INSTRUCTIONS

COLLINS Type 32RA

RADIO TRANSMITTER

MODEL 8

Output 75 Watts Radiotelegraph

Output 50 Watts Radiotelephone

Frequency Range

1.5 TO 15.0 MC

Manufactured By

COLLINS RADIO COMPANY

CEDAR RAPIDS, IOWA, U.S.A.

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BOOK NO. 346-3174

WARNING

OPERATION OF THIS EQUIPMENT INVOLVES THE USE OF HIGH VOLTAGES WHICH ARE DANGEROUS TO LIFE. OPERATING PERSONNEL SHOULD AT ALL TIMES OBSERVE ALL THE SAFETY RULES LISTED BELOW. DO NOT CHANGE TUBES WITH HIGH VOLTAGE SUPPLY ON. WHEN MAKING ADJUSTMENTS WITHIN THE EQUIPMENT EXTREME CARE SHOULD BE EXERCISED TO PREVENT TOUCHING HIGH VOLTAGE CIRCUITS. ALL TUNING ADJUSTMENTS WITHIN THE TRANSMITTER SHOULD BE MADE USING AN INSULATED SCREWDRIVER. ALWAYS TURN OFF HIGH VOLTAGE AND DISCHARGE CIRCUITS BY GROUNDING BEFORE TOUCHING THEM.

Since the use of high voltages which are dangerous to human life is necessary to the successful operation of the radio transmitting equipment covered by these instructions, certain precautionary measures must be carefully observed by the operating personnel during the adjustment and operation of the equipment.

KEEP AWAY FROM LIVE CIRCUITS: When testing circuits of the transmitter it is preferable to make continuity and resistance checks rather than directly checking voltages at points in the circuit when high voltage is applied. Under no circumstances should tuning adjustments be made within the transmitter with an uninsulated screwdriver.

GUARANTEE

This equipment is guaranteed against defects in material, workmanship or manufacture, for a period of one year from the date of delivery. Our obligation under this guarantee is limited to repairing or replacing any item which shall prove, by our examination, to be thus defective, provided the item is returned to the factory for inspection with all transportation charges paid. Before returning any item believed to be of defective material, workmanship or manufacture, a detailed report must be submitted to the company giving exact information as to the nature of the defect. The information shall include, in as much detail as possible, all subject material listed under instructions for replacement of parts. Upon receipt of the report by the company, a returned equipment tag will be forwarded to the shipper without delay. **The returned equipment tag must accompany all shipments of defective parts. No action will be taken on any equipment returned to the company unless the shipment includes the return tag.**

THE COLLINS RADIO COMPANY

REPLACEMENT OF PARTS

In case a replacement under the guarantee is desired, a full report must be submitted to the company. This report shall cover all details of the failure and must include the following information:

(A) Date of delivery of equipment.
(B) Date placed in service.
(C) Number of hours in service.
(D) Part number of item.
(E) Item number (obtain from Parts List or Schematic Diagram).
(F) Type number of unit from which part is removed.
(G) Serial number of unit.
(H) Serial number of the complete equipment.
(I) Nature of failure.
(J) Cause of failure.
(K) Remarks.

When requisitioning replacement parts, the following information must be furnished:

(A) Quantity required.
(B) Part number of item.
(C) Item number (obtain from Parts List or Schematic Diagram).
(D) Type number of unit.
(E) Serial number of unit.
(F) Serial number of equipment.

NOTE: Blank Service Report forms will be found in the appendix of this instruction book.

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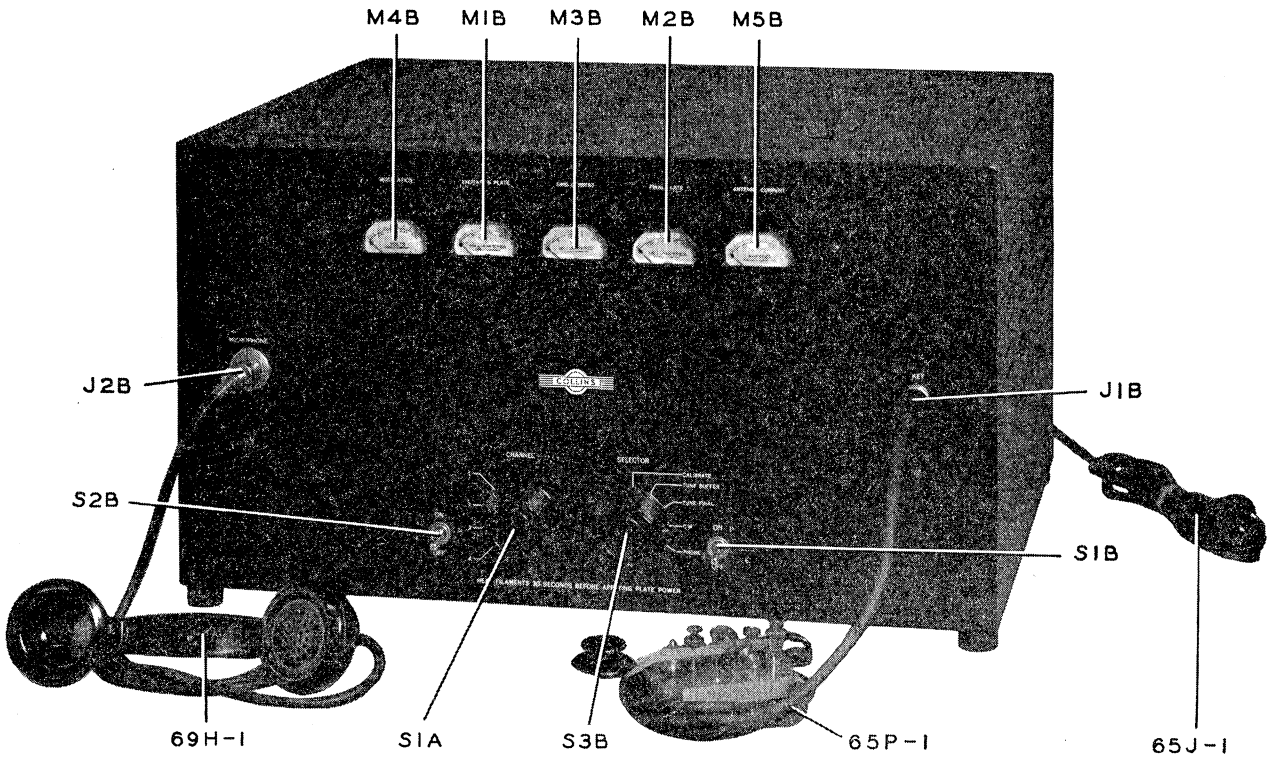


FIG. 1 32RA TRANSMITTER & ACCESSORIES
FRONT VIEW

Figure 1

I GENERAL CHARACTERISTICS

1. **EQUIPMENT.**—The Type 32RA Transmitter is completely contained in one unit. The complete installation consists of the transmitter unit, microphone, key and power cord. The transmitter components are housed in a cabinet 12" high, 22" wide, and 18" deep. The height is exclusive of mounting feet. The weight of the complete transmitter ready for operation is approximately 120 pounds.

The 32RA Transmitter is designed for table mounting. An area 22" wide by 18" deep on the table top is required. At least 2" clearance at the rear of the transmitter should be allowed for antenna and power connections.

2. **TUBE COMPLEMENT.**—Tubes are employed as follows in the 32RA Transmitter:

Tube Type	Quan.	Circuit Function	Unit Type
6L6G	1	H.F. Oscillator and Multiplier	33K
6L6G	1	Buffer and Multiplier	33K
807	3	Power Amplifier	33K
6C5	1	Audio Input Amplifier	9Z
6L6G	4	Modulator	9Z
80	1	Exciter Power Rectifier	411B
866A	2	Amplifier and Modulator Power Rectifier	411B

3. **GENERAL DESCRIPTION**—The Type 32RA equipment is a low power, general purpose radiotelephone and radiotelegraph transmitter. It is especially applicable in services where up to four frequency channels must be quickly available.

The transmitter cabinet is of the console type, suitable for table mounting. Ventilating louvers are provided in the top, back, and two sides, assuring adequate ventilation for all heat producing elements. The construction is of heavy gauge, electrically welded sheet steel with a durable gray crinkle finish outside and a flat gray enamel finish inside.

The components of the transmitter are so arranged that unit construction is possible and are broken down in four units as follows:

101L Panel and Cable Assembly
33K Radio Frequency Unit
9Z Speech Amplifier and Modulator
411B Power Supply

All wiring is entirely independent of the cabinet and all units may be readily removed from the cabinet for inspection or replacement.

4. **TYPE OF EMISSION.**—A1 telegraph and A3 telephone emission are available with the 32RA Transmitter. Keying of the carrier for telegraph operation is accomplished by interruption of the cathode circuit of the buffer and final amplifier stages. Keying speeds up to 60 words per minute may be employed. The audio frequency response of the transmitter in telephone operation is uniform within plus or minus 2 db from 400 to 5000 cycles per second and the audio frequency amplitude distortion is less than 5% rms total harmonics at any modulation level. The residual noise level is more than 50 db below 100% modulation.

5. **FREQUENCY RANGE.**—The frequency range of the 32RA Transmitter is normally 1.5 mc to 15 mc. The equipment is designed to work into unbalanced antennas or transmission lines having an impedance of 30 to 1200 ohms.

6. **FREQUENCY CHANGE METHOD.**—Four separate and unrelated frequencies within the range 1.5 to 15 mc may be set up. Any one of the four frequencies may be selected instantaneously by means of a single rotary switch. No retuning of any circuit is required when changing from one frequency to another. The oscillator may be either crystal controlled or self-excited depending upon the use of crystals or plug-in master oscillator tuning units. All tuning elements are of the plug-in type and may be changed at will. Tuning controls are located inside the cabinet and require the use of an insulated screwdriver for making adjustments.

7. **POWER OUTPUT.**—The nominal rated power output of the 32RA Transmitter is 50 watts radiotelephone and 75 watts radiotelegraph delivered into a 70 ohm artificial load at

ADDENDUM

Collins Type 32RA-8 Radio Transmitter
Instructions

Refer to paragraph: "18. COILS AND CRYSTALS", page 13. The information given regarding coils and crystal frequencies is essentially correct, however, it should be noted that the crystal frequencies are NOT restricted to the range 1500 kc to 3750 kc. The only factors limiting the fundamental frequencies of crystals used in this equipment are the activity and reliability of the crystals. The use of active crystals in the range 3750 to 5000 kc should prove entirely satisfactory. In consideration of reliability of operation, it is recommended that no crystals above 5000 kc fundamental frequency be used.

3-22-43.

On Page 34, under the 9Z-8 Modulator Parts List, C3D should be listed "Same as C2D" instead of "same as C3C" as shown in the list.

On Page 35, a resistor should be added as follows:

R18D Resistor, Audio Gain Control Same as R2D

On Page 38, the 7th line from the bottom, showing R2D, should read as follows:

1 R2D, R18D 10,000 ohm WW Pot. 377N225A 05M M

9-25-43.

any frequency within the specified range. The transmitter is capable of 100% modulation for telephone operation.

8. **POWER SOURCE AND INPUT REQUIREMENTS.**—The 32RA Transmitter is designed to operate from a 115 volt, single phase, 50/60 cycle a-c power source. The maximum input power requirement is 390 watts at 0.9 power factor.

9. **CONTROLS.**—A simplified system of control is employed in the 32RA Transmitter. Two heavy duty toggle switches control the filament and plate power circuits. The switches are so interlocked that the plate power cannot be turned on until after the filament power switch has been operated. A press-to-talk button associated with the microphone may be used to turn on the plate power instead of the plate power switch when transmissions of short duration are contemplated. A selector switch provides for the application of plate power to successive r-f stages as well as the selection of proper circuits for telephone or telegraph emission.

10. **ACCESSORIES.**—A Type 65J-1 Power Cord, a Type 65P-1 Telegraph Key (with cord and plug), and a Type 69H-1 Handset are the only accessories required for the 32RA Transmitter.

II INSTALLATION

11. **UNCRATING.**—Open packing cases with care. When cases are marked with arrows to indicate upright position, remove covers of cases only and lift units out carefully. Search all packing material for small packages. Remove wrapping from equipment and blow or lightly brush away packing dust and shavings. In case of damage, file all claims promptly with the transportation company. It is necessary to preserve the original packing box and packing material in case a claim is to be filed with the transportation company.

12. **INSPECTION.**—Inspect cables and wiring for possible broken or displaced wires. Make sure that all terminal connections are tight. Inspect each unit for loose screws or bolts. Make certain all controls such as switches, dials, etc., operate properly.

13. **PLACING TRANSMITTER.**—The console type cabinet is designed to be placed on the operating table along with the receiving apparatus. It occupies a space 22" wide by 18" deep. At least two inches should be allowed at the rear for making antenna and power input connections. Sufficient clearance at the sides should be provided for free circulation of air.

14. **FUSES.**—All fuses should be examined and their ratings checked. Correct fuse positions are shown in the top view photograph of the transmitter. The fuses employed in this equipment with corresponding parts list item numbers are tabulated below:

Fuse Item Number	Circuit	Fuse Rating
F1C	A.C. Power Line Fuse	10 amp.
F2C	H.V. Primary Fuse	6 amp.
F3C	L.V. & Bias Primary Fuse	3 amp.

15. **EXTERNAL CONNECTIONS.**—Place all power switches in the OFF position before attempting to make any external connections. The external connections for the 32RA Transmitter are as follows:

(1) A.C. Power Line
(2) Microphone and Key
(3) Radiation System

a. Power Line.—The 32RA Transmitter is designed to operate from a 115 volt, single phase, 50/60 cycle power source. The supply line should be checked for these specifications before connections are made. The maximum power required from the line by this equipment is 390 watts. The power line is connected to the transmitter by means of a convenience cord supplied with the equipment. One end of the cord is plugged into the flush receptacle on the transmitter and the other end is placed in a standard outlet.

b. Microphone and Key. — The microphone plug is inserted in the MICROPHONE jack, J5B, on the front of the transmitter. It is very important, in order to avoid radio frequency feedback problems, to make sure the clamping ring on the microphone plug is tightly turned up on the threads around the input receptacle. Push-to-talk control connections are made as a part of the microphone circuit connections.

The telegraph key is plugged into the KEY jack, J4B, on the panel.

c. Radiation System.—The 32RA Transmitter is designed for use with unbalanced antennas only. The antenna and ground terminals are located on a terminal strip on the rear of the cabinet. The antenna terminals are arranged so that a separate antenna may be used for each of the four channels. By use of jumper wires one antenna may be used for several channels if desired.

A good, low resistance ground should be connected to the ground terminal. If the ground is poor the audio system may develop feedback. The output of the transmitter will also be seriously impaired by a poor ground system.

Several types of antennas are suitable for use with the 32RA Transmitter. One of the most simple and easily installed types is the inverted "L" antenna. This consists of a horizontal flat top section with a single wire lead-in connected to one end. The antenna length

should be considered as the combined length of the flat top and lead-in sections.

For portable or mobile service a self-supporting telescope type vertical antenna is very useful. However, due to its limited length, the use of this antenna should be confined to the higher frequencies.

Perhaps the most efficient type of antenna is the guyed vertical antenna composed of concentric metal pipes or of structural sections such as used for rural wind-powered generators. This type of antenna is more permanent but also more expensive to install than most other types. The height of this type of antenna can usually be made great enough for maximum efficiency on the lower frequencies. Locate the transmitter as near the base of the antenna as possible so the lead-in will be short.

The electrical length of any antenna including the lead-in, used with this equipment, should preferably be not less than one-quarter wavelength on the lowest operating frequency. Avoid the vicinity of half wavelength antennas or multiples thereof, since it is very difficult to load antennas of this length. Where one antenna is to be used for several frequency channels, the length should be chosen to avoid the regions of half wavelengths or multiples thereof. Allowing for end effects,

$$\text{Length of quarter-wave antenna (feet)} = \frac{240}{\text{Operating frequency (mc)}}$$

For example, if the lowest operating frequency will be 2.0 mc (2000 kc), the antenna and lead-in might be made approximately 120 feet long. If there were no operating frequencies near 4.0, 8.0 or 12.0 mc, the antenna would probably be suitable to all four channels. If an antenna proves troublesome to load on one operating frequency, it may be lengthened or shortened a small amount. This will usually clear the trouble. If one antenna is not satisfactory for all frequencies, a separate antenna can always be connected to any channel on which loading trouble occurs.

III PRELIMINARY ADJUSTMENT

OPERATION OF THIS EQUIPMENT INVOLVES THE USE OF HIGH VOLTAGES WHICH ARE DANGEROUS TO LIFE. OPERATING PERSONNEL SHOULD AT ALL TIMES OBSERVE ALL OF THE SAFETY RULES. DO NOT CHANGE TUBES WITH HIGH VOLTAGE SUPPLY ON. WHEN MAKING ADJUSTMENTS WITHIN THE EQUIPMENT EXTREME CARE SHOULD BE EXERCISED TO PREVENT TOUCHING HIGH VOLTAGE CIRCUITS. ALL TUNING ADJUSTMENTS WITHIN THE TRANSMITTER SHOULD BE MADE USING AN INSULATED SCREWDRIVER. ALWAYS TURN OFF HIGH VOLTAGE AND DISCHARGE CIRCUITS BY GROUNDING BEFORE TOUCHING THEM.

16. **PRELIMINARY.**—Be certain the filament and plate power switches are in the OFF position. Turn the AUDIO GAIN control, located on the 9Z Modulator Unit, to the full off (counterclockwise) position. Place the SELECTOR switch in the CALIBRATE position.

17. **TUBES.**—Each of the units requires tubes in accordance with the list shown on page one. Each tube position is engraved with the proper tube type designation. All tubes may now be inserted, using the engravings and the top view photograph as a guide. When placing plate leads on the plate cap connections of tubes, use care so as to avoid putting any mechanical strain on the glass.

18. **COILS AND CRYSTALS.**—Although the 32RA is a four channel transmitter designed for rapid frequency changing, plug-in coils and crystals are used so that it is possible to place any channel on any frequency within the service range with a minimum of effort.

The frequency of the oscillator may be controlled by either master oscillator coils or quartz crystals. Each channel requires two additional coil units, one for the exciter plate tank circuits and one for the output network.

a. Crystals.—Crystal control may be employed on any frequency within the service range. The equipment has been designed for crystals in the frequency range of 1500 to 3750 kc. The operating frequency is twice crystal frequency in the range 3750 to 7500 kc, and four times crystal frequency in the range 7500 to 15,000 kc. The transmitter should never be operated on the *third* harmonic of the crystal frequency, since this harmonic frequency is generally unreliable.

b. Master Oscillator Coils.—When it is desired to operate the 32RA Transmitter with a self-controlled master oscillator circuit, it is necessary to place a type 145J Master Oscillator Frequency Control Unit in the crystal socket corresponding to the CHANNEL control switch position. This frequency control unit consists of a low loss tank coil with a fixed tuning capacity forming a high Q tank circuit which serves in place of the quartz crystal. The frequency of operation of this tank circuit may be varied over a frequency range of approximately 1.25 to 1 by means of an adjustable core. The position of this core may be adjusted by means of a screw protruding from the top of the unit.

The transmitter may be operated on the first, second, third or fourth harmonic of the *master oscillator* coils. The operating range of the master oscillator coil group for each harmonic is as follows:

Oscillator Freq. Range	Operating Harmonic	Operating Freq. Range
1500-3750 kc.	1st	1500-3750 kc.
1500-3750 kc.	2nd	3000-7500 kc.
1500-3750 kc.	3rd	4500-11250 kc.
1500-3750 kc.	4th	6000-15000 kc.

From the above list it may be seen that in some ranges between 3000 and 11,250 kc, the transmitter may be operated on any one of several harmonics of the master oscillator coils.

c. Exciter Coils.—The type 7000C-5 plug-in exciter coil units employed in the oscillator and buffer stages on each channel consist of one or two tank coils and two variable capacitors mounted in an aluminum shield 2" x 2" x 4½". The windings are placed on a grooved ceramic form supplied with pins to fit a medium seven prong socket.

The coil units employed in the exciter stages on frequencies from 1.5 to 9 mc, are constructed with one tank coil only. These coils (#1, 2, 3

and 4) are tapped to provide two frequency ranges which may be selected as desired by placing the knurled screw at the top of each coil can in the screw holes adjacent to the range desired. The frequency ranges covered by the two tank circuit arrangements of each coil are designated RANGE-A and RANGE-B. Coils #5 and #6 have only one frequency range which is shown under RANGE-B. In coils #1, 2, 3, and 4, the tank capacitor designated TUNING is employed in the buffer plate tank circuit, and the capacitor designated EXCITATION is employed as the excitation control for the power amplifier stage. In coils #5 and 6 the capacitor designated EXCITATION is employed with a separate tank coil in the oscillator plate circuit. Coils #5 and 6 are used for all frequencies above 9 mc.

The frequency range of each coil is as follows:

Coil No.	Range	Frequency Range
1	A	1.5 - 2.1 mc
	B	2.0 - 2.7
2	A	2.5 - 3.4
	B	3.2 - 4.5
3	A	4.0 - 5.5
	B	5.2 - 7.0
4	A	6.0 - 8.2
	B	8.0 - 10.0
5	A	None
	B	9.0 - 12.0
6	A	None
	B	12.0 - 15.0

d. Output Network Coils.—The two Type 190 series coils employed in the output network cover the entire frequency range of the transmitter. These coils are wound on threaded ceramic forms with tinned wire. A rider is provided on each coil for selecting any number of turns desired. The 190F coil has 56 turns and should be used in the range below 5.0 mc. The 190E coil has 25 turns and should be used in the range above 5 mc.

e. Tuning Charts.—Tuning charts are shown on page 25 to assist the operator in selecting the proper coils for any desired output frequency. The Exciter Tuning Chart indicates the proper master oscillator coil for any frequency and also shows which harmonic of the coil should be used. The approximate setting of the antenna coil may also be determined from the Antenna Coil Tuning Chart.

An important function of the Exciter Tuning Chart in connection with the 7000C-5 exciter coils is to indicate the approximate settings of the TUNING and EXCITER capacitors for either RANGE-A or RANGE-B of any coil. This will assist the operator in selecting the proper harmonic when frequency multiplying is employed. Some of the exciter coils will tune to either the third or fourth oscillator harmonic in a single coil range.

Examples of the use of these charts are given as follows:

Example (a) Crystal controlled operation on 3810 kc:

As previously mentioned under Crystals, the operating frequency is twice crystal frequency in the range 3750 kc to 7500 kc. Therefore, a 1905 kc crystal will be required. Referring to the Exciter Tuning Chart, it may be seen that, for an operating frequency of 3810 kc, buffer coil #2, Range B or coil #3, Range A may be used in the buffer tank circuit. The approximate TUNING dial setting for either coil may be noted from the chart.

The antenna coil tuning chart indicates that the 190F coil will be required for 3810 kc, and that the coil should be set at approximately 18 turns.

Example (b) Master Oscillator Operation on 8412 kc:

Referring to the Exciter Tuning Chart, buffer coil #4, Range B will be required. The approximate TUNING dial settings will be 35. The bar graph of the frequency range of the master oscillator coils shows that there are two coils which may be used. The 145J-4 coil will be suitable with frequency quadrupling in which case the oscillator frequency will be one-fourth 8412 kc, or 2103 kc. The 145J-6 coil will be suitable with frequency tripling, in which case the oscillator frequency will be one-third of 8412 kc, or 2804 kc.

The 190E antenna coil will be required for 8412 kc operation and the tap should be set at approximately 11 turns.

19. **RADIO FREQUENCY CIRCUIT ADJUSTMENT.**—In general, when complete sets of coils are supplied for one or more channels and the frequency is specified, the coils will be shipped from the factory pre-tuned except for the power amplifier coil. The exciter coil unit should not require adjustment. However, when a set of coils is supplied for a general tuning range and no specified frequency is ordered, it will be necessary to adjust each tuning control beginning with the oscillator. When returning of the exciter stages is required, the procedure outlined below should be followed.

a. Transmitter Tuning Procedure. — **CAUTION:** The plate voltage employed in this equipment may exceed 550 volts and is therefore dangerous to life. Always turn the PLATE switch off before making any adjustments inside equipment, except when using an *insulated screwdriver*. Do not touch the antenna coils or the plate caps on the tubes when the PLATE switch is on.

A dummy antenna may be used in place of the regular antenna for preliminary adjustments. This type of load will be especially helpful to the operator who is not familiar with this equipment since the dummy antenna is much easier to load than an actual antenna. An ordinary 100 or 150 watt tungsten lamp will be suitable for this purpose.

After the crystal or master oscillator unit has been plugged into the five-prong socket of the channel on which operation is desired, the following procedure should be used to tune the transmitter:

(1) Place the CHANNEL switch in the position of the channel on which operation is desired.

(2) Place the SELECTOR switch in the CALIBRATE position.

(3) Referring to the Exciter Tuning Chart on page 25 select the proper type 7000C-5 coil for the desired output frequency. If the coil has a dual range, place the knurled shorting screw into the hole on the coil nameplate which is adjacent to the range desired. Tighten the knurled screw down well by hand.

(4) Plug the coil into the medium seven-prong socket of the channel desired. (Refer to Fig. 5.)

(5) Referring to the Antenna Coil Tuning Chart on page 25 select either the 190E or 190F antenna coil, depending upon the output frequency, and adjust the rider on the coil to give the number of turns indicated for the operating frequency.

(6) Turn the FILAMENT switch ON.

(7) After allowing 30 seconds for the filaments to heat, turn the PLATE switch ON. *Note:* This operation applies **550 volts** d.c.

(8) A reading of 30-35 ma should be observed on the EXCITATION PLATE meter. This is the oscillator plate current.

(9) If master oscillator unit is being used, the frequency of the unit should be adjusted as follows:

(a) Remove PLATE voltage.

(b) Loosen the lock nut on the large adjustment screw.

(c) Restore PLATE voltage.

(d) Using a suitable frequency standard such as a multivibrator and receiver, adjust the frequency of the master oscillator by adjusting the screw on the top of the unit: Note: If a power absorbing device such as a wavemeter is to be used, the frequency should be adjusted after the final amplifier has been tuned. In this case, a receiver may be used to obtain an approximate setting of the master oscillator.

(e) Remove PLATE voltage and carefully tighten the friction type lock nut so that vibration will not disturb the adjustment of the master oscillator unit.

(f) Check the frequency after restoring PLATE power.

(10) Remove PLATE voltage and set SELECTOR to the TUNE BUFFER position.

(Note: *Always* remove plate voltage before changing the position of the SELECTOR or CHANNEL dials. This will prevent burning switch contacts.)

(11) Again apply PLATE voltage and, after setting the EXCITATION dial at about 50, adjust the TUNING dial for maximum GRID CURRENT. The curves on page 25 may be used as a guide for setting the TUNING dial. Note: If either coil #5 or #6 is used, it may be necessary to set the EXCITATION dial at some other point than 50 to get any appreciable grid current when the TUNING dial is adjusted.

(12) Now adjust the EXCITATION dial to give approximately 7 ma of GRID CURRENT and readjust the TUNING dial for maximum GRID CURRENT. Note: If coil #5 or #6 is used, adjust both dials for maximum GRID CURRENT.

(13) Remove PLATE power and set SELECTOR switch to the TUNE FINAL position.

(14) Reapply PLATE power and if coil #1, 2, 3, or 4 is used, readjust the GRID CURRENT to approximately 7 ma by means of the EXCITATION DIAL, peaking it with the TUNING dial.

(15) Set the ANTENNA TUNING capacitor at maximum capacity and adjust the FINAL AMP. TUNING capacitor for minimum FINAL PLATE current.

(16) If the FINAL PLATE current is less than 140-150 ma, decrease the number of turns on the tank coil. CAUTION: *Always remove PLATE power before making any adjustments inside equipment.* Add turns if the FINAL PLATE current is above 140-150 ma. Retune FINAL AMP. TUNING capacitor for minimum FINAL PLATE current.

(17) Remove PLATE power, set the SELECTOR to the CW operating position and restore PLATE power.

(18) Adjust the ANTENNA TUNING capacitor to bring the FINAL PLATE current up to 300 ma and retune the FINAL AMP. TUNING capacitor for minimum FINAL PLATE current. If the tubes cannot be loaded to 300 ma, decrease the number of turns on the tank coil slightly.

(19) Repeat step (18) if necessary until the tubes are loaded to 300 ma with the FINAL AMP. TUNING capacitor tuned for minimum FINAL PLATE current.

(20) After the transmitter has been properly adjusted, the settings of the 7000C-5 coil should be checked against the curves on page 25 so as to avoid the possibility of being on the wrong harmonic of the oscillator. It may be found that the coil selected will tune equally well on either the third or fourth harmonic of the oscillator frequency, therefore care must be used to obtain the desired output frequency.

(21) Remove the PLATE voltage.

b. Audio Adjustments.—After the transmitter has been properly tuned on a given channel, the audio adjustments may be completed. The following procedure is recommended:

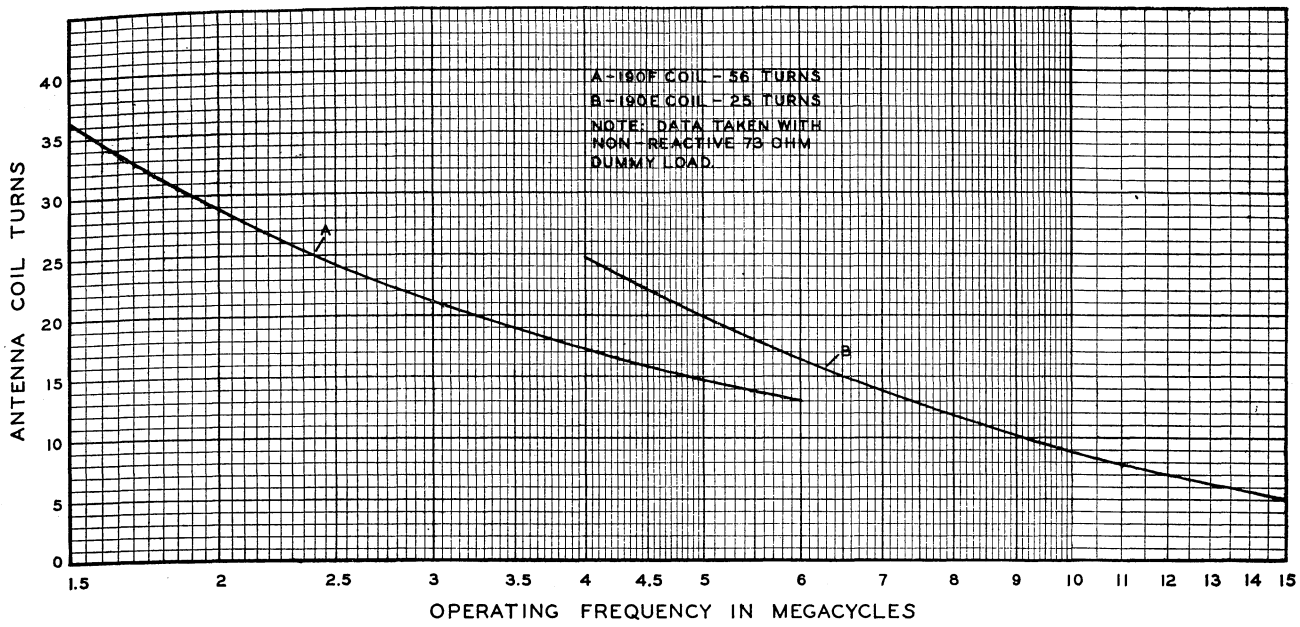
(1) Plug the microphone into the MICROPHONE receptacle provided on the front panel. Be sure to tighten the locking ring well, since a poor contact may cause r-f feedback in the audio system.

(2) Place the SELECTOR in the PHONE position.

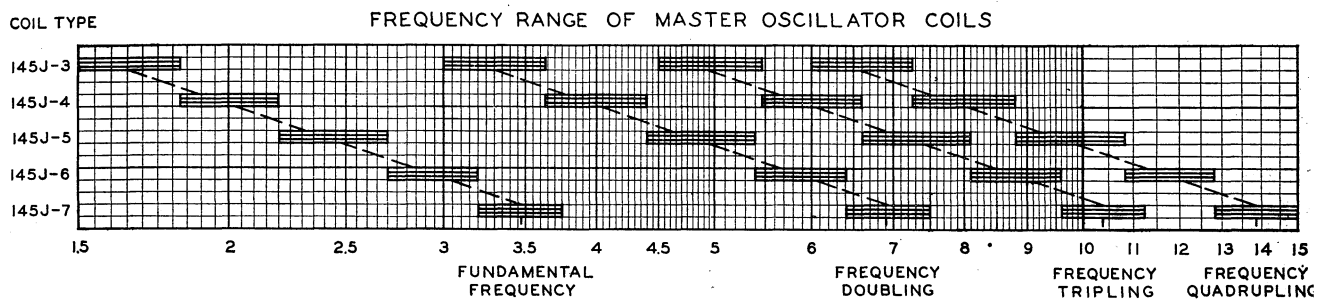
(3) Place the switch on the front end of the 9Z Modulator Unit in the MOD. position. When the switch is in this position, the MODULATION meter will read to the red line at 400 volts when the transmitter is modulated 100% with a pure tone. (The adjusting potentiometer for this meter, located beneath the chassis, has been adjusted at the factory and will not require attention in the field.)

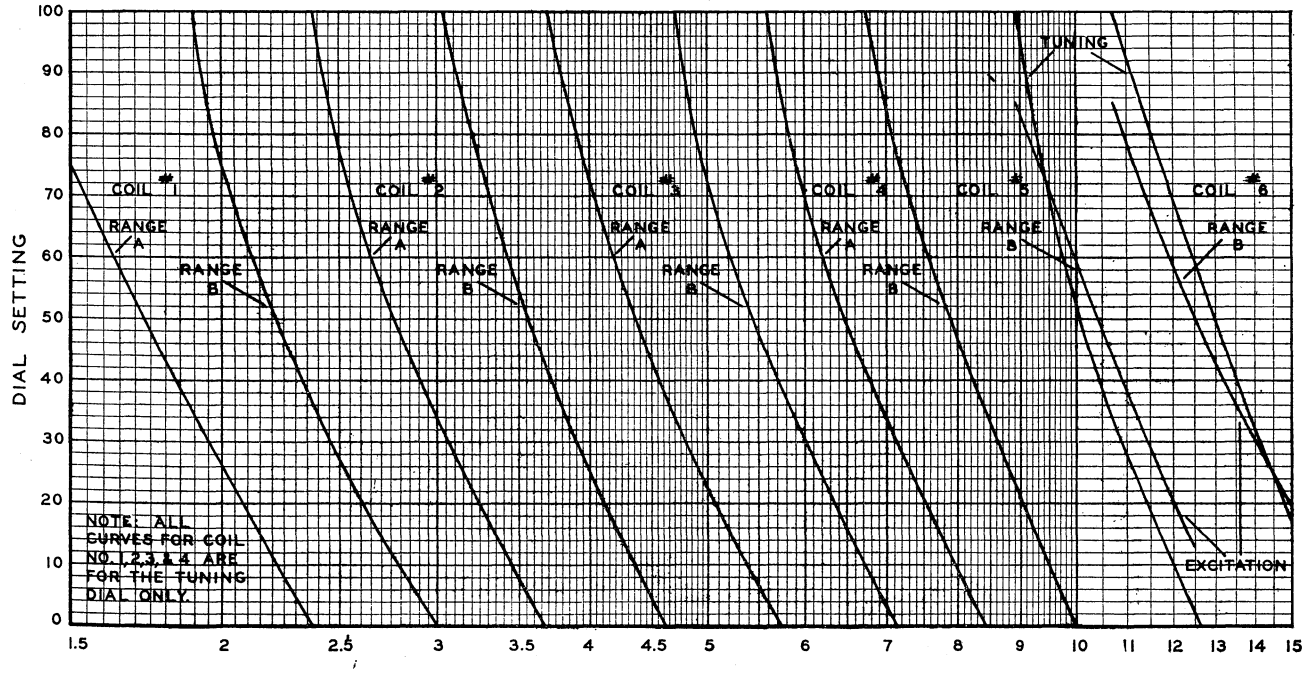
(4) Turn on the plate voltage by pressing the push-to-talk button on the microphone. The FINAL PLATE meter should read approximately 225 ma which is the normal reading for phone operation.

(5) While talking in a normal tone of voice, advance the AUDIO GAIN control, located on the front of the 9Z Modulator Unit, in a clockwise direction until the MODULATION meter reads approximately 250 volts on peaks. This



ANTENNA COIL TUNING CHART





EXCITER TUNING CHART

reading represents the 100% modulation level for voice input. It would be well to check the modulation by means of a cathode-ray oscilloscope.

The audio adjustments are now complete and will not require further attention when operating on other channels. Always be sure that the FINAL PLATE current is approximately 225 ma when operating on phone.

c. Routine Operation.—After the transmitter has been properly tuned on all frequencies, changing from one channel to another will merely involve the rotation of the CHANNEL selector dial to the desired channel. Do not forget to remove PLATE power before changing channels.

To shift from phone to CW, remove the PLATE power while changing the SELECTOR dial from the PHONE to the CW position.

IV CIRCUIT DESCRIPTION

20. **CONTROL CIRCUITS.** — The transmitter power circuits are controlled from the front panel by means of two switches. When both switches are in the OFF position, all power circuits are open. When the FILAMENT switch is ON, power for heating all filaments is supplied. When the PLATE switch is in the ON position, the transformers supplying the plate and bias voltages are energized. The switches are interlocked so that the high voltage cannot be turned on unless the FILAMENT switch is in the ON position. A push-to-talk button associated with the microphone may be used to turn on the plate power of the transmitter instead of the PLATE switch when transmissions of short duration are contemplated. When this is desired, it is necessary to place the PLATE power switch in the OFF position. The SELECTOR switch provides for application of plate power to successive r-f stages as well as the selection of the proper circuits for Phone or CW emission. Provision is made for application of the plate voltage to the final amplifier through a dropping resistor to facilitate tuning.

21. **KEYING CIRCUIT.**—Keying is accomplished in the 32RA Transmitter by interruption of the cathode circuit of the buffer and final amplifier tubes.

22. **CHANNEL SELECTOR SYSTEM.** — Four frequency channels are available in the 32RA Transmitter. The tuning elements on each channel are made up of individual, pre-tuned tank circuits. These elements are of the plug-in type and may be readily changed. Channel selection is obtained by means of the CHANNEL switch, which selects the required group of tuned elements for the frequency desired.

23. **POWER SUPPLIES.**—Two plate power supply systems are employed in this equipment. One supply employs a Type 80 rectifier tube in a full wave circuit with a capacitor input filter. This supply has a total output voltage of approximately 470 volts, and furnishes 380 volts to the r-f oscillator, buffer/doubler and speech amplifier stages. It also supplies 90 volts bias to the final amplifier grids.

The main plate power supply employs two 866A rectifier tubes in a full-wave circuit with a two section choke input filter. This supply furnishes 540 volts to the final amplifier in CW operation, and supplies 450 volts to the final amplifier and modulator in phone operation. The plate transformer is provided with a tapped primary for reducing the output voltage for phone operation.

The rectifier tubes of the two power supplies are supplied with filament power from the same transformer that energizes the r-f and audio tube filaments. The plate transformer for each supply is individually fused.

24. **AUDIO SYSTEM.**—A two-stage speech amplifier-modulator unit is employed in the 32RA transmitter. The input consists of a single 6C5 tube and microphone transformer designed to be used with a single button carbon microphone. This stage drives the Class AB modulator stage. The modulator stage consists of four 6L6G tubes operating in a push-pull-parallel circuit. The modulator stage modulates the Class C r-f amplifier directly.

Microphone current for the single button carbon microphone is obtained from bridging resistors in the cathode circuit of the modulator stage. An audio gain control adjusts the input level to the 6C5 tube grid circuit. This stage is transformer coupled to the modulators. The bias for each stage is obtained from a cathode resistor. A push-to-talk button associated with the microphone operates a relay in the power supply which turns on the plate power of the transmitter for push-to-talk operation.

25. **RADIO FREQUENCY SECTION.**—

a. Oscillator.—The 32RA Transmitter employs a beam power type oscillator tube which is controlled by a low temperature coefficient quartz crystal or a master oscillator coil unit, providing an oscillator having high frequency stability. The oscillator is designed so that power output may be obtained on its harmonic frequencies as well as its fundamental frequency. The control grid and the screen grid of the tube together with the cathode consitute the primary oscillator circuit which is allowed to oscillate at all times voltage is applied to the

screen grid. The primary oscillator circuit is coupled to the plate circuit by means of the electron stream. This circuit feature performs an isolation function, thus providing further stabilization of the oscillator frequency.

b. Buffer Amplifier.—This stage employs a 6L6G beam power tube and is operated either as an intermediate amplifier or as a frequency doubler. The grid circuit is capacitively coupled to the plate circuit of the oscillator tube and employs a combination of cathode resistor and grid leak bias. Cathode bias prevents excessive plate current should the excitation fail. Approximately 380 volts is applied to the plate of the tube. Screen potential is obtained by means of a dropping resistor in series with the plate voltage.

c. Final Amplifier.—The final radio frequency amplifier employs three type 807 tubes operating in a parallel circuit. These tubes are operated as plate molulated Class C amplifiers. A fixed grid bias of approximately 90 volts is employed. Approximately 450 or 540 volts d.c., depending on the type of emission, is applied to the plates of the tubes. Screen potential is obtained by means of a resistor in series with the plate voltage.

d. Radio Frequency Output Circuit. — The output circuit consists of a pi network capable of operating into an unbalanced antenna or transmission line. Use of this type of output network greatly simplifies the tuning procedure. As this network is a low pass filter, harmonic attenuation is attained. The elements of the pi network are of such values that a large range of impedances may be matched. The output coils are provided with a coil tapping device which permits the choice of the number of turns at will. The input capacitor of the network is provided with a pair of jacks so that a bridging capacitor may be installed for operation on the lower frequencies when the range of capacitance of the variable plate tuning capacitor proves insufficient.

V MAINTENANCE

This radio equipment is constructed of materials considered to be the best obtainable for the purpose, and has been carefully inspected and adjusted using accurate test equipment. No one but an authorized and competent service man equipped with proper test facilities should be permitted to service this equipment.

26. **ROUTINE INSPECTION.**—Routine inspection schedules should be set up for periodic checks of this equipment. This inspection should include examination of the mechanical system for excessive wear or binding and of the electrical system for electrical defects. Make a check of emission characteristics of all tubes. After the emission check, examine the prongs on all tubes to make sure that they are free from corrosion. See that all tubes are replaced correctly and fully in their sockets, and that good electrical contact is made between the prongs of the tube and the socket. Check the relay for proper operation and inspect the relay contacts to make certain that the contact surfaces are clean and free from pits and projections. Make certain that contacts of all receptacles and plugs such as microphone, key and cable connectors are clean and that these make firm mechanical connection between one another.

If the routine inspection of the equipment is carried out faithfully, the chances of improper operation of the equipment are greatly minimized. It is, therefore, important that this inspection be made frequently. It should be sufficiently thorough to include all major electrical circuits of the equipment as well as the mechanical portion.

27. **CLEANING.**—The greatest enemy to uninterrupted service in equipment of this type is corrosion and dirt. Corrosion itself is accelerated by the presence of dust and moisture on the component parts of the assembly. It is impossible to keep moisture out of the equipment in certain localities, but foreign particles and dust can be periodically removed by means of a soft brush and a dry, oil-free jet of air. Remove the dust as often as a perceptible quantity accumulates in any part of the equipment. It is very important that rotating equipment such as variable condensers and tap switches be kept free from dust to prevent undue wear. Likewise, variable condenser plates should be kept free from dirt to avoid flashover on modulation peaks.

28. **RELAYS.**—In general the contact adjustment of the a-c type relay is not critical. Spare contacts and spare coils can be obtained and replacement made when necessary. Never use an abrasive on the contact surfaces. Relays which have excessive hum are usually not seating properly. Dirt on the pole faces is the most likely cause of this and may be removed by washing with gasoline.

29. **FUSES.** — This equipment requires three plug type fuses. Fuses which have failed should be replaced with spares only after the circuit in question has been carefully examined to make certain that no permanent fault exists. Be sure each replacement fuse has the proper rating as is engraved next to the socket in which it is to be placed.

30. **CRYSTALS.**—The low frequency-temperature coefficient quartz crystals as supplied in Collins Transmitters are extremely active and rugged. They should require little or no attention over long periods of time. The type 1 series crystal holders are sealed against moisture and dirt and should not be opened unless all tests of the oscillator circuit point to erratic condition in the crystal.

If required, the crystal and electrodes may be cleaned with carbon tetrachloride and a soft cloth. After reassembling the holder and before resealing with duco cement in the case of type 1 series holder, the holder with crystal in position should be heated to drive out any excess moisture. The temperature in the heating process should not exceed 60 degrees C.

It is recommended that crystals should not be examined unless a fault develops, since frequent cleaning and handling will in time change the frequency.

31. **REMOVAL OF UNITS.**—In order to remove the power, r-f or modulator units from the equipment, the front panel must be re-

moved. The power and modulator units cannot be removed until after the r-f unit has been removed. Care should be used to avoid damaging the wiring or component parts on the units.

The following procedure is recommended for disassembling the transmitter:

(1) Set the transmitter on its right side with the front panel forward.

(2) Carefully pull off the cable connector attached to each of the three units. Place the fingers on either side of the connector and work it back and forth gently until it pulls off. Caution: *Do not remove the connectors by pulling on the cable wires. This may cause the wires or connectors to break.*

(3) Using a #6 Bristo wrench, loosen the two set screws on the sleeve coupler of the CHANNEL switch. This coupler is located behind the detent mechanism.

(4) Remove the two screws on the ends of the row of meters and then remove the back plate behind the meters.

(5) Loosen the nuts on the ANTENNA CURRENT meter and remove the two lead wires.

(6) Remove the eight screws along the edges of the front panel and pull off the front panel assembly.

(7) Remove the three screws on the front edge and the two screws on the back edge of the r-f unit.

(8) Lift the front end of the r-f unit up and then pull the unit forward slightly to free the antenna bushings. Then lift the unit out the top of the cabinet being careful not to damage any of the switches, etc., beneath the chassis.

(9) The modulator and power units may now be removed as desired by removing the screws along the front and rear edges of the units. Note: To remove the screws in the rear corners of the cabinet (one on each of the modulator and power units) unscrew the rubber mounting feet and insert a slender screwdriver through the tapped holes to heads of the screws.

To reassemble the transmitter, simply reverse the foregoing procedure. Be sure to properly align the CHANNEL switch knob and shaft before tightening the set screws on the sleeve coupler.

32. **TROUBLE SHOOTING.**—A common cause of improper operation of radio equipment is tube failure. A complete set of tested spare tubes should be kept on hand at all times. If faulty operation of the transmitter is observed and tube failure suspected, each tube may be checked by replacing it with a like tube known to be in good condition. In case an open fuse is found, it is an indication of overload on some circuit in the transmitter. The overload may be caused by a short circuit. The short circuit may be due to a foreign article being dropped into the cabinet, a defective condenser, defective tubes or a high voltage arc. A direct short is most readily found by means of a continuity meter. The d-c resistance of the various circuits may be checked in order to locate the fault.

Defective tubes causing an overload in power circuits may usually be located by inspection. It will be found that excessive heating or sputtering within the vacuum tubes is a good indication of a fault in the tube circuit. High voltage arcs may be caused by bent condenser plates, corrosion or dust. It is well known that one of the greatest sources of trouble in equipment located in a salt atmosphere is corrosion. Corrosion resulting from salt spray or salt laden atmosphere may cause failure of the equipment for no apparent reason. In general, it will be found that contacts such as tap switches, tube prongs, cable plug connectors and relay contacts are most affected by corrosion. When it is necessary to operate the equipment in localities subject to such corrosive atmosphere, inspection of wiping contacts, cable plugs, relays, etc., should be made more frequently in order to keep the equipment in good condition.

The table of TYPICAL VOLTAGES, in the PERFORMANCE DATA section of the APPENDIX, is supplied to assist the operator in trouble shooting. Open and short circuits will usually be accompanied by a change in the voltages applied to one or more of the tubes. A check of the various tube voltages against the typical values shown in the table will assist in locating the source of trouble.

VI APPENDIX

APPENDIX

PERFORMANCE DATA

Typical Meter Readings

Meter	SELECTOR Position				
	CALI-BRATE	TUNE BUFFER	TUNE FINAL	CW	PHONE
EXCITATION PLATE—ma.	32	60	60	60	60
GRID CURRENT—ma.	0	7	7	8	8
FINAL PLATE—ma.	0	0	135	300	225
ANTENNA CURRENT*—amp.	0	0	0.4	1.2	0.85
MODULATION—VM pos.**	0	0	270	490	425
MODULATION—Mod pos.	0	0	0	0	0–250

* With 70 ohm resistive load.
** Actual voltage is approx. 10% higher than indicated.

Typical Voltages

Tube Type	Circuit Function	Filament	Cathode	Control Grid	Screen Grid	Plate
6L6G	Oscillator	6.3	26	—12 to — 24	180	260
6L6G	Buffer/Doubler	6.3	35	—41 to —165	225	380
3—807's	Final Amplifier					
	(Phone Operation)	6.3	0	—90	260	450
	(CW Operation)	6.3	0	—90	315	540
6C5G	Speech Amplifier	6.3	8	0	---	215
4—6L6G	Modulator	6.3	25	0	310	450
2—866A H. V. Rectifier						
	(Phone Operation)	2.5	d-c output 450 v.			
	(CW Operation)	2.5	d-c output 540 v.			
80	L. V. & Bias Rectifier	5.0	d-c output 470 v. (total)			

APPENDIX

Typical Audio Frequency Data

FREQUENCY RESPONSE

The following data was taken with an input level of —19 db to the preamplifier at 75% modulation at a frequency of 1000 cps.

Frequency	DB	Frequency	DB
200	—6.5	2000	+0.2
400	—2.2	3000	—0.2
700	—0.4	5000	—2
1000	0	7000	—3.6
1500	+0.2		

AUDIO INPUT LEVEL REQUIREMENT

Audio level required for 100% modulation is —19 db.

AUDIO FREQUENCY DISTORTION

The a-f distortion at 75% modulation is 1.5% rms.

NOISE LEVEL

The noise level on the carrier below 100% modulation is —60 db.

CARRIER SHIFT

The carrier shift at 100% modulation is —1.5%.

Tuning Data

The table below may be filled in after the tuning data for the four channels has been obtained.

	CHANNEL			
	1	2	3	4
Operating Frequency—kc.	_____	_____	_____	_____
Crystal or M.O. Freq.—kc.	_____	_____	_____	_____
EXCITER dial setting	_____	_____	_____	_____
TUNING dial setting	_____	_____	_____	_____
Antenna coil-turns	_____	_____	_____	_____

PARTS LIST

33K-9 R-F Unit

CAPACITORS

Item	Circuit Function	Specification	Collins Part No.	Mfr. Code	Mfr's. Type	Notes
C1A	Capacitor, Channel #1 M. O. Tank	.001 mf ±1% 1000 TV	912N210D	75C	1R	
C2A	Capacitor, Channel #1 M. O. Tank	.002 mf ±1% 1000 TV	912N220D	75C	1R	
C3A	Capacitor, Channel #2 M. O. Tank	Same as C1A				
C4A	Capacitor, Channel #2 M. O. Tank	Same as C2A				
C5A	Capacitor, Channel #3 M. O. Tank	Same as C1A				
C6A	Capacitor, Channel #3 M. O. Tank	Same as C2A				
C7A	Capacitor, Channel #4 M. O. Tank	Same as C1A				
C8A	Capacitor, Channel #4 M. O. Tank	Same as C2A				
C9A	Capacitor, Osc. Grid Leak Bypass	.008 mf ±20% 600 TV	909N280C	02S	C	
				75C	1W	
C10A	Capacitor, Oscillator Grid	.000025 mf ±10% 900 TV	909N425C	02S	D	
				64S	MT	
C11A	Capacitor, Oscillator Cathode Bypass	.00025 mf ±10% 900 TV	909N325C	02S	D	
				64S	MT	
C12A	Capacitor, Osc. Screen Bypass	.006 mf ±10% 1000 TV	910N260E	02S	BE-10	
C13A	Capacitor, Osc. Plate Supply Bypass	.006 mf ±10% 1000 TV	910N260A	75C	9L	
				02S	A-10	
				64S	XM	
C14A	Capacitor, Osc. Plate Coupling	.0005 mf ±10% 900 TV	909N350C	75C	1W	
				02S	C	
				64S	MW	
C15A	Capacitor, Doubler Cathode Bypass	Same as C13A				
C16A	Capacitor, Doubler Screen Bypass	Same as C13A				
C17A	Capacitor, Doubler Plate Coupling	.0005 mf ±10% 1000 TV	910N350A	75C	9L	
				02S	A2-10	
				64S	XM	
C18A	Capacitor, P. A. Grid Coupling	Same as C9A				
C19A	Capacitor, P. A. Cathode Bypass	.006 mf ±10% 1500 TV	915N260E	02S	BE-15	
C20A	Capacitor, P. A. Screen Bypass	.002 mf ±10% 1500 TV	915N220E	02S	BE-15	
C21A	Capacitor, P. A. Plate Coupling	.002 mf ±10% 1500 TV	950N220A	02S	BE-15	

PARTS LIST

CAPACITORS (Cont.)

Item	Circuit Function	Specification	Collins Part No.	Mfr. Code	Mfr's. Type	Notes
C22A	Capacitor, P. A. Screen Bypass	Same as C20A				
C23A	Capacitor, Ch. #1 Antenna Tuning	420 mmf Variable	920N98A	77J	H	
C24A	Capacitor, Ch. #1 Plate Tuning	250 mmf Variable	920N97A	77J	F	
C25A	Capacitor, Ch. #2 Antenna Tuning	Same as C23A				
C26A	Capacitor, Ch. #2 Plate Tuning	Same as C24A				
C27A	Capacitor, Ch. #3 Antenna Tuning	Same as C23A				
C28A	Capacitor, Ch. #3 Plate Tuning	Same as C24A				
C29A	Capacitor, Ch. #4 Antenna Tuning	Same as C23A				
C30A	Capacitor, Ch. #4 Plate Tuning	Same as C24A				

MISCELLANEOUS ELECTRICAL PARTS

E1A	Thermocouple, Antenna Ammeter	0-3 amp a-c	457N97	80T		
E2A	Suppressor, P. A. Plate Parasitic	Special h-f suppressor	GC-1064A	64C	GC-1064A	
E3A	Suppressor, P. A. Plate Parasitic	Same as E2A				
E4A	Suppressor, P. A. Plate Parasitic	Same as E2A				

PLUG RECEPTACLES

J1A	Plug, 33K R-F Unit Connector	16 Contact Plug Recept.	367N816R	91J	S-1416	

INDUCTORS

L1A	Choke, Osc. Cathode R-F	2.5 mh 0.125 amp 50 ohm	240N53	05N		
L2A	Choke, Osc. Plate R-F	Special Choke Coil	GA-543A	64C	GA-543A	
L3A	Choke, Doubler Plate R-F	Same as L1A				
L4A	Coil, Ch. #1 Exciter Tank	Range to be specified	7000C-5	64C	7000C-5	
L5A	Coil, Ch. #2 Exciter Tank	Same as L4A				
L6A	Coil, Ch. #3 Exciter Tank	Same as L4A				
L7A	Coil, Ch. #4 Exciter Tank	Same as L4A				
L8A	Choke, P. A. Grid R-F	2.5 mh 0.125 amp 50 ohm	240N2	05N		
L9A	Choke, P. A. Plate R-F	2.5 mh 0.5 amp 8.0 ohm	240N25	05H		
L10A	Choke, Antenna Static Drain	1.0 mh 0.6 amp 6.0 ohm	240N26	82C		

INDUCTORS (Cont.)

Item	Circuit Function	Specification	Collins Part No.	Mfr. Code	Mfr's. Type	Notes
L11A	Coil, Ch. #1 P. A. Plate Tank	Single-layer, plug-in type. Specify range	190E-1 or 190F-1	64C	190E-1 190F-1	
L12A	Coil, Ch. #2 P. A. Plate Tank	Same as L11A				
L13A	Coil, Ch. #3 P. A. Plate Tank	Same as L11A				
L14A	Coil, Ch. #4 P. A. Plate Tank	Same as L11A				

RESISTORS

R1A	Resistor, Osc. Grid Leak	10,000 ohm ±10% 1 w	704N10M	28J	BT1	
R2A	Resistor, Osc. Grid	50,000 ohm ±10% 1 w	704N50M	28J	BT1	
R3A	Resistor, Osc. Screen Supply	50,000 ohm ±10% 2 w	706N50M	28J	BT2	
R4A	Resistor, Osc. Plate Supply	5000 ohm ±10% 10 w	710NA5M	25P	Brown Devil	
R5A	Resistor, Doubler Grid	100,000 ohm ±10% 2 w	706N100M	28J	BT2	
R6A	Resistor, Doubler Cathode	1000 ohm ±10% 10 w	710NA1M	25P	Brown Devil	
R7A	Resistor, Doubler Screen Supply	Same as R5A				
R8A	Resistor, Osc. Cathode	1000 ohm ±10% 2 w	706N1M	28J	BT2	
R9A	Resistor, P. A. Grid	27 ohm ±10% ½ w	701N27	22A	EB	
R10A	Resistor, P. A. Grid	Same as R9A				
R11A	Resistor, P. A. Grid	Same as R9A				
R12A	Resistor, P. A. Screen Supply	10,000 ohm ±10% 25 w	710NC10M	25P		

SWITCHES

S1A	See S1A1, S1A2, S1A3, S1A4, S1A5, S1A6, S1A7, S1A8	Special 8 pole, 4 position, tap switch				
S1A1	Switch, M.O.—Crystal Selector	1 pole, 11 pos, 1 sec. shorting	269N8	05P	"H"	
S1A2	Switch, M. O.—Crystal Selector	Same as S1A1				
S1A3	Switch, Exciter Tank Coil Selector	Same as S1A1				
S1A4	Switch, Exciter Tank Coil Selector	Same as S1A1				
S1A5	Switch, Exciter Tank Coil Selector	Same as S1A1				

PARTS LIST

SWITCHES (Cont.)

Item	Circuit Function	Specification	Collins Part No.	Mfr. Code	Mfr's. Type	Notes
S1A6	Switch, P. A. Tank Coil Selector	1 pole, 4 pos., shorting ceramic tap switch	269N26	05P	"H"	
S1A7	Switch, P. A. Tank Coil Selector	Same as S1A6				
S1A8	Switch, Antenna Selector	Same as S1A6				

VACUUM TUBES

V1A	Tube, R-F Oscillator	Beam Power Amplifier	6L6G			
V2A	Tube, Buffer-Amplifier	Same as V1A				
V3A	Tube, Power Amplifier	Beam Power Amplifier	807			
V4A	Tube, Power Amplifier	Same as V3A				
V5A	Tube, Power Amplifier	Same as V3A				

SOCKETS

X1A	Socket, R-F Oscillator Tube	8 prong bakelite	220N181	60A		
X2A	Socket, Buffer-Amplifier Tube	Same as X1A				
X3A	Socket, Power Amp. Tube	Five prong chassis mtg.	220N151	60A	S-5	
X4A	Socket, Power Amp. Tube	Same as X3A				
X5A	Socket, Power Amp. Tube	Same as X3A				
X6A	Socket, Ch. #1 M. O. & Crystal	Same as X3A				
X7A	Socket, Ch. #2 M. O. & Crystal	Same as X3A				
X8A	Socket, Ch. #3 M. O. & Crystal	Same as X3A				
X9A	Socket, Ch. #4 M. O. & Crystal	Same as X3A				
X10A	Socket, Ch. #1 Exciter Tank Coil	7 prong chassis mtg.	220N179	60A	S7L-1	
X11A	Socket, Ch. #2 Exciter Tank Coil	Same as X10A				
X12A	Socket, Ch. #3 Exciter Tank Coil	Same as X10A				
X13A	Socket, Ch. #4 Exciter Tank Coil	Same as X10A				

PARTS LIST

101L-7 Panel

JACKS AND RECEPTACLES

Item	Circuit Function	Specification	Collins Part No.	Mfr. Code	Mfr's. Type	Notes
J1B	Jack, Key	Closed Circuit Midget for ¼" diam.	360N106	05M	Midget	
J2B	Receptacle, Microphone	3 prong conn. chassis mounting	369N7	60A	PC3F	

METERS

M1B	Milliammeter, Exciter Plate	0-200 ma. d. c.	450NF200	80T	227	
M2B	Milliammeter, Final Plate	0-500 ma d. c.	450NF500	80T	227	
M3B	Milliammeter, Final Grid	0-25 ma d. c.	450NF25	80T	227	
M4B	Voltmeter, H. V. Plate and Modulation	0-500 v d. c.	458N021F	80T		
M5B	Ammeter, Antenna	0-3 amp r. f., external thermocouple	457N98	80T		

PLUGS

P1B	Socket, R-F Unit Connector	16 Prong Connector Plug	367N816P	91J	P-1416	
P2B	Socket, Power Supply Connector	Same as P1B				
P3B	Socket, Modulator Connector	Same as P1B				

RESISTORS

R1B	Resistor, Keying	10,000 ohm ±10% 10 w	710NA10M	25P	Brown Devil	
R2B	Resistor, P. A. Tuning	2000 ohm ±10% 25 w	710NC2M	25P	0207	

SWITCHES

S1B	Switch, Plate Power	15 amp 125 v DPST Toggle	260N101	84A	80302	
S2B	Switch, Filament Power	Same as S1B				

SWITCHES (Cont.)

Item	Circuit Function	Specification	Collins Part No.	Mfr. Code	Mfr's. Type	Notes
S3B	See S3B1, S3B2, S3B3, S3B4, S3B5, S3B6	6 circuit non-shorting 5 pos. adjustable stop	259N143	25C 05P		
S3B1	Switch, H. V. Plate Trans.	Part of S3B				
S3B2	Switch, Exc. Plate Meter	Part of S3B				
S3B3	Switch, Mod. Pl. Voltage	Part of S3B				
S3B4	Switch, P. A. Tuning	Part of S3B				
S3B5	Switch, Mod. Trans. Shtg.	Part of S3B				
S3B6	Switch, Mod. Screen	Part of S3B				

PARTS LIST

411B-4 Power Supply

CAPACITORS

Item	Circuit Function	Specification	Collins Part No.	Mfr. Code	Mfr's. Type	Notes
C1C	Capacitor, H. V. Supply Filter	10 mf ±10% 600 WV	930N11	75C	KG	
C2C	Capacitor, H. V. Supply Filter	Same as C1C				
C3C	Capacitor, L. V. & Bias Supply Filter	4 mf ±10% 600 WV	930N62A-M	64S		
C4C	Capacitor, L. V. & Bias Supply Filter	Same as C3C				
C5C	Capacitor, P. A. Grid Bias Filter	2 mf ±10% 700 WV	930N61A-M	64S		

FUSES

F1C	Fuse, Power Line	10 amp plug type	264N110	40E	Plug	
F2C	Fuse, H. V. Plate Trans.	6 amp plug type	264N106	40E	Plug	
F3C	Fuse, L. V. & Bias Trans.	3 amp plug type	264N103	40E	Plug	

JACKS AND RECEPTACLES

J1C	Socket, Power Line Fuse	660 v 2⅜" x 1⅝" single mounting	265N101	90B	4063	
J2C	Socket, H. V. Plate Trans. Fuse	Same as J1C				
J3C	Socket, L. V. & Bias Trans. Fuse	Same as J1C				
J4C	Power Supply Unit Connector Plug	Same as J1A				

RELAYS

K1C	Relay, Push-to-Talk	6 v a-c coil N. O. cont.	410N15	85G	Series 40	

INDUCTORS

L1C	Reactor, H. V. Supply Filter	4 hy 400 ma	668S75B	55C	8A-40	
L2C	Reactor, H. V. Supply Filter	Same as L1C				
L3C	Reactor, L. V. & Bias Supply Filter	10 hy 200 ma	668S453A	55C	8A-31	

PARTS LIST

PLUGS

Item	Circuit Function	Specification	Collins Part No.	Mfr. Code	Mfr's. Type	Notes
P1C	Plug, Power Line	A. C. Flush Mtg. Plug	368N1	80H		

RESISTORS

R1C	Resistor, H. V. Supply Bleeder	50,000 ohm ±10% 50 w	710ND50M	25P		
R2C	Resistor, L. V. & Bias Supply Bleeder	3,000 ohm ±10% 25 w	710NC3M	25P		
R3C	Resistor, L. V. & Bias Supply Bleeder	25,000 ohm ±10% 25 w	710NC25M	25P		
R4C	Resistor, L. V. & Bias Supply Bleeder	1000 ohm ±10% 25 w	710NC1M	25P		

TRANSFORMERS

T1C	Transformer, H. V. Supply Plate	Pri: 110, 115, 120, 125, 130 v 50/60 cps 350 VA Sec: 675/675 v 0.353 amp 480 VA	662S726	55C		
T2C	Transformer, Filament	Pri: 110 v 50/60 cps Sec: 5 v CT 3 amp, 5 v CT 6.0 amp, 2.5 v CT 2.0 amp, 6.3 v CT 10 amp	662S446	55C	2BE-5075	
T3C	Transformer, L. V. & Bias Supply Plate	Pri: 110 v 50/60 cps Sec: 400/400 v 0.27 amp	662S463	55C	2A2-50	

VACUUM TUBES

V1C	Tube, H. V. Supply Rect.	Half-wave Mercury vapor Rectifier	866A			
V2C	Tube, H. V. Supply Rect.	Same as V1C				
V3C	Tube, L. V. & Bias Supply Rectifier	Full-wave High Vacuum Rectifier	80			

SOCKETS

X1C	Socket, H. V. Supply Rect. Tube	4 prong bakelite	220N141	60A		
X2C	Socket, H. V. Supply Rect. Tube	Same as X1C				
X3C	Socket, L. V. & Bias Supply Rect.	Same as X1C				

PARTS LIST

9Z-8 Modulator

CAPACITORS

Item	Circuit Function	Specification	Collins Part No.	Mfr. Code	Mfr's. Type	Notes
C1D	Capacitor, Mod. Meter Coupling	Same as C5C				
C2D	Capacitor, Modulator Cathode Bypass	20 mf 100 WV	183N5	75C	CCA-AY	
C3D	Capacitor, Microphone Supply Filter	Same as C3C				
C4D	Capacitor, Modulator Screen Bypass	Same as C3C				
C5D	Capacitor, Audio Amp. Plate Decoupling	Same as C3C				

MISCELLANEOUS ELECTRICAL PARTS

E1D	Rectifier, Modulation Meter	Copper-Oxide, Bridge Type Rectifier	353N3	67C	M-2	

JACKS AND RECEPTACLES

J1D	Modulator Unit Connector Plug Receptacle	Same as J1A				

RESISTORS

R1D	Resistor, H. V. Plate Voltmeter Multiplier	500,000 ohm ±10% 1 w	704N500M	28J	BT1	
R2D	Resistor, Mod. Indicator Control	10,000 ohm W. W. Pot.	377N225A	05M	M	
R3D	Resistor, Mod. Indicator	15,000 ohm ±10% 1 w	704N15M	28J	BT1	
R4D	Resistor, Mod. Grid	250 ohm ±10% ½ w	707N250	28J	BW–½	
R5D	Resistor, Mod. Plate	10 ohm ±10% 1 w	703N10	22A	GB	
R6D	Resistor, Mod. Plate	Same as R5D				
R7D	Resistor,	Same as R4D				
R8D	Resistor,	Same as R4D				
R9D	Resistor,	Same as R5D				
R10D	Resistor,	Same as R5D				
R11D	Resistor,	Same as R4D				
R12D	Resistor,	100 ohm ±10% 10 w	710NA100	25P	Brown Devil	

PARTS LIST

RESISTORS (Cont.)

Item	Circuit Function	Specification	Collins Part No.	Mfr. Code	Mfr's. Type	Notes
R13D	Resistor,	50 ohm ±10% 10 w	710NA50	25P	Brown Devil	
R14D	Resistor,	20,000 ohm ±10% 1 w	704N20M	28J	BT1	
R15D	Resistor,	Same as R3A				
R16D	Resistor, Audio Amp. Cathode	2500 ohm ±10% 2 w	706N2500	28J	BT2	
R17D	Resistor, Microphone Current Balancing	Same as R13D				

TRANSFORMERS

T1D	Transformer, Modulation	Pri: 4100 ohm CT 30-8000 cps Sec: 11 & 12: 1880 ohm Sec: 11 to 13: 2200 ohm 2400 v test, 50 w	667S355A	55C		
T2D	Transformer, Audio Interstage	Pri: 20,000 ohm CT 30-10,000 cps Sec: 80,000 ohm CT	667S228H	55C		
T3D	Transformer, Microphone	17, 50, 125, 200, 250, 333, 500 ohm to 80,000 (split) 30-10,000 cps	667S210L	55C		

VACUUM TUBES

V1D	Tube, Modulator	Same as V1A				
V2D	Tube, Modulator	Same as V1A				
V3D	Tube, Modulator	Same as V1A				
V4D	Tube, Modulator	Same as V1A				
V5D	Tube, Audio Amplifier	Voltage Amplifier Triode	6C5 or 6C5G			

SOCKETS

X1D	Socket, Modulator Tube	Same as X1A				
X2D	Socket, Modulator Tube	Same as X1A				
X3D	Socket, Modulator Tube	Same as X1A				
X4D	Socket, Modulator Tube	Same as X1A				
X5D	Socket, Audio Amp. Tube	Same as X1A				

PARTS LIST

69H-1 Handset

Item	Circuit Function	Specification	Collins Part No.	Mfr. Code	Mfr's. Type	Notes
	Microphone Handset	Carbon Button Telephone Handset with push button in handle	977N18	82G	F-3AW-3	
	Microphone Plug	3 prong male cable connector. No positioning detent	369N6	60A	MC3M	
	Microphone Cable	5′ 3-conductor shielded rubber covered	425N031	24B	No. 8423	

65P-1 Telegraph Key Cord

	Telegraph Key Cable	Super-service cord rubber covered No. 18 A. W. G.	424N021	24B	"SJ" CAT. TUFFY 18	
	Telegraph Key Plug	2 circuit phone plug 0.248″ Dia. sleeve	361N104	05M	CAT. No. 75	
	Key-Cord Insulation	Insulating sleeving Size No. 6 .166″ I. D. .016″ Wall thickness	152N764	20V	Varflex	
	Key-Cord Insulation	Insulating sleeving Size No. 2 .263″ I. D. .020″ Wall thickness	152N768	20V	Varflex	

65J-1 Power Cord

	Power Cord and Plug	6′ 2-conductor 5 amp. cord with moulded plug	426N1	24B	KG3270	
	Female connector Body for Power Cord	15 amp. 125 volt female 2 contact connector	368N2	80H	CAT. No. 6630	

274N7 Telegraph Key

	Telegraph Key	3/8″ dia. contacts	274N7	42S	R-64	

SPARE PARTS LIST

Quan.	All Symbol Designations Involved	Description	Collins Part No.	Mfr.	Mfr's. Type	Notes
2	C1A, C3A, C5A, C7A	.001 mf ±1% 1000 TV	912N210D	75C	1R	
2	C2A, C4A, C6A, C8A	.002 mf ±1% 1000 TV	912N220D	75C	1R	
1	C9A, C18A	.008 mf ±20% 600 TV	909N280C	02S	C	
				75C	1W	
1	C10A	.000025 mf ±10% 900 TV	909N425C	02S	D	
				64S	MT	
1	C11A	.00025 mf ±10% 900 TV	909N325C	02S	D	
				64S	MT	
1	C12A	.006 mf ±10% 1000 TV	910N260E	02S	BE-10	
2	C13A, C15A, C16A	.006 mf ±10% 1000 TV	910N260A	75C	9L	
				02S	A-10	
				64S	XM	
1	C17A	.0005 mf ±10% 1000 TV	910N350A	75C	9L	
				02S	A2-10	
				64S	XM	
1	C14A	.0005 mf ±10% 900 TV	909N350C	75C	1W	
				02S	C	
				64S	MW	
1	C19A	.006 mf ±10% 1500 TV	915N260E	02S	BE-15	
1	C20A, C22A	.002 mf ±10% 1500 TV	915N220E	02S	BE-15	
1	C21A	.002 mf ±10% 1500 TV	950N220A	02S	BE-15	
2	C1C, C2C	10 mf ±10% 600 WV	930N11	64C	KG	
2	C3C, C4C, C4D, C5D	4 mf ±10% 600 WV	930N62A-M	64S		
1	C5C, C1D	2 mf ±10% 600 WV	930N61A-M	64S		
1	C2D, C3D	20 mf 100 v	183N5	75C	CCA-AY	
2	E2A, E3A, E4A	47 ohm ±10% 1 w	703N47	22A	GB	
6	F1C	10 amp plug type	264N110	40E	Plug	
6	F2C	6 amp plug type	264N106	40E	Plug	
6	F3C	3 amp plug type	264N103	40E	Plug	
1	R1A	10,000 ohm ±10% 1 w	704N10M	28J	BT1	
1	R2A	50,000 ohm ±10% 1 w	704N50M	28J	BT1	
1	R3A, R15D	50,000 ohm ±10% 2 w	706N50M	28J	BT2	
1	R4A	5000 ohm ±10% 8 w	710NA5M	25P	Brown Devil	

SPARE PARTS LIST

Quan.	All Symbol Designations Involved	Description	Collins Part No.	Mfr.	Mfr's. Type	Notes
1	R5A, R7A	100,000 ohm ±10% 2 w	706N100M	28J	BT2	
1	R6A	1000 ohm ±10% 10 w	710NA1M	25P	Brown Devil	
1	R8A	1000 ohm ±10% 2 w	706N1M	28J	BT2	
2	R9A, R10A, R11A	27 ohm ±10% ½ w	701N27	22A	EB	
1	R12A	10,000 ohm ±10% 25 w	710NC10M	25P		
1	R1B	10,000 ohm ±10% 10 w	710NA10M	25P	Brown Devil	
1	R2B	2000 ohm ±10% 25 w	710NC2M	25P	0207	
1	R1C	50,000 ohm ±10% 50 w	710ND50M	25P		
1	R2C	3000 ohm ±10% 25 w	710NC3M	25P		
1	R3C	25,000 ohm ±10% 25 w	710NC25M	25P		
1	R4C	1000 ohm ±10% 25 w	710NC1M	25P		
1	R1D	500,000 ohm ±10% 1 w	704N500M	28J	BT1	
1	R2D	10,000 ohm WW Pot.	377N225A	05M	M	
1	R3D	15,000 ohm ±10% 1 w	704N15M	28J	BT1	
2	R4D, R7D, R8D, R11D	250 ohm ±10% ½ w	707N250	28J	BW½	
2	R5D, R6D, R9D, R10D	10 ohm ±10% 1 w	703N10	22A	GB	
1	R12D, R17D	100 ohm ±10% 10 w	710NA100	25P	Brown Devil	
1	R14D	20,000 ohm ±10% 1 w	704N20M	28J	BT1	
1	R16D	2500 ohm ±10% 2 w	706N2500	28J	BT2	

APPENDIX

LIST OF MANUFACTURERS

22A Allen-Bradley Company
118 W. Greenfield Avenue
Milwaukee, Wisconsin

60A American Phenolic Corp.
1250 W. Van Buren St.
Chicago, Illinois

84A Arrow-Hart & Hegeman Co.
103 Hawthorne Street
Hartford, Connecticut

90B Bryant Electric Company
Barnum Station
Bridgeport, Connecticut

55C Chicago Transformer Corp.
3501 West Addison
Chicago, Illinois

67C Conant Electrical Labs.
135 North 66th Street
Lincoln, Nebraska

75C Cornell-Dubilier Electric Corp.
1000 Hamilton Blvd.
South Plainfield, New Jersey

82C Coto-Coil Company
73 Willard Avenue
Providence, Rhode Island

40E Economy Fuse & Mfr. Co.
Greenview Ave. at Diversey Pky.
Chicago, Illinois

85G Guardian Electric Mfg. Co.
1620-27 West Walnut St.
Chicago, Illinois

05H Hammarlund Mfg. Co.
424 W. 33rd St.
New York, New York

80H Harvey Hubbell, Inc.
1930 Thomas Street
Bridgeport, Connecticut

28J International Resistance Co.
1100 Terminal Commerce Bldg.
Philadelphia, Pennsylvania

77J E. F. Johnson Company
Waseca, Minnesota

91J Howard B. Jones
2300 West Wabansia Ave.
Chicago, Illinois

05M P. R. Mallory & Company
1941 Thomas Street
Indianapolis, Indiana

05N National Company, Inc.
Malden, Massachusetts

05P Oak Manufacturing Co.
1260 Clybourne Avenue
Chicago, Illinois

25P Ohmite Manufacturing Co.
4837 W. Flourney Street
Chicago, Illinois

02S Sangamo Electric Co.
1935 Funk Street
Springfield, Illinois

64S Solar Manufacturing Corp.
Bayonne, New Jersey

80T Triplett Elec. Inst. Co.
Bluffton, Ohio

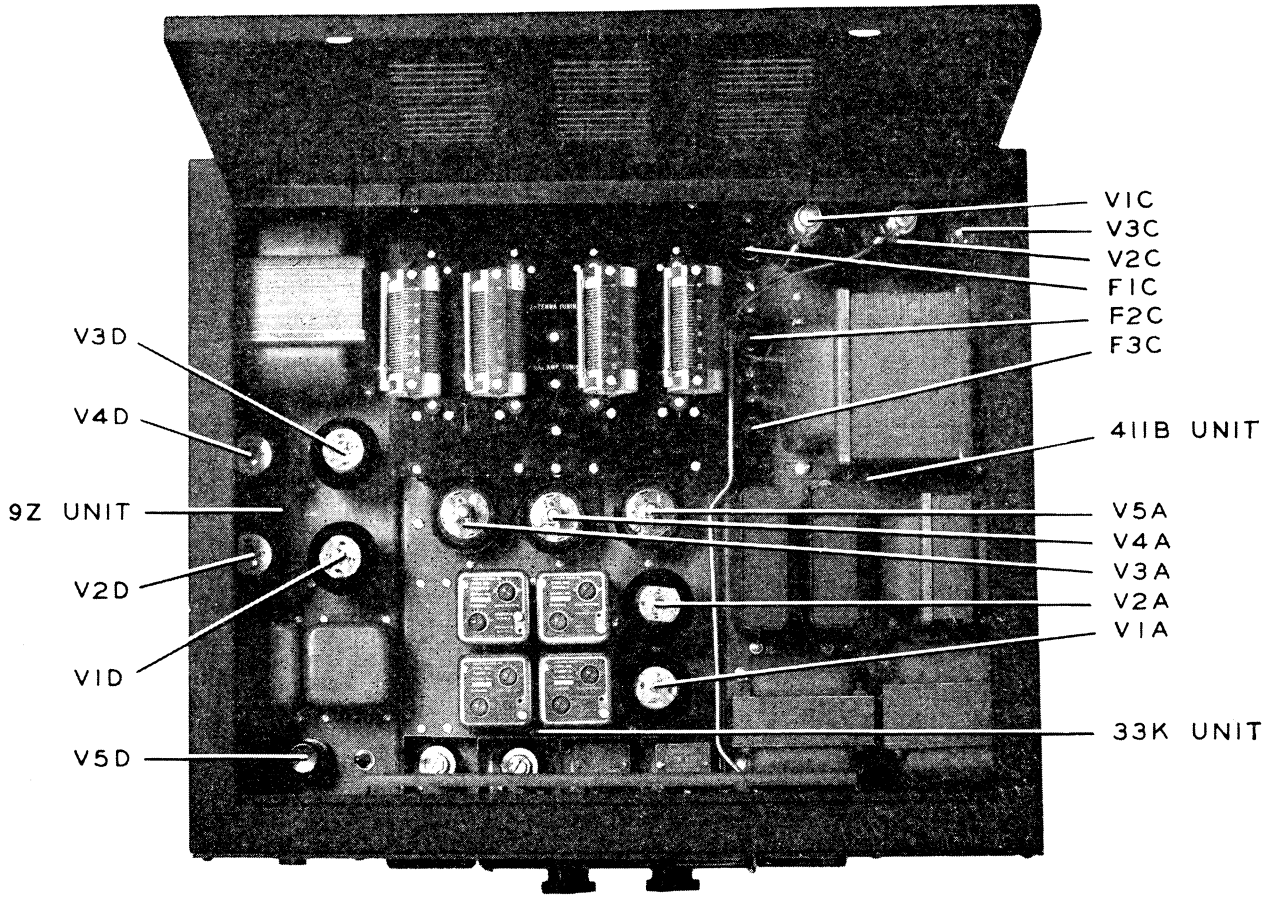


FIG. 2 32RA TRANSMITTER
TOP VIEW OPEN

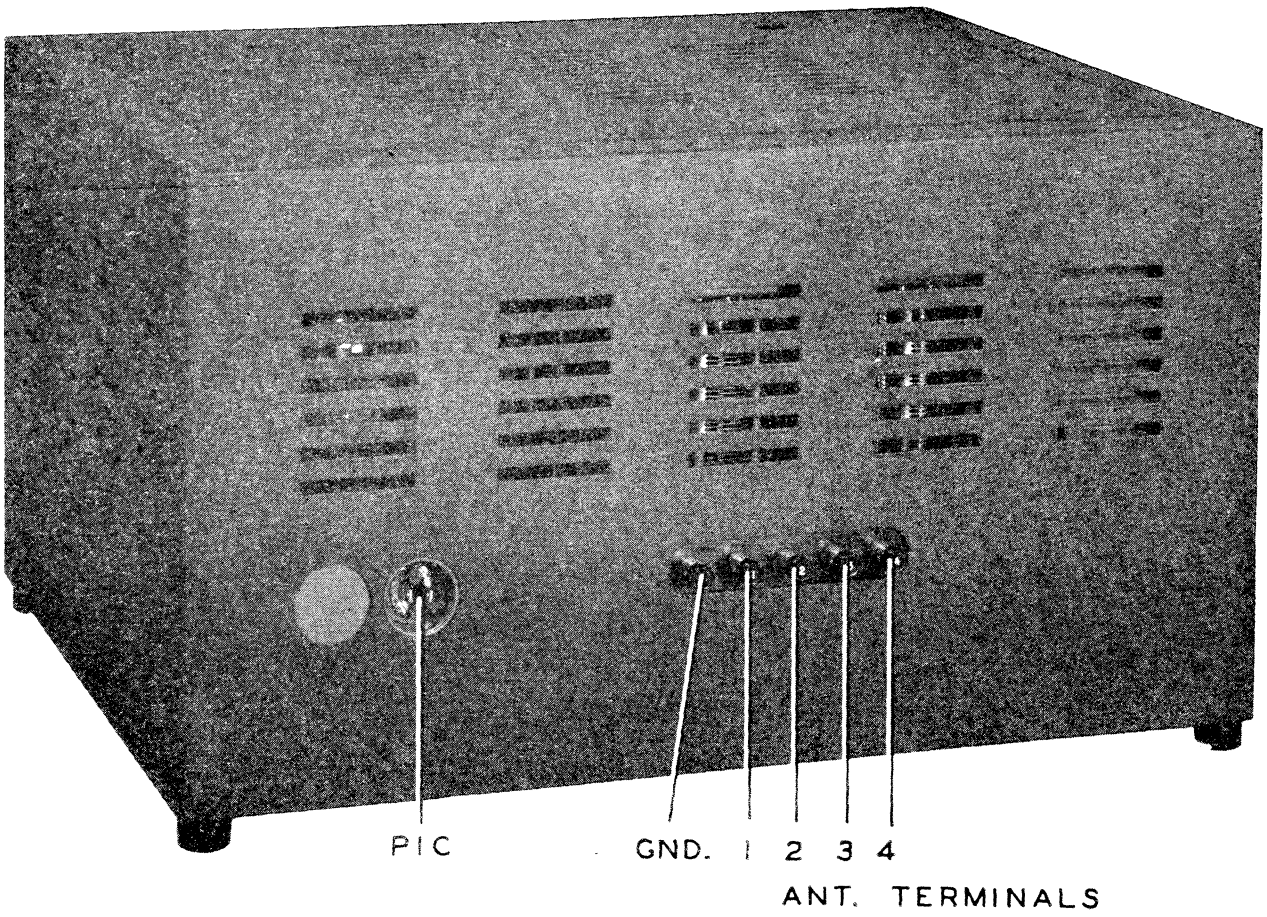


FIG. 3 32RA TRANSMITTER
REAR VIEW

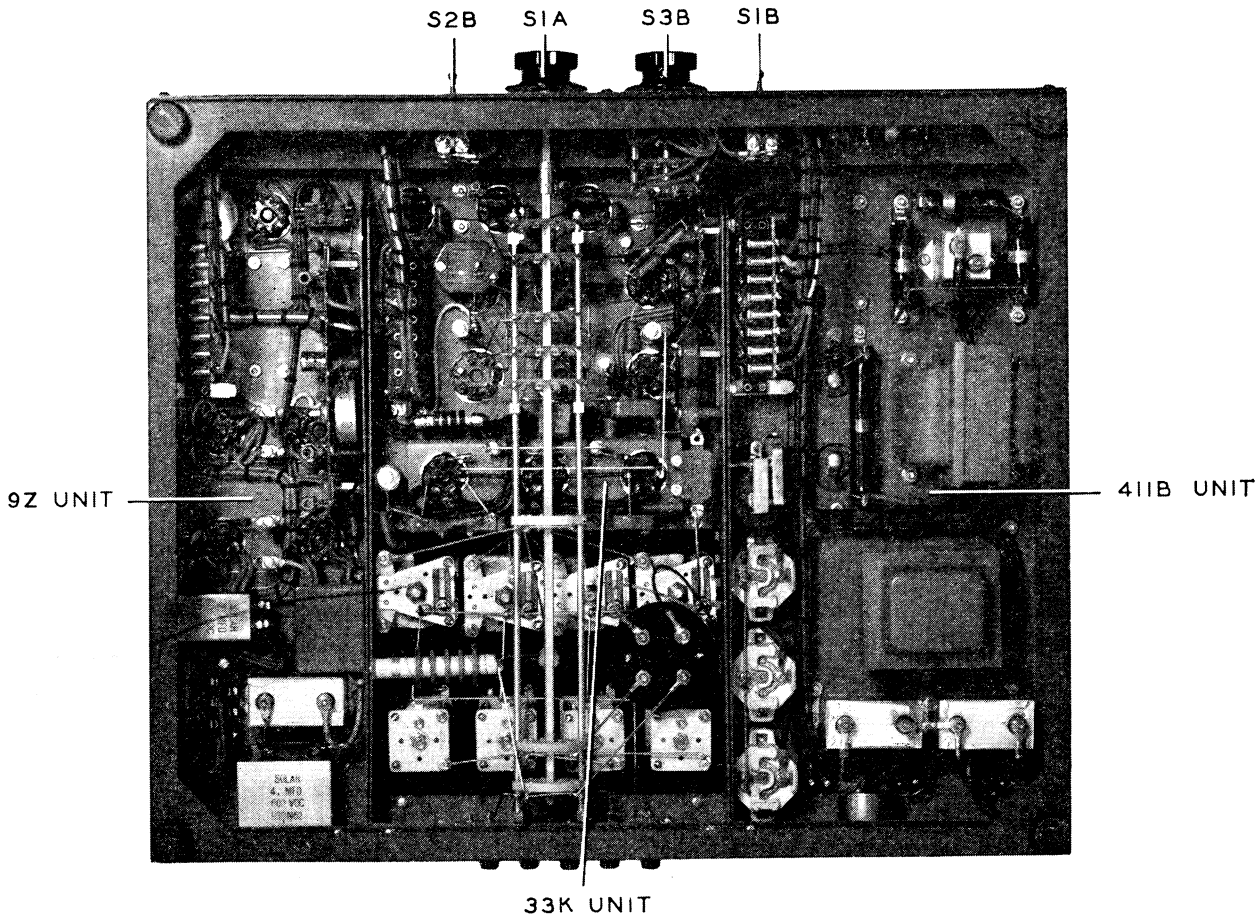


FIG 4 32RA TRANSMITTER
BOTTOM VIEW OPEN

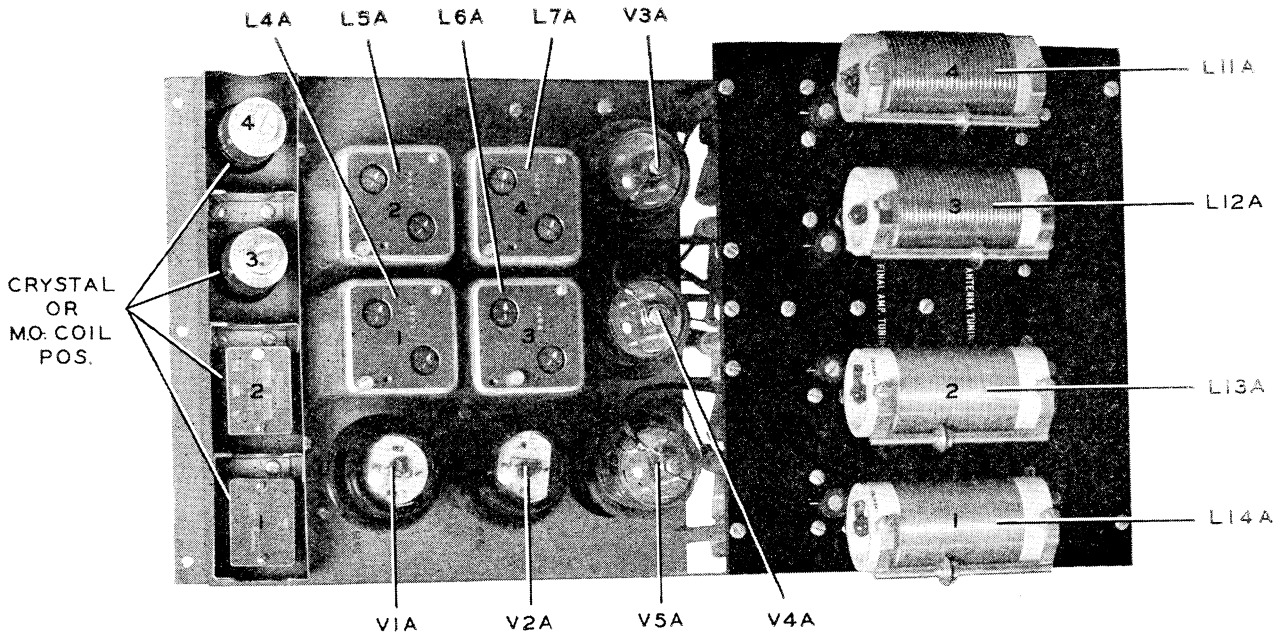


FIG. 5 33K R-F UNIT
TOP VIEW

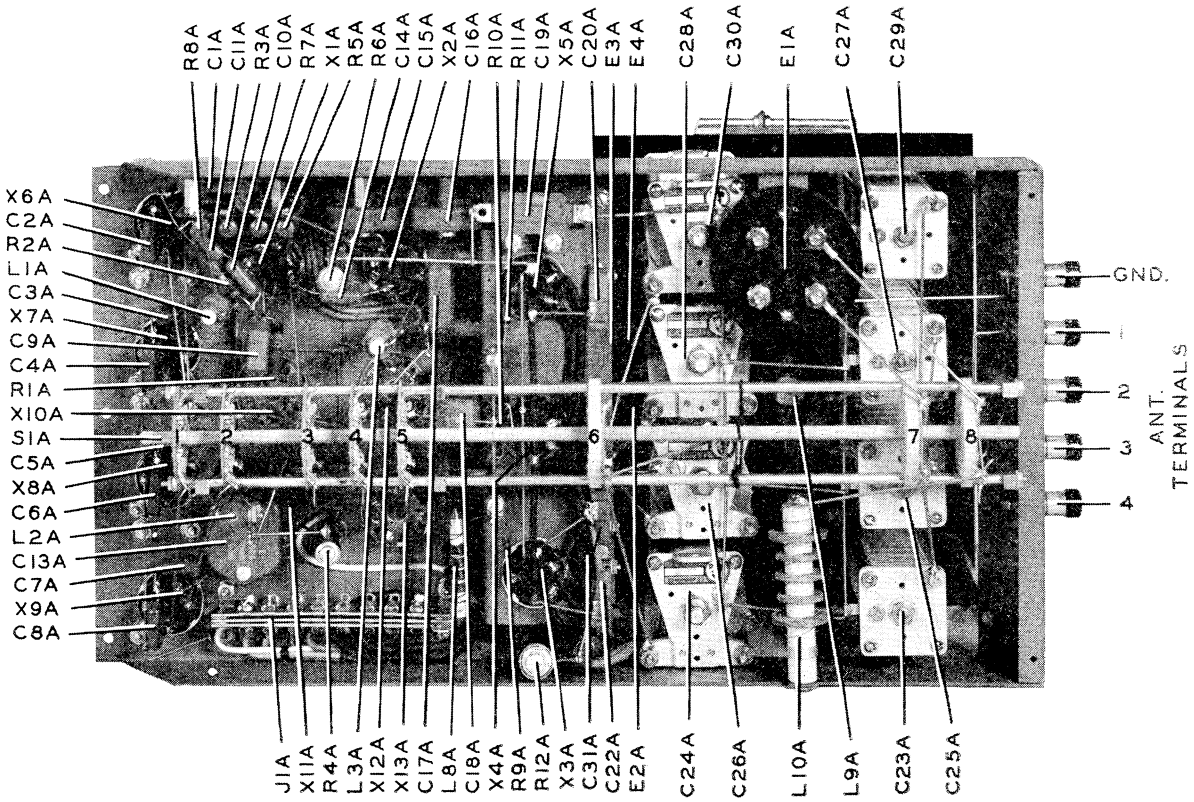


FIG. 6 33K R-F UNIT
BOTTOM VIEW

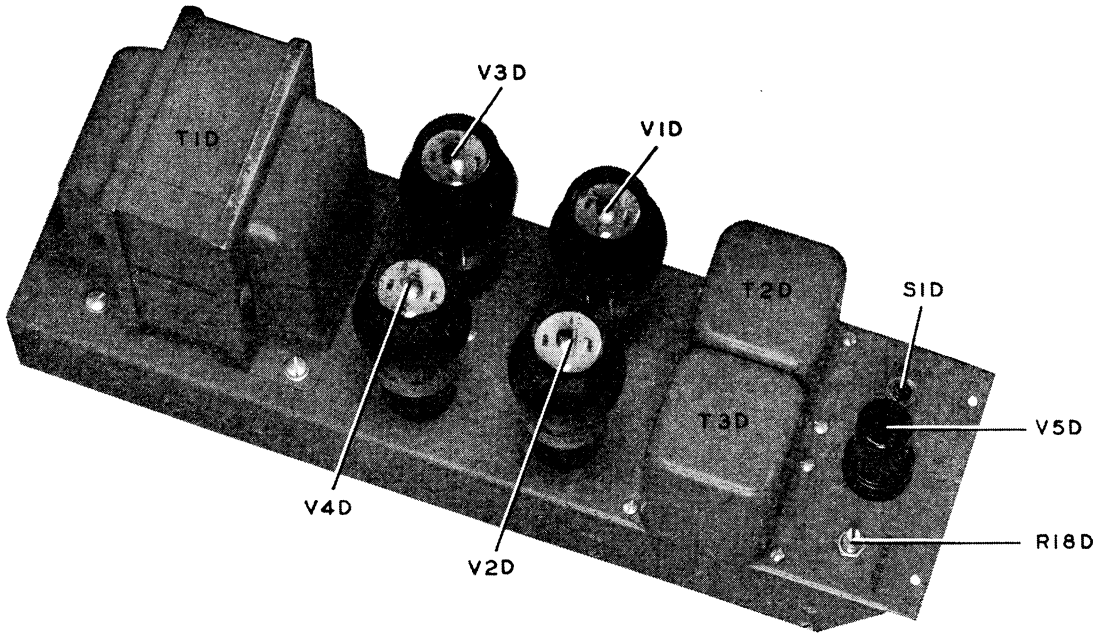


FIG. 7 9Z MODULATOR UNIT
TOP VIEW

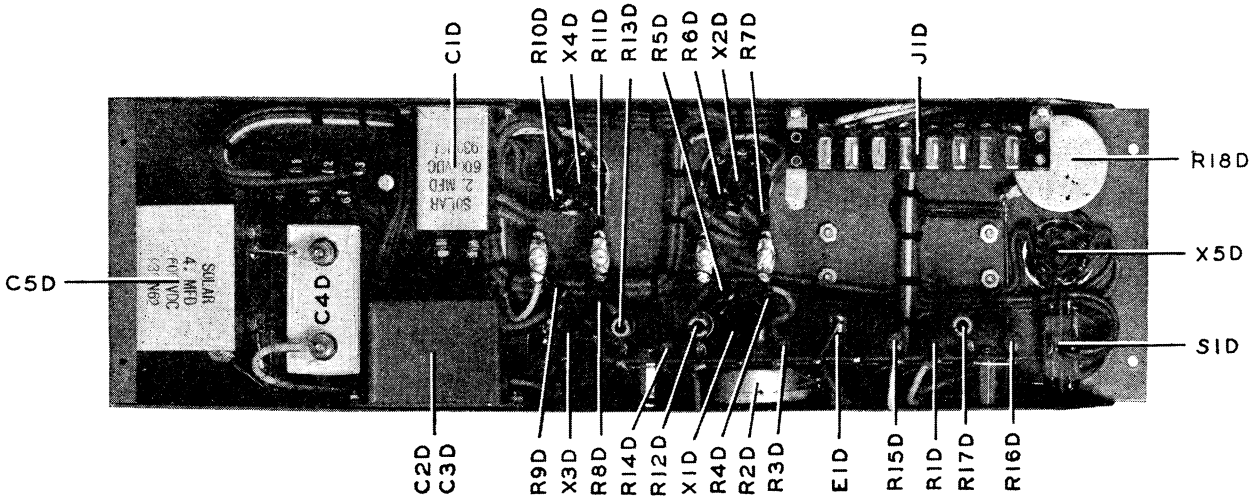


FIG 8 9Z MODULATOR UNIT
BOTTOM VIEW

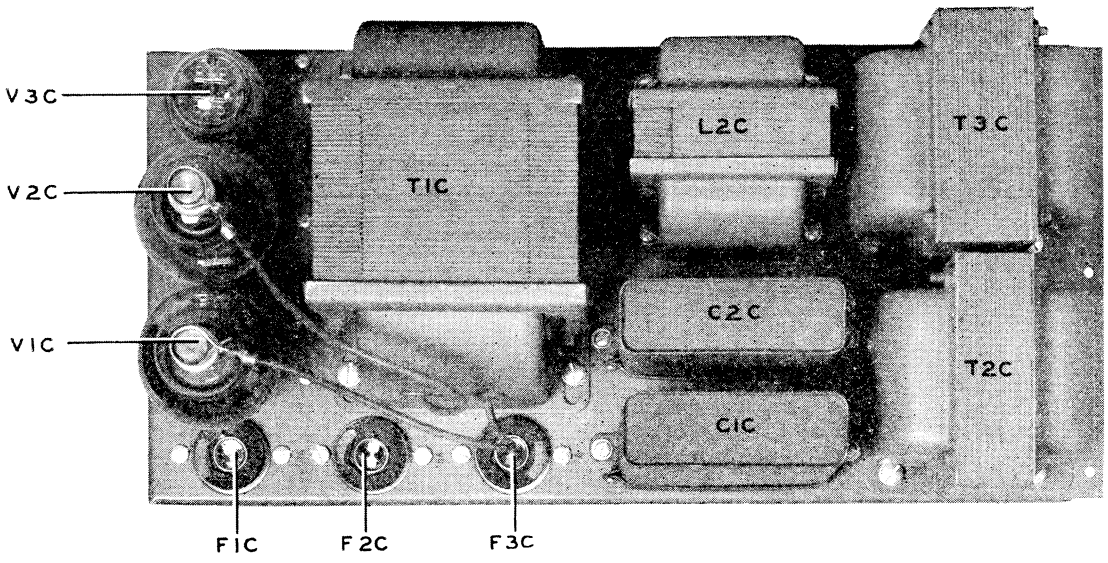


FIG. 9 411B POWER UNIT

TOP VIEW

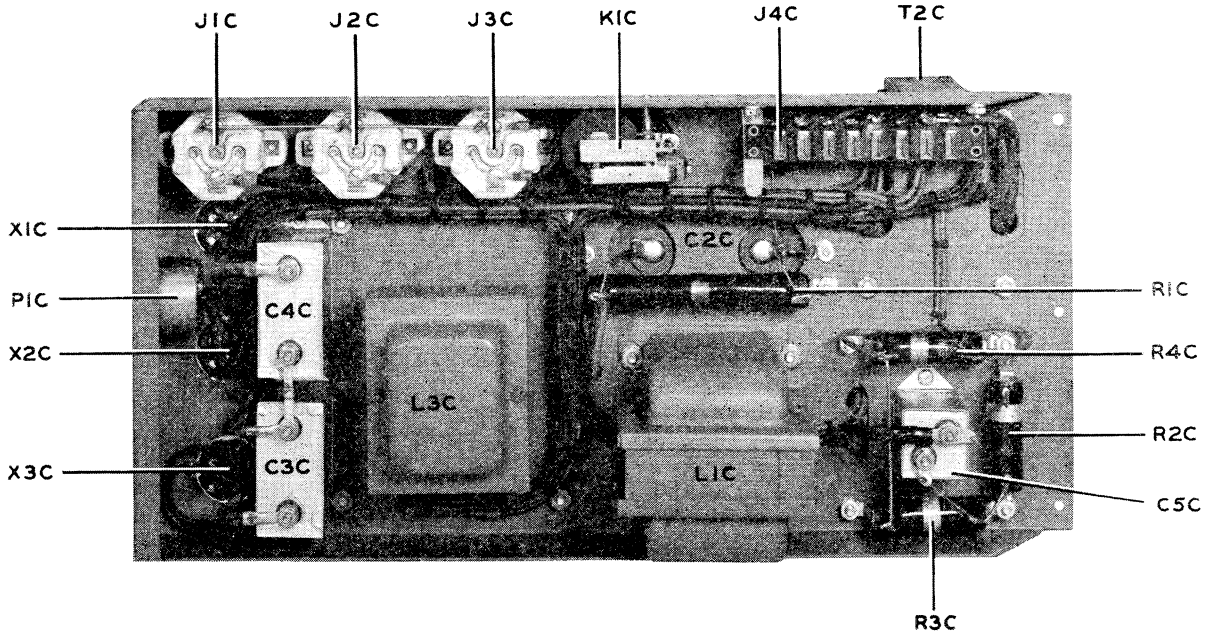


FIG. 10 411B POWER UNIT

BOTTOM VIEW

APPENDIX

STANDARD CABLE WIRE CODE

Numerals refer to RMA Color Code
Letters refer to wire size & type

ALL WIRE RUBBER INSULATED WITH BRAID COVERING

NEW Color Code	OLD Color Code	COLOR	CONSTRUCTION RATINGS
A0	B	Black	
*A1	N	Brown	16 Strands No. 30 Tinned
A2	R	Red	0.0156" Rubber Comp. Wall
A3	O	Orange	Glazed Cotton Braid
*A4	Y	Yellow	
A5	G	Green	3 Amp. 500 Volts D.C.
A6	L	Blue	
A9	W	White	
A02		Black—Red Tracer	
A32		Orange—Red Tracer	
A52		Green—Red Tracer	
A62		Blue—Red Tracer	
A92		White—Red Tracer	
B0	RB	Black	
B2	RR	Red	26 Strands No. 30 Tinned
B3		Orange	0.0313" Rubber Comp. Wall
*B4	RY	Yellow	Glazed Cotton Braid
B5	RG	Green	
B6	RL	Blue	6 Amp. 750 Volts D.C.
B9	RW	White	
C0		Black	
C2		Red	65 Strands No. 30 Tinned
C3		Orange	0.031" Rubber Comp. Wall
C5		Green	Glazed Cotton Braid
C6		Blue	
C9		White	20 Amp. 750 Volts D.C.
C09	CF	Black—White Tracer	
C29	CC	Red—White Tracer	
C39		Orange—White Tracer	
C59	CB	Green—White Tracer	
C69		Blue—White Tracer	
*C10	CA	Brown—Black Tracer	
*C40	CE	Yellow—Black Tracer	
*C90	CD	White—Black Tracer	
D0	H	Black	19 Strands No. 27 Tinned 3/64" Live Rubber Wall Lacquered Double Braid—5KV

APPENDIX

SERVICE REPORT

REPLACEABLE COMPONENTS

Please fill out this form and submit it by mail to the COLLINS RADIO COMPANY, CEDAR RAPIDS, IOWA, U.S.A., when reporting failure of component parts. A properly completed report must be submitted for each part before any accounts will be adjusted. An accurate report will assure the correct replacement part.

IDENTIFICATION OF COMPONENT

Owner_____

Equipment Type No._____ Serial No._____

Unit Type No._____ Serial No._____

Component Item No._____ Stock No._____

Description of Component_____

_____

_____

SERVICE DATA

Date Equipment Received_____ Date in Service_____

Date of Failure_____ Hours of Service_____

NATURE OF FAILURE _____ _____

_____

_____

_____

_____

OPERATING DATA AND CONDITIONS (At time of failure)

Line Voltage_____Abnormal Meter Readings_____

Ambient Temperature_____°F. Electrical Storm?_____

Associated Fuse Failure_____

Additional Comments_____

_____

_____

_____

_____

APPENDIX

SERVICE REPORT

REPLACEABLE COMPONENTS (CONT.)

PRESENT STATUS OF EQUIPMENT

Out of Service_____Component Replaced_____

Temporary Repair (state nature)_____

_____

Date of Report_____Signed_____

THESE ENTRIES TO BE MADE BY THE COLLINS RADIO COMPANY

Received_____R.T. No._____Results of Factory Test:_____

_____

_____Replacement Order No._____

Disposition_____

_____

Form CDF-7

APPENDIX

SERVICE REPORT

REPLACEABLE COMPONENTS

Please fill out this form and submit it by mail to the COLLINS RADIO COMPANY, CEDAR RAPIDS, IOWA, U.S.A., when reporting failure of component parts. A properly completed report must be submitted for each part before any accounts will be adjusted. An accurate report will assure the correct replacement part.

IDENTIFICATION OF COMPONENT

Owner_____

Equipment Type No._____ Serial No._____

Unit Type No._____ Serial No._____

Component Item No._____ Stock No._____

Description of Component_____

_____

_____

SERVICE DATA

Date Equipment Received_____ Date in Service_____

Date of Failure_____ Hours of Service_____

NATURE OF FAILURE_____ _____

_____

_____

_____

_____

OPERATING DATA AND CONDITIONS (At time of failure)

Line Voltage_____Abnormal Meter Readings_____

Ambient Temperature_____°F. Electrical Storm?_____

Associated Fuse Failure_____

Additional Comments_____

_____

_____

_____

_____

APPENDIX

SERVICE REPORT

REPLACEABLE COMPONENTS (CONT.)

PRESENT STATUS OF EQUIPMENT

Out of Service_____Component Replaced_____

Temporary Repair (state nature)_____

_____

Date of Report_____Signed_____

THESE ENTRIES TO BE MADE BY THE COLLINS RADIO COMPANY

Received_____R.T. No._____Replacement Order No._____

Results of Factory Test:_____

_____

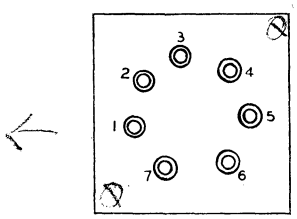
Disposition_____

_____

Form CDF-7

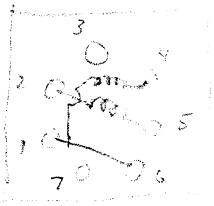
MAT.:	GRADE:	DRAWN BY: WFS	DATE:	COLLINS RADIO COMPANY
FINISH:		TRACED BY: MRJ	DATE: 1-29-41	CEDAR RAPIDS, IOWA
		CHECKED BY: WFS	DATE: 3-26-41	
UNIT: SCHEMATIC: 7000C-5 TUNING COIL ASSEMBLY			SCALE	DRAWING NO. 102A-1

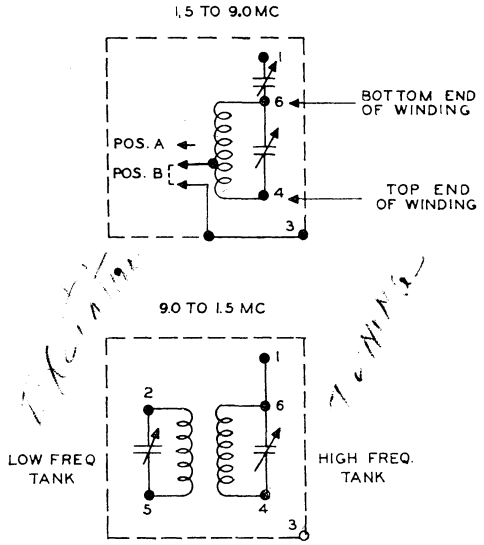
D145A



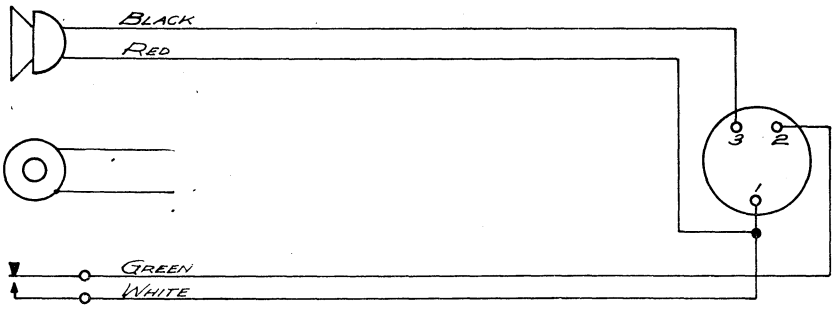
BOTTOM VIEW

COIL FORM BASE





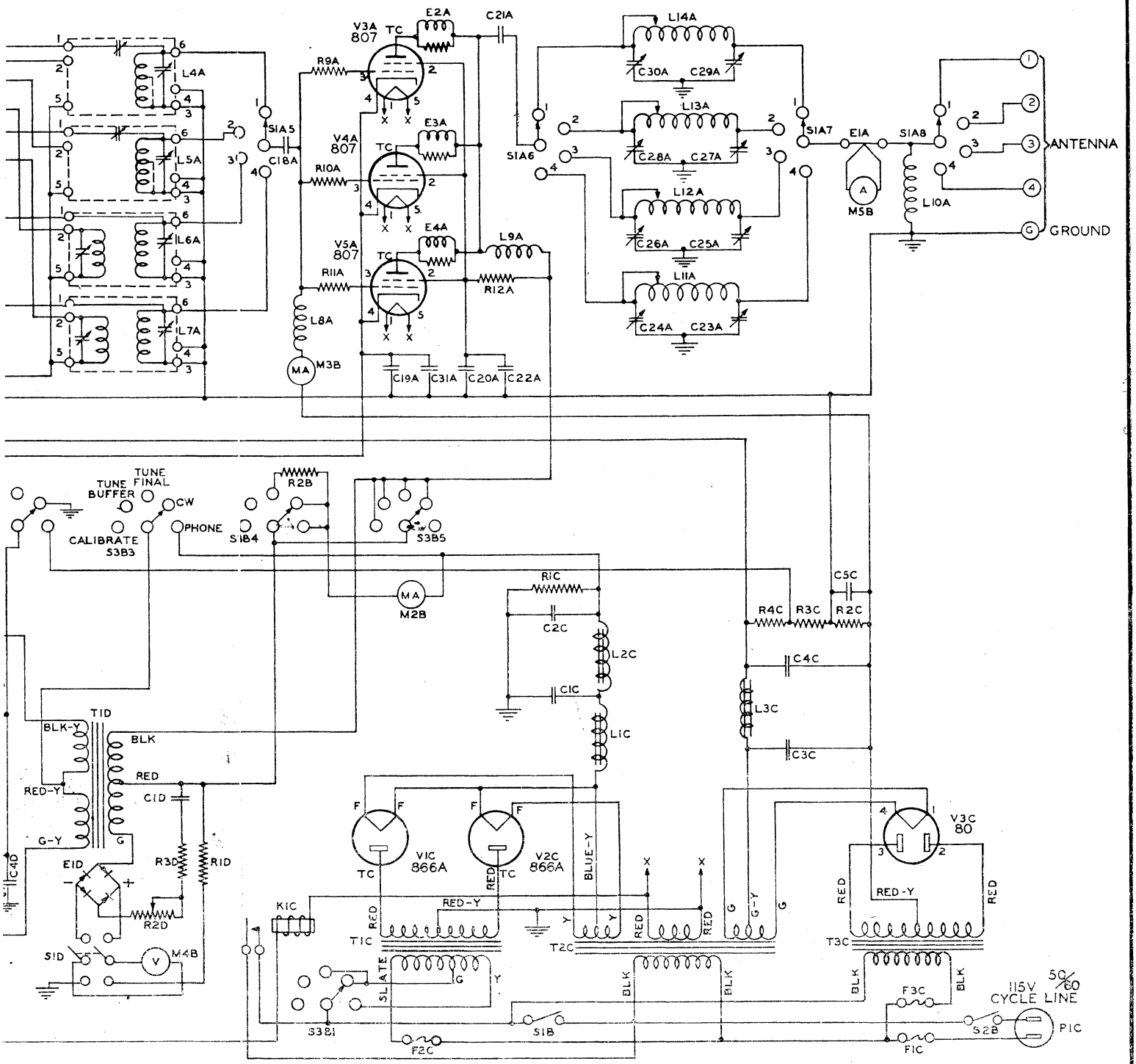
MAT.:	GRADE:	DRAWN BY: L.E.B	DATE:	COLLINS RADIO COMPANY
FINISH:		TRACED BY: B.R.M	DATE: 8-13-1940	CEDAR RAPIDS, IOWA
		CHECKED BY: L.E.B	DATE: 8-13-40	
UNIT: 69H-1 HANDSET SCHEMATIC			SCALE	DRAWING NO. 1580A-1



JS RADIO COMPANY DAR RAPIDS, IOWA	UNIT: 32RA-8 COMPLETE TRANSMITTER SCHEMATIC DESIGN: AG DETAIL: NDB DATE: 10-2-42 LAYOUT: CHECK: AG DATE:	REVISED: DATE:	SCALE	DWG. NO. 1275C	

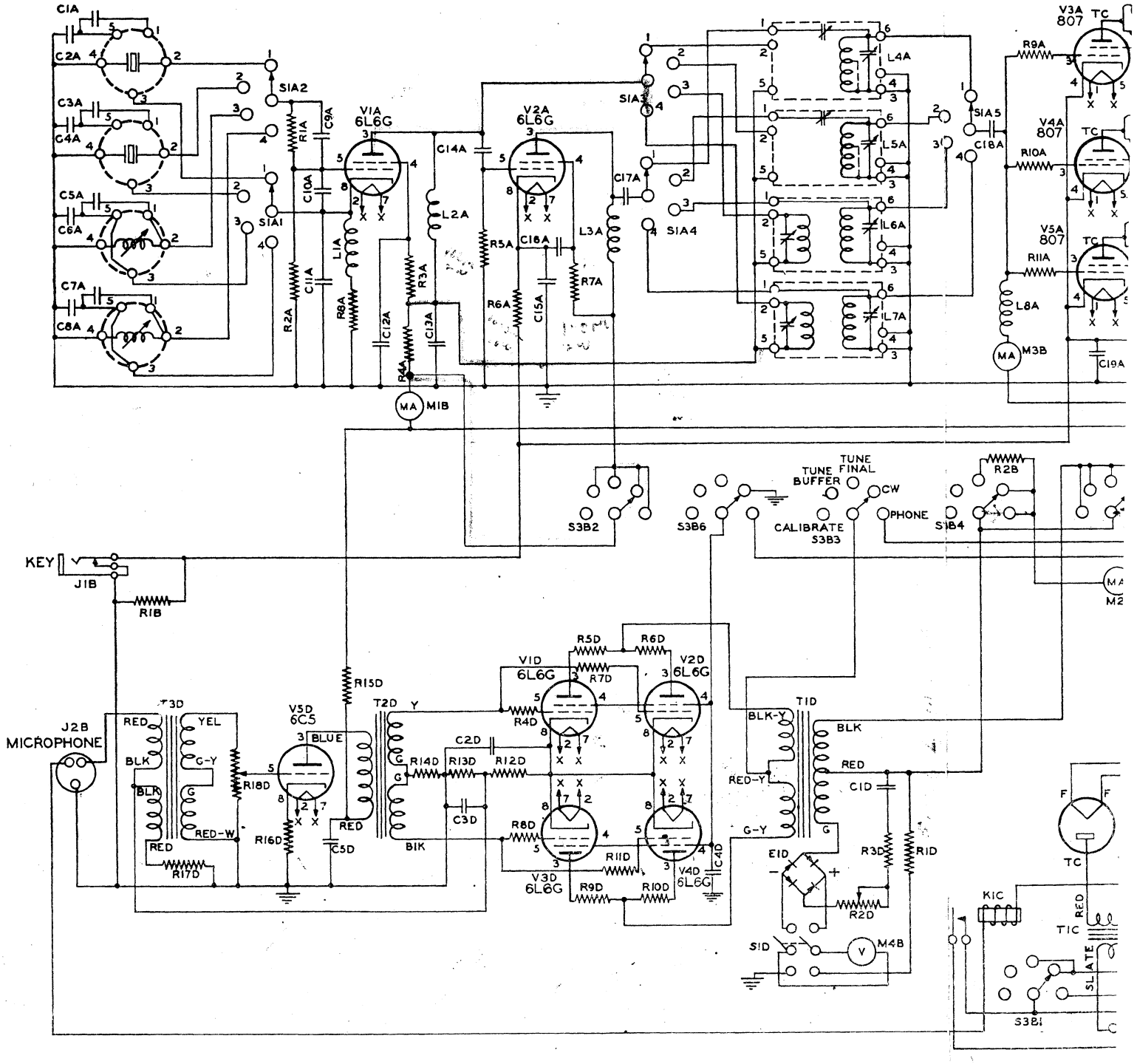
QUANTITY: G F E D C B A

IT.	PART NO.	DESCRIPTION	MAT'L	FIN.

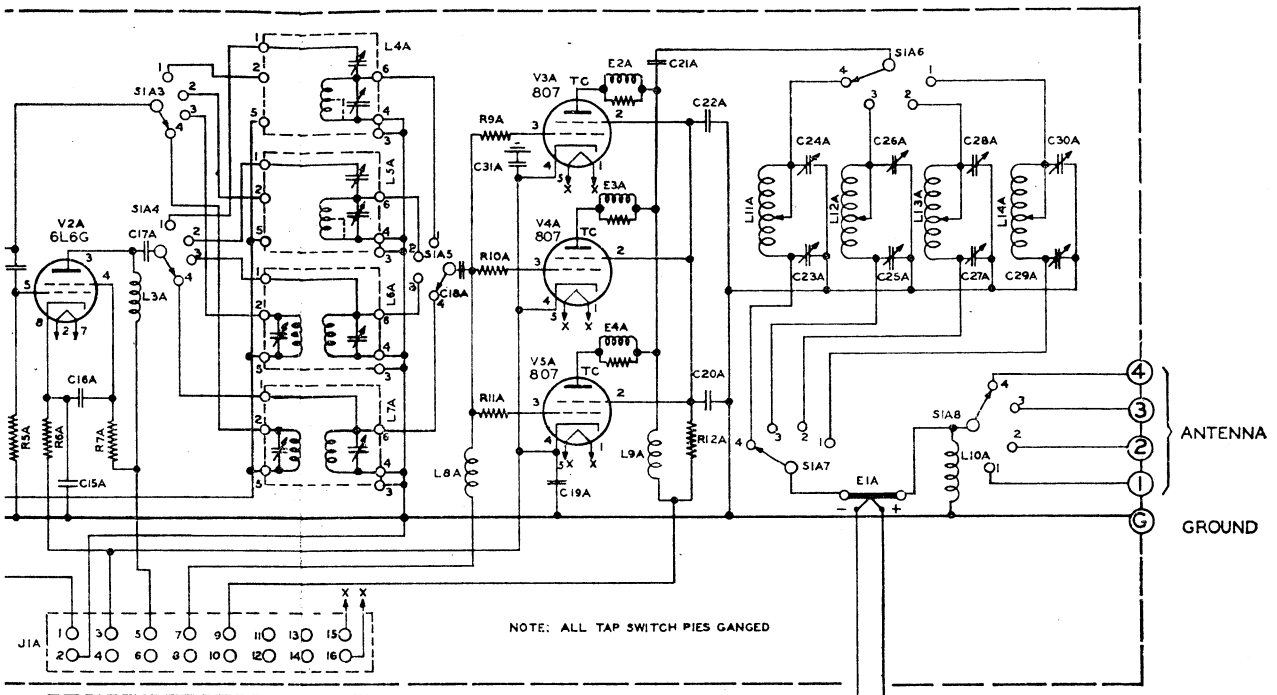


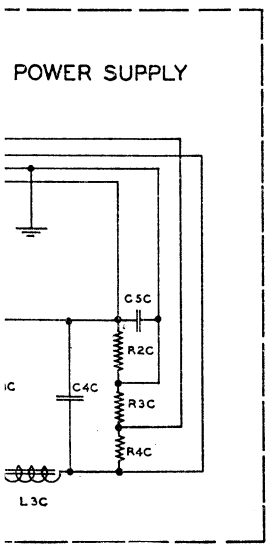
COLLINS RADIO COMPANY
CEDAR RAPIDS, IOWA

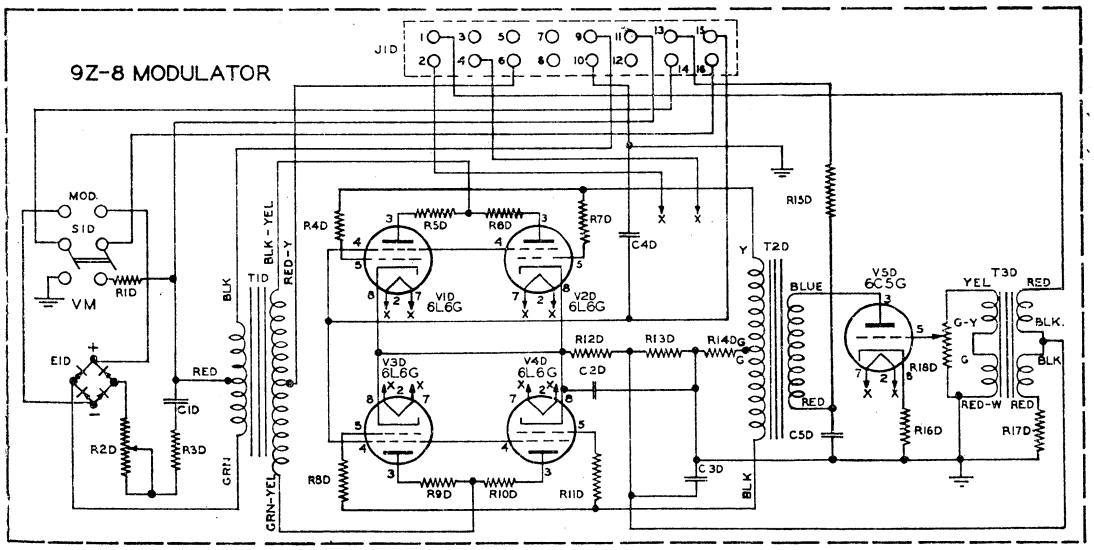
UNIT: 32RA-8 COMPL
DESIGN: [illegible] DETAIL: NDK
LAYOUT: [illegible] CHECK: [illegible]
QUANTI

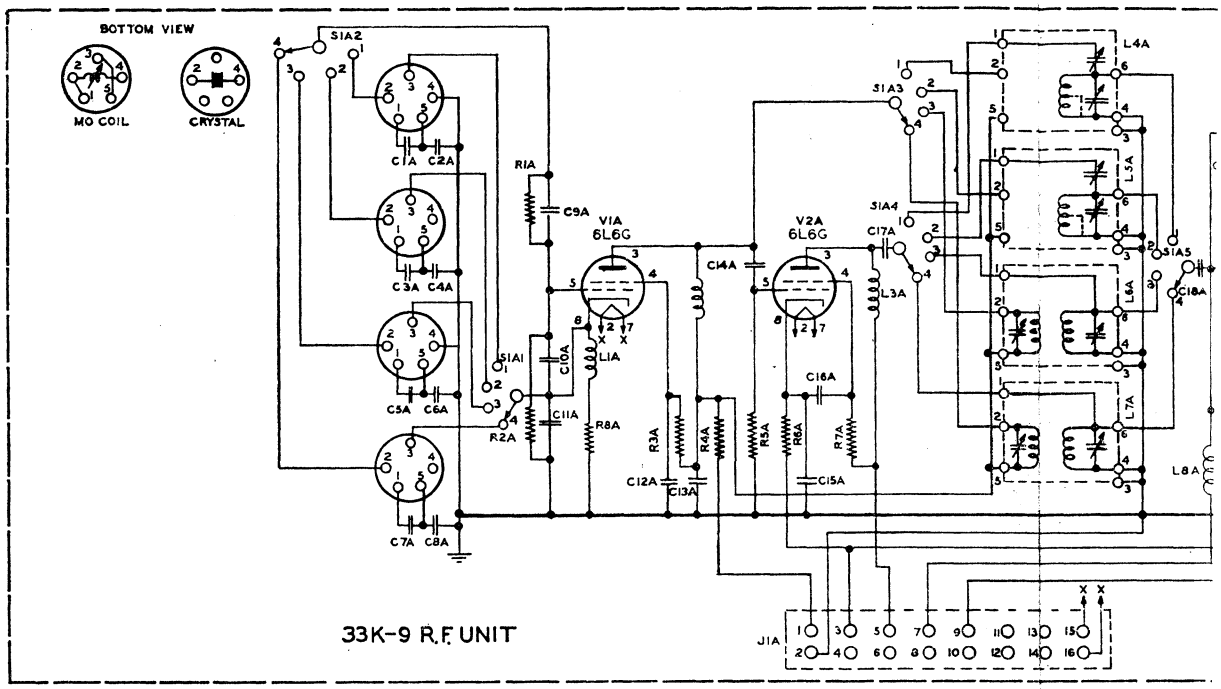


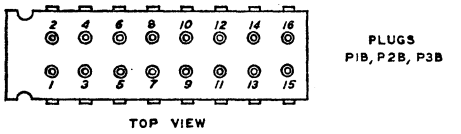
UNIT: 32RA-8 CABLING SCHEMATIC			
REVISED DATE	DRAWN BY: LEB	DATE	DWG NO. 622D
MAT	TRACED BY: NDK	DATE 10-13-42	
FINISH	CHECKED BY: JB	DATE	

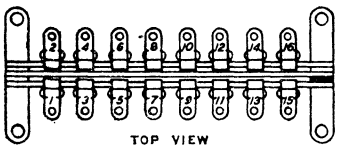


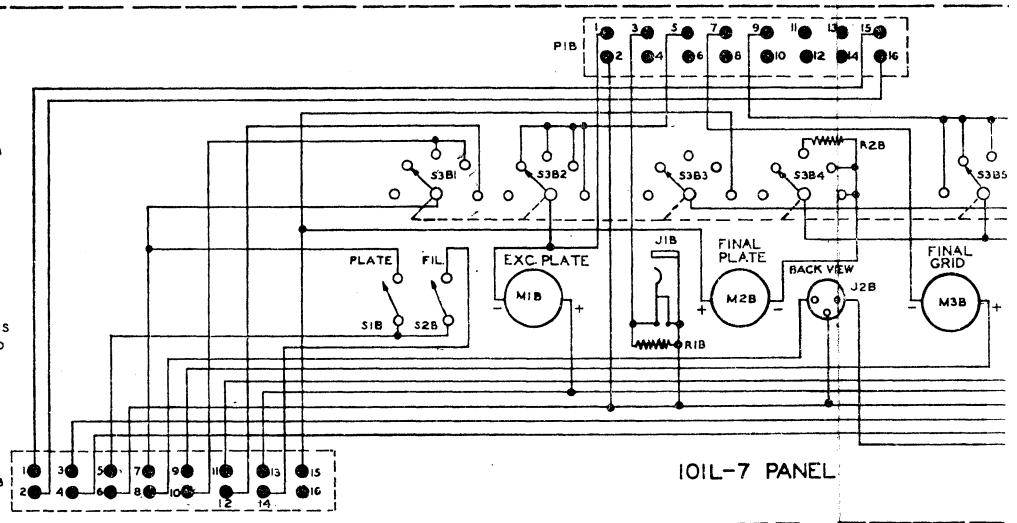


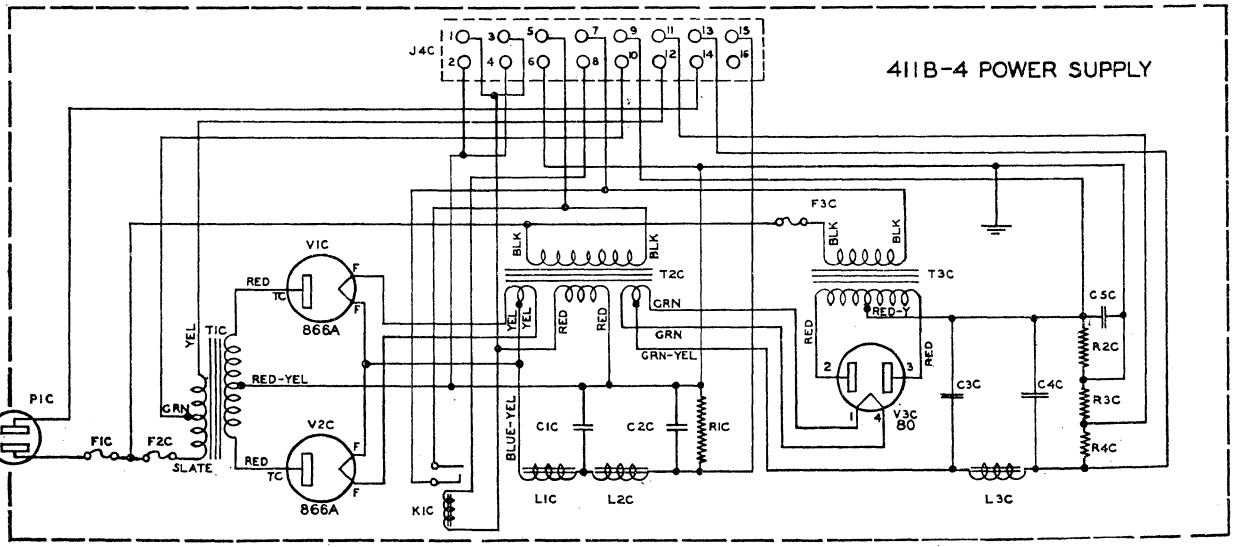


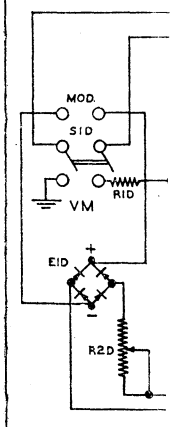

BOTTOM VIEW
MO COIL
CRYSTAL
S1A2
C1A C2A
C3A C4A
C5A C6A
C7A C8A
S1A1
R1A
C9A
V1A 6L6G
V2A 6L6G
C10A
L1A
C11A
R8A
R2A
C14A
C16A
C17A
S1A3
S1A4
S1A5
L3A
L4A
L5A
L6A
L7A
L8A
C18A
R3A
R4A
R5A
R6A
R7A
C12A C13A
C15A
J1A
33K-9 R.F. UNIT


PLUGS
P1B, P2B, P3B
TOP VIEW

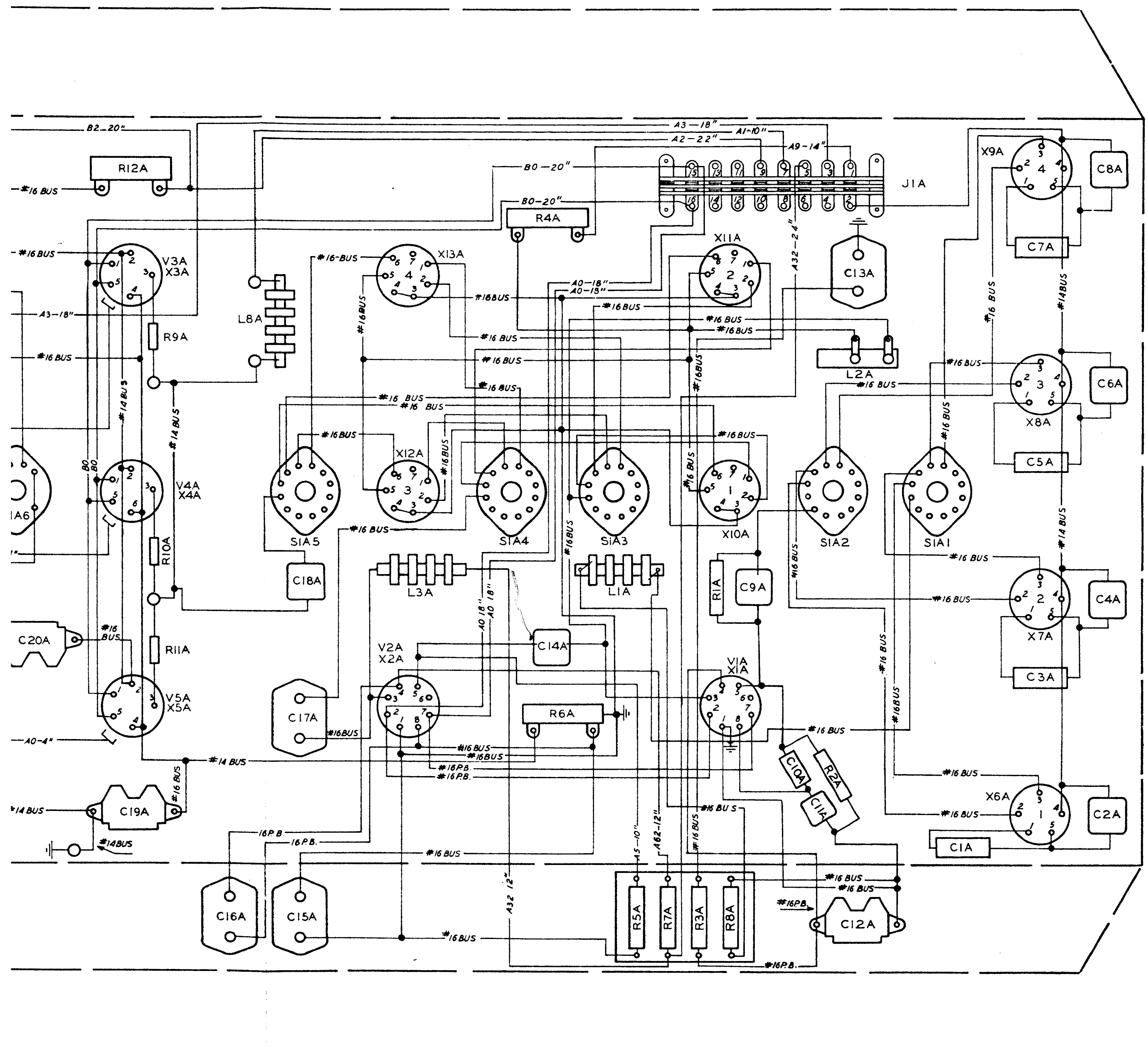

RECEPTACLES
J1A, J4C, J1D
TOP VIEW


P1B
S3B1
S3B2
S3B3
S3B4
S3B5
R2B
PLATE
FIL
S1B
S2B
EXC. PLATE
M1B
J1B
R1B
FINAL PLATE
M2B
BACK VIEW
J2B
FINAL GRID
M3B
P2B
101L-7 PANEL


J4C
411B-4 POWER SUPPLY
110V 50/60~
P1C
F1C
F2C
SLATE
GRN
YEL
T1C
RED-YEL
V1C
V2C
866A
866A
RED
TC
F
K1C
BLK
T2C
T3C
F3C
GRN
GRN-YEL
BLUE-YEL
RED-Y
V3C 80
C1C
C2C
R1C
C3C
C4C
C5C
R2C
R3C
R4C
L1C
L2C
L3C

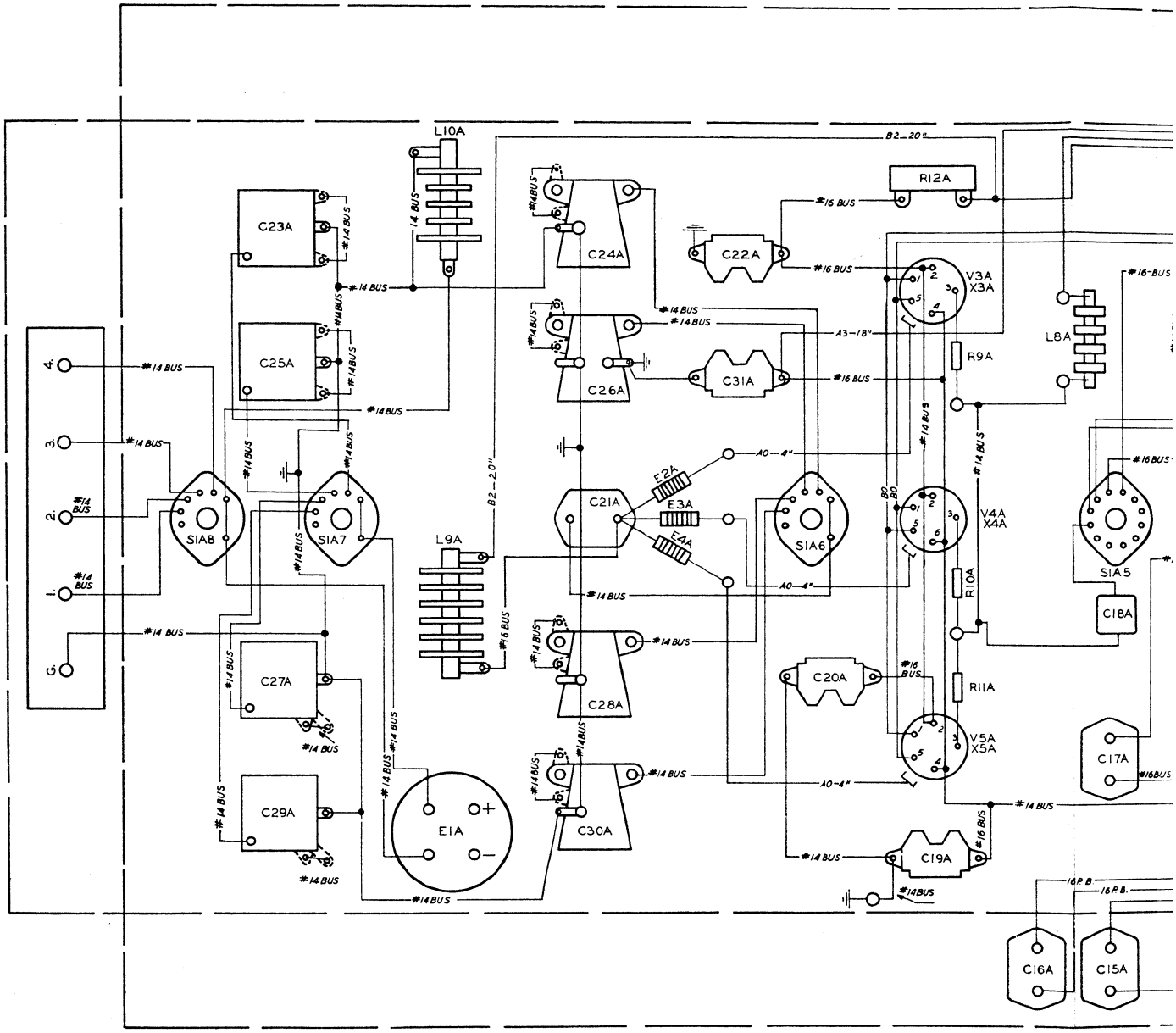

9Z-8 MOD
MOD.
S1D
VM
R1D
E1D
R2D

COLLINS RADIO COMPANY CEDAR RAPIDS, IOWA	UNIT: 33K-9 PRACTICAL WIRING DIAGRAM DESIGN: LAYOUT: DETAIL: F.T.F CHECK: DATE: 10-23-42 DATE:	REVISED: REG D-3118 DATE: 1-14-43	32RA-8 SCALE	DWG. NO. 531D-2
	QUANTITY: G F E D C B A	IT.	PART NO.	DESCRIPTION / MAT'L / FIN.



DO NOT SCALE DWG.

COLLINS RADIO
CEDAR RAPIDS



RADIO COMPANY
IR RAPIDS, IOWA

UNIT: 101L-7 PRACTICAL WIRING DIAGRAM 32RA-8

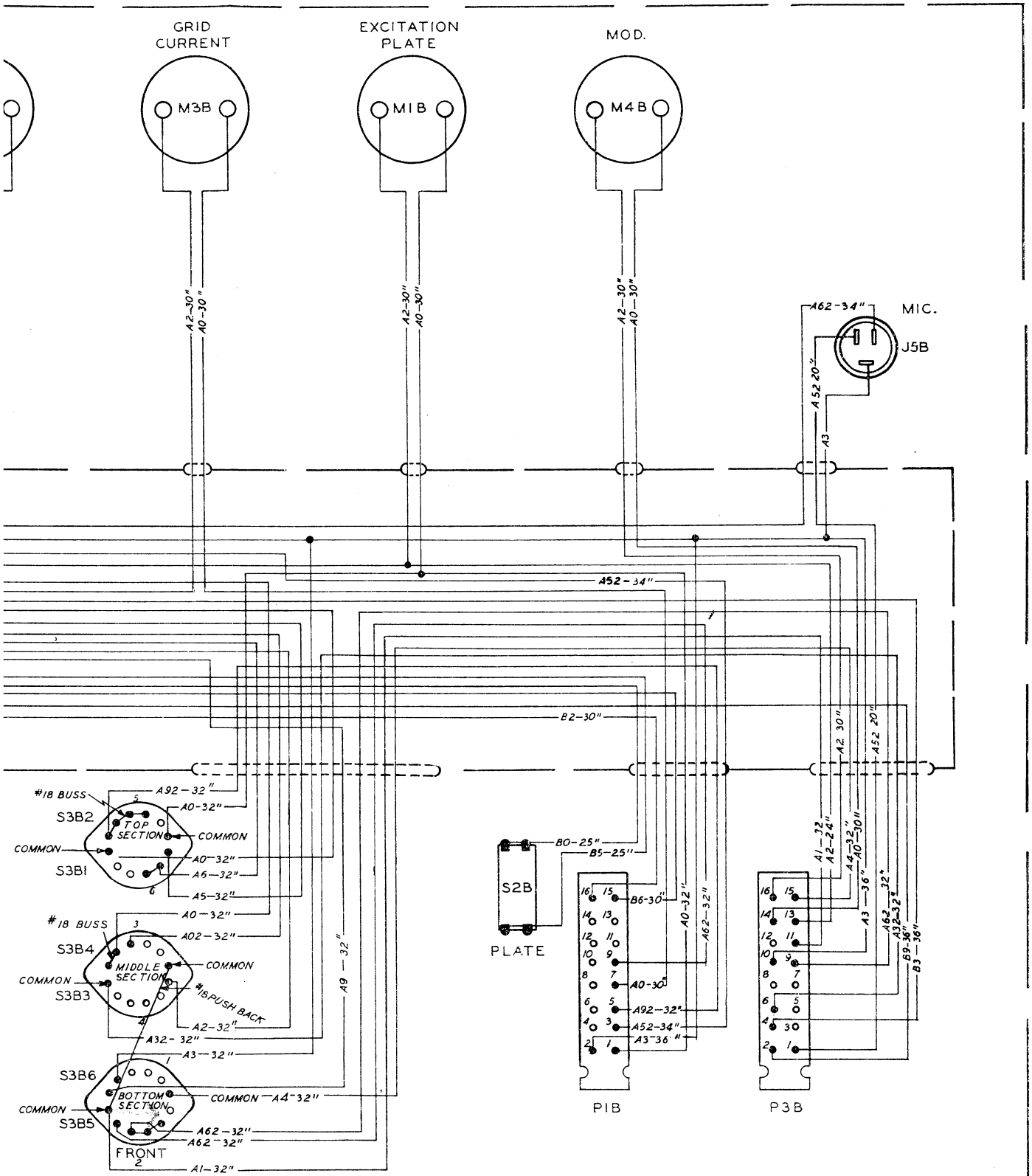
DESIGN: LAYOUT | DETAIL: DLS | CHECK: | DATE: 10-23-42 | DATE:

REVISED: REG D-3123 DATE: 1-14-43

SCALE

DWG. NO. 1154C-2

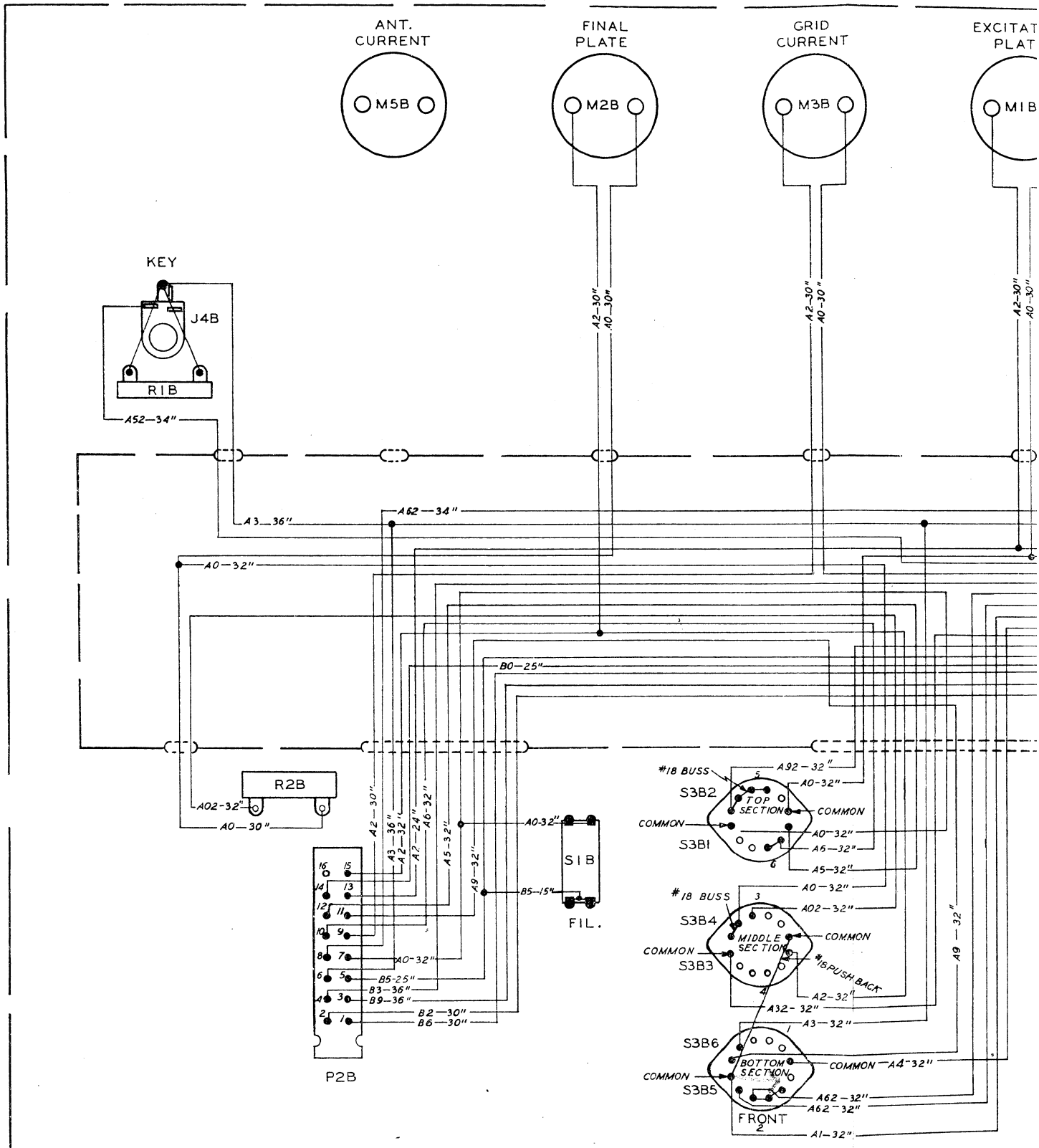
QUANTITY G F E D C B A	IT.	PART NO.	DESCRIPTION	MAT'L	FIN.



DO NOT SCALE DWG.

COLLINS RADIO COMPANY
CEDAR RAPIDS, IOWA

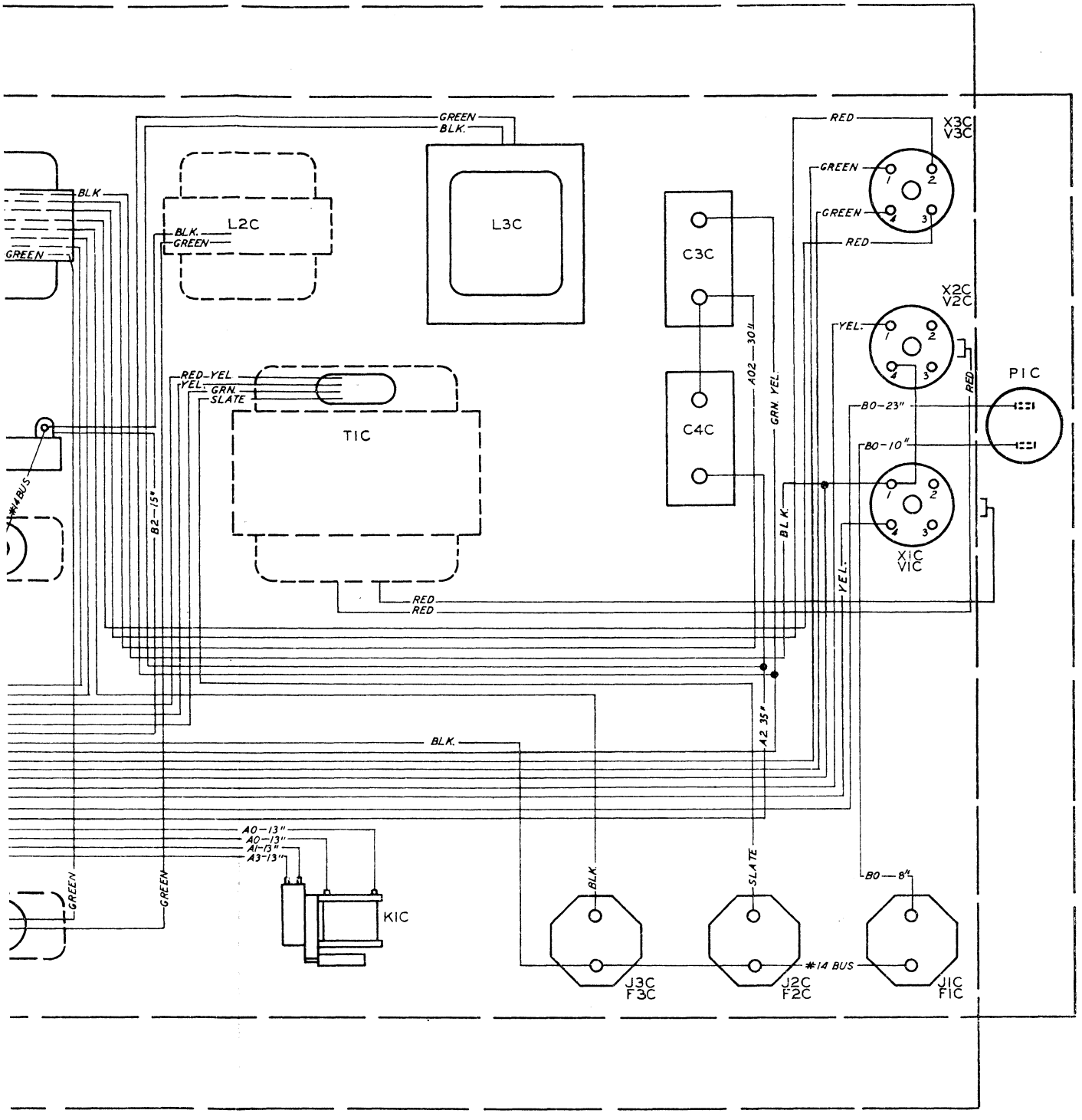
UNIT: 101L-7 PRACTIC
DESIGN: DETAIL: DLS DATE
LAYOUT CHECK: DATE
QUANTITY



ALL FRACTIONAL DIMENSIONS ± 1/64
ALL DECIMAL DIMENSIONS ± .005
UNLESS OTHERWISE NOTED.

S RADIO COMPANY AR RAPIDS, IOWA	UNIT: 411B-4 PRACTICAL WIRING DIAGRAM			32RA-8	DWG. NO. 1152C-2
	DESIGN: DETAIL: F.T.F. DATE: 10-23-42 LAYOUT: CHECK. DATE:	REVISED: REG D-3/24	DATE: 1-14-43	SCALE	

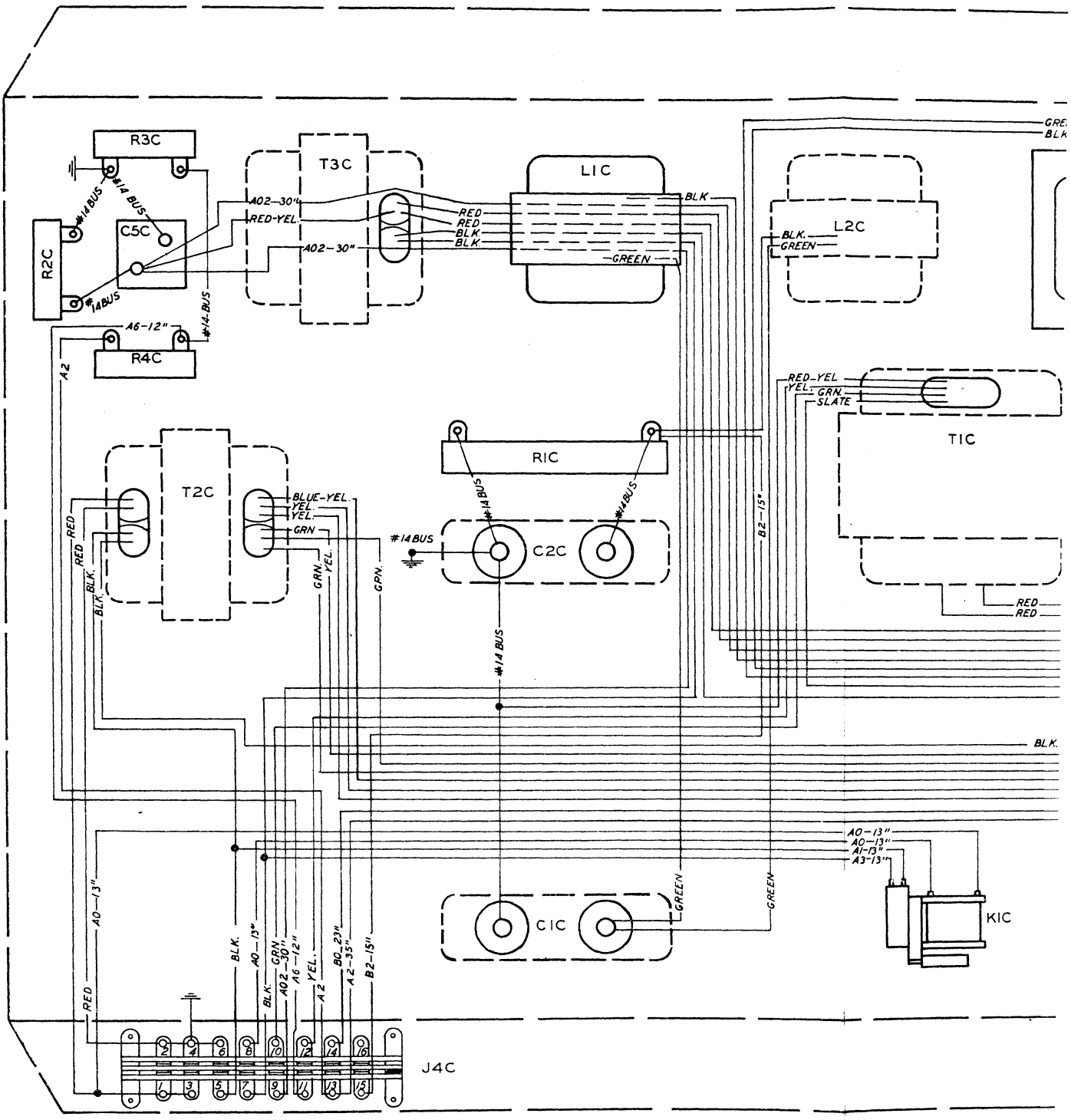
QUANTITY G F E D C B A	IT.	PART NO.	DESCRIPTION	MAT'L	FIN.



DO NOT SCALE DWG.

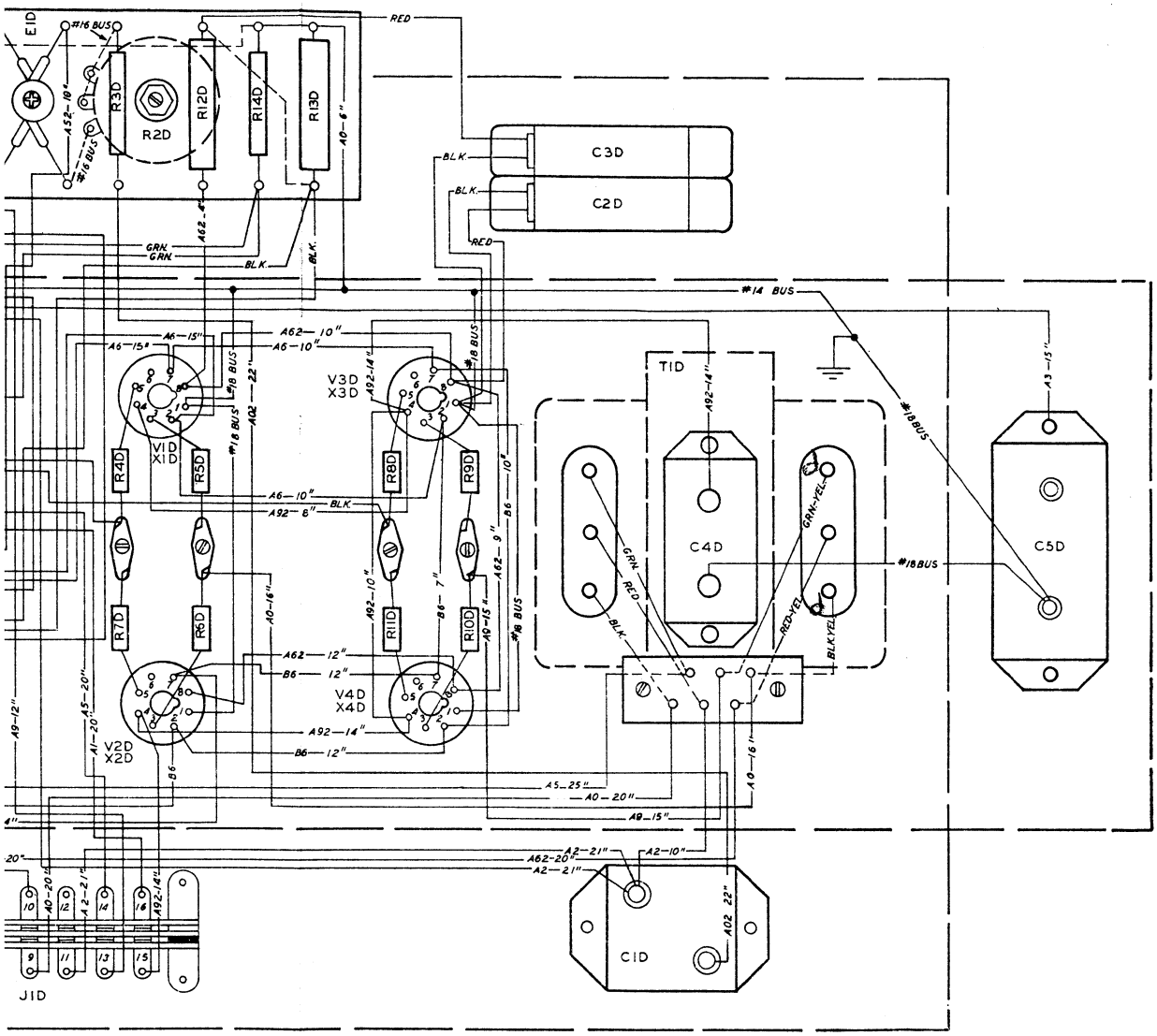
COLLINS RADIO COMPANY
CEDAR RAPIDS, IOWA

UNIT: 411B-4 PRACTI(
DESIGN: [illegible] DETAIL: F.T.F. DATE:
LAYOUT: CHECK. LB DATE:
QUANTITY



ALL FRACTIONAL DIMENSIONS ± 1/64
ALL DECIMAL DIMENSIONS ± .005
UNLESS OTHERWISE NOTED.

COLLINS RADIO COMPANY CEDAR RAPIDS, IOWA	UNIT: 9Z-8 PRACTICAL WIRING DIAGRAM				32RA-8	DWG. NO. 572D-1
	DESIGN: [illegible] DETAIL: N.D.F. DATE: 11-23-42 LAYOUT: CHECK: [illegible] DATE:	REVISED: REG D-3117 DATE: 1-14-43	SCALE			
QUANTITY G F E D C B A	IT.	PART NO.	DESCRIPTION	MAT'L	FIN.	



DO NOT SCALE DWG.

COLLINS RAD
CEDAR RAP