, Line Shaft			830			507 5514 00
		WICK LUBRICATOR, Autotune Singleturn Unit			830			500 4630 001
		WICK LUBRICATOR Autotune Multiturn Unit			830			500 4644 001
		WICK LUBRICATOR, Autotune Chain Drive			830			500 4635 001

TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION
FOR NAVY MODEL TCZ-2 TRANSMITTING EQUIPMENT

NAVY TYPE COL-23410 REMOTE CONTROL UNIT

Symbol Designation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing and Part Number
		MISCELLANEOUS ELECTRICAL PARTS						
E-901	Pilot Light Mounting	MOUNTING, pilot light, polarized ruby jewel		AN-QQ-S-91	1200	80		262 1270 00
		PILOT LAMPS						
I-901	Pilot Lamp	LAMP, 28 v 0.17 amp T3-1/4 bulb, bayonet base			1888	Mazda #313		262 3270 00
		JACKS AND RECEPTACLES						
J-901	Headphone Jack	JACK, Single circuit, for 1/4" plug	-49025A		3030 2040	SC1A		358 1040 00
J-902	Audio Input Connector	TERMINAL STRIP, 2 terminal			830			500 2218 002
J-903	Microphone Jack	JACK, three circuit for 3/16" plug	-49039		3030 2040	SC2AB		358 1050 00
J-904	Telegraph Key Jack	JACK, single circuit, for 1/4" plug	-49025A		3030 2040	SC1A		358 1040 00
		PLUGS						
P-901	Control Cable Connector	CONNECTOR, 27 terminal wall mounting, 10 amp contacts	-49946		630	NK-27-32SL		371 4050 00
		RESISTORS						
*R-901	Headphone Series Resistor	RESISTOR, 1800 ohm ±20% 1 watt	-63288-182		2360	BT1-Navy		729 7180 04

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TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION (Cont.)

Symbol Designation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing and Part Number
		RESISTORS (Cont.)						
R-902	Volume Control	ATTENUATOR, Bridged T pad, 500 ohm, metalized	-631874 pot plus two -RC21BE511M Resistors		2360	9680-8791		380 2010 00
		SWITCHES						
S-901	Phones-Speaker Switch	SWITCH, Toggle, DPDT, 3 amp 125 v	-24003		2160	20905-GH		266 1030 00
S-901	Alternate							266 0002 00
S-902	Channel Selector Switch	SWITCH, Single circuit, non-shorting, 11 position one deck			3410			259 1421 00
S-903	Emission Selector Switch	SWITCH, three circuit, shorting, four position, two deck			3410			259 1361 00
		TRANSFORMERS (See figure 7-75 for Winding Data)						
T-901	Speaker Coupling Transformer	TRANSFORMER, 500 ohm Line to six ohm voice coil			2525			667 7051 00
		LOUD SPEAKER						
LS-901	Loud Speaker	SPEAKER, 5" PM, 6 ohm voice coil	-49437		2525	S2482		271 2200 00

TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION
FOR NAVY MODEL TCZ-2 TRANSMITTING EQUIPMENT

NAVY TYPE -481628 ANTENNA SHUNT CAPACITOR

Symbol Designation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing and Part Number
		CAPACITORS						
C-1101	Antenna Shunt Capacitor	CAPACITOR, 25 mmf ±10% 10 kv test	-482977-10		30 4210	1860-201 XYA-10-425		914 1762 00
C-1102	Antenna Shunt Capacitor	CAPACITOR, 25 mmf ±10% 10 kv test	-482977-10		30 4210	1860-201 XYA-10-425		914 1762 00
C-1103	Antenna Shunt Capacitor	CAPACITOR, 25 mmf ±10% 10 kv test	-482977-10		30 4210	1860-201 XYA-10-425		914 1762 00

TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION
FOR NAVY MODEL TCZ-2 TRANSMITTING EQUIPMENT

65X-7 CONTROL CABLE (500 1496 00D)
(Power Unit to transmitter)

Symbol Desig-nation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Desig-nation	Spcl. Tol. or Mod.	Contractor's Drawing and Part Number
		PLUGS						
P-1501	Cable Connector Plug	CONNECTOR, 27 terminal 90° plug female			630	NK-27-23-11/16		371 4060 00
P-1502	Cable Connector Plug	CONNECTOR, 27 terminal straight plug male			630	RNK-27-22C-11/16		371 4049 00
		CABLES						
W-1501	Connecting Cable	MULTI-CONDUCTOR CABLE, 27 conductors all #22 ga			360			424 2710 00

TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION
FOR NAVY MODEL TCZ-2 TRANSMITTING EQUIPMENT

65X-8 POWER CABLE (500 1497 OOD)
(Power Unit to Transmitter)

Symbol Designation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing and Part Number
		PLUGS						
P-1601	Cable Connector Plug	CONNECTOR, 10 terminal straight	U-7/U		630	FK10-21-9/16		371 5140 00
P-1602	Cable Connector Plug	CONNECTOR, 10 terminal 90° plug	U-9/U		630	RFK-10-24C-9/16		371 5129 00
		CABLES						
W-1601	Connecting Cable	MULTI-CONDUCTOR CABLE, two #14, one #18 and seven #22 ga			360			424 1010 00

TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION
FOR NAVY MODEL TCZ-2 TRANSMITTING EQUIPMENT

65X-9 POWER CABLE (500 1498 00C)
(Transmitter to Load Coil)

Symbol Designation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing and Part Number
		MISCELLANEOUS ELECTRICAL PARTS						
E-1701	Reducer Bushing	BUSHING, clamp reducer from 7/16" to .280"			630	P		371 1110 00
E-1702	Reducer Bushing	BUSHING, clamp reducer from 7/16" to .280"			630	P		371 1110 00
		PLUGS						
P-1701	Cable Connector Plug	CONNECTOR, 3 terminal 90° plug			630	RNK-27-22C-11/16		371 1090 00
P-1702	Cable Connector Plug	CONNECTOR, 3 terminal straight plug			630	RWK-C3-22C 7/16		371 1109 00
		CABLES						
W-1701	Connecting Cable	Two Conductor shielded CABLE, #20 AWG				#8422		425 0250 00

TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION
FOR NAVY MODEL TCZ-2 TRANSMITTING EQUIPMENT

NAVY TYPE COL-211624 POWER UNIT

Symbol Designation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing and Part Number
		CAPACITORS						
C-1901	Audio Coupling Capacitor	CAPACITOR, paper, 2.0 mf ±20% 400 WV	-48403-B20		911			954 2484 00
C-1901	Alternate	CAPACITOR, paper, 2.0 mf +40 -15%, 600 WV	CP53B1FF205					961 4062 00
C-1901	Alternate	CAPACITOR, paper, 2.0 mf +40 -15%, 600 WV	CP50B1FF205					961 4070 00
C-1901	Alternate	CAPACITOR, paper, 2.0 mf ±20%, 400 WV	-48403-B20		911			954 2444 00
C-1902	Spark Suppressor	CAPACITOR, paper, 2.0 mf ±20%, 400 WV	-48403-B20		911			954 2484 00
C-1902	Alternate	CAPACITOR, paper, 2.0 mf +40 -15%, 600 WV	CP53B1FF205					961 4062 00
C-1902	Alternate	CAPACITOR, paper, 2.0 mf +40 -15%, 600 WV	CP50B1FF205					961 4070 00
C-1902	Alternate	CAPACITOR, paper, 2.0 mf ±20%, 400 WV	-48403-B20		911			954 2444 00
C-1903	LV Filter	CAPACITOR, paper, 8 mf ±20%, 800 WV	-482935-20		911	KG-U-4080		930 1940 00
C-1904	LV Filter	CAPACITOR, paper, 8 mf ±20%, 800 WV	-482935-20		911	KG-U-4080		930 1940 00
C-1905	HV Filter	CAPACITOR, paper, 4 mf ±20%, 2000 WV	-481417-20		911	TJU-20040		930 4040 00
C-1905	Alternate	CAPACITOR, paper, 4 mf +20% -10%, 2000 WV	CP70E1FJ405V					962 4013 00
C-1906	HV Filter	CAPACITOR, paper, 4 mf ±20%, 2000 WV	-481417-20		911	TJU-20040		930 4040 00
C-1906	Alternate	CAPACITOR, paper, 4 mf +20% -10%, 2000 WV	CP70E1FJ405V					962 4013 00

TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION (Cont.)

Symbol Designation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing and Part Number
		CAPACITORS (Cont.)						
C-1907	C-1907A, C-1907B	DUAL CAPACITOR, paper 0.1/0.1 mf ±20% 600 WV	-48312-B20		911 4250	DYRT 2527-9		956 4016 40
C-1907A	LV Noise Filter	Part of C-1907						
C-1907B	LV Noise Filter	Part of C-1907						
C-1907	Alternate	DUAL CAPACITOR, 0.1/0.1 mf +40 -15%, 600 WV	CP51B4FF104					961 5038 00
C-1908	C-1908A, C-1908B	DUAL CAPACITOR, paper 0.1/0.1 mf ±20%, 600 WV	-48312-B20		911 4250	DYRT 2527-9		956 4016 40
C-1908A	HV Noise Filter	Part of C-1908						
C-1908B	HV Noise Filter	Part of C-1908						
C-1908	Alternate	DUAL CAPACITOR, 0.1/0.1 mf +40 -15%, 600 WV	CP51B4FF104					961 5038 00
C-1909	Spark Filter	CAPACITOR, paper, 2.0 mf ±20%, 400 WV	-48403-B20		911			954 2484 00
C-1909	Alternate	CAPACITOR, paper, 2.0 mf +40 -15%, 600 WV	CP53B1FF205					961 4062 00
C-1909	Alternate	CAPACITOR, paper, 2.0 mf +40 -15%, 600 WV	CP50B1FF205					961 4070 00
C-1909	Alternate	CAPACITOR, paper, 2.0 mf ±20%, 400 WV	-48403-B20		911			954 2444 00
C-1910	Dynamotor Input Noise Filter	CAPACITOR, mica, 0.01 mf ±20%, 500 WV	-48643-A20		911 4030	4L H-10		910 1107 40
C-1911	LV Noise Filter	CAPACITOR, paper, 0.1 mf ±20%, 600 WV	-48197-C20		4250 911 4210			956 2018 40
C-1911	Alternate	CAPACITOR, paper, 0.1 mf ±10%, 600 WV	CP50B1FF104K					961 4018 00
C-1912	HV Output Noise Filter	CAPACITOR, paper, 0.1 mf ±20%, 1500 WV			911 4250	DYR-15010		930 0012 00
C-1913	Dynamotor Input Noise Filter	CAPACITOR, Mica, 0.01 mf ±20%, 500 WV	-48643-A20		911 4030	4L H-10		910 1107 40

PARTS LIST BY SYMBOL DESIGNATION (Cont.)

Symbol Designation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Designation	Spcl. Tol or Mod.	Contractor's Drawing and Part Number
		CAPACITORS (Cont.)						
C-1914	28 v Output Noise Filter	CAPACITOR, mica, 0.01 mf ±20% 500 WV	-48643-A20		911 4030	4L H-10		910 1107 40
C-1915	28 v Output Noise Filter	CAPACITOR, paper, 2.0 mf ±20%, 400 WV	-48403-B20		911			954 2484 00
C-1915	Alternate	CAPACITOR, paper, 2.0 mf +40 -15%, 600 WV	CP53B1FF205					961 4062 00
C-1915	Alternate	CAPACITOR, paper, 2.0 mf +40 -15%, 600 WV	CP50B1FF205					961 4070 00
C-1915	Alternate	CAPACITOR, paper, 2.0 mf ±20%, 400 WV	-48403-B20		911			954 2444 00
C-1916	HV Output Noise Filter	CAPACITOR, paper, 0.1 mf ±20%, 1500 WV			911 4250	DYR-15010		930 0012 00
C-1917	28 v Output Ripple Filter	CAPACITOR, paper, 4 mf ±20%, 50 WV	-482934-20		911 4250	PC9B36		930 0013 00
C-1918	14 v Output Noise Filter	CAPACITOR, mica, 0.01 mf ±20%, 500 WV	-48643-A20		911 4030	4L H-10		910 1107 40
C-1919	14 v Ripple Filter	CAPACITOR, Electrolytic, 20 mf +100 -10%, 100 WV	-482956		911 3030	RVL-10051-1 SPO 38482		183 3310 00
C-1919	Alternate	CAPACITOR, Electrolytic, 20 mf +150 -10%, 150 WV	CE630200J					184 6527 00
C-1920	Line Filter	CAPACITOR, paper, 2 mf ±10%, 600 WV	-48777-10		911 1640	KG-3020 A7649		930 7822 00
C-1920	Alternate	CAPACITOR, paper, 2 mf +20 -10%, 600 WV	CP70B1FF205V					962 4010 00
C-1921	Line Filter	CAPACITOR, paper, 2 mf ±10%, 600 WV	-48777-10		911 1640	KG-3020 A7649		930 7822 00
C-1921	Alternate	CAPACITOR, paper, 2 mf +20 -10%, 600 WV	CP70B1FF205V					962 4010 00
C-1922	C-1922A, C-1922B	DUAL CAPACITOR, 0.1/0.1 mf +20 -10%, 600 WV	CP51B4FF104V					961 5037 00
C-1922A	Line Filter	Part of C-1922						
C-1922B	Line Filter	Part of C-1922						

Symbol Designation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Designation	Spcl. Tol or Mod.	Contractor's Drawing and Part Number
		CAPACITORS (Cont.)						
C-1922	Alternate	DUAL CAPACITOR, paper 0.1/0.1 mf ±10%, 600 WV	-48312-B10		911 4250	DYRT 2527-9		956 4016 20
C-1923	14 v Output Ripple Filter	CAPACITOR, Electrolytic, 20 mf +100 -10%, 100 WV	-482956		911 3030	RVL-10051-1 SPO 38482		183 3310 00
C-1923	Alternate	CAPACITOR, Electrolytic, 20 mf +150 -10% 150 WV	CE630200J					184 6527 00
		DYNAMOTORS						
D-1901	Low Voltage Dynamotor	DYNAMOTOR, Input: 115 v DC Output #1: 28 v DC 15 amp Output #2: 14 v DC 1.2 amp	CAEN-211623		4960			231 0028 00
D-1902	High Voltage dynamotor	DYNAMOTOR, Inptu: 115 V DC Output #1: 400 v DC 750 ma Output #2: 750 v DC 350 ma	CAEN-211622		4960			231 0029 00
		MISCELLANEOUS ELECTRICAL PARTS						
E-1901	Feedthru Bushing	BUSHING 3/8" x 5/8" Ceramic	NS4W4202					190 0006 00
E-1901	Alternate	BUSHING 3/8" x 5/8" Ceramic	-61511		2410	979A		190 2919 00
E-1902	Feedthru Bushing	BUSHING PLUG, 5/8" x 5/8" Ceramic	NS4W4102					190 0002 00
E-1902	Alternate	BUSHING PLUG, 5/8" x 5/8" Ceramic	NS3W4102		2410			190 2920 00
E-1904	Resistor Mounting Block	BLACK PORCELAIN 1" x 1-5/8"			60			193 1000 00
E-1907	Pilot Light Bracket	Mounting for miniature bayonet base bulb			1200	30		262 1230 00
E-1908	Pilot Light Bracket	Mounting for miniature bayonet base bulb			1200	30		262 1230 00

TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION (Cont.)

Symbol Designation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing and Part Number
		FUSES						
F-1901	Power Line Fuse	CARTRIDGE FUSE, 30 amp 250 v, 9/16" x 2"			2520	380-030		264 2301 00
F-1902	Power Line Fuse	CARTRIDGE FUSE, 30 amp 250 v 9/16" x 2"			2520	380-030		264 2301 00
F-1903	D-1901 Dynamotor Primary Fuse	CARTRIDGE FUSE, 15 amp 250 v 13/32" x 1-1/2"						264 6009 00
F-1904	D-1902 Dynamotor Primary Fuse	CARTRIDGE FUSE, 15 amp 250 v 13/32" x 1-1/2"						264 6009 00
F-1905	28 v Supply Fuse	CARTRIDGE FUSE, 15 amp 250 v 13/32" x 1-1/2"						264 6009 00
F-1906	14 v Supply Fuse	CARTRIDGE FUSE, 3 amp 250 v 13/32" x 1-1/2"						264 6002 00
F-1907	400 v Supply Fuse	CARTRIDGE FUSE, aircraft, 1 amp 1000 v, 3/8" x 3"			2920	2104		264 7040 00
F-1908	1150 v Supply Fuse	CARTRIDGE FUSE, aircraft, 1 amp 2500 v 3/8" x 4-1/2"			2920	2109		264 7090 00
		PILOT LAMPS						
I-1901	Pilot Light Bulb	PILOT LAMP, miniature base, 12-16 volts 0.10 amp			1881 3846	T-3-1/4		262 3260 00
I-1902	Pilot Light Bulb	PILOT LAMP, miniature base, 12-16 volts 0.10 amp			1881 3846	T-3-1/4		262 3260 00
		JACKS AND RECEPTACLES						
J-1901	Transmitter to Power Unit Control Cable Connector	PLUG CONNECTOR, wall mounting, 27 term	-49938		630	NK-27-32S-2		371 4010 00
J-1902	Transmitter to Power Unit Power Cable Connector	PLUG CONNECTOR, wall mounting, 10 term	-49939		630	RFK-10-31SL-2		371 5119 00

TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION (Cont.)

Symbol Designation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Designation	Spcl. Tol or Mod.	Contractor's Drawing and Part Number
		JACKS AND RECEPTACLES (Cont.)						
J-1903	Remote Control Terminal Board	TERMINAL BOARD, 27 terminals			830			571 1545 20
J-1904	Remote Transmitter Power Terminal Board	Part of J-1903, 10 terminals						
J-1905	Navy RADIOPHONE Terminal Board	TERMINAL BOARD, 21 terminals			830			500 3964 002
J-1906	HV Dynamotor Connector Socket	CONNECTOR, 6 contact, wall mounting, female	-49942		830			500 2072 001
J-1907	LV Dynamotor Connector Socket	CONNECTOR, 6 contact, wall mounting, female	-49942		830			500 2072 001
J-1908	Relay Mounting Plate	Bakelite plate drilled to mount K-1901 and K-1903			830			502 3879 002
J-1909	Relay Mounting Plate	Bakelite plate drilled to mount K-1902 and K-1904			830			502 3880 002
J-1910	Filter Box Terminal Board	TERMINAL BOARD, 10 terminals			830			571 2121 10
		RELAYS						
K-1901	Master Start Relay	RELAY, Contacts 3 PNO, coil 115 v DC			287			405 0019 00
K-1901	Alternate	RELAY, Contacts 3 PNO, coil 115 v DC	-29533		2050	G-33549		405 2203 10
K-1902	Carrier Relay	RELAY, Contacts 2 PNO, coil 7.2-14 v DC	-29523		287	R-30		405 0013 00
K-1902	Alternate	RELAY, Contacts 2 PNO, coil 7.2-14 v DC	-29524		2050	G-33402		405 2205 10
K-1903	Keying Relay	RELAY, Contacts 2 PDT, coil 115 v DC	-29525		287	R-39D		405 0015 00
K-1903	Alternate	RELAY, Contacts 2 PDT, coil 115 v DC	-29526		1820	JD115RR		405 2208 00

TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION (Cont.)

Symbol Designation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing and Part Number
		RELAYS (Cont.)						
K-1904	Plate Power Relay	RELAY, Contacts 2 PNO, coil 25-28 v DC	-29531		287	R-39D		405 0014 00
K-1904	Alternate	RELAY, Contacts 2 PNO, coil 28 v DC nom	-29532		1820	JD28AA		405 2206 00
		INDUCTORS AND REACTORS						
L-1901	14 v Output Filter	REACTOR, 0.15 hy 1.0 amp 2500 v	-302062		780			678 2600 00
L-1902	400 v Output Filter	REACTOR, 6 hy 0.3 amp, 2500 v	-302061		780			678 2390 00
L-1903	1150 v Output Filter	REACTOR, 6 hy 0.4 amp, 10,000 v	-302063		780			678 1510 00
L-1904	14 v Output Noise Filter	CHOKE, 22 microh	-47902		1384 3030	 RF-583		240 5400 00
L-1905	14 v Output Noise Filter	CHOKE, 22 microh	-47902		1384 3030	 RF-583		240 5400 00
L-1906	28 v Output Noise Filter	CHOKE, 22 microh	-47902		1384 3030	 RF-583		240 5400 00
L-1907	28 v Output Noise Filter	CHOKE, 22 microh	-47902		1384 3030	 RF-583		240 5400 00
L-1908	LV Dynamotor Input Filter	CHOKE, 22 microh	-47902		1384 3030	 RF-583		240 5400 00
L-1909	LV Dynamotor Input Filter	CHOKE, 22 microh	-47902		1384 3030	 RF-583		240 5400 00
L-1910	HV Dynamotor Input Filter	CHOKE, 22 microh	-47902		1384 3030	 RF-583		240 5400 00
L-1911	HV Dynamotor Input Filter	CHOKE, 22 microh	-47902		1384 3030	 RF-583		240 5400 00
L-1912	400 v Output Noise Filter	CHOKE, 1.0 mh 300 ma Pie wound	-47895		3220 3090	R-300U		240 5800 00
L-1913	400 v Output Noise Filter	CHOKE, 1.0 mh 300 ma Pie wound	-47895		3220 3090	R-300U		240 5800 00

10462

TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION (Cont.)

Symbol Designation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing and Part Number
		INDUCTORS AND REACTORS (Cont.)						
L-1914	400 v Output Noise Filter	CHOKE, 1.0 mh 300 ma	-47895		3220 3090	R-300U		240 5800 00
L-1915	1150 v Output Noise Filter	CHOKE, 1.0 mh 300 ma	-47895		3220 3090	R-300U		240 5800 00
L-1916	1150 v Output Noise Filter	CHOKE, 1.0 mh 300 ma	-47895		3220 3090	R-300U		240 5800 00
L-1917	1150 v Output Noise Filter	CHOKE, 1.0 mh 300 ma	-47895		3220 3090	R-300U		240 5800 00
L-1918	1150 v Output Noise Filter	CHOKE, 1.0 mh 300 ma	-47895		3220 3090	R-300U		240 5800 00
L-1919	Line Filter	CHOKE, 22 microh	-47902		1384 3030	 RF-583		240 5400 00
L-1920	Line Filter	CHOKE, 22 microh	-47902		1384 3030	 RF-583		240 5400 00
		PLUGS						
P-1901	HV Dynamotor Connector Plug	CONNECTOR, chassis mount, 6 contact, male	CJC-49251		2580	P-406-AB1/16		363 2060 00
P-1902	LV Dynamotor Connector Plug	CONNECTOR, chassis mount, 6 contact,male	CJC-49251		2580	P-406-AB1/16		363 2060 00
		RESISTORS						
R-1901	Relay Current Limiting Resistor	RESISTOR, 63 ohms ±5% 120 w	63881-F		4250			733 0169 00
R-1902	Spark Filter Resistor	RESISTOR, 200 ohm ±20% 2 w	63705-201		2360	133-0200-7		709 2005 40
R-1902	Alternate	RESISTOR, 200 ohms ±5% 2 w	RW55E201					747 7533 00
R-1903	Meter Shunt	RESISTOR, Section #1: 13.4 ohms ±5% Section #2: 6.7 ohms ±5%	COM-633920		3450			717 4100 00

TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION (Cont.)

Symbol Desig-nation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Desig-nation	Spcl. Tol. or Mod.	Contractor's Drawing and Part Number
		RESISTORS (Cont.)						
R-1904	Spark Suppressor Resistor	RESISTOR, 200 ohms ±20% 2 w	63705-201		2360	133-0200-7		709 2005 40
R-1904	Alternate	RESISTOR, 200 ohm ±5% 2 w	RW55E201					747 7533 00
R-1905	Pilot Light Dropping Resistor	RESISTOR, 1000 ohms ±5% 20 w	63011F		4250			733 1661 00
R-1905	Alternate	RESISTOR, 1000 ohms ±5% 20 w	RW15F102					746 2540 00
R-1906	Line Voltage Bleeder	RESISTOR, 100,000 ohms ±20% 1/2 w	RC21BF104					745 2171 00
R-1906	Alternate	RESISTOR, 100,000 ohms ±20% 1/2 w	RC20BF104					745 1171 00
		SWITCHES						
S-1902	4 Wire Power Switch	TOGGLE SWITCH, SPST 1 amp 250 v	-24567		2160	20994-ET		266 1010 00
S-1905	Panel Interlock Switch	SWITCH, push toggle, SPNO, 3 amp 250 v			2160	3592-N		266 1050 00
S-1905	Alternate	SWITCH, push toggle, SPNO, 0.5 amp 125 v DC	-24195		1881			266 0001 00
S-1905	Alternate	SWITCH, push toggle, SPNO, 0.5 amp 125 v DC	-24563		1883	1GA19A44		266 0003 00
S-1906	EMERGENCY Switch	SWITCH DPST, 20 amp 250 v AC	-24458		1010	7402		260 0007 00
S-1907	4 WIRE - 6 WIRE Selector Switch	SWITCH, toggle, 3 PDT, 10 amp 250 v AC	-24565		1010	8660		260 0008 00
S-1908	LOCAL-REMOTE Switch	SWITCH, lever multi contact	-24566		830			502 0210 004
S-1909	ON Push Button	PUSH BUTTON, Black, normally open and closed contacts			2160	B-2		260 2020 00
S-1910	OFF Push Button	PUSH BUTTON, Red, normally open and closed contacts			2160	B-2		260 2030 00
		TRANSFORMERS						
T-1901	Audio Coupling	TRANSFORMER, audio Pri: tapped at 200, 400, 600 ohms. Sec: tapped at 42, 60, 82, and 106 ohms	-302040		780			677 2610 00

TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION
FOR NAVY MODEL TCZ-2 TRANSMITTING EQUIPMENT

65X-10 CONTROL CABLE (500 4474 00D)
(From Remote Unit to Power Unit)

Symbol Desig-nation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Desig-nation	Spcl.Tol. or Mod.	Contractor's Drawing and Part Number
		PLUGS						
P-2301	Cable Connector Plug	CONNECTOR, 27 terminal	-49950		630	NK-27-21C-11/16		371 4020 00
		CABLES						
S-2301	Connecting Cable	CABLE, 27 conductor						424 2710 00

TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION
FOR NAVY MODEL TCZ-2 TRANSMITTING EQUIPMENT

NAVY TYPE COL-47505 ANTENNA LOAD COIL

Symbol Desig-nation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Desig-nation	Spcl. Tol. or Mod.	Contractor's Drawing and Part Number
		CAPACITORS						
C-3001	Meter Series Capacitor	CAPACITOR, 0.0007 mf ±20% 5000 AC TV			4250 911	 PL-762-6LS		906 3701 40
C-3001	Alternate							938 2060 00
*C-3002	Relay Power Line Filter	CAPACITOR, 0.01 mf ±20% 500 v DC WV	-48643-A20		911 4030	4L H-10		910 1107 40
*C-3003	Relay Power Line Filter	CAPACITOR, 0.01 mf ±20% 500 v DC WV	-48643-A20		911 4030	4L H-10		910 1107 40
C-3004	Meter Series Capacitor	CAPACITOR, mica 200 mmf ±5% 5000 Peak WV						906 3201 00
C-3004	Alternate							938 2032 00
		MISCELLANEOUS ELECTRICAL PARTS						
E-3001	Ceramic Feedthru	INSULATOR, ceramic feedthru			830			507 7007 00
E-3002	Ceramic Feedthru Bowl	FEEDTHRU, ant lead in and xtmr ant to load coil terminals			830			507 7009 00
		JACKS AND RECEPTACLES						
J-3001	Relay Power Connector, Part of Relay K-3001	JACK, 2 terminal, part of Relay K-3001						
J-3002	Input Terminal	FEEDTHRU AND BINDING POST ASSEMBLY ceramic			830			571 1746 20
J-3003	Ground Terminal	BINDING POST, 5/8" push type			1320 4217	 10000 series		372 1410 00

10466

TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION (Cont.)

Symbol Designation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Designation	Spel. Tol. or Mod.	Contractor's Drawing and Part Number
		JACKS AND RECEPTACLES (Cont.)						
J-3004	Connection to Antenna Terminal on Transmitter	BINDING POST, 5/8" push type			1320 4217	 10000 series		372 2110 00
J-3005	ANT Connector Terminal	BINDING POST, 5/8" push type			1320 4217	 10000 series		 372 2110 00
J-3006	Relay Power Connector	CONNECTOR, 3 terminal chassis mounting type	-49937		630	WK-C3-32S		371 1040 00
		RELAYS						
K-3001	Antenna Keying Relay	RELAY, SPDT with vacuum contactor	-29520		2050	G32881		410 2100 00
		INDUCTORS AND REACTORS						
L-3001	200 to 575 kc Load Coil Assembly	INDUCTOR, loading coil assem			830			502 1708 003
L-3002	200 to 575 kc Variometer Assembly	VARIOMETER ASSEMBLY			830			502 1709 004
L-3003	Variometer and Load Coil Assembly 575 to 1500 kc	INDUCTOR, variometer and load coil assembly			830			502 1710 004
L-3005	Static Drain Choke	CHOKE, 6 mh multi-section dual lateral wound	-47907		950			240 5900 00
		METERS						
M-3001	Antenna Meter	THERMOAMMETER, 0-3 amp ±2% 30 scale divisions	-22438		4910	507		457 1140 00

TABLE 6-2
PARTS LIST BY SYMBOL DESIGNATION (Cont.)

Symbol Desig-nation	Function	Description	Navy or JAN Type Number	Navy Drawing or Spec.	Mfr. Code	Mfr's Desig-nation	Spcl.Tol or Mod.	Contractor's Drawing and Part Number
		PLUGS						
P-3001	Relay Connector	SOCKET CONNECTOR, chassis mounting 2 terminal	-49866		2580	S-302-AB		366 2020 00
		SWITCHES						
S-3001	Load Coil Selector Switch Assembly	TAP SWITCH, 2 position, DPDT			830			502 5300 004
S-3002	575 to 1500 kc Selector Switch	TAP SWITCH, ceramic insulation			830			502 1712 003
S-3003	200 to 575 kc Selector Switch	TAP SWITCH, ceramic insulation			830			502 5118 004
S-3004	K-3001 Relay Vacuum Contact	SWITCH, SPDT 8 amp 250 v vacuum sealed	-24163		1881	GL-34		260 6010 00

* Navy Type Number is for a suitable replacement part.
** Standard vacuum tubes are supplied by numerous well known manufacturers
*** The High Frequency Oscillator Unit assembly includes the 96K-1 Multiturn Autotune Unit"B" (Multiturn Unit includes Wick Lubricator Assem).

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TABLE 6-3

PARTS LIST BY NAVY TYPE NUMBERS

Quan	Navy Type Number	All Symbol Designations Involved
	MOTOR	
1	-211476	B-101
	CAPACITORS	
1	-48197-C20	C-1911
1	-48312-B10	C-1922 Alternate
2	-48312-B20	C-1907, C-1908
4	-48403-B20	C-1901, C-1902, C-1909, C-1915
2	-48410-B20	C-106, C-117
6	-48643-A20	C-1910, C-1913, C-1914, C-1918, C-3002, C-3003
2	-48710-B10	C-2205, C-2206
1	-48713-B20	C-121
2	-48777-10	C-1920, C-1921
1	-48777-20	C-126
4	-48789-B20	C-107, C-119, C-120A, C-120B
1	-481033-B20	C-3001
1	-481223-20	C-2211
1	-481279-B20	C-402
1	-481319-F1	C-409B
1	-481327-C5	C-2213 Alternate
1	-481385-F1	C-405C
2	-481409-B10	C-108, C-116
1	-481410-B10	C-205
1	-481411-B10	C-204
1	-481411-B20	C-127
2	-481417-20	C-1905, C-1906
2	-481506-B20	C-209 Alternate, C-210 Alternate
1	-481677-1	C-101
1	-481678-1	C-102-C-103-C-104
2	-481679	C-111, C-115
1	-481680	C-411
1	-481681	C-136
1	-481682	C-408B
1	-481683-2	C-410A
1	-481684-2	C-406
3	-481685-2	C-403, C-408C, C-412
1	-481686-2	C-409C
1	-481687-1	C-407
1	-481688-1/2	C-404
1	-481689-10	C-130
3	-481690-10	C-122A, C-122B, C-129
3	-481691-5	C-124A, C-124B, C-124C

TABLE 6-3

PARTS LIST BY NAVY TYPE NUMBERS

Quan.	Navy Type Number	All Symbol Designations Involved
	CAPACITORS (Cont.)	
5	-482111-B20	C-109, C-110, C-113, C-114, C-401
1	-482934-20	C-1917
2	-482935-20	C-1903, C-1904
5	-482936-10	C-203, C-2207, C-2208, C-2209, C-2210
1	-482937-20	C-138
1	-482938-B5	C-105
2	-482939-B20	C-132, C-133
1	-482940-B10	C-137
2	-482942-B20	C-118, C-128
1	-482947-10	C-112
1	-482948-5	C-131
1	-482949-10	C-206
5	-482951-F10	C-405A, C-405B,C-409A, C-410B, C-410C
2	-482952-F1	C408A, C-410D
6	-482956	C-201, C-202, C-207, C-208, C-1919, C-1923
2	-482959	C-134, C-135
3	-482977-10	C-1101, C-1102, C-1103
2	CE630200J	C-1919 Alternate, C-1923 Alternate
1	-CM 20C 300M	C-2213
2	-CM 35B 103M	C-209 Alternate, C-210 Alternate
1	CP50B1FF104K	C-1911 Alternate,
4	CP50B1FF205X	C-1901 Alternate, C-1902 Alternate, C-1909 Alternate, C-1915 Alternate
1	CP51B4FF104V	C-1922
2	CP51B4FF104X	C-1907 Alternate, C-1908 Alternate
4	CP53B1FF205X	C-1901 Alternate, C-1902 Alternate, C-1909 Alternate, C-1915 Alternate
2	CP70B1FF205V	C-1920 Alternate, C-1921 Alternate
2	CP70E1FJ405V	C-1905 Alternate, C-1906 Alternate
1		C-125
2		C-209, C-210
2		C-1912, C-1916
3		C-2201, C-2202, C-2203

TABLE 6-3

PARTS LIST BY NAVY TYPE NUMBERS

Quan.	Navy Type Number	All Symbol Designations Involved
	CAPACITORS (Cont.)	
1		C-2204
1		C-2212
1		C-2214
1		C-3004
	DYNAMOTORS	
1	CAEN-211622	D-1902
1	CAEN-211623	D-1901
	MISCELLANEOUS ELECTRICAL PARTS	
1	-61152	E-401
1	-61170	E-105
1	-61415	E-402
1	-61503	E-104
2	-61511	E-103A, E-1911 Alternate
1	-61512	E-106A
1	-61513	E-107
2	NS 3W 4102	E-109B, E-1902 Alternate
1	NS 4W 4102	E-1902
1	NS 4W 4204	E-1901
2		E-102, E-901
1		E-103B
1		E-106B
1		E-108
2		E-1701, E-1702
1		E-1904
2		E-1907, E-1908
1		E-3001
1		E-3002
1		E-3003
	FUSES	
2		F-1901, F-1902
3		F-1903, F-1904, F-1905
1		F-1906
1		F-1907
1		F-1908
	PILOT LAMPS	
2		I-101, I-901
2		I-1901, I-1902

TABLE 6-3

PARTS LIST BY NAVY TYPE NUMBERS

Quan.	Navy Type Number	All Symbol Designations Involved
	JACKS AND RECEPTACLES	
6	-49025A	J-101, J-103, J-104, J-105, J-901, J-904
2	-49039	J-102, J-903
1	-49566	J-111
1	-49663	J-112
1	-49932	J-106
1	-49933	J-107
1	-49934	J-108
1	-49935	J-115
1	-49936	J-116
1	-49937	J-3006
1	-49938	J-1901
1	-49939	J-1902
2	-49942	J-1906, J-1907
1		J-109
1		J-110
2		J-113, J-3003
1		J-114
3		J-117, J-3004, J-3005
1		J-118
1		J-902
1		J-1903
1		J-1904
1		J-1905
1		J-1908
1		J-1909
1		J-1910
1		J-3001
1		J-3002
	RELAYS	
1	-29513	K-101
1	-29519	K-105
1	-29520	K-3001
1	-29523	K-1902
1	-29524	K-1902 Alternate
1	-29525	K-1903
1	-29526	K-1903 Alternate
1	-29531	K-1904
1	-29532	K-1904 Alternate
1	-29533	K-1901 Alternate
1	-29604	K-101 Alternate
1	-29605	K-102
1	-29606	K-102 Alternate
1	-29607	K-103
1	-29609	K-104

TABLE 6-3

PARTS LIST BY NAVY TYPE NUMBERS

Quan.	Navy Type Number	All Symbol Designations Involved
	RELAYS (Cont.)	
1	-29610	K-104 Alternate
1		K-1901
	INDUCTORS AND REACTORS	
9	-47895	L-116, L-117, L-1912, L-1913, L-1914, L-1915, L-1916, L-1917, L-1918
10	-47902	L-1904, L-1905, L-1906, L-1907, L-1908, L-1909, L-1910, L-1911, L-1919, L-1920
4	-47903	L-102, L-103, L-115, L-403
1	-47904	L-104
1	-47905	L-107
1	-47906	L-108
2	-47907	L-109, L-3005
1	-47908	L-402
1	-47909	L-110
1	-302061	L-1902
1	-302062	L-1901
1	-302063	L-1903
1	-302095	L-2201
1		L-101
1		L-105
1		L-106
1		L-112
1		L-113
1		L-114
1		L-401
1		L-3001
1		L-3002
1		L-3003
	LOUD SPEAKERS	
1	-49437	LS-901
	METERS	
1	-22438	M-3001
1	-22499	M-101
1	-22500	M-101
1	-22501	M-102
1	-22502	M-102

TABLE 6-3

PARTS LIST BY NAVY TYPE NUMBERS

Quan.	Navy Type Number	All Symbol Designations Involved
	PLUGS	
1	-49661	P-401
1	-49662	P-201
1	-49866	P-3001
1	-49944	P-101
1	-49946	P-901
1	-49947	P-1501
1	-49948	P-1701
1	-49949	P-1702
1	-49950	P-2301
2	CJC-49251	P-1901, P-1902
1	U-7/U	P-1601
1	U-8/U	P-1502
1	U-9/U	P-1602
1		P-102
1		P-2201
	RESISTORS	
1	-63011F	R-1905
2	-63288-104	R-102, R-107
2	-63288-153	R-401, R-2209
1	-63288-182	R-901
1	-63288-221	R-2217 Alternate
1	-63288-222	R-207
1	-63288-223	R-101
1	-63288-224	R-2211
5	-63288-470	R-103, R-104, R-106, R-108, R-112
1	-63291-101	R-202
2	-63291-221	R-201, R-204
1	-63355-104	R-211
1	-63355-153	R-203
1	-63355-222	R-2215
1	-63355-474	R-212
1	-63355-754	R-213
2	-63360-104	R-2202, R-2212A
1	-63360-105	R-208
2	-63360-154	R-2204, R-2216
2	-63360-224	R-209, R-2212B
1	-63360-333	R-2208
3	-63360-473	R-2203, R-2205, R-2206
4	-63360-474	R-205, R-210, R-2213, R-2214
1	-63535-10	R-133
1	-63678-100	R-135
2	-63678-221	R-216, R-2217

TABLE 6-3

PARTS LIST BY NAVY TYPE NUMBERS

Quan.	Navy Type Number	All Symbol Designations Involved
	RESISTORS (Cont.)	
1	-63678-750	R-134
2	-63703-251	R-214, R-215
2	-63705-201	R-1902, R-1904
1	-63881-F	R-1901
1	-631874-20 Pot plus two RC21BE511M resistors	R-902
1	-632958-2-1/2	R-2207
2	-633157-10	R-129, R-130
1	-633182-10	R-2210
1	-633225-10	R-206
1	-633226-10	R-131
1	-633227-10	R-116
1	-633229-10	R-123
1	-633230-10	R-115
1	-633239-10	R-121
3	-633240-10	R-105, R-109, R-110
1	-633241-10	R-124
4	-633242-10	R-117, R-118, R-119, R-120
1	-633243-2	R-128
1	-633244-2	R-132
1	-633245-2	R-111
1	-633249	R-2201
1	COM-633920	R-1903
1	RC20BF104	R-1906 Alternate
1	RC21BF104	R-1906
1	RW15F102	R-1905 Alternate
2	RW55E201	R-1902, Alternate R-1904 Alternate
3		R-113, R-114, R-136
1		R-137
	SWITCHES	
2	-24003-A	S-201, S-901
1	-24195	S-1905 Alternate
1	-24458	S-1906
1	-24560	S-104
1	-24563	S-1905 Alternate
1	-24565	S-1907
1	-24566	S-1908
1	-24567	S-1902
1	-24569	S-112
1	-24570	S-115
1	-24571	S-113D
1	-24572	S-114

TABLE 6-3

PARTS LIST BY NAVY TYPE NUMBERS

Quan.	Navy Type Number	All Symbol Designations Involved
	SWITCHES	
1	-24573	S-111
2	CG 24163	S-116, S-3004
1		S-101
1		S-102
1		S-103
1		S-105
1		S-106
1		S-107
1		S-108
1		S-109
1		S-110
1		S-113
1		S-202
1		S-401
1		S-1905
1		S-1909
1		S-1910
1		S-3002
1		S-3003
	TRANSFORMERS	
1	-47912	T-102
1	-302035	T-101
1	-302036	T-201
1	-302037	T-202
1	-302038	T-203
1	-302039	T-901
1	-302040	T-1901
	VACUUM TUBES	
2	6V6GT	V-202, V-203
1	12SA7	V-2202
1	12SJ7	V-201
2	12SL7GT	V-2201, V-2203
2	811	V-105, V-106
1	813	V-104
1	837	V-101
3	1625	V-102, V-103, V-401
	CABLES	
1		W-1501
1		W-1601
1		W-1701
1		W-2301

TABLE 6-3

PARTS LIST BY NAVY TYPE NUMBERS

Quan.	Navy Type Number	All Symbol Designations Involved
	SOCKETS	
2	-49362	X-105, X-106
4	-49366	X-101, X-102, X-103, X-401
1	-49384	X-104
6	-49423	X-201, X-202, X-203, X-2201, X-2202, X-2203
1	-49951	X-2204
	CRYSTALS	
1	CR-2-B/U (200 kc)	Y-2201
	TUNED CIRCUIT ASSEMBLIES	
1	-47911	Z-2202
1	-47923	Z-2201

TABLE 6-4
EQUIPMENT SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR NAVY MODEL TCZ-2 TRANSMITTING EQUIPMENT

Quantity	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
			MOTORS					
1	-211476	B-101	Motor, 1/20 hp, 28 v DC		1390			508 0818 31
	-211476	Alternate B-101	Motor, 1/20 hp, 28 v DC		1740	NY-818C		508 0818 33
2		B-101	Bearing, for AUTOTUNE motor		3330	77037		309 1220 00
		Alternate B-101	Bearing, for AUTOTUNE motor		1390	37DD		234 0068 00
10		B-101	Brush for 508 0818 33		1740	F811		234 1302 00
10		B-101	Brush for 508 0818 31		1390	94718-A		234 1300 00
2		B-101	Holder, Brush for 508 0818 33		1740	FF-830		234 0066 00
1		B-101	Holder, Brush for 508 0818 31		1390	94717-B		234 0069 00
2		B-101	Cap, Brush holder		1390	96254-A		234 0058 00
2		B-101	Cap, Brush holder		1740	F-825		234 0060 00
			CAPACITORS					
1	-48197-C20	C-1911	Capacitor, Paper .1 mf ±20% 600 WV		4250 911 4210			956 2018 40
1	-48197-C20	C-1912, C-1916	Capacitor, Paper .1 mf ±20% 1500 WV		911 4250	DYR 15010		930 0012 00
1	-48312-B	C-1907, C-1908	Capacitor, Paper 2 x .1 mf ±20% 600 WV		911 4250 4210	DYRT 2527-9 2XDRTM		956 4016 40
1	-48312-B10	C-1922A, C-1922B	Capacitor, Paper 2 x .1 mf ±10% 600 WV		911 4250 4210	DYRT 2527-9 2XDRTM		956 4016 20
	-48312-B20	Alternate C-2212A, C-2212B	Capacitor, Paper 2-0.1 mf ±10% 600 WV		911 4210 4250	DYRT-6011 2XDRTM 2527-9		956 4016 40 or 956ND01W-K

TABLE 6-4
EQUIPMENT SPARE PARTS LIST BY NAVY TYPE NUMBERS

Quantity	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
			CAPACITORS (Cont.)					
2	-48403-B20	C-1901, C-1902, C-1909, C-1915	Capacitor, Paper 2 mf ±20% 400 WV		911			954 2484 00
		Alternate						
	-48403-B20	C-1901, C-1902, C-1909, C-1915	Capacitor, Paper 2 mf ±20% 400 WV		911			954 2444 00
1	-48410-B20	C-106, C-117	Capacitor, Mica .006 mf ±20% 1000 TV		911 4030	4LS HLS-10		910 2603 40 or 910N260C-M
2	-48643-A20	C-1910, C-1913, C-1914, C-1918, C-3002, C-3003	Capacitor, Mica .01 mf ±20% 1000 TV		911 4030	4L H-10		910 1107 40 or 910N110G-M
1	-48710-B10	C-2205, C-2206	Capacitor, Mica .00001 mf ±10% 1000 TV		911 4030	5WS KS		909 4107 52 or 909N410GN-K
1	-48713-B20	C-121A, C-121B, C-121C	Capacitor, Paper, triple sect 0.1 mf ±20% 600 WV		911 4210	DYRT-6111 3XDMRT6.1		956 0001 00
1	-48777-10	C-1920, C-1921	Capacitor, Paper 2 mf ±10% 600 WV		911 1640 1880	KG-3020 A7649 67X2		930 7822 00
		Alternate						
	-48777-20	C-126	Capacitor, Paper, oil filled 2.0 mf ±20% 600 WV		911	KG-3020		930 7824 00 or 930N78B-M
1	-48789-B20	C-107	Capacitor, Mica .002 mf ±20% 1000 TV		911 4030	4LS HLS-10		910 2203 40 or 910N220C-M
1	-48789-B20	C-119	Capacitor, Mica .002 mf ±20% 2500 TV		911 4030	4LS HLS-25		925 2203 40 or 925N220C-M
1	-48789-B20	C-120A, C-120B	Capacitor, Mica .002 mf ±20% 5000 TV		911 4030	4LS HLS-50		950 2203 40 or 950N220C-M
		Alternate						
	-48847-B20	C-2201, C-2202, C-2203	Capacitor, Mica .006 mf ±20% 900 TV		4030 911	CLS 1WLS		909 2603 54

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TABLE 6-4
EQUIPMENT SPARE PARTS LIST BY NAVY TYPE NUMBERS

Quantity	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
			CAPACITORS (Cont.)					
1	-481033-B20	C-3001	Capacitor, Mica .0007 mf ±20% 5000 WV		911 4030	6LS F2		906 3701 40 or 906N370A-M
1	-481279-B20	C-402	Capacitor, Mica .00005 mf ±20% 900 TV		4030 911	Type "C" 1WL		909 4503 40 or 909N450C-M
1	-481319-F1	C-409B	Capacitor, Mica .0004 mf ±1% 500 TV		4170			912 3408 60 or 912N340H-F
	-481327-C5	Alternate C-2213	Capacitor, Mica 30 mmf ±5% 500 WV		911	5R		912 4303 10 or 912N430C-J
1	-481385-F1	C-405C	Capacitor, Mica .001 mf ±1% 500 TV		4170			912 2108 60 or 912N210H-F
1	-481409-B10	C-108,C-116	Capacitor, Mica .0005 mf ±10% 1500 TV		4030	BE-15		915 3505 20
1	-481410-B	C-205	Capacitor, Mica .001 mf ±10% 1500 TV		4030	BE-15		915 2105 20 or 915N210E-K
1	-481411-B	C-204	Capacitor, Mica .006 mf ±10% 1500 TV		4030	BE-15		915 2605 20 or 915N260E-K
1	-481411-B20	C-127	Capacitor, Mica .006 mf ±20% 1500 TV		4030	BE-15		915 2605 40 or 915N260E-M
1	-481417-20	C-1905,C-1906	Capacitor, Paper 4 mf ±20% 2000 WV		911	TJU-20040		930 4040 00
	-481425-B20	Alternate C-2214	Capacitor, Mica .005 mf ±20% 600 TV		911 4030 4210	3WLS JLS MKBW		909 2506 40
	-481506-B20	Alternate C-209,C-210	Capacitor, Mica 10,000 mmf ±20% 600 TV DC		911	1WL		909 0002 00
1	(481677-1)	C-101	Capacitor, Ceramic) .000185 ±1% 1000 TV)		4210			571 1433 30 or GA-1433C

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TABLE 6-4
EQUIPMENT SPARE PARTS LIST BY NAVY TYPE NUMBERS

Quantity	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
			CAPACITORS (Cont.)					
	(Refer to C-101)	C-102, C-103, C-104	Set of 3 matched ceramic capacitors total 413 mmf ±1% 1000 TV					
1	-481679	C-111, C-115	Capacitor, Ceramic 6 section, variable, 1000 TV		700	828-003		917 6130 00
1	-481680	C-411	Capacitor, Ceramic 5 sect variable 1000 TV		700	826-003		917 5110 00 or 917N5A1
1	-481681	C-136	Capacitor, Ceramic 13 mmf variable		700	822-009		917 1010 00 or 917N101
1	-481682-2	C-408B	Capacitor, Mica .00015 mf ±2% 1000 TV		700	810-250		913 0017 00
1	-481683-2	C-410A	Capacitor, Mica .00025 mf ±2% 1000 TV		700	810-290		913 0024 00 or 913N325N7-G
1	-481684-2	C-406A	Capacitor, Mica .000125 mf ±2% 1000 TV		700	814-106		913 0001 00
1	-481685-2	C-403, C-408C, C-412	Capacitor, Ceramic .0003 mf ±2% 1000 TV		700	816-035		913 3307 00 or 913N330-G
1	-481686-2	C-409C	Capacitor, Mica .00035 mf ±2% 1000 TV		700	816-041		913 0014 00
1	-481687-1	C-407	Capacitor, Ceramic Set of 3 matched capacitors total .00088 mf ±1% temp coef: Neg 32 PPM/°C +15 -61 PPM/°C		700	816-043		913 1200 00
1	-481688-½	C-404	Capacitor, Ceramic Set of 3 matched capacitors total .00083 mf ±½% 500 WV		700	816-044		913 1100 00 or 913NA1
1	-481689-10	C-130	Capacitor, Ceramic 25 mmf ±10% 1500 TV		700	850-001		913 4253 20 or 913N425C-K
1	-481690	C-122A, C-122B, C-129	Capacitor, Ceramic 50 mmf ±10% 1500 TV		700	850-002		913 4503 20 or 913N450C-K

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TABLE 6-4
EQUIPMENT SPARE PARTS LIST BY NAVY TYPE NUMBERS

Quantity	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's Desig-nation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
			CAPACITORS (Cont.)					
1	-481691	C-124A, C-124B, C-124C	Capacitor, Ceramic 67 mmf ±5% 1500 TV		700	850-003		913 4673 10 or 913N467C-J
1	-482111-B20	C-109, C-110, C-113, C-114, C-401	Capacitor, Mica .002 mf ±20% 1500 TV		4030	BE-15		915 2205 40
1	-482410-20	C-2211	Capacitor, Paper .5 mf ±20% 600 WV		911 4210	DYR-6050 X-DMR6-.5		956 0006 00 or 956NSOBYX1-M
1	-482934-20	C-1917	Capacitor, Paper 4 mf ±20% 50 WV		911	PC9B36		930 0013 00
1	-482935-20	C-1903, C-1904	Capacitor, Paper 8 mf ±20% 800 WV		911	KG-U-4080		930 1940 00
3	-482936-10	C-203, C-2207, C-2208, C-2209, C-2210	Capacitor, Paper oil filled .05 mf +20% -10% 600 WV		3030			930 0010 00
1	-482937-20	C-138	Capacitor, Paper .1 mf ±20% 600 WV		1640 3030			930 0006 00
1	-482938-B5	C-105	Capacitor, Mica .005 mf ±5% 2500 TV		911 4030	4LST HLST		925 2502 10 or 925N250K-J
1	-482939-B20	C-132, C-133	Capacitor, Mica .004 mf ±20% 600 TV		911 4030	3WS JS		909 2406 40 or 909N240F
	-482940-B10	Alternate C-137	Capacitor, Mica .0015 mf ±10% 900 TV		4210 4030			909 2156 20 or 909N215F-K
1	-482941-B10	C-3004	Capacitor, Mica 200 mmf ±10% 5000 TV		911 4030	6L F		906 3202 00
1	-482942-B20	C-118, C-128	Capacitor, Mica .002 mf ±20% 7500 TV		4030	A2LS		975 2201 40 or 975N220A-M
1	-482947-10	C-112	Capacitor, Mica .00025 mf ±10% 1500 TV		4030	BE-15		915 3255 20
1	-482948	C-131	Capacitor, Mica .0008 mf ±5% 1000 TV		4030	BE-10		910 3805 10 or 910N380E-J

TABLE 6-4
EQUIPMENT SPARE PARTS LIST BY NAVY TYPE NUMBERS

Quantity	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
			CAPACITORS (Cont.)					
1	-482949-10	C-206	Capacitor, Mica .003 mf ±10% 1500 TV		4030	BE-15		915 2305 20 or 915N230E-K
1	-482951-F10	C-405A,C-405B, C-409A,C-410B C-410C	Capacitor, Mica .002 mf ±1% 500 TV		4170			912 2208 60 or 912N220H-F
1	-482952-F1	C-408A,C-410D	Capacitor, Mica .0015 mf ±1% 500 TV		4170			912 2158 60
6	-482956	C-201,C-202, C-207,C-208, C-1919,C-1923	Capacitor, Electrolytic 20 mf +100% -10% 100 v		911 3030	RVL-10051-1 SPO 38482		183 3310 00 or 183N33A
1	-482959	C-134,C-135	Capacitor, Midget variable 28 mmf 1000 TV		3410			922 5100 00 or 922N51
	-482959	Alternate C-134, C-135	Capacitor, Midget variable 28 mmf 1000 TV		230			922 0007 00
1	-482977-10	C-1101, C-1102, C-1103	Capacitor, Mica 25 mmf ±10% 10,000 TV		30	1860-201		914 1762 00 or 914N1X6-K
1	CM20B201	C-2204	Capacitor, Mica .0002 mf ±5% 1000 TV		4170			935 0118 00
1	CM20C300	C-2213	Capacitor, Mica 30 mmf ±5% 500 WV					935 0144 00
	CM30C152	Alternate C-137	Capacitor, Mica .0015 mf ±2% 1000 TV					935 4109 00
1	CM35B103	C-209,C-210	Capacitor, Mica .01 mf ±20% 600 TV					935 2118 00
1	CM35B152	C-137	Capacitor, Mica .0015 mf ±5% 1000 TV					935 2081 00
1	CM35B512	C-2214	Capacitor, Mica 5100 mmf ±5% 1000 TV					935 2105 00

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TABLE 6-4
EQUIPMENT SPARE PARTS LIST BY NAVY TYPE NUMBERS

Quantity	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
			CAPACITORS (Cont.)					
1	CM35B622	C-2201, C-2202, C-2203	Capacitor, Mica 6200 mmf ±5% 1000 TV					935 2108 00
	CM40B512	Alternate C-2214	Capacitor, Mica 5100 mmf ±5% 1000 TV					935 3035 00
	CM45B202	Alternate C-107	Capacitor, Mica .002 mf ±5% 1200 WV					936 0268 00
	CM45B202	Alternate C-119	Capacitor, Mica .002 mf ±5% 2000 TV					936 0268 00
	CM70B201	Alternate C-3004	Capacitor, Mica 200 mmf ±5% 5000 TV					938 2032 00
	CM70B751	Alternate C-3001	Capacitor, Mica 750 mmf ±5% 5000 WV					938 2060 00
	CN35A103	Alternate C-209, C-210	Capacitor, Paper .01 mf +60% -20% 400 WV					934 0003 00
	CN35A602	Alternate C-2201, C-2202, C-2203	Capacitor, Paper .006 mf +60% -20% 600 WV		911	ASA: CN 35A602		934 0002 00
	CP50B1FF-104K	Alternate C-1911	Capacitor, Paper .1 mf ±10% 600 WV					961 4018 00
	CP50B1FF-205X	Alternate C-1901, C-1902, C-1909, C-1915	Capacitor, Paper 2 mf +40% -15% 600 WV					961 4070 00

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TABLE 6-4

EQUIPMENT SPARE PARTS LIST BY NAVY TYPE NUMBERS

Quantity	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
			CAPACITORS (Cont.)					
1	CP50B4FF-104L	C-2212A, C-2212B	Capacitor, Paper 2-0.1 mf ±15% 600 WV					961 5036 00
	CP51B4FF-104V	Alternate C-1922A, C-1922B	Capacitor, Paper 2 x .1 mf +20% -10% 600 WV					961 5037 00
	CP51B4FF-104X	Alternate C-1907, C-1908	Capacitor, Paper 2 x .1 mf +40% -15% 600 WV					961 5038 00
	CP53B1FF-205X	Alternate C-1901, C-1902, C-1909, C-1915	Capacitor, Paper 2 mf +40% -15% 600 WV					961 4062 00
	CP70B1FF-205V	Alternate C-1920, C-1921	Capacitor, Paper 2 mf +20% -10% 600 WV					962 4010 00
1	CP70B1FF-205X	C-126	Capacitor, Paper, oil filled 2.0 mf +40% -15% 600 WV					962 4011 00
	CP70E1FJ-405V	Alternate C-1905, C-1906	Capacitor, Paper 4 mf +20% -10% 2000 WV					962 4013 00
			DYNAMOTOR PARTS					
10		D-1901, D-1902	Brush, Pos Input for 231 0028 00 and 231 0029 00, .874" diam x 1-23/32" lg		4960	A-8469		234 0124 00
40		D-1901, D-1902	Brush, Neg Input for 231 0028 00 and 231 0029 00, .87" diam x 1-23/32" lg		4960	A-8489-1		234 0125 00
20		D-1901	Brush, Pos LV for 231 0028 00, .87" diam x 1-23/32" lg		4960	A-5743		234 0127 00

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TABLE 6-4

EQUIPMENT SPARE PARTS LIST BY NAVY TYPE NUMBERS

Quantity	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
			DYNAMOTOR PARTS (Cont.)					
20		D-1901	Brush, Neg LV for 231 0028 00, .3" diam x 1-9/16" lg		4960	A-5743-1		234 0126 00
20		D-1901	Brush, Pos HV, for 231 0028 00, .43" diam x 1-27/32" lg		4960	A-8410		234 0129 00
20		D-1901	Brush, Neg HV, for 231 0028 00, .43" diam x 1-27/32" lg		4960	A-8410-1		234 0128 00
20		D-1902	Brush, Pos LV, for 231 0029 00, .3" diam x 1-23/32" lg		4960	A-6556		234 1261 00
20		D-1902	Brush, Neg LV, for 231 0029 00 .3" diam x 1-23/32" lg		4960	A-6556-1		234 1271 00
20		D-1902	Brush, Pos HV, for 231 0029 00, .21" diam x 1-1/2" lg		4960	A-5742		234 1241 00
20		D-1902	Brush, Neg HV for 231 0029 00, .21" diam x 1-1/2" lg		4960	A-5742-1		234 1251 00
24		D-1901, D-1902	Holder, Brush, Pos and Neg Input, for 231 0028 00 and 231 0029 00, 2-5/8" x 1-3/16" x 1.3"		4960	A-6485		234 0073 00
12		D-1901	Holder, Brush, Pos and Neg LV for 231 0028 00, 1-21/32" x 31/32" x .87"		4960	A-8575		234 0130 00
12		D-1901	Holder, Brush, Pos and Neg HV, for 231 0028 00, 1-9/16" x 1-1/8" x .74"		4960	A-8572		234 0131 00

TABLE 6-4
EQUIPMENT SPARE PARTS LIST BY NAVY TYPE NUMBERS

Quantity	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
			DYNAMOTOR PARTS (Cont.)					
6		D-1902	Holder, Brush, Pos LV Output for 231 0029 00, 2-3/8" x 2-9/16" x .6"		4960	A-6487		234 0074 00
6		D-1902	Holder, Brush, Neg LV Output for 231 0029 00, 2-3/16" x 2-9/16" x 7/16"		4960	A-6673		234 0072 00
6		D-1902	Holder, Brush, Pos HV Output for 231 0029 00, 2-3/4" x 1" x 1-3/16"		4960	A-6489		234 0070 00
6		D-1902	Holder, Brush, Neg HV Output for 231 0029 00, 2-3/4" x 1" x 1-3/16"		4960	A-6489-1		234 0071 00
24		D-1901, D-1902	Cap, Brush Holder, Pos and Neg Input for 231 0028 00 and 231 0029 00, 15/16 - 27 thd, .46" thk		4960	A-6588		234 0056 00
24		D-1901, D-1902	Cap, Brush Holder, Pos and Neg LV for 231 0028 00 and 231 0029 00, 7/16 - 27 thd, 9/32" thk		4960	A-5065		234 4090 00
12		D-1901	Cap, Brush Holder, Pos or Neg HV, for 231 0028 00, 5/8 - 27 thd, 11/32" thk		4960	5635		234 4120 00
12		D-1902	Cap, Brush Holder, Pos or Neg HV, for 231 0029 00, 3/8 - 27 thd, 11/32" thk		4960	A-5125		234 0057 00
2		D-1901, D-1902	Field Coil, Replacement for 231 0028 00, 231 0029 00		4960	B-8568 (F-510)		234 0143 00
1		D-1901	Armature, Replacement for 231 0028 00		4960	C-8564 (A-513)		234 0141 00

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TABLE 6-4
EQUIPMENT SPARE PARTS LIST BY NAVY TYPE NUMBERS

Quantity	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
			DYNAMOTOR PARTS (Cont.)					
1		D-1902	Armature, Replacement for 231 0029 00		4960	C-8483 (A-512)		234 0142 00
2		D-1901, D-1902	Bearing, Replacement for 231 0028 00, 231 0029 00		4960	6211		234 0075 00
			MISCELLANEOUS ELECTRICAL PARTS					
2	-61152	E-401	Insulator, Feedthru, button ceramic 3/16 x 5/8		2410			190 2932 00
1	-61415	E-402	Insulator, Standoff, ceramic 3/8 x 1/2		2410	395L-1/2		190 2329 00 or 190NSL5
1	-61488	E-105	Insulator, Standoff, cyl ceramic 1/2 x 1		2410	397-L1		190 2327 00 or 190NSL3
4	-61503	E-104	Insulator, Standoff, ceramic 3/8-1/2 x 3/4		2410	GS-10		190 2570 00 or 190NSN7
	-61511	Alternate E-103A, E-1901	Insulator, Feedthru, ceramic 1/2-5/8 x 3/8		2410			190 2919 00
1	-61512	E-106A	Insulator, Feedthru, conical ceramic 3/4 to 7/8 OD x 7/8		2410			190 2921 00 or 190NBI21
3	-61513	E-107	Insulator, Bushing ~~insert~~ 3/16 x 5/8		2410			190 2929 00
	NS3W4102	~~Alternate~~ E-109B, E-1902	Insulator, Feedthru, conical ceramic 1/2 to 5/8 OD x 5/8		2410			190 2920 00
3	NS4W4102	E-109B, E-1902	Insulator, Ceramic bushing, 1/2-5/8 x 5/8					190 0002 00
4	NS4W4202	E-103A, E-1901	Insulator, Feedthru, ceramic 1/2-5/8 x 3/8					190 0006 00

TABLE 6-4
EQUIPMENT SPARE PARTS LIST BY NAVY TYPE NUMBERS

Quantity	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
			MISCELLANEOUS ~~ELECTRICAL~~ PARTS (Cont.)					
1	RE13A317	E-103B	Insulator, Feedthru, ceramic 1/2-5/8 x 5/8		2410			190 2925 00 or 190NBI25
1	RE13A317	E-106B	Insulator, Feedthru, conical ceramic 3/4 to 7/8 OD x 7/8		2410			190 2926 00 or 190NBI26
1		E-102, E-901	Pilot light bracket for miniature base bulb		1200	Cat. 80		262 1270 00 or 262N127
1		E-108	Insulator, Feedthru, bowl type		2410	YA-1685B		581 1685 20 or 1685B
3		E-401	Insulator, Bushing receptacle 1-1/8, 1-3/4 x 2-1/2					190 2917 00
1		E-1701, E-1702	Bushing, Rubber cable clamp reducer 7/16 OD .28 ID x 5/8		630	P		371 1110 00
2		E-1904	Ceramic Block for resistor clip		60			193 1000 00 or 193N1
1		E-1907, E-1908	Pilot lamp receptacle		1200	30		262 1230 00
1			Jewel, green		1200			262 2180 00
1			Jewel, red		1200			262 2160 00
2		E-3001	Feedthru, Ceramic		830			507 7007 00
1		(E-3001, J-3002)	Feedthru, xmtr to loading coil term		830			571 1746 20
1		E-3002	Feedthru~~, Antenna lead in~~ and xmtr ant to load coil ~~terminals~~		830			507 7009 00
1		E-3003	Shockmount, Meter M-3001 3/16" x 4" OD		4640			200 5360 00 or 200N536
1			Clip, for choke L-107		2920			265 3010 00
2			Clip, 3/8" ferrule		2920 2049			265 4010 00 or 265 1005 00
1			Clip, 9/16" ferrule					265 5010 00
1			Clip, 1-1/8" ferrule		2520		388-208	265 9020 00

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TABLE 6-4
EQUIPMENT SPARE PARTS LIST BY NAVY TYPE NUMBERS

Quantity	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's Desig-nation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
			MISCELLANEOUS ELECTRICAL PARTS (Cont.)					
1			Tube, Hold down, for V-101 V-102, V-103		830			571 1208 20
1			Tube, Hold down, for V-105 V-106		830			572 1208 20
			FUSES					
4		F-1901,F-1902	Fuse, Renewable cartridge 30 amp		2520	380-030		264 2301 00
20		F-1901,F-1902	Fuse, Renewable link for 264 2301 00, 30 amp		2520			264 2302 00
30		F-1903,F-1904 F-1905	Fuse, Non-renewable, 15 amp					264 6009 00
10		F-1906	Fuse, Non-renewable, 3 amp 1-1/2" long, 13/32" diam ends					264 6002 00
20		F-1907	Fuse, 1 amp 1000 v 3" long, 3/8" diam ends		2920	2104		264 7040 00
20		F-1908	Fuse, 1 amp 2500 v 4½" long, 3/8" diam ends		2920	2109		264 7090 00
			PILOT LAMPS					
4		I-101,I-901	Lamp, 28 v .17 amp miniature bayonet base		1881	T3-1/4		262 3270 00
4		I-1901,I-1902	Lamp, 12-16 v, .1 amp miniature bayonet base		1881	T3-1/4		262 3260 00
		Alternate	Lamp, 12-16 v, .1 amp miniature bayonet base					262 0019 00

TABLE 6-4
EQUIPMENT SPARE PARTS LIST BY NAVY TYPE NUMBERS

Quantity	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
			JACKS AND RECEPTACLES					
3	-49025A	J-101, J-103, J-104, J-105, J-901, J-904	Jack, 1 circuit for plugs with 1/4" barrel		3040 3240	SC1A		358 1040 00
1	-49039	J-102, J-903	Jack, 3 circuit		3030 3240	SCA2B		358 1050 00
1	-49566	J-111	Connector, 8 term female socket		2580	300		366 2080 00 or 366N208
1	-49572	J-114	Connector, 6 term female chassis mtg		2580	300		366 2060 00
1	-49663	J-112	Connector, 12 term female chassis mtg		2580	300		366 2120 00
1	-49932	J-106	Connector, 27 term female wall mtg		630	RNK-27-31SL		371 4039 00 or 371N403R
1	-49933	J-107	Connector, 3 term female wall mtg		630	RWK-C3-31SL		371 1059 00 or 371N105R
1	-49934	J-108	Connector, 10 term male wall mtg		630	FK-10-32S		371 5130 00 or 371N513
1	-49935	J-115	Connector, 12 term male octal style cable		200	70-12		369 1700 00
1	-49936	J-116	Connector, 15 term male chassis mtg		2580	300		366 2150 00 or 366N215
1	-49937	J-3006	Connector, 3 term chassis mtg type		630			371 1040 00
1	-49938	J-1901	Connector, 27 term, wall mtg type		630	NK-27-32S -2		371 4010 00
1	-49939	J-1902	Connector, 10 term wall mtg type		630	RFK-10-31SL-2		371 5119 00
1	-49942	J-1906, J-1907	Connector, 6 term wall mtg		830			500 2072 001
1		J-109, J-118	Binding Post, 5/8" push type		1320 4217	10,000 Series		372 2210 00 or 372N22A

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TABLE 6-4
EQUIPMENT SPARE PARTS LIST BY NAVY TYPE NUMBERS

Quantity	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
			JACKS AND RECEPTACLES (Cont.)					
1		J-110	Binding Post, 5/8" push type		1320 4217	10,000 Series		372 2410 00 or 372N24A
1		J-113, J-3003	Binding Post, 5/8" push type		1320 4217	10,000 Series		372 1410 00 or 372N14A
1		J-117	Binding Post, 5/8" push type		1320			372 2110 00
1		J-3004, J-3005	Binding Post, 5/8" push type					372 2410 00
1			Connector, 6 term socket chassis mtg type		2580	SS-6-AB1/16		364 2060 00
			RELAYS					
1	-29513	K-101	Relay, 3PDT, coil: 28 v DC		284	R-30-F		405 0012 00
	-29513	Alternate K-101	Relay, 3PDT, coil: 28 v DC		2050	G-33177		405 2201 10 or 405NB201A
	-29514-A	Alternate K-102	Relay, Multi-contact DT coil: 28 v DC		4310			410 0011 00
1	-29515	K-103	Relay, DPDT and SPST coil: 28 v DC		284	R22A		410 0012 00
	-29515	Alternate K-103	Relay, DPDT and SPST coil: 28 v DC		2050	G32811-A		410 0015 00
	-29515	Alternate K-103	Relay, DPDT and SPST coil: 28 v DC		2050	G32811		410 1700 00
1	-29516	K-104	Relay, DPDT, coil: 28 v DC		284	R-22-B		410 0013 00

TABLE 6-4
EQUIPMENT SPARE PARTS LIST BY NAVY TYPE NUMBERS

Quantity	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
			RELAYS (Cont.)					
	-29516	Alternate K-104			2050			410 0014 00
1	-29519	K-105	Relay, SPDT, SPNC & SPNO, coil: 18-32 v DC		2050	G-33304		410 0010 00
1	-29520	K-3001	Relay, SPDT coil: 28 v DC		2050	G-32881		410 2100 00 or 410N21
1	-29523	K-1902	Relay, 2PNO coil: 12 v DC		287	R-30		405 0013 00
	-29524	Alternate K-1902	Relay, 2PNO coil: 12 v DC		2050	G-33402		405 2205 10
1	-29525	K-1903	Relay, DPDT coil: 115 v DC		287	R-39D		405 0015 00
	-29526	Alternate K-1903	Relay, DPDT coil: 115 v DC		1820	JD 115RR		405 2208 00
1	-29531	K-1904	Relay, 2PNO coil: 28 v DC		287	R39D		405 0014 00
	-29532	Alternate K-1904	Relay, 2PNO coil: 28 v DC		1820	JD28AA		405 2206 00
1	-29533	K-1901	Relay, 3PNO coil: 115 v DC		2050	G-33549		405 2203 10
		Alternate K-1901	Relay, 3PNO coil: 115 v DC		287			405 0019 00
	-29604	Alternate K-101	Relay, 3PDT, coil: 28 v DC		1820	27D		405 0009 00
1	-29605	K-102	Relay, Keying type with vacuum switch, 3PNO, 1PNC, 2PDT coil, 28 v DC		2050	G-32877A		410 0008 00
			INDUCTORS AND REACTORS					
9	-47895	L-116, L-117, L-1912, L-1913, L-1914, L-1915, L-1916, L-1917, L-1918	Choke, 1 mh .3 amp duo-lateral wound		3090	R-300U		240 5800 00 or 240N58

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TABLE 6-4
EQUIPMENT SPARE PARTS LIST BY NAVY TYPE NUMBERS

Quantity	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
			INDUCTORS AND REACTORS (Cont.)					
10	-47902	L-1904, L-1905, L-1906, L-1907, L-1908, L-1909, L-1910, L-1911, L-1919, L-1920	Choke, 22 uh 55T #12 E		3030	RF583		240 5400 00
4	-47903	L-102, L-103, L-115, L-403	Choke, 2.5 mh .125 amp		3220 3090	R-100U		240 5300 00 or 240N53
1	-47904	L-104	Choke, 208 uh ±1% duo-lateral wound		4335			240 6000 00 or 240N60
1	-47905	L-107	Choke, 2.5 mh .125 amp		3220	R100		240 2100 00 or 240N2A
1	-47906	L-108	Choke, 100 uh ±10%		830	GA-1404C		571 1404 30 or GA-1404C
2	-47907	L-109, L-3005	Choke, 6 mh, multi section duo-lateral wound		950			240 5900 00 or 240N59
1	-47908	L-402	Choke, 8 mh, .125 amp		2140	CH-8		240 4100 00 or 240N4A
1	-47909	L-110	Choke, 190 mh ±10 mh		830	GA-1395C		571 1395 30
1	-302061	L-1902	Reactor, Filter, 6 hy .3 amp		780			678 2390 00
1	-302062	L-1901	Reactor, Filter .15 hy, 1 amp		780			678 2600 00
1	-302063	L-1903	Reactor, 6 hy +20% -0% .4 amp		780			678 1510 00
1	-302095	L-2201	Inductor, .25 hy to oscillate at 1000 cps with .1 mf capacitor		780	7822		678 2470 00
1		L-101	Inductor, HF osc tuning		830	GA-671D		571 0671 40
1		L-105	Inductor, 1st multiplier		830			571 1687 20 or GA-1687B
1		L-106	Inductor, 2nd multiplier plate 9-1/2 turns #24 wire		830			571 1686 20 or GA-1686B

TABLE 6-4
EQUIPMENT SPARE PARTS LIST BY NAVY TYPE NUMBERS

Quantity	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
			INDUCTORS AND REACTORS (Cont.)					
1		L-114	Inductor, Plate tank padding 2.1 uh ±5%		830	GA-1114A		571 1114 10
1		L-401	Inductor, LF osc grid 19.956 uh ±1%		830	GA-1259C		571 1259 30
1		L-3001	Inductor, load coil assem		830			502 1708 003
			PLUGS					
1	-49565	P-2201	Connector, 8 term chassis mtg plug					365 2080 00
1	-49661	P-401	Connector, 6 term male chassis mounting		2580	300		365 2060 00 or 365N206
1	-49662	P-201	Connector, 12 term male chassis mtg		2580	P-312-AB		365 2120 00 or 365N212
1	-49866	P-3001	Connector, 2 term chassis mtg socket		2580	S-302-AB		366 2020 00 or 366N202
1	-49944	P-101	Connector, 12 term octal style female chassis mtg		200	M1P		369 1600 00 or 369N16
1	-49946	P-901	Connector, 27 term wall mtg receptacle		630	K		371 4050 00 or 371N405
1	-49947	P-1501	Connector, 27 term 90 degree plug female		630	NK-27-23-11/16		371 4060 00 or 371N406
1	-49948	P-1701	Connector, 3 term 90 degree angle plug		630	WK-C3-23C7/16		371 1090 00 or 371N109
1	-49949	P-1702	Connector, 3 term straight plug		630	RWK-C3-22C7/16		371 1109 00 or 371N110R
1	-49950	P-2301	Connector, 27 term straight plug female		630	NK-27-21C-11/16		371 4020 00 or 371N402
1	U-7/U	P-1601	Connector, 10 term straight plug		630	FK10-21-9/16		371 5140 00 or 371N514

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TABLE 6-4
EQUIPMENT SPARE PARTS LIST BY NAVY TYPE NUMBERS

Quantity	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
			PLUGS (Cont.)					
1	U-8/U	P-1502	Connector, 27 term straight plug male		630	RNK-27 22C11/16		371 4049 00 or 371N404R
1	U-9/U	P-1602	Connector, 10 term 90 degree angle plug		630	RFK10-24C9/16		371 5129 00 or 371N512R
1		P-1901,P-1902	Connector, 6 term chassis mtg plug		2580	P-406-AB1/16		363 2060 00
			RESISTORS					
1	-63011F	R-1905	Resistor, 1000 ohm ±5% 20 w		4250			733 1661 00
	-63288-104	Alternate R-102,R-107	Resistor, 100,000 ohm ±10% 1 w		2360	BT1-Navy		729 7100 42 or 729NG100M-K
	-63288-153	Alternate R-401,R-2209	Resistor, 15,000 ohm ±10% 1 w		2360	BT1-Navy		729 7154 20 or 729NG15M-K
1	-63288-182	R-901	Resistor, 1800 ohm ±20% 1 w		2360	BT1-Navy		729 7180 04 or 729NG1800-M
	-63288-203	Alternate R-137	Resistor, 20,000 ohm ±20% 1 w		2360	BT1-Navy		729 7204 40
	-63288-221	Alternate R-2217	Resistor, 220 ohm ±10% 1 w					729 0001 00
	-63288-222	Alternate R-207	Resistor, 2200 ohm ±10% 1 w		2360	BW1-Navy		708 0002 00 or 708N2200NA-K
	-63288-223	Alternate R-101	Resistor, 22,000 ohm ±10% 1 w		2360	BT1-Navy		729 7224 20 or 729NG22M-K

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TABLE 6-4
EQUIPMENT SPARE PARTS LIST BY NAVY TYPE NUMBERS

Quantity	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
			RESISTORS (Cont.)					
	-63288-224	Alternate R-2211	Resistor, .22 meg ±10% 1 w					729 7220 42
	-63288-470	Alternate R-103,R-104, R-106,R-108, R-112	Resistor, 47 ohm ±20% 1 w		4220			729 7474 00 or 729NG47-M
1	-63291-101	R-202	Resistor, 100 ohm ±5% 1/2 w		90			703 1100 10 or 703NA100-J
1	-63291-221	R-201,R-204	Resistor, 220 ohm ±5% 1 w		90			703 1220 10 or 703NA220-J
1	-63355-104	R-211	Resistor, 100,000 ohm ±5% 1/2 w		2360	BT1/2-Navy		729 5100 41 or 729NE100M-J
	-63355-153	Alternate R-203	Resistor, 15,000 ohm ±5% 1/2 w		2360	BT1/2-Navy		729 5154 10 or 729NE15M-J
	-63355-222	Alternate R-2215	Resistor, 2200 ohm ±5% 1/2 w		2360	BT1/2-Navy		729 5220 01 or 729NE2200-J
	-63355-474	Alternate R-212	Resistor, 470,000 ohm ±5% 1/2 w		2360	BT1/2-Navy		729 5470 41 or 729NE470M-J
	-63355-754	Alternate R-213	Resistor, 750,000 ohm ±5% 1/2 w		2360	BT1/2-Navy		729 5750 41 or 729NE750M-J
1	-63360-104	R-2202, R-2212A	Resistor, 100,000 ohm ±10% 1/2 w		2360	BT1/2-Navy		729 5100 42 or 729NE100M-K
	-63360-105	Alternate R-208	Resistor, 1 meg ±10% 1/2 w		2360	BW1-Navy		729 0008 00 or 729NE1Meg-K

TABLE 6-4
EQUIPMENT SPARE PARTS LIST BY NAVY TYPE NUMBERS

Quantity	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
			RESISTORS (Cont.)					
	-63360-154	Alternate R-2204,R-2216	Resistor, 150,000 ohm ±10% 1/2 w		2360	BT1/2-Navy		729 5150 42 or 729NE150M-K
	-63360-224	Alternate R-209,R-2212B	Resistor, 220,000 ohm ±10% 1/2 w		2360	BT1/2-Navy		729 5220 42 or 729NE220M-K
	-63360-473	Alternate R-2203,R-2205, R-2206	Resistor, 47,000 ohm ±10% 1/2 w		2360	BT1/2-Navy		729 5474 20 or 729NE47M-K
	-63360-474	Alternate R-205,R-210, R-2213,R-2214	Resistor, 470,000 ohm ±10% 1/2 w		2350	BT1/2-Navy		729 5470 42 or 729NE470M-K
1	-63535-10	R-133	Resistor, 50 ohm ±10% 10 w		3450			710 1501 20 or 710NA50A-K
	-63678-100	Alternate R-135	Resistor, 10 ohm ±10% 1/2 w		2360	BW1/2		707 1052 00 or 707N10N-K
	-63678-221	Alternate R-216	Resistor, 220 ohm ±10% 1/2 w					707 2205 20
	-63678-221	Alternate R-2217	Resistor, 220 ohm ±20% 1/2 w		2360	BW1/2		707 2205 40
	-63678-750	Alternate R-134	Resistor, 75 ohm ±10% 1/2 w		2360	BW1/2		707 7552 00 or 707N75N-K
	-63703	Alternate R-2217	Resistor, 220 ohm ±20% 1 w		2360	BW1-Navy		708 2205 40
	-63703-251	Alternate R-214,R-215	Resistor, 250 ohm ±10% 1 w		2360	BW1-Navy		708 2505 12 or 708N250NA-K
1	-63705-201	R-1902,R-1904	Resistor, 200 ohm ±20% 2 w		2360	133-0200-7		709 2005 40

TABLE 6-4
EQUIPMENT SPARE PARTS LIST BY NAVY TYPE NUMBERS

Quantity	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
			RESISTORS (Cont.)					
1	-63881F	R-1901	Resistor, 63 ohm ±5% 120 w ferrule type		4250			733 0169 00
1	-632958-2½	R-2207	Resistor, 85 ohm ±2-1/2% 10 w		3450			710 0003 00
1	-633157-10	R-129, R-130	Resistor, 1000 ohm ±10% 10 w		3450	BD		710 1141 20 or 710NA1MA-K
1	-633182-10	R-2210	Resistor, 15,000 ohm ±10% 10 w		3450			710 0010 00
1	-633225-10	R-206	Resistor, 42 ohm ±10% 10 w		3450	BD		710 1422 20 or 710NA42B-K
1	-633226-10	R-131	Resistor, 350 ohm ±10% 10 w		3450	BD		710 0021 00
1	-633227-10	R-116	Resistor, 1 ohm ±10% 25 w		3450	BD		710 1112 00 or 710NA1A-K
2	-633228-20	R-113, R-114, R-136	Resistor, 150 ohm ±20% 10 w		3450	BD		710 0019 00 or 710NA150B-M
1	-633229-10	R-123	Resistor, 12.6 ohm ±10% 25 w		3450			710 0045 00 or 710NC12.6A-K
1	-633230-10	R-115	Resistor, 100 ohm ±10% 25 w		3450			710 0048 00
1	-633239-10	R-121	Resistor, 0.8 ohm ±10% 50 w		3450			710 0013 00 or 710ND0.8A-K
2	-633240-10	R-105, R-109, R-110	Resistor, 20,000 ohm ±10% 25 w		3450	0218		710 0078 00 or 710NC20MA-K
1	-633241-10	R-124	Resistor, 25,000 ohm ±10% 25 w		3450	0219		710 0081 00 or 710NC25MA-K
2	-633242-10	R-117, R-118, R-119, R-120	Resistor, 5000 ohm ±10% 25 w		3450	0212		710 3541 20 or 710NC5MA-K
1	-633243-2	R-128	Resistor, 4000 ohm ±2% 1 w		2360	WW3		721 3447 00 or 721NL4M-G
1	-633244-2	R-132	Resistor, 50,000 ohm ±2% 0.8 w		2360	WW3		721 3504 70 or 721NL50M-G
1	-633245-2	R-111	Resistor, 235 ohm ±2% 1 w		2360	WW3		721 3235 70 or 721NL235-G
1	-633249	R-2201	Resistor, 2-15 ohm rheostat		4975			381 9010 00 or 381N901

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TABLE 6-4
EQUIPMENT SPARE PARTS LIST BY NAVY TYPE NUMBERS

Quantity	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
			RESISTORS (Cont.)					
	RC20BF104	Alternate R-211	Resistor, 100,000 ohm ±5% 1/2 w					745 1169 00
	RC20BF104	Alternate R-1906	Resistor, 100,000 ohm ±20% 1/2 w					745 1171 00
1	RC20BF105	R-208	Resistor, 1 meg ±10% 1/2 w					745 1212 00
1	RC20BF153	R-203	Resistor, 15,000 ohm ±5% 1/2 w					745 1134 00
1	RC20BF154	R-2204, R-2216	Resistor, 150,000 ohm ±5% 1/2 w					745 1176 00
1	RC20BF221	R-216	Resistor, 220 ohm ±10% 1/2 w					745 1058 00
1	RC20BF221	R-2217	Resistor, 220 ohm ±20% 1/2 w					745 1059 00
1	RC20BF222	R-2215	Resistor, 2200 ohm ±5% 1/2 w					745 1099 00
1	RC20BF224	R-209, R-2212B	Resistor, 220,000 ohm ±10% 1/2 w					745 1163 00
1	RC20BF333	R-2208	Resistor, 33,000 ohm ±5% 1/2 w					745 1148 00
2	RC20BF473	R-2203, R-2205, R-2206	Resistor, 47,000 ohm ±10% 1/2 w					745 1156 00
2	RC20BF474	R-205, R-210, R-2213, R-2214	Resistor, 470,000 ohm ±10% 1/2 w					745 1198 00
1	RC20BF474	R-212	Resistor, 470,000 ohm ±5% 1/2 w					745 1197 00
1	RC20BF750	R-134	Resistor, 75 ohm ±5% 1/2 w					745 1039 00
1	RC20BF754	R-213	Resistor, 750,000 ohm ±5% 1/2 w		2360	BT1/2-Navy		745 1207 00
1	RC21BF100K	R-135	Resistor, 10 ohm ±10% 1/2 w					745 2002 00
1	RC21BF104	R-1906	Resistor, 100,000 ohm ±20% 1/2 w					745 2171 00
1	RC30BF104	R-102, R-107	Resistor, 100,000 ohm ±10% 1 w					745 3170 00
1	RC30BF153	R-401, R-2209	Resistor, 15,000 ohm ±10% 1 w					745 3135 00
1	RC30BF222	R-207	Resistor, 2200 ohm ±10% 1 w					745 3100 00
1	RC30BF223	R-101	Resistor, 22,000 ohm ±10% 1 w					745 3142 00
1	RC30BF223	R-137	Resistor, 22,000 ohm ±20% 1 w					745 3143 00
1	RC30BF224	R-2211	Resistor, .22 meg ±10% 1 w					745 3184 00

TABLE 6-4
EQUIPMENT SPARE PARTS LIST BY NAVY TYPE NUMBERS

Quantity	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
			RESISTORS (Cont.)					
1	RC30BF241	R-214, R-215	Resistor, 240 ohm ±5% 1 w					745 3060 00
3	RC30BF470	R-103, R-104, R-106, R-108, R-112	Resistor, 47 ohm ±20% 1 w					745 3031 00
	RE13A372G	Alternate R-137	Resistor, 22,000 ohm ±20% 1 w					729 7224 40
	RW15F102	Alternate R-1905	Resistor, 1000 ohm ±5% 20 w					746 2540 00
	RW55E201	Alternate R-1902, R-1904	Resistor, 200 ohm ±5% 2 w					747 7533 00
1		R-902	Resistor, 500 ohm "T" pad attenuator		2360	CSMPD		380 2010 00 or 380N201
1		R-1903	Resistor, Two section, 13.4 ohm ±5%, 6.7 ohm ±5%, max current .5 amp		3450			717 4100 00
		Alternate R-2208	Resistor, 33,000 ohm ±10% 1/2 w		2360	BT1/2-Navy		729 5334 20 or 729NE33M-[illegible]
			SWITCHES					
	-24003	Alternate S-901	Switch, Toggle, DPDT		1883	1GA4C56		266 0002 00
1	-24003-A	S-201	Switch, Toggle, DPDT 1 amp 250 v					266 0004 00
	-24195	Alternate S-1905	Switch, Push toggle, normally open, interlock					266 0001 00
1	-24458	S-1906	Switch, Toggle, DPST 20 amp 250 v					260 0007 00

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TABLE 6-4
EQUIPMENT SPARE PARTS LIST BY NAVY TYPE NUMBERS

Quantity	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
			SWITCHES (Cont.)					
1	-24560	S-104	Switch, Toggle, SPST #20 amp 24 v		1010	8817		260 1100 00 or 260N110
	-24563	Alternate S-1905	Switch, Push toggle, normally open, interlock					266 0003 00
1	-24565	S-1907	Switch, Toggle, 3PDT 10 amp 250 v					260 0008 00
1	-24566	S-1908	Switch, Lever, multi-contact					502 0210 004
1	-24567	S-1902	Switch, Toggle, SPST					266 1010 00
1	-24569	S-112	Switch, Leaf, SPST		830	Y983A		508 0983 10
1	-24570	S-115	Switch, Leaf, SPST		830	Y-981A		508 0981 10 or Y-981A
1	-24571	S-113D	Switch, Leaf, SPST		830	Y-1048A		508 1048 10 or Y-1048A
1	-24572	S-114	Switch, Leaf, 1 SPDT 2 SPST		830	Y-1136B		508 1136 20 or Y-1136B
1		S-101A	Switch, Special moving arm		830	GA-1445A		571 1445 10 or GA-1445A
1		S-101B	Stationary arm		830	GA-2002A		571 2002 10 or GA-2002A
1		S-102	Switch, Rotary, 18 contact		830			500 0085 00B
1		S-103	Switch, Rotary, 7 contact		830			500 0206 00B
1		S-105	Switch, Rotary 3 pos 2 circuit non-shorting		3410			259 1391 00 or 259N139A
1		S-106	Switch, Rotary, 5 circuit 3 position 2 pi		3410			259 0004 00
1		S-107	Switch, Rotary, 2 pos 4 circuit shorting		3410			259 1411 00 or 259N141A
1		S-108	Switch, Rotary, 12 contact non-shorting		3410			259 1401 00 or 259N140A

TABLE 6-4
EQUIPMENT SPARE PARTS LIST BY NAVY TYPE NUMBERS

Quantity	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
			SWITCHES (Cont.)					
1		S-109	Switch, Rotary, 12 contact shorting		3410	25851-DH-L		259 1371 00 or 259N137A
1		S-110	Switch, Rotary, 4 pos 3 circuit shorting		3410			259 1362 00 or 259N136B
1		S-111	Switch, leaf, SPDT		830	GA-1557B		571 1557 20
		Alternate S-111	Switch, leaf, SPDT		830			502 4170 002
1		S-113	Switch, Multi-element S-113A thru S-113H, L-113 and L-114, complete with ceramic capacitors		830	186P-1		571 0885 30
1		S-113C	Switch, Single contact arm assem		830	GA-1074A		571 1074 10 or GA-1074A
		Alternate S-114						500 0247 002
1		S-116, S-3004	Switch, Special SPDT 8 amp 250 v vacuum sealed		1881	GL-34		260 6010 00 or 260N601
1		S-202	Switch, Rotary, 1 sect 6 cont, shorting type		3030			259 1490 00 or 259N149
1		S-401	Switch, Rotary assem, LF osc		830	GA-1021A		571 1021 10 or GA-1021A
1		S-401	Switch, Stator assem, LF osc		830	GA-1544B		571 1544 20 or GA-1544B
1		S-901	Switch, Toggle, DPDT 1 amp 250 v		2160	20905-GH		266 1030 00 or 266N103
1		S-902	Switch, Rotary, 11 cont non-shorting		3410			259 1421 00 or 259N142A
1		S-903	Switch, Rotary, 3 circuit 4 pos, 2 deck					259 1361 00
1		S-1905	Switch, Push toggle, normally open, interlock					266 1050 00

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TABLE 6-4
EQUIPMENT SPARE PARTS LIST BY NAVY TYPE NUMBERS

Quantity	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
			SWITCHES (Cont.)					
1		S-1909	Switch, Start, black normally open and normally closed					260 2020 00
1		S-1910	Switch, Stop, red normally opened and normally closed					260 2030 00
1		S-3001	Switch, 2 sections SPDT (DPDT)					502 5300 004
1		S-3002	Switch Shaft, assem		830			502 1747 003
1		S-3002	Switch Stator, assem		830			502 1748 002
3		S-3002, S-3003	Standoff, 3/8" x 2" ceramic		830			507 6158 00
1		S-3003	Switch Shaft, assem		830			502 5116 002
1		S-3003	Switch Stator, assem		830			502 5117 002
			TRANSFORMERS					
1	-47912	T-102	Transformer, RF					571 1716 20
1	-302035	T-101	Transformer, Modulation Pri: 15,000 ohm CT 150 ma Secd #1: 7300 ohm Secd #2: 970 ohm 300 to 4000 cps ±2 db		780	7950		677 0002 00
1	-302036	T-201	Transformer, Audio coupling Pri: 75 ohm Secd: 125,000 ohm 100 - 5000 cps		780	7823		677 2590 00 or 677N259
1	-302037	T-202	Transformer, Audio coupling Pri: 5000 ohm 30 ma Secd: 2000 ohm 300 - 4000 cps		780	7821		677 2530 00 or 677N253
1	-302038	T-203	Transformer, Sidetone					677 2540 00
1	-302039	T-901	Transformer, Speaker Input: 500 ohm to 6 ohm voice coil					667 7051 00

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TABLE 6-4
EQUIPMENT SPARE PARTS LIST BY NAVY TYPE NUMBERS

Quantity	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's Designation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
			TRANSFORMERS (Cont.)					
1	-302040	T-1901	Transformer, Coupling Pri: 200,400,600 ohms Secd: 42,60,82,106 ohms		780			677 2610 00
			VACUUM TUBES					
	6V6	Alternate V-202,V-203	Tube, Vacuum, beam pentode		* *	6V6		254 0198 00
4	6V6GT/G	V-202,V-203	Tube, Vacuum, beam pentode		* *	6V6GT		254 0200 00
2	12SA7	V-2202	Tube, Vacuum, pentode converter		* *	12SA7		254 0247 00
	12SA7GT/G	Alternate V-2202	Pentagrid Converter		* *	12SA7/GT		254 0248 00
2	12SJ7	V-201	Tube, Vacuum, triple grid amplifier		* *	12SJ7		254 0254 00
	12SJ7/GT	Alternate V-201	Tube, Vacuum, triple grid amplifier		* *	12SJ7/GT		254 0255 00
4	12SL7GT	V-2201,V-2203	Dual Triode		* *	12SL7GT		254 0258 00
4	811	V-105,V-106	Tube, Vacuum, triode		* *	811		254 0395 00
2	813	V-104	Tube, Vacuum, beam pentode		* *	813		254 0397 00
2	837	V-101	Tube, Vacuum, beam pentode		* *	837		254 0406 00
6	1625	V-102,V-103, V-401	Tube, Vacuum, beam pentode		* *	1625		254 0458 00
			CABLES					
1			Cable, 27 conductor, control					500 1496 00D or 65X-7
1			Cable, 10 conductor, power					500 1497 00D or 65X-8

** Standard vacuum tubes are supplied by numerous well-known manufacturers.

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TABLE 6-4
EQUIPMENT SPARE PARTS LIST BY NAVY TYPE NUMBERS

Quantity	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's Desig-nation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
			CABLES (Cont.)					
1			Cable, 2 conductor, relay power					500 1498 00C or 65X-9
1			Cable, 27 conductor, remote					500 4474 004 or 65X-10
			SOCKETS					
2	-49366	X-101,X-102, X-103,X-401	Socket, Tube, 7 prong, ceramic		2570	227		220 5730 00 or 220N573
		Alternate X-101,X-102, X-103,X-401						220 1006 00
1	-49951	X-2204	Crystal Socket		810	9816		292 0012 00
1		X-104	Socket, Tube, 7 prong, wafer ceramic		2570	237		220 5711 00 or 220N571A
1		X-105,X-106	Socket, Tube, 4 prong, ceramic		2570	224		220 5450 00 or 220N545
3		X-201,X-202, X-203,X-2201, X-2202,X-2203	Socket, Tube, octal ceramic		200	88-8		220 1850 00 or 220N185
			CRYSTAL					
1		Y-2201	Crystal, Quartz, mounted freq 200 kc		830			291 0002 00
			TUNED CIRCUIT ASSEMBLIES					
1	-47911	Z-2202A, Z-2202B	Inductor assembly		70			278 0002 00
1	-47923	Z-2201A, Z-2201B	Inductor assembly		70			278 0001 00

TABLE 6-4
EQUIPMENT SPARE PARTS LIST BY NAVY TYPE NUMBERS

Quantity	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's Desig-nation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
			MISCELLANEOUS					
1			Shockmount, Power unit, channel type		4640	101C3		200 7020 00
2			Shockmount chassis type, 1-3/4 square x 5/8		4640	5150P		200 0003 00
1			Lead Assembly, final plate		830			571 1175 10 or GA-1175A
1			Lead Assembly, plate		830			571 2021 10 or GA-2021A
1			Lead Assembly, mod plate		830			571 2030 10 or GA-2030A
1			Lead Assembly, multiplier coil		830			571 2583 10 or GA-2583A
1			Lead Assembly, multiplier coil		830			571 2584 10
1			Lead Assembly, LF osc		830			571 2587 10 or GA-2587A
1			Lead Assembly, multiplier coil		830			571 2588 10 or GA-2588A
1			Lead Assembly, multiplier coil		830			571 2589 10 or GA-2589A
1			Lead Assembly, mod plate		830			571 2639 10 or GA-2639A
1			Ground Strap, assembly		830			571 2170 10 or GA-2170A
4			Lubrication Kit, singleturn wick		830			500 4630 001
1			Lubrication Kit, multiturn wick		830			500 4644 001
1			Lubrication Kit, chain wick		830			500 4635 001
1			Wrench, #4 Bristo		500			024 2900 00
1			Wrench, #6 Bristo		500			024 9730 00
1			Wrench, #8 Bristo		500			024 0019 00
1			Wrench, #10 Bristo		500			024 9710 00

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TABLE 6-4
EQUIPMENT SPARE PARTS LIST BY NAVY TYPE NUMBERS

Quantity	Navy or JAN Type Number	All Symbol Designations Involved	Description	Navy Spec. or Dwg. No.	Mfr. Code	Mfr's Desig- nation	Spcl. Tol. or Mod.	Contractor's Drawing or Part Number
			MISCELLANEOUS (Cont.)					
1			Screwdriver, Phillips #1		4707			024 3000 00
1			Screwdriver, Phillips #2		4707			024 3100 00
1			Screwdriver, .070" shank		4296	555C		024 0015 00
1			Crank, Autotune		830	GA-1149A		571 1149 10 or 1149-A
1			Wrench, External spanner		830			507 5733 00 or X-5733
1			Wrench, Internal spanner		830			507 5734 00 or X-5734
2			Track Channel, assem		830			571 0821 30
1			L Track channel		830			500 4278 002
1			R Track channel		830			500 4279 002
1			Feeler Gauge .005"		830			500 9135 001
2			Spare Parts boxes		830			500 6656 004 or 502 7025 004
1			Spare Parts box		830			500 3535 004 or 502 7026 004
3			Spare Parts box seal		830			004 7490 00

2. APPLICABLE COLOR CODES.

a. HOOKUP WIRE CODE. - This wire code is the standard code for all unit wiring in connection with the Model TCZ-2 Radio Transmitting Equipment.

(1) Two classes of wire are employed, consisting of flame resistance and bus bar.

(2) Flame resistant wire is supplied in two degrees of insulation rated at 1000 volts and 3000 volts. The voltage rating of the wire is indicated by an identification thread in the strands of the conductor. A blue thread indicates 1000 volts insulation while a white thread indicates 3000 volts insulation. Two other threads of different colors serve to indicate the manufacturer of the wire and the year in which it was made.

(3) Standard RMA Color Code Numerals are used for designating the body color and the color of the tracers. This code is as follows:

0 - Black	5 - Green
1 - Brown	6 - Blue
2 - Red	7 - Violet
3 - Orange	8 - Gray
4 - Yellow	9 - White

NOTE

Wires employing code numbers 7 and 8, also 4, are not used.

(4) The wire color code is made up of a letter designating the wire size and voltage rating of insulation followed by numerals designating the body color and the colors of up to three tracers.

(5) A shielded flame resistant wire is indicated by inserting the letter S after the first letter of the code. Example: AS956 indicates a white wire with green and blue tracers in a tinned shielding braid.

(6) The wire code used in the NAVY MODEL TCZ-2 Equipment is as follows:

CABLE WIRE CODE

Color Code	Body Color	First Tracer Color	Second Tracer Color	Third Tracer Color	Wire Specifications
*A9	White				No. 22 A.W.G
*A90	White	Black			Flameproof Insulation
*A92	White	Red			Lacquered Glass Braid
*A93	White	Orange			1000 volt rating
*A95	White	Green			
*A96	White	Blue			
A902	White	Black	Red		
A9020	White	Black	Red	Black	
A9023	White	Black	Red	Orange	
A9025	White	Black	Red	Green	
A9026	White	Black	Red	Blue	
A903	White	Black	Orange		
A9030	White	Black	Orange	Black	
A9035	White	Black	Orange	Green	
A9036	White	Black	Orange	Blue	
A905	White	Black	Green		
A9050	White	Black	Green	Black	
A906	White	Black	Blue		
A9060	White	Black	Blue	Black	
A9202	White	Red	Black	Red	
A923	White	Red	Orange		
A925	White	Red	Green		
A9252	White	Red	Green	Red	
A9256	White	Red	Green	Blue	
A926	White	Red	Blue		
A9262	White	Red	Blue	Red	
A9303	White	Orange	Black	Orange	
A935	White	Orange	Green		
A9353	White	Orange	Green	Orange	
A9356	White	Orange	Green	Blue	
A936	White	Orange	Blue		
A9363	White	Orange	Blue	Orange	
A9505	White	Green	Black	Green	
A9525	White	Green	Red	Green	
A9535	White	Green	Orange	Green	
A956	White	Green	Blue		
A9606	White	Blue	Black	Blue	
A9626	White	Blue	Red	Blue	
A9636	White	Blue	Orange	Blue	
	White				

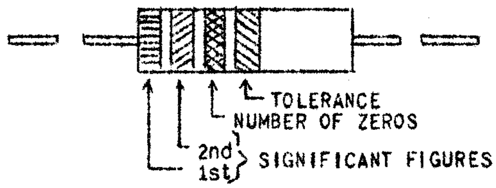
Color Code	Body Color	First Tracer Color	Second Tracer Color	Third Tracer Color	Wire Specifications
B9	White				No. 20 A.W.G Flameproof Insulation Lacquered Glass Braid 1000 volt rating
*B90	White	Black			
B91	White	Brown			
B92	White	Red			
B93	White	Orange			
B94	White	Yellow			
B95	White	Green			
B96	White	Blue			
B902	White	Black	Red		
B925	White	Red	Green		
C9	White				No. 18 A.W.G. Flameproof Insulation Lacquered Glass Braid 1000 volt rating
C90	White	Black			
C92	White	Red			
C95	White	Green			
C96	White	Blue			
C902	White	Black	Red		
C903	White	Black	Orange		
C925	White	Red	Green		
C935	White	Orange	Green		
*CS93	White	Orange			
D9	White				No. 16 A.W.G. Flameproof Insulation Lacquered Glass Braid 1000 volt rating
D90	White	Black			
D91	White	Brown			
D92	White	Red			
D93	White	Orange			
D95	White	Green			
D96	White	Blue			
D902	White	Black	Red		
D903	White	Black	Orange		
D925	White	Red	Green		
D935	White	Orange	Green		
D936	White	Orange	Blue		
E9	White				No. 14 A.W.G. Flameproof Insulation Lacquered Glass Braid 1000 volt rating
E90	White	Black			
E92	White	Red			
E93	White	Orange			
E95	White	Green			
E96	White	Blue			
E902	White	Black	Red		
E903	White	Black	Orange		
E920	White	Red	Black		
E925	White	Red	Green		

Color Code	Body Color	First Tracer Color	Second Tracer Color	Third Tracer Color	Wire Specifications
F9 F91 F96 F906	White White White White	 Brown Blue Black	 Orange		No. 12 A.W.G. Flameproof Insulation Lacquered Glass Braid 1000 volt rating
J9 J90	White White	 Black			No. 6 A.W.G. Flameproof Insulation Lacquered Glass Braid 1000 volt rating
L92 L96	White White	Red Blue			No. 20 A.W.G. Flameproof Insulation Lacquered Glass Braid 3000 volt rating
N90 N92 N95 N96 N902 N906	White White White White White White	Black Red Green Blue Black Black	 Red Blue		No. 16 A.W.G. Flameproof Insulation Lacuqered Glass Braid 3000 volt rating

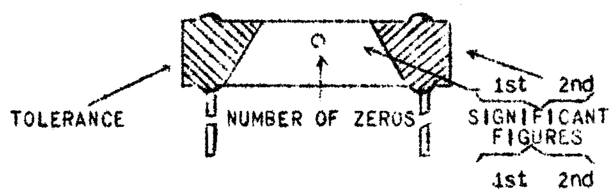
b. CODE FOR BUS-BAR. - The code for bus-bar is made up of the letter designation BB followed by the wire size as shown below:

#20 - BB20	#14 - BB14
#18 - BB18	#12 - BB12
#16 - BB16	

COLOR CODE FOR FIXED RESISTORS—VALUES IN OHMS



Resistor with axial wire leads.



Resistor with radial wire leads.

BODY		END		DOT OR BAND		END	
1st Band		2nd Band		3rd Band		End Band	
Color	Value	Color	Value	Color	Value	Color	Tolerance
Black......	0	Black......	0	Gold.......	0.1	Gold.......	(J) ± 5%
Brown......	1	Brown	1	Silver.....	0.01	Silver.....	(K) ±10%
Red........	2	Red........	2	Black......	None	None.......	(M) ±20%
Orange.....	3	Orange.....	3	Brown......	0		
Yellow.....	4	Yellow.....	4	Red........	00		
Green......	5	Green......	5	Orange.....	000		
Blue.......	6	Blue.......	6	Yellow.....	0000		
Violet.....	7	Violet.....	7	Green......	00000		
Gray.......	8	Gray.......	8	Blue.......	000000		
White......	9	White......	9	Violet.....	0000000		
				Gray.......	00000000		
				White......	000000000		

EXAMPLE FOR AXIAL-LEAD RESISTOR

Band	Color	Significant Figures		Number of Zeros	Tolerance
		1st	2nd		
1	Red	2	...	...	...
2	Orange	...	3	...	...
3	Yellow	...	...	0000	...
4	Gold	...	...	...	±5%

The resistance of this resistor is 230,000 ohms ±5%

EXAMPLE FOR RADIAL-LEAD RESISTOR

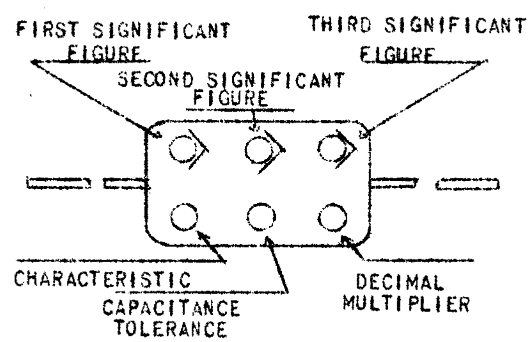
Position	Color	Significant Figures		Number of Zeros	Tolerance
		1st	2nd		
Body	Orange	3	...	...	...
End	Blue	...	6	...	...
Dot	Green	...	...	00000	...
End	Silver	...	...	...	±10%

The resistance of this resistor is 3,600,000 ohms ±10%

COLOR CODE FOR FIXED MICA CAPACITORS

Color	CAPACITANCE *		Tolerance	Characteristic
	Significant Figure	Decimal Multiplier		
Black	0	1	20 per cent (M)	A
Brown	1	10	1 per cent	B
Red	2	100	2 per cent (G)	C
Orange	3	1,000	3 per cent	D
Yellow	4	...	4 per cent	E
Green	5	...	5 per cent	F
Blue	6	...	6 per cent	G
Violet	7	...	7 per cent	...
Gray	8	...	8 per cent	...
White	9	...	9 per cent	...
Gold	...	0.1	5 per cent (J)	...
Silver	...	0.01	10 per cent (K)	...

* Capacitance in micromicrofarads.



Color code scheme for JAN standard fixed mica capacitors. The significance of the letters denoting "characteristic" will be found in the Joint Army-Navy Specification JAN-C-5.

3. MANUFACTURERS OF REPLACEABLE PARTS.

TABLE 6-5 - LIST OF MANUFACTURERS

30	Aerovox Corporation 740 Belleville Avenue New Bedford, Mass.
60	The Akron Porcelain Co. Akron, Ohio
70	Aladdin Radio Industries, Inc. 223 West Jackson Boulevard Chicago, Illinois
90	Allen-Bradley Company 136 West Greenfield Avenue Milwaukee, 4, Wisconsin
200	American Phenolic Corporation 1830 South 54th Avenue Chicago, Illinois
230	American Steel Package Co. Defiance, Ohio
284	Automatic Electric Sales Corp. 1033 W. Van Buren St. Chicago, 7, Illinois
287	Automatic Electric Mfg. Co. Mankato, Minnesota
360	Belden Manufacturing Company P.O. Box 507A Chicago, 80, Illinois
500	Bristol Company 66 Bride Street Waterbury, 91, Conn.
630	Cannon Electric Development Co. 3209 Humboldt Street Los Angeles, 31, California
700	Centralab 900 E. Keefe Avenue Milwaukee, 1, Wisconsin
780	Chicago Transformer Corp. 3501 Addison Street Chicago, 18, Illinois
810	Cinch Manufacturing Corp. 2335-2347 W. Van Buren St. Chicago, 12, Illinois
830	Collins Radio Company 855 35th Street N.E. Cedar Rapids, Iowa
880	Continental Rubber Works Erie, Pennsylvania
911	Cornell-Dubilier Corporation 333 Hamilton Blvd. South Plainfield, 6, New Jersey
950	Coto-Coil Company, Inc. 65 Pavilion Ave. Providence, 5, Rhode Island
1010	Cutler-Hammer, Inc. 315 N. 12th St. Milwaukee, Wisconsin
1200	Drake Manufacturing Company 1713 West Hubbard Street Chicago, Illinois
1320	Hugh H. Eby, Inc. 18 W. Chelten Avenue Philadelphia, 44, Pa.
1384	Electronic Laboratories, Inc. 122 West New York Street Indianapolis, Indiana
1390	Emerson Electric Mfg. Co., Inc. 1824 Washington Ave. St. Louis, 3, Missouri

1640 John E. Fast and Co.
3123 N. Pulaski Road
Chicago, 41, Illinois

1740 Fractional Motors
1501 North Halsted
Chicago, Illinois

1820 G. M. Laboratories, Inc.
4314-26 North Knox Ave.
Chicago, Illinois

1880 General Electric Co.
1 Plastics Ave.
Pittsfield, Mass.

1881 General Electric Co.
840 S. Canal Street
Chicago, Illinois

1883 General Electric Co.
Appliance and Mdse. Dept
1285 Boston Ave.
Bridgeport, Conn.

1888 General Electric Co.
Electronics Dept.
754 State Street
Schenectady, 7, N. Y.

2040 Groove Pin Corporation
2017 Kerrigan Ave.
Union City, New Jersey

2050 Guardian Electric Mfg. Co.
1400 West Washington Blvd.
Chicago, 7, Illinois

2140 Hammarlund Mfg. Co., Inc.
460 West 34th Street
New York, 1, N. Y.

2160 Hart and Hegeman Division
Arrow Hart and Hegeman Elec. Co.
103 Hawthorne Street
Hartford, Connecticut

2350 Insuline Corp. of America
The Insuline Building
3602 35th Ave
Long Island City, New York

2360 International Resistance Co.
401 North Broad Street
Philadelphia, 8, Pennsylvania

2410 Isolantite Incorporated
Belleville, New Jersey

2520 Jefferson Electric Co.
Bellwood, Illinois

2525 Jensen Radio Manufacturing Co.
6601 S. Laramie Avenue
Chicago, 38, Illinois

2570 E. F. Johnson Company
Waseca, Minnesota

2580 Howard B. Jones
2460 W. George St.
Chicago, 18, Illinois

2850 Layelle Rubber Company
424 North Wood Street
Chicago, Illinois

2920 Littelfuse Incorporated
4757 Ravenswood Ave.
Chicago, 40, Illinois

3030 P. R. Mallory and Co., Inc.
3029 East Washington St.
Indianapolis, 6, Indiana

3040 Maresh Sheet Metal Works
905 17th St., N. E.
Cedar Rapids, Iowa

3090 Meissner Mfg. Co.
Mt. Carmel, Illinois

3220 National Company, Inc.
61 Sherman Street
Malden, 48, Massachusetts

3240 National Fabricated Products Co.
2650 West Belden Avenue
Chicago, 47, Illinois

3330 New Departure
Div. General Motors Corp.
Bristol, Conn.

3410 Oak Manufacturing Company
1260 Clybourn Avenue
Chicago, 10, Illinois

3450 Ohmite Manufacturing Company
4835 West Flournoy Street
Chicago, 44, Illinois

3580 Pheoll Manufacturing Co.
5700 Roosevelt Road
Chicago, 50, Illinois

3846 Raytheon Production Corp.
55 Chapel Street
Newton, Massachusetts

4030 Sangamo Electric Company
1935 Funk Street
Springfield, Illinois

4170 F. W. Sickles Company
Box 920
Springfield, 2, Massachusetts

4210 Solar Manufacturing Corp
285 Madison Ave.
New York, 17, New York

4217 Soreng Manegold Company
1901 Clybourn Avenue
Chicago, Illinois

4220 Walter Speck
225 N. Pine St.
Langhorne, Pa.

4230 Speer Resistor Corp.
St. Mary's, Pennsylvania

4240 Sperti Inc.
Beech and Kenilworth Aves.
Norwood Station
Cincinnati, Ohio

4250 Sprague Specialties Company
North Adams, Massachusetts

4296 The L. S. Starrett Co.
Athol, Mass.

4310 Struthers Dunn Incorporated
1321 Arch St.
Philadelphia, 7, Pa.

4335 S. W. Inductor Company
1056-58 North Wood Street
Chicago, 22, Illinois

4640 United States Rubber Co.
440 W. Washington Street
Chicago, 6, Illinois

4704 Vaco Products, Co.
317 East Ontario
Chicago, Illinois

4870 Western Electric Co., Inc.
300 Central
Kearny, New Jersey

4900 Westinghouse Elec. & Mfg. Co.
East Pittsburgh, Pennsylvania

4910 Weston Elec. Instrument Corp.
Newark, New Jersey

4960 Wincharger Corporation
East 7th at Division St.
Sioux City, 6, Iowa

4975 Wirt Company
5221-27 Green Street
Germantown, Philadelphia, Pa.

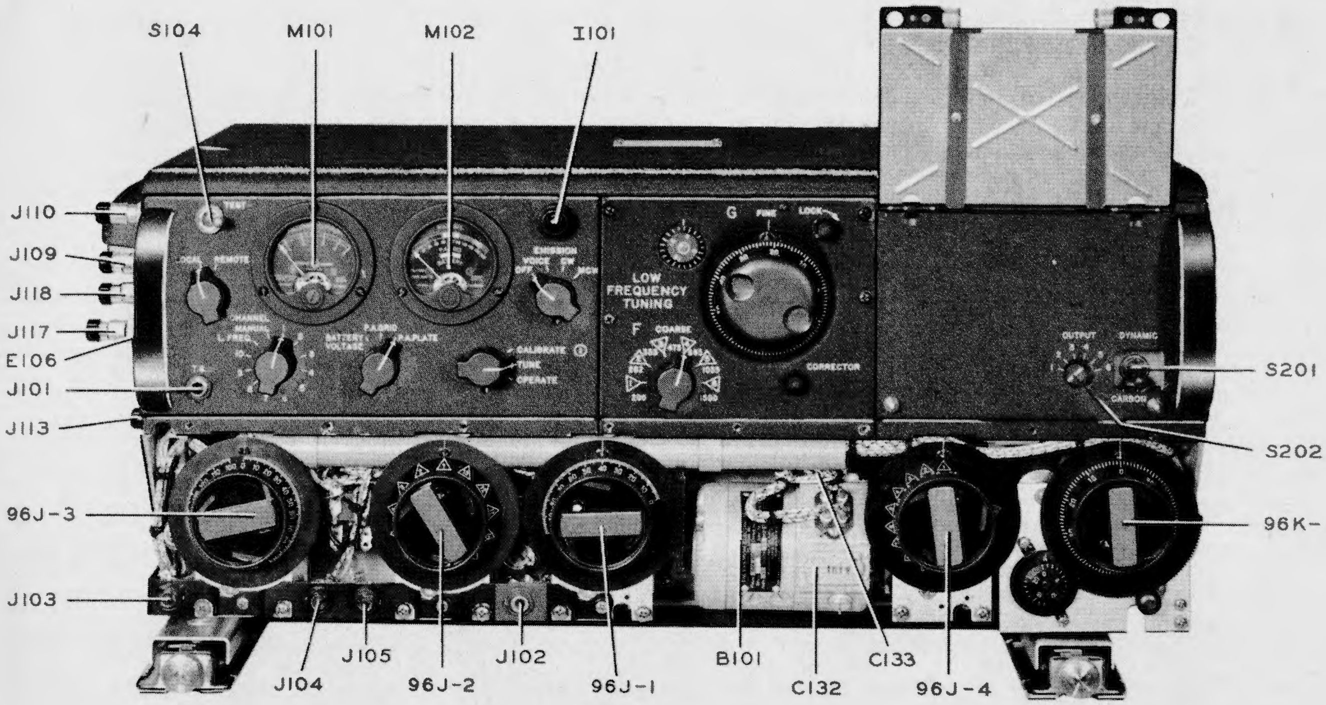


Figure 7-1 Navy Type COL-52286-A Transmitter Unit - Front Open View

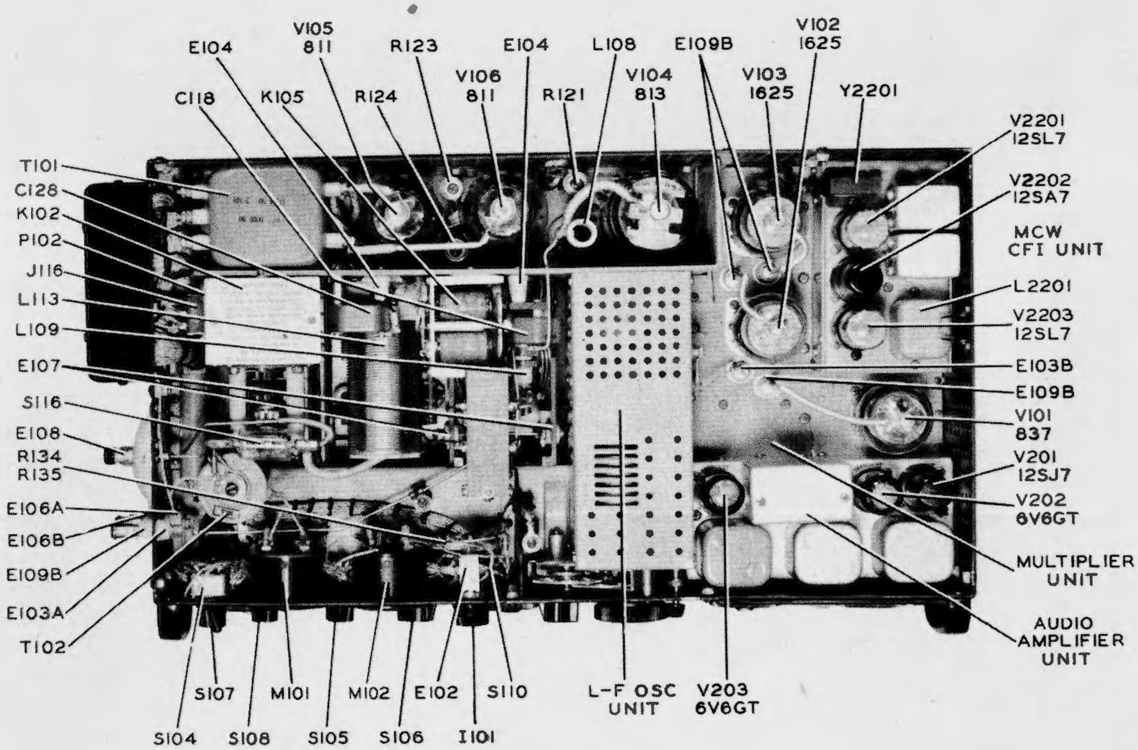


Figure 7-2 Navy Type COL-52286-A Transmitter Unit - Top Open View

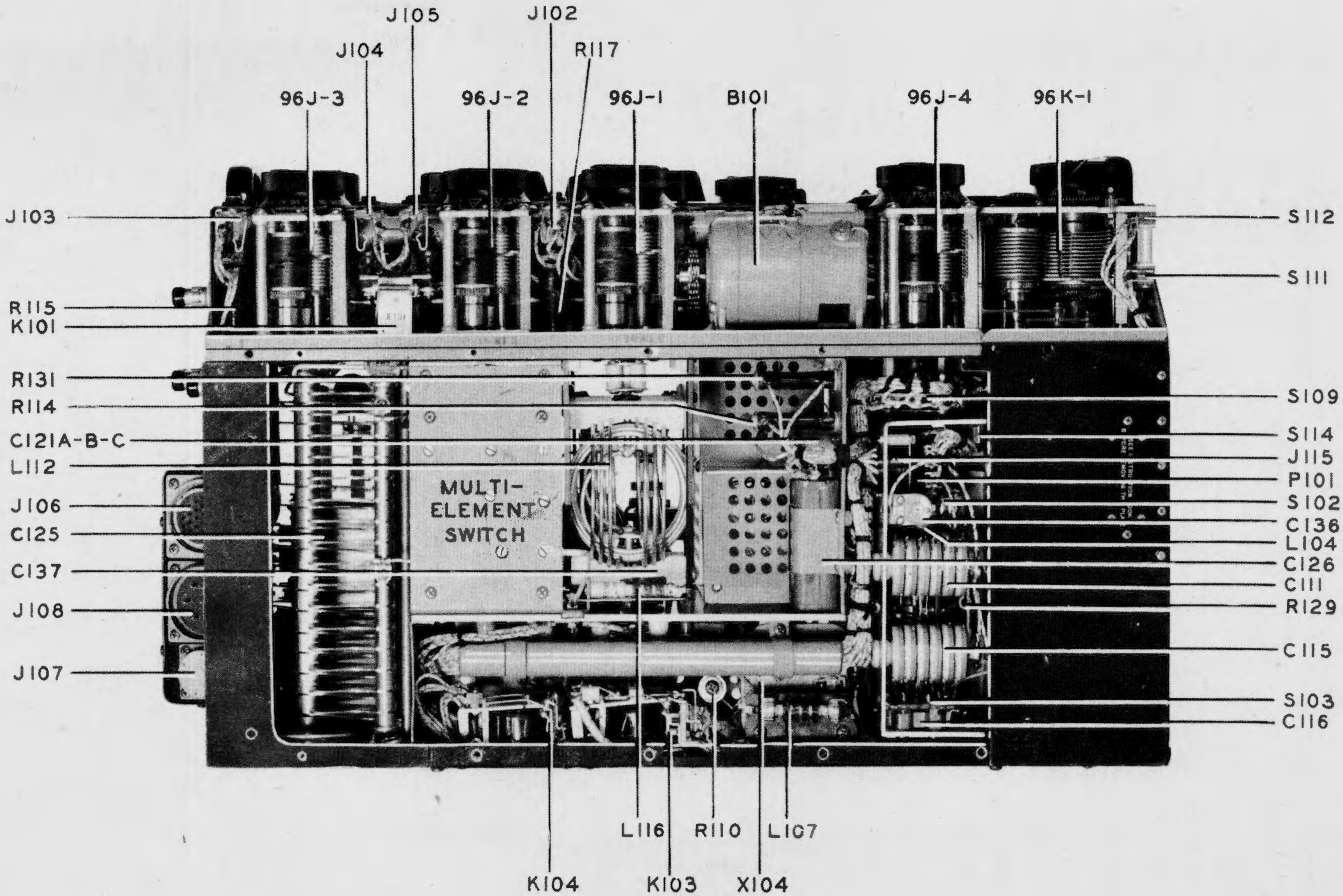


Figure 7-3 Navy Type COL-52286-A Transmitter - Bottom View

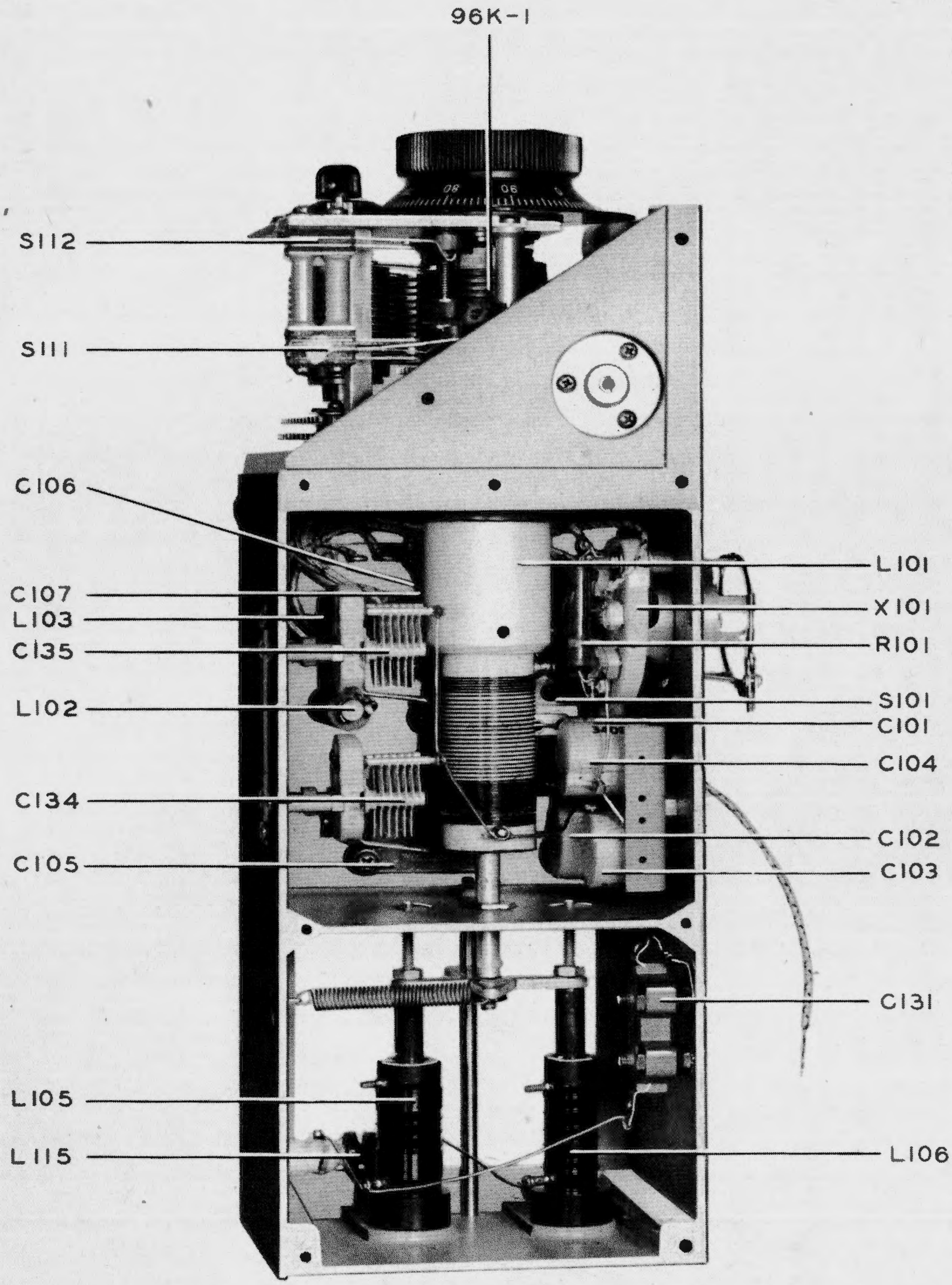


Figure 7-4 High Frequency Oscillator - Side Open View

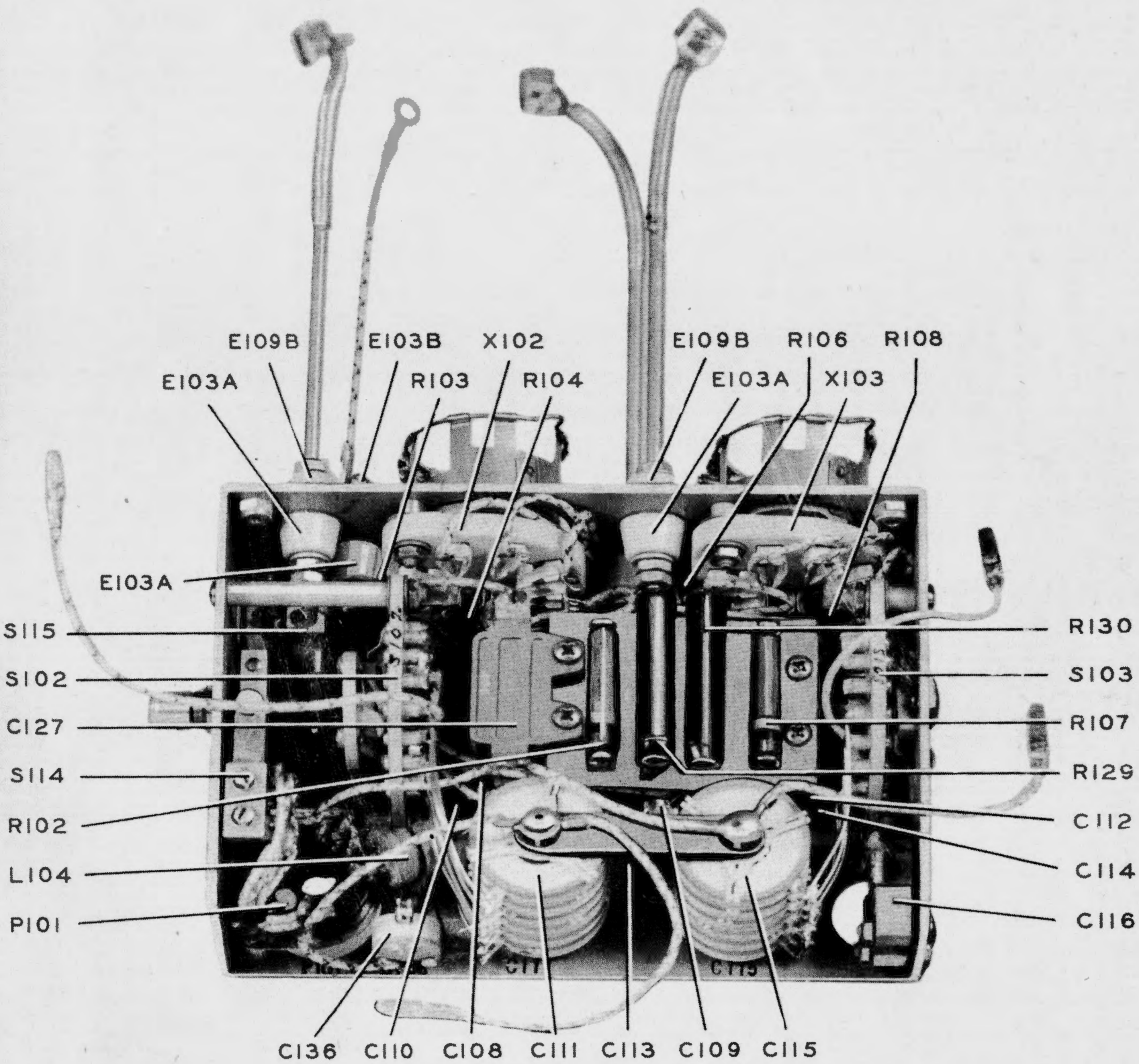


Figure 7-5 Frequency Multiplier - Side Open View

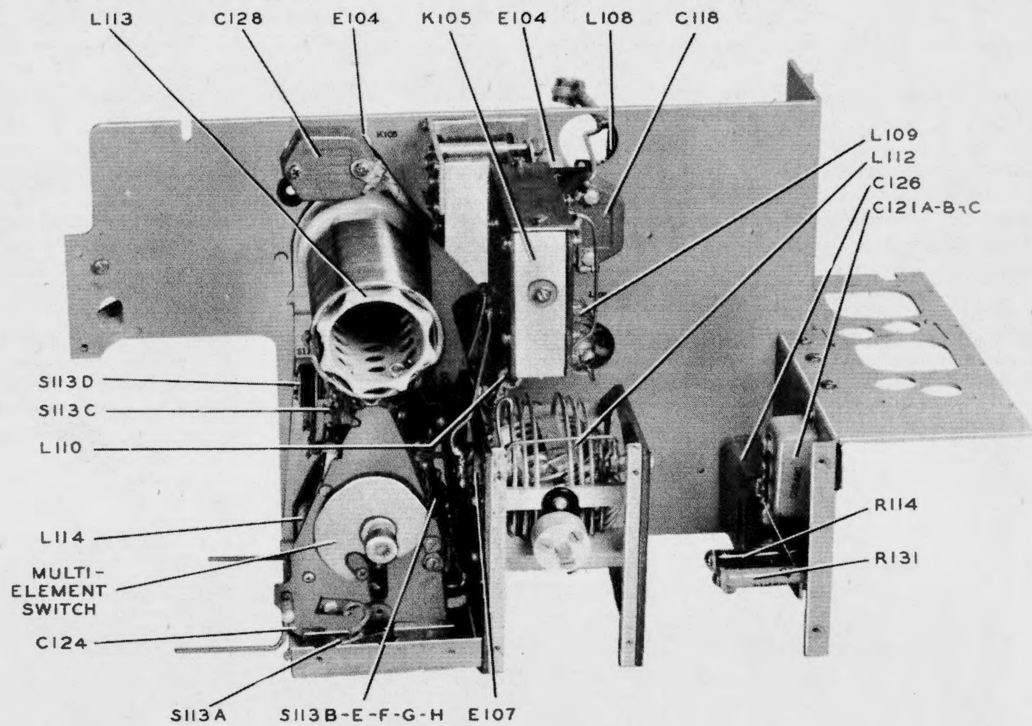


Figure 7-6 Fire Wall Assembly - Top View

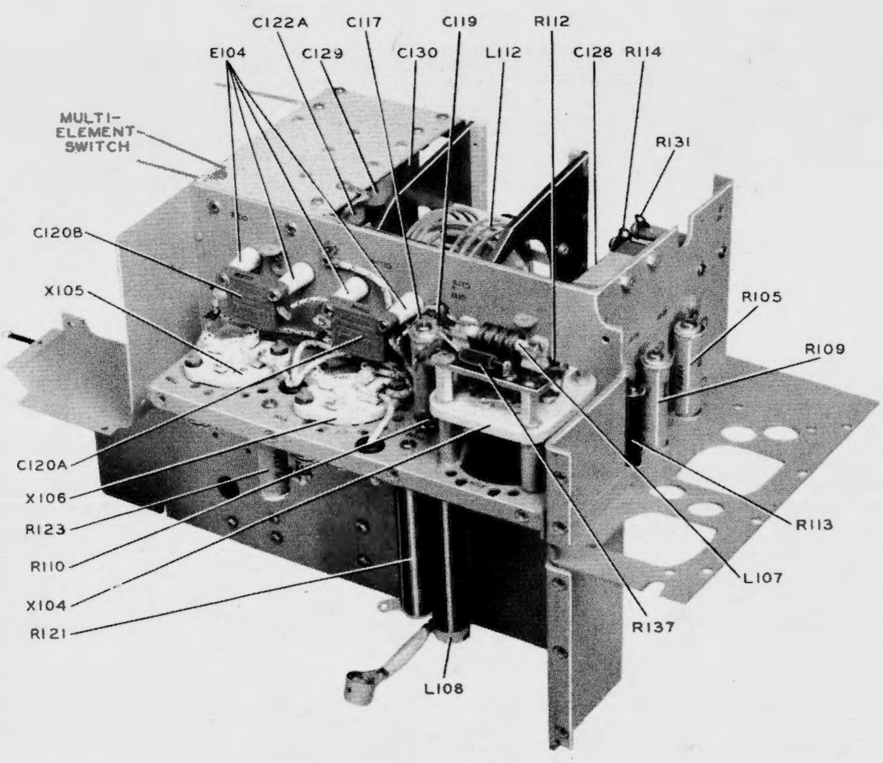


Figure 7-7 Fire Wall Assembly - Bottom View

Figure 7-8 Low Frequency Oscillator Unit - Front View

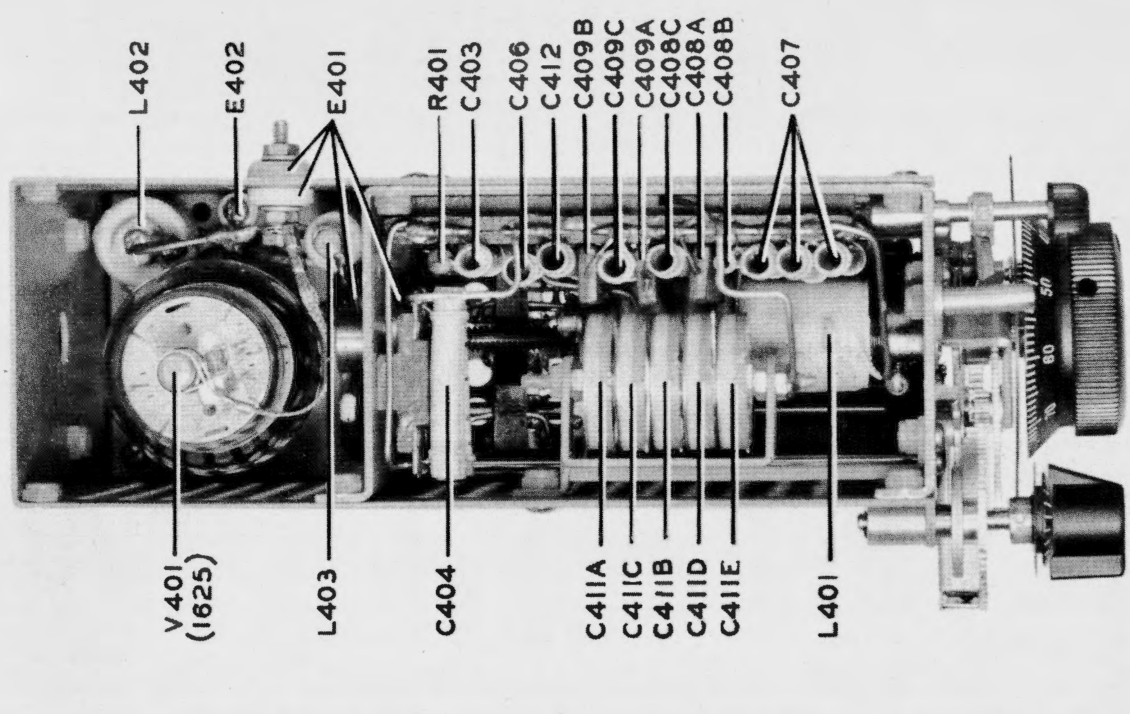


Figure 7-9 Low Frequency Oscillator Unit - Top Open View

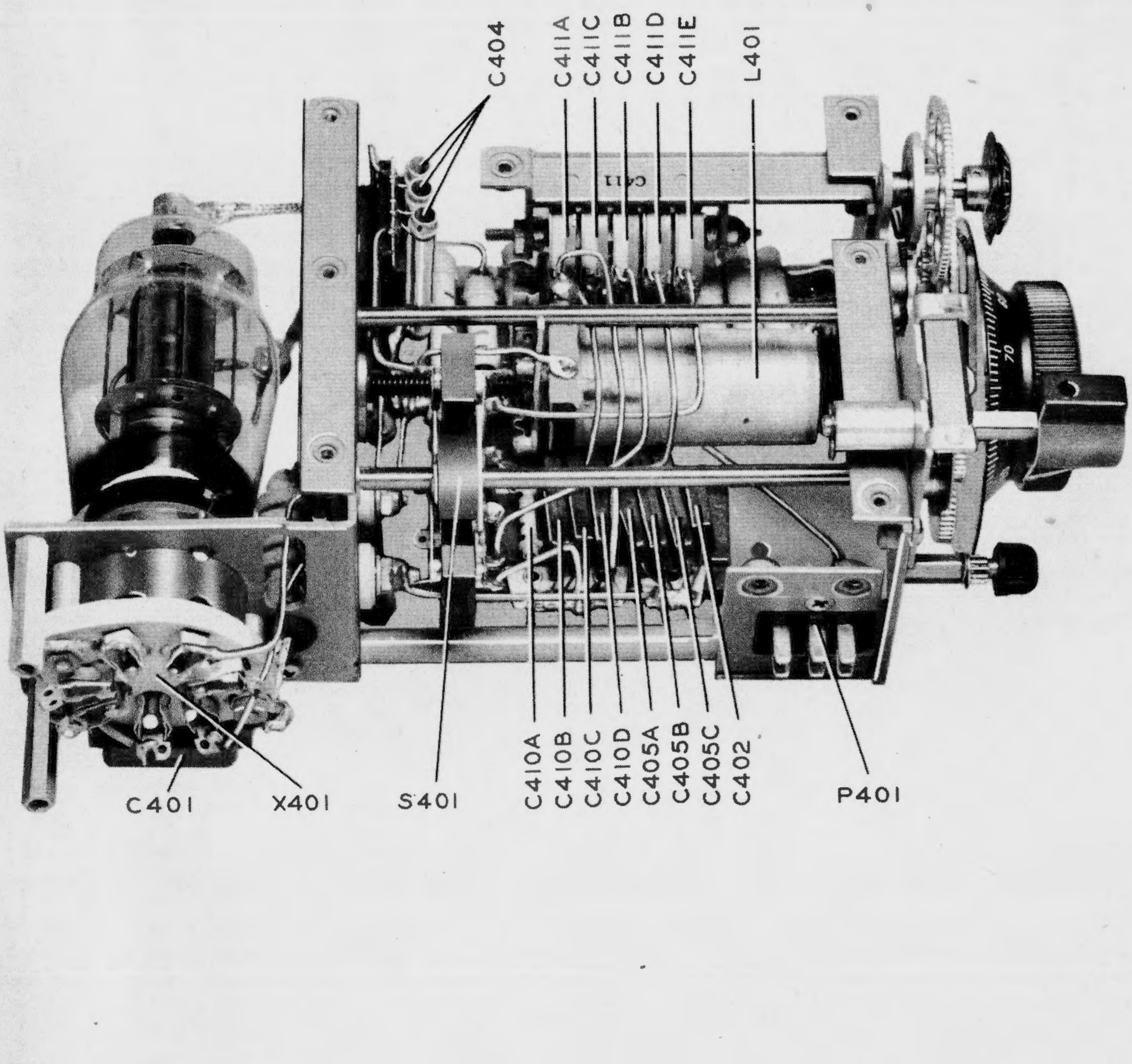


Figure 7-10 Low Frequency Oscillator Unit - Bottom Open View

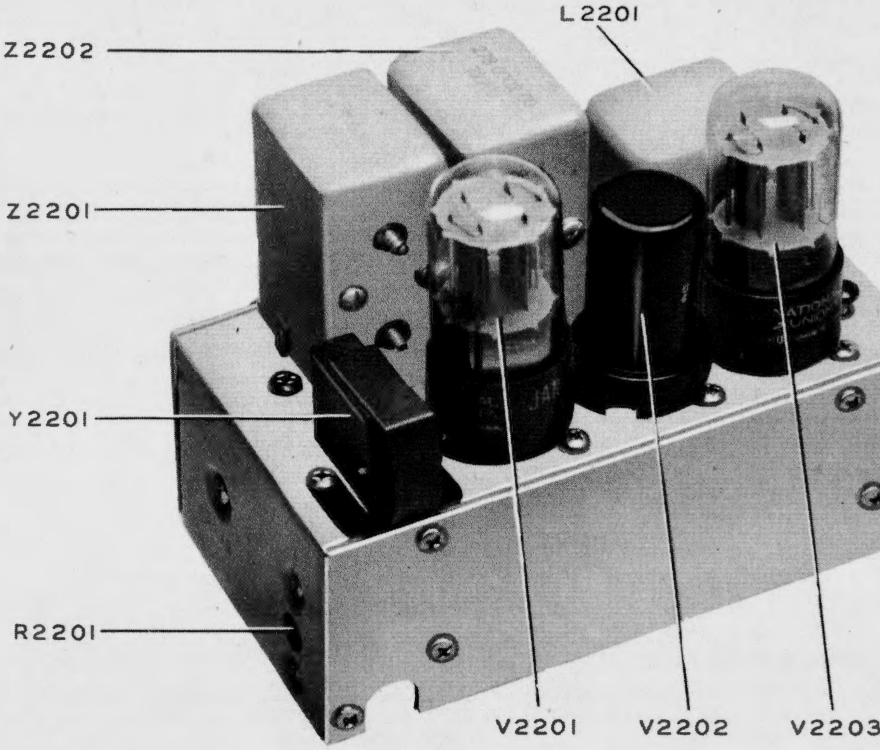


Figure 7-11 MCW-CFI Unit - Top View

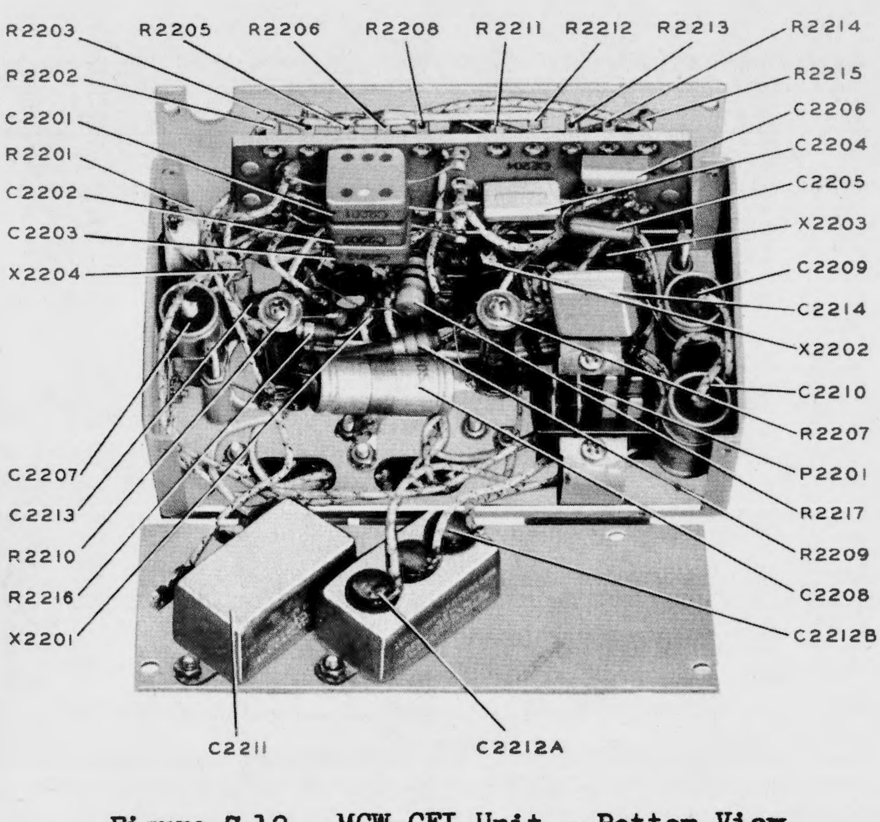


Figure 7-12 MCW-CFI Unit - Bottom View

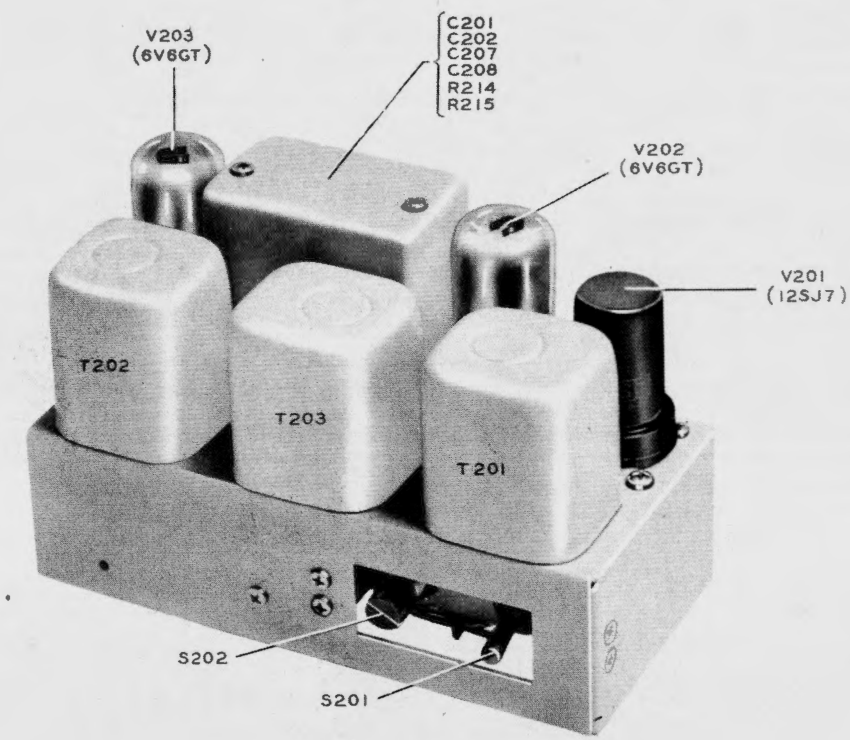


Figure 7-13 Audio Amplifier Unit - Top View

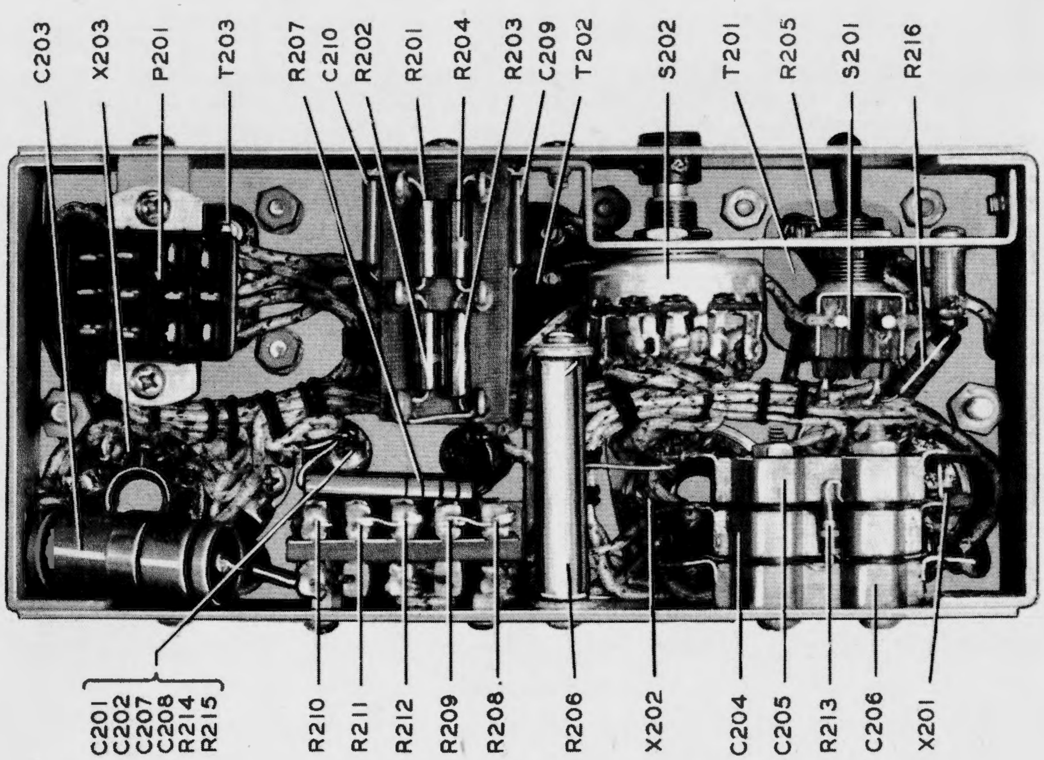


Figure 7-14 Audio Amplifier Unit - Bottom View

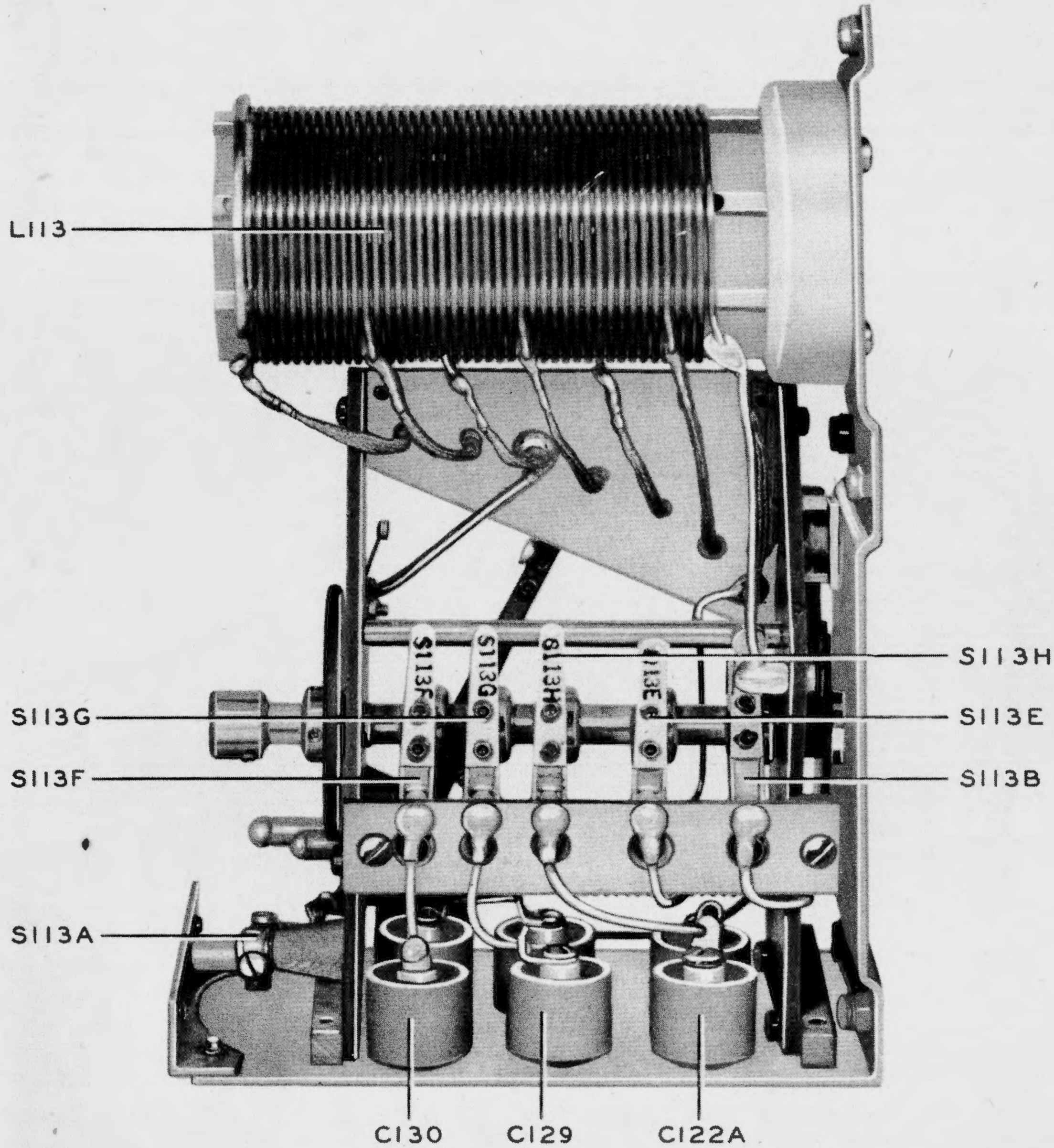


Figure 7-15 Multi-Element Switch - Right Side View

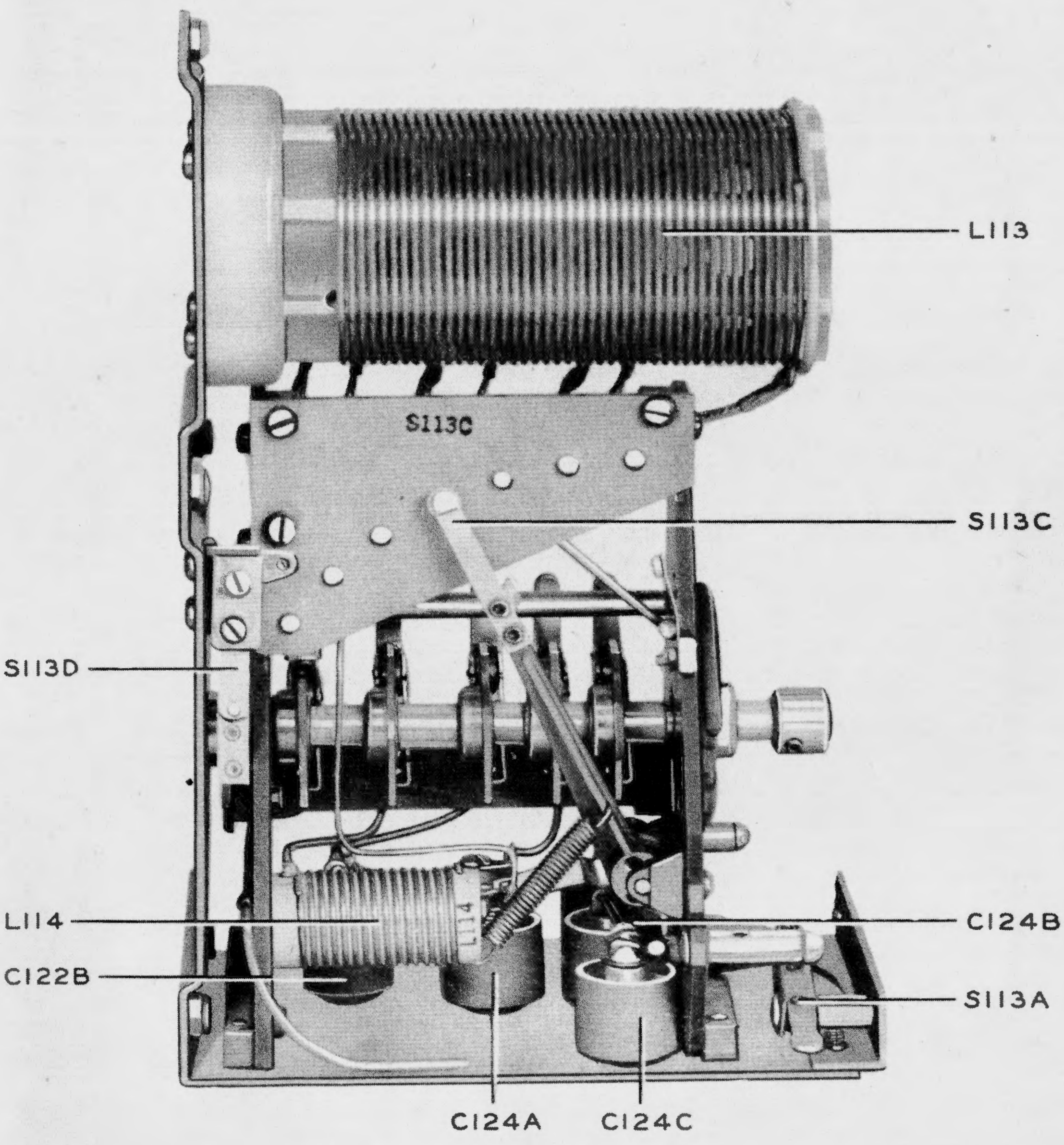


Figure 7-16 Multi-Element Switch - Left Side View

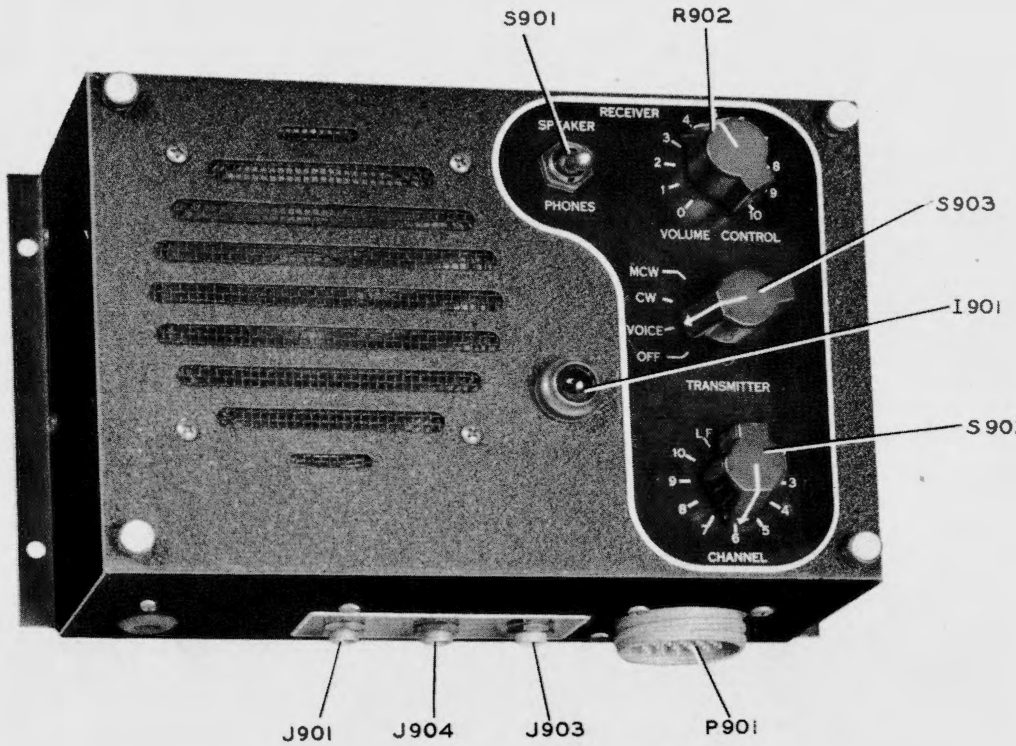


Figure 7-24 Navy Type COL-23410 Remote Control Unit - Top View

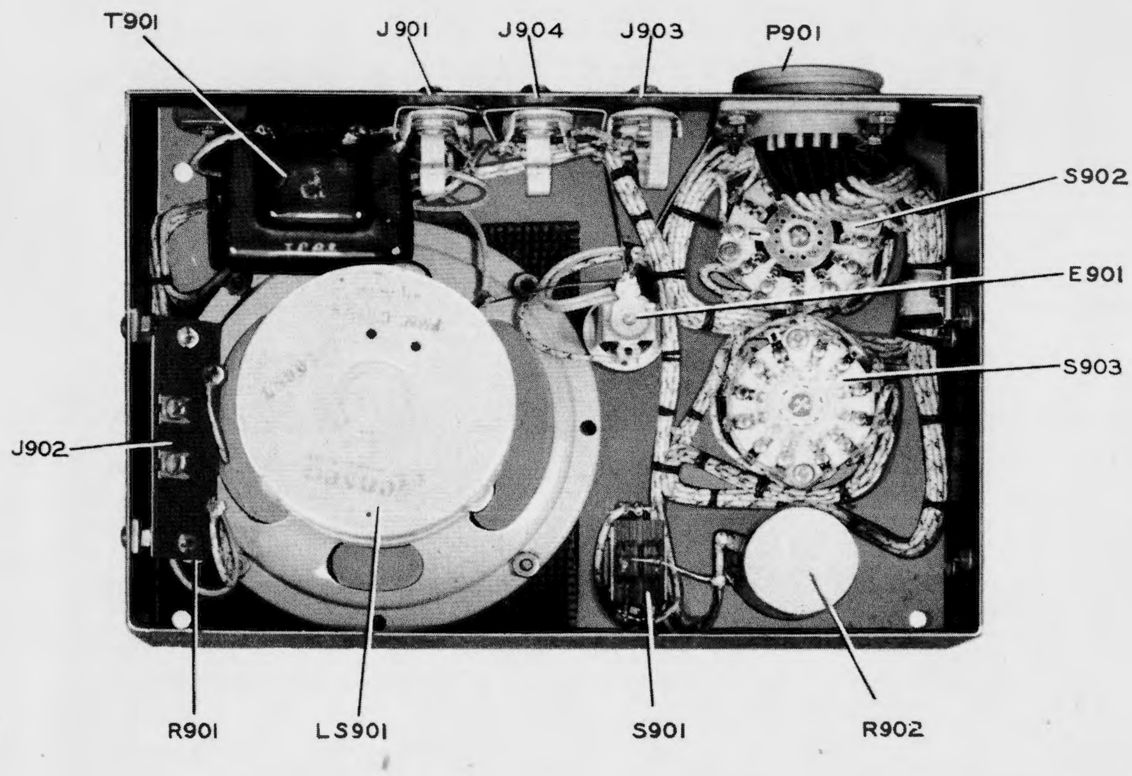


Figure 7-25 Navy Type COL-23410 Remote Control Unit - Bottom View

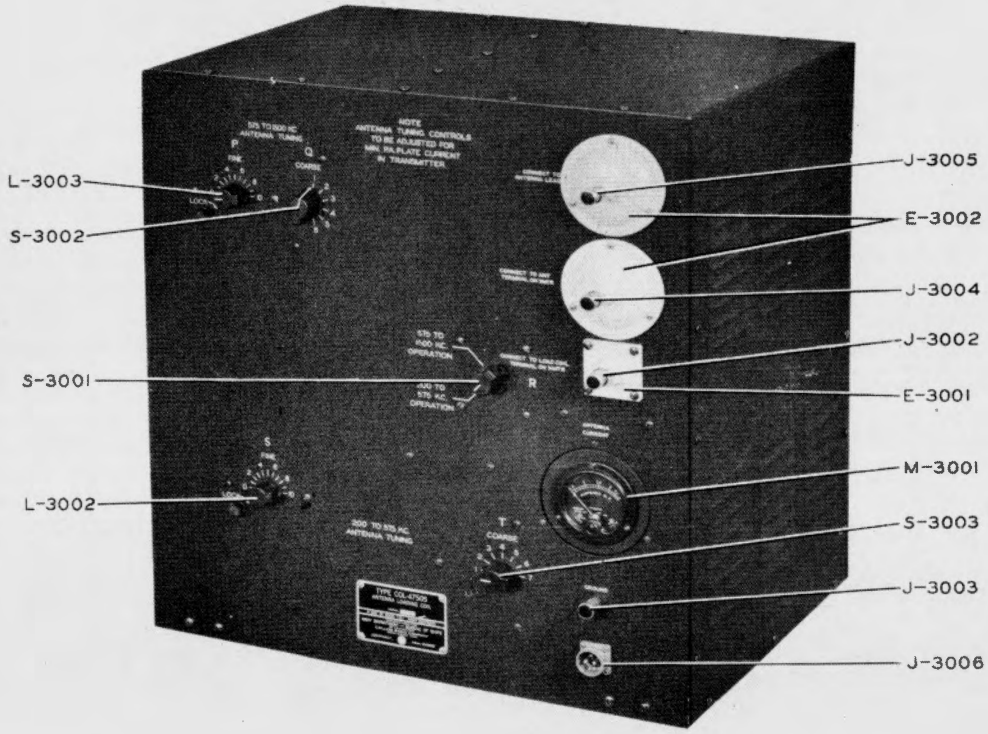


Figure 7-26 Navy Type COL-47505 Antenna Loading Coil Unit - Front View

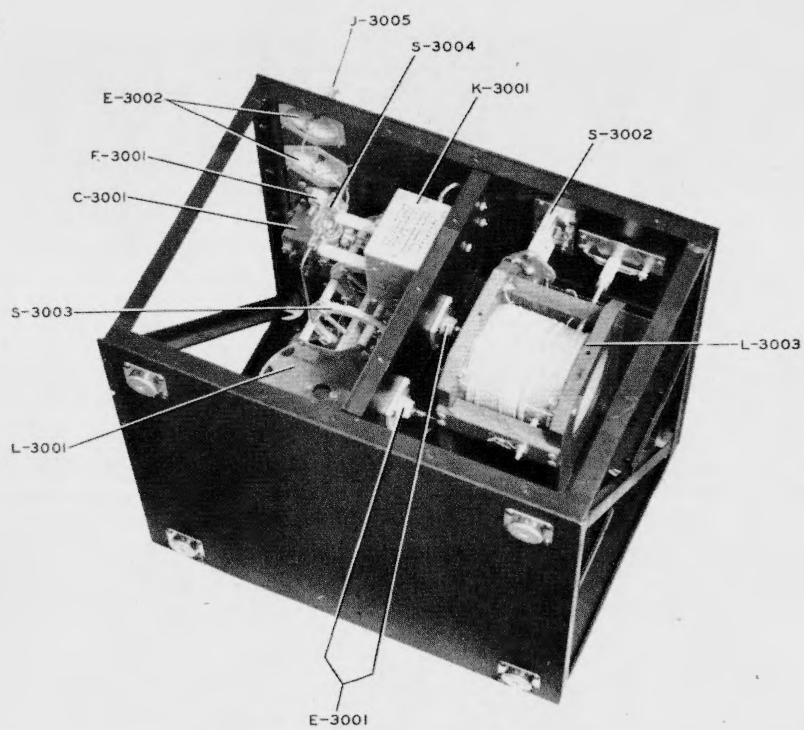


Figure 7-27 Navy Type COL-47505 Antenna Loading Coil Unit - Top Open View

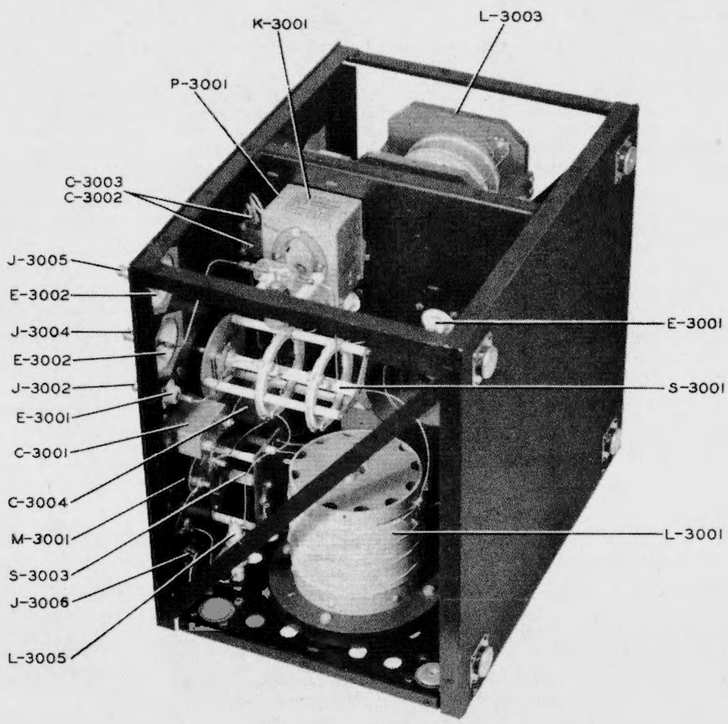


Figure 7-28 Navy Type COL-47505 Antenna Loading Coil Unit - Right Side Open View

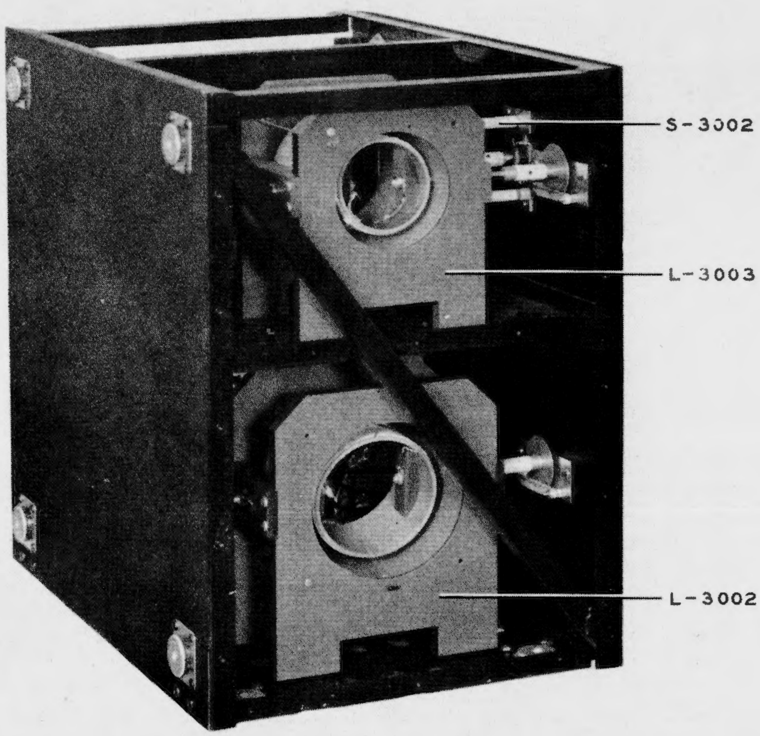


Figure 7-29 Navy Type COL-47505 Antenna Loading Coil Unit - Left Side Open View

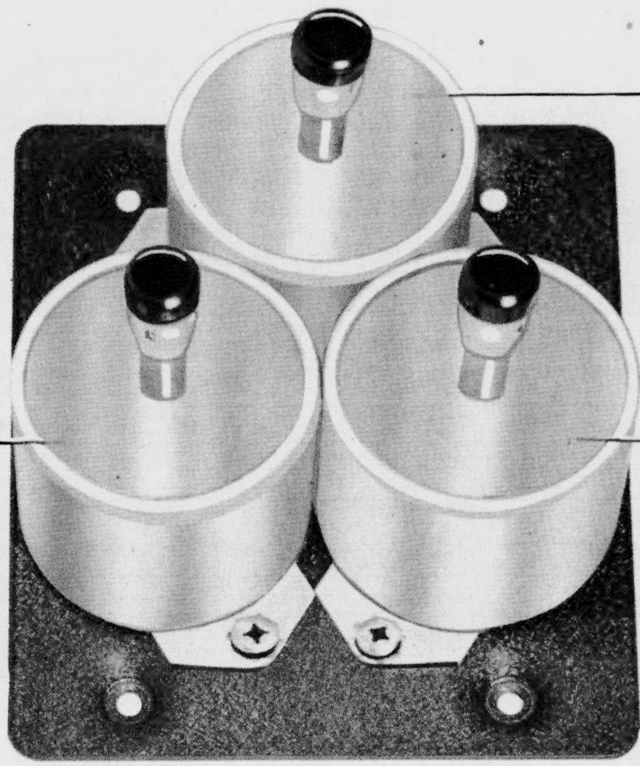


Figure 7-30 Navy Type COL-481628 Antenna Shunt Capacitor - Top View

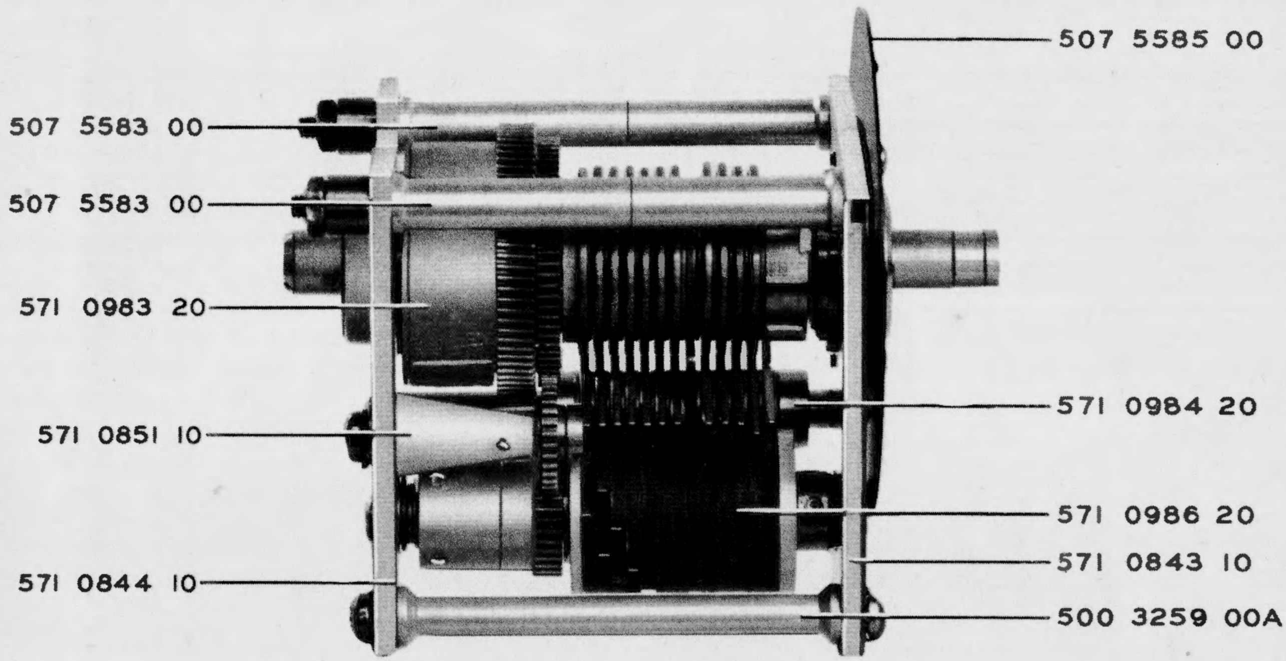


Figure 7-31 96J Autotune Singleturn Unit - Left Side View

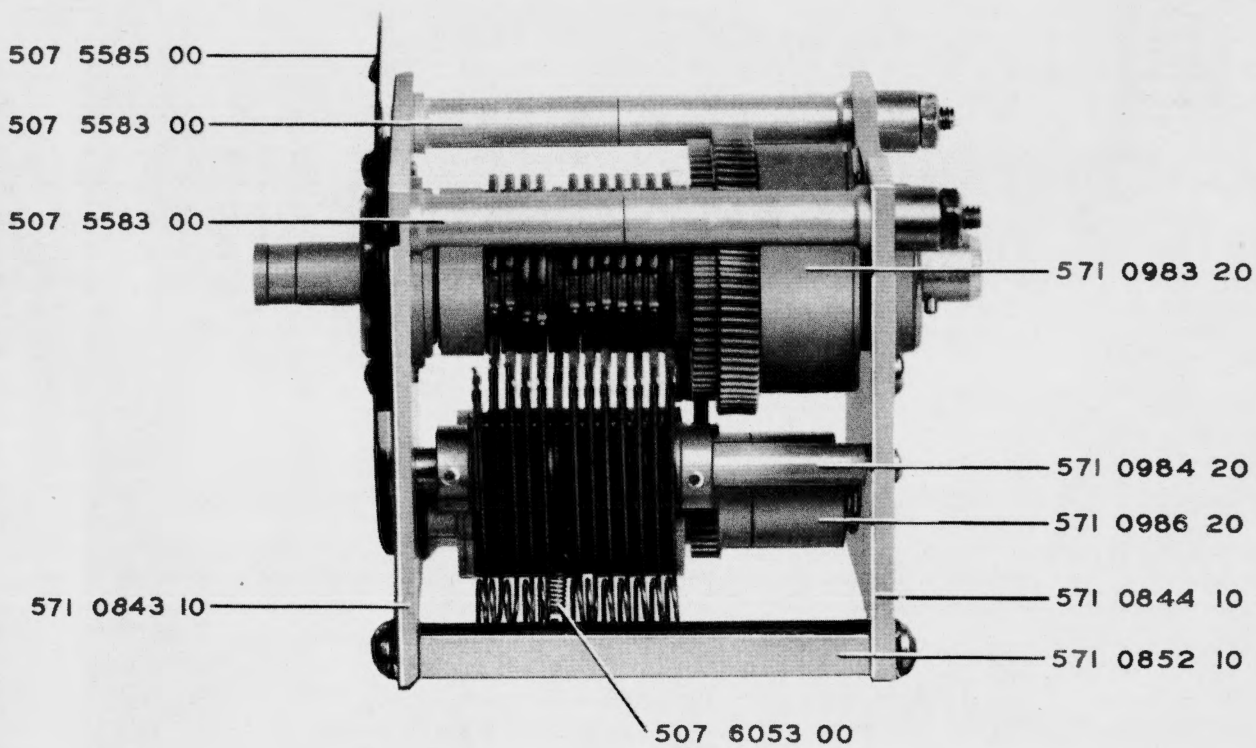


Figure 7-32 96J Autotune Singleturn Unit - Right Side View

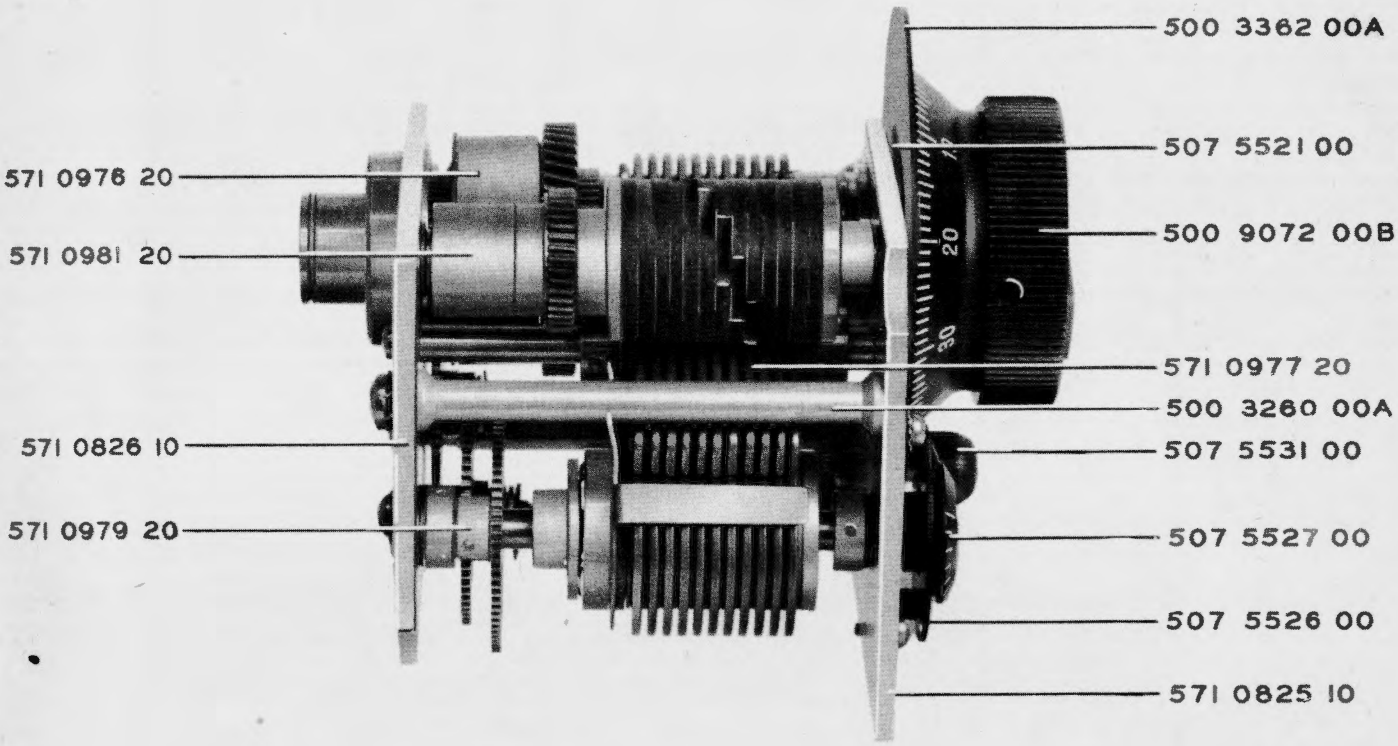


Figure 7-33 96K Autotune Multiturn Unit - Left Side View

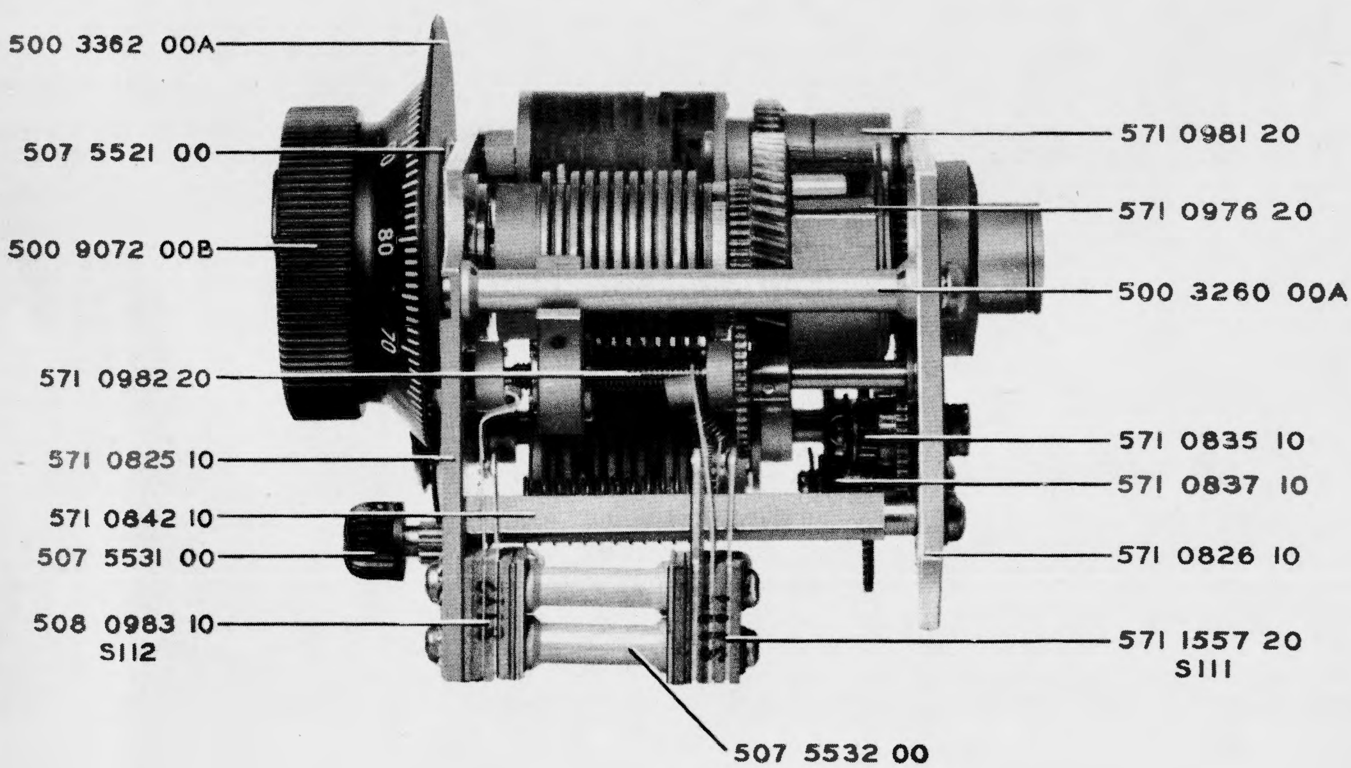


Figure 7-34 96K Autotune Multiturn Unit - Right Side View

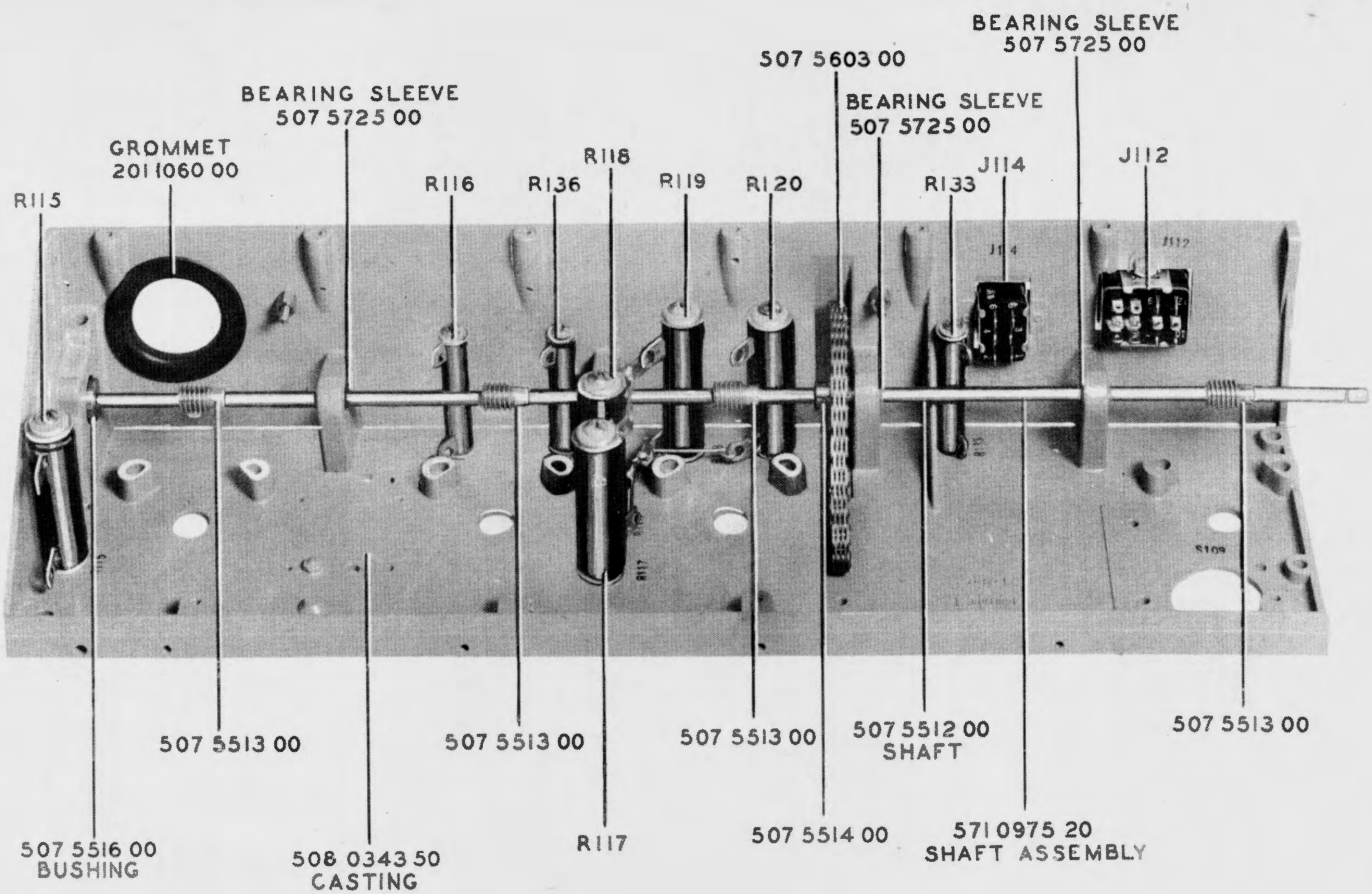


Figure 7-35 Autotune Casting

NOTE: ALL FRACTIONAL DIMENSIONS ± 1/32 UNLESS OTHERWISE NOTED.

WEIGHT: 66 POUNDS

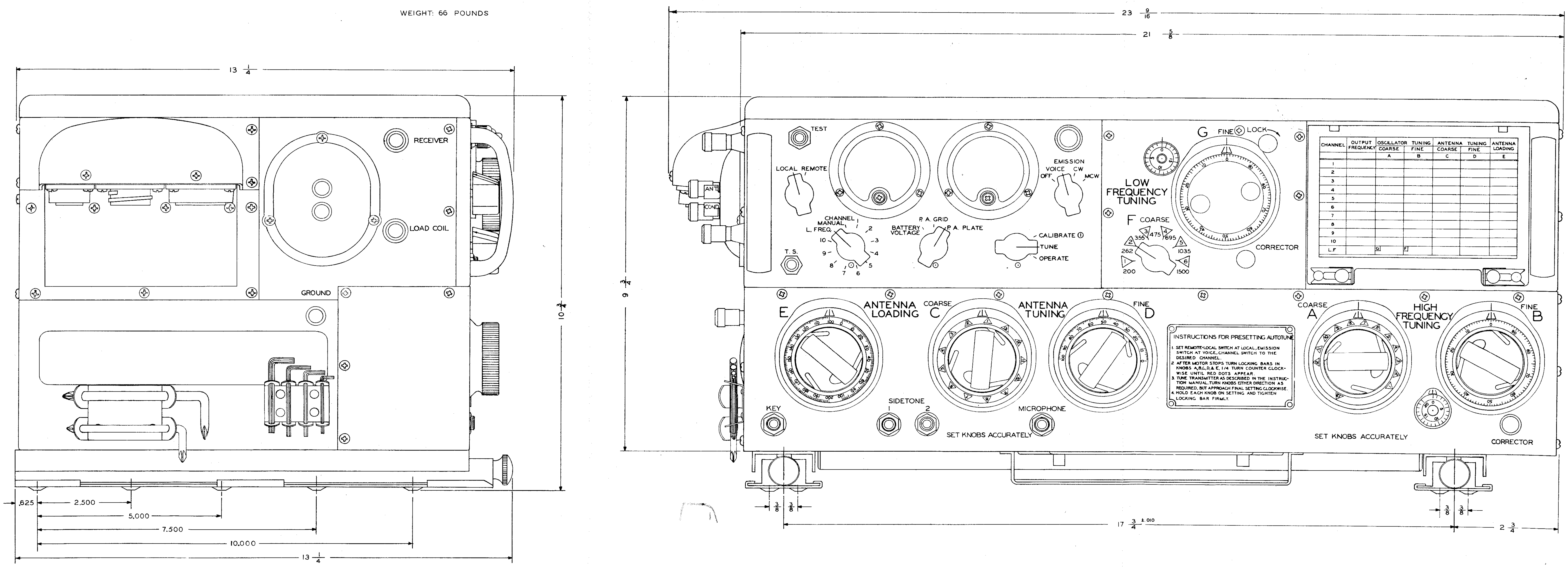


Figure 7-36 Navy Type COL-52286-A Radio Transmitter Installation Diagram

Figure 7-36 Navy Type COL-52286-A Radio Transmitter
Installation Diagram

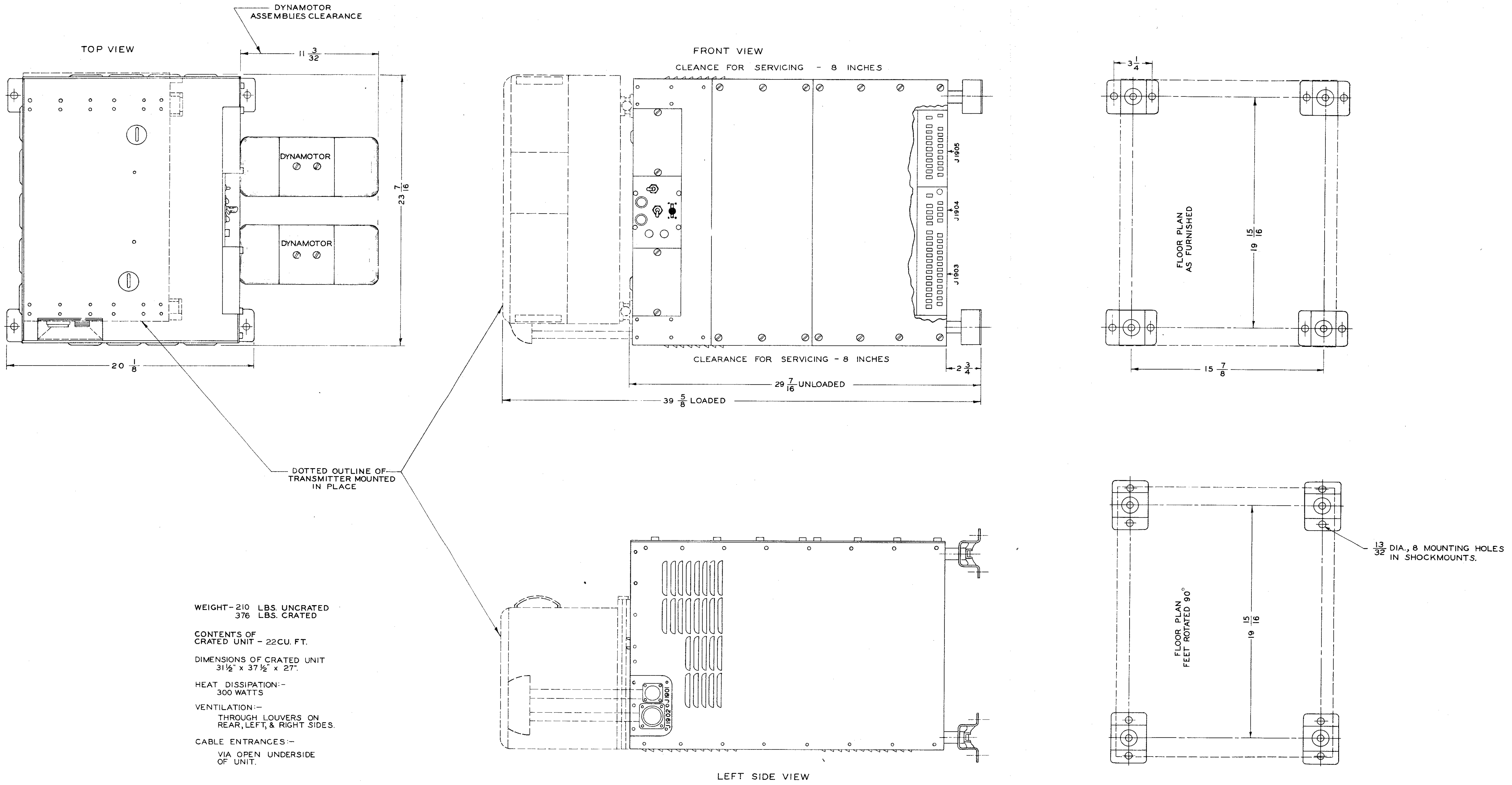


Figure 7-37 Navy Type COL-211624 Dynamotor Assembly
Power Unit Installation Diagram

Figure 7-37 Navy Type COL-211624 Dynamotor Assembly
Power Unit Installation Diagram

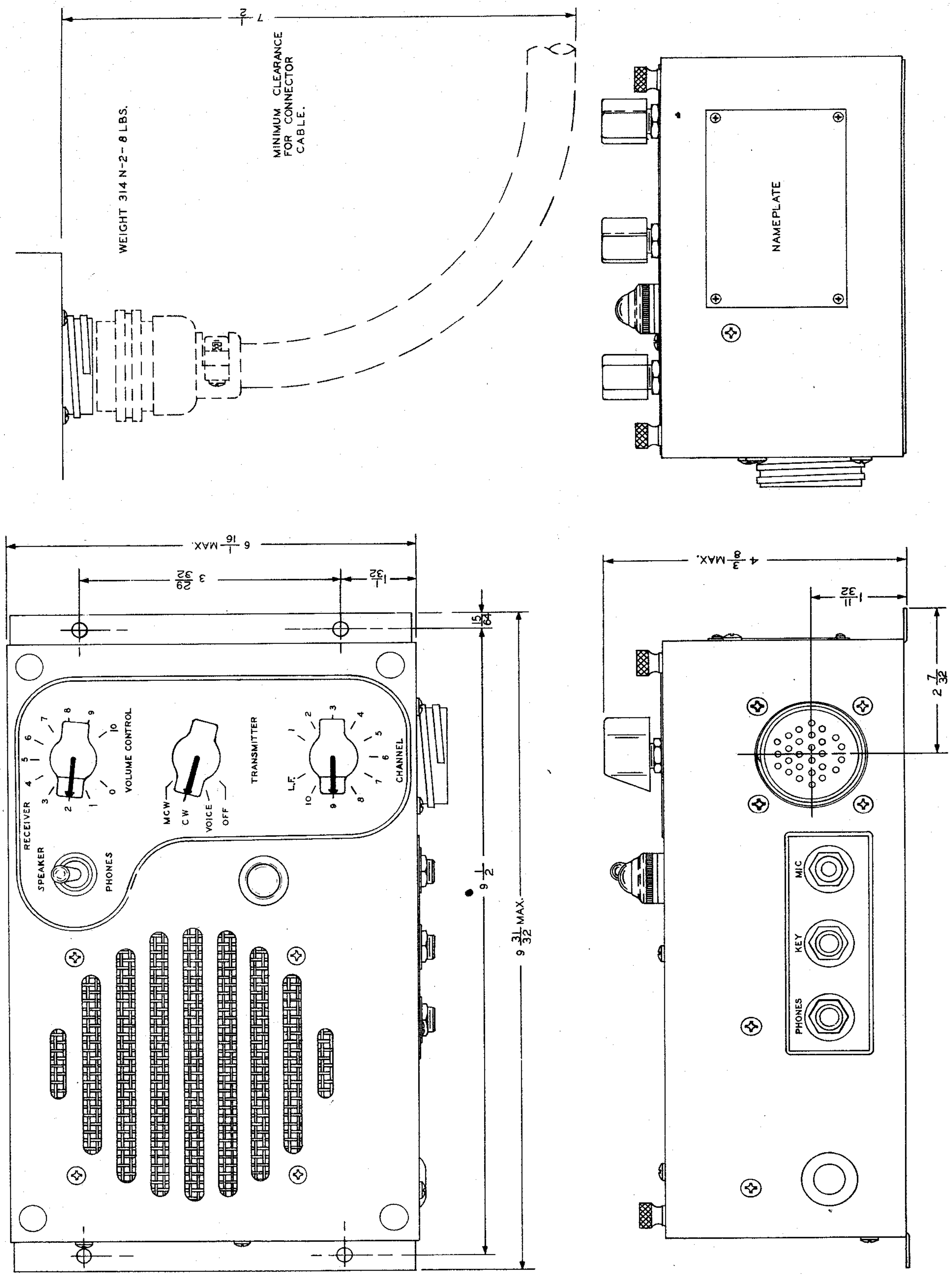


Figure 7-38 Navy Type COL-23410 Remote Control Unit Installation Diagram

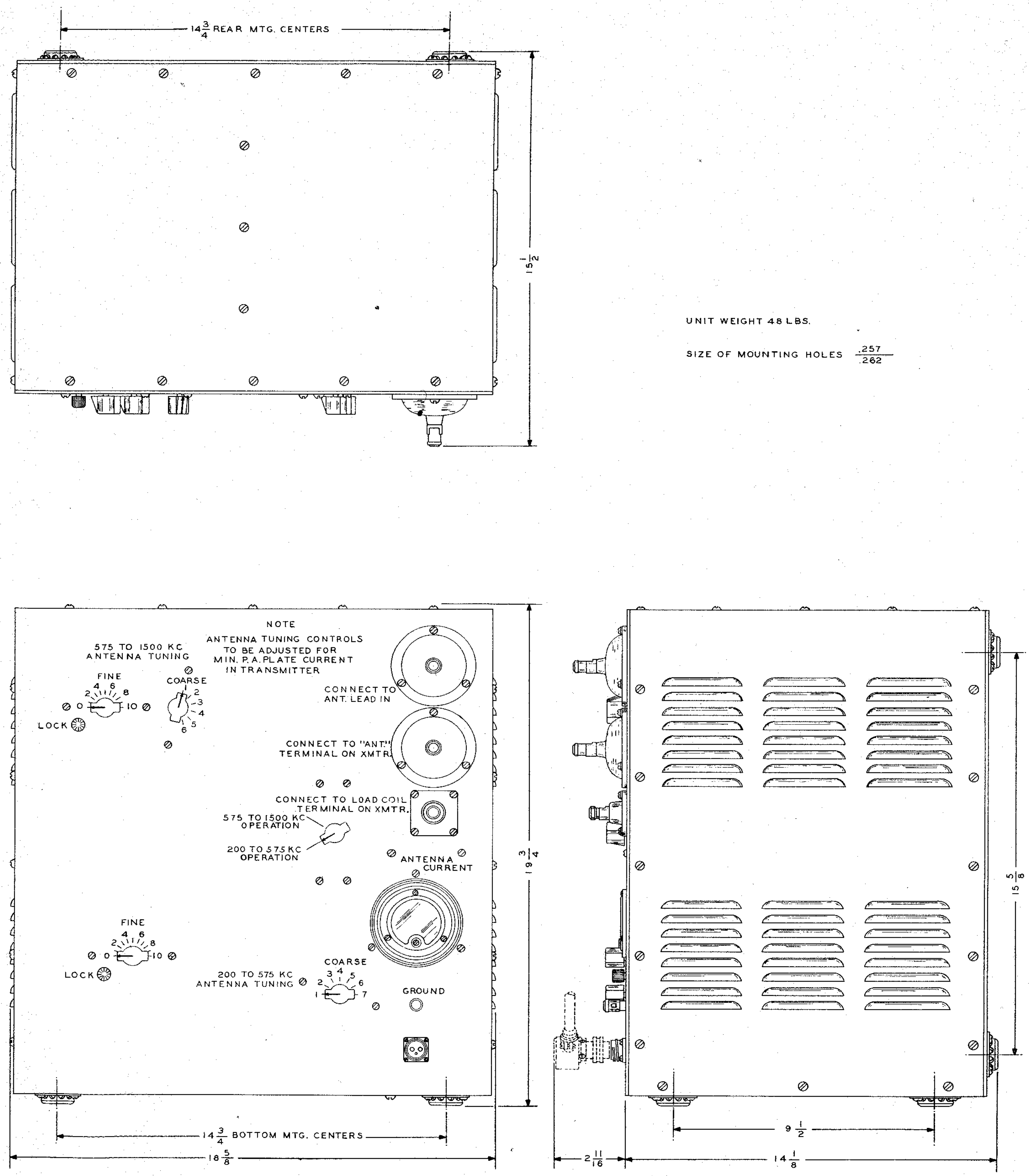


Figure 7-39 Navy Type COL-47505 Antenna Loading Coil Unit Installation Diagram

WEIGHT: 1 POUND 9.5 OZ.

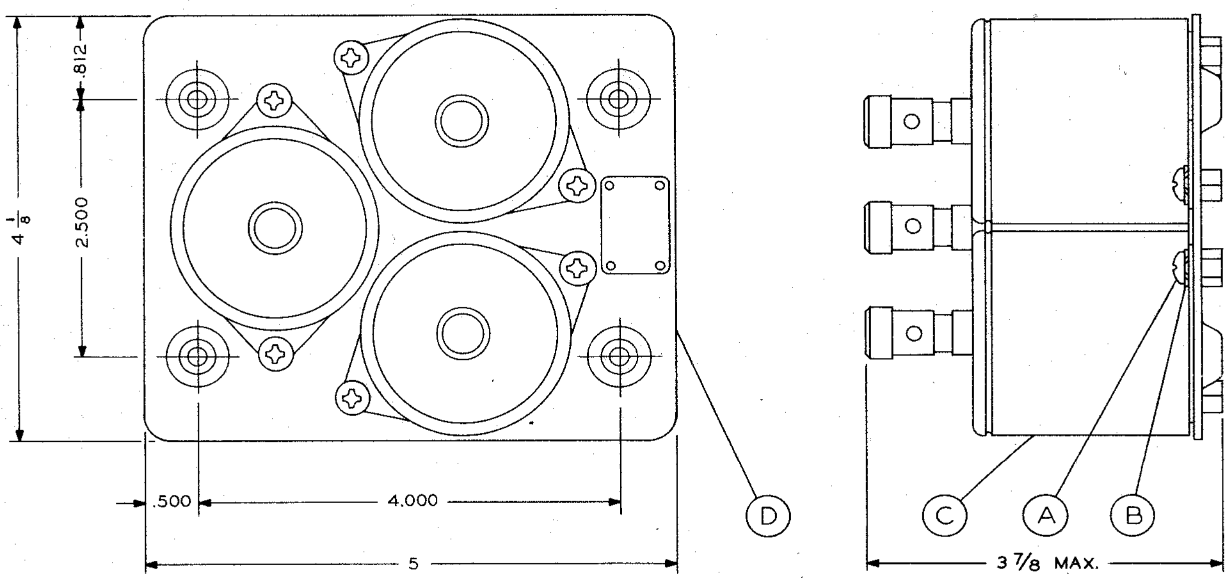
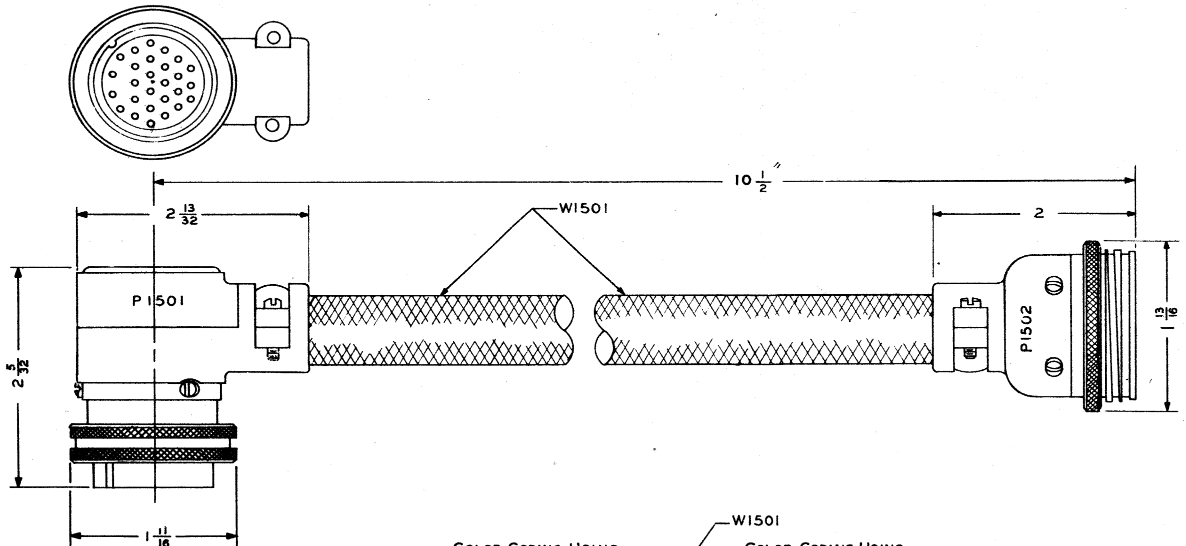
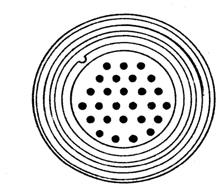
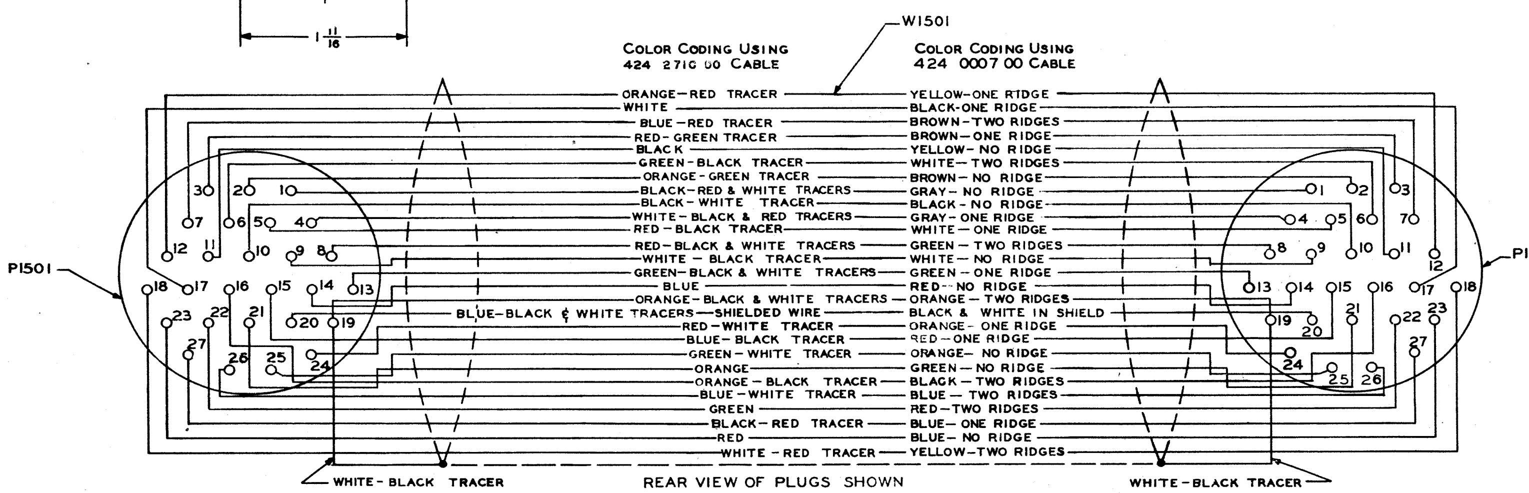


Figure 7-40 Navy Type COL-481628 Antenna Shunt Capacitor Installation Diagram



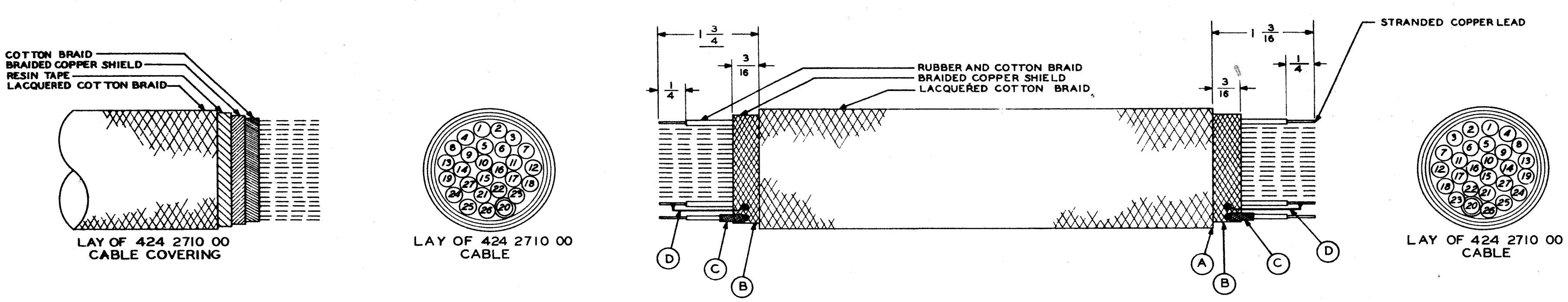


QTY.	ITEM NO.	DESCRIPTION	COLLINS PART NO.	MFG. PART NO.	MFG.
1	P1501	CONNECTOR PLUG – FEMALE	371 4060 00	NK-27-21-C11/16	10C
1	P1502	CONNECTOR PLUG – MALE	371 4049 00	RNK-27-22-C11/16	10C
.9	W1501	CABLE FT.	424 2710/0007 00		24B
1.2		.118 INSULATING SLEEVING FT.	152 1226/7610 00		
0.3		#22 HOOKUP WIRE -A90- FT.	440 0902/2902 00		
0.1		.166 INSULATING SLEEVING FT.	152 1223/7640 00		

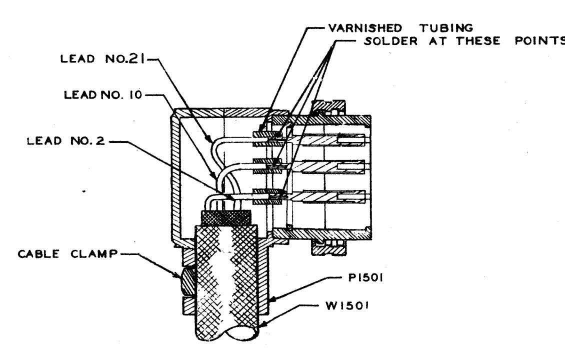


NOTE: ALL WIRES ARE OF THE SAME GUAGE. CONNECT PINS IN P1501 TO LIKE NUMBERED PINS IN P1502.

1. CUT THE CABLE TO THE PROPER LENGTH FOR THE INSTALLATION INVOLVED. ALLOW ENOUGH ADDITIONAL LENGTH SO THAT THE RADIUS OF ANY BEND IN THE CABLE IS NEVER LESS THAN 8 INCHES, AND THE CABLE IS NOT TIGHT ENOUGH TO INTERFERE WITH THE ACTION OF THE SHOCKMOUNTS, OR TO DAMAGE THE CONNECTIONS.
2. CHECK DRAWING FOR PROPER CABLE LAY.
3. FOR PLUG P1502, CUT THE LACQUERED COTTON BRAID AND RESIN TAPE 1-3/16 INCH FROM THE END OF THE CABLE. (A)
4. SOLDER A 3/16 INCH LENGTH OF THE BRAIDED COPPER SHIELD MEASURED FROM THE LACQUERED COTTON BRAID; UNBRAID THE SHIELD AND CUT OFF THE LOOSE WIRES AND COTTON BRAID EVEN WITH THE SOLDERED PORTION OF THE BRAIDED COPPER SHIELD (B)
5. UNBRAID THE SHIELD ON #20 WIRE, TURN BACK AND SOLDER TO MAIN SHIELD. (C)
6. STRIP INSULATION 1/4 INCH BACK FROM ENDS OF WIRES.
7. ON WIRE #19 TWIST AND SOLDER A PIECE OF #22, WIRE, BRING BACK AND SOLDER TO MAIN SHIELD. (D)
8. TIN ENDS OF WIRES
9. SLIP THE PLUG CAP AND LOCKING RING OVER CABLE.
10. SLIP A 1/2 INCH PIECE OF VARNISHED TUBING OVER EACH WIRE. USE VARNISHED TUBING WHICH GIVES A SNUG FIT.
11. SOLDER WIRES TO PLUG TERMINALS AND SLIP VARNISHED TUBING OVER THE CONNECTION.
12. WHEN ALL WIRES HAVE BEEN SOLDERED TO THE PLUG TERMINALS FASTEN THE PLUG CAP AND LOCKING RING OVER THE PLUG TERMINALS AND TIGHTEN THE CABLE CLAMP.
13. INSTRUCTIONS APPLY TO PLUG P1501 EXCEPT INSTRUCTIONS #3 SUBSTITUTE 1 3/4 INCHES IN #3
14. USE RESIN CORE SOLDER FOR ALL SOLDERED CONNECTIONS.
15. SYMBOL DESIGNATIONS AS SHOWN TO BE STAMPED ON PARTS, (NONE ON CABLE).



TOOLS RECOMMENDED FOR ASSEMBLY OF CABLE
WIRE STRIPPER LONG NOSE PLIERS SIDE CUTTING PLIERS SCREW DRIVER SOLDERING IRON



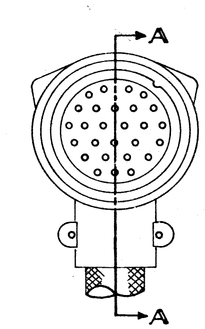
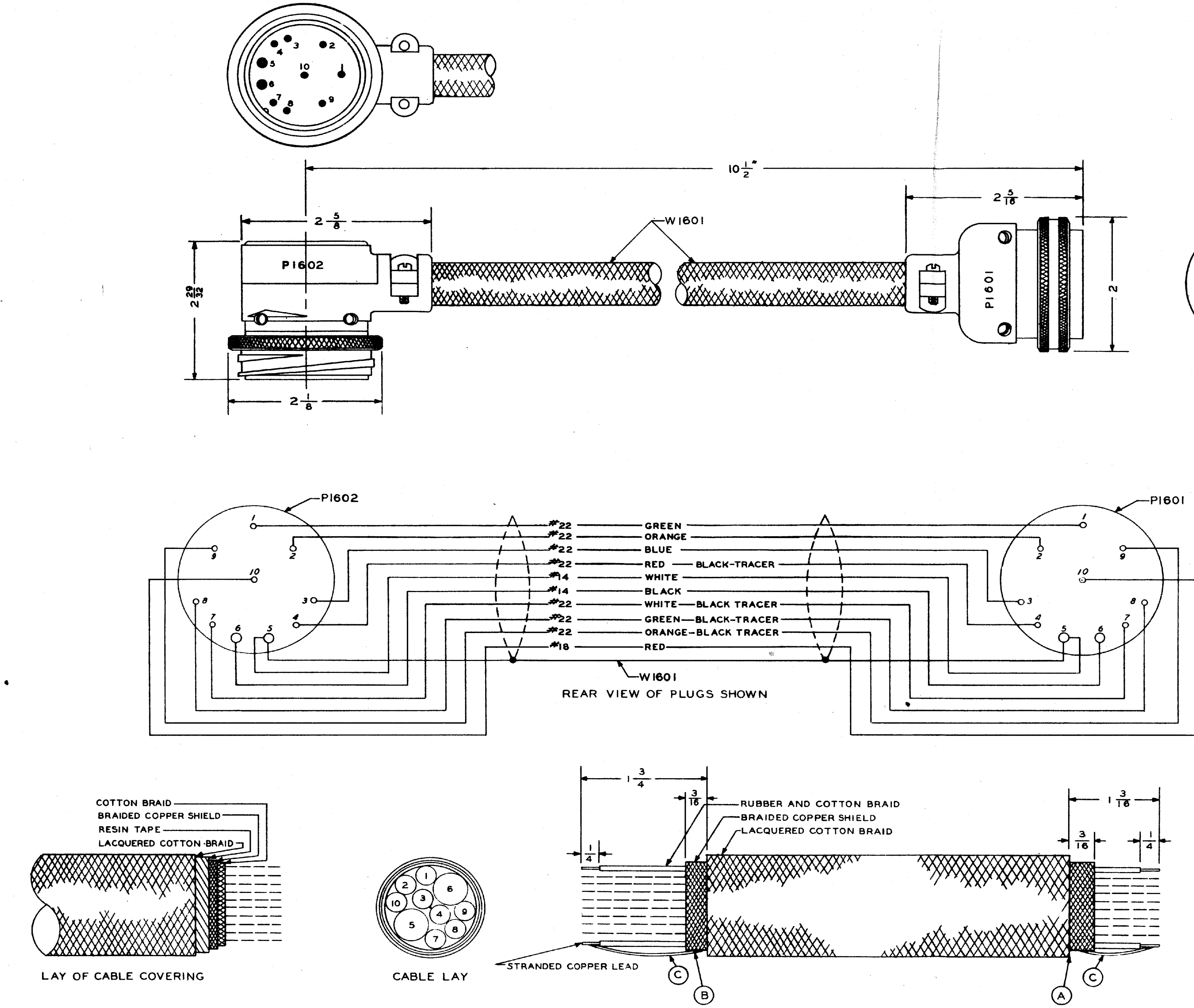
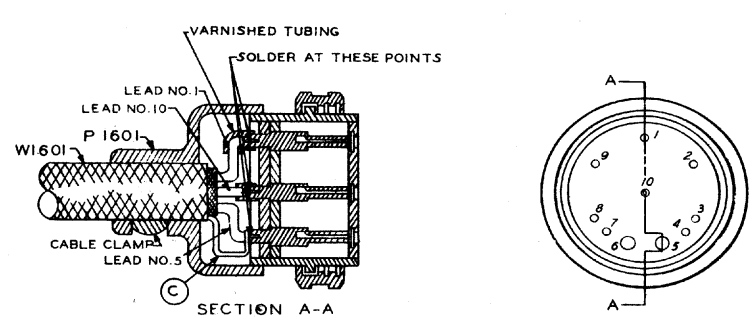


Figure 7-41 65X-7 Control Cable Assembly Diagram



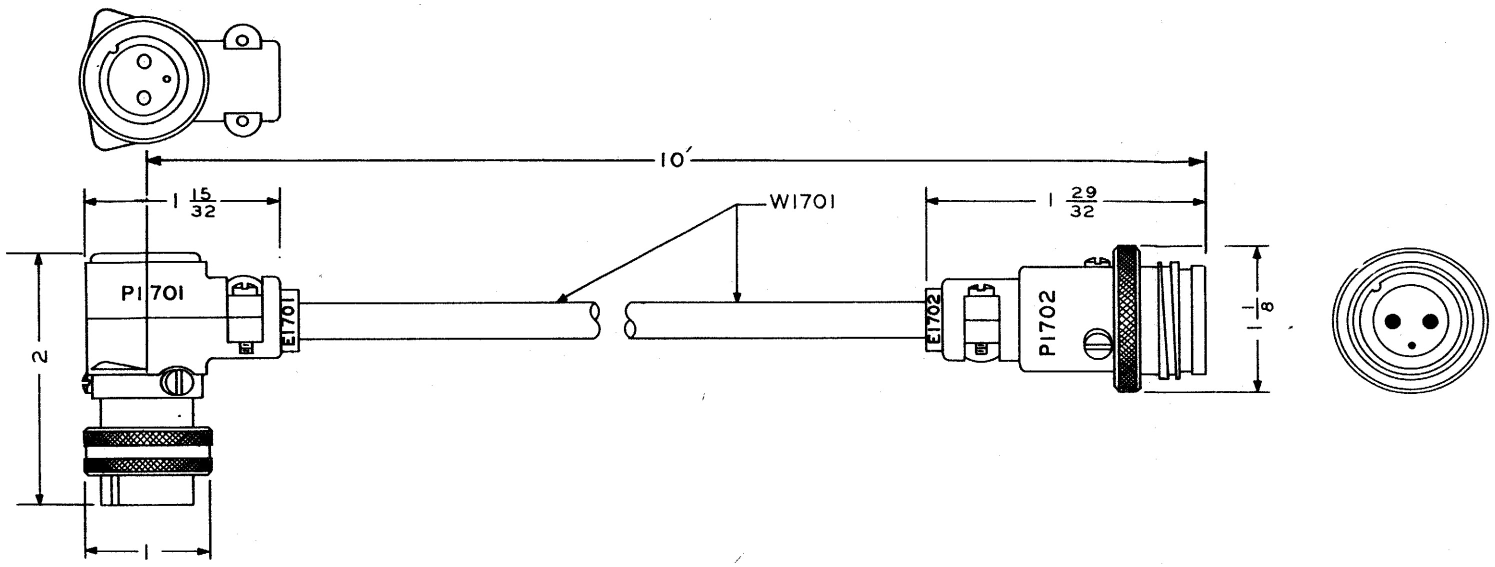
TOOLS RECOMMENDED FOR ASSEMBLY OF CABLE
WIRE STRIPPER LONG NOSE PLIERS SIDE-CUTTING PLIERS SCREWDRIVER SOLDERING IRON



QTY.	ITEM NO.	DESCRIPTION	COLLINS PART NO.	MFG. PART NO.	MFG.
1	P1601	CONNECTOR PLUG-FEMALE	371 5140 00	FK-10-21-C 9/16	10C
1	P1602	CONNECTOR PLUG-MALE	371 5129 00	RFK-10-24-C 9/16	10C
1.2	W1601	CABLE-10 CONDUCTOR FT.	424 1010 00		24B
0.7'	E	.118 INSULATING SLEEVING, FT.	152 1226 7610 00		
0.3'	D	#22 HOOK-UP WIRE -A9-. FT.	440 0901 2901 00		
0.2'	F	166 INSULATING SLEEVING, FT.	152 1223 7640 00		

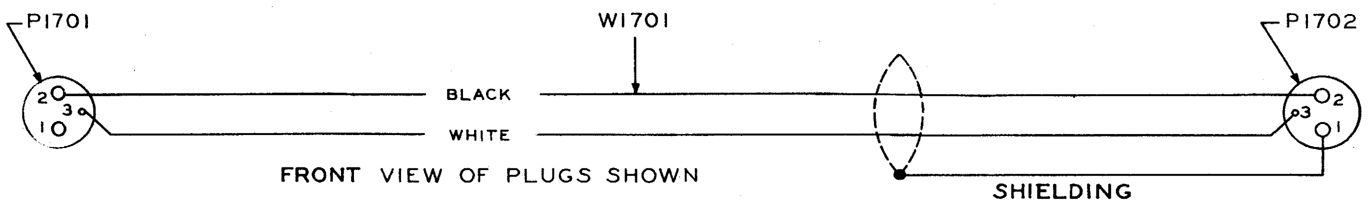
1. CUT THE CABLE TO THE PROPER LENGTH FOR THE INSTALLATION INVOLVED. ALLOW ENOUGH ADDITIONAL LENGTH SO THAT THE RADIUS OF ANY BEND IN THE CABLE IS NEVER LESS THAN 8 INCHES AND THE CABLE IS NOT TIGHT ENOUGH TO INTERFERE WITH THE ACTION OF THE SHOCKMOUNTS OR TO DAMAGE THE CONNECTORS.
2. CHECK DRAWING FOR PROPER CABLE LAY.
3. FOR PLUG P1601 CUT THE LACQUERED COTTON BRAID AND RESIN TAPE 1 3/16 INCH FROM THE END OF THE CABLE. (A)
4. SOLDER A 3/16 INCH LENGTH OF THE BRAIDED COPPER SHIELD MEASURED FROM THE LACQUERED COTTON BRAID, UNBRAID THE SHIELD AND CUT OFF THE LOOSE WIRES AND THE COTTON BRAID EVEN WITH THE SOLDERED PORTION OF THE BRAIDED COPPER SHIELD. (B)
5. STRIP INSULATION BACK 1/4 INCH FROM ENDS OF THE WIRES.
6. TWIST AND SOLDER A PIECE OF #22 WIRE TO #5 WIRE, BRING BACK AND SOLDER TO SHIELD. (C)
7. TIN ENDS OF WIRES, & SLIP SLEEVING (E) AND (F) OVER CONDUCTORS.
8. SLIP THE PLUG CAP AND LOCKING RING OVER CABLE.
9. SLIP A 1/2 INCH PIECE OF VARNISHED TUBING OVER EACH WIRE. USE VARNISHED TUBING WHICH GIVES A SNUG FIT.
10. SOLDER WIRES TO PLUG TERMINALS AND SLIP VARNISHED TUBING OVER THE CONNECTIONS.
11. WHEN ALL WIRES HAVE BEEN SOLDERED TO THE PLUG TERMINALS FASTEN THE PLUG CAP AND LOCKING RING OVER THE PLUG TERMINALS AND TIGHTEN THE CABLE CLAMP.
12. INSTRUCTIONS APPLY TO PLUG P1602 EXCEPT INSTRUCTION #3. SUBSTITUTE 1 3/4 INCH IN THIS INSTRUCTION.
13. USE RESIN CORE SOLDER ON ALL SOLDERED CONNECTIONS.
14. SYMBOL DESIGNATIONS AS SHOWN TO BE STAMPED ON PARTS (NONE ON CABLE).

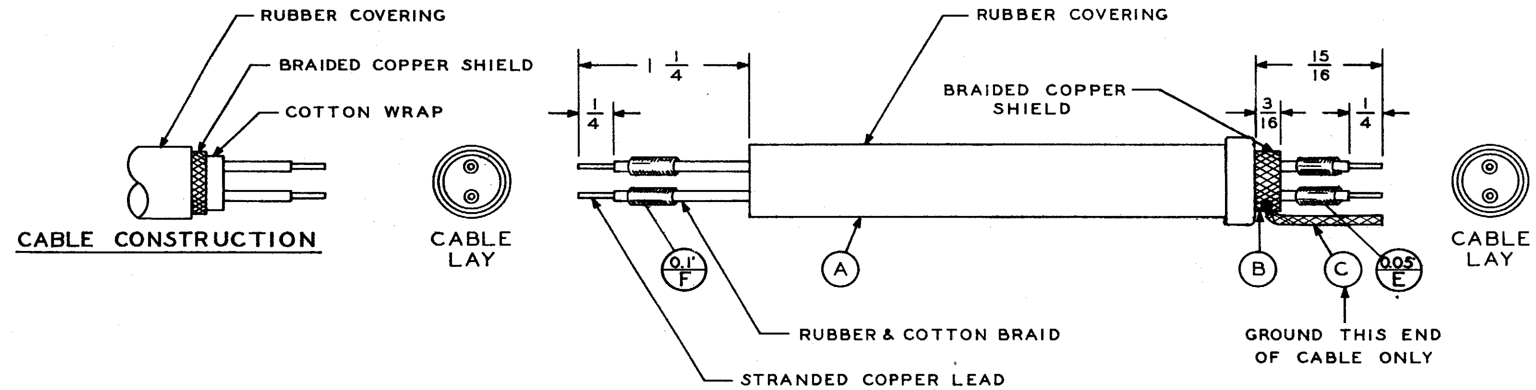
Figure 7-42 65X-8 Power Cable Assembly Diagram



REQ'D	ITEM NO.	DESCRIPTION	COLLINS PART NUMBER	MFG. PART NUMBER	MFG.
1	P1701	CONNECTOR PLUG - FEMALE	371 1090 00	WK-C3-23C 7/16	10C
1	P1702	CONNECTOR PLUG - MALE	371 1109 00	RWK-C3-22C 7/16	10C
2	E1701-2	SPLIT REDUCER BUSHING	371 1110 00		10C
10.5	W1701	CABLE 2 CONDUCTOR FT.	425 0250/0015 00	#8422	24B
0.1	E	.118 INSULATING SLEEVING FT.	152 1226/7610 00		
0.2	F	.166 INSULATING SLEEVING FT.	152 1223/7640 00		

1. CUT THE CABLE TO THE PROPER LENGTH. ALLOW ENOUGH ADDITIONAL LENGTH FOR STRIPPING BOTH ENDS OF WIRES.
2. CHECK DRAWING FOR PROPER CABLE LAY.
3. FOR PLUG P1702 CUT THE RUBBER COVERING 15/16 INCHES FROM THE END OF THE CABLE (A).
4. TURN BACK APPROXIMATELY 1/4 INCH OF THE RUBBER COVERING. SOLDER A 3/16 INCH LENGTH OF THE BRAIDED COPPER SHIELD MEASURED FROM THE RUBBER COVERING: UNBRAID THE SHIELD AND TWIST. CUT OFF THE COTTON WRAP EVEN WITH THE SOLDERED PORTION OF THE BRAIDED COPPER SHIELD (B).
5. STRIP INSULATION BACK 1/4 INCH FROM ENDS OF WIRES.
6. TIN ENDS OF WIRES, & SLIP SLEEVING (E) & (F) OVER CONDUCTORS.
7. TIN THE TWISTED SHIELD (C) 5/8 INCH FROM END AND SOLDER TO #1 PIN ON THE CONDUCTOR PLUG.
8. PUSH RUBBER COVERING BACK OVER SHIELDING.
9. SLIP THE PLUG CAP AND LOCKING RING OVER CABLE.
10. SOLDER WIRES TO PLUG TERMINALS.
11. FASTEN THE PLUG CAP AND LOCKING RING OVER THE PLUG TERMINALS AND TIGHTEN CABLE CLAMP.
12. INSTRUCTIONS APPLY TO P1701, EXCEPT INSTRUCTIONS #4, #7 & #8 SUBSTITUTE 1 1/4 INCHES IN #3.
13. USE ROSIN CORE SOLDER FOR ALL SOLDERED CONNECTIONS.
14. SYMBOL DESIGNATIONS AS SHOWN TO BE STAMPED ON PARTS (NONE ON CABLE).





TOOLS RECOMMENDED FOR ASSEMBLY OF CABLE
WIRE STRIPPER LONG NOSE PLIERS SIDE-CUTTING PLIERS SCREWDRIVER SOLDERING IRON

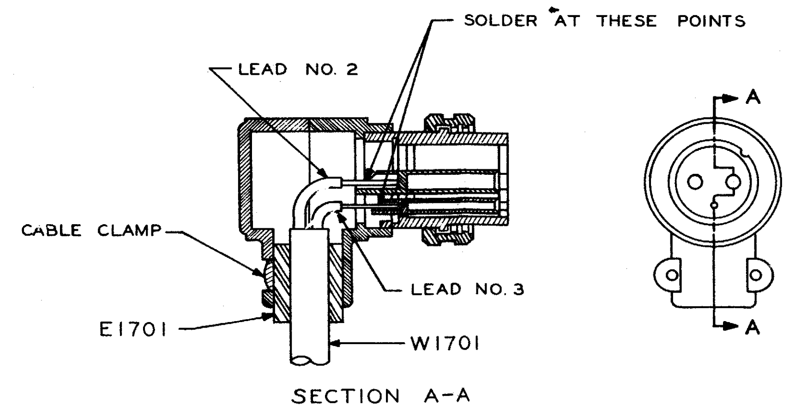
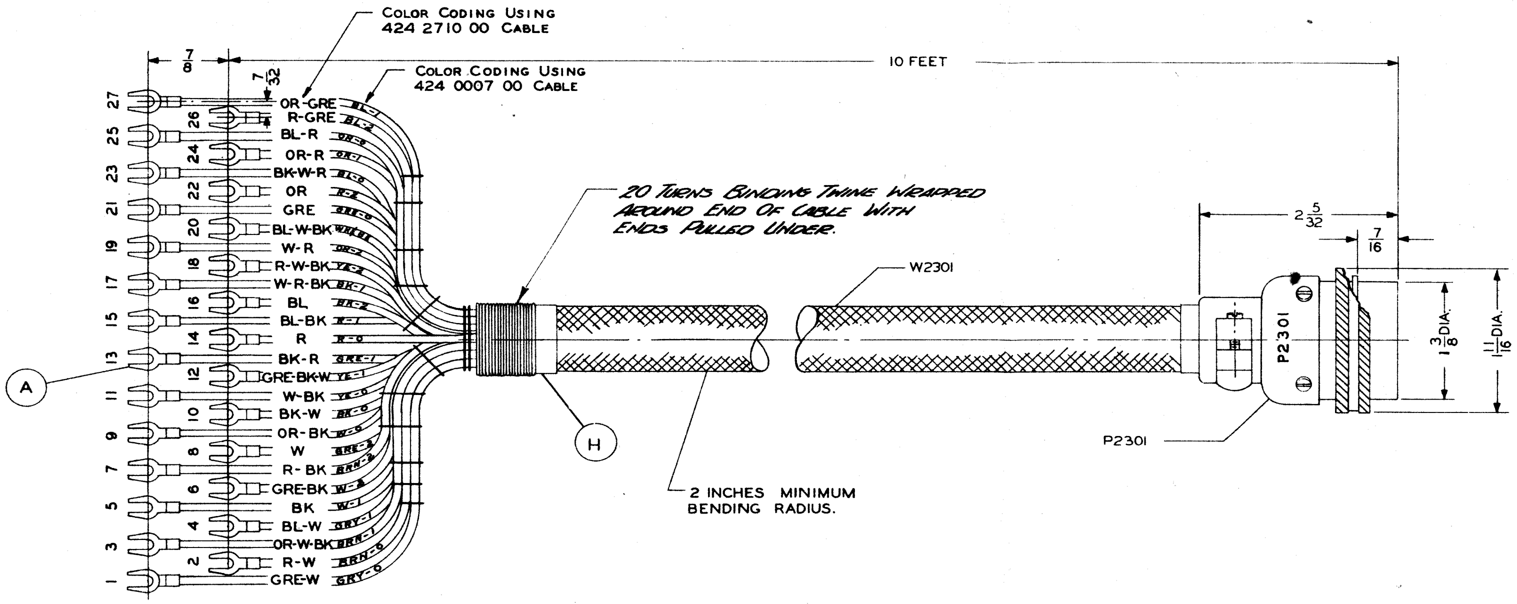
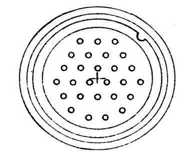
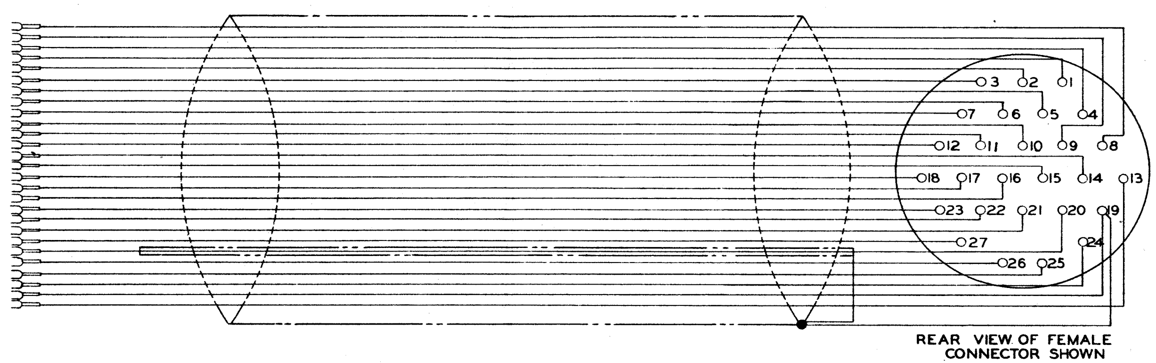


Figure 7-43 65X-9 Antenna Loading Coil Cable Assembly Diagram

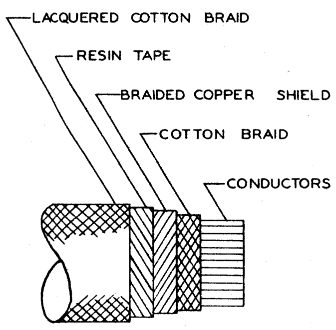




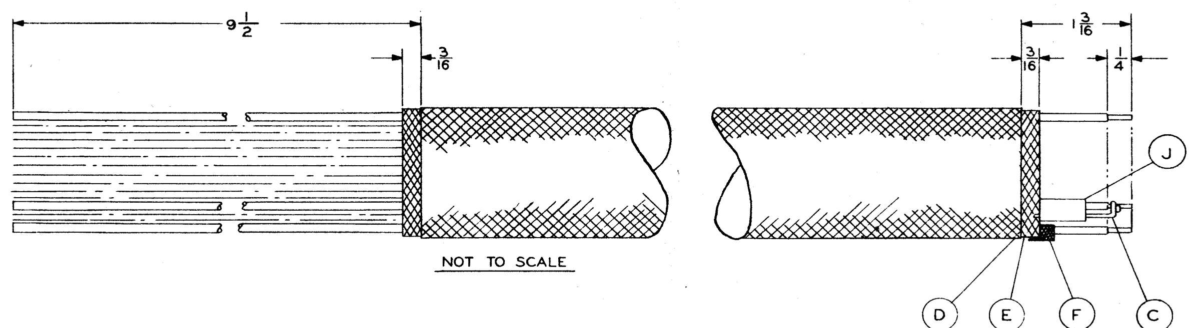


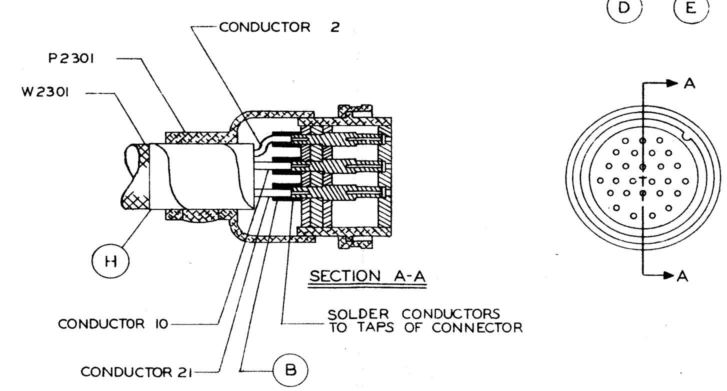
REQ'D	ITEM NO	PART NAME		COLLINS PART NO.	MFG. PART NO.	MFG.
1	P2301	FEMALE CONNECTOR		371 4020 00	NK-27-21C 11/16	10C
10.5	W2301	CABLE	FT.	424 2710/0007 00		24B
27	A	SOLDER LUG		304 4900 00	WE134	2030
1.1	B	SLEEVING	FT.	152 1226 00		
.3	C	WIRE-22 A.W.G.	FT.	440 0922/2922 00		
.8	H	FRICTION TAPE	FT.	004 0175 00		
.1	J	SLEEVING	FT.	152 1223 00		

TERM. NO.	CABLE DATA		CABLE DATA		
	CONDUCTOR COLOR	NUMBER OF RIDGES	CONDUCTOR BODY COLOR	FIRST TRACER	SECOND TRACER
1	GRAY	0	GREEN	WHITE	
2	BROWN	0	RED	WHITE	
3	BROWN	1	ORANGE	WHITE	BLACK
4	GRAY	1	BLUE	WHITE	
5	WHITE	1	BLACK		
6	WHITE	2	GREEN	BLACK	
7	BROWN	2	RED	BLACK	
8	GREEN	2	WHITE		
9	WHITE	0	ORANGE	BLACK	
10	BLACK	0	BLACK	WHITE	
11	YELLOW	0	WHITE	BLACK	
12	YELLOW	1	GREEN	BLACK	WHITE
13	GREEN	1	BLACK	RED	
14	RED	0	RED		
15	RED	1	BLUE	BLACK	
16	BLACK	2	BLUE		
17	BLACK	1	WHITE	RED	BLACK
18	YELLOW	2	RED	WHITE	BLACK
19	ORANGE	2	WHITE	RED	
20	WH.& BLACK IN SHIELD		BLUE (SHIELDED)	WHITE	BLACK
21	GREEN	0	GREEN		
22	RED	2	ORANGE		
23	BLUE	0	BLACK	WHITE	RED
24	ORANGE	1	ORANGE	RED	
25	ORANGE	0	BLUE	RED	
26	BLUE	2	RED	GREEN	
27	BLUE	1	ORANGE	GREEN	



424 2710 00
CABLE CONSTRUCTION





TOOLS RECOMMENDED FOR ASSEMBLY OF CABLE
WIRE STRIPPER LONG NOSE PLIERS SIDE CUTTING PLIERS SCREW DRIVER SOLDERING IRON

NOTES:-

1- CUT CABLE TO PROPER LENGTH, ALLOWING ENOUGH ADDITIONAL LENGTH FOR STRIPPING BOTH ENDS OF WIRES.
2- CHECK DRAWING TO INSURE PROPER ASSEMBLY OF WIRES WITH THE TERMINALS ON THE PLUG.
3- FOR PLUG P2301:
   A - CUT THE LACQUERED COTTON BRAID & RESIN TAPE 1 3/16 INCHES FROM THE END OF THE CABLE (D)
   B - SOLDER A 3/16 INCH LENGTH OF THE BRAIDED COPPER SHIELD MEASURED FROM THE LACQUERED COTTON BRAID, UNBRAID THE SHIELD AND CUT OFF THE LOOSE WIRES & COTTON BRAID EVEN WITH THE SOLDERED PORTION OF THE BRAIDED COPPER SHIELD. (E)
   C - UNBRAID THE SHIELD (F) ON CONDUCTOR 20. TURN BACK AND SOLDER TO MAIN SHIELD. (E)
   D - STRIP INSULATION 1/4 INCH BACK FROM THE ENDS OF THE CONDUCTORS.
   E - ON CONDUCTOR 19 TWIST & SOLDER ONE END OF WIRE (C) BRING BACK AND SOLDER TO MAIN SHIELD.
   F - TIN ENDS OF CONDUCTORS.
   G - SLIP THE PLUG CAP & LOCKING RING OVER CABLE.
   H - SLIP SLEEVING (B) (J) 1/2 IN. LG. OVER EACH CONDUCTOR.
   I - SOLDER CONDUCTORS TO PLUG TERMINALS AND SLIP SLEEVING OVER CONNECTION.
   J - WRAP APPROXIMATELY 2 TURNS OF FRICTION TAPE (H) AROUND THE END OF THE LACQUERED COTTON BRAID & COPPER SHIELDING.
   K - FASTEN THE PLUG CAP & LOCKING RING OVER PLUG TERMINALS AND TIGHTEN CABLE CLAMP.
4- FOR LUG END OF CABLE:
   A - CUT THE LACQUERED COTTON BRAID & RESIN TAPE AS SHOWN FROM END OF CABLE.
   B - SOLDER A 3/16 INCH LENGTH OF THE BRAIDED COPPER SHIELD MEASURED FROM THE LACQUERED COTTON BRAID, UNBRAID THE SHIELD AND CUT OFF LOOSE WIRES & COTTON BRAID EVEN WITH THE SOLDERED PORTION OF THE BRAIDED COPPER SHIELD.
   C - CABLE & CUT WIRES TO LENGTH PER TERMINAL BOARD 1545B AS SHOWN.
   D - CLAMP THE SOLDER LUGS (A) OVER THE ENDS OF THE CONDUCTORS & INSULATION AND SOLDER.
   E - WRAP APPROXIMATELY 2 TURNS OF FRICTION TAPE (H) AROUND THE END OF LACQUERED COTTON BRAID & COPPER SHIELDING.
5- ALL DIMENSIONS IN INCHES UNLESS OTHERWISE SPECIFIED.
6- SYMBOL DESIGNATION AS SHOWN TO BE STAMPED ON PLUG, (NONE ON CABLE).

Figure 7-44 65X-10 Remote Control Cable Assembly Diagram

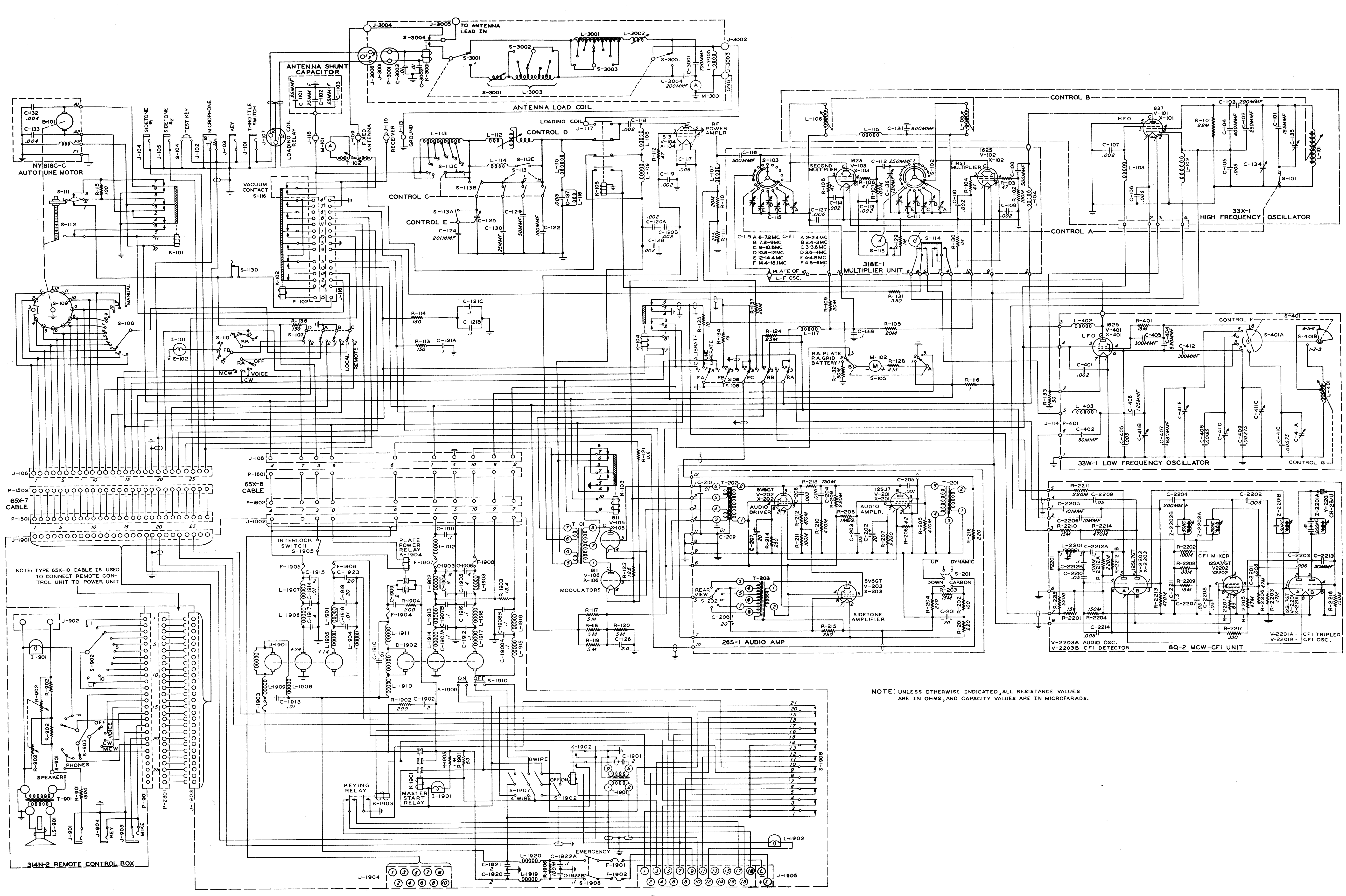
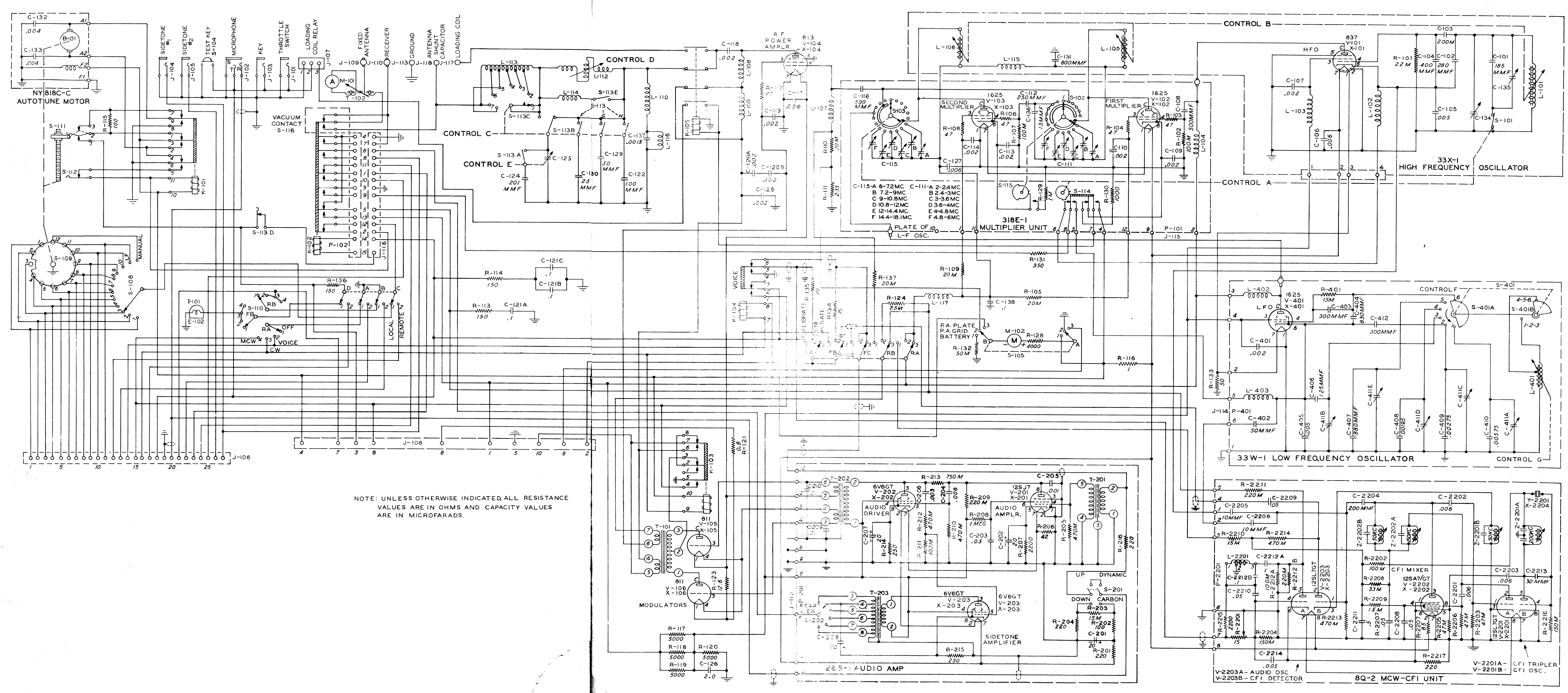


Figure 7-45 Navy Model TCZ-2 Complete Schematic

Figure 7-45 Navy Model TCZ-2 Complete Schematic



igure 7-46 Navy Type COL-52286-. Transmitter Schematic

Figure 7-46 Navy Type COL-52286-A Transmitter Schematic

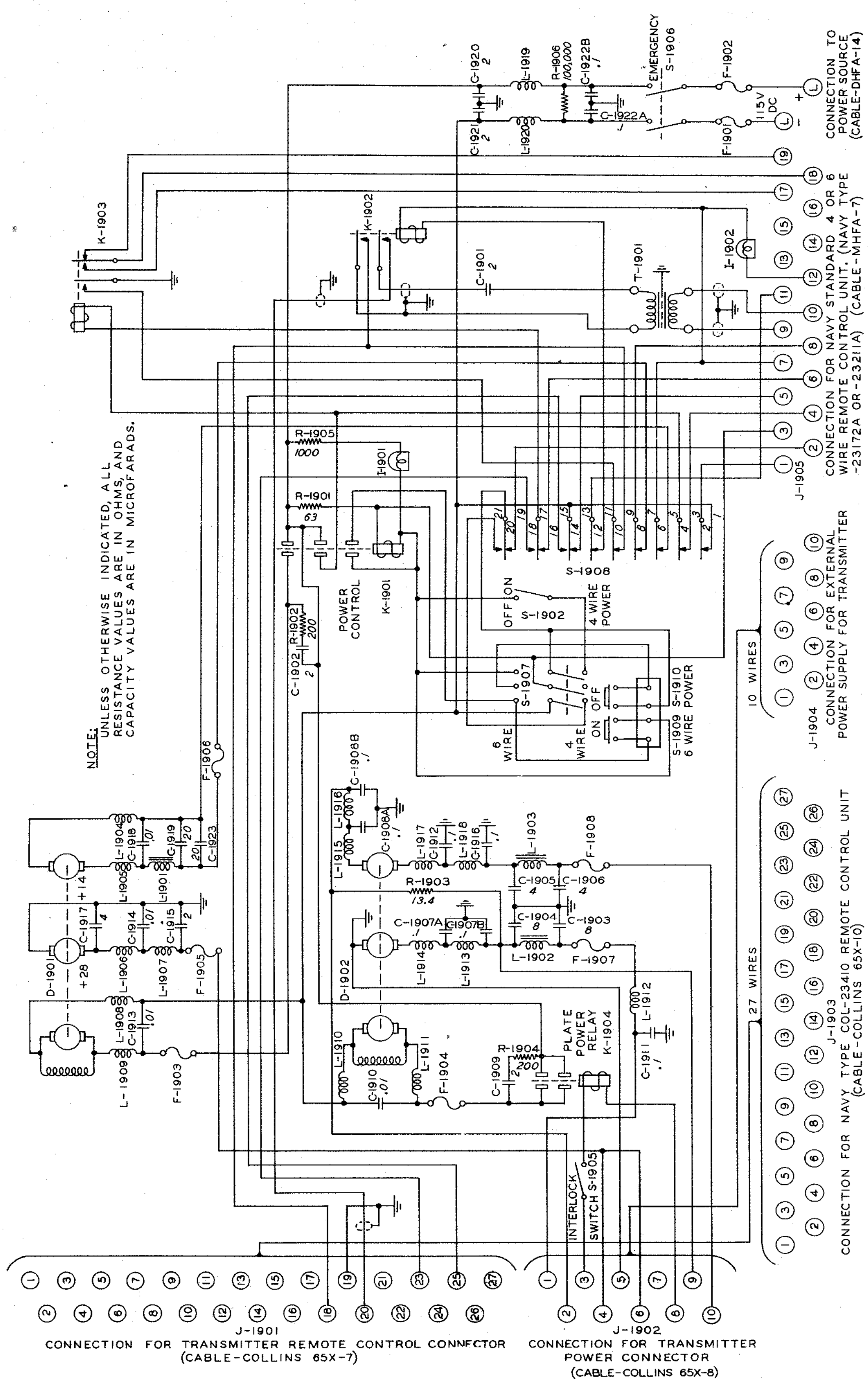


Figure 7-47 Navy Type COL-211624 Dynamotor Assembly Power Unit Schematic

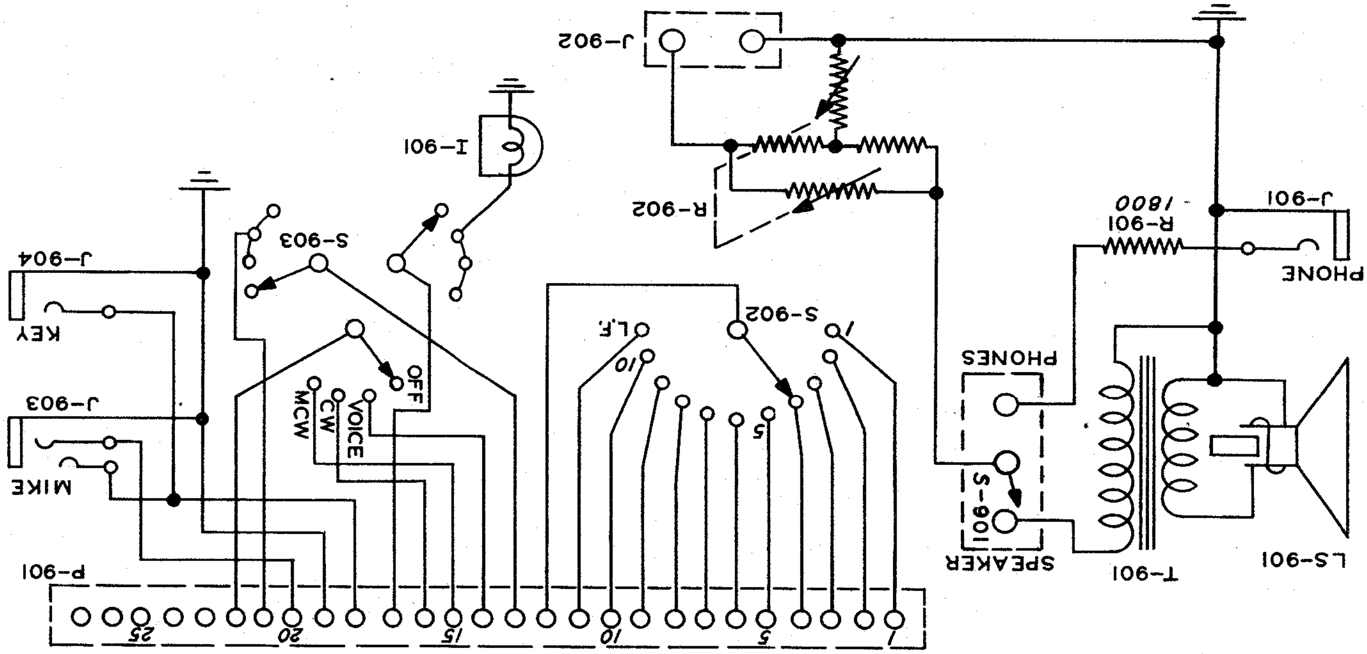
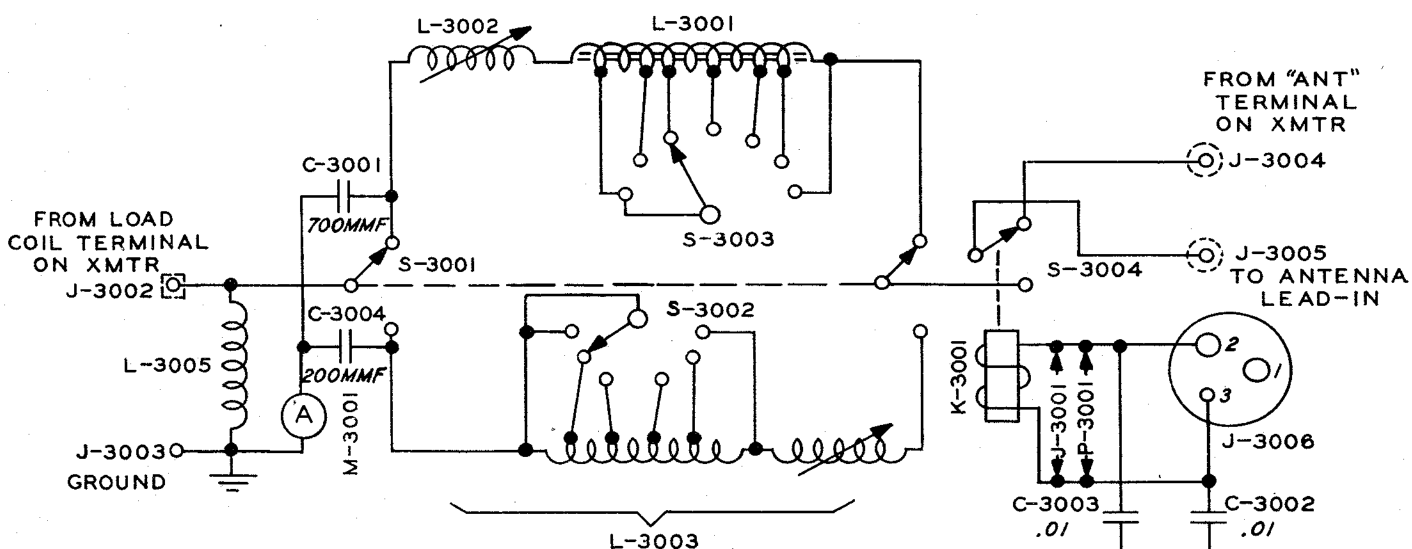


Figure 7-48 Navy Type COL-23410 Remote Control Unit Schematic



NOTE: UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS, AND CAPACITY VALUES ARE IN MICROFARADS.

Figure 7-49 Navy Type COL-47505 Antenna Loading Coil Schematic

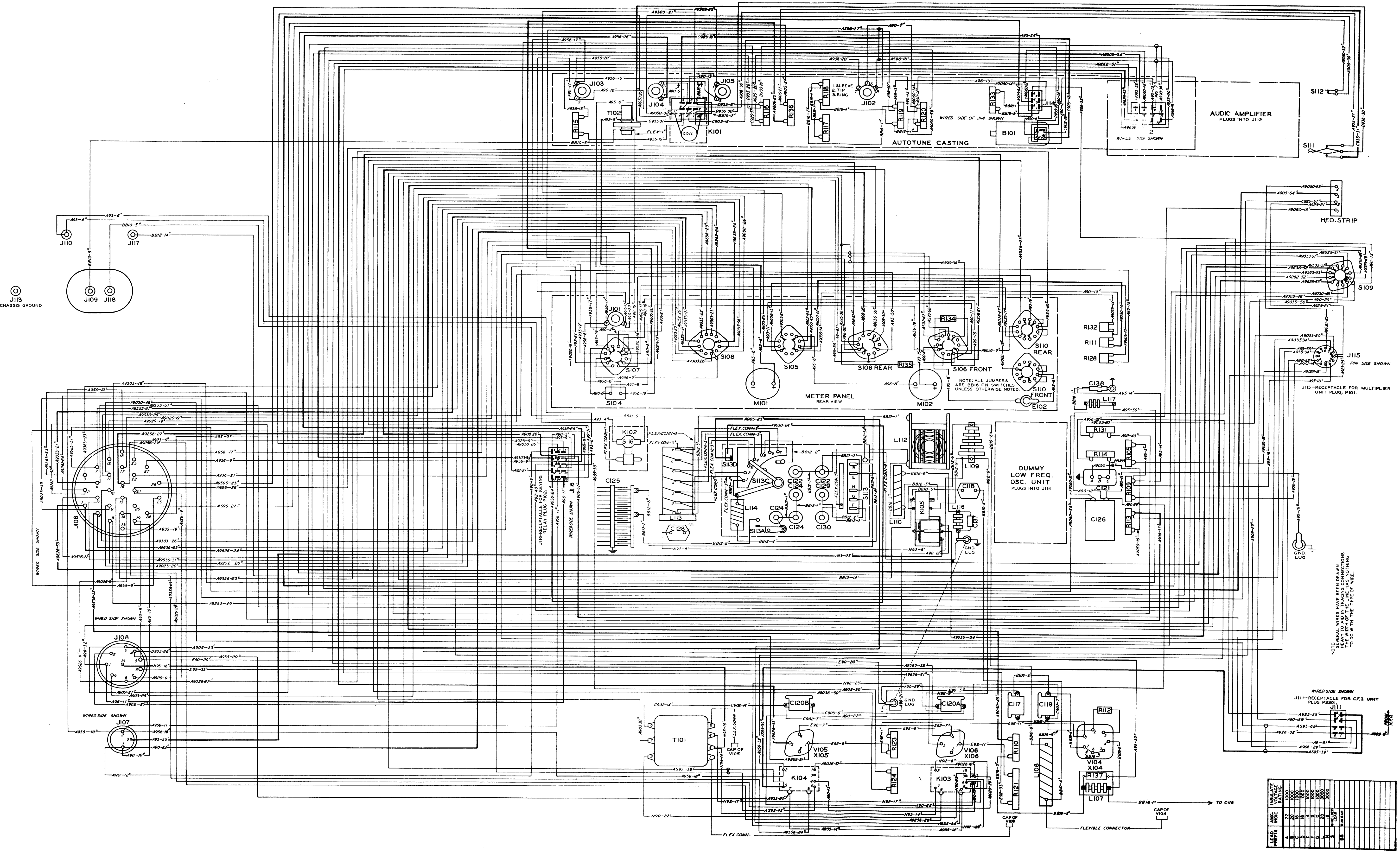


Figure 7-50 Navy Type COL-52286-A Transmitter Practical Wiring Diagram

Figure 7-50 Navy Type COL-52286-A Transmitter Practical Wiring Diagram

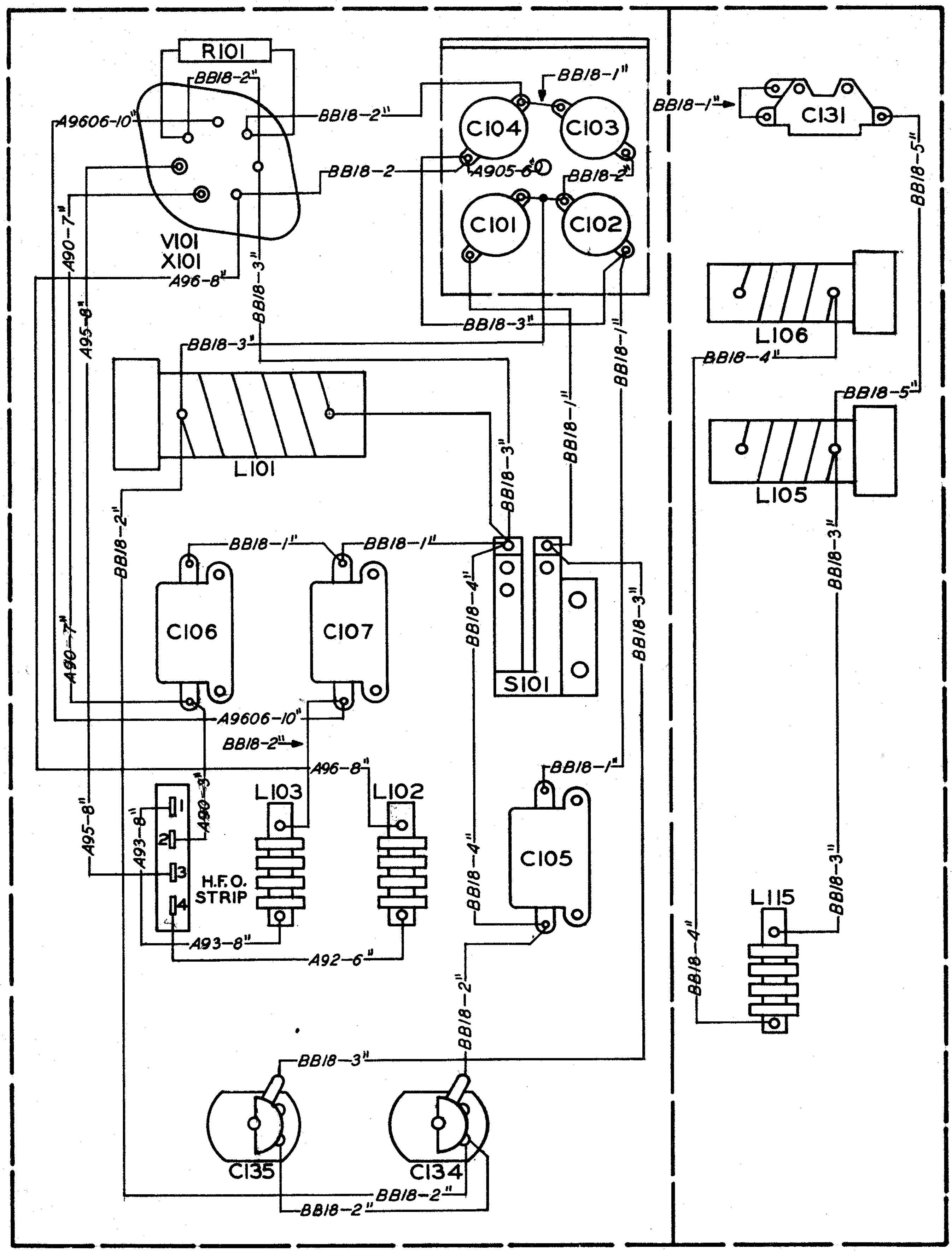


Figure 7-51 High Frequency Oscillator Practical Wiring Diagram

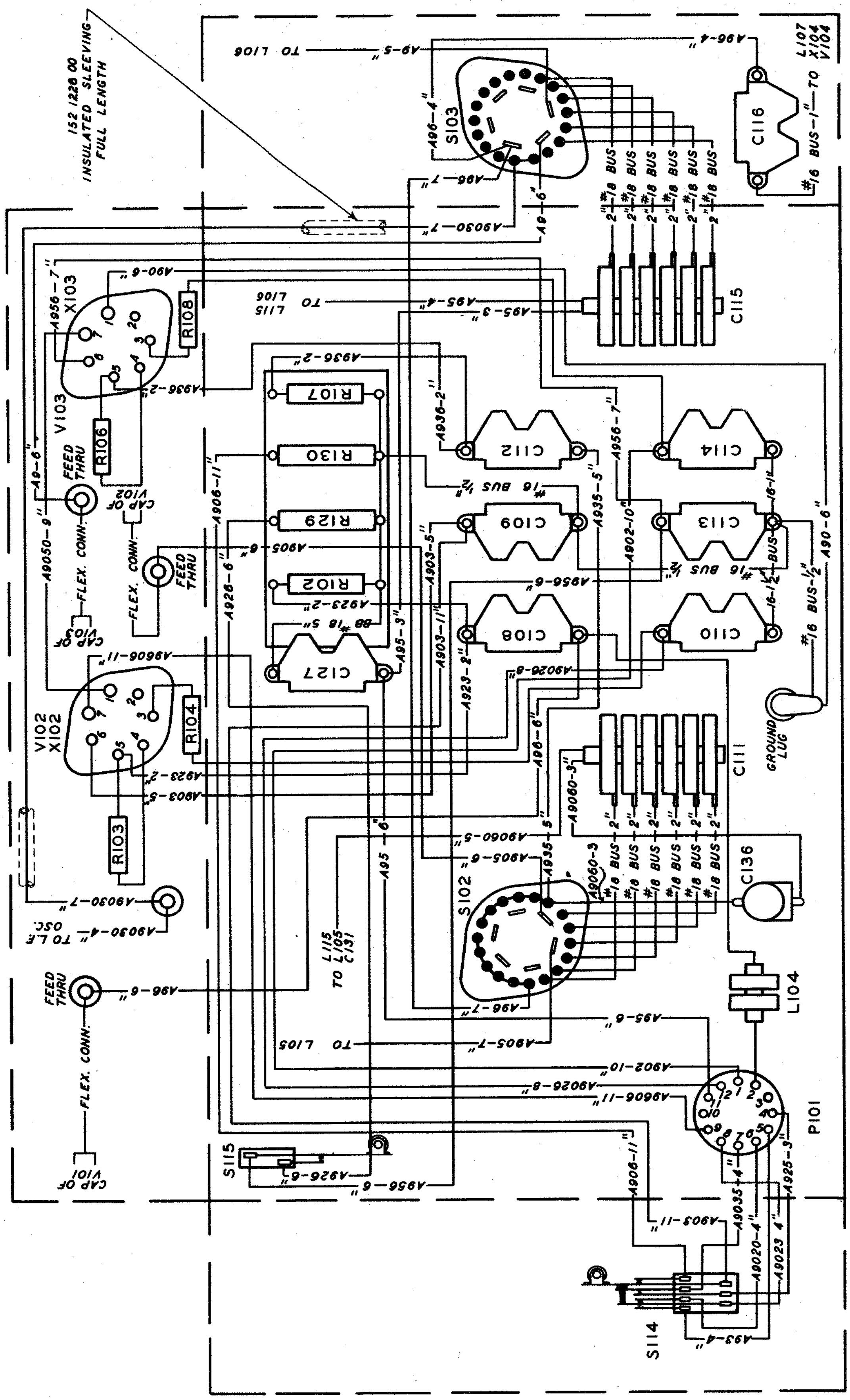


Figure 7-52 Multiplier Practical Wiring Diagram

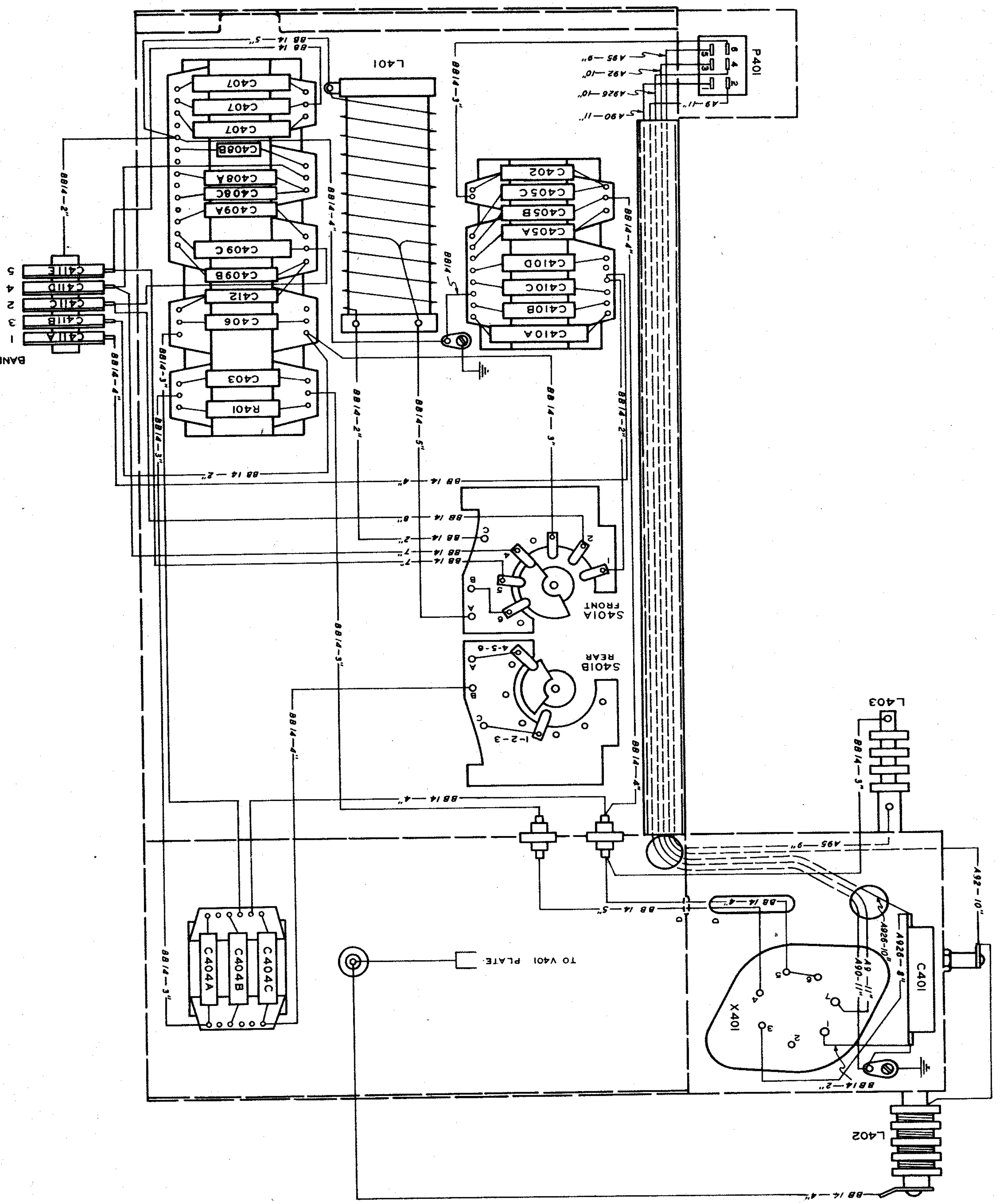


Figure 7-53 Low Frequency Oscillator Practical Wiring Diagram

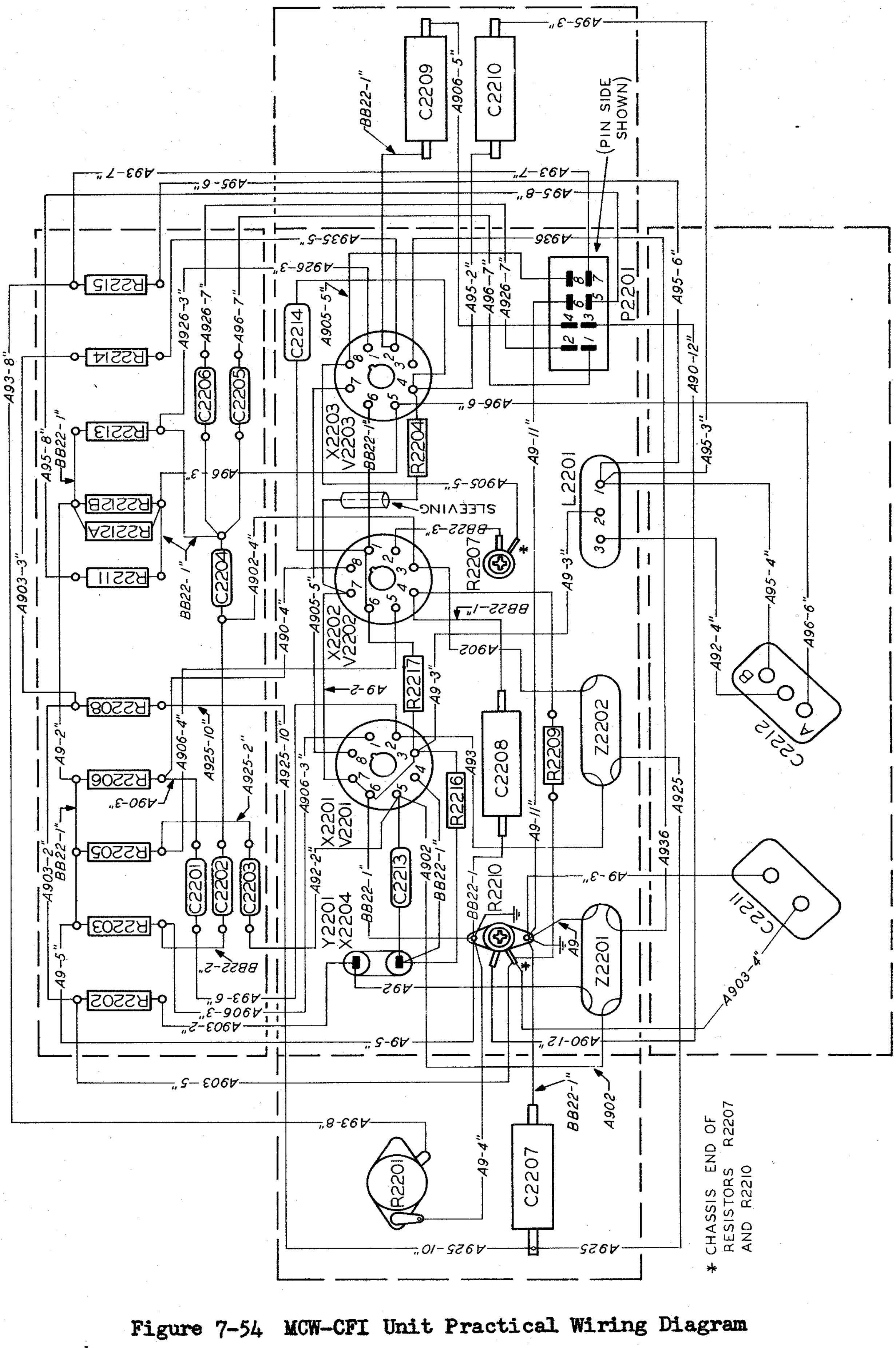


Figure 7-54 MCW-CFI Unit Practical Wiring Diagram

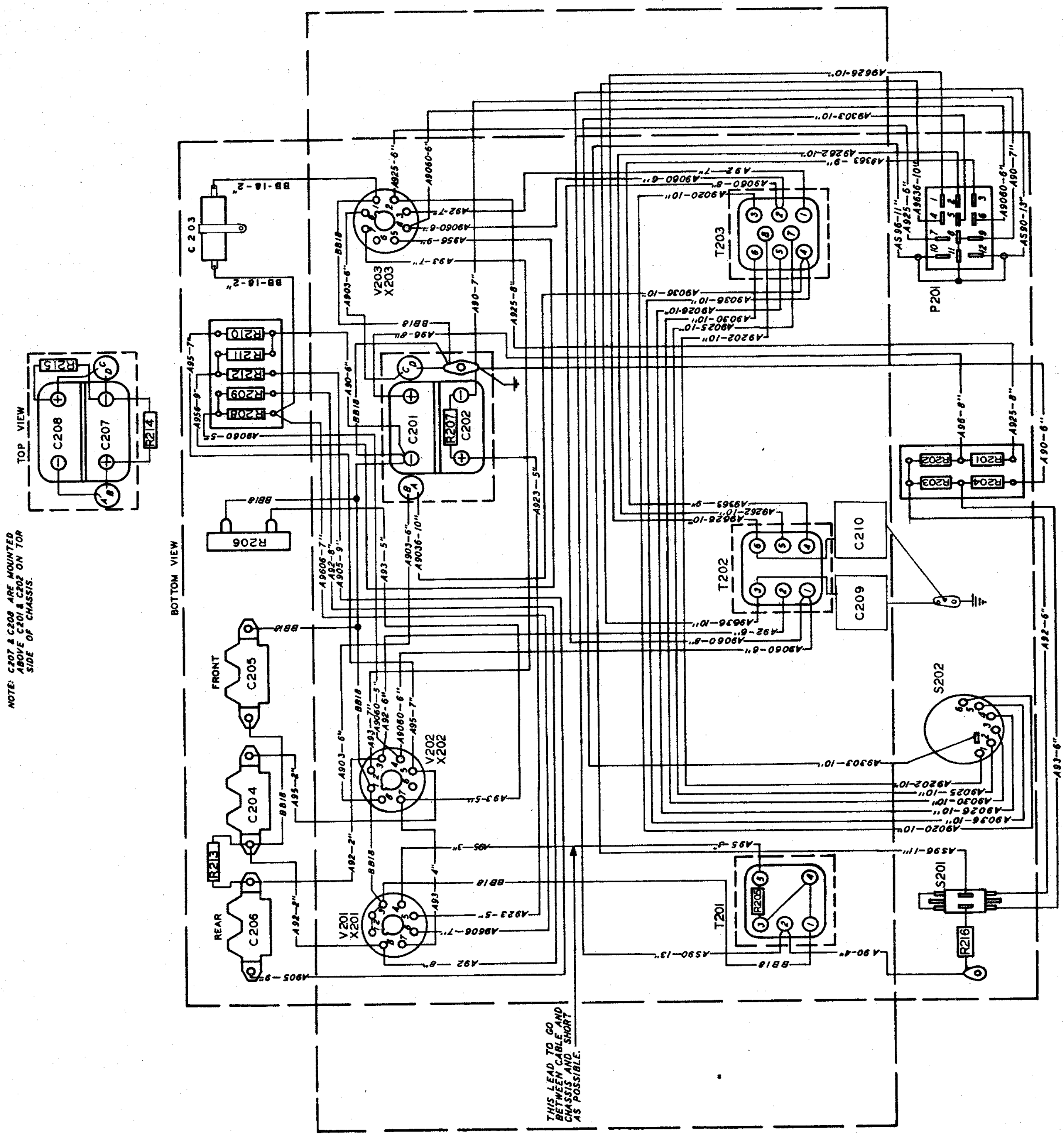


Figure 7-55 Audio Amplifier Practical Wiring Diagram

QUAN-TITY	ITEM NO.	QUANTITIES ARE FOR ONE ASSEMBLY		
		COLLINS PART NUMBER	BUREAU OF SHIPS PART NUMBER	PART NAME
3		152 7610 00		INSULATED SLEEVING, FEET
3		152 7640 00		INSULATED SLEEVING, FEET
6.5		152 7670 00		INSULATED SLEEVING, FEET
3		200 1120 00		GROMMETS
2		304 1500 00		1/4" SOLDER LUGS
40		304 1800 00		3/16" SOLDER LUGS
60		304 2000 00		3/16" SOLDER LUGS
45		304 5200 00		SPADE SOLDER LUG
8		313 0002 00		6-32 NUT
8		343 0168 00		6-32 x 5/16 PH. HEAD SCREW
1	J1901	371 4010 00		27 TERMINAL CONNECTOR
1	J1902	371 5119 00		10 TERMINAL CONNECTOR
8		373 0001 00		#6 INTERNAL SHAKE WASHER
7.6	F9	440 0401 00		WIRE, FEET
9.2	F91	440 0403 00		WIRE, FEET
5.9	F96	440 0408 00		WIRE, FEET
5.9	F902	440 0409 00		WIRE, FEET
1.4	F903	440 0410 00		WIRE, FEET
5.9	F905	440 0411 00		WIRE, FEET
2.1	F923	440 0413 00		WIRE, FEET
11.9	F925	440 0414 00		WIRE, FEET
8.8	E90	440 0502 00		WIRE, FEET
13.3	E92	440 0504 00		WIRE, FEET
5.4	E93	440 0505 00		WIRE, FEET
3	E95	440 0507 00		WIRE, FEET
6	E96	440 0508 00		WIRE, FEET
5.7	D92	440 0604 00		WIRE, FEET
26.3	C90	440 0702 00		WIRE, FEET
12.2	C92	440 0704 00		WIRE, FEET
10.7	C93	440 0705 00		WIRE, FEET
10	C95	440 0707 00		WIRE, FEET
23.8	C96	440 0708 00		WIRE, FEET
5.9	C902	440 0709 00		WIRE, FEET
8	C903	440 0710 00		WIRE, FEET
0.5	C905	440 0711 00		WIRE, FEET
18.1	A90	440 0902 00		WIRE, FEET
11.2	A92	440 0903 00		WIRE, FEET
23.	A93	440 0904 00		WIRE, FEET
35.	A95	440 0905 00		WIRE, FEET
18.2	A96	440 0906 00		WIRE, FEET
21.5	A902	440 0907 00		WIRE, FEET
24.4	A903	440 0912 00		WIRE, FEET
13.6	A905	440 0916 00		WIRE, FEET
22.7	A906	440 0918 00		WIRE, FEET
13.2	A923	440 0921 00		WIRE, FEET
12.3	A925	440 0922 00		WIRE, FEET
7.5	A926	440 0925 00		WIRE, FEET
7.5	A935	440 0929 00		WIRE, FEET
9.8	A936	440 0932 00		WIRE, FEET
7.4	A956	440 0937 00		WIRE, FEET
24.8	AS90	443 2229 00		WIRE, FEET
12.2	N92	447 1692 00		WIRE, FEET
10.2	N902	447 1690 20		WIRE, FEET
1	J1905	500 3963 002		21 TERMINAL STRIP
1		507 6308 00		RECEPTACLE MOUNTING PLATE
1	J1903 J1904	571 1545 20		37 TERMINAL STRIP

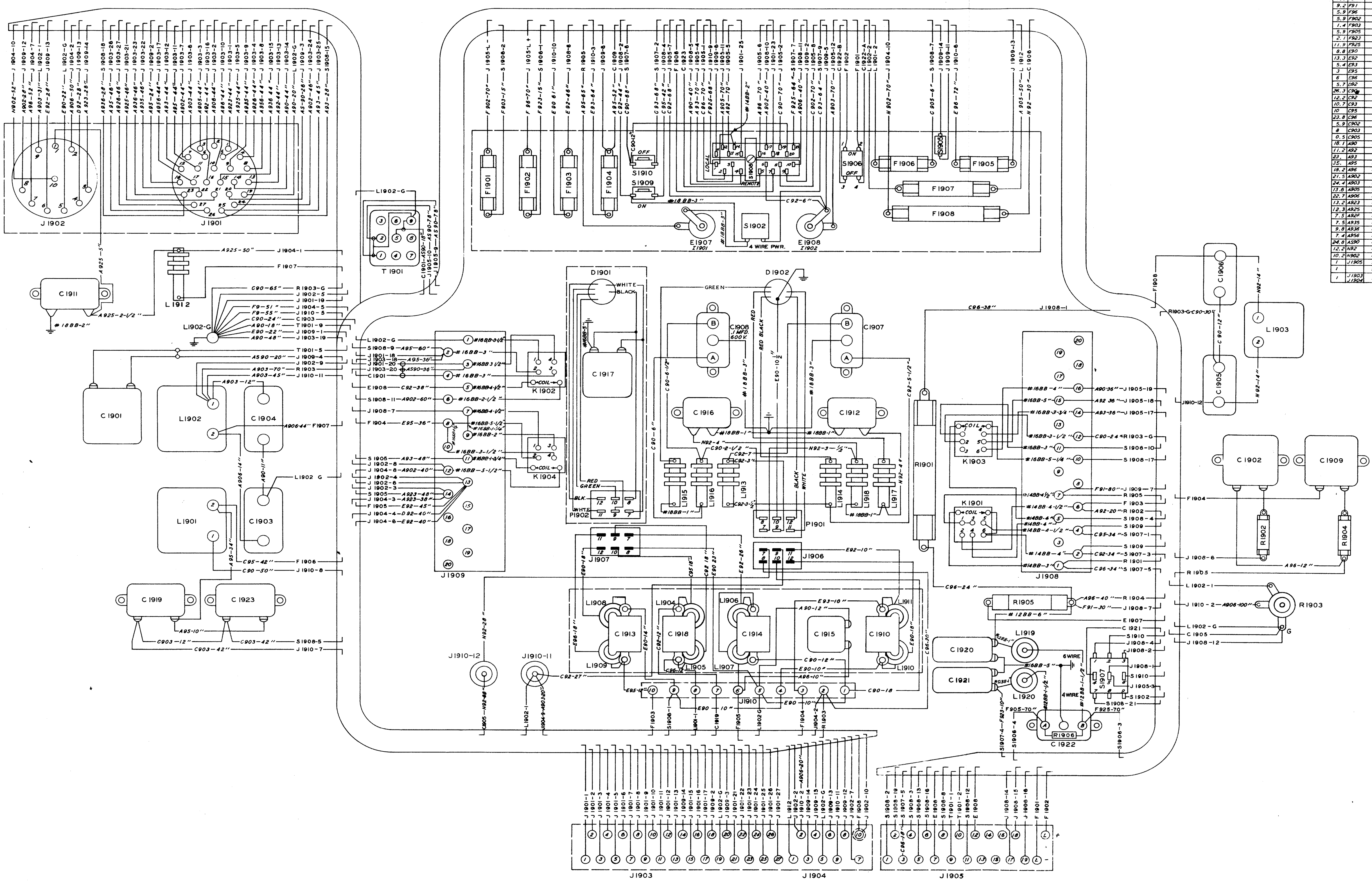


Figure 7-56 Navy Type COL-211624 Dynamotor Assembly Power Unit Practical Wiring Diagram

Figure 7-56 Navy Type COL-211624 Dynamotor Assembly Power Unit Practical Wiring Diagram

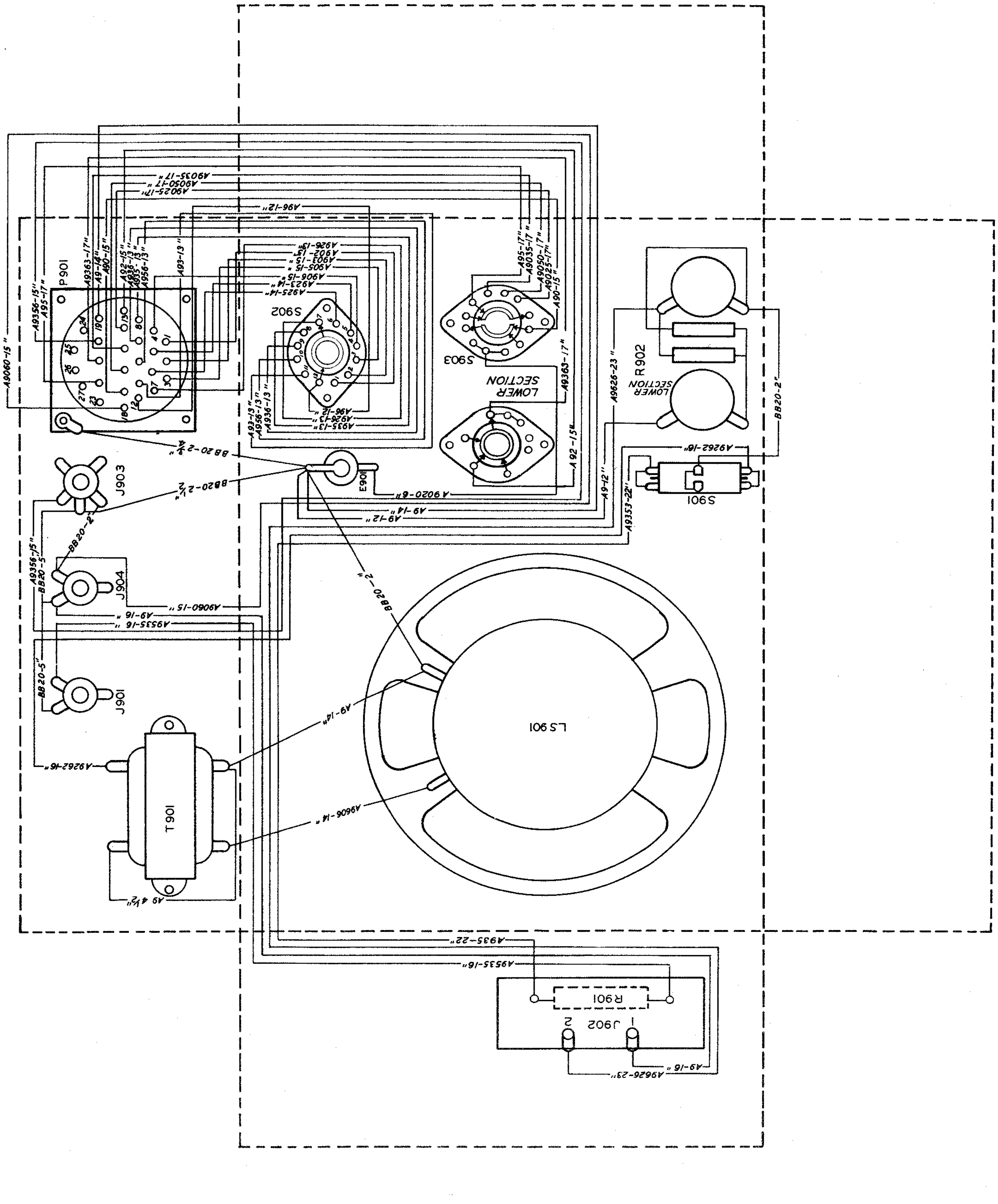


Figure 7-57 Navy Type COL-23410 Remote Control Unit
Practical Wiring Diagram

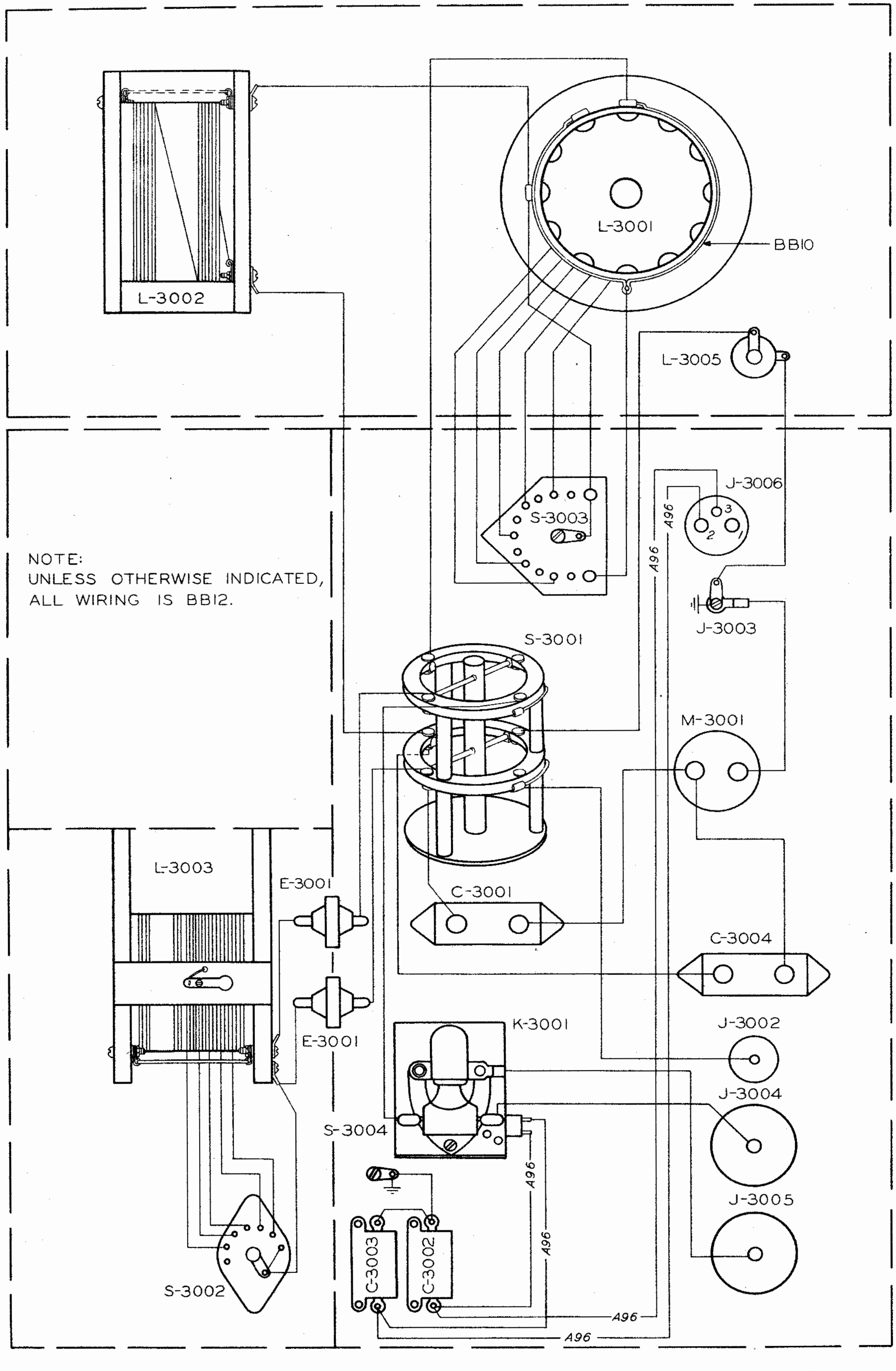


Figure 7-58 Navy Type COL-47505 Antenna Loading Coil Practical Wiring Diagram

QA	IT.	PART NO.	DESCRIPTION	MAT'L	FIN.
1	A	507 5718 00	COIL FORM		
15.	B	421 2440 00	#24 D.E. WIRE FT.		
2	C	312 3460 00	4-40 X 3/8 BRASS STUD		

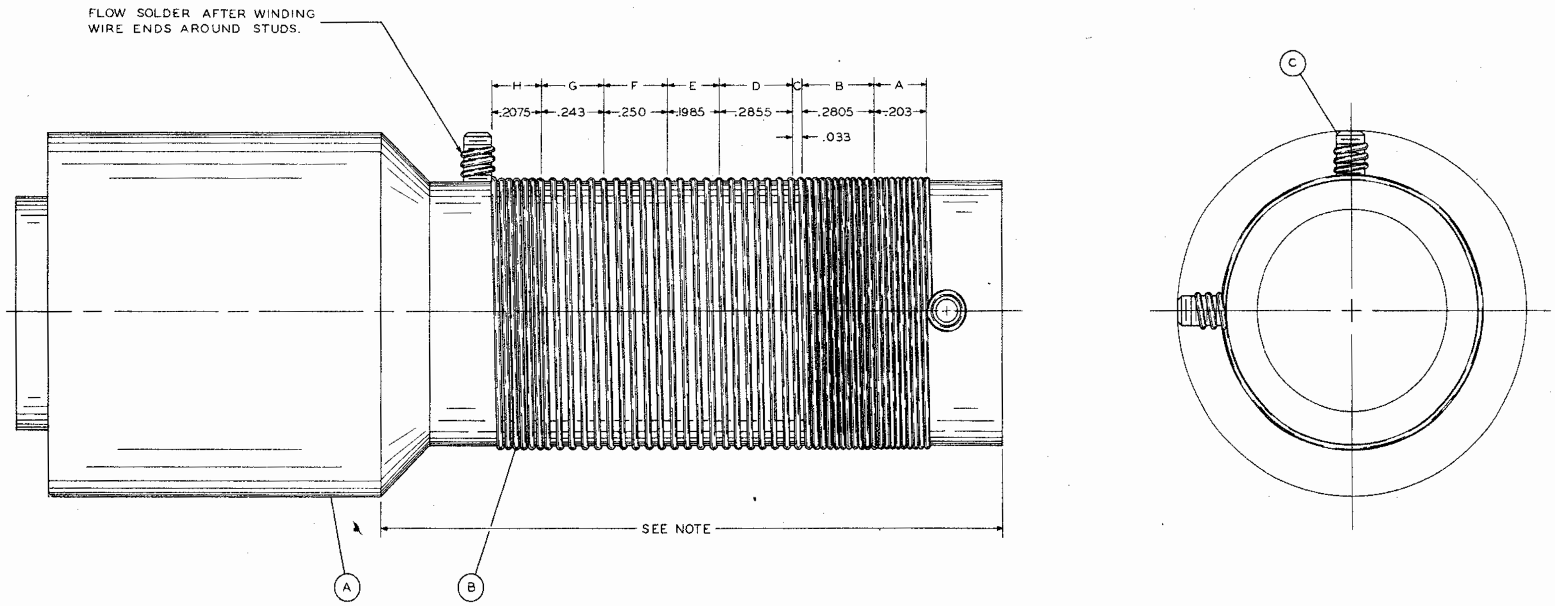


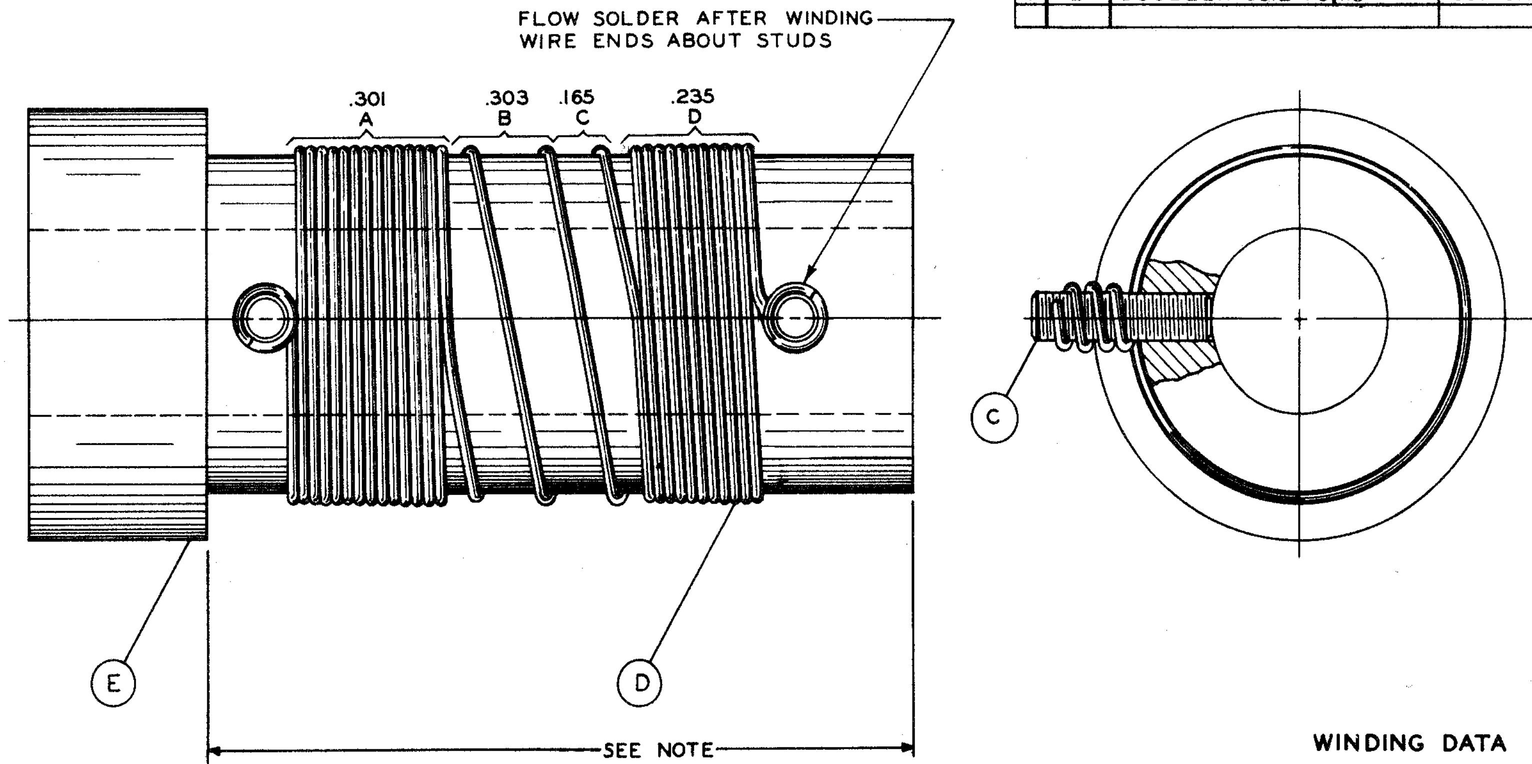
Figure 7-59 HF Oscillator Grid Inductor L-101

ASSEMBLY NOTES:
1. CEMENT STUDS (C) INTO COIL FORM (A) WITH SAUEREISEN CEMENT
2. WIND COIL AS PER WINDING DATA.
3. APPLY WITH BRUSH OR SPRAY GUN ONE COAT OF POLYSTYRENE CEMENT #912 AFTER WINDING.

WINDING DATA

WINDINGS	NUMBER OF TURNS	PITCH	TURNS PER INCH
A	9	.02255	44.346
B	11	.0255	39.215
C	1	.0332	30
D	6	.04758	21.017
E	4	.04962	20.154
F	5	.0500	20
G	5	.0486	20.576
H	6 1/4	.0332	30

GA	ITEM	DESCRIPTION	PART NO.	MAT'L	FIN.
2	C	#2-56 X 7/16 BRASS STUD	312 3390 00		
7	D	#24 D.E. WIRE FT	421 2440 00		
1	E	DOUBLER COIL FORM	507 5716 00		



WINDING DATA

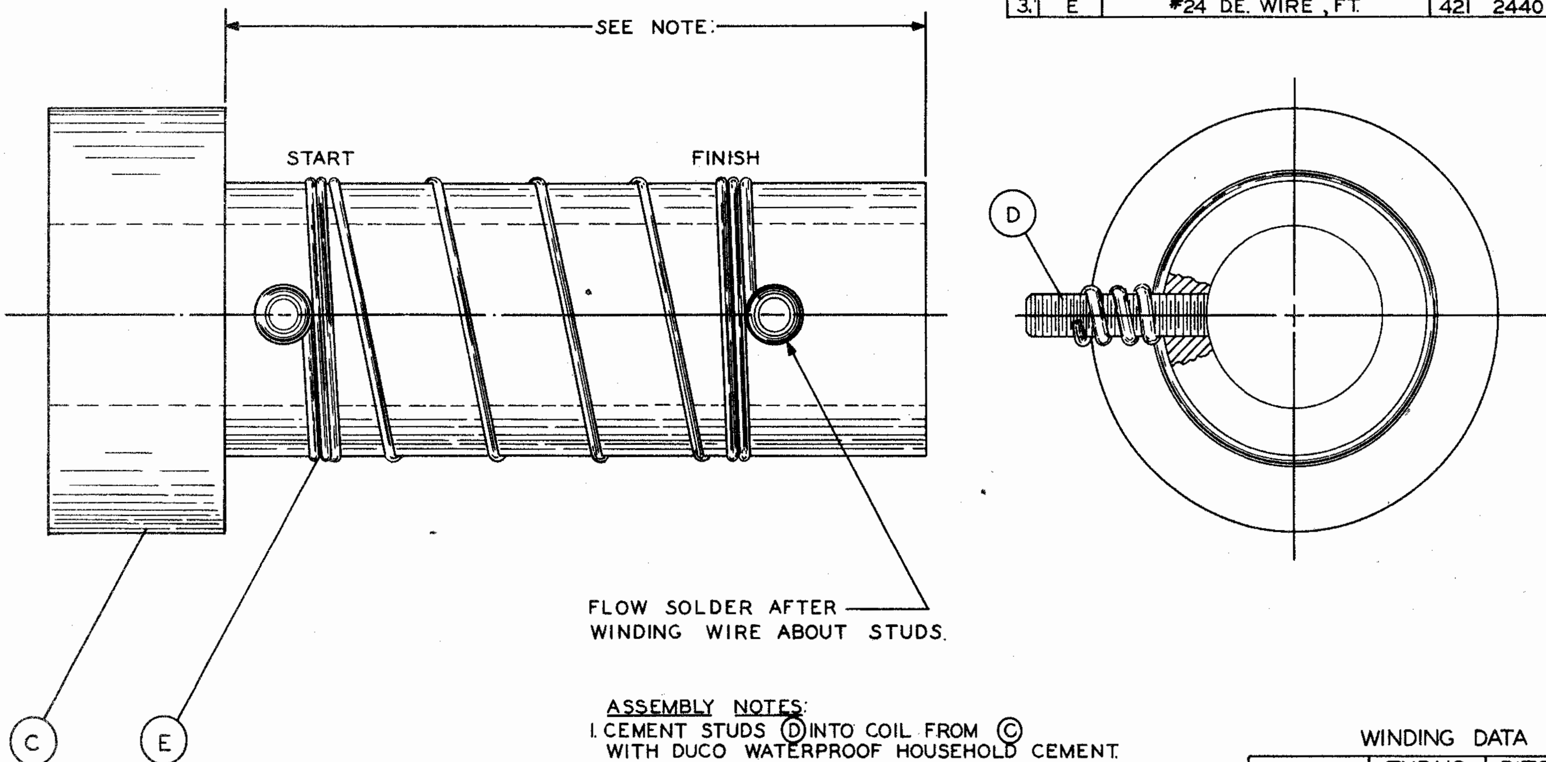
WINDING		NO. OF TURNS	PITCH	TURNS PER INCH
A	A	14	.0215	46.51
B	B	2	.1515	6.61
C	C	1	.165	6.06
D	D	11	.0215	46.51

ASSEMBLY NOTES

1. CEMENT STUDS C INTO COIL FORM E WITH DUCO WATERPROOF HOUSEHOLD CEMENT.
2. WIND COIL AS PER WINDING DATA.
3. APPLY WITH BRUSH OR SPRAY GUN ONE COAT OF #1202 CLEAR GLYPTAL CEMENT AFTER WINDING.

Figure 7-60 First Multiplier Plate Inductor L-105

GA	ITEM	DESCRIPTION	PART NO.	MAT'L	FIN.
1	C	COIL FORM	507 5717 00		
2	D	#2-56 X7/16 BRASS STUD	312 3390 00		
3	E	#24 DE. WIRE, FT.	421 2440 00		



ASSEMBLY NOTES:

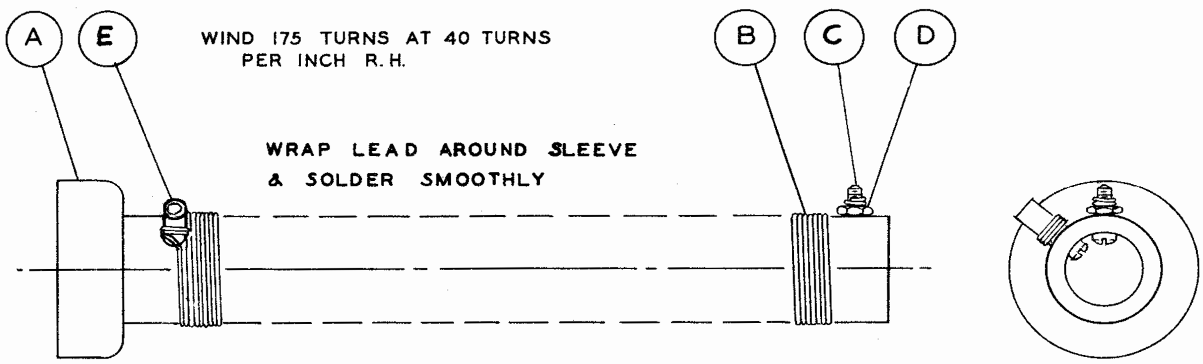
1. CEMENT STUDS (D) INTO COIL FROM (C) WITH DUCO WATERPROOF HOUSEHOLD CEMENT.
2. WIND COIL AS PER WINDING DATA.
3. APPLY WITH BRUSH OR SPRAY GUN ONE COAT OF #1202 CLEAR GLYPTAL CEMENT AFTER WINDING.

WINDING DATA

	TURNS	PITCH	TOTAL
START	2-3/4	.022	.0605
	1/4	.218	.115
	1/2	.252	.241
	1/2	.178	.330
	1/2	.170	.415
	1/2	.168	.499
	1/2	.212	.605
	1/2	.174	.692
	1/4	.188	.739
	1/2	.230	.854
FINISH	2-1/4	.023	.906

Figure 7-61 Second Multiplier Plate Inductor L-106

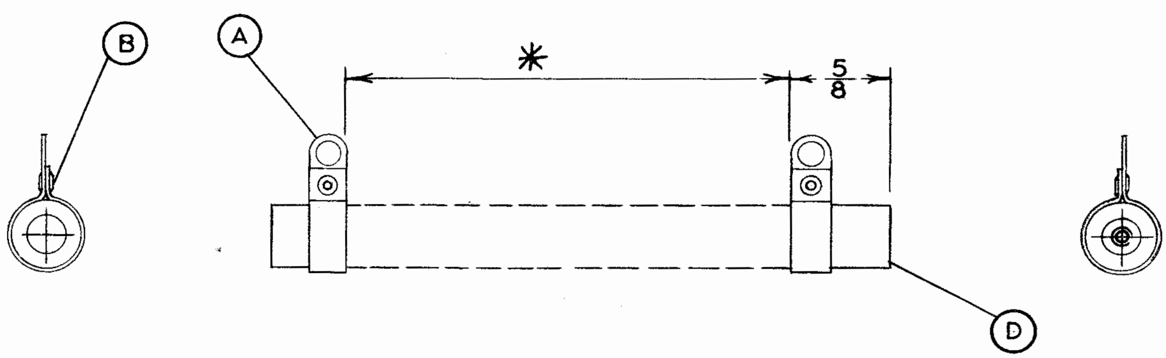
A	IT.	DESCRIPTION	PART NO.	MAT'L	FIN.
1	A	COIL FORM	507 5739 10		
X	B	#27 CHROME OXIDE WIRE 3 1/2 FT. L.	421 2730 00		
2	C	#2-56 X 3/8 FILL. HD. SCR.	321 0022 00		
1	D	#2-56 HEX. NUTS	313 0006 00		
1	X	ASSEMBLY PER QUANT. "A."	571 1448 10		
1	E	SOLDERING SLEEVE	507 6842 00		



GLUE ITEMS C INTO A WITH SOUEREISEN.
SOLDER ENDS OF WIRE TO ITEM C.

Figure 7-62 PA Plate Feed Choke L-108 571-1404-30

A	IT.	DESCRIPTION	PART NO.	MAT'L	FIN.
2	A	CLAMP	139 4600 00		
2	B	.087 x .167 EYELETS	307 2800 00		
1	C	40 FEET #35 S.S.E. COPPER WIRE	421 3530 00		
1	D	COIL FORM	507 5742 00		
1	X	ASS'Y OF PARTS PER GROUP A.	571 2103 10		



CLOSE WIND * TURNS ITEM C
FOR 190MH ± 10MH INDUCTANCE
SOLDER ENDS TO ITEM B
* APPROXIMATELY 340 TURNS

Figure 7-63 Output Network Static Drain Choke L-110

A	ITEM	DESCRIPTION	PART NO.	MAT'L	FIN.
1	A	ROTOR COIL 5 FT. WIRE	421 0006 00	NOTE	
2	B	ROTOR MTG. BAR # 2	507 6092 00		
2	C	ROTOR MTG. BAR # 1	507 6093 00		
2	D	ROTOR ATTACHMENT PLATE	507 6098 00		
4	E	6-32 X 5/16 PH. BRASS SCREW	343 0112 00		
4	F	#6 PHOS. BR. INT. SHAKE WASHER	373 3020 00		
1	X	ASS'Y. OF PARTS PER. QUANT. A	571 1246 20		

COIL #10 (.100) MEDIUM HARD DRAWN
SILVER PLATED COPPER WIRE

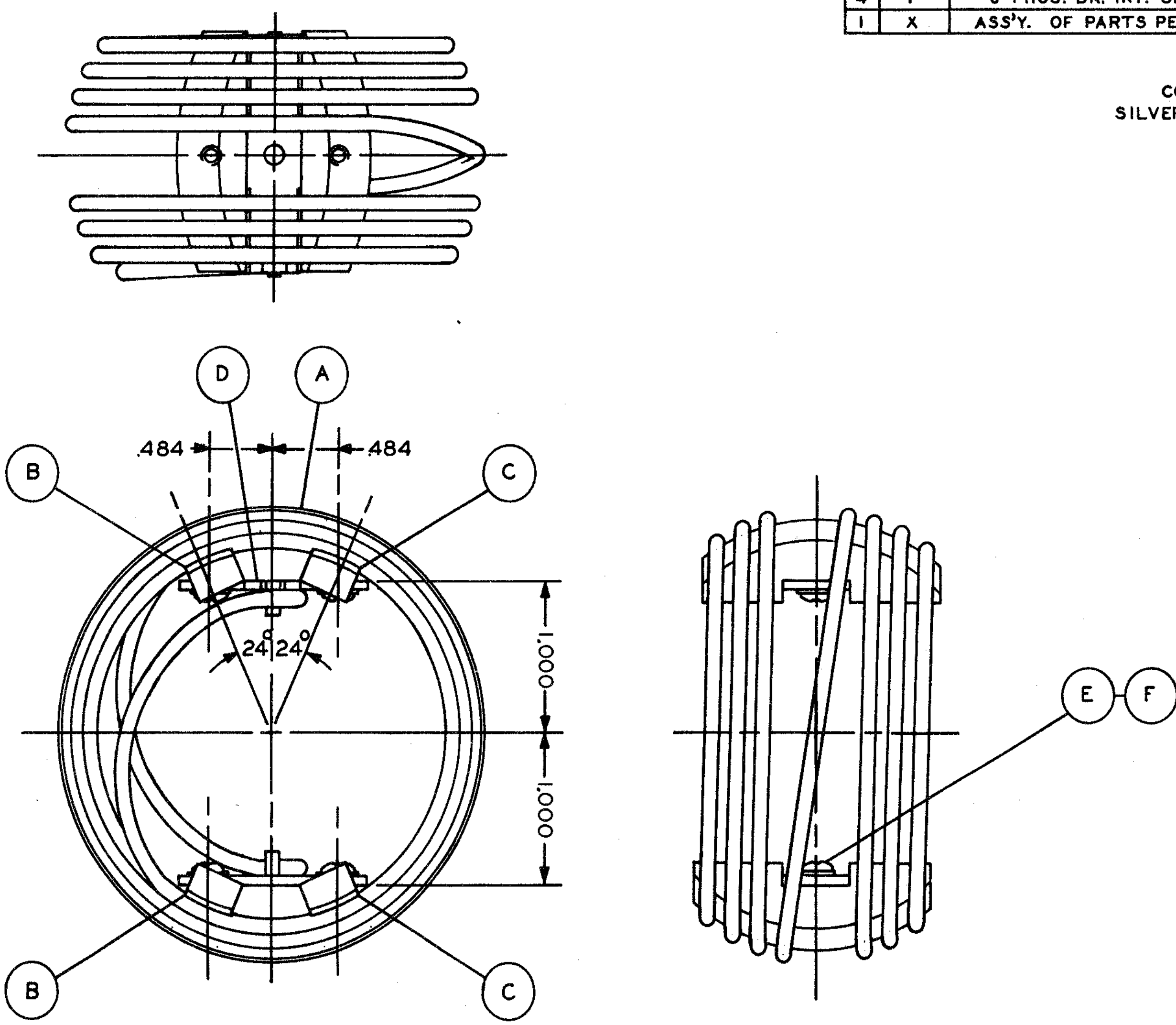
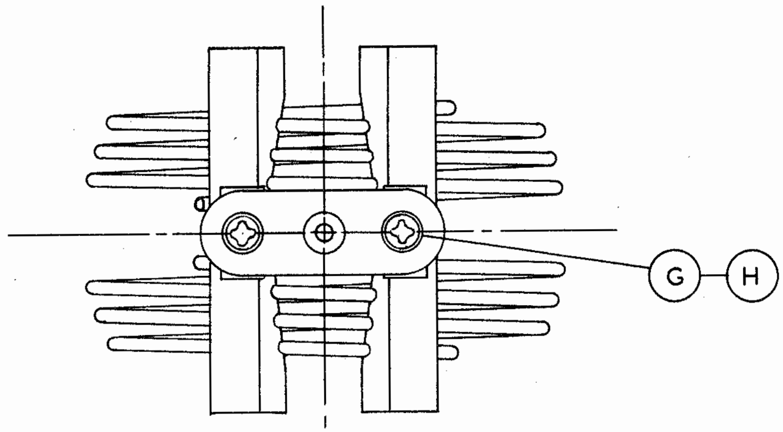


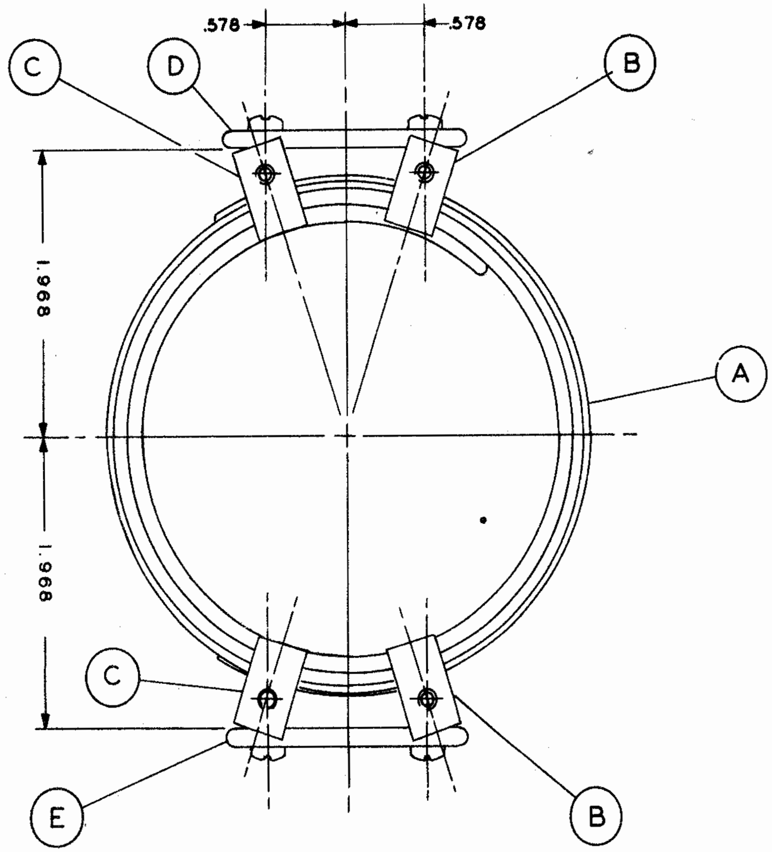
Figure 7-64 PA Plate Inductor - Rotor for L-112

A	ITEM	DESCRIPTION	PART NO.	MAT'L	FIN.
1	A	STATOR COIL. 5FT. OF WIRE	421 000600	NOTE	
2	B	MOUNTING BAR #2	507 6100 00		
2	C	MOUNTING BAR #1	507 6099 00		
1	D	ROTOR BEARING BAR #1	507 6090 00		
1	E	ROTOR BEARING BAR #2	507 6091 00		
	F				
4	G	6-32 x 5/16 PH. BIND. HD. SCREW. BRASS	343 0112 00		
4	H	#6 PHOS. BR. INT. SHAKE. WASHER	373 3020 00		
1	X	ASS'Y OF PARTS PER QT. "A"	571 1245 20		

COIL: #10 (.100) MEDIUM HARD DRAWN SILVER PLATED COPPER WIRE.

NOTE: ENDS OF COILS TO BE ROUND AND FREE FROM SHARP EDGES.





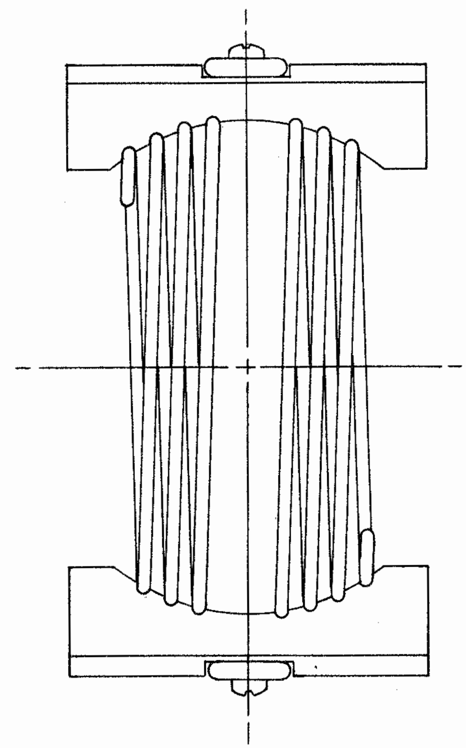
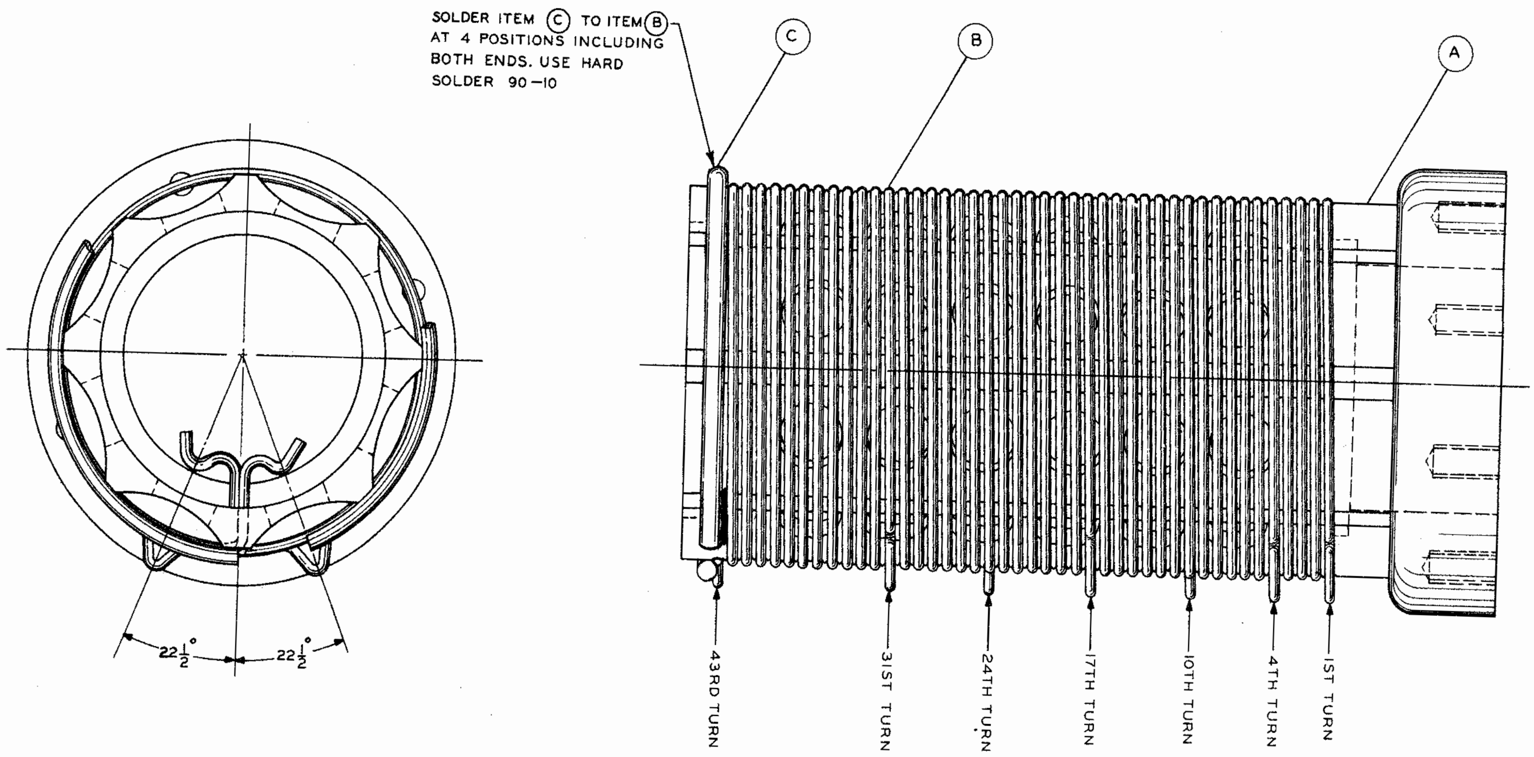
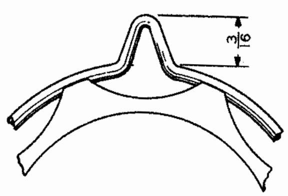


Figure 7-65 PA Plate Inductor - Stator for L-112

GA	IT.	PART NO.	DESCRIPTION	MAT'L.	FIN.
1	A	571 1100 20	COIL FORM		
1	B	421 1421 00	28 FT. #14 LEAD COVERED COPPER WIRE		
1	C	507 7350 00	CORONA RING		





ENLARGED DETAIL OF TAP LOOPS

WINDING DATA

WIRE	GUAGE	PART NO.	APPROXIMATE NUMBER OF TURNS	TYPE OF WINDING	L.	DIST. C.	Q.	FREQ.	CAP.
LEAD COVERED COPPER WIRE	14	421 1421 00	43	SINGLE LAYER	42μH		325	2.0M C.	150μμFD.

Figure 7-66 Antenna Loading Inductor L-113

A	IT.	DESCRIPTION	PART NO.	MAT'L	FIN.
1	A	COIL FORM	5075922 00		
4'	B	#16 LEADED COPPER WIRE, FT	421 1621 00		

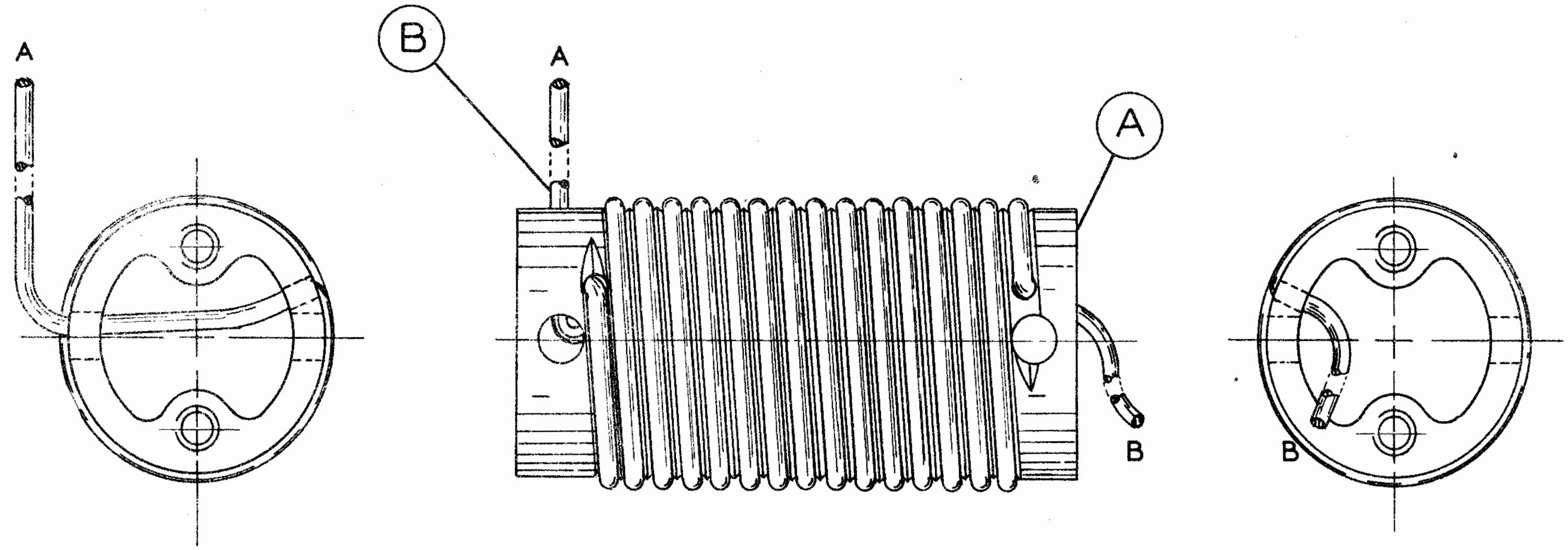


Figure 7-67 PA Plate Tank Padding Inductor L-114

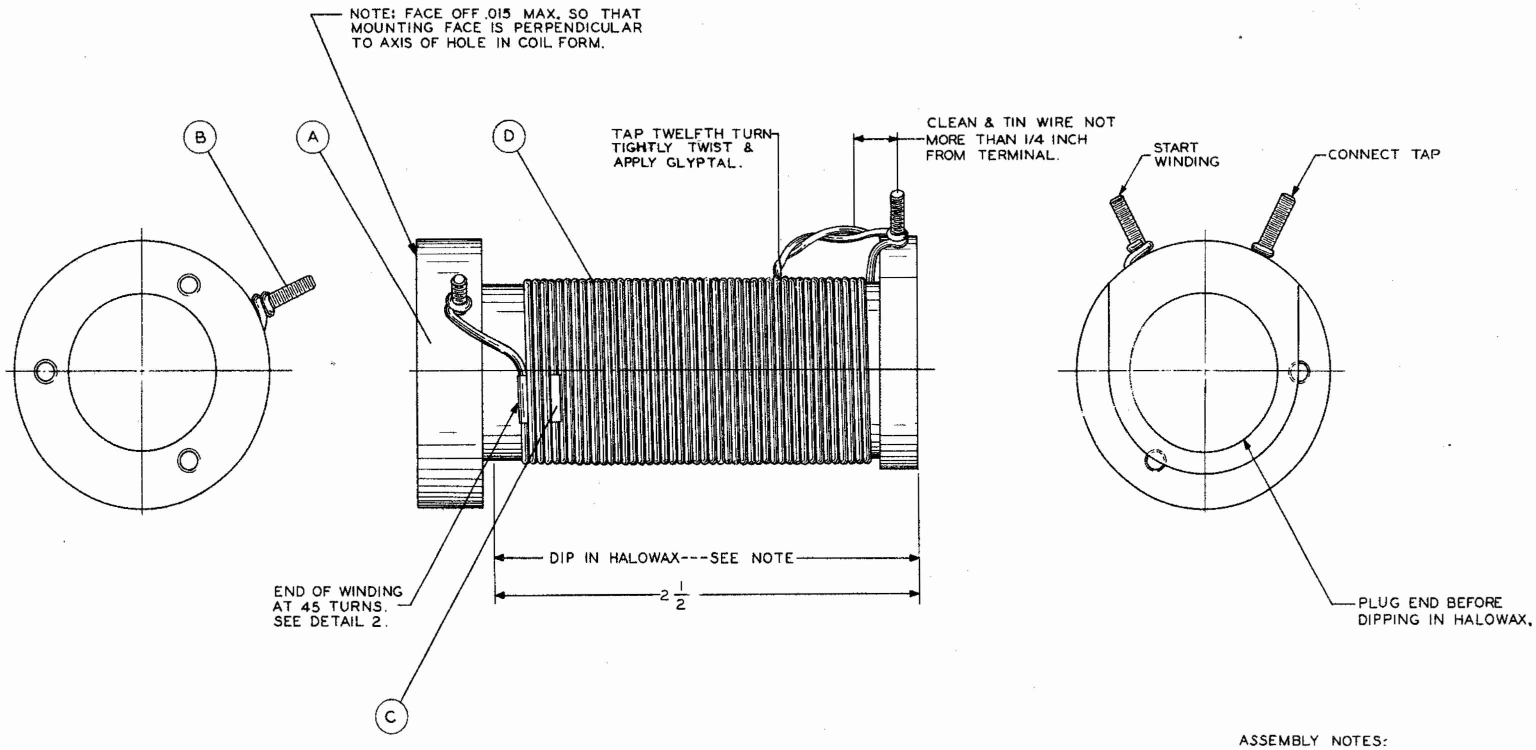
END "A" IS THREE INCHES LONG

END "B" IS ONE INCH LONG

WINDING & TEST DATA (WITH Q METER)

WIRE	GUAGE	PART NUMBER	NO. OF TURNS	TYPE OF WINDING	L. μh (MIN)	Q.	FREQ. (mc)	CAP. (μμf)
LEADED COPPER WIRE	16	421 1621 00	15	SINGLE LAYER	2.1 ± 5%	270. MIN.	18.	37.

GA	IT.	PART NO.	DESCRIPTION	MAT'L	FIN.
1	A	571 1868 20	L. F. OSCILLATOR COIL FORM		
3	B	312 3380 00	2-56 X 5/8 STUD		
0.2	C	014 4000 00	TAPE 1/4 X .005 FT.		
130	D	422 5100 00	48-38 LITZ WIRE, FT.		

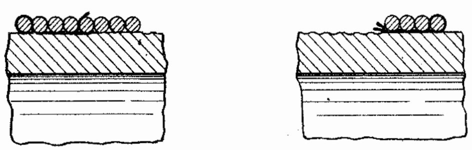


ASSEMBLY NOTES:

1. IMPREGNATE WITH CERESE AA OR EQUIVALENT AT TEMPERATURE OF 121°-126°C. (250°-260°F.) UNTIL AIR BUBBLES CEASE. LET COOL, THEN FLASH DIP IN HALOWAX NO. 2141 AT TEMPERATURE OF 176°-182°C. (350°-360°F.)

   NOTE: THE COAT OF WAX MUST BE FREE FROM BUBBLES & BLOW HOLES & NOT MORE THAN 1/32 IN. THICK.

2. CEMENT ITEM (B) TO ITEM (A) WITH DUCO CEMENT 4N457



DETAIL NO. 2

TAPE AT END OF WINDING.

DETAIL NO. 1

TAPE AT START OF WINDING.

WINDING DATA NOTE: INDUCTANCE AT 1000 C.P.S. 20.0 MH.

WIRE	GUAGE	PART NO.	NO. OF TURNS	TYPE OF WINDING	L.	DIST. C.	Q.	FREQ.	CAP.
48-38 LITZ	19	422 5100 00	45	SINGLE LAYER	19,956 μh ±1%	3,166 MMF.	104 ±8%	2000 KC.	320 MMF.

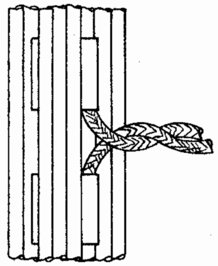
Figure 7-68 LF Oscillator Grid Inductor L-401

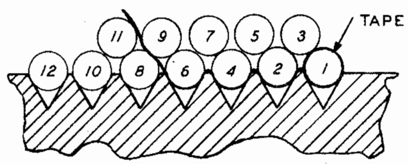
NOTES:
1. LENGTH OF TAPS TO BE $3\frac{1}{2}$".
2. RIGHT HAND WINDING.

TAP NO. FROM TOP	TOTAL TURNS FROM TOP	INDUCTANCE BETWEEN TOP & TAP (ON "Q" METER WITH CQ AT 400MMF)	Q BETWEEN TOP & TAP	FREQUENCY AT WHICH Q IS MEAS.	
1	47.5	622	193	334	
2	82.5	1490	235	206	
3	107.5	2380	228	163	
4	129.5	3270	180	139	
5	142.5	3985	96	126	
6 (END)	145.75	5040	165	112	

QUANTITIES LISTED ARE FOR ONE ASSEMBLY					
500	500	500	ITEM NO.	PART NUMBER	PART NAME
		18	A	288 1002 00	MOLDED IRON CORE
		6	B	323 0072 00	8-32X½ SL. B.H. SCR.
		6	C	323 0097 00	10-32X1⅛ SL B H SCR.
		3	D	330 4240 00	6-32X ⅜ FIBRE SCREEN
		203	E	422 0064 001	60-38 LITZ WIRE, FT.
		3	F	500 2700 001	COIL WINDING TERMINAL
		1	G	502 1717 003	LOAD COIL FORM
		1	H	502 1718 003	IRON CORE SUPPORT
		1	J	502 1719 003	LOAD COIL BASE
		1	K	502 1720 003	LOAD COIL SUB-BASE
		1	L	502 1721 002	LOAD COIL SPACER
		6	M	502 1722 002	IRON CORE SUPPORT ROD
		2.0	N	014 4000 00	ARMATURE TAPE, FT.
		1.5	P	421 1020 00	#10 TINNED CU BUS, FT.
		2	Q	310 6210 00	#10 BR. FLAT WASHER
		2	R	323 0096 00	10-32X1" S.B.H. SCREW
		2	S	373 7040 00	#10 EXT. P B SHAKE
		2	T	322 0081 00	10-32X1¼ S.F.H. SCREW

DETAIL SHOWING METHOD OF TAPING AT TAPS.
SCALE 10=1





DETAIL SHOWING METHOD OF TAPING START & END OF WINDING & SEQUENCE OF 2 LAYER BANK WINDING.
SCALE 10=1

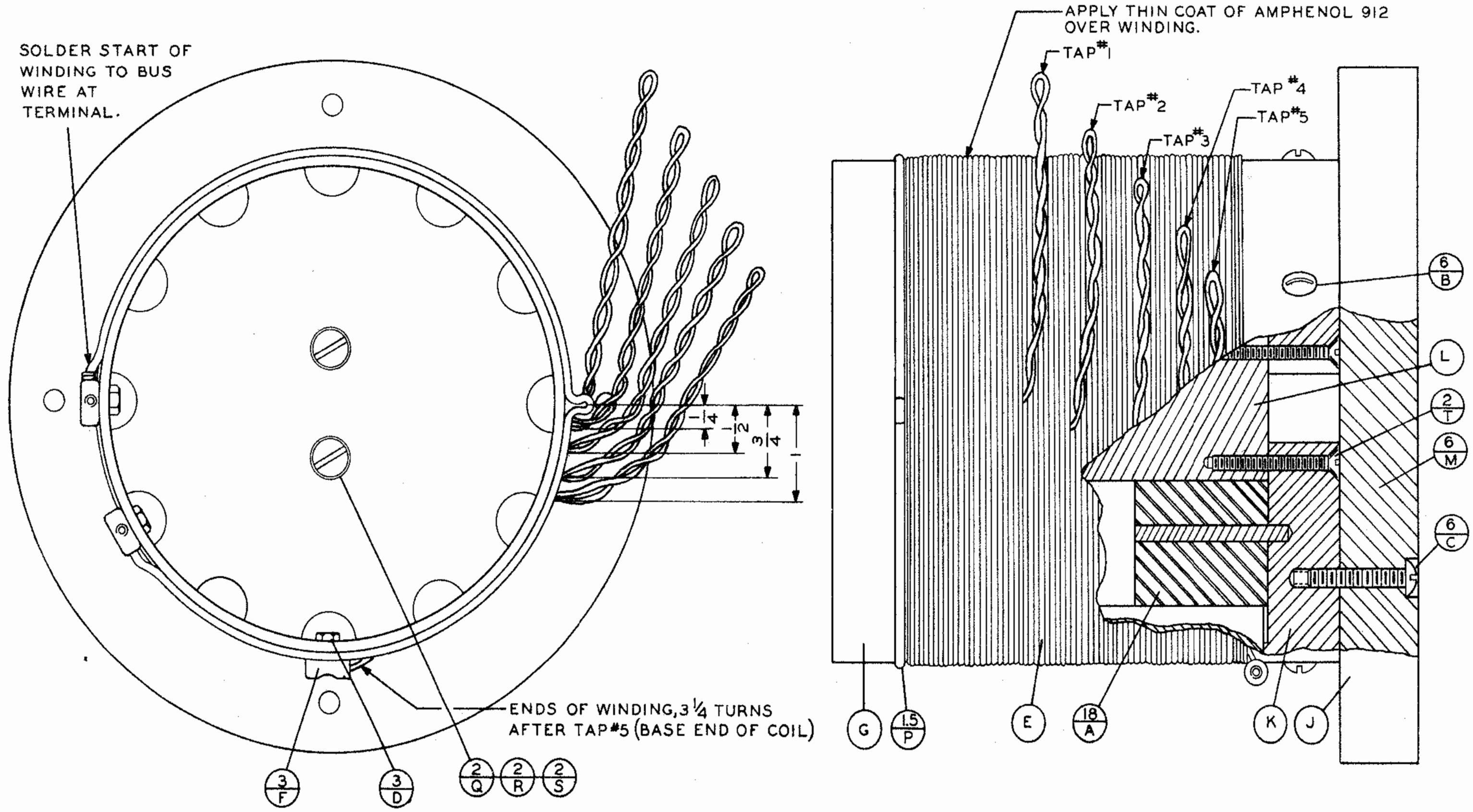
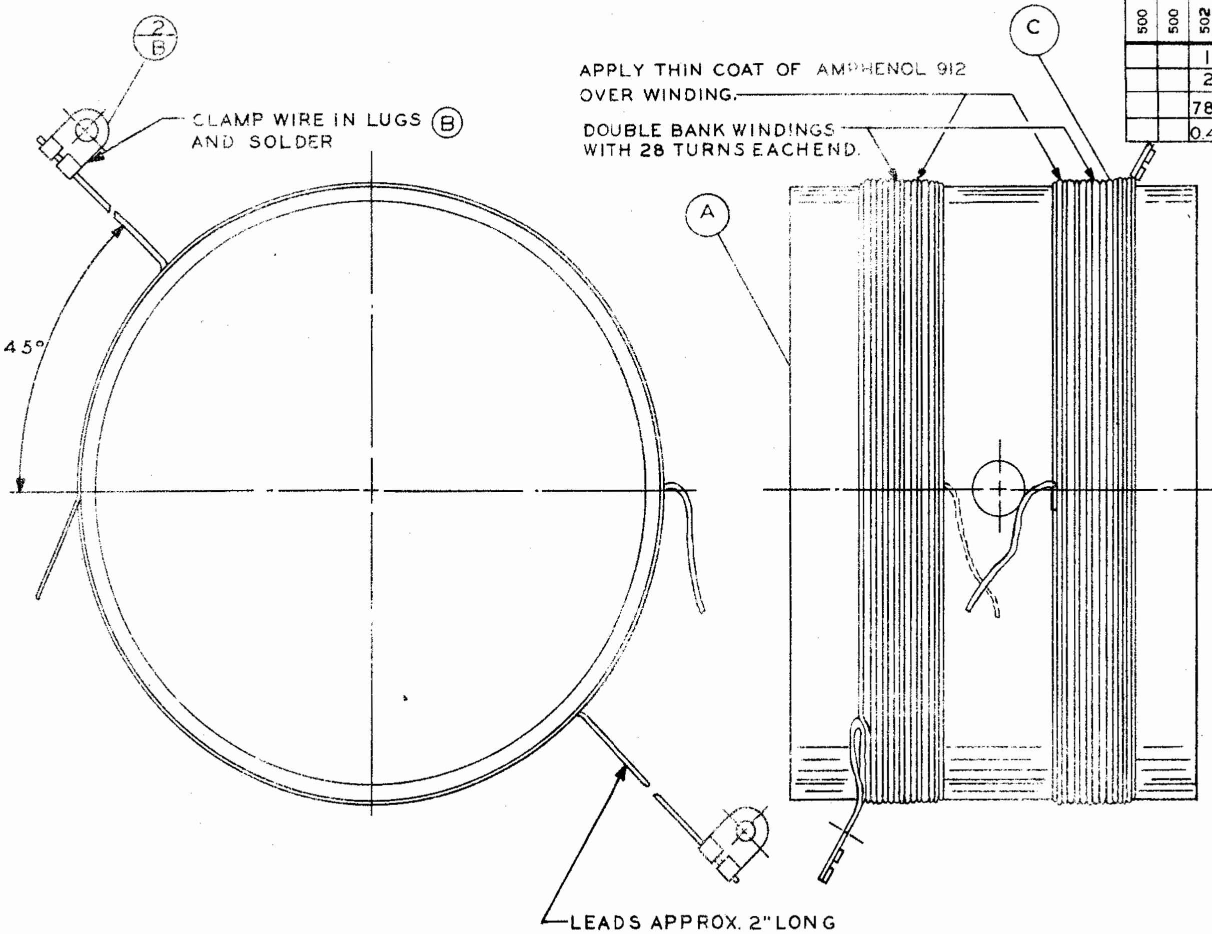
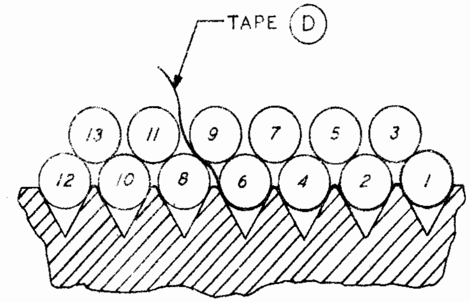


Figure 7-69 Antenna Loading Coil L-3001

QUANTITIES LISTED ARE FOR [illegible]					
500	500	502 1723 002	ITEM NO.	PART NUMBER	PART NAME
		1	A	502 1730 003	STATOR COIL FORM
		2	B	304 6100 00	#6 SOLDER LUG
		78'	C	422 0064 00	60-38 LITZ WIRE, FT.
		0.4	D	014 4000 00	ARMATURE TAPE, FT.



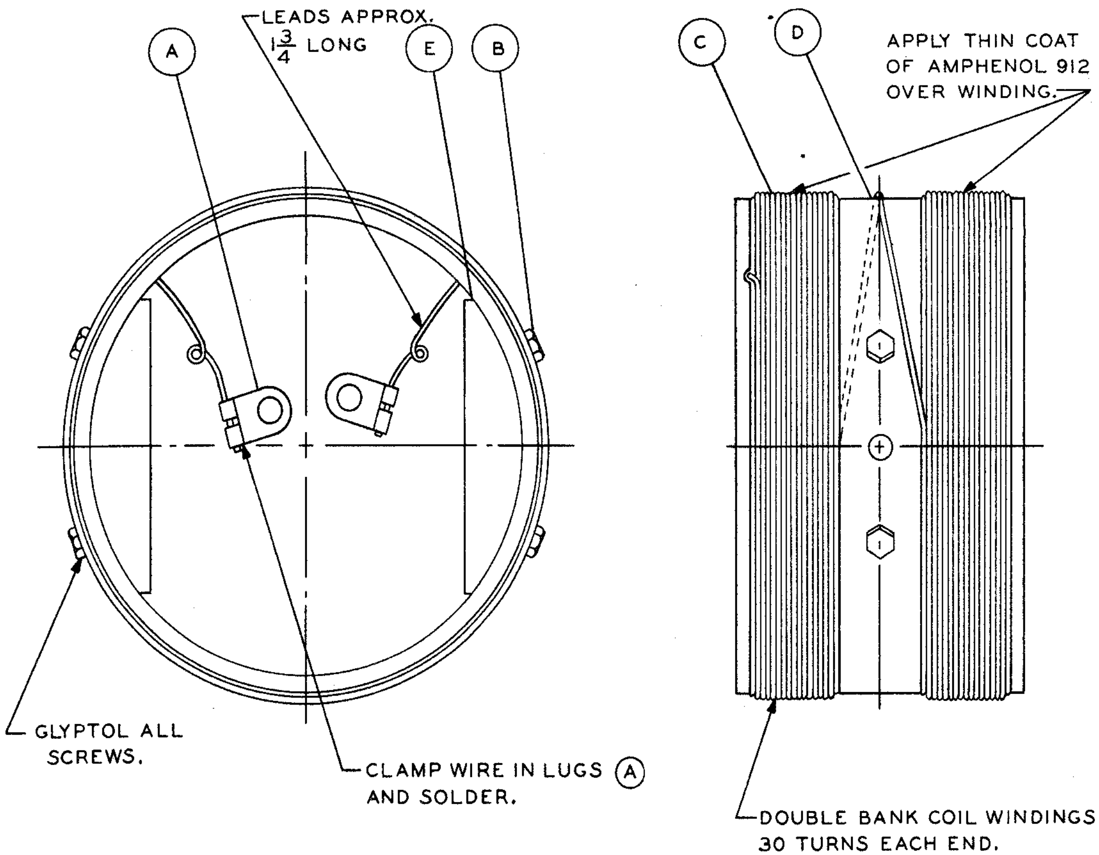


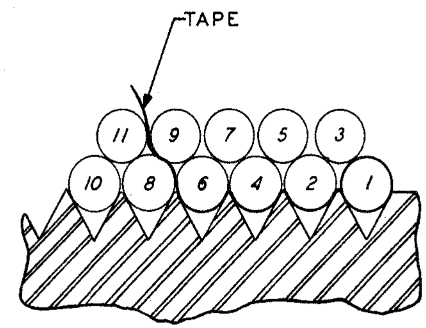
DETAIL SHOWING METHOD OF TAPING START & END OF WINDING AND SEQUENCE OF DOUBLE BANK WINDING.
SCALE 10:1

Figure 7-70 Antenna Loading Coil - Stator for L-3002

Figure 7-71 Antenna Loading Coil - Rotor for L-3002

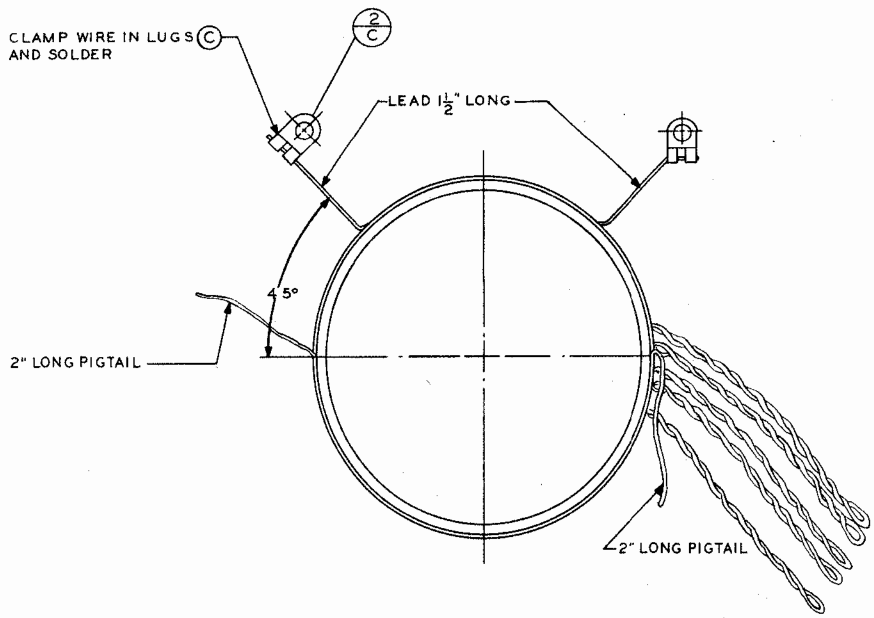
QUANTITIES LISTED ARE FOR ONE ASSEMBLY					
500	500	500	ITEM NO.	PART NUMBER	PART NAME
		2	A	304 5000 00	#10 SOLDER LUG
		4	B	330 4240 00	6-32X 3/8 FIBRE HEX HD SCREW
		65	C	422 0064 00	WIRE 60-38 LITZ, FT.
		1	D	502 1731 00	COIL FORM
		2	E	502 1732 002	ROTOR SHAFT SURPORT
		0.4	F	014 4000 00	ARMATURE TAPE, FT.

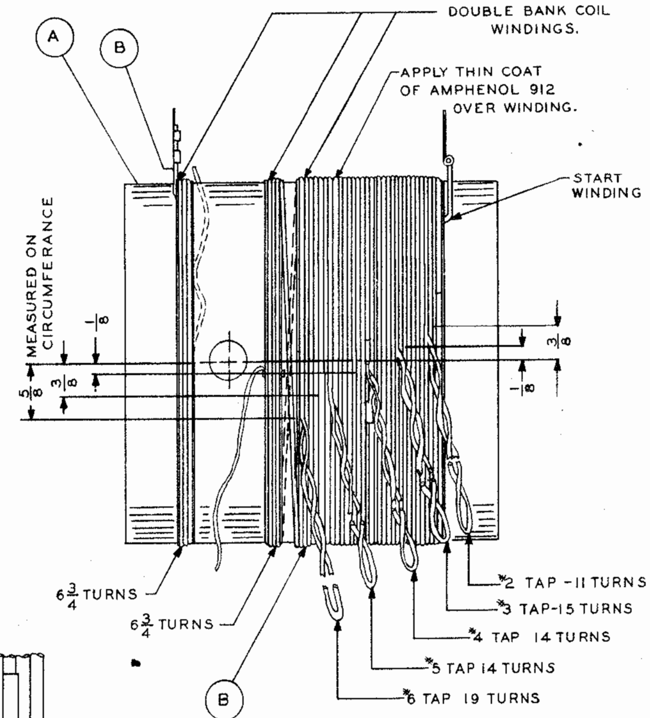




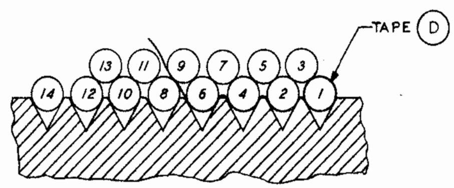
DETAIL SHOWING METHOD OF TAPING START OF WINDING AND SEQUENCE OF DOUBLE BANK WINDING.
SCALE 10:1

QUANTITIES LISTED ARE FOR ONE ASSEMBLY					
500	500	502 17 38 003	ITEM NO.	PART NUMBER	PART NAME
		1	A	502 174 003	STATOR COIL FORM
		94	B	422 0064 00	60-38 LITZ WIRE, FT.
		2	C	304 6100 00	#6 SOLDER LUG
		8'	D	014 4000 00	ARMATURE TAPE



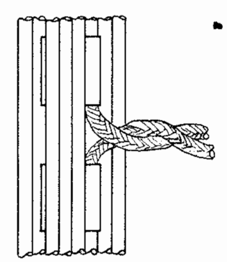


ALL TAPS BROUGHT OUT FROM COIL TO BE 3½" LONG.



DETAIL SHOWING METHOD OF TAPING START OF WINDING AND SEQUENCE OF DOUBLE BANK WINDING.

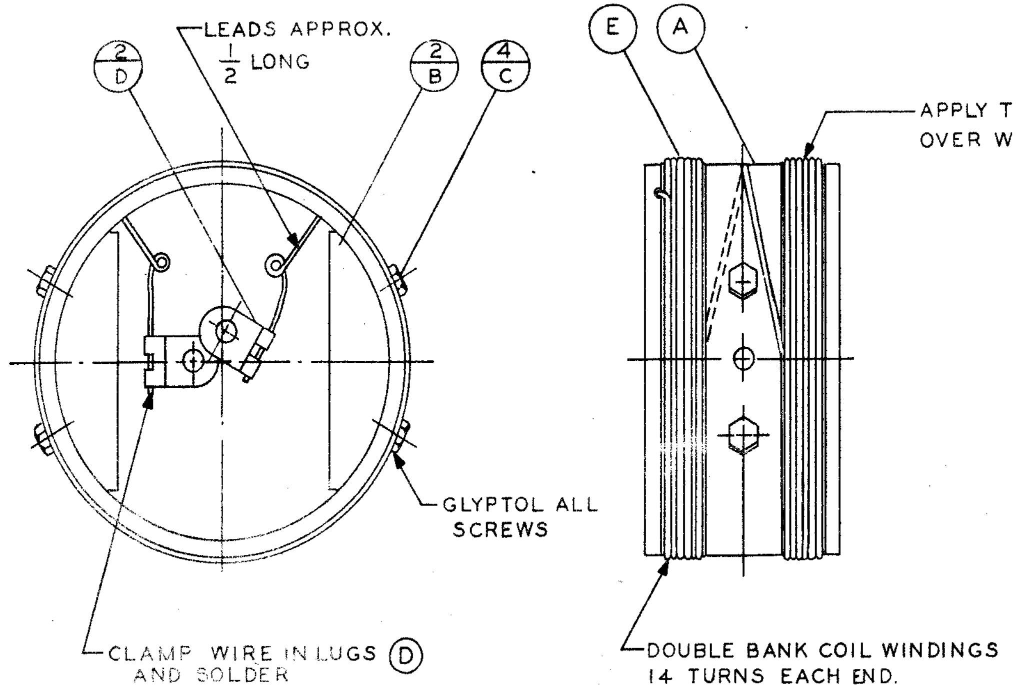
SCALE 10:1

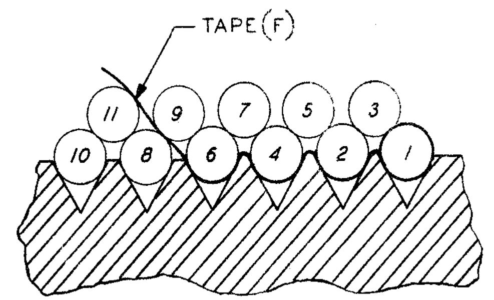


DETAIL SHOWING METHOD OF TAPING AT TAPS
SCALE 4:1

Figure 7-72 Antenna Loading Coil - Stator for L-3003

QUANTITIES LISTED ARE FOR ONE ASSEMBLY					
500	500	502 1739002	ITEM NO.	PART NUMBER	PART NAME
		1	A	502 1744 002	COIL FORM
		2	B	502 1743 002	ROTOR SHAFT SUPPORT
		4	C	330 4240 00	6-32X3/8 FIBRE HEX. HD. SCR.
		2	D	304 5000 00	SOLDER LUG
		23	E	422 0064 00	60-38 LITZ WIRE, FT.
		0.4	F	014 4000 00	ARMATURE TAPE, FT.





DETAIL SHOWING METHOD OF TAPING START & END OF WINDING AND SEQUENCE OF DOUBLE BANK WINDING
SCALE 10:1

Figure 7-73 Antenna Loading Coil - Rotor for L-3003

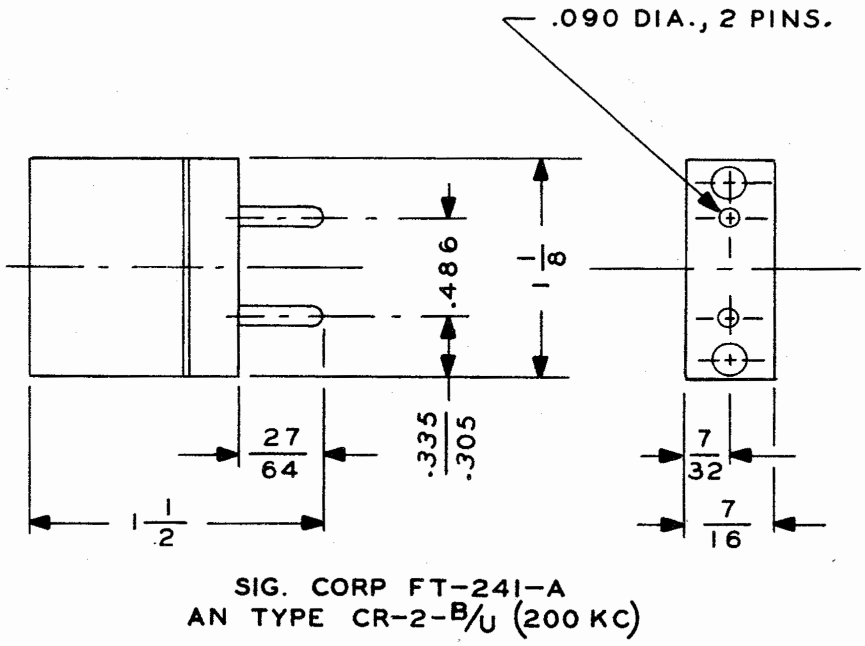


Figure 7-74 Type CR-2-B/U (200 kc) Crystal Unit