TM 11-2671

WAR DEPARTMENT TECHNICAL MANUAL

RADIO TRANSMITTERS

(Wilcox Electric Types 96A, 96C, and 96C3)

WAR DEPARTMENT *19 DECEMBER 1945*

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WASHINGTON 25, D. C., 19 Dec 1945

TM 11-2671, Radio Transmitters (Wilcox Electric Types 96A, 96C, and 96C3), is published for the information and guidance of all concerned.

[A. G. 300.7 (28 Sep 44).]

BY ORDER OF THE SECRETARY OF WAR:

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(For explanation of symbols see FM 21-6.)

WARNING

HIGH VOLTAGE

is used in the operation of
this equipment

DEATH ON CONTACT

MAY RESULT IF OPERATING PERSONNEL
FAIL TO OBSERVE SAFETY PRECAUTIONS.

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DESTRUCTION NOTICE

WHY — To prevent the enemy from using or salvaging this equipment for his benefit.

WHEN — When ordered by your commander.

HOW — 1. Smash — Use sledges, axes, handaxes, pickaxes, hammers, crowbars, heavy tools.

2. Cut — Use axes, handaxes, machetes.

3. Burn — Use gasoline, kerosene, oil, flame throwers, incendiary grenade.

4. Explosives — Use firearms, grenades, TNT.

5. Disposal — Bury in slit trenches, fox holes, other holes. Throw in streams. Scatter.

USE ANYTHING IMMEDIATELY AVAILABLE FOR DESTRUCTION OF THIS EQUIPMENT.

WHAT — 1. Smash — Chassis, panel, transformers, chokes, capacitors, resistors, terminal boards, sockets, coils, tubes, controls.

2. Cut — All wiring or cables.

3. Burn — This technical manual.

4. Bend — Control brackets and shafts.

5. Bury or scatter — Any or all of above pieces after breaking.

DESTROY EVERYTHING

SAFETY NOTICE

Voltages as high as 4,000 volts are used in the operation of this equipment. These voltages are dangerous to life.

The slide which contains most of the electrical circuits is provided with an interlock switch which removes the high-voltage when the slide is pulled out. In addition the transmitter is provided with a high-voltage switch, the control knob of which appears in the front center of the cabinet just below the slide. This knob, when pulled ALL the way out, removes the 2000-volt, 4000-volt, —500-volt and +500-volt supplies from the equipment, and grounds the terminals to which these voltages had been applied. This grounding operation bleeds off charges on the various capacitors. As an added safety precaution each of the high-voltage capacitors should be grounded with a grounding stick before maintenance work is done on the transmitter.

Open the 220-volt a-c supply switch and remove the main fuses before servicing the transmitter.

Radio-frequency voltages as high as 4,000 volts may develop on the antenna of this transmitter. Do not touch the antenna when the transmitter is in use.



RESCUE.

In case of electric shock, shut off the high voltage at once and ground the circuits. If the high voltage cannot be turned off without delay, free the victim from contact with the live conductor as promptly as possible. Avoid direct contact with either the live conductor or the victim's body. Use a dry board, dry clothing, or other nonconductor to free the victim. An ax may be used to cut the high-voltage wire. Use extreme caution to avoid the resulting electric flash.

SYMPTOMS.

a. Breathing stops abruptly in electric shock if the current passes through the breathing center at the base of the brain. If the shock has not been too severe, the breath center recovers after a while and normal breathing is resumed, provided that a sufficient supply of air has been furnished meanwhile by artificial respiration.

b. The victim is usually very white or blue. The pulse is very weak or entirely absent and unconsciousness is complete. Burns are usually present. The victim's body may become rigid or stiff in a very few minutes. This condition is due to the action of electricity and is not to be considered rigor mortis. Artificial respiration must still be given, as several such cases are reported to have recovered. The ordinary and general tests for death should never be accepted.

TREATMENT.

a. Start artificial respiration immediately. At the same time send for a medical officer, if assistance is available. Do not leave the victim unattended. Perform artificial respiration at the scene of the accident, unless the victim's or operator's life is endangered from such action. *In this case only*, remove the victim to another location, but no farther than is necessary for safety. If the new location is more than a few feet away, artificial respiration should be given while the victim is being moved. If the method of transportation prohibits the use of the Shaeffer prone pressure method, other methods of resuscitation may be used. Pressure may be exerted on the front of the victim's diaphragm, or the direct mouth-to-mouth method may be used. Artificial respiration, once started, must be continued, without loss of rhythm.

b. Lay the victim in a prone position, one arm extended directly overhead, and the other arm bent at the elbow so that the back of the hand supports the head. The face should be turned away from the bent elbow so that the nose and mouth are free for breathing.

c. Open the victim's mouth and remove any foreign bodies, such as false teeth, chewing gum, or tobacco. The mouth should remain open, with the tongue extended. Do not permit the victim to draw his tongue back into his mouth or throat.

d. If an assistant is available during resuscitation, he should loosen any tight clothing to permit free circulation of blood and to prevent restriction of breathing. He should see that the victim is kept warm, by applying blankets or other covering, or by applying hot rocks or bricks wrapped in cloth or paper to prevent injury to the victim. The assistant should also be ever watchful to see that the victim does not swallow his tongue. He should continually wipe from the victim's mouth any frothy mucus or saliva that may collect and interfere with respiration.

e. The resuscitating operator should straddle the victim's thighs, or one leg, in such manner that:

(*1*) the operator's arms and thighs will be vertical while applying pressure on the small of the victim's back;

(*2*) the operator's fingers are in a natural position on the victim's back with the little finger lying on the last rib;

(*3*) the heels of the hands rest on either side of the spine as far apart as convenient without allowing the hands to slip off the victim;

(*4*) the operator's elbows are straight and locked.

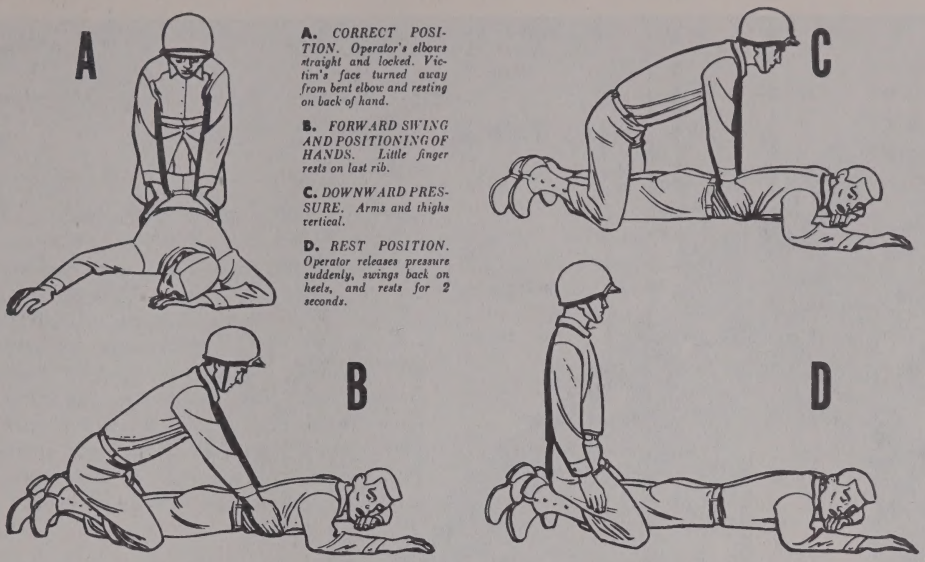
f. The resuscitation procedure is as follows:

(*1*) Exert downward pressure, not exceeding 60 pounds, for 1 second.

(*2*) Swing back, suddenly releasing pressure, and sit on the heels.

(*3*) After 2 seconds rest, swing forward again, positioning the hands exactly as before, and apply pressure for another second.

g. The forward swing, positioning of the hands, and the downward pressure should be accomplished in one continuous motion, which requires 1 second. The release and backward swing require 1 second The addition of the 2-second rest makes a total of 4



A. *CORRECT POSITION. Operator's elbows straight and locked. Victim's face turned away from bent elbow and resting on back of hand.*

B. *FORWARD SWING AND POSITIONING OF HANDS. Little finger rests on last rib.*

C. *DOWNWARD PRESSURE. Arms and thighs vertical.*

D. *REST POSITION. Operator releases pressure suddenly, swings back on heels, and rests for 2 seconds.*

seconds for a complete cycle. Until the operator is thoroughly familiar with the correct cadence of the cycle, he should count the seconds aloud, speaking distinctly and counting evenly in thousands. Example: one thousand and one, one thousand and two, etc.

h. Artificial respiration should be continued until the victim regains normal breathing or is pronounced dead by a medical officer. Since it may be necessary to continue resuscitation for several hours, relief operators should be used if available.

RELIEVING OPERATOR.

The relief operator kneels beside the operator and follows him through several complete cycles. When the relief operator is sure he has the correct rhythm, he places his hands on the operator's hands without applying pressure. This indicates that he is ready to take over. On the backward swing, the operator moves and the relief operator takes his position. The relieved operator follows through several complete cycles to be sure that the new operator has the correct rhythm. He remains alert to take over instantly if the new operator falters or hesitates on the cycle.

STIMULANTS.

a. If an inhalant stimulant is used, such as aromatic spirits of ammonia, the individual administering the stimulant should first test it himself to see how close he can hold the inhalant to his own nostril for comfortable breathing. Be sure that the inhalant is not held any closer to the victim's nostrils, and then for only 1 or 2 seconds every minute.

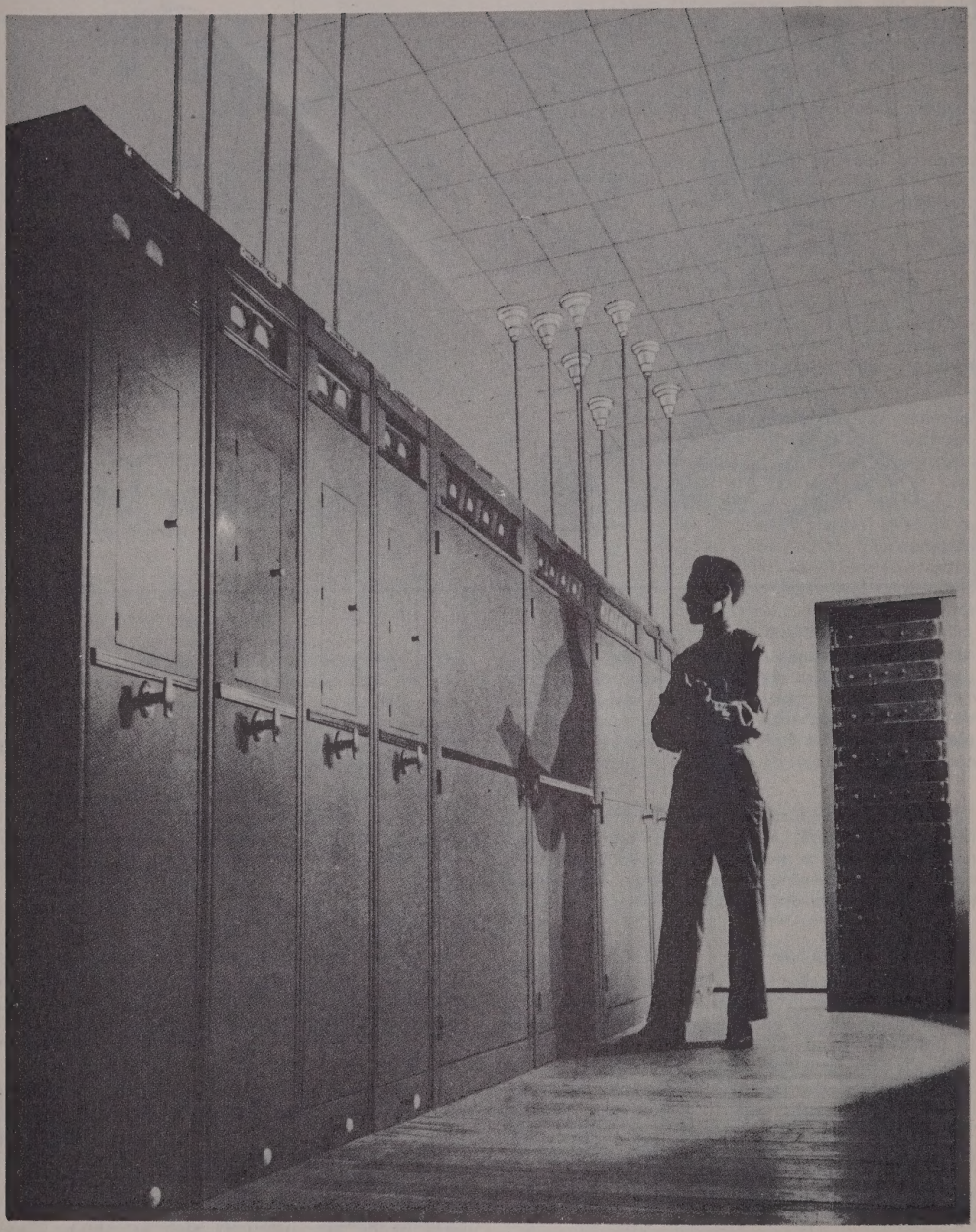
b. After the victim has regained consciousness, he may be given hot coffee, hot tea, or a glass of water containing ½ teaspoon of aromatic spirits of ammonia. *Do not give any liquids to an unconscious victim.*

CAUTIONS.

a. After the victim revives, keep him LYING QUIETLY. Any injury a person may have received may cause a condition of shock. Shock is present if the victim is pale and has a cold sweat, his pulse is weak and rapid, and his breathing is short and gasping.

b. Keep the victim lying flat on his back, with his head lower than the rest of his body and his hips elevated. Be sure that there is no tight clothing to restrict the free circulation of blood or hinder natural breathing. Keep him warm and quiet.

c. A resuscitated victim must be watched carefully as he may suddenly stop breathing. *Never leave a resuscitated person alone until it is CERTAIN that he is fully conscious and breathing normally.*



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Figure 1. Radio transmitter (Wilcox Electric type 96C3) and associated equipment.

PART ONE

INTRODUCTION

SECTION I. DESCRIPTION

1. GENERAL.

Radio transmitters (Wilcox Electric types 96C and 96C3) are designed to generate 2,500 watts of carrier power at any frequency from 2,000 to 18,000 kilocycles (kc). The transmitter is housed in a steel cabinet which contains all of the transmitter equipment, but not the power supplies nor the modulator. The rectifier and modulator are separate units. In conjunction with its associated control and power equipment, the transmitter may be used for continuous-wave (c-w), voice modulated, or teletype transmission. The equipment is intended primarily for point-to-point and ground-to-air communications. Types 96A and 96C are earlier models of the 96C3. Type 96A was designed for operation from 2,000 to 12,000 kc, but when equipped with additional coils and with careful tuning procedure, it can be operated up to 17,000 kc.

2. APPLICATION OF EQUIPMENT.

a. Radio Transmitters types 96C and 96C3. Figure 2 is a block diagram of a typical installation of types 96C and 96C3 and their associated power and control equipment. Power is nor-

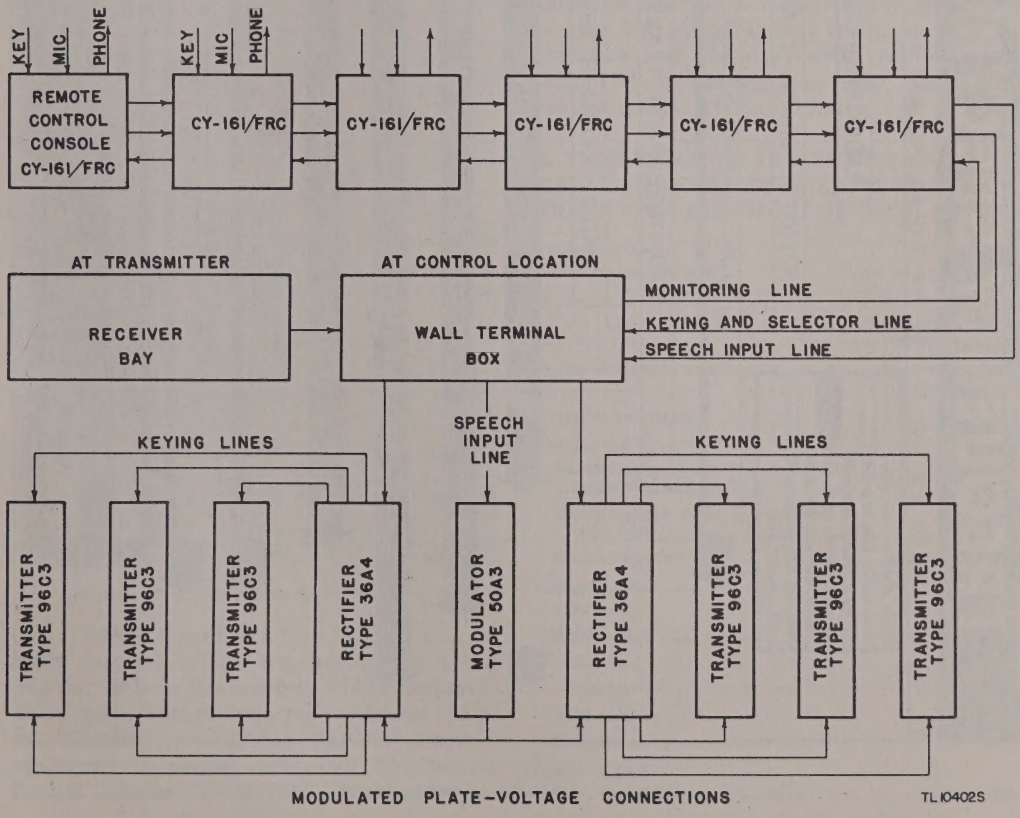


Figure 2. Radio transmitter (Wilcox Electric type 96C3) and associated equipment, block diagram.

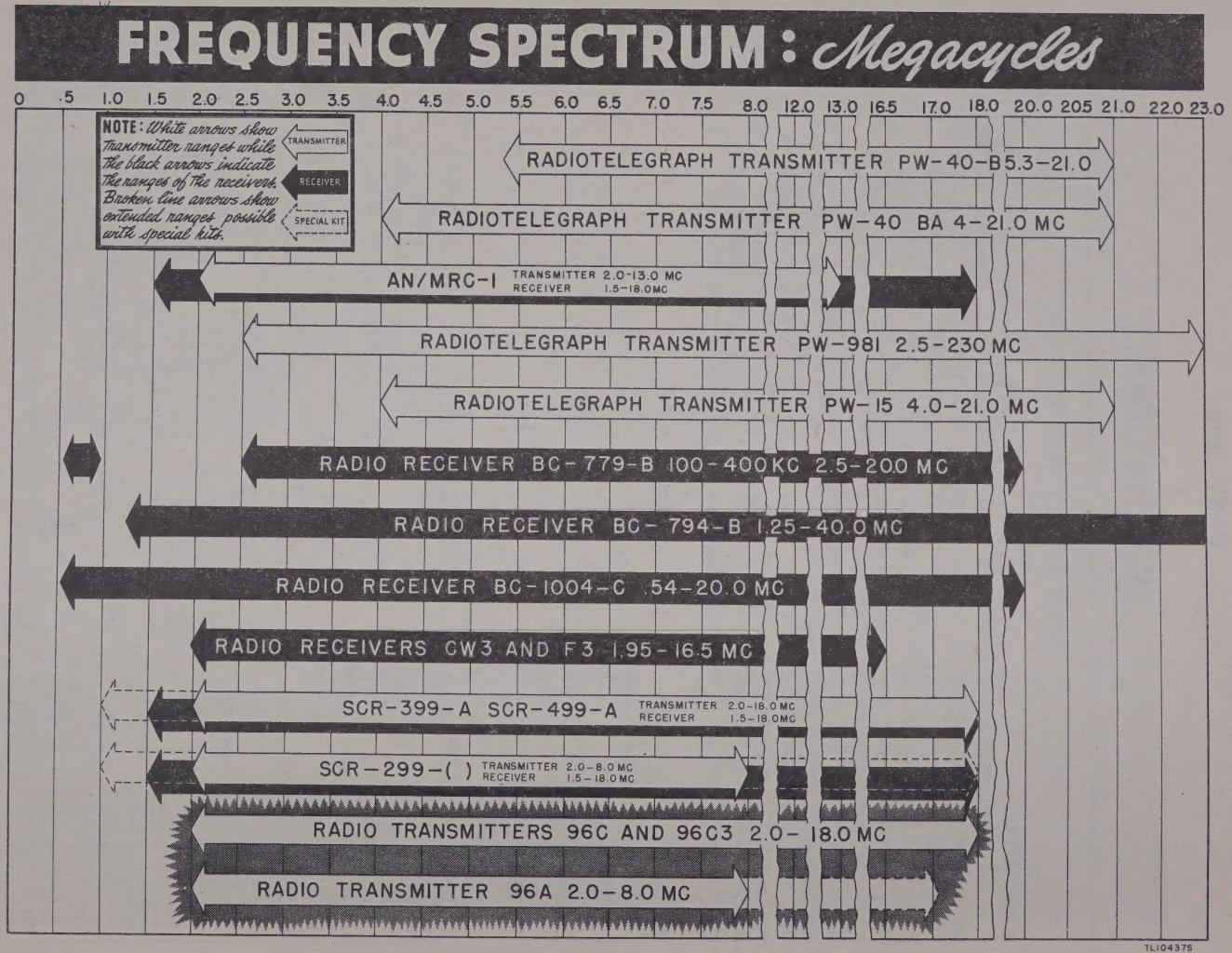


Figure 3. Frequency spectrum chart.

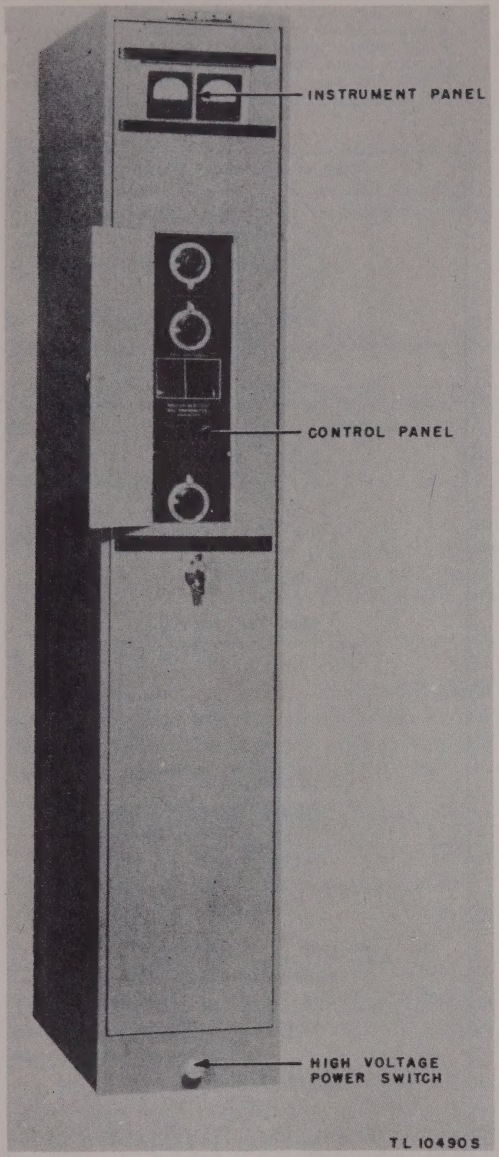


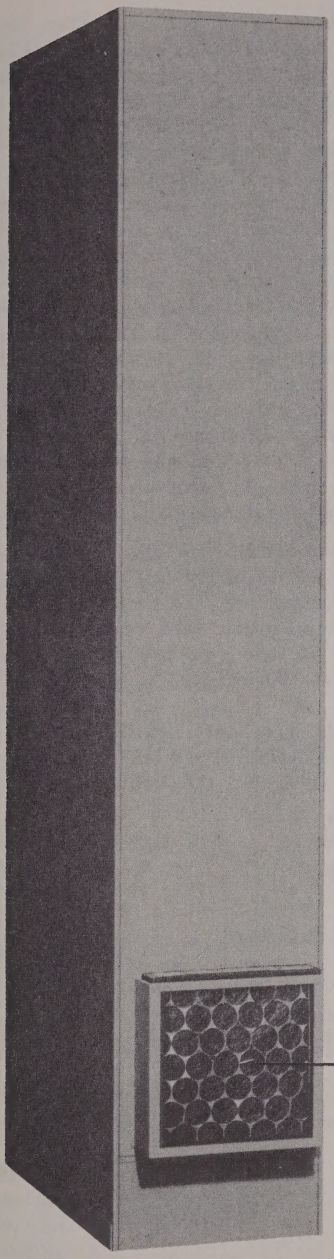
Figure 4. Radio transmitter (Wilcox Electric type 96C3), front view.

mally supplied to the transmitters from the rectifier (Wilcox Electric type 36A4), and modulated plate voltage from the modulator (Wilcox Electric type 50A3). The transmitting equipment is usually controlled by Remote Control Console CY-161/FRC. For smaller installations consisting of not more than two transmitter channels, the transmitting equipment may be controlled by remote control console (Wilcox Electric type CS380F). With Remote Control Console CY-161/FRC, any number of transmitting channels up to nine may be remotely controlled. Two rectifiers type 36A4 are required to supply power for five or more transmitters. Control facilities are provided in the remote control consoles for as many as four modulators. Receiver bay (Wilcox Electric type 113A) may also be installed at or near the control station and is controlled by Remote Control Console CY-161/FRC. The receiver bay consists of a steel cabinet in which may be installed eight fixed-frequency receivers (Wilcox Electric types CW3 or F3). Receiver type CW3 is designed for c-w reception and receiver type F3 for phone reception. Any combination of the two types may be installed in the receiver bay.

b. Radio Transmitter type 96A. The application of type 96A is similar to the application of type 96C except that it is designed for installation and operation with rectifier-modulator (Wilcox Electric type 26B) and remote control console (Wilcox Electric type CS380).

3. TECHNICAL CHARACTERISTICS OF RADIO TRANSMITTERS (WILCOX ELECTRIC TYPES 96A, 96C, AND 96C3).

Frequency range:	
One preset channel	2,000 kc to 18,000 kc
Transmitter type	crystal-controlled, amplifier-doubler, power-amplifier
Types of signals transmitted	c-w, m-c-w, voice, and teletype
Type of modulation	amplitude
Number of tubes:	
Exciter stage radio transmitters types 96C and 96C3	7
Exciter stage radio transmitter type 96A	6
Final amplifier	2
Power input:	
4,000-volt	0.850 amp
2,000-volt	0.175 amp
+500-volt	0.120 amp
—500-volt	0.050 amp
+12-volt	1.0 amp
220-volt ac	10.0 amp
Power output:	
C-w, m-c-w, voice or teletype	2,500 watts



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Figure 5. Radio transmitter (Wilcox Electric type 96C3), rear view

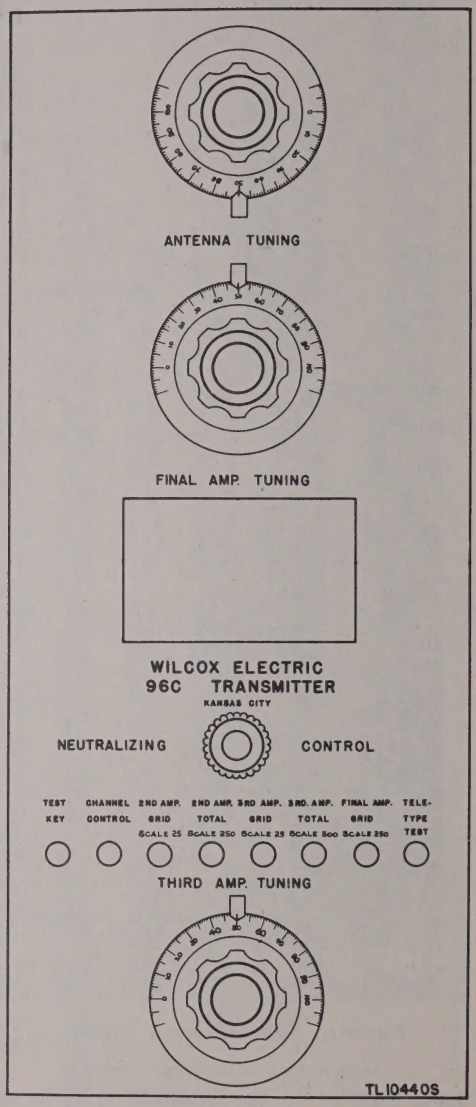


Figure 6. Radio transmitter (Wilcox Electric type 96C3), panel details.

NOTE: Radio transmitter type 96A is not adapted to teletype operation. Radio transmitters types 96C and 96C3 having serial Nos. 1 to 2323 are not adapted to continuous teletype operation. Radio transmitter type 96C3, serial No. 2324 and all following, are adapted to continuous teletype operation.

Power supply:
Radio transmitters types 96C and 96C3:
Plate and bias supplies ..... rectifier type 36A4
Modulated plate voltage ..... modulator type 50A3
Radio transmitter type 96A:
Rectifier-modulator type 26B

Weight:
Radio transmitters (Wilcox Electric) types 96C and 96C3 ..... 365 lb.
Radio transmitter type 96A ..... 375 lb.

4. FREQUENCY SPECTRUM CHART.

Figure 3 is a frequency spectrum chart of radio transmitters types 96A, 96C, and 96C3, including the frequency range of other equipment with which the transmitters normally communicate.

5. TABLE OF COMPONENTS.

COMPONENT	Required No.	Height (in.)	Depth (in.)	Length (in.)	Volume (cu ft)	Weight (lb)
Cabinet, radio transmitter (Wilcox Electric, type 96C3)	1	73¾	26¼	12¼	13.6	365
Exciter unit (Wilcox Electric, type 96C3-10)	1	8¾	8½	17¼		27
Coil set	1					6.7
Tube set, operating	1					11.0
TM11-2671	2	8	⅜	10½		1.0
Teletype modification kit	1					6.0

NOTE: This list is for general information only. See appropriate publications for information pertaining to requisition of spare parts.

6. PACKING DATA.

The equipment is packed in seven wooden boxes of weights and dimensions given in the following table. The contents of each box are listed in the table of components (par. 5).

Package No.	Height (in.)	Depth (in.)	Length (in.)	Volume (cu. ft.)	Weight (lb.)
1	87½	38¾	19¾	38.8	667
2, 3, 4	28¼	21¼	23¼	8.1	46
5	27⅛	11⅞	5¾	1.1	19
6	26¼	14⅛	7½	1.6	*
7	9⅛	13	29¼	2.0	*

7. DESCRIPTION OF MAJOR COMPONENTS OF RADIO TRANSMITTER (WILCOX ELECTRIC TYPE 96C3).

a. Radio Transmitter Cabinet. Radio Transmitter type 96C3 is assembled in a steel cabinet 72 inches high, $12\frac{5}{16}$ inches wide, and $24\frac{5}{8}$ inches deep. Figure 4 is a front view of the transmitter with the control panel door open. Figure 5 is a rear view of the cabinet showing the air inlet grill and filter for the forced air ventilating system.

b. Instrument Panel. The instrument panel contains two ammeters for checking currents in all of the important circuits in the transmitter. Multiscale ammeter M2 at the right indicates all grid and plate currents except the final-amplifier plate current. The various circuits are connected to the instrument individually by pressing the meter push buttons on the control panel. Ammeter M1 at the left indicates the total current of the final amplifier. It is permanently connected in this circuit.

c. Control Panel. All of the controls and adjustments of the transmitter are concentrated in the control panel (fig. 6). The control panel has a window for observing the operation of the power tubes.

d. Cabinet Slide. All of the transmitter circuit and relay equipment is mounted on a slide which can be pulled out readily to expose all of the equipment for maintenance. The construction of the slide is shown clearly in figures 44 and 45. To move the slide forward to the position shown in figure 44 the handle at the front of the cabinet is given a quarter-turn to the left to unlatch the slide. The slide may then be pulled forward. All electrical connections to the slide are made by flexible leads. The transmitter's nameplate is mounted on the triangular brace at the top front of the slide (fig. 44). The nameplate gives the type and serial num-

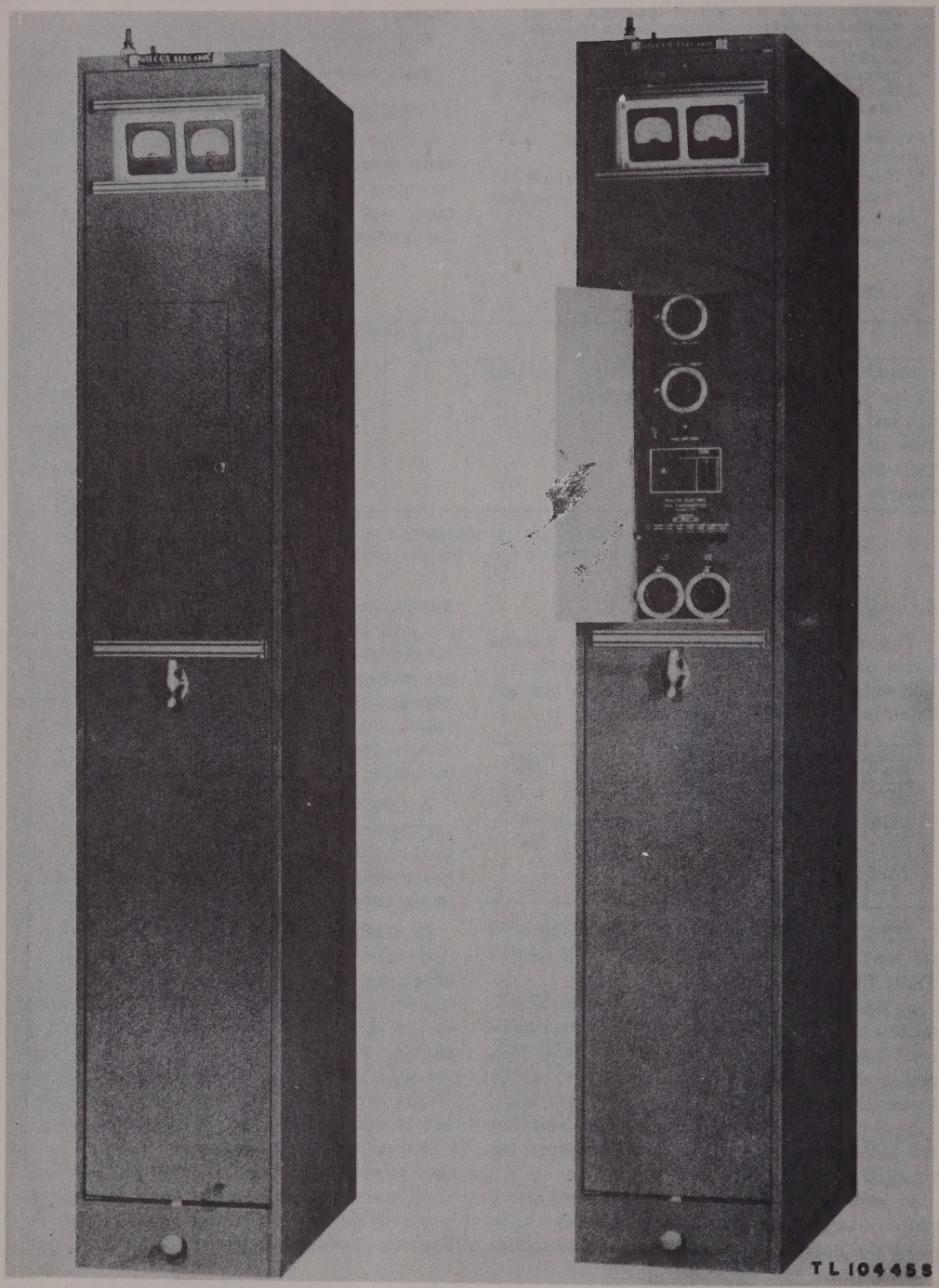


Figure 7. Radio transmitter (Wilcox Electric type 96A), front views.

ber of the transmitter. The type number was changed from 96C to 96C3 on serial No. 926. Serial No. 926 and all succeeding transmitters are type 96C3.

e. Exciter Unit. The exciter unit is assembled on a 17¼ inch by 8⅜-inch chassis which is mounted on the slide just below the final-amplifier tubes as shown in figure 44. Figure 46 is a side view of the exciter unit. The unit includes the crytal controlled oscillator, the first amplifier, the second amplifier, and the third amplifier, exclusive of the plate circuit. It also includes the electronic keying circuit, the electronic channel control, and the bias isolator circuit.

f. Final Amplifier. The final amplifier equipment is mounted in the upper half of the slide as shown in figure 44.

g. Antenna-loading Network. The antenna-loading network capacitor and coil are mounted in the top of the slide.

h. High-voltage Switch. The high-voltage switch is mounted in the base of the cabinet and is operated by the knob located at the front of the cabinet just above the base. All of the high-voltage direct-current (d-c) supplies required for the transmitter are connected through this switch. The switch also carries two interlocks which are described as part of the relay system.

i. Relay System. The transmitter is equipped with an extensive relay system for channel control and keying from a remote control console, and for protection of the equipment and the operators.

(1) Channel Control. The electronic channel control consists of a tube and a group of relays which apply filament voltages to several of the transmitter tubes and apply several other voltages to prepare the transmitter for transmission. The control is actuated by closing a transmitter selector switch at the remote control console. The tube and part of the relays are mounted in the exciter unit.

(2) Keying Control. The electronic keying control consists of a tube which places the transmitter carrier on the air whenever it receives a 1,000-cycle signal from the remote control console. The 1,000-cycle signal is keyed at the remote console. The keying control tube and circuit are part of the exciter unit.

(3) Bias Relay. In case of failure of the bias supply, the bias control relay disconnects the power tube filament transformers and certain plate voltages to prevent damage to the tubes. The relay is mounted in the exciter unit.

(4) Overload Relay. The overload relay shuts off the 4,000-volt supply in the rectifier in case of an overload on the final amplifier. The relay is mounted in the exciter unit.

(5) Underload Relay. The underload relay operates in conjunction with the modulator interlock to disconnect the modulated plate voltage from the transmitter when the final-amplifier output is too low for satisfactory voice modulation. The relay is mounted in the exciter unit.

(6) Interlock System. The transmitter is equipped with a complete interlock system to protect the operator from contact with high voltage. The cabinet slide carries one interlock switch and the high-voltage switch carries two. The 4,000-volt and 2,000-volt supplies from the rectifier are shut off instantly when the interlock circuit is opened. Opening the slide without pulling the high-voltage switch knob out opens the interlock and shuts off the high-voltage supplies from all of the transmitters. However if the high-voltage switch is opened first, the rectifier will be shut off only during the time in which the switch is being opened.

WARNING: Do not operate the slide interlock except by pushing the slide into the cabinet.

j. Blower Assembly. The blower assembly is mounted at the bottom of the slide as seen in figure 44. The blower draws air through the grill and filter at the back of the cabinet, and is exhausted through a grill in the top of the cabinet.

k. Fuses. The transmitter has four fuses for the protection of the transmitter circuits from overload. These fuses are mounted in fuse clips at the lower part of the slide (fig. 44).

8. DIFFERENCES IN MODELS.

a. Radio Transmitter Type 96C. Type 96C is identical with type 96C3 except for a minor circuit change in the electronic keying control equipment. This slight change in design does not result in any change in the operation of the equipment. See paragraph 7d for serial numbers of types 96C and 96C3.

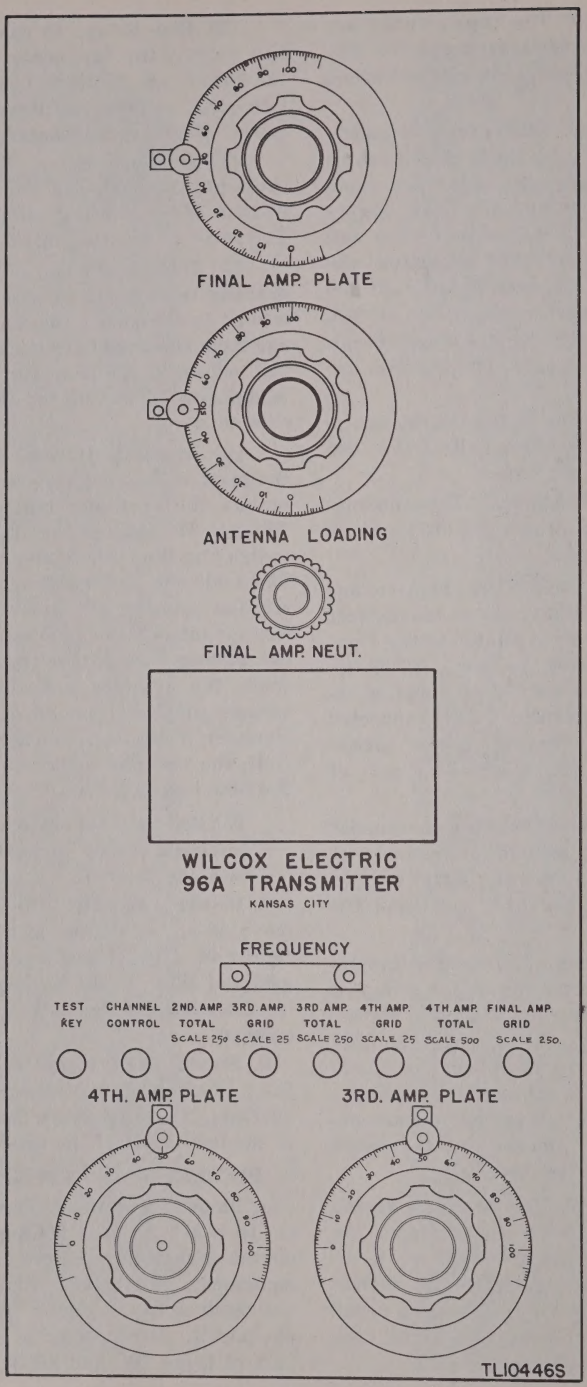


Figure 8. Radio transmitter (Wilcox Electric type 96A), front panel details.

b. Radio Transmitter Type 96A. Type 96A was the first of this group of transmitters. It is assembled in the same cabinet as types 96C and 96C3, has the same power output and covers about the same frequency range, but is quite different in electrical and mechanical design as seen in figures 7, 8, 52, and 53.

c. Modification of Radio Transmitter Type 96C3 for Teletype Operation. The addition of a larger final amplifier blocking capacitor C38 for continuous teletype operation necessitated the mechanical redesign of the final-amplifier circuits. The changes are shown clearly in figure 51. Transmitters with serial No. 2324 and higher are manufactured according to figure 51. The modification for teletype operation also involves the installation of a coaxial cable and connector to conduct the teletype signals to the exciter unit. Since this modification is made in the field the installation is described under auxiliary equipment in section XI.

SECTION II. INSTALLATION

9. SITING.

a. Radio Transmitters Types 96C and 96C3. The location of the transmitter equipment will be determined by the availability of suitable grounding, space for the several antennas and suitable housing. The amount of room space required for any number of units can readily be determined from the diagram of installation dimensions (fig. 9). Adequate clearance to the walls must be maintained for servicing the equipment. The floor must be smooth and level to make the units line up accurately. The weight table below should be used to check the floor loading. The total weight of the installation will be determined by the number of units installed.

Component	Weight (lb)
Rectifier (Wilcox Electric type 36A4)	1616
Modulator (Wilcox Electric type 50A3)	963
Transmitter (Wilcox Electric type 96C3)	365

b. Radio Transmitter Type 96A. Since type 96A is connected to different power equipment than types 96C and 96C3, the space requirements are somewhat different. Otherwise the siting problems are the same. See figure 10 for installation dimensions of the type 96A.

10. UNPACKING AND REMOVAL OF WATERPROOFING.

Use particular care when unpacking or handling the equipment, because it may be damaged easily when not protected by the packing case. In unpacking the transmitter and associated equipment, follow the steps outlined below.

a. Opening Box No. 1.

(1) Set crate on floor, with skids down, close to installation point.

(2) Remove steel bands.

(3) Using a nail puller, remove the lower two rows of nails from both sides of the crate. Remove the lowest row of nails from both end pieces of the crate.

(4) Lift crate straight up until free and set it aside.

(5) Remove waterproof lining, taking care to avoid damage to moisture barrier beneath.

(6) Remove moisture barrier by cutting away heat-sealed surfaces along three sides. Roll back out of way.

(7) Remove steel bands binding unit to pallet. The silica-gel bags beneath the bands may be discarded or saved for reprocessing. The cabinet can then be lifted out.

b. Opening Boxes No. 2, 3, and 4. These boxes contain one set of operating tubes and two sets of spare tubes. Two copies of TM 11-2671 will be packed with the operating tubes.

(1) Remove steel bands and eight wood screws from lid.

(2) Lift lid, exposing contents packed in corrugated carton. Each tube is contained in a two-piece, slide-corrugated fiberboard carton and is further contained in a standard tube carton.

c. Opening Box No. 5 (Teletype Modification Kit).

(1) Remove strapping and pull nails from lid of box. Lift off boards, exposing waterproof case liner.

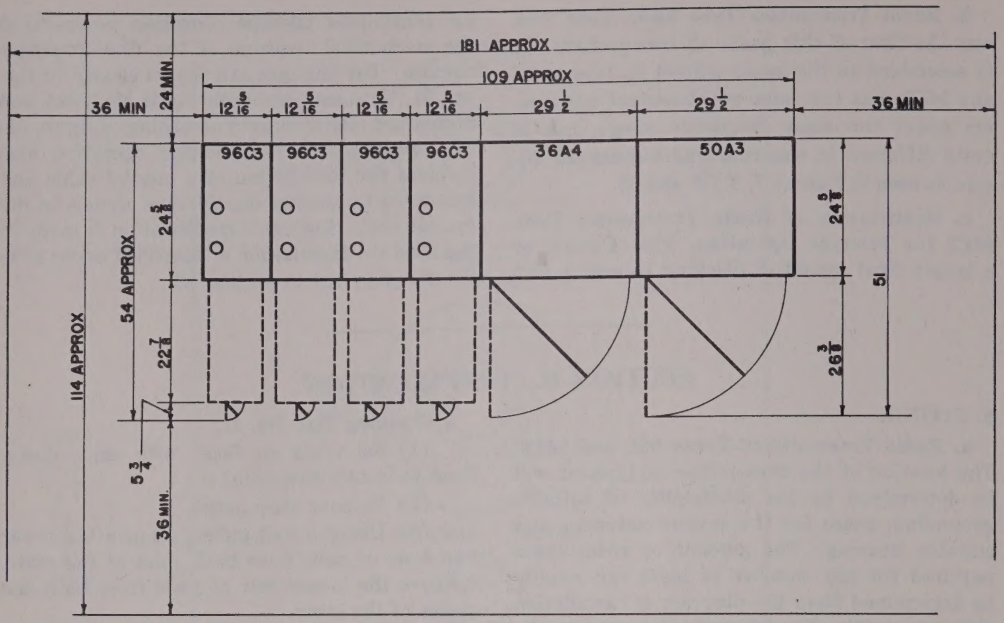


Figure 9. Radio transmitter (Wilcox Electric type 96C3) and associated equipment, installation dimensions.

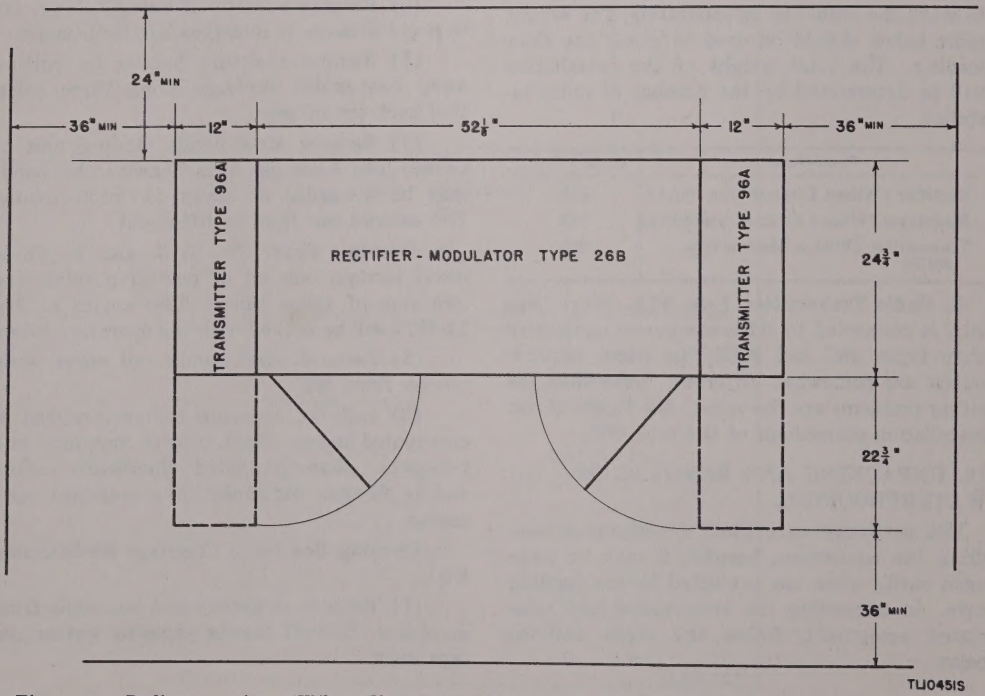


Figure 10. Radio transmitter (Wilcox Electric type 96A) and associated equipment, installation dimensions.

(2) Remove case liner and cut through corrugated carton to reveal four packages. One foil envelope incloses the gooseneck connector and concentric line. Another foil envelope contains the inner-outer telescope assembly. The transmission line box and box top and Socket SO-39 are wrapped in a third foil envelope, together with necessary hardware. A package of Kraft paper and waxed wrapper holds the transmission line box slide cover.

d. Opening Box No. 6. This box is similar to Box No. 5 and may be opened in the same way. Removal of the case liner discloses ten packages. Four contain Johnson coils, each packed separately in boxes covered with Kraft paper and waxed wrappers. Four packages contain ceramic coils inclosed in foil tubes. Each coil is packed with silica gel in a carton padded with tissue paper. The crate also contains the final-amplifier plate blocking capacitor C38 (par. 8c), packed in a wax-sealed carton. Four operating fuses, F1, F2, F3, and F4, are wrapped in a foil envelope making up the tenth package.

e. Opening Box No. 7 (Spare Parts). Remove strapping and pull nails from box lid, exposing corrugated carton, containing one complete set of spare parts as itemized on the accompanying packing lists.

11. MOUNTING TRANSMITTER EQUIPMENT CABINETS.

a. Transmitters Types 96C and 96C3. Figure 11 gives the mounting and drilling dimensions for four transmitters, one rectifier, and one modulator. These dimensions may readily be extended to cover any number of units. The bolt holes for wood flooring or expansion bolts for concrete should be drilled before the cabinets are moved into place. In case of steel flooring, the holes should be drilled and tapped for ¼-20 machine screws. After drilling the holes in the floor, move the transmitter cabinet approximately into place and withdraw the transmitter slide. To remove the slide from the cabinet, turn the handle a quarter-turn to the left and pull the slide forward to the stop. In this position the cabinet will tilt forward unless the slide is supported at the front. Remove the antenna and ground leads from the bushings at the top of the slide. Remove the slide and set it on the floor in front of the cabinet by disengaging the four catches at the front end of the slide supports. Lower the slide to the floor carefully to avoid damage to the transmitter equipment. It is not necessary to disconnect the flexible cable from the transmitter terminal board if the slide is turned to the left directly in front of the cabinet. Shift the cabinet to its exact location over the bolt holes and fasten it to the floor after replacing the slide in the cabinet. Reconnect the ground and antenna leads and re-engage the catches on the slide supports. Push the slide into the cabinet and then withdraw it to check the operation of the roller supports. The catches should stop the slide when it is pulled forward.

b. Transmitter Type 96A. Set the rectifier-modulator in place and attach it to the floor with four bolts through the holes in the corner of the cabinet Remove the transmitter slide from the cabinet to facilitate installing it beside the rectifier-modulator. First remove the antenna and ground connections from the slide. Then disconnect the flexible cable on the slide from the terminal board, trip the locks and remove the slide from the cabinet. Set the cabinet beside the rectifier-modulator and attach it to the floor with ½-inch or $\frac{5}{16}$-inch lag screws through the holes provided in the bottom of the cabinet. Disassemble the remaining transmitters as described above, and attach in place on either side of the rectifier-modulator. After all transmitters are bolted in place, drill a hole with a No. 10 drill through the sides of the cabinets near the top front, and fasten together with a 10-32 machine screw. Reassemble all slides in the cabinets.

12. INSTALLATION OF EXCITER UNIT.

a. Radio Transmitters Types 96C and 96C3. The exciter unit is mounted on the transmitter slide as shown in figure 44. It is attached with three machine screws at each end of the unit. To start the nuts on the screws inside the exciter unit, open the door shown at the lower part of the slide in figure 45. After the unit is attached to the slide, clamp the rubber-covered cable with the clamp provided on transformer T2 (figs. 44 and 46).

b. Radio Transmitter Type 96A. The exciter unit is installed by inserting it in its compartment as seen in figure 47. There are no attaching screws or bolts.

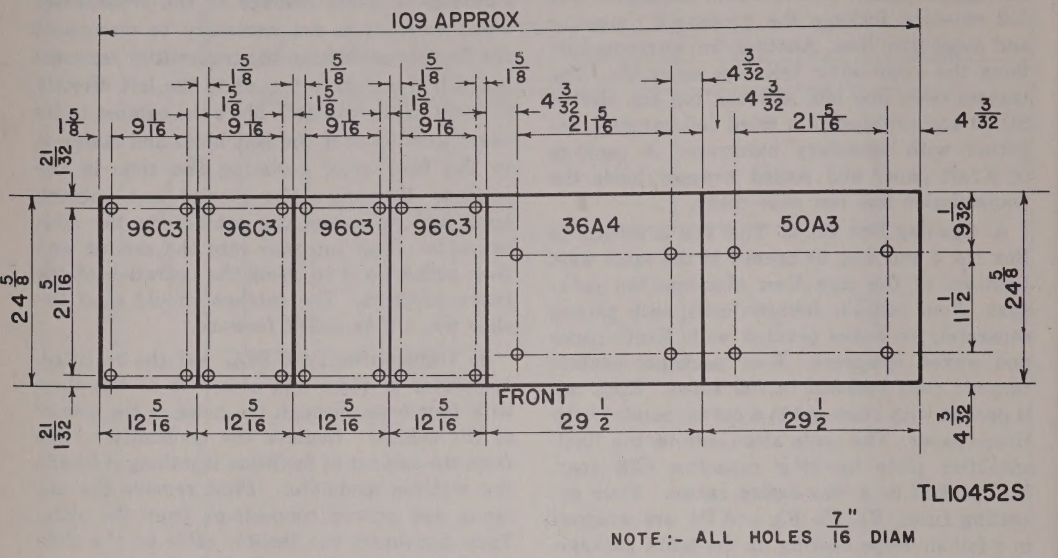


Figure 11. Radio transmitter (Wilcox Electric type 96C3) and associated equipment, mounting dimensions.

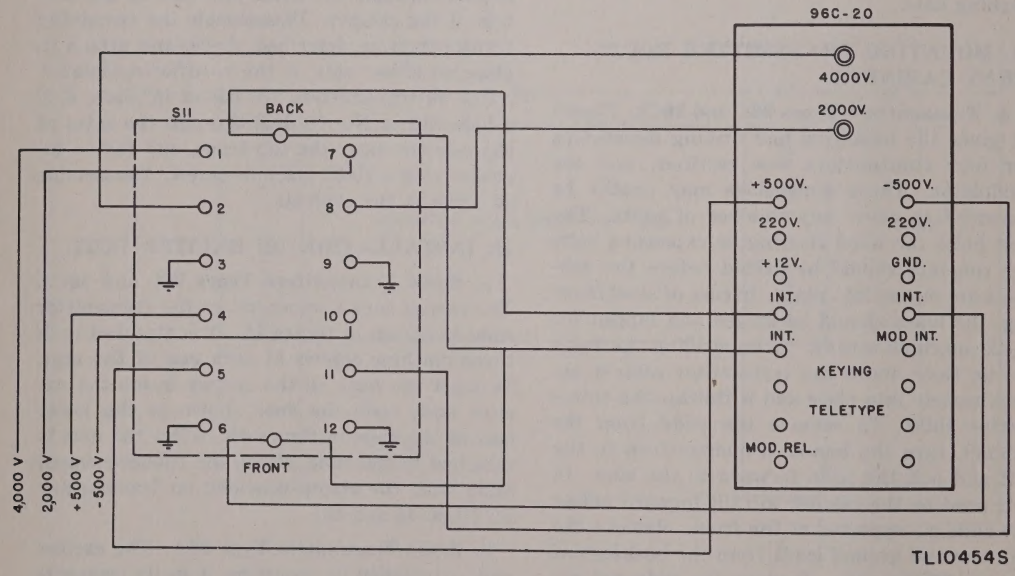


Figure 12. Radio transmitter (Wilcox Electric type 96C3), connections from high-voltage switch to terminal board.

13. CONNECTIONS BETWEEN CABINET COMPONENTS.

a. Radio Transmitters Types 96C and 96C3. Connect jack J1 of the transmitter wiring to plug P1 of the exciter unit (figs. 44 and 46). This is the only connection to be made within the transmitter except the connections to the tube plates and grids and the tap connections to the final-amplifier plate coil and the antenna-loading coil.

b. Radio Transmitter Type 96A. Connect jack J1 of the transmitter wiring to plug P1 of the exciter unit (fig. 47). This is the only connection to be made within the transmitter except the tube plate and grid connections and tap connections to the fourth and final-amplifier tuning coils and the antenna-loading coil.

14. INTERCONNECTIONS FOR RADIO TRANSMITTER (WILCOX ELECTRIC TYPE 96C3).

All interconnections between the various units are made through the cableway extending along the rear of each unit just above the base. The hole in the side of the cabinet is shown at the extreme lower right of figure 44. A cover is provided for the units at either end of the transmitter equipment line. Line connections from the remote control console wall terminal box are led into the equipment through the opening in the base at one end of the equipment. Figure 56 is a complete interconnection diagram for a station having only one transmitter. All power and control connections between the transmitter equipment units are shown in a cable to simplify the diagram. The first number is the wire number and the second the number of the cable. The bend where the wire enters the cable indicates its direction after entering the cable. The 4,000-volt, 2,000-volt, +500-volt, and —500-volt power supplies are connected to the high-voltage switch in the base of the transmitter as shown in figure 12. It is very important that no error be made in these four connections. The location of high-voltage switch S11, transmitter terminal board 96C-20, and alternating-current (a-c) line switch S8 are shown clearly in figure 13. Refer to paragraph 17 for interconnections for teletype operation.

15. TRANSMITTER EQUIPMENT INTERCONNECTIONS FOR MULTIPLE UNIT STATIONS.

Figures 57, 58, 59, and 60 show the interconnections for various numbers of transmitters type 96C3, rectifiers type 36A4 and modulators type 50A3. The method of illustrating the connections is the same as in figure 56 except that an increased number of cables are utilized to simplify the tracing of the drawings. The wires are grouped as cables only for schematic diagram purposes, the cables having no physical significance in the actual wiring. All interconnecting leads are placed at random in the cableway. For details of the connections to the receiver bay type 113A refer to TM 11-853.

16. INTERCONNECTIONS FOR RADIO TRANSMITTER (WILCOX ELECTRIC TYPE 96A).

All interconnections are made through the cableway extending along the rear of each unit just above the base. The hole in the side of the cabinet is shown at the extreme lower right of figure 52. A cover is provided for the units at either end of the transmitter equipment line. Line connections from the remote control stations are led into the transmitter equipment through the opening in the base at one end of the line. Figure 61 is an interconnection diagram for a station consisting of two radio transmitters type 96A and one rectifier-modulator type 26B. All power and control connections between the units are shown in a cable to simplify the diagram. The first number is the wire number and the second the number of the cable. The 4,000-volt, 2,000-volt, 500-volt, and bias supplies are connected to the high-voltage switch in the base of the transmitter. These connections are made to the switchbox in the same manner as for transmitters types 96C and 96C3 (fig. 12). For information concerning the interconnections of a larger number of transmitters see Transmitting Equipment Instruction Book for Ground Station (Wilcox Electric type 96A).

17. INTERCONNECTIONS FOR TELETYPE OPERATION.

The 4,000-volt plate supply must be filtered for teletype operation. To reconnect the power supply to any transmitter for teletype operation, remove its 4,000-volt plate connection from the stand-off insulator on relay switching unit

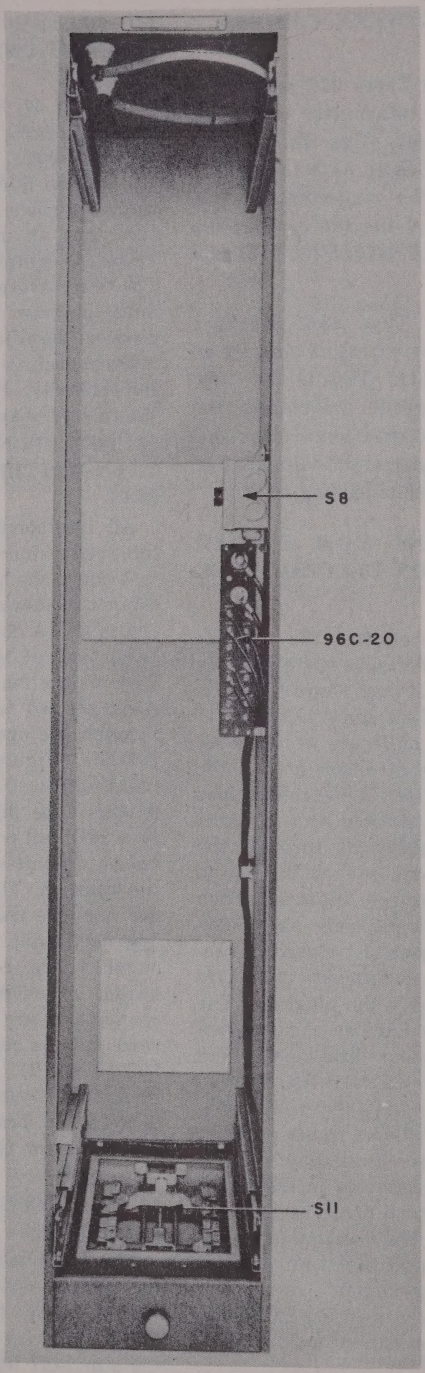


Figure 13. Radio transmitter (Wilcox Electric type 96C3), cabinet interior.

(Wilcox Electric type 36A-16) in the rectifier, and reconnect to the stand-off insulator on shelf C marked +4000 FIL (TM 11-2666). This reconnection is shown as a dotted line in figures 56 to 60. Any number of transmitters may be reconnected for teletype operation but they are then not available for either c-w or voice-modulated transmission. The coaxial line from the teletype sending equipment is connected to a special connector mounted at the back of the transmitter cabinet. See paragraphs 61 to 64 for details of this connection.

18. INSTALLATION OF PLATE AND ANTENNA COILS.

a. Radio Transmitters Types 96C and 96C3, Serial Nos. 1 to 2323.

(1) Final-amplifier plate and antenna coils L9 and L10 (fig. 44) are mounted on the stand-off insulators with machine screws. There are two pairs of these coils, one for the lower part of the freuency range and the other for the upper part of the frequency range.

(2) Third-amplifier plate coil L7 (fig 44) is wound on a ceramic plug-in form. Four of these coils are required to cover the full frequency range of the transmitter. The coils are plugged into the socket in the position shown in figure 44. Attach the two tap connections with the small machine screws provided.

b. Radio Transmitters Types 96C and 96C3 Serial Nos. 2324 and Above.

(1) Antenna coil L10 is attached to the stand-off insulators in the top of the slide, and final-amplifier plate coil L9 is attached to the stand-off insulators just below. There are two pairs of these coils to cover the lower and upper parts of the frequency range.

(2) Third-amplifier plate coil L7 is installed as explained in subparagraph (2) above.

c. Radio Transmitter Type 96A.

(1) Final-amplifier plate coil L5 (fig. 52) is mounted on the stand-off insulators at the top of the slide. Four of these coils are required to cover the full frequency range of the transmitter.

(2) Fourth-amplifier plate coil L4 (fig. 52) is attached to the stand-off insulators near the middle of the slide. Four are required to cover the full frequency range of the transmitter.

19. INSTALLATION OF CRYSTAL AND TUBES.

a. Radio Transmitters Types 96C and 96C3. Remove the crystal and tubes from their containers and check to see if all are in good physical condition. Pull the slide forward to the full length of its travel. Remove the shields from the oscillator unit and insert the crystal and the oscillator tube JAN-6AC7/1852 (fig. 14). To insert the tube, align the guide of the tube pin with the keyway in the socket and push straight down. Replace the shields. Refer to the tube location chart for the location of the other tubes in the exciter unit (fig. 15). Attach the plate connection clips to tubes V3, V4, and V7. To install the two final-amplifier tubes, insert the tube in the socket with the pin at the side of the tube base aligned with the slot in the socket, and turn the tube clockwise to the stop. Attach the plate and grid connections (fig. 44).

b. Radio Transmitter Type 96A. Remove the crystal and tubes from their containers and check to see if all are in good physical condition. Pull the slide forward to the full length of its travel. Remove the plug from the exciter and draw the exciter from its compartment. Remove the oscillator shield and insert the crystal and oscillator tube JAN-6AC7/1852 (fig. 16). To insert the tube, align the guide of the tube pin with the keyway in the socket and push straight down. Replace the shield. Refer to the tube location chart for the location of other tubes in the exciter unit. Attach the plate connection clips to tubes V3, V4, V5, and V6. To install the two final-amplifier tubes, insert the tube in the socket with the pin at the side of the tube base aligned with the slot in the socket, and turn the tube clockwise to the stop. Attach the plate and grid connections.

20. INSTALLATION OF FUSES.

a. Radio Transmitters Types 96C and 96C3. The fuse locations are shown clearly in figure 17. Fuse ratings are given in the following table:

Fuse No.	Description	Rating
F1	2,000-v supply fuse	1 a 5,000 v
F2	4,000-v supply fuse	2 a 10,000 v
F3	500-v supply fuse	1 a 2,000 v
F4	Bias fuse	1 a 2,000 v

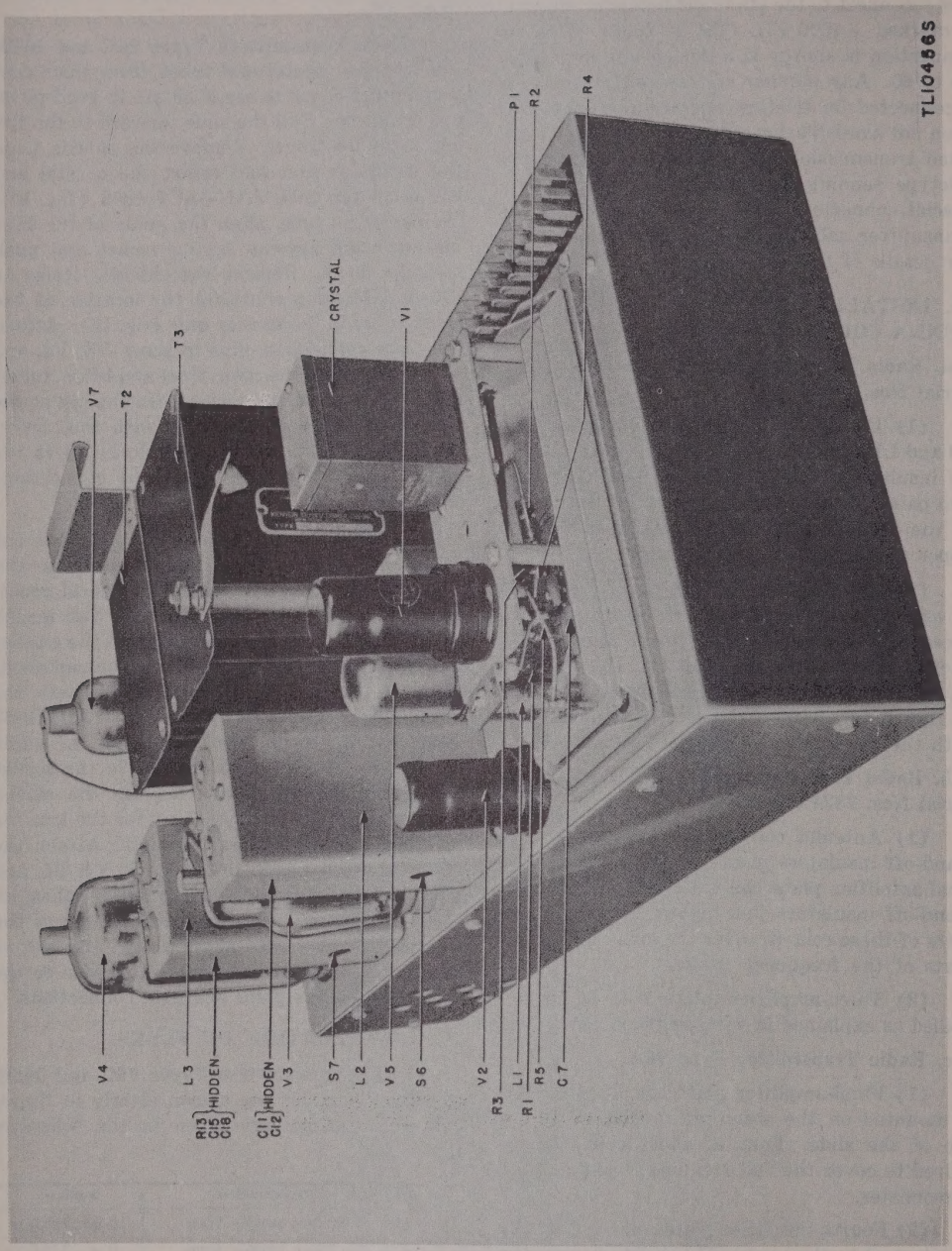


Figure 14. Exciter unit (Wilcox Electric type 96C3-10), less oscillator shields.

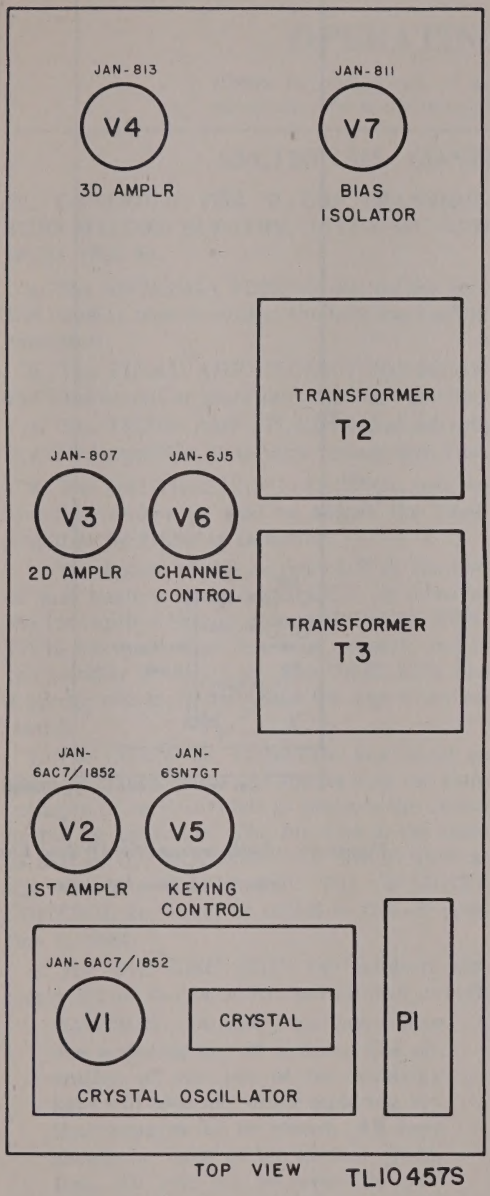


Figure 15. Exciter unit (Wilcox Electric type 96C3-10), tube location chart.

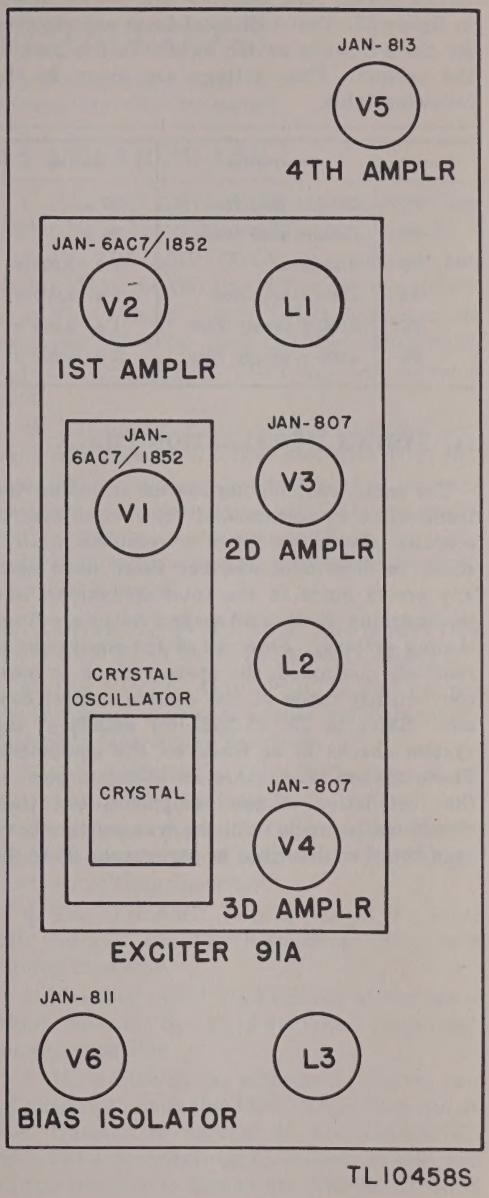


Figure 16. Radio transmitter (Wilcox Electric type 96A), exciter unit, tube location chart.

b. Radio Transmitter Type 96A. The transmitter circuit fuse locations are shown clearly in figure 52. Two additional fuses are required for the a-c power switch located in the back of the cabinet. Fuse ratings are given in the following table.

Fuse No.	Description	Rating
F1	Cabinet plug fuse	10 a
F2	Cabinet plub fuse	10 a
F3	Bias fuse	1 a 1,000 v
F4	500-v supply fuse	1 a 1,000 v
F5	2,000-v supply fuse	1 a 5,000 v
F6	4,000-v supply fuse	2 a 10,000 v

21. SYSTEM INSTALLATION CHECK.

The radio transmitting system including the transmitter equipment and the remote control consoles should be given a complete system check to determine whether there have been any errors made in the interconnections, and to determine whether all control relays are functioning properly. Since all of the equipment is remotely controlled, the system check is most conveniently made at the remote control console. Refer to TM 11-2622 for details of the system checks to be made on the equipment. These system checks are an essential part of the installation of the equipment, but they should not be made until the transmitters have been tuned as described in paragraphs 95 to 99.

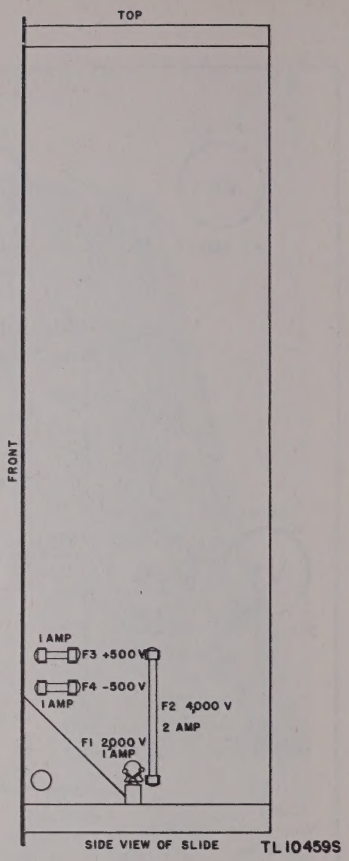


Figure 17. Radio transmitter (Wilcox Electri type 96C3), fuse locations.

PART TWO

OPERATING INSTRUCTIONS

NOTE: For information on destroying this equipment to prevent enemy use, refer to the destruction notice at the front of the manual.

SECTION III. CONTROLS AND THEIR USE

22. CONTROLS FOR RADIO TRANSMITTERS WILCOX ELECTRIC TYPES 96C AND 96C3) (fig. 6).

a. The ANTENNA TUNING dial on the control panel is used to adjust the antenna loading capacitor.

b. The FINAL AMP. TUNING dial adjusts the final-amplifier plate tank tuning capacitor.

c. The THIRD AMP. TUNING dial adjusts the third-amplifier plate tank tuning capacitor.

d. The NEUTRALIZING CONTROL just below the window is used to adjust the final-amplifier neutralizing capacitor.

e. The button at the extreme left of the row of push buttons is the TEST KEY. It turns on the transmitter carrier if the CHANNEL CONTROL key next right has been pressed, and if the rectifier is turned on. The TEST KEY has a spring return which opens the key when released.

f. The CHANNEL CONTROL key turns on filament transformers and applies bias and plate voltages to various tubes to prepare the transmitter for operation. The function is the same as that of the TRANSMITTER SELECTOR at the remote control console. The CHANNEL CONTROL key must be pulled to the off position to open.

g. The 2ND AMP. GRID key connects ammeter M2 in the second-amplifier grid circuit.

CAUTION: Do not press more than one metering key at a time. The operation of any one of the metering keys will open any other metering key that happens to be closed. All keys should be open under normal operation. All keys can be opened by partially closing a key adjacent to the closed one.

h. The 2ND AMP. TOTAL key connects ammeter M2 in the second-amplifier cathode circuit.

i. The 3RD AMP. GRID key connects ammeter M2 in the third-amplifier grid circuit.

j. The 3RD AMP. TOTAL key connects ammeter M2 in the third-amplifier cathode circuit.

k. The FINAL AMP. GRID key connects ammeter M2 in the final-amplifier grid circuit.

l. The TELETYPE TEST key has no function.

m. The ammeter M1 indicates the total current flow through the final-amplifier (fig. 43).

n. The knob at the bottom front of the cabinet controls high-voltage switch S11. All transmitter circuits are disconnected from the high-voltage supplies and grounded when the knob is pulled forward.

23. CONTROLS FOR RADIO TRANSMITTER (WILCOX ELECTRIC TYPE 96A) (fig. 8).

a. The FINAL AMP. PLATE dial on the control panel is used to adjust the final-amplifier plate tank tuning capacitor.

b. The ANTENNA LOADING dial adjusts the antenna loading capacitor.

c. The knob marked FINAL AMP. NEUT. just above the window controls the final-amplifier neutralizing capacitor.

d. The 4TH AMP. PLATE dial at the lower left controls the fourth-amplifier plate tank tuning capacitor.

e. The 3RD AMP. PLATE dial at the lower right controls the third-amplifier plate tank tuning capacitor.

f. The button at the extreme left of the row of push buttons is the TEST KEY. It turns on the transmitter carrier if the CHANNEL CONTROL key next right has been pressed, and if the rectifier is turned on. The TEST KEY has a spring return which opens the key when released.

g. The CHANNEL CONTROL key turns on filament transformers and applies bias and plate voltages to various tubes to prepare the trans-

mitter for operation. The function is the same as that of the transmitter selector switch at the remote control console. The CHANNEL CONTROL key must be pulled to the off position to open.

h. The 2ND AMP. TOTAL key connects ammeter M2 in the second-amplifier cathode circuit.

CAUTION: Do not press more than one metering key at a time. The operation of any metering key will open any other metering key that happens to be closed. All keys should be open under normal operation.

i. The 3RD AMP. GRID key connects ammeter M2 in the third-amplifier grid circuit.

j. The 3RD AMP. TOTAL key connects ammeter M2 in the third-amplifier cathode circuit.

k. The 4TH AMP. GRID key connects ammeter M2 in the fourth-amplifier grid circuit.

l. The 4TH AMP. TOTAL key connects ammeter M2 in the fourth-amplifier cathode circuit.

m. The FINAL AMP. GRID key connects ammeter M2 in the final-amplifier grid circuit.

n. The ammeter M1 indicates the total current flow through the final amplifier as in figure 43.

o. The knob at the front base of the cabinet controls high-voltage switch S10. Pull the knob forward to the stop to disconnect all high-voltage supplies from the transmitter circuits. This action also grounds the transmitter circuits.

SECTION IV. OPERATION

24. STARTING AND STOPPING PROCEDURE FOR RADIO TRANSMITTERS (WILCOX ELECTRIC TYPES 96C AND 96C3).

After the transmitter has been tuned as described in paragraph 95 it is ready for operation. To start the transmitter, pull the slide forward and close the a-c power switch. Close the slide. To stop the transmitter open the same switch. Instructions for starting and stopping the associated power equipment are given in TM 11-2666 and TM 11-2650.

25. STARTING AND STOPPING PROCEDURE FOR RADIO TRANSMITTER (WILCOX ELECTRIC TYPE 96A).

After the transmitter has been tuned as described in paragraph 94, 99, and 100 it is ready for operation. To start the transmitter, pull the slide forward and close the a-c line switch. Close the slide. To stop the transmitter open the same switch. Instructions for starting and stopping the associated power equipment are given in Transmitting Equipment Instruction Book for Ground Station (Wilcox Electric type 96A).

SECTION V. EQUIPMENT PERFORMANCE CHECK LIST

26. PURPOSE AND USE OF CHECK LIST.

a. **General.** The equipment performance check list (par. 27) will help the operator to determine whether the transmitter is functioning properly. The check list gives the item to be checked, the conditions under which the item is to be checked, the normal indications for correct operation, and corrective measures that the operator can take. The check list is divided into two sections. The first is a check list for radio transmitters types 96C and 96C3. The second is for radio transmitter type 96A.

(1) **Radio Transmitters Types 96C and 96C3.** Items 1 to 5 are checked before starting, items 6 to 12 during operation, and items 13 to 20 when stopping. Items 9 to 12 should be checked at least once during a normal operating period or at least four times daily during continuous operation.

(2) **Radio Transmitter Type 96A.** Items 1 to 5 are checked before starting, items 6 to 12 during operation, and items 13 to 21 when stopping. Items 9 to 12 should be checked at least once during a normal operating period or at least four times daily during continuous operation.

b. Action or Condition. For some items the information given in the action or condition column requires pushing certain test keys or adjusting certain controls to permit checking the items. For others the information gives action which must be taken in order to check the normal indication specified in the normal indication column.

c. Normal Indications. The normal indications column includes the visible and audible signs that the operator may observe when he checks the items. Tolerances are given for the meter readings. These readings may be considered satisfactory if they fall within these tolerances. If a meter reads outside the limits specified, trouble may be impending. Corrective measures should be taken as soon as possible on items which do not show normal indications.

d. Corrective Measures. The corrective measures are those which can be taken by the operator without calling in a repairman. Reference to part five in the table indicates that the correction of the trouble cannot be made during operation and that trouble shooting by an experienced repairman is necessary. If the transmitter is completely inoperative or if the recommended corrective measures fail to restore normal operation, trouble shooting is necessary. However, if the tactical situation requires that communication be maintained and if the set is not completely inoperative, the operator must maintain the set in operation as long as it is possible to do so.

e. Preparatory and Starting Items. The preparatory and starting items should be checked each time a transmitter is placed in operation. The meter readings are correct for a-c input voltage of 220 volts. If input voltage exceeds this value the meter readings will be slightly higher. Meter readings should be recorded daily so that impending break-downs, indicated by meter readings which are not normal, may be prevented. The operator must become thoroughly familiar with the normal operation of the equipment so that he may recognize, by both audible and visual means, changes such as meter readings and relay clicks which indicate improper operation of the transmitter.

f. Stopping Items. The items in the stopping group are checked whenever a transmitter is taken out of operation. Any abnormal conditions at this time are symptoms of trouble in the equipment which should be corrected before the next period of operation.

27. EQUIPMENT PERFORMANCE CHECK LIST.

a. Radio Transmitters Types 96C and 96C3.

	Item No.	Item	Action or condition	Normal indications	Corrective measures
PREPARATORY	1	High-voltage switch	Pull out		
	2	Cabinet slide	Turn handle and pull out		
	3	Plug P1.	Plugged into jack J1.		
	4	Antenna terminals	Connected to antenna		
	5	Test keys	Return all test keys to off position		
START	6	A-c power switch	Turn ON	Exciter filaments light	Refer to part five
	7	Cabinet slide	Close and turn handle		
	8	High-voltage switch	Push all the way in		
	9	Meter readings	CHANNEL CONTROL and TEST KEY closed, and the following meter test key closed:	Blower motor heard. Filaments of final amplifier light.	Refer to part five. Refer to part five.
			TELETYPE TEST	0	Check tubes V8 and V9
			FINAL AMP. GRID	50 to 70 ma.	Check tube V4
			3RD AMP. TOTAL	80 to 140 ma.	Check tube V4
			3RD AMP. GRID	3.8 to 8.2 ma.	Check tube V3
			2ND AMP. TOTAL	43 to 65 ma.	Check tube V3
			2ND AMP. GRID	3 to 4 ma.	Check tubes V8 and V9
	10	Meter reading	Close CHANNEL CONTROL and TEST KEY. Read final-amplifier total meter.	0.850 amp.	Retune
EQUIPMENT PERFORMANCE	11	Channel control equipment	Transmitter selected for use by remote operator	Final-amplifier filaments light Blower motor runs	Refer to part five
	12	Meter readings	Transmitter keyed by remote operator	See items 9 and 10 for normal readings	See items 9 and 10
STOP	13	High-voltage switch	Pull out		
	14	Cabinet slide	Turn handle and pull out		
	15	A-c power switch	Turn OFF	Exciter filaments go out	
	16	Cabinet slide	Close and turn handle		
	17	3RD AMP. TUNING dial	Tighten thumbnut to prevent detuning		

a. Radio Transmitters Types 96C and 96C3 (contd).

	Item No.	Item	Action or condition	Normal indications	Corrective measures
STOP	18	FINAL AMP. TUNING dial	Tighten thumbnut to prevent detuning		
	19	ANTENNA TUNING dial	Tighten thumbnut to prevent detuning		
	20	Control panel door	Close and lock		
PREPARATORY		**b. Radio Transmitter Type 96A.**			
	1	High-voltage switch	Pull out		
	2	Cabinet slide	Turn handle and pull out		
	3	Plug P1.	Plugged into jack J1.		
START	4	Antenna terminals	Connected to antenna		
	5	Test keys	Return all test keys to off position		
	6	A-c power switch	Turn ON	Exciter filaments light	Refer to part five
	7	Cabinet slide	Close and turn handle		
	8	High-voltage switch	Push all the way in		
	9	Meter readings	CHANNEL CONTROL and TEST KEY keys closed, and the following meter test key closed:		
			FINAL GRID	75 to 85 ma.	Check tubes V6 and V7
			4TH AMP. TOTAL	140 to 160 ma.	Check tube V5
			4TH AMP. GRID	6 to 8 ma.	Check tube V5
			3RD AMP. TOTAL	45 to 55 ma.	Check tube V4
			3RD AMP. GRID	1.5 to 2.5 ma.	Check tube V4
			2ND AMP. TOTAL	45 to 55 ma.	Check tube V3
	10	Meter readings	Close CHANNEL CONTROL and TEST KEY. Read final amplifier total meter.	0.800 amp.	Check tubes V6 and V7

27. EQUIPMENT PERFORMANCE CHECK LIST (Cont'd).

b. Radio Transmitter Type 96A (contd).

	Item No.	Item	Action or condition	Normal indications	Corrective measures
EQUIPMENT PERFORMANCE	11	Channel control equipment	Transmitter selected for use by remote operator	Final-amplifier filaments light Blower motor runs	Refer to part five
	12	Meter readings	Transmitter keyed by remote operator	See items 9 and 10 for normal readings	See items 9 and 10
STOP	13	High-voltage switch	Pull out		
	14	Cabinet slide	Turn handle and pull out		
	15	A-c power switch	Turn OFF	Exciter filaments go out	
	16	Cabinet slide	Close and turn handle		
	17	FINAL AMP. PLATE dial	Tighten thumbnut to prevent detuning		
	18	ANTENNA LOADING dial	Tighten thumbnut to prevent detuning		
	19	3RD AMP. PLATE dial	Tighten thumbnut to prevent detuning		
	20	4TH AMP. PLATE dial	Tighten thumbnut to prevent detuning		
	21	Control panel door	Close and lock		

PART THREE

MAINTENANCE INSTRUCTIONS

SECTION VI. PREVENTIVE MAINTENANCE TECHNIQUES

28. MEANING OF PREVENTIVE MAINTENANCE.

Preventive maintenance is a systematic series of operations performed at regular intervals on equipment, when turned off, to eliminate major break-downs and unwanted interruptions in service, and to keep the equipment operating at top efficiency. To understand what is meant by preventive maintenance, it is necessary to distinguish between preventive maintenance, trouble shooting, and repair. The prime function of preventive maintenance is to *prevent* break-downs and, therefore, the need for repair. On the other hand, the prime function of trouble shooting and repair is to locate and correct *existing* defects. The importance of preventive maintenance cannot be overemphasized. A system of radio communication depends on the performance of every set. It must be *ready* to go on the air when it is needed, and it must operate efficiently. Therefore, it is vitally important that radio operators and repairmen maintain their radio sets properly.

NOTE: The operations in sections VI and VII are first and second echelon (organization operators and repairmen) maintenance. Some operations in section X are higher echelon maintenance.

29. DESCRIPTION OF PREVENTIVE MAINTENANCE TECHNIQUES.

a. General. Most of the electrical parts used in radio transmitter types 96A, 96C, and 96C3 require routine preventive maintenance. This preventive maintenance varies. Some parts require a different kind of maintenance than others. Some require more, some less. Definite and specific instructions must be followed. Hit-or-miss techniques cannot be applied. This section of the manual contains these specific instructions and serves as a guide for personnel assigned to perform the six basic maintenance operations: Feel, Inspect, Tighten, Clean, Adjust, and Lubricate. Throughout this manual the lettering system for the six operations will be as follows:

F — Feel
I — Inspect
T — Tighten
C — Clean
A — Adjust
L — Lubricate

The first two operations show if the other four are needed. Selection of operations is based on a general knowledge of field needs. For example, dust encountered on dirt roads during cross-country travel filters into equipment no matter how much care is taken to prevent it. Rapid changes in weather (such as heavy rain followed by blistering heat), excessive dampness, snow, and ice tend to cause corrosion of exposed surfaces and parts. Without frequent inspections and the necessary tightening, cleaning, and lubricating operations, equipment becomes undependable and subject to break-down when it is needed most.

b. Feel. The feel operation is used most often to check rotating machinery, such as dynamotors, blower motors, and drive motors, also to determine whether electrical connections and bushings are overheated. Feeling will show the need for lubrication or the existence of other defects requiring correction. The maintenance man *must* become familiar with the normal operating temperatures of motors, transformers, and other parts, to recognize signs of overheating.

NOTE: It is important to perform the feel operation as soon as possible after shut-down and always before any other maintenance is done.

c. Inspect. Inspection is the most important operation in preventive maintenance. A careless observer will overlook evidences of minor trouble. Although these defects may not at the moment interfere with performance of the equipment, invaluable time and effort can be saved if they are corrected *before* they lead to major break-downs. To be able to recognize the signs of a defective set, make every effort to become thoroughly familiar with indications

of *normal* functioning. Inspection consists of *carefully* observing all parts of the equipment, noticing their color, placement, state of cleanliness, etc. Inspect for the following conditions:

(1) Overheating, as indicated by discoloration, blistering, or bulging of the parts or surface of the container; leakage of insulating compounds; and oxidation of metal contact surfaces.

(2) Placement, by observing that all leads and cabling are in their original positions.

(3) Cleanliness, by carefully examining all recesses in the units for accumulation of dust, especially between connecting terminals and binding posts. Parts, connections, and joints should be free of dust, corrosion, and other foreign matter. In tropical and high-humidity areas, look for fungus growth and mildew.

(4) Tightness, by testing any connection or mounting which appears to be loose.

d. Tighten, Clean, and Adjust. These operations explain themselves. Specific procedures to be followed in performing them are given wherever necessary throughout part three.

> **CAUTION: Screws, bolts, and nuts should not be tightened carelessly. Fittings tightened beyond the pressure for which they are designed will be damaged or broken.**

Whenever a loose connection is tightened, it should be moistureproofed and fungiproofed again by applying the varnish with a small brush. See section X for details of moistureproofing and fungiproofing.

e. Lubricate. Lubrication refers to the application of grease or oil to the bearings of motors or other rotating shafts. It may also mean the application of a light oil to door hinges or other sliding surfaces on the equipment.

30. VACUUM TUBES.

> NOTE: Do not work on tubes immediately after shut-down. Severe burns may result from contact with the envelopes of hot tubes.

a. Inspect (I).

(1) Inspect glass and metal tube envelopes, tube caps, and tube connector clips for accumulation of dirt and for corrosion. Tubes with loose plate caps, grid caps, or envelopes should be replaced if possible.

(2) Examine the spring clips that make contact with the plate caps of transmitter tubes for corrosion and for loss of tension with resulting looseness. Check the condition of wires soldered to the spring clips. The wires should be free of frayed insulation or broken strands.

(3) Inspect the firmness of the tubes in their sockets. Make the inspection by pressing the tubes down in the sockets and testing them in that position, *not* by partially withdrawing the tubes and jiggling them from side to side. Movement of a tube tends to weaken the pins in the base and unnecessarily spread the contacts in the socket. Inspect the tube sockets at the time the tubes are removed.

(4) Be careful when removing a tube from its socket, especially if it is a high-power tube. Never jar a warm tube. Always remove connections to the plate caps and grid caps.

b. Tighten (T). Tighten all loose connections to the tube sockets or to the tubes. If the connections are dirty or corroded, clean them before tightening. When tightening locknuts that hold the sockets to the insulated bushings, do not apply excessive pressure. Too much pressure will crack the bushings.

c. Clean (C).

(1) Clean the tubes, if necessary. Tubes operated at high voltage and with exposed plate and grid connections, such as in the transmitter, must be kept free of dirt and dust because of possible leakage between grid and plate terminals. In contrast, tubes operating at low voltages and not having exposed grid and plate caps do not require frequent cleaning. However, do not permit dirt to accumulate on low-voltage tubes.

(2) Remove dust and dirt from the glass or metal envelopes with a clean, lint-free, dry cloth. If proper care is used, the grid and plate caps may be cleaned with a piece of No. 0000 sandpaper by wrapping the paper around the caps and *gently* rubbing the surface. Excessive pressure is not needed; nor is it necessary to grip the cap tightly. Wipe the caps with a clean dry cloth.

(3) Clean corroded or dirty tube pins with fine sandpaper.

(4) When tube sockets are cleaned and the contacts can be reached, fine sandpaper may be used to remove corrosion, oxidation, and dirt.

d. Adjust (A). Adjust loose tube connector clips. Do not flatten tube connector clips during

adjustment. Flattened clips do not make adequate contact with the tube pins. Adjustment can be made with a pair of long-nose pliers.

31. PLUGS AND JACKS.

a. Inspect (I).

(1) Inspect the prongs or barrels of the plugs for accumulation of dirt and corrosion.

(2) Inspect the firmness of the plugs in their respective jacks.

(3) Inspect plugs and jacks for loose connections and for loose locking nuts.

b. Tighten (T). Tighten all loose locking nuts on plugs and jacks. Do *not* apply too much pressure in the tightening operation.

c. Clean (C).

(1) Clean the plugs and jacks if necessary.

(2) Clean the barrel or prongs of corroded or dirty plugs with No. 0000 sandpaper.

(3) When jacks are cleaned, and the contacts can be reached, fine sandpaper may be used to remove corrosion, oxidation, and dirt.

d. Adjust (A). Adjust loose jack clips. Do not adjust tighter than necessary to make a firm connection. Excessive adjustment may result in broken or damaged clips. Make adjustments with a small screwdriver or with long-nose pliers depending on the type of jack.

32. CABLES AND CONNECTORS.

a. Inspect (I). Inspect the cables for deterioration, excessive wear, cuts, and kinks. Give special attention to junction points and connectors. Inspect for improper placement of cables which places them under strain.

b. Tighten (T). Tighten the nuts which hold the connectors together. Tighten the clamps which hold the cable in the connectors.

c. Clean (C). Clean the connectors and pins with a cloth or, if necessary, with Polish, Metal Paste or No. 0000 sandpaper. If paste metal polish is used, be sure to remove all traces of the polish after the cleaning operation in order to maintain good contact. Remove grease and oil from the cable or associated parts with a soft cloth dampened with Solvent, Dry-cleaning.

33. RHEOSTATS AND POTENTIOMETERS.

a. Inspect (I). Inspect for loose terminal connections and accumulations of dirt and grease. Inspect for excessive corrosion on exposed contact points on switches. Inspect for evidence of overheating of rheostats.

b. Clean (C). Remove accumulation of grease and dirt with a soft clean cloth dampened with dry-cleaning solvent (SD).

34. CAPACITORS.

a. Inspect (I).

(1) Inspect the terminals of large fixed capacitors for corrosion and loose connections. Carefully inspect the mountings to discover loose mounting screws or brackets. Examine the leads for poor insulation, cracks, and evidence of dry rot. Cut away frayed strands on the insulation. If the wire is exposed, wrap it with friction tape. The terminals of the capacitor should not show cracks or breaks.

(2) Inspect the case of each large fixed capacitor thoroughly for leaks, bulges, and discoloration. When an oil-filled capacitor is found leaking, remove it and replace it if a replacement is available. Equipment may operate with a leaking capacitor. However, replacement should be made as soon as possible to avoid break-down.

(3) Inspect the plates of variable capacitors for dirt, dust, or lint. Examine the movable set of plates for signs of damage or misalignment that would cause them to touch the fixed plates during tuning. Rotate the movable plates using the panel tuning control, and thus check for proper operation of the capacitor.

b. Tighten (T).

(1) Tighten loose terminals, mountings, and connections on the capacitor.

(2) Carefully tighten the retaining nuts on the insulation bushings, if leakage occurs around the gasket of oil-filled capacitors. When tightening a nut, be careful not to break the bushing or damage the gasket.

c. Clean (C). Clean the case of fixed capacitors, the insulating bushings, and any connections that are dirty or corroded. The capacitor cases and bushings can usually be cleaned with a dry cloth. However, if the dirt deposit is hard to remove, moisten the cloth in dry-cleaning solvent (SD).

d. Lubricate (L). Refer to section VIII.

35. RESISTORS.

a. Inspect (I). Inspect the coating of the

vitreous-enameled resistors for signs of cracks and chipping, especially at the ends. Examine the bodies of all types of resistors for blistering, discoloration, and other indications of overheating. Replace resistors only after the cause of the overheating has been located and corrected. Inspect leads and all other connections for corrosion, dirt, dust, looseness, and broken strands in the connecting wires. Check the security of all mountings. Do not attempt to move resistors with pigtail connections, because there is danger of breaking the connections at the point where they enter the body of the resistor. Such defects cannot be repaired.

b. Tighten (T). Tighten resistor connections and mountings whenever they are found loose. If a resistor is allowed to remain loose, vibration may break the connection or damage the body.

c. Clean (C).

(1) Clean all carbon resistors with a small brush.

(2) The vitreous-enameled resistors must be kept clean to avoid leakage between the terminals. Wipe them with a dry cloth. However, if the dirt deposit is unusually hard to remove, use dry-cleaning solvent (SD).

(3) Resistors with discolored bodies cannot be cleaned. Discoloration indicates that there has been overloading and overheating at some time prior to the inspection. The discoloration is probably due to circuit trouble which requires analysis and correction. Trouble-shooting procedures are described in part five.

NOTE: When fungiproofed resistors are heated, a harmless brown stain may appear.

36. SWITCHES.

a. Inspect (I).

(1) Inspect the mechanical action of each switch, and, while so doing, look for signs of dirt or corrosion on all exposed elements. In some cases, it will be necessary to examine the elements of the switch visually: in others, the action of the switch is checked by flipping the control knob or toggle, or by pressing the switch button and noting the freedom of the movement and the amount of spring tension.

(2) Examine the ganged switches to see if the contacts are clean. Inspection is visual. Do not pry the leaves of the switch apart. The rotary members should make good contact with the stationary members; and as the former slides into the latter, a spreading of the stationary contact leaves should be visible. Switch action should be free. Wiping action of the contacts usually removes any dirt at the point of contact.

b. Tighten (T). Tighten the mounting nuts on all switches. Loose mounting nuts cause unnecessary strain on switch wiring when the switch is rotated.

c. Clean (C). Clean the exterior surfaces of switches with a stiff brush moistened with dry-cleaning solvent (SD).

d. Adjust (A). Adjust stationary contacts of rotary switches only if poor or no contact is indicated. Using long-nose pliers, adjustment should be done carefully until a noticeable spreading of the stationary contact occurs when it is engaged by the rotary contact.

e. Lubricate (L). Refer to section VIII.

37. TRANSFORMERS AND CHOKES.

a. Inspect (I).

(1) Inspect the terminals of the transformers and chokes for corrosion and loose connections. Carefully inspect the mountings to discover loose mounting screws, studs, or brackets. Examine the leads for poor insulation, cracks, and evidences of dry rot. Cut away frayed strands on the insulation. If the wire is exposed, wrap it with friction tape.

(2) Thoroughly inspect the terminal insulators of the transformers and chokes for cracked or broken insulators.

(3) Inspect the transformers and chokes for leaks of insulating compound or discoloring due to overheating.

b. Tighten (T). Tighten loose terminals, mountings, and connections to transformers and chokes, when necessary. Do not break the bushing or damage the gasket.

c. Clean (C). Clean the cases of the transformers and chokes, the insulating bushings, and all connections that are dirty or corroded. The cases and bushings can usually be cleaned with a clean dry cloth. However, if the dirt deposit and grease are hard to remove, moisten the cloth in dry-cleaning solvent (SD).

38. RELAYS.

a. Inspect (I).

(1) Inspect the relays for accumulation of

corrosion, grease and dirt.

(2) Inspect the contact points for accumulation of dirt and corrosion.

b. Clean (C).

(1) Remove the accumulation of corrosion, grease, and dirt with a soft, dry cloth or soft brush. Clean dirty contacts by using a clean cloth moistened with dry-cleaning solvent (SD).

(2) In case of excessive pitting and corrosion the relay should be replaced. However, if the pitting is not too severe the contacts may be burnished with a relay burnishing tool, using care to keep contact surfaces parallel. Be careful not to spring the contact arms.

NOTE: Relays do not normally require much maintenance. In case the contacts are in bad condition, replace the relay.

39. TERMINAL BOARDS AND INSULATORS.

a. Inspect (I). Inspect terminal boards for accumulation of dirt and grease. Inspect connections for tightness.

b. Tighten (T). Tighten all loose connections with the proper size screwdriver or wrench. Excessive tightening may damage terminal screws or crack insulators.

c. Clean (C). Remove accumulation of grease and dirt with a clean dry cloth.

40. BLOWER.

a. Feel (F). Feel the blower as soon as possible after shut-down so that overheated bearings, and other defects causing overheating, can be detected.

b. Inspect (I). Inspect the rotation of the fan to see that it turns freely. Inspect motor connections for loose or frayed wires, or for signs of deterioration.

c. Tighten (T). Tighten all assembly and mounting screws on the blower.

d. Clean (C). Remove all accumulated dust and foreign matter from the blower openings. Use a stiff brush for this purpose. Remove accumulation of dirt and grease from the motor frame.

e. Lubricate (L). Refer to section VIII.

41. AIR FILTER.

a. Inspect (I). Inspect the fiber-glass air filter for accumulation of dust.

b. Clean (C).

(1) Remove accumulation of dust from the filter with a dry cloth, soft brush, or dry compressed air. Do not use damp or oily cloths to remove the dust. Replace air filter if it cannot be cleaned.

(2) Remove dust from inside of cabinet with a dry cloth, soft brush, or dry compressed air.

42. METERS.

Meters are extremely delicate instruments and must be handled very carefully. They require very little maintenance. They are precision instruments and ordinarily cannot be repaired in the field.

a. Inspect (I). Inspect the leads and connections to the meters. Look for loose, dirty, and corroded connections. Look for cracked or broken cover glasses. Since the movement of a meter is extremely delicate, its accuracy will be seriously affected if the glass is broken and dirt and moisture filter through.

b. Tighten (T). Tighten all loose connections. Any loose meter wires should be inspected for dirt or corrosion before they are tightened. The tightening of meter connections requires a special technique because careless handling can easily crack the meter case.

c. Clean (C). Meter cases can usually be cleaned with a dry cloth. If cleaning is difficult, dampen the cloth with dry-cleaning solvent (SD). Clean dirty connections with a small brush dipped in dry-cleaning solvent (SD), or with a small piece of cloth dipped in the solvent.

d. Adjust (A). Normally the meters in the transmitter should indicate zero when the equipment is turned off. Before deciding that a meter needs readjusting, tap the meter case *lightly* with the tip of the finger. This helps the needle to overcome the slight friction which sometimes exists at the bearings and prevents an otherwise normal meter from coming to rest at zero. If adjustment is needed, insert the tip of a very thin screwdriver in the slotted screw head located below the meter glass and *slowly* turn the adjusting screw until the pointer is at zero. Lightly tap the meter case again and view the meter face and pointer *full on* and not from either side. Avoid turning the screw too far, because the needle may be bent or the hairspring damaged.

43. CABINETS, CHASSIS, AND MOUNTINGS.

a. Inspect (I). Inspect the outside and inside

of the cabinet thoroughly, paying strict attention to every detail. Check the ventilating mountings, the panel screws, and the zero settings of the meters (par. 42). Examine the panels for loose knobs, dials, and switches. Examine air filters for dirt. Inspect the slide for freedom of movement.

b. Clean (C). Clean each cabinet, outside and in, with a clean dry cloth. Use dry compressed air to blow out all accumulated dirt and dust. If the air filters cannot be cleaned with compressed air or a stiff brush (par. 41) replace them with clean filters.

CAUTION: Take care when handling the spun-glass air filters; try to keep small glass splinters from entering the fingers.

Repaint any surface that is found scratched, rusted or chipped.

c. Tighten (T). Tighten all loose mounting bolts, panel screws, and control knobs.

d. Lubricate (L). Refer to section VIII for lubrication instructions.

SECTION VII. ITEMIZED PREVENTIVE MAINTENANCE

44. INTRODUCTION.

For ease and efficiency of performance, preventive maintenance on radio transmitters types 96A, 96C, and 96C3 will be broken down into operations that can be performed at different time intervals. In this section the preventive maintenance work to be performed on the transmitters at specified time intervals is broken down into units of work called items. The general techniques involved and the application of FITCAL operations in performing preventive maintenance on individual parts are discussed in sections VI and VIII. These general instructions are not repeated in this section. When performing preventive maintenance, refer to sections VI and VIII if more information is required for the following items. Perform all work with the power removed from the equipment. After preventive maintenance has been performed on a given day, put the equipment into operation and check it for satisfactory performance. (See par. 27, Equipment Performance Check Lists.)

45. PREVENTIVE MAINTENANCE TOOLS AND MATERIALS.

The following preventive maintenance tools and materials will be needed:

Common hand tools
Clean cloth
#0000 sandpaper
Crocus cloth
Fine file
Solvent, dry-cleaning (SD)

NOTE: Gasoline will not be used as a cleaning fluid for any purpose. Dry-cleaning solvent (SD) is available, as a cleaning fluid, through established supply channels. Oil, Fuel, Diesel, may be used for cleaning purposes when dry-cleaning solvent (SD) is not at hand. Carbon tetrachloride will be used as a cleaning fluid only in the following cases: Where inflammable solvents cannot be used because of the fire hazard, and for cleaning electrical contacts including relay contacts, plugs, commutators, etc.

46. ITEM 1, EXTERIOR OF RADIO TRANSMITTER (figs. 4, 5, and 7).

Operations.

ITCL	Cabinet.
ITC	Control knobs.
IC	Inspection door glass.
ICA	Meter panel and meters.
ITC	Switches.
ITC	Dials.

Remarks. Tighten all loose control knobs and dials. Use the proper screwdriver or wrench. Tighten any loose locknuts on switches and shaft bearings extending through the panels, being careful not to rotate the entire assembly.

47. ITEM 2. EXCITER UNIT (figs. 44, 46, 41 and 50).

Preliminary steps. Remove all power from the cabinet. Withdraw the slide from the cabinet to its full travel. Open the door on the left side of the slide which exposes the interior of the exciter unit.

Operations.

ITCA	Tubes and sockets.
ITC	Cables and connectors.
ITC	Rheostats and potentiometers.
ITCL	Capacitors.
ITC	Resistors.
ITCL	Switches.

FITC Transformers and chokes.
IC Relays.

48. ITEM 3, FINAL AMPLIFIER (figs. 44, 52, and 51).

Preliminary steps. Remove all power from the cabinet. Pull the high-voltage switch knob forward as far as possible. Withdraw the slide from the cabinet. Short-circuit all high voltage capacitors to the chassis with a shorting stick (par. 56).

Operations.

ITCA Tubes and sockets.
ITC Cables and connectors.
ITCL Capacitors.
ITC Resistors.
FITC Transformers and chokes.
ITC Insulators.

Remarks. When removing power amplifier tubes, be sure to release the clips and any clamps which hold the tubes in their sockets.

49. ITEM 4, BLOWER AND AIR FILTER (figs. 5, 44 and 52).

Preliminary steps. Remove all power from the equipment. Withdraw the slide from the cabinet to the full extent of its travel.

Operations.

FITCL Blower.
IC Air filter.

50. ITEM 5, CABLES AND TERMINAL BOARDS (figs. 44, 45, 52 and 13).

Operations.

ITC Cables and connectors.
ITC Terminal boards and insulators.
ITCA Plugs and jacks.

51. PREVENTIVE MAINTENANCE CHECK LIST.

The following check list is a summary of the preventive maintenance operations to be performed on radio transmitters types 96A, 96C, and 96C3. The time intervals shown on the check list may be reduced at any time by the local commander. For best performance of the equipment perform operations at least as frequently as called for in the check list. The echelon column indicates which operations are first echelon maintenance and which operations are second echelon maintenance. Operations are indicated by the letters of the word FITCAL. For example, if the letters ITCA appear in the operations column, the item to be treated must be inspected (I), tightened (T), cleaned (C), and adjusted (A).

ITEM NO.	OPERATIONS	ITEM	When Performed			Echelon
			Daily	Monthly	Every three months	
1	ITCA	Exterior of radio transmitter	X			1st
1	L	Door latches and hinges			X	1st
2	FITCA	Exciter unit	X			1st
2	L	Variable capacitor, shaft bearings, and rotary switches			X	2d
3	FITCA	Final amplifier	X			1st
3	L	Variable capacitor and shaft bearings			X	2d
4	FITC	Blower and air filter	X			1st
4	L	Blower motor bearings		X		2d
5	ITCA	Cables and terminal boards	X			1st

NOTE: X indicates when operations are to be performed.

F	I	T	C	A	L
Feel	Inspect	Tighten	Clean	Adjust	Lubricate

SECTION VIII. LUBRICATION

52. APPROVED LUBRICANTS FOR RADIO TRANSMITTERS (WILCOX ELECTRIC TYPES 96A, 96C, and 96C3).

The following table lists the lubricating materials necessary in servicing radio transmitters (Wilcox Electric types 96A, 96C, and 96C3).

SYMBOLS	STANDARD NOMENCLATURE
PS	Oil, Lubricating, Preservative, Special
GL	Grease, Lubricating, Special
OE 10	Oil, Engine
SD	Solvent, Dry-cleaning

NOTE: To apply oil, dip a 22 B & S gauge wire ½ inch into oil, withdraw and apply drop where specified.

53. BLOWER MOTOR BEARINGS.

Lubricate the blower motor bearings every 256 operating hours or monthly as follows:

a. Motor, Type No. JS3-50. Apply 2 to 4 drops of engine oil (OE 10) through oil holes on bearing housings of motor, type No. JS3-50.

b. Motor, Type No. 5KH43AB27B. Lift the hinged oil cup covers of motor, type No. 5KH43AB27B, and apply 6 to 8 drops of engine oil (OE 10) to each cup.

c. Variable Capacitor Shaft Bearings. Every 512 operating hours or every three months, apply special lubricating grease (GL), or 1 or 2 drops of special preservative lubricating oil (PS) to all variable capacitor shaft bearings.

54. ROTARY SWITCHES.

Every 512 operating hours or every three months, clean the contacts of the rotary switches with dry-cleaning solvent (SD) if necessary, and allow to dry thoroughly. Apply special lubricating grease (GL) sparingly to contacts and to detent cams.

55. DOOR LATCHES AND HINGES.

Every 512 operating hours or every three months apply engine oil (OE 10) sparingly to door latches and hinges.

SECTION IX. SPECIAL TOOLS

56. SHORTING STICK.

a. General. When the power is shut off on most radio equipment, the capacitors will normally discharge through bleeder resistors, or through the voltage divider to ground. Occasionally, a failure occurs in a bleeder or voltage-divider network, and the capacitors remain charged. If contact is made to a charged capacitor with any part of the human body, severe burns may result. Therefore, as a precautionary measure, discharge capacitors before performing any preventive maintenance or trouble shooting.

b. Construction of Shorting Stick. Obtain a hardwood dowel, ½ inch in diameter and 15 inches long. Drill a ⅛-inch hole 2 inches deep in the end of the dowel (fig. 18). Press-fit a piece of copper or brass bus-wire into the hole, leaving approximately 1 inch of bus-wire extending beyond the end of the dowel. Solder one end of a 36-inch length of flexible, No. 10 wire to the bus-wire, as close to the dowel as possible. Attach battery clamp No. 21A to the other end of the flexible wire. Apply several layers of friction tape over the soldered connection of the flexible wire and the bus-wire, leaving approximately ½ inch of the bus-wire extended untaped. Continue the tape from the soldered connection down over the dowel and the insulated wire, firmly taping the wire to the dowel for a distance of 2 inches from the soldered joint. Apply two layers of rubber tape and two layers of friction tape to the opposite end of the dowel, extending the tape upward 6 inches to form an insulated handle for the shorting stick.

c. Use of Shorting Stick. Connect the battery clamp to the chassis near the capacitor to be discharged. Hold the shorting stick by the insulated handle, and touch the exposed bus-wire to the capacitor terminals.

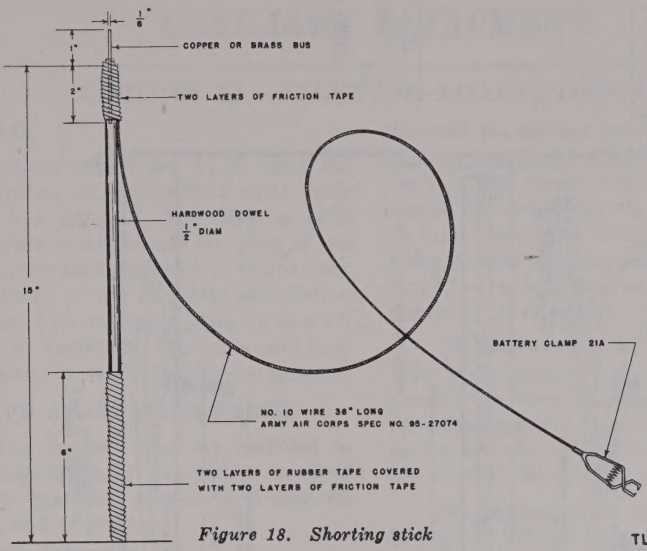


Figure 18. Shorting stick

SECTION X. MOISTUREPROOFING AND FUNGIPROOFING

57. GENERAL.

a. Excessive failure of parts and loss of operating efficiency are usually caused, not by inferior parts or equipment, but by the accumulated effects of moisture in high-humidity areas. Rapid temperature changes coupled with conditions of fog, rain, and dew or high humidity promote such failures.

b. The effects of moisture (and fungus growth) on resistors, capacitors, coils, chokes, transformer windings, terminal boards, and insulating strips can be recognized in the form of corrosion, low insulation resistance, flash-overs, and crosstalk.

58. TREATMENT TO REDUCE FAILURES.

a. To reduce the above failures, a moistureproofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection. The treatment consists of applying a film of moisture and fungi-resistant varnish to all susceptible parts of the equipment. This film provides a nonwetting surface which forms a moisture barrier. Fungus growth is prevented by a fungicide in the varnish. Equipments which have been so treated are marked MFP and dated. Equipments not so marked should be examined and if it is obvious that the treatment has not been applied, the equipment should be returned at the first opportunity to third or higher echelon maintenance units for treatment.

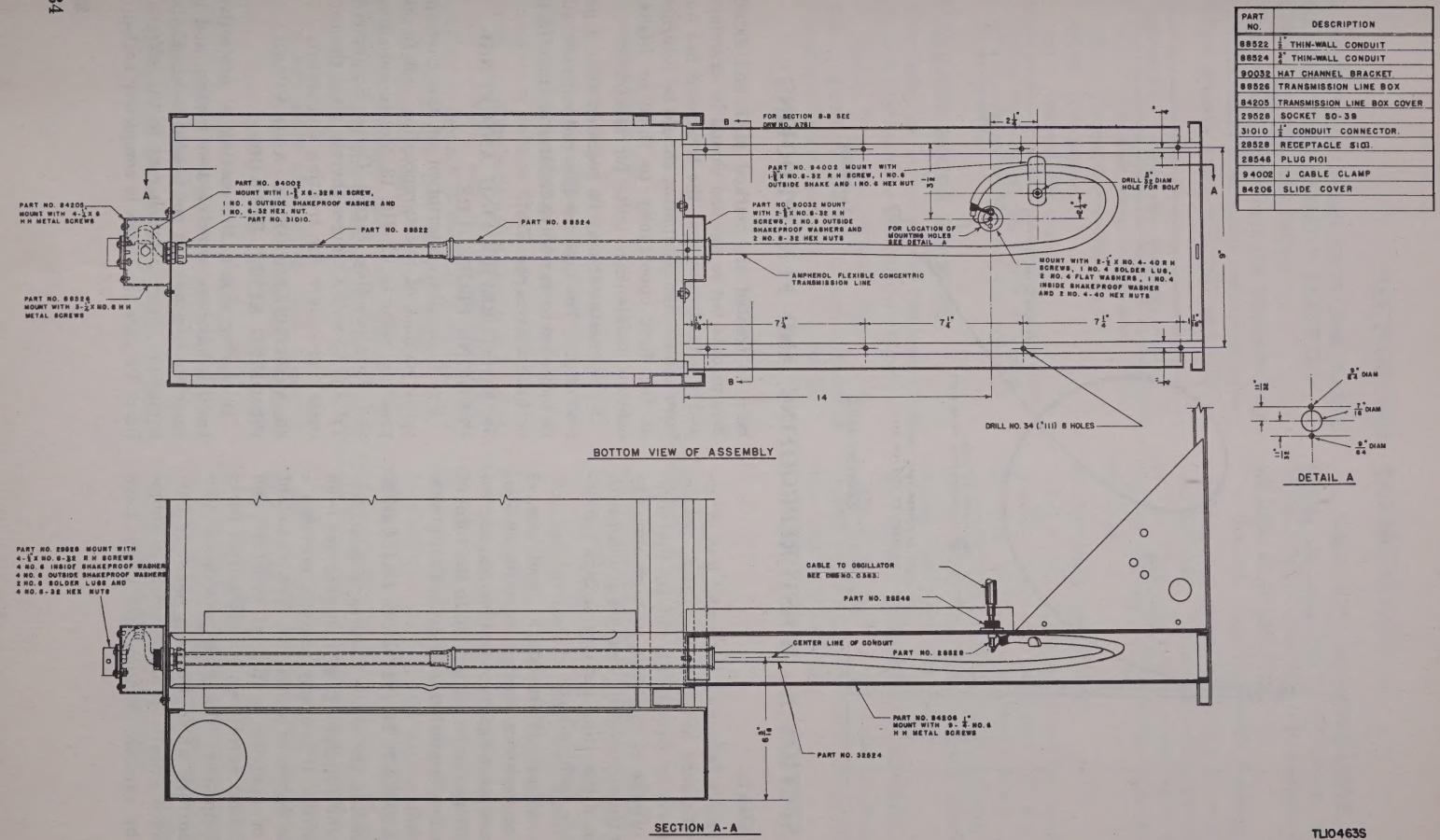
b. Re-treatment may be required after a period of use. The need for this re-treatment will be indicated by excessive failures or the effects outlined above (par. 57b).

59. MOISTUREPROOFING AND FUNGIPROOFING PROCEDURE.

For a detailed description of the varnish-spray method of moistureproofing and fungiproofing, refer to TB SIG 13, Moistureproofing and Fungiproofing Signal Corps Equipment. TB SIG 13 with Changes thereto gives the necessary procedure for treating equipment.

60. MOISTUREPROOFING AND FUNGIPROOFING AFTER REPAIRS.

If, during repair, the coating of protective varnish has been punctured or broken, and if complete treatment is not needed to reseal the equipment, apply a brush coat to the affected part. Be sure the break is completely sealed.



PART NO.	DESCRIPTION
88522	1/2" THIN-WALL CONDUIT
88524	3/4" THIN-WALL CONDUIT
90032	HAT CHANNEL BRACKET
88526	TRANSMISSION LINE BOX
84205	TRANSMISSION LINE BOX COVER
29528	SOCKET SO-38
31010	1/2" CONDUIT CONNECTOR
28528	RECEPTACLE S103
28546	PLUG P101
94002	J CABLE CLAMP
84206	SLIDE COVER

Figure 19. Teletype modification, assembly of telescoping conduit.

PART FOUR

AUXILIARY EQUIPMENT

SECTION XI. TELETYPE ADAPTATION KIT

61. GENERAL.

All transmitters which are to be used for teletype operation must have a coaxial cable transmission line installed. The cable extends from a transmission line box at the back of the transmitter to the oscillator unit in the exciter. A general picture of the complete installation can be obtained by studying figures 19 and 20. Instructions for installing the cable and connectors are given in the following paragraphs.

62. TELETYPE ADAPTATION PARTS.

The following major items are included in the teletype adaptation kit in addition to all of the necessary machine screws, lockwashers, nuts, clamps, etc. (fig. 21).

Gooseneck connector.
Coaxial line.
Telescoping conduit.
Transmission line box.
Slide cover.
Set of teletype modification drawings.

63. PREPARATION OF TRANSMITTER.

a. Removing Transmitter Slide. If the tubes have been installed they should be removed before proceeding with the installation of the teletype cable. Be careful in removing and handling the tubes. Put all tubes in a box, or store in some other safe place during the installation of the teletype adaptation kit. Disconnect the flexible antenna strips from the bushings in the top of the cabinet, and detach the main terminal board from the cabinet. Release the slide catches and remove the slide from the cabinet. Prop the slide up so that the lower back side and bottom can be reached for drilling.

b. Drilling Cabinet and Slide. Some of the cabinets have been predrilled at the factory. However, in no case have the nine holes for attaching the bottom cover plate been drilled. Note whether the holes shown in figure 24 have been drilled in the cabinet at hand. If so, proceed with the instructions as given in subparagraph (3) below.

(1) Holes in Rear of Lower Slide Chassis. Remove the bottom cover plate (fig. 22) from the kit and clamp TEMPLATE No. 1 to the back of the lower slide chassis as shown in figure 23. Center punch through the template to locate the three holes. Drill the two outer holes $\frac{3}{16}$ inch and the middle hole $\frac{3}{8}$ inch. Enlarge the middle hole to $1\frac{1}{2}$" with a Greenlee punch or other means. Remove all burrs.

(2) Holes in Bottom of Slide Chassis. Four holes must be drilled in the bottom of the slide chassis for mounting receptacle type S101 and for attaching the coaxial cable clamp. The location and size of the holes for the receptacle are given in DETAIL A of figure 19.

(3) Bottom Cover-plate Mounting Holes. Clamp the bottom cover plate to the bottom of the slide. Center punch through the nine holes marked A around the edge of the cover plate. Drill the nine holes with a No. 33 drill.

(4) Holes in Cabinet Back. The cabinet back must be drilled for the coaxial cable and to attach the transmission line box (fig. 24). Place TEMPLATE No. 2 of the slide cover against the back of the cabinet as shown in figure 24 and center punch the four holes. Drill the three outer holes with a No. 34 drill. Drill the middle hole $\frac{3}{8}$ inch and enlarge to $\frac{7}{8}$ inch with a Greenlee punch or other means. Remove all burrs.

c. Realignment of Oscillator Socket. The oscillator tube socket must be rotated 45° clockwise to align with the plug in the gooseneck connector unit (fig. 24). Remove the oscillator shields, crystal and oscillator tube V5 from the exciter unit. Insert a small screwdriver under the socket ring clamp and pry out until the ring releases the socket. Lift the socket up and rotate one notch position clockwise as viewed from the top of the assembly. Press the socket down into the new position and replace the socket ring clamp. Be careful in rotating the socket so that no connections to it are broken or shorted out. In a few cases it may be necessary to loosen a connection or two in order to properly rotate the socket to its new position.

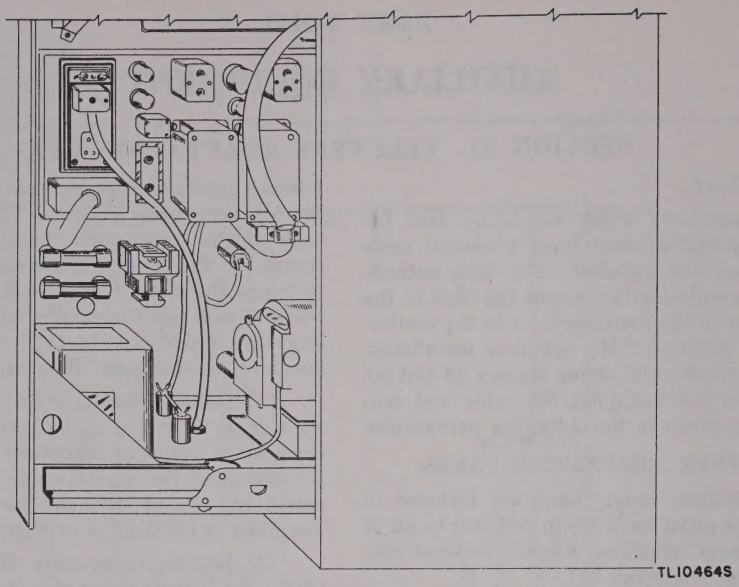


Figure 20. Teletype modification, installation of gooseneck connector unit.

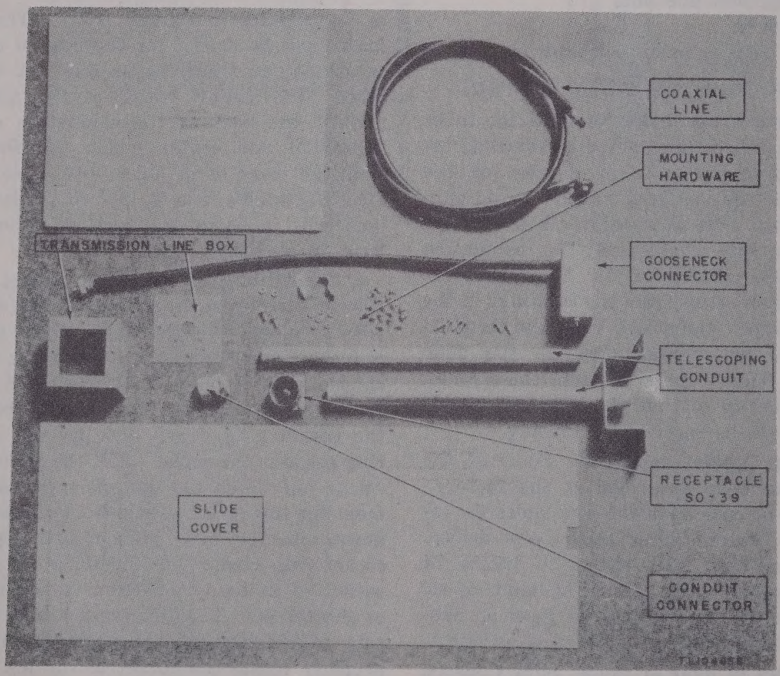


Figure 21. Teletype adaptation parts.

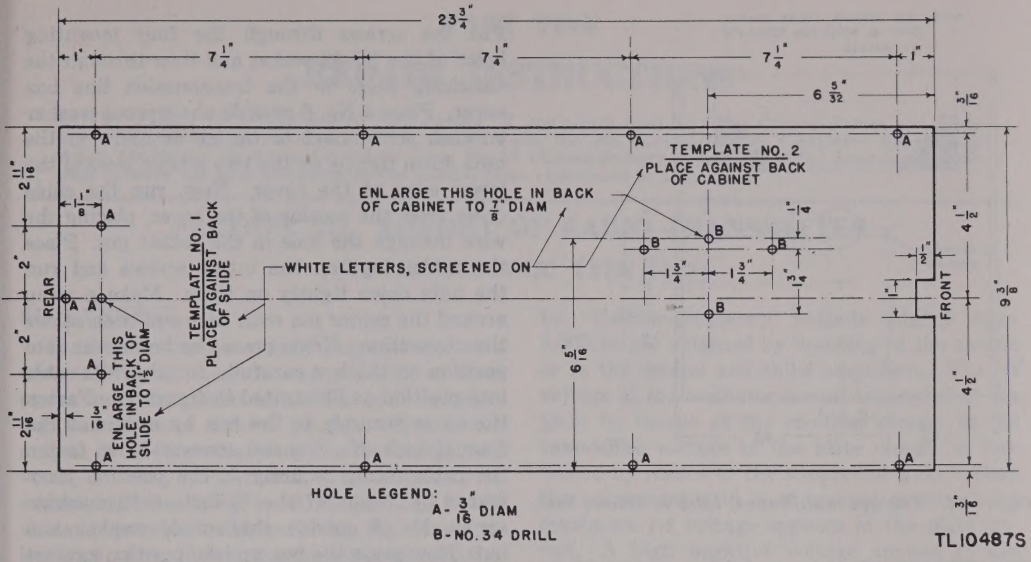


Figure 22. Teletype adaptation kit, bottom cover plate.

If any connections are removed make certain that they are reconnected properly. The old and new positions of the socket are shown in figure 25.

64. INSTALLATION.

a. Installation of Cable and Conduit in Lower Slide Chassis. Take the telescoping conduit and the coaxial cable from the kit. The 4½-foot coaxial cable has two solder lugs attached to the shield at one end and an S101 receptacle, together with its mounting hardware, at the other end. Feed the solder lug end of the coaxial cable through the telescoping conduit from the large end. Put the telescoping conduit through the 1½-inch hole in the lower slide chassis and attach it by means of the channel bracket which comes assembled on the tubes (fig. 19). This bracket mounts with 2⅜-inch, 8-32 roundhead machine screws and has No. 8 outside shakeproof washers under the nuts. Form the cable into a loop as indicated and mount the S101 receptacle. To mount this receptacle, first unscrew the ½-inch, 4-40 roundhead machine screws allowing the receptacle to come apart. Be careful not to lose any of the mounting hardware. Now place the receptacle neck on the top side of the chassis and the receptacle itself on the bottom. Put the 4-40 machine screws through the mounting holes. Next put the No. 4 flat washers on the screw against the bakelite. Then place the No. 4 shakeproof solder lug on the screw indicated in figure 19 and the No. 4 inside shakeproof washer on the other screw. Run the nuts down on the screws reasonably tight, but be careful not to strip the threads. Now, mount the cable clamp as shown in figure 19. The clamp is attached with a ⅜-inch, 6-32 roundhead machine screw, No. 6 outside shakeproof washer, and hexagon nut. It is important that this clamp hold the cable firmly. If there is any movement of the cable in the clamp the connections will eventually be broken.

b. Installation of Lower Chassis Cover Plate. Attach the cover plate to the bottom of

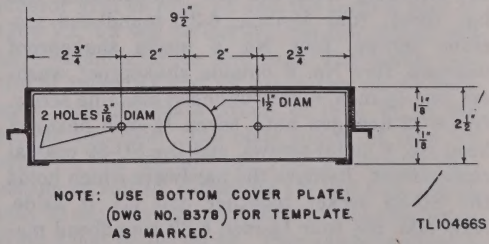


Figure 23. Teletype modification, holes in lower slide chassis.

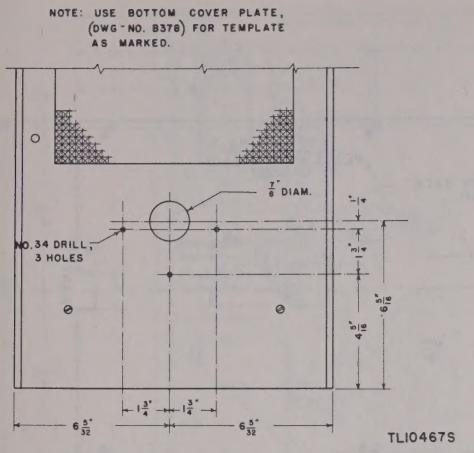


Figure 24. Teletype modification, holes in cabinet back.

the slide with the nine metal screws provided.

c. Installation of Transmission Line Box. Remove the outer nut from the conduit connector which is fastened on the outer end of the ½-inch conduit tube. Now, place the slide back in the cabinet and push it at least half way into the cabinet. With the filter box removed from the cabinet back, pull the cable and telescope tube to the back of the cabinet. Place the end of the conduit fitting through the ⅞-inch hole in the cabinet and run the nut down tightly on the fitting. After the above operations are complete, push the slide all the way into the cabinet checking carefully to see that it will close completely and latch in place. Now, pull the cable out through the back of the cabinet 1 foot or so to make for greater ease in attaching the transmission line box and socket. Place the cable through the transmission line box but do not attach the box to the cabinet. Take the following from the kit: transmission line box cover, four ½-inch, 6-32 roundhead machine screws, four No. 6 inside shakeproof washers, five No. 6 outside shakeproof washers, one ⅜-inch, 6-32 roundhead machine screw, five 6-32 hexagon nuts, seven ¼-inch hexagon head No. 6 metal screws, and the SO-39 coaxial cable socket. Remove the hardware which holds the SO-39 socket together and lay it aside. Now take the four ½-inch 6-32 roundhead machine screws and place a No. 6 inside shakeproof washer on each under the screw head. Put the screws through the four mounting holes of the SO-39 socket and then through the matching holes in the transmission line box cover, Place a No. 6 outside shakeproof washer on each screw next to the cover and run the nuts down tightly on the two screws toward the lower edge of the cover. Now, run the cable down from the topside of the cover, placing the wire through the hole in the socket pin. Place the solder lugs on the upper screws and run the nuts down tightly on them. Make a wrap around the center pin with wire and then solder the connection. Next, press the box cover into position on the box carefully forming the cable into position as illustrated in figure 19. Fasten the cover securely to the box by means of the four ¼-inch, No. 6 metal screws. Now, fasten the cable clamp securely in the position illustrated by means of the ⅜-inch, 6-32 machine screw, No. 6 outside shakeproof washer and nut. Now press the box up into position against the cabinet back and fasten securely in place with three ¼-inch No. 6 hexagon head metal screws. Place the filter box back in its proper place on the cabinet back, replace the cabinet terminal board and reconnect the flexible antenna and ground leads.

d. Installation of Gooseneck Connector. Take the gooseneck connector unit from the kit and plug the shielded octal plug into the socket formerly occupied by oscillator tube V5. Insert plug P101 into the newly installed S101 receptacle, in the bottom of the slide chassis, and screw the collar down firmly. Replace the tubes, close the slide, and the installation is complete.

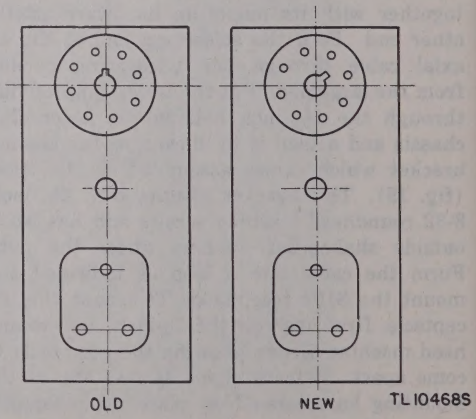


Figure 25. Teletype modification, oscillator socket realignment.

PART FIVE

REPAIR INSTRUCTIONS

NOTE: Failure or unsatisfactory performance of equipment used by Army Ground Forces and Army Service Forces will be reported on W.D., A.G.O. Form No. 468 (Unsatisfactory Equipment Report); by Army Air Forces, on Army Air Forces Form No. 54 (Unsatisfactory Report). If either form is not available, prepare the data according to the sample form reproduced in figure 42.

SECTION XII. THEORY OF RADIO TRANSMITTER

(WILCOX ELECTRIC TYPE 96C3)

65. GENERAL.

The transmitter consists of a crystal oscillator and intermediate power amplifiers, a final power amplifier, antenna loading unit, and keying and channel control circuits. The power output is 2,500 watts on phone or continuous wave, or teletype operation. The frequency is adjustable from 2,000 to 18,000 kc. The transmitter is provided with terminals for remote or local operation. Power is supplied from rectifier type 36A4, modulator type 50A3, and from a 220-volt single-phase line. A block diagram of the radio frequency and associated circuits is shown in figure 26. Figures 27 and 28 comprise a complete schematic diagram.

66. EXCITER UNIT.

a. General. Figure 28 is a schematic diagram of the exciter unit and the final amplifier. The exciter unit comprises a crystal oscillator and three amplifying stages.

b. Crystal Oscillator. Pentode Tube, JAN-6AC7/1852 (VI) is used in the oscillator stage. The screen grid, control grid, and cathode are incorporated in a Pierce oscillator circuit. The plate and suppressor grids are the output amplifier and output controlling circuits, respectively. The quartz crystal plate is placed between the anode and the control grid. Grid-leak resistor R1 provides proper operating bias for the oscillator. The high resistance network R2, R3, and R4 in the oscillator anode circuit reduces the applied d-c potential to a very low value. The r-f voltage in the grid circuit of this oscillator is very low. When the transmitter is selected for operation by transmitter selector switches at the remote control station the oscillator is in operation continuously in the grid circuit. In order to obtain the frequency range of the transmitter (2,000 to 18,000 kc) the crystal must oscillate between 2,000 and 5,000 kc. Carrier-frequency outputs higher than 5,000 kc are obtained by doubling in the second or in the second and third amplifiers. The r-f voltage of the oscillator circuit is coupled to the plate by means of the electron stream in the tube. The voltage in the plate circuit is controlled by means of the suppressor grid. When the suppressor grid is at ground potential the maximum r-f voltage appears in the plate circuit. A high negative voltage applied to the suppressor grid blocks the electron stream to the plate and prevents the oscillator signal from appearing in the plate circuit. This is carrier-off or key-up condition of the transmitter. The voltage of the suppressor grid is controlled by the keying control circuit (par. 68). The plate circuit of tube V1 is fed through plate choke L1 and is coupled to the grid of Tube JAN-6AC7/1852 (V2) through capacitor C7.

c. First Amplifier. Tube V2 is a buffer between the oscillator and the second amplifier. The grid circuit of Tube V2 is returned through resistor R5 to the suppressor grid of Tube V1 thus making the d-c voltage of the two grids the same. When the suppressor grid of tube V1 is at ground potential, the control grid of tube V2 is also at ground potential, and tube V2 then has its maximum gain. R-f voltage on the grid of V2 will be amplified in the plate circuit. When high negative voltage is applied to the suppressor grid of tube V1 and the control grid of tube V2, V2 will be cut off and the circuit will have its minimum or zero gain. The double control of tubes V1 and V2 suppresses all r-f voltages from the plate circuit of tube V2 in the key-up condition. The plate circuit of tube V2 operates into the 96C-10.2 resonant circuit consisting of coil L2 capacitors C9 and C10, which may be adjusted for resonance at any frequency from 2,000 to 10,000 kc. This range is divided into three bands. Selection of the bands is made

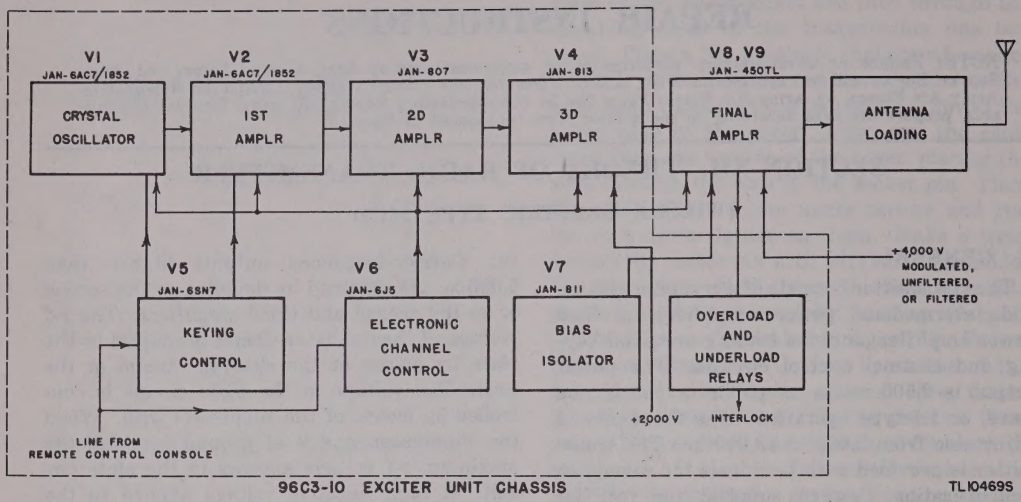
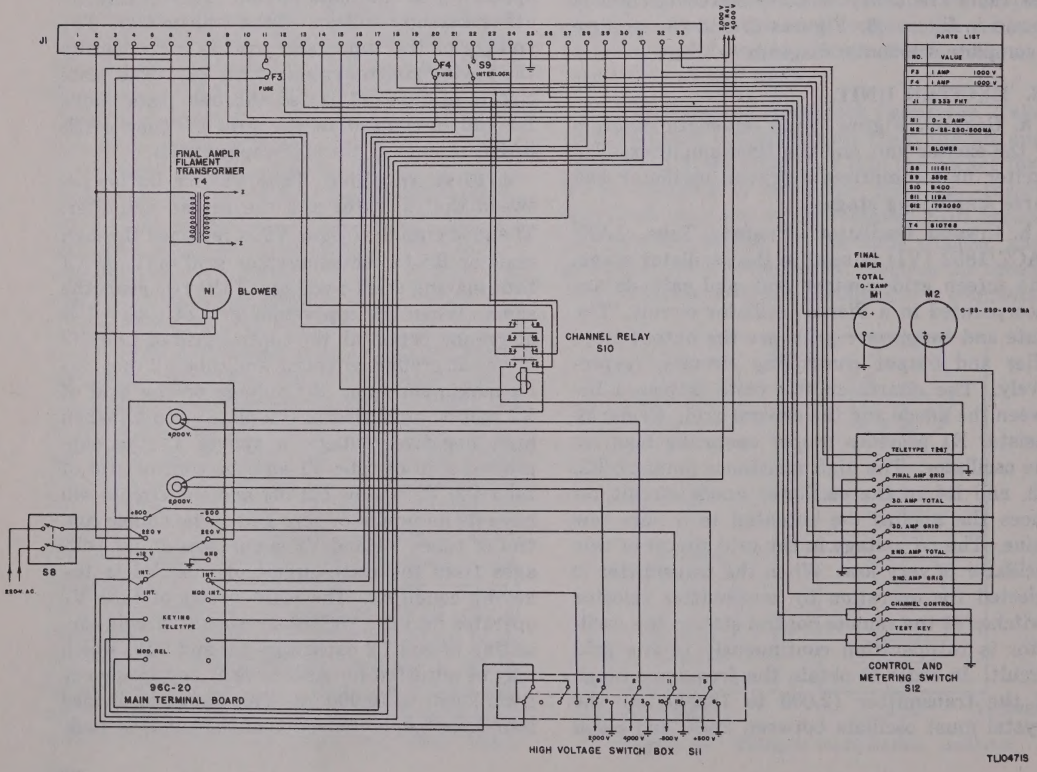


Figure 26. Radio transmitter (Wilcox Electric type 96C3), block diagram.



PARTS LIST

NO.	VALUE
F3	1 AMP 1000 V
F4	1 AMP 1000 V
C1	2.333 FMT
M1	0-1 AMP
M2	0-25-250-500 MA
N1	BLOWER
S8	111611
S9	5806
S10	8400
S11	1193A
S12	1793050
T4	810768

Figure 27. Radio transmitter (Wilcox Electric type 96C3), cabinet wiring.

by switch S6. Position 1 of switch S6 selects band 1 which has a nominal frequency range of 2,000 to 3,600 kc; position 2 selects band 2 which has a nominal range of 3,600 to 5,600 kc; while position 3 selects band 3 which has a nominal range of 5,600 to 10,000 kc. Any frequency within these bands is obtained by tuning capacitors C9 and C10. Plate potential is supplied to tube V2 through the resonant circuit 96C-10.2 from the voltage-dividing network R25 and R26 which is across the +500-volt d-c power supply. The r-f current is bypassed to ground through capacitor C11. Resistor R6, bypassed by capacitor C3, provides cathode bias for tube V2. Screen potential is supplied from the voltage dividing network R7 and R8 which connects to the plate supply lead. The screen is bypassed by capacitor C4. The plate of tube V2 is coupled to the grid of Tube JAN-807 (V3) through capacitor C12. This capacitor is an integral part of the 96C-10.2 assembly.

d. Second Amplifier. Beam power tube V3 is used in the second amplifier. R-f grid current is returned to ground for r-f through capacitor C6. Bias is supplied through resistors R10, R9, and R14 from the voltage divider network across the —500-volt bias supply. The negative grid bias limits the plate current to keep the tube within the allowable plate dissipation rating. The r-f voltage applied to the grid of tube V3 is large enough to cause the flow of grid current. The grid current is metered by placing meter M2 across calibrated resistor R14. Resistor R10 prevents the generation of spurious frequencies. The plate circuit of tube V3 operates into the 96C-10.3 resonant circuit, which may be adjusted to any frequency from 2,000 to 10,000 kc by means of switch S7 and capacitors C16 and C17 in the same manner as 96C-10.2 (subpar. c above). Plate voltage is supplied to tube V3 from the +500-volt supply. The plate is bypassed to ground through capacitor C15. Resistor R13 is inserted in the plate circuit to prevent generation of spurious frequencies. Screen voltage is supplied from the +500-volt supply through resistor R12. Capacitor C14 bypasses the screen supply for r-f. Resistor R11 in the cathode circuit provides for metering of the total cathode current. Meter M2 is switched across R11 by means of a key on switch S12 on the control panel. The plate of tube V3 is coupled to the grid of Tube JAN-813 (V4) through capacitor C18. This capacitor is an integral part of the 96C-10.3 assembly.

e. Third Amplifier. Beam power tube V4 is used in the third amplifier. The r-f grid current is returned through choke L4, grid leak resistor R28, and capacitor C22 to ground. Bias is obtained from the voltage divider network across the —500-volt bias supply (fig. 30). The negative bias is great enough to prevent the flow of plate current when no signal is applied to the grid. The r-f voltage applied to the grid is large enough to drive the grid positive and cause grid current to flow. The grid current is measured by placing meter M2 across calibrated resistor R29 in the grid return circuit. The plate circuit of tube V4 operates into the 96C-11 resonant circuit, described in paragraph 69. The resonant circuit is composed of capacitor C29 in parallel with coil L7 which is any one of four plug-in coils. By selecting the proper coil, the resonant circuit can be varied in frequency from 2,000 to 18,000 kc. At the higher frequencies capacitor C29 is removed from the circuit by means of a removable link. Capacitors C19 and C20 in the filament circuit bypass r-f currents to ground and keep these currents out of the filament supply leads. Resistor R32 is placed on the center tap of filament transformer T2 to provide means for measuring the total cathode current of tube V4. This measurement is made by switching meter M2 across resistor R32. The screen grid potential is supplied by the voltage dividing network R30 and R31 across the +500-volt supply. The screen grid is bypassed to ground by capacitor C21. Plate voltage is supplied through plate choke L6. Choke L11 is an anti-parasitic choke. R-f plate currents are bypassed to ground by capacitors C31 and C39. The tuned circuit components are located on the slide panel. Their functions are discussed in paragraph 69.

67. ELECTRONIC CHANNEL CONTROL.

Electronic channel control is accomplished by means of tube V6. The plate circuit of tube JAN-6J5 (V6) operates into channel relay S1, which in turn operates channel control relay S2. Figure 29 is a block diagram of the channel control, and figure 28 is a schematic diagram, which includes the channel control circuits. Tube V6 is normally biased to plate current cut-off by means of the voltage-divider R21 and R22 across the —500-volt bias supply.

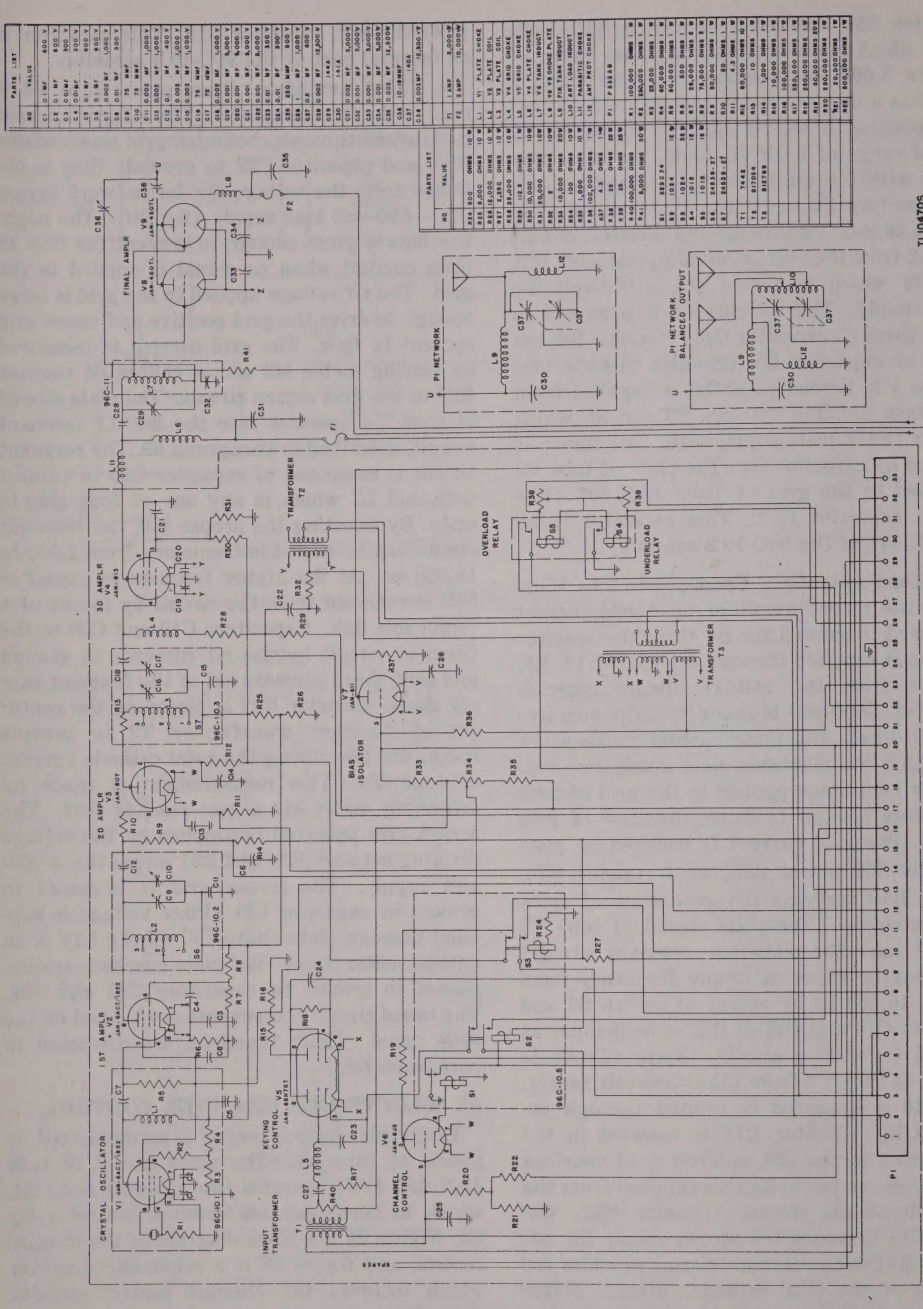


Figure 28. Radio transmitter (Wilcox Electric type 96C3), exciter and final amplifier, schematic diagram.

The grid of tube V6 is connected to the center-tap of the input side of keying line transformer T1. By means of remotely located control equipment the simplex circuit of the keying lines is grounded when the transmitter is selected for use. This grounds the grid of tube V6 and permits plate current to flow in the tube and the coil of relay S1, causing the relay contacts to close. The closed relay contacts place +12 volts across the coil of relay S2 closing its contacts. The lower set of contacts of relay S2 connect a 220-volt alternating current to the operating coil of channel relay S10. The upper set of contacts connect keying control tube V5 to a tap on the bias supply bleeder. For a discussion of the complete operation of channel relay S10 see paragraph 75. Resistor R19 keeps plate dissipation of tube V6 within rated value. Plate voltage is furnished through plug P1 and jack J1 from the +500-volt supply. A CHANNEL CONTROL key is provided on the control panel for testing purposes. Closing this key grounds one side of relay S2, causing it to operate.

68. KEYING CONTROL CIRCUITS.

Figure 30 is a partial schematic diagram which shows the keying control circuit. Twin triode tube JAN-6SN7GT (V5) is used as the keying control tube. In the key-up condition the second triode section develops a high negative potential across resistor R16 which is applied to the controlling grids of tubes V1 and V2 (par. 66). The two triode sections of tube V5 are connected as a direct coupled amplifier. A signal applied to the grid of the input section appears greatly amplified in the plate circuit of the output section. Step-up transformer T1 is inserted between the keying line and the grid of the input section of tube V5. A manual adjustment of the signal applied to this grid is made by means of potentiometer R40. The grid bias is taken from the adjustable slider on resistor R34, and is adjusted to plate current cut-off for no signal on the grid. Thus a signal applied to the input grid through transformer T1 will, on the positive peaks, cause plate current to flow, resulting in a voltage drop across plate load resistor R18. Plate potential is secured through resistor R18 from the bias supply bleeder. The grid of the second triode section is directly connected to the plate of the first section, and the cathode is connected to the grid return circuit. The plate potential for the second triode section is obtained from the bias supply bleeder by means of the voltage drop across resistors R27 and R24. Plate return is through resistors R15 and R16. Under key-up condition there is no signal applied to the input grid with resultant zero plate current flow and zero voltage drop across resistor R18. The cathode and grid of the second section of tube V5 are then at the same potential, and maximum plate current flows through resistors R15 and R16. The negative voltage drop across resistor R16 is applied to the control grids of tubes V1 and V2, and prevents the oscillator voltage from being amplified. A signal applied to the input grid of tube V5 through transformer T1 results in a voltage drop across resistor R18. This places a large negative voltage on the grid (terminal 4) of the second triode section of tube V5. Plate current ceases to flow in this section and there is no voltage drop across resistor R16. In this condition the controlling grids of tubes V1 and V2 are at ground potential and amplify the oscillator voltage. Capacitors C24 and C8 are placed across resistors R18 and R16, in order to introduce a time constant to prevent the voltage drop across resistor R16 from following the a-c voltage applied to the input grid of V5. The minimum frequency at which the keying control circuit will produce a constant carrier output for key-down condition is determined by the time constants of the circuit. This minimum frequency is approximately 300 cycles. Local operation of the transmitter for test purposes is obtained by means of the TEST KEY on the control panel. This key connects the grids of tubes V1 and V2 directly to ground. To prevent excessive plate dissipation in tube V5, resistor R15 is inserted in the plate circuit of the second triode section.

69. FINAL-AMPLIFIER STAGE.

a. General. The final-amplifier stage consists of the resonant plate circuit of tube V4 (which is also the grid circuit of Tube JAN-450TL (V8) and Tube JAN-450TL (V9), the final-amplifier tube, neutralizing circuit, antenna-loading networks, and various relay control and fuse circuits. Bias isolator Tube JAN-811 (V7) overload relay S5 and underload relay S4, while located on the exciter unit chassis 96C3-10, are an integral part of the final-amplifier circuit. Figure 31 is a partial schematic diagram of the final amplifier.

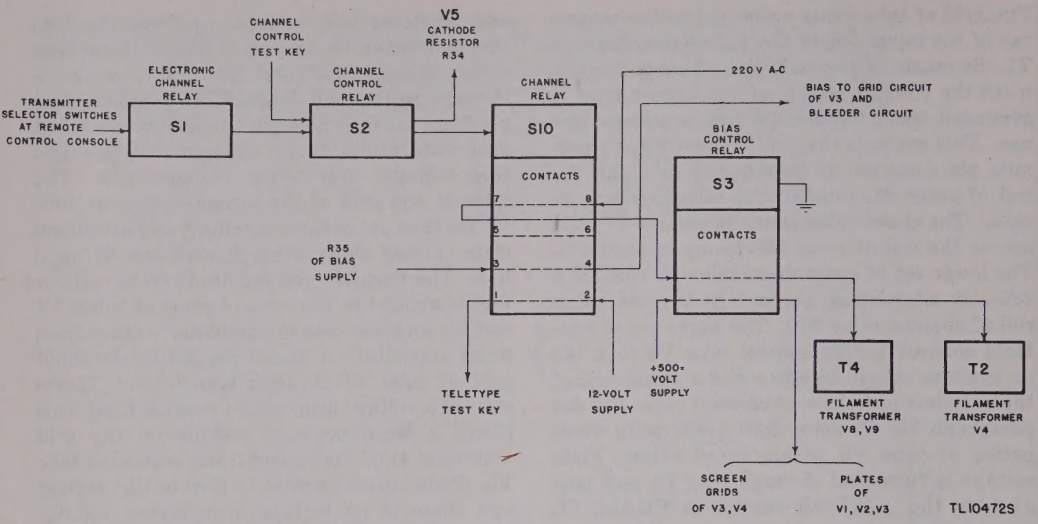


Figure 29. Radio transmitter (Wilcox Electric type 96C3), channel control equipment, block diagram.

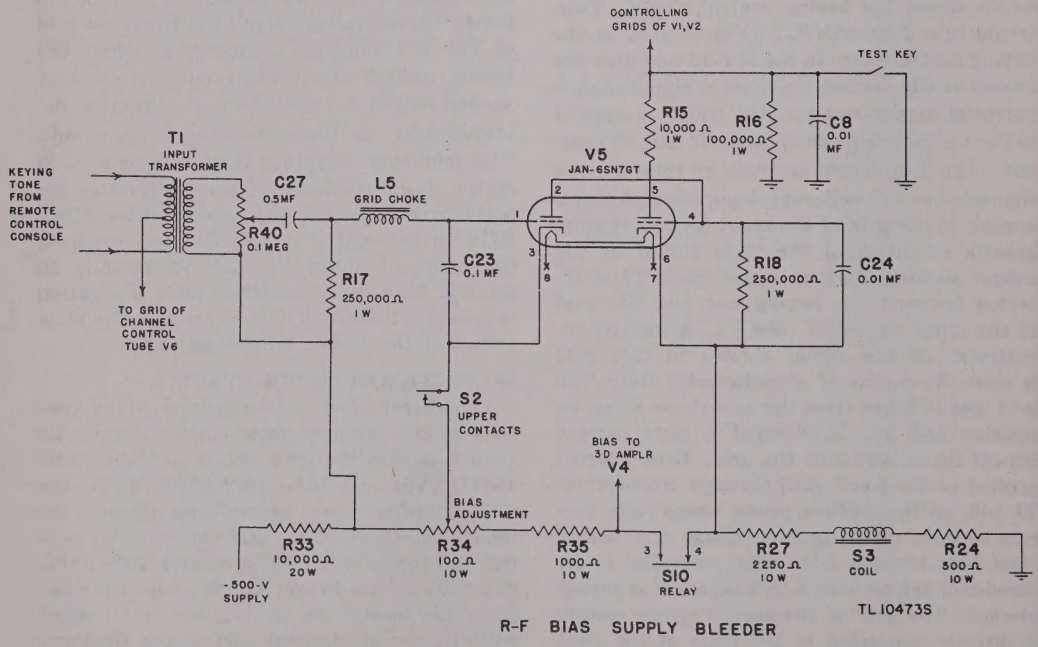


Figure 30. Radio transmitter (Wilcox Electric type 96C3) keying control circuit, schematic diagram.

b. Final Amplifier. Radio-frequency grid voltage is supplied to final-amplifier tubes V8 and V9 from the plate circuit of third amplifier tube V4. The plate of tube V4 operates into a resonant 96C-11 circuit, the centertap of which is held at r-f ground potential through the bypassing action of capacitor C32. Capacitor C28 is a blocking capacitor which keeps high d-c voltages off the grids of tubes V8 and V9. The resonant circuit is tuned by capacitor C29. A removable link is provided on capacitor C29 which is opened to reduce the capacitance for high-frequency operation of the transmitter. R-f voltage from a tap on inductor L7 is fed to the paralleled grids of final-amplifier tubes V8 and V9. Capacitors C33 and C34 provide a direct return path to ground for the r-f current. Plate voltage is fed to the plates of tubes V8 and V9 through plate choke L8. Capacitor C35 provides an r-f bypass to ground. The r-f voltage across r-f choke L8 is fed to the antenna-loading network. Capacitor C30 is provided with a link, which is opened to obtain minimum capacitance for the high-frequency range. Capacitor C38 blocks the high d-c plate voltage from the antenna-loading network.

c. Neutralization. The purpose of neutralization is to cancel the current which is fed back to the grid circuit through the grid-plate capacitance in order to prevent tubes V8 and V9 from oscillating. The Rice system, which is used, consists essentially of a bridge circuit which balances the current fed back to the grid circuit through the grid-plate capacitances by an equal but opposing current fed through neutralizing capacitor C36. Figure 32 shows the radio-frequency paths entering into the neutralizing process. Figure 31 is a partial schematic diagram of the complete final-amplifier circuit. It will be noted from figure 32 that the r-f voltage from the third amplifier is impressed across coil L7 which is a tapped coil. The voltage across the section L_{AB} of coil L7 is fed to the grids to be amplified. The amplified r-f voltage appearing across r-f choke L8 causes r-f current to flow in the circuit composed of blocking capacitor C38, neutralizing capacitor C36, and section L_{BC} of L7. The current through L_{BC} induces a voltage in L_{AB} opposite in phase to the voltage in L_{AB} resulting from current flow through the grid-plate capacitances, C_a and C_b, of tubes V8 and V9. Thus, when capacitor C36 is properly adjusted the two voltages cancel, and no net voltage from the plate circuit appears across terminals AB. It is important to note that L_{AB} and L_{BC} are sections of single coil L7 and that an r-f current in L_{BC} induces a voltage in L_{AB} due to the mutual inductance of these two sections. This induced voltage in L_{AB} is the opposing voltage discussed above. The discussion above neglects the effect of capacitor C38. However, the capacitance of C38 is high (0.02 microfarad (mf)) so the net capacitance of capacitors C36 and C38 in series is nearly equal to the capacitance of capacitor C36 alone. The taps on coil L7 are set so that L_{AB} and L_{BC} are nearly equal. For this setting of the taps the approximate condition for balance is that C_a plus C_b equals capacitor C36. The method of securing complete neutralization is discussed in paragraph 95f.

70. ANTENNA-LOADING NETWORKS.

Networks are provided for operating the final amplifier into either an unbalanced or balanced transmission line or antenna system. These two networks are designated PI NETWORK and PI NETWORK-BALANCED OUTPUT, respectively, on figure 28. Part of the electrical components are used in both networks. For both types of operation the r-f voltage across choke L8 of the final amplifier is applied across the input terminals of the antenna-loading network.

a. Pi Section-Unbalanced. The network consisting of chokes L9 and capacitors C30 and C37 matches the impedance of the plate circuit of the final amplifier to an unbalanced transmission line or antenna system. The transmitter is loaded by decreasing capacitor C37 and adjusting capacitor C30 for resonance at the required output frequency. Choke L12 is a protective choke to draw to ground charges which may appear on the antenna, thus preventing damage to the capacitors in the antenna-loading network. In case of failure of plate blocking capacitor C38, choke L12 also grounds the high d-c plate voltage causing overload relay S5 to operate until fuse F2 blows. The inductance of choke L12 is high enough to neglect its shunting effect on the antenna-loading network.

b. Pi Section-Balanced Output. The balanced output network consists of chokes L9 and L10 and capacitors C30 and C37. This network

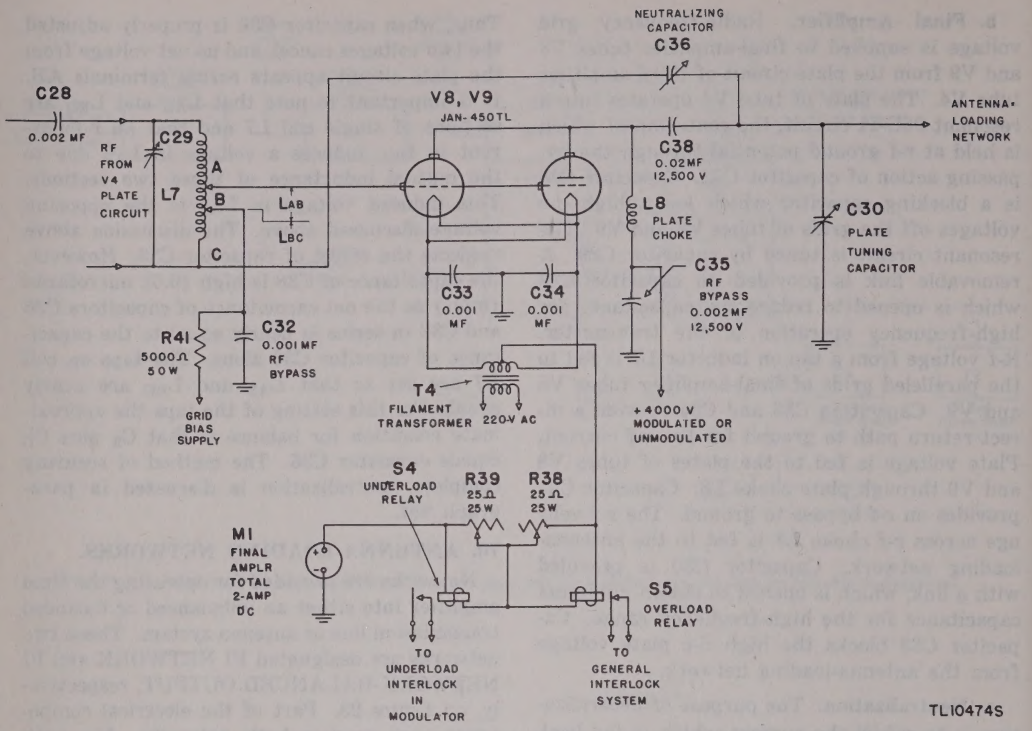


Figure 31. Final amplifier, partial schematic diagram.

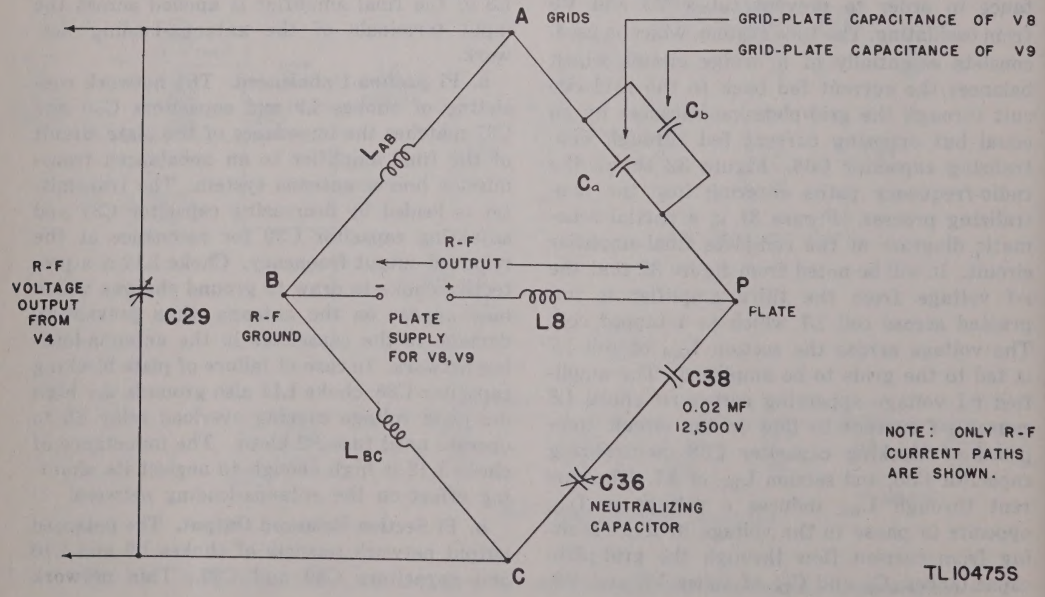


Figure 32. Neutralization circuit, simplified schematic diagram.

matches the impedance of the plate circuit of the final amplifier to a balanced transmission line or antenna system. The taps on choke L10 are adjusted to secure the proper impedance to match the transmission line impedance. In operation, the position of these taps is adjusted to give equal currents in both wires of the transmission line. The transmitter is loaded by decreasing capacitor C37, and adjusting capacitor C30 for resonance at the required output frequency. The function of choke L12 is discussed in paragraph a above.

71. BIAS ISOLATOR.

Figure 33 is a partial schematic diagram of the bias isolation circuit. Bias isolator tube V7 is inserted in the grid return lead of the final-amplifier stage to prevent the current flow in the grids of this stage from causing a change in the r-f bias supply voltage. If such a change were permitted, the bias on the tubes in the exciter would vary, causing amplification of an unwanted signal. When a radio-frequency voltage is applied to the grids of tubes V8 and V9 from the plate circuit of the third amplifier, grid current flows during the positive voltage peaks and rectification occurs. The grid of V7 is connected to the negative side of the —500-volt r-f bias supply. Grid leak resistor R36 returns the grid of tube V7 to the filament circuit through the centertap of the filament winding of transformer T3. The plate of tube V7 is grounded through final-amplifier grid metering resistor R37. When the transmitter is in the static or key-up condition, a large voltage drop occurs across resistor R36, which biases tube V7 very nearly to cut-off. The impedance of the plate-to-filament circuit becomes quite high and the d-c potential of the filament circuit approaches the potential of the grid bias supply. This potential is applied to the grids of the final amplifier through grid leak resistor R41. In the dynamic or key-down condition of the transmitter the grids of the final amplifier draw current through resistors R41 and R36. The voltage drop across resistor R36 resulting from the flow of grid current in the final amplifier, opposes the voltage drop produced in the static condition and causes tube V7 to be conducting and of low impedance. The filament circuit of tube V7 becomes negative with respect to the grid, and the current flow to the grids of tube V8 and V9 is passed through the plate-to-filament circuit of bias isolator tube V7. The plate-to-filament impedance is much lower than the impedance of resistor R36 and absorbs a greater part of the current flow. The plate impedance of tube V7 becomes a part of the grid leak circuit, and determines the bias applied to tubes V8 and V9. An indication of the final-amplifier grid current is obtained by resistor R37 inserted between the plate of the isolator tube and ground. The FINAL AMP. GRID push button on the control panel places meter M2 across calibrated resistor R37 and indicates the grid current flow.

72 OVERLOAD AND UNDERLOAD PROTECTION.

Figure 31 is a partial schematic diagram which shows the circuit of the overload and underload relays. Figures 27 and 28 are schematic diagrams showing all of the amplifier circuits. Figure 34 is a block diagram of the circuits. The total current from final-amplifier tubes V8 and V9 passes through the centertap of the filament winding of transformer T4 and then through the overload and underload relays S5 and S4. The current then passes through final-amplifier total meter M1 to ground.

a. Overload Relay S5. The contacts of overload relay S5 are normally closed, opening only when excessive current flows from tubes V8 and V9. The point at which relay S5 operates is fixed by adjusting shunting resistor R38. This resistor is adjusted according to desired output and final-amplifier plate current. When the current rises above this value, relay S5 operates and opens its contacts causing the system interlock to operate. This removes the d-c plate voltage from tubes V4, V8, and V9. The relay recloses immediately and continues to recycle until the overload condition is removed or fuse F2 is blown.

b. Underload Relay S4. The contacts of underload relay S4 are closed when the total final-amplifier current is above a predetermined amount. The point at which relay S4 operates is fixed by adjusting shunting resistor R39. The relay contacts are in series with the modulator underload interlock system. Opening the contacts of relay S4 operates relays in the modulator, and removes modulated plate voltage from the final-amplifier tubes in the transmitter. (For additional information refer to TM 11-2650 Modulator (Wilcox Electric type 50A3).)

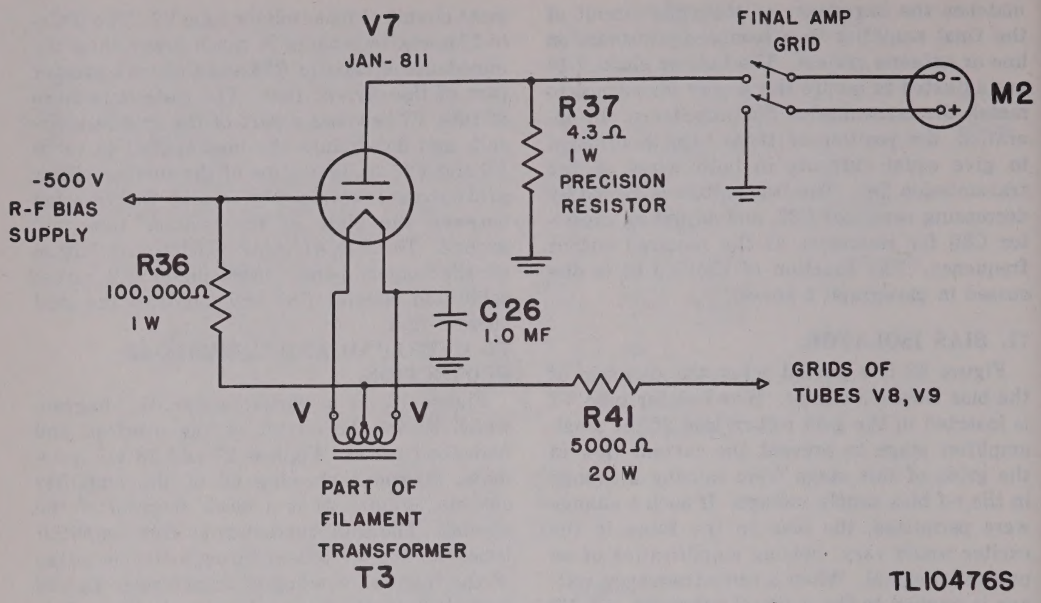


Figure 33. Bias isolator, partial schematic diagram.

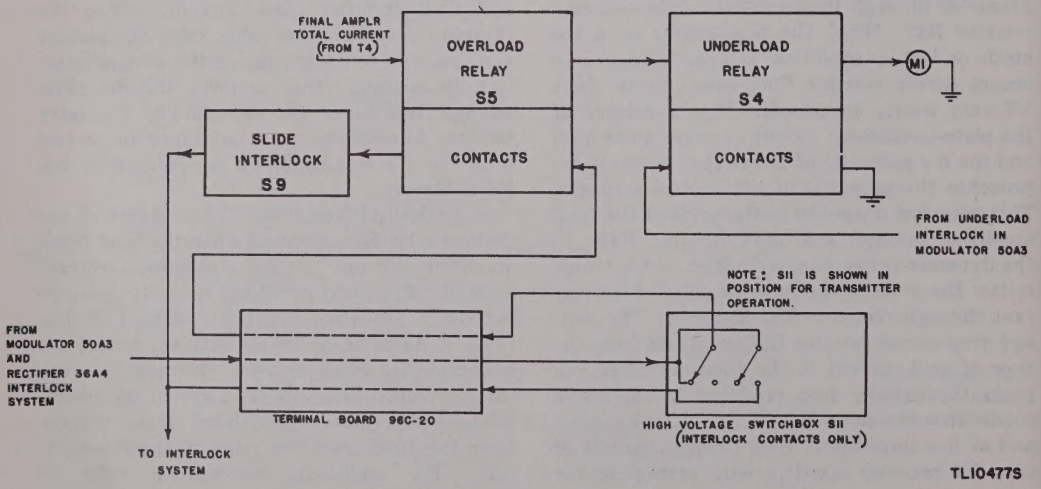


Figure 34. Radio transmitter (Wilcox Electric type 96C3) interlock circuit, block diagram.

73. BIAS CONTROL.

Figure 29 is a block diagram of the channel control equipment and shows the operation of bias control relay S3. Figure 35 is a partial schematic diagram of this relay. Bias control

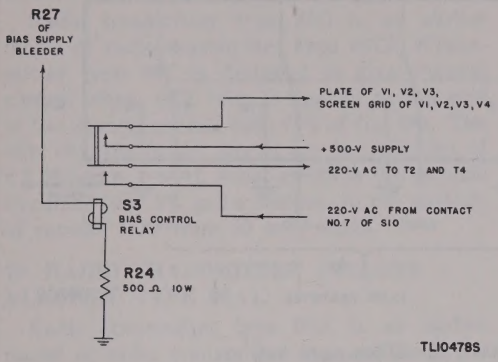


Figure 35. Bias control, partial schematic diagram.

relay S3 serves to protect the tubes in the transmitter in case of failure of the —500-volt r-f bias supply. The relay is connected in series which make up switch S12, are discussed in If normal current flows through the bleeder and relay coil, the relay contacts are closed. Should the bias supply fail, relay S3 opens and the contacts disconnect plate voltage from tubes V1, V2, and V3. The contacts also disconnect screen grid voltages from tubes V1, V2, V3, and V4. In addition, the 220-volt a-c supply to filament transformers T2 and T4 is interrupted. This immediately removes filament voltage from the third- and final-amplifier stages and prevents injury to tubes V4, V8, and V9.

74. TEST KEYS.

The function of the various test keys located on the control panel in the front of the cabinet, which make up switch S12, are discussed in paragraphs describing the equipment with which the keys are associated. Figure 36 is a schematic diagram of the meter and test key circuits.

a. Teletype Test. When the TELETYPE TEST key is closed, +12 volts is applied through contacts 1 and 2 of switch S10 to one of the leads marked SPARE in figure 28. The other SPARE lead is grounded at the same time. This key has no function when the equipment is used in a normal manner.

b. Final Amplifier Grid. The function of the FINAL AMP. GRID key is discussed in paragraph 71.

c. Third Amplifier Total. The function of the 3RD. AMP. TOTAL key is discussed in paragraph 66e.

d. Third Amplifier Grid. The function of the 3RD. AMP. GRID key is discussed in paragraph 66e.

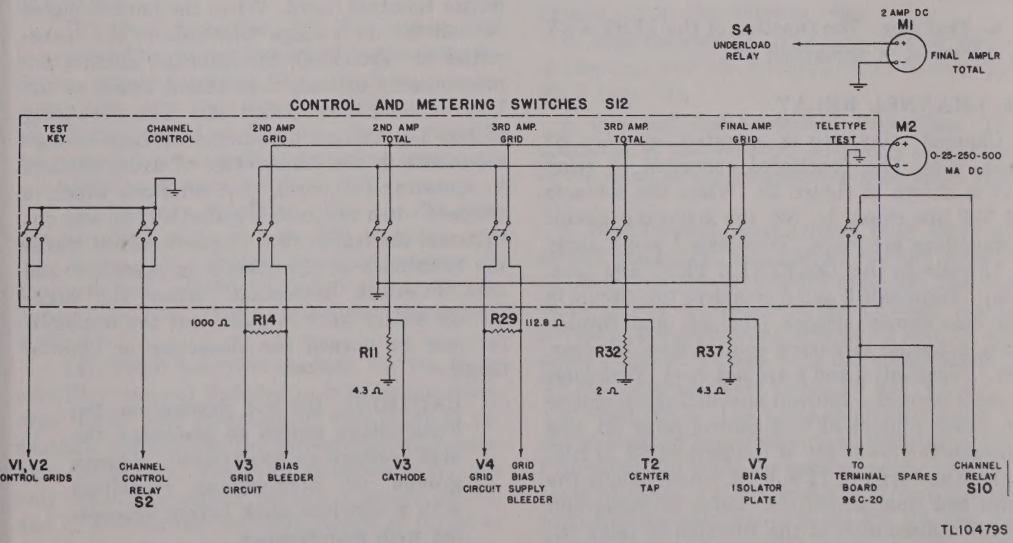


Figure 36. Radio transmitter (Wilcox Electric type 96C3), metering and test key circuits, schematic diagram.

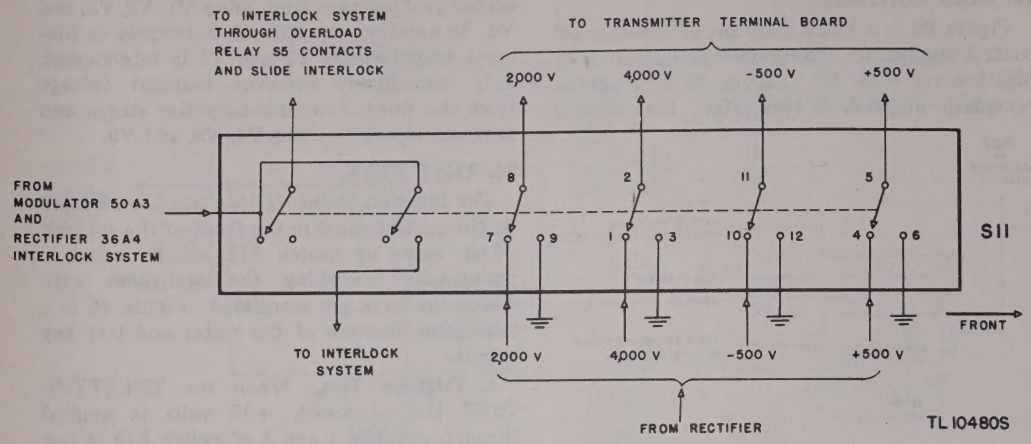


Figure 37. High-voltage switchbox, partial schematic diagram.

e. Second Amplifier Total. The function of the 2ND. AMP. TOTAL key is discussed in paragraph 66d.

f. Second Amplifier Grid. The function of the 2ND. AMP. GRID key is discussed in paragraph 66d.

g. Channel Control. The function of the CHANNEL CONTROL key is discussed in paragraph 67.

h. Test Key. The function of the TEST KEY is discussed in paragraph 68.

75. CHANNEL RELAY.

Channel relay S10 is operated by relay S2 (par. 67). The functional operation of relay S10 is shown in figure 29. When the contacts of S10 are closed by S2, the following circuit connections are made. Terminals 1 and 2 apply +12 volts to the TELETYPE TEST key (par. 74a). Terminals 3 and 4 complete the circuit in the bias supply bleeder (fig. 30) and furnish plate potential to keying control tube V5 (par. 68). Terminals 5 and 6 are not used. Terminals 7 and 8 connect a 220-volt alternating current to the lower contact of bias control relay S3, and through the lower set of contacts of S3 to filament transformers T2 and T4, which supply the third and final amplifiers. Refer to paragraph 73 for a discussion of the function of relay S3.

76. HIGH-VOLTAGE SWITCHBOX.

Figure 37 is a partial schematic diagram of the high-voltage switch box. All d-c voltages from the rectifier are connected to terminals in the high-voltage switchbox. High-voltage switch S11 is operated by the knob at the bottom center on the front of the cabinet (fig. 4). When the knob is pushed all the way in, the d-c voltages are connected to the main transmitter terminal board. When the knob is pulled out, all the d-c voltage terminals in the transmitter are grounded; the interlock circuits are momentarily opened, then closed again as the knob is completely pulled out. The grounding of the d-c voltages discharges all high-voltage capacitors in the transmitter to avoid damage to operating personnel. The interlock which is reclosed when the knob is pulled all the way out bypasses the transmitter in question, but leaves the remainder of the station in operation and with interlock protection. After the high-voltage switch knob is pulled out the transmitter may be opened for inspection or maintenance.

> **CAUTION: Do not depend on the high-voltage switch to discharge the high-voltage capacitors. Always ground all high-voltage capacitors with a shorting stick before proceeding with maintenance.**

SECTION XIII. THEORY OF RADIO TRANSMITTERS

(WILCOX ELECTRIC TYPES 96C AND 96A)

77. RADIO TRANSMITTER (WILCOX ELECTRIC TYPE 96C).

Radio transmitter type 96C is an earlier model of radio transmitter type 96C3. Transmitter type 96C is designed to give channel control when +12 volts is applied to the grid of the channel control tube (V6 of fig. 28). The only changes in the circuit are the addition of a 3,000-ohm, 1-watt, resistor R23 in the cathode circuit of tube V6, and a decrease in the wattage of resistor R19 from 20 to 3 watts.

78. RADIO TRANSMITTER (WILCOX ELECTRIC TYPE 96A).

Radio transmitter type 96A is an earlier model of radio transmitter type 96C3. Front views of type 96A are shown in figure 7 and a right interior view of the transmitter is shown in figure 52. All differences in the following discussion are based on radio transmitter 96C3 as the basic model. For component part designations refer to figure 38, which is a schematic diagram of transmitter type 96A.

a. Exciter Type 91A.

(1) Crystal Oscillator. Plate bypass capacitor C4 is 0.1 mf instead of 0.01 mf. The filament bypass capacitors are 0.1 mf instead of 0.01 mf.

(2) First Amplifier, V2. The screen grid is bypassed to ground instead of to the cathode. Screen bypass capacitor C8, cathode bypass capacitor C7, and plate bypass capacitor C9 are all 0.1 mf instead of 0.01 mf. One of the 75-micromicrofarad (mmf) plate tuning capacitors is omitted in transmitter type 96A.

(3) Second Amplifier, V3. A 50-ohm screen antiparasitic resistor R35 is added, and the screen-grid, voltage-dropping resistor is changed from 50,000 to 20,000 ohms. Screen bypass capacitor C18 is 0.005 mf instead of 0.002 mf.

(4) Third Amplifier-doubler, V4. The third amplifier was not included in radio transmitter type 96C3. The operation of this stage is essentially the same as the second amplifier (subpar. (3) above). The third amplifier is for use only when the carrier output is above 10 mc, and in this service the tank circuit is tuned to double the frequency of the grid signal. For lower frequency operation this stage may be eliminated by removing coil L2 from its socket and connecting the plate lead from capacitor C20 to the plate cap of tube V3.

(5) Fourth Amplifier, V5. The fourth amplifier in radio transmitter type 96A performs the same function as the third amplifier in radio transmitter type 96C3 (par. 66). The grid choke, grid return capacitor, and plate lead antiparasitic resistor are omitted in radio transmitter type 96A, and no r-f bypass capacitor is provided in the plate circuit.

b. Final Amplifier, V6 and V7. Grid antiparasitic resistors R36 and R37 are added in the grid leads of tubes V6 and V7 to prevent parasitic oscillation. Two blocking capacitors C30 and C31 in series, instead of one, block the d-c plate voltage from the antenna-loading circuit.

c. Antenna loading Circuit. The network consisting of capacitors C33 and C34, and coil L5 functions as a matching network to match the final amplifier to the antenna for unbalanced operation. No provision is made for balanced operation. Antenna relay S3 is provied, which connects the final-amplifier output to the antenna when channel relay S2 is closed by channel control relay S1. Capacitor C39 is an r-f bypass across the antenna relay coil.

d. Bias Isolator V8. The bias isolator circuit is identical with the circuit of transmitter type 96C3 (par. 71).

e. Overload and Underload Protection. The operation of the overload and underload relays is the same as for transmitter type 96C3 (par. 72).

f. Bias Control. Bias control relay S5 is operated when the bias bleeder circuit is completed by contacts on channel relay S2. The contacts of rely S5 complete the primary supply circuit to filament transformers T2 and T3, and apply filament voltage to fourth-amplifier tube V5 and final-amplifier tubes V6 and V7.

g. Test Keys. The test key circuits are similar to those in transmitter type 96C3 (par. 74). Provisions are made for indicating the grid currents of tubes V4, V5, and V6-V7, and for the total cathode currents of tubes V3, V4, and V5. A separate, permanently connected meter, M1,

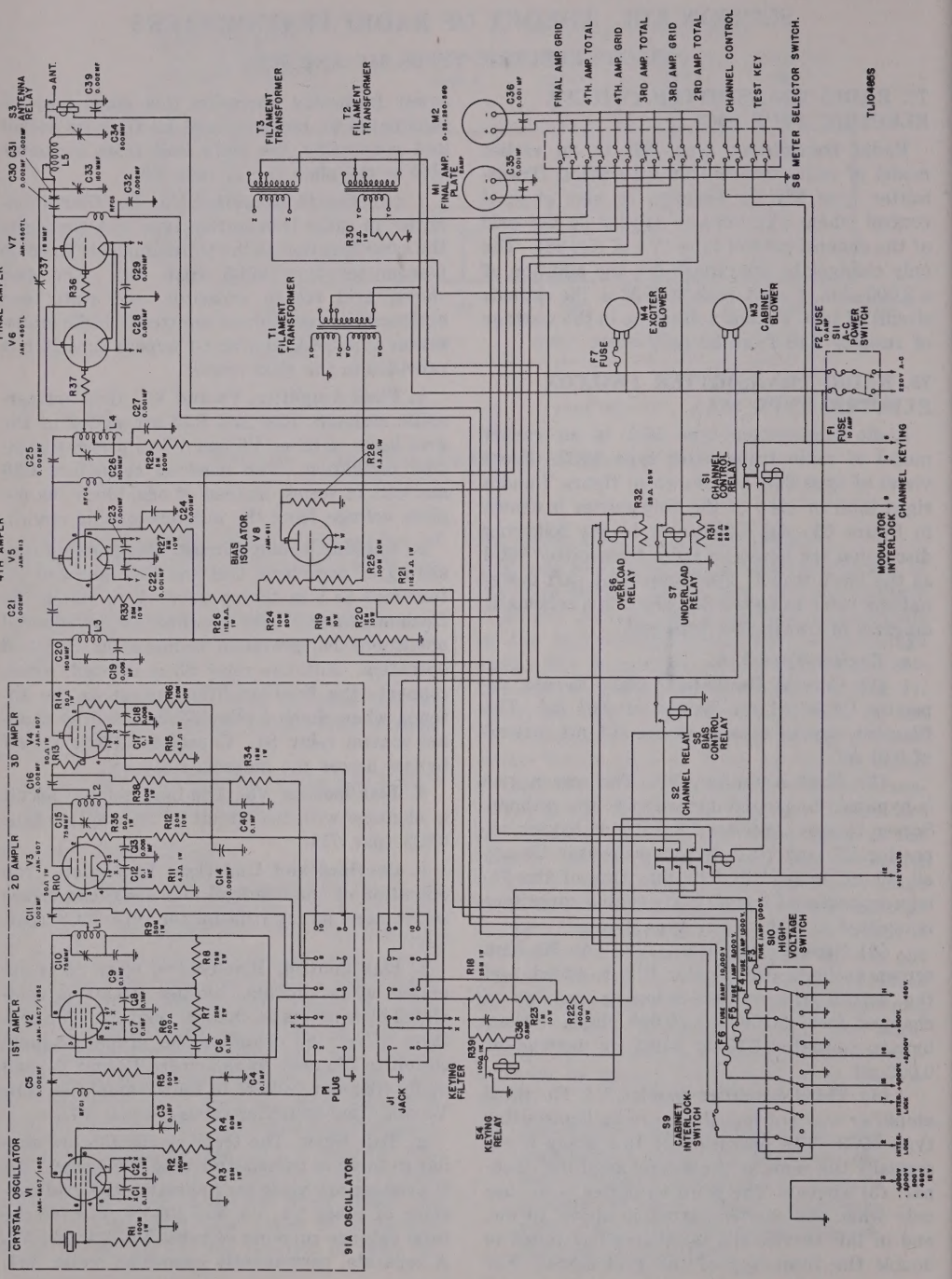


Figure 38. Radio transmitter (Wilcox Electric type 96A), schematic diagram.

indicates the total current of tubes V6 and V7. No TELETYPE TEST key is provided. Figure 8 shows the panel designation of the various test keys.

h. Channel Control. Channel control relay S1 is closed by grounding one side of its operating coil through the action of dialing equipment in the modulator, which has in turn been operated by a remotely located control station. Relay S1 contacts close channel relay S2 and the circuit to keying relay S4. Channel relay S2 applies +12 volts to one side of keying relay S4 and closes the bias bleeder circuit, thus operating bias control relay S5 (subpar. f above). Relay S2 also applies plate and screen voltages to tubes V1, V2, V3, and V4, and, through the contacts of relay S5, energizes transformers T2 and T3 and cabinet blower motor M3. It also closes antenna relay S3.

i. Keying. Keying is accomplished by grounding keying relay S4, thus applying +12 volts to its operating coil. The ground is simplexed to transmitter type 96A from remotely located control equipment. The TEST KEY on control panel switch S8 is provided for test purposes at the transmitter. The network, consisting of resistors R18 and R39 and capacitor C38, is a key click filter.

j. High-voltage Switchbox S10. The high-voltage switchbox is similar to the switchbox in transmitter type 96C3 (par. 76).

SECTION XIV. TROUBLE SHOOTING

79. GENERAL TROUBLE-SHOOTING INFORMATION.

a. General. No matter how well equipment is designed and manufactured, faults occur in service. When such faults occur, the repairman must locate and correct them as rapidly as possible. This section contains general information to aid personnel engaged in the important duty of trouble shooting.

b. Trouble-shooting Data. Take advantage of the material supplied to help in the location of faults. Consult the following trouble-shooting data when necessary:

(1) Block diagram of radio transmitter type 96C3 (fig. 26).

(2) Schematic diagrams of radio transmitter type 96C3 (figs. 27 and 28).

(3) Complete schematic diagram of radio transmitter type 96A (fig. 38).

(4) Partial block diagrams. These diagrams aid in understanding the operation of various parts of the transmitter.

(5) Simplified and partial schematic diagrams. These diagrams are particularly useful in trouble shooting, becaue the repairman can follow the electrical functioning of the circuits more easily than on the regular schematics, thus speeding trouble location.

(6) Voltage and resistance data for all socket connections (fig. 39).

(7) Resistor color code (fig. 54).

(8) Capacitor color code (fig. 55).

(9) Illustrations of components, front, rear, and interior views aid in locating and identifying parts.

(10) Pin connections. Pin connections on sockets, plugs, and receptacles are numbered or lettered on the various diagrams.

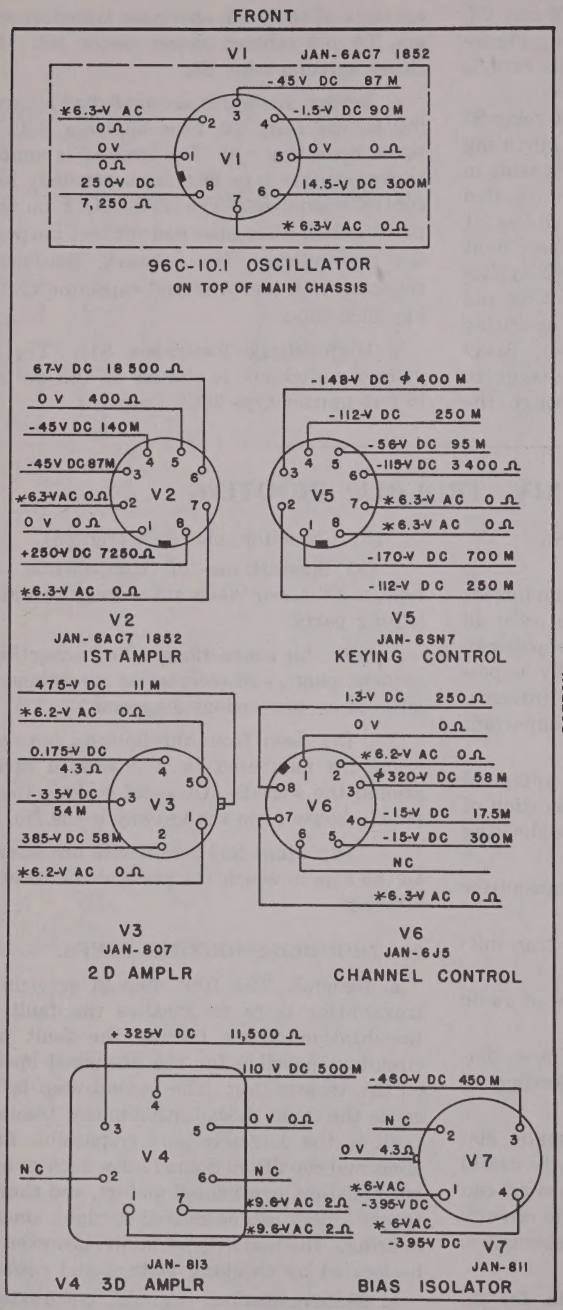
(a) Seen from the bottom, pin connections are numbered in a clockwise direction around the sockets. On octal sockets the first pin clockwise from the keyway is the No. 1 pin.

(b) Plugs and receptacles are numbered on the side to which the associated connector is attached.

80. TROUBLE-SHOOTING STEPS.

a. General. The first step in servicing the transmitter is to sectionalize the fault. Sectionalization means tracing the fault to the circuit responsible for the abnormal operation of the transmitter. The second step is to localize the fault. Localization means tracing the fault to the defective part responsible for the abnormal condition. Some faults, such as burned out resistors, overheated motors, and shortened transformers, can be located by sight, smell, and hearing. The majority of faults, however, must be located by checking voltage and resistance.

b. Sectionalization. Careful observation of the performance of the transmitter will often sectionalize the fault to a particular part. Ad-



NOTES

1. 115-V A-C INPUT.
2. ALL MEASUREMENTS TAKEN FOR STATIC (KEY UP) CONDITION.
3. D-C VOLTAGES MEASURED WITH VACUUM TUBE VOLTMETER (RCA VOLTOHMYST JR).
4. A-C VOLTAGES MEASURED WITH 1,000-OHM-PER-VOLT METER.
5. ALL RESISTANCE MEASUREMENTS TO GROUND (CHASSIS).
6. * INDICATES MEASURMENT ACROSS FILAMENTS.
7. ϕ INDICATES THAT MEASUREMENT IS TAKEN WITH ASSOCIATED RELAY CLOSED.

TL10481S

Figure 39. Exciter unit (Wilcox Electric type 96C3-10), voltage-resistance chart.

ditional sectionalizing of the fault will be discussed in paragraph 86.

c. Localization. Paragraphs 87, 88, 89, and 90 contain trouble-shooting charts which list abnormal symptoms and their probable causes. These charts also give the procedure for determining which of the probable locations of the fault is the exact one. In addition, the voltage-resistance chart (fig. 39) shows the resistance and voltage at each socket pin connection.

81. VOLTAGE MEASUREMENTS.

a. General. Voltage measurements are an almost indispensable aid to the repairman, because most troubles either result from abnormal voltages or produce abnormal voltages. Voltage measurements are taken easily, because they are always made between two points in a circuit and the circuit need not be interrupted.

(1) Unless otherwise specified, the voltages listed on the voltage charts are measured between the indicated points and ground (chassis).

(2) Always begin by setting the voltmeter on the highest range so that the voltmeter will not be overloaded. Then, if it is necessary to obtain increased accuracy, set the voltmeter to a lower range.

(3) In checking cathode voltage, remember that a reading can be obtained when the cathode resistor is actually open. The resistance of the meter may actually act as a cathode resistor. Thus, the cathode voltage may be approximately normal only as long as the voltmeter is connected between cathode and ground. Before the cathode voltage is measured, make a resistance check with a cold circuit to determine whether the cathode resistor is normal.

b. Precautions Against High Voltage. Certain precautions must be followed when measuring voltages above a few hundred volts. High voltages are dangerous and can be fatal. When it is necessary to measure high voltages, observe the following rules:

(1) Connect the ground lead to the voltmeter.

(2) Place one hand in your pocket. This will eliminate the possibility of making accidental contact with either ground or another part of the circuit and causing the electricity to travel from one hand to the other.

(3) If the voltage is less than 300 volts, connect the test lead to the hot terminal (which may be either positive or negative with respect to ground).

(4) If the voltage is greater than 300 volts, shut off the power, connect the hot lead, step away from the voltmeter, turn on the power, and note the reading on the voltmeter. Do not touch any part of the voltmeter, particularly when it is necessary to measure the voltage between two points which are above ground.

c. Voltmeter Loading. It is essential that the voltmeter resistance be at least 10 times as large as the resistance of the circuit across which the voltage is measured. If the voltmeter resistance is comparable to the circuit resistance, the voltmeter will indicate a voltage lower than the actual voltage which is present when the voltmeter is removed from the circuit.

(1) The resistance of the voltmeter on any range can always be calculated by the following simple rule: Resistance of the voltmeter equals the ohms per volt multiplied by the full-scale range in volts. For example: The resistance of a 1,000-ohm-per-volt meter on the 300-volt range is 300,000 ohms. (R = 1,000 ohms per volt times 300 volts = 300,000 ohms.)

(2) To minimize the voltmeter loading in high-resistance circuits, use the highest voltmeter range. Although only a small deflection will be obtained (possibly only 5 divisions on a 100-division scale) the accuracy of the voltage measurement will be increased. The decreased loading on the voltmeter will more than compensate for the inaccuracy which results from reading only a small deflection on the scale of the voltmeter.

(3) When a voltmeter is loading a circuit, the effect can always be noted by comparing the voltage readings on two successive ranges. If the voltage readings do not agree the loading is excessive. The reading (not the deflection) on the highest range will be greater than that the voltage readings do not agree, the loading ing the circuit heavily, the deflection of the pointer will remain nearly the same when the voltmeter is shifted from one range to the other.

(4) The ohm-per-volt sensitivity of the voltmeter used to obtain the readings on the voltage and resistance chart in this manual is

printed on the chart. Use a meter having the same ohm-per-volt sensitivity, otherwise it will be necessary to consider the effect of loading.

82. RESISTANCE MEASUREMENTS.

An ohmmeter is commonly used for resistance measurements in servicing defective equipment. Before making a resistance measurement the meter probes must be short-circuited and the zero adjustment made. This adjustment consists merely of turning the zero-adjustment knob or screw so that the meter reads zero ohms when the probes are short-circuited. This adjustment must be repeated for each ohmmeter scale used. The zero adjustment for ohmmeter measurements is not to be confused with the adjustment in the lower center of the meter face which adjusts the position of the pointer to zero before voltage measurements are made.

83. CAPACITOR TESTS.

a. General. It is often necessary to check for leakage or open or short circuits which are caused by puncture of the dielectric between the plates of capacitors of the tinfoil and paper or mica types. This does not apply to wet electrolytic types since this type is self-healing.

b. Open Capacitors. To check a capacitor for a suspected open circuit, place a good capacitor in parallel with it. In r-f circuits keep the leads as short as those of the suspected capacitor. This precaution is not necessary in audio-frequency circuits and the leads may be several inches long. Proper operation of the equipment after the auxiliary capacitor is added indicates that the suspected capacitor is open and should be replaced.

c. Shorted or Leaky Capacitors. To check capacitors suspected of being shorted or leaky, observe the kick indication on an ohmmeter. Before making the check remove one of the capacitor leads from the circuit so that the circuit will not affect the test. Adjust the ohmmeter to its highest range and connect it across the capacitor. If the capacitor is good, the needle will flick over slightly as the capacitor charges, then drop gradually back to infinity. This shows that the capacitor is not shorted. If the ohmmeter needle does not go back to infinity the capacitor is leaky and should be replaced. The flick of the needle will be small for small capacitors and the test is not reliable for capacitors which are smaller than about 0.05 mf. Electrolytic capacitors will normally show a resistance reading, and the test above indicates a defective electrolytic capacitor only when the resistance reading is less than about 1,000 ohms.

84. TUBE CHECKING.

a. Purpose. Tubes are the most frequent causes of defective operation. For this reason, the first step in trouble shooting within a component is to check and replace any tubes whose failure may account for the observed symptoms, such as abnormal meter readings. Tube checkers are used to test the tube for adequate emission of electrons and for shorted elements.

b. Tube Replacement Check. While tube checkers will eliminate tubes with low emission or shorted elements, the results are not always conclusive because the conditions are not the same as those under which the tube operates in the equipment. For this reason, the final test of a tube which has not been shown to be defective by a tube checker is its replacement by a good tube. In many cases this test is easier and quicker than testing the tube with a tube checker.

c. Tube Checking Instructions. The operation of various tube checkers is quite different. An instruction manual is provided with each tube checker and should be read to learn how to check a particular tube. Ordinarily charts are given which list the proper connections to make to the tube to be checked, and the setting of the tube checker controls and readings which will be secured for a good tube.

85. TROUBLE-SHOOTING PROCEDURES.

The accompanying trouble-shooting charts, if properly used, simplify trouble shooting. There are five charts. The first chart covers sectionalization of trouble in transmitter types 96C and 96C3, lists the symptoms which may be recognized easily by the operator, and gives the probable location of the trouble, as well as the recommended corrections. The other charts are to be used to localize trouble in the channel control and keying circuits, bias supply and control circuits, the exciter, and the final amplifier. Trouble-shooting procedures on transmitter type 96A are similar to those used in locating trouble in transmitter types 96C and 96C3.

86. SECTIONALIZING TROUBLE IN TRANSMITTER.

Symptoms	Probable trouble	Corrections
1. Transmitter dead. Filaments not lighted in exciter.	1. Switch S8 open. Switch S8 defective. A-c supply lines defective.	1. Close switch. Repair or replace switch. Repair supply line.
2. Transmitter dead. Exciter filaments lighted.	2. High-voltage switch S11 open or defective. Slide interlock S9 defective. High-voltage cables open.	2. Close or repair switch. Replace interlock. Repair or replace cables.
3. Exciter current readings normal. Final-amplifier currents low or zero.	3. Defective final amplifier. Defective meter M1.	3. Refer to paragraph 90. Replace meter.
4. Equipment operating. Current reading low.	4. Exciter improperly tuned. Crystal activity low. Exciter defective. Low line voltage.	4. Refer to paragraph 95. Replace crystal. Refer to paragraph 89. Check line voltage.
5. Current reading normal. Communication poor.	5. Antenna improperly placed or installed.	5. Check antenna.
6. Final-amplifier tube filaments fail to light when CHANNEL CONTROL test key is depressed.	6. Channel control circuit defective.	6. Refer to paragraph 87.
7. All filaments light. Transmitter fails to key.	7. Keying circuit defective.	7. Refer to paragraph 87.

87. LOCALIZING TROUBLE IN CHANNEL CONTROL AND KEYING CIRCUITS (figs. 29 and 30).

1. When CHANNEL CONTROL test key is closed:		
a. Relay S1 fails to operate.	a. Relay S1 defective. Keying line open. Defective tube V6. Open resistor R19. Bias bleeder circuit open.	a. Repair or replace relay. Repair Keying line. Replace tube. Replace resistor. Refer to paragraph 88.
b. Relay S1 operates; relay S2 fails to operate.	b. Ground on blade of relay S1 open. Relay S2 defective. +12-volt supply open.	b. Repair relay. Repair or replace relay. Repair.
c. Relays S1 and S2 operate; relay S10 fails to operate.	c. Defective contacts on relay S2 Defective relay S10.	c. Repair or replace contacts. Repair or replace relay.
2. When TEST KEY is closed keying control circuit fails to operate.	Open circuit to tubes V1 and V2.	
	Open line to TEST KEY.	Repair.
3. Keying circuit fails to operate on keying signal from control console.	Transformer T1 defective. Resistor R40 out of adjustment. Capacitor C27 open. Choke L5 open. Tube V5 defective. Capacitor C23 shorted. Resistor R34 out of adjustment. Bias bleeder circuit open.	Replace transformer. Adjust (paragraph 96). Replace capacitor. Replace choke. Replace tube. Replace capacitor. Adjust resistor (paragraph 96). Refer to paragraph 88.

88. LOCALIZING TROUBLE IN BIAS SUPPLY AND CONTROL CIRCUIT (figs. 30 and 40).

Symptoms	Probable trouble	Corrections
1. No plate or screen voltage to exciter stage tubes.	Fuse F3 or F4 blown.	Replace fuse.
	Relay S3 defective.	Repair or replace relay.
	Relay S10 defective.	See paragraph 87.
	Resistor R33 open.	Replace resistor.
	Resistor R34 open.	Replace resistor.
	Resistor R35 open.	Replace resistor.
	Resistor R27 open.	Replace resistor.
	Resistor R24 open.	Replace resistor.
	—500-volt supply defective.	Refer to TM 11-2666.
2. No bias to tubes V4, V8, and V9.	Refer to Item 1 above.	Refer to Item 1 above.

89. LOCALIZING TROUBLE IN EXCITER UNIT (fig. 28).

1. Voltages at all pins of V1 normal except:		
a. No voltage at pins 2 and 7.	a. Winding on transformer T3 burned out. Filament lead broken.	a. Replace transformer. Repair lead.
b. No voltage at pin 3.	b. Shorted capacitor C8. Defective keying control circuit.	b. Replace capacitor. Refer to paragraph 87.
c. No voltage at pin 4.	c. Open resistor R2 or R4. Shorted capacitor C5.	d. Replace resistor. Replace capacitor.
d. No voltage at pin 6.	d. Open choke L1. Shorted capacitor C5. Open resistor R25.	d. Repair or replace choke L1. Replace capacitor. Replace resistor.
e. No voltage at pin 8.		
f. No carrier signal.	f. Defective crystal. Defective tube V1.	f. Replace crystal. Replace tube.
2. Voltage at all pins of V2 normal except:		
a. No voltage at pins 2 and 7.	a. Burned out winding in filament transformer T3. Open filament lead.	a. Replace transformer. Repair filament lead.
b. No voltage at pin 3.	b. Refer to 1b above.	b. Refer to 1b above.
c. High positive voltage at pin 4.	c. Shorted capacitor C7.	c. Replace capacitor.
d. No voltage at pin 4.	d. Refer to 1b above. Open resistor R5.	d. Refer to 1b above. Replace resistor.
e. No voltage at pin 6.	e. Resistor R8 or R25 open. Shorted capacitor C4.	e. Replace resistor. Replace capacitor.
f. No voltage at pin 8.	f. Resistor R25 open or R26 shorted.	f. Replace resistor.
3. Voltage at all pins of V3 normal except:		
a. No voltage at pins 1 and 5.	a. Burned out winding on transformer T3.	a. Replace transformer.
b. No voltage at pin 2.	b. Shorted capacitor C14. Open resistor R12. Bias circuit open.	b. Replace capacitor. Replace resistor. Check relay S3 and bias circuit (paragraph 88).

89. LOCALIZING TROUBLE IN EXCITER UNIT (fig. 28) (contd).

Symptoms	Probable trouble	Corrections
c. No voltage at pin 3.	c. Open resistor R10 or R9. Shorted capacitor C6.	c. Replace resistor. Replace capacitor.
d. High positive voltage at pin 3.	d. Shorted capacitor C12.	d. Replace capacitor.
e. No voltage at pin 4.	e. Shorted capacitor C13.	e. Replace capacitor.
f. No voltage on tube V3 cap.	f. Open resistor R13. Open coil L3. Defective contacts on switch S7. Shorted capacitor C15. Bias circuit open.	f. Replace resistor. Repair or replace coil. Repair or replace switch. Replace capacitor. Check relay S3 and bias circuit (par. 88).
4. Voltages at all pins of tube V4 normal except:		
a. No voltage at pins 1 and 7.	a. Burned out transformer T2. Relay S3 defective.	a. Replace transformer. Check relay.
b. No voltage at pin 3.	b. Shorted capacitor C21. Shorted resistor R31. Open resistor R30. Relay S3 defective.	b. Replace capacitor. Replace resistor. Replace resistor. Check relay.
c. No voltage at pin 4.	c. Open choke L4. Open resistor R28. Burned out fuse F4. Relay S3 defective.	c. Replace choke. Replace resistor. Replace fuse. Check relay.
d. Positive voltage at pin 4.	d. Shorted capacitor C18.	d. Replace capacitor.

90. LOCALIZING TROUBLE IN FINAL AMPLIFIER (fig. 31).

1. Meter M1 reading too high.	1. Final amplifier not neutralized. Resistor R41 shorted. Capacitor C32 grounded. Bias supply defective.	1. Refer to paragraph 95. Replace resistor. Replace capacitor. Refer to paragraph 88.
2. Meter M1 reading too low.	2. Capacitor C35 partially shorted. Capacitor C38 shorted. +4000 volt supply low. Bias supply too high. Defective tube V8 or V9.	2. Replace capacitor. Replace capacitor. Refer to TM 11-2666. Refer to paragraph 88. Replace tube.
3. Tube V8 or V9 has distinct bluish glow. Meter M1 reads too high.	3. Tube V8 or V9 gassy.	3. Replace tube.
4. Overload relay S5 operates at too low a current.	4. Relay S5 out of adjustment. Relay S5 defective.	4. Refer to paragraph 97. Replace relay.
5. Underload relay S4 operates at too high a current.	5. Relay S4 out of adjustment. Relay S4 defective.	5. Refer to paragraph 97. Replace relay.
6. Voltages at pins of bias isolator tube V7 normal except:		
a. No d-c voltage at pins 1 and 3.	a. Open resistor R36. Shorted capacitor C26. Defective bias circuit.	a. Replace resistor. Replace capacitor. Refer to paragraph 88.
b. No a-c voltage from pins 1 to 4.	b. Defective transformer T3.	b. Replace transformer.
c. No voltage at pin 3.	c. Defective bias circuit.	c. Refer to paragraph 88.

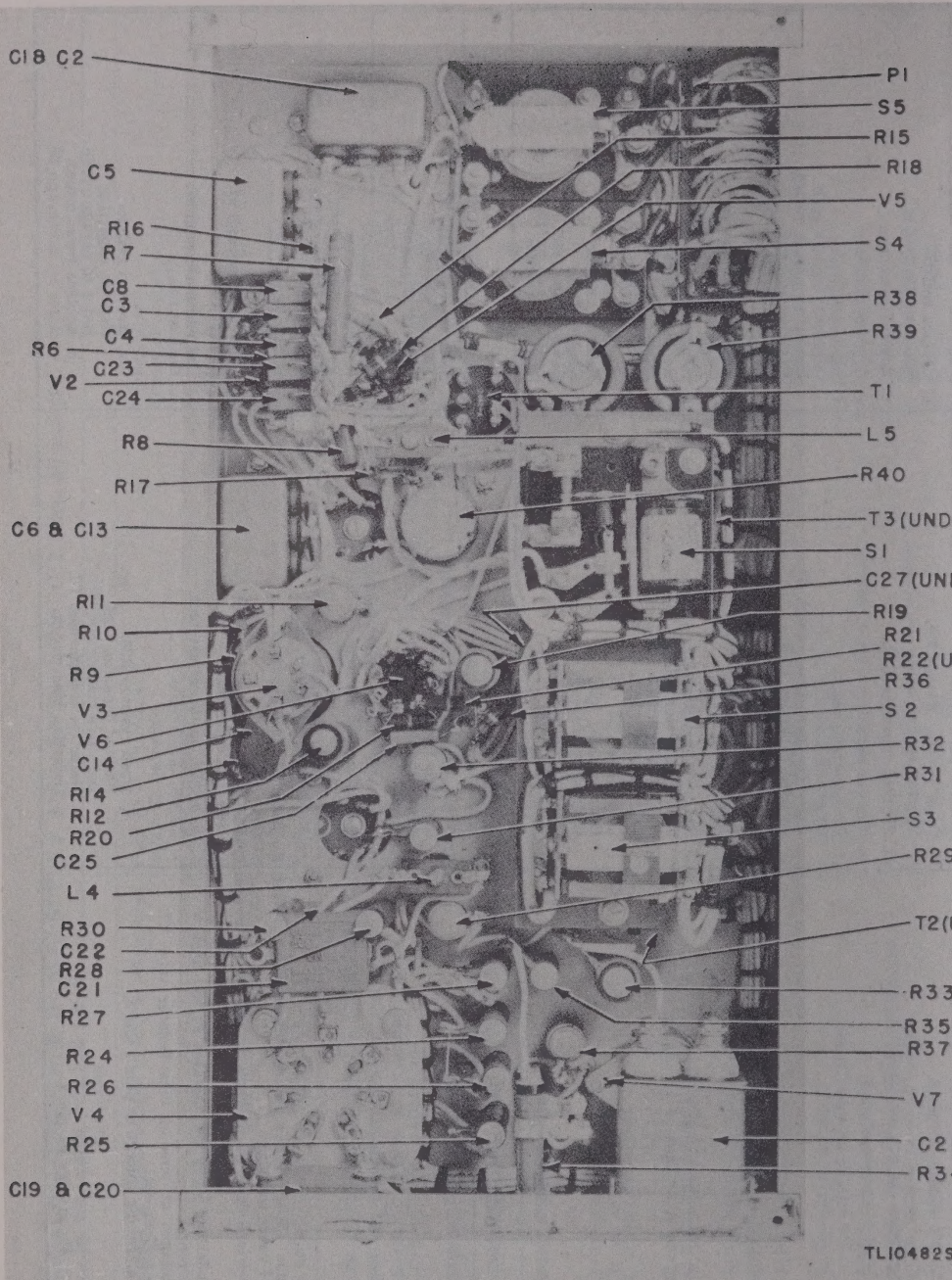


Figure 40. Exciter unit (Wilcox Electric type 96C3-10), interior.

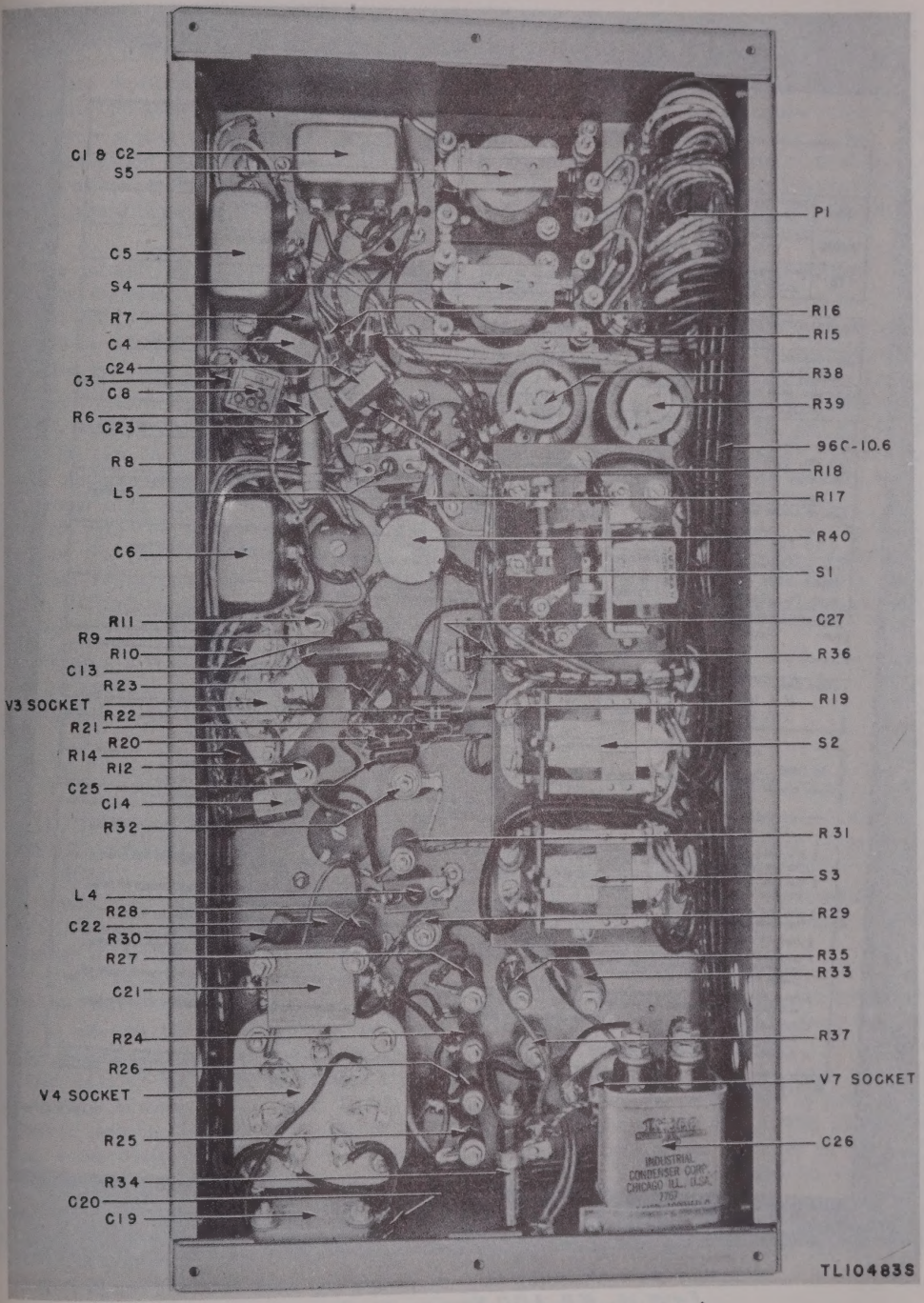
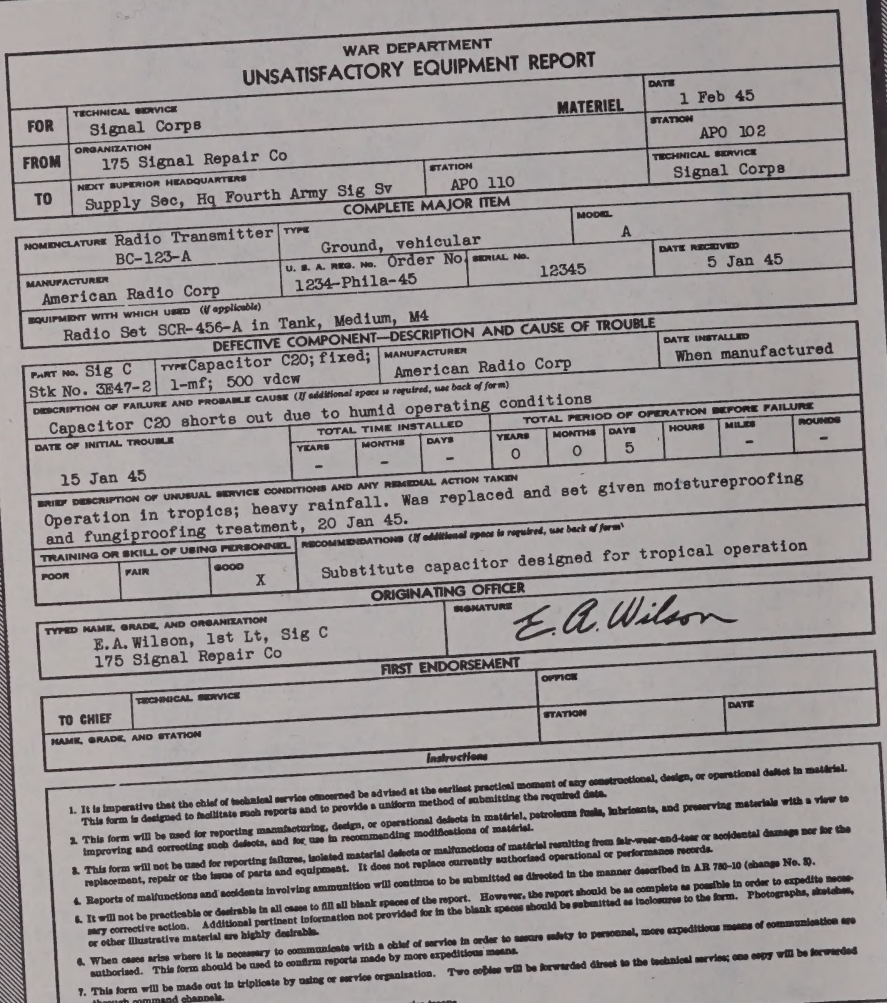


Figure 41. Exciter unit (Wilcox Electric type 96C-10), interior.



WAR DEPARTMENT

UNSATISFACTORY EQUIPMENT REPORT

FOR	TECHNICAL SERVICE: Signal Corps	MATERIEL	DATE: 1 Feb 45
FROM	ORGANIZATION: 175 Signal Repair Co		STATION: APO 102
TO	NEXT SUPERIOR HEADQUARTERS: Supply Sec, Hq Fourth Army Sig Sv	STATION: APO 110	TECHNICAL SERVICE: Signal Corps

COMPLETE MAJOR ITEM

NOMENCLATURE	TYPE	MODEL
Radio Transmitter BC-123-A	Ground, vehicular	A

MANUFACTURER	U. S. A. REG. No.	SERIAL No.	DATE RECEIVED
American Radio Corp	Order No 1234-Phila-45	12345	5 Jan 45

EQUIPMENT WITH WHICH USED (*If applicable*): Radio Set SCR-456-A in Tank, Medium, M4

DEFECTIVE COMPONENT—DESCRIPTION AND CAUSE OF TROUBLE

PART No.	TYPE	MANUFACTURER	DATE INSTALLED
Sig C Stk No. 3E47-2	Capacitor C20; fixed; 1-mf; 500 vdcw	American Radio Corp	When manufactured

DESCRIPTION OF FAILURE AND PROBABLE CAUSE (*If additional space is required, use back of form*): Capacitor C20 shorts out due to humid operating conditions

DATE OF INITIAL TROUBLE	TOTAL TIME INSTALLED			TOTAL PERIOD OF OPERATION BEFORE FAILURE					
	YEARS	MONTHS	DAYS	YEARS	MONTHS	DAYS	HOURS	MILES	ROUNDS
15 Jan 45	-	-	-	0	0	5		-	-

BRIEF DESCRIPTION OF UNUSUAL SERVICE CONDITIONS AND ANY REMEDIAL ACTION TAKEN: Operation in tropics; heavy rainfall. Was replaced and set given moistureproofing and fungiproofing treatment, 20 Jan 45.

TRAINING OR SKILL OF USING PERSONNEL			RECOMMENDATIONS (*If additional space is required, use back of form*)
POOR	FAIR	GOOD	
		X	Substitute capacitor designed for tropical operation

ORIGINATING OFFICER

TYPED NAME, GRADE, AND ORGANIZATION	SIGNATURE
E.A. Wilson, 1st Lt, Sig C 175 Signal Repair Co	E.A. Wilson

FIRST ENDORSEMENT

TO CHIEF	TECHNICAL SERVICE	OFFICE	
NAME, GRADE, AND STATION		STATION	DATE

Instructions

1. It is imperative that the chief of technical service concerned be advised at the earliest practical moment of any constructional, design, or operational defect in matériel. This form is designed to facilitate such reports and to provide a uniform method of submitting the required data.
2. This form will be used for reporting manufacturing, design, or operational defects in matériel, petroleum fuels, lubricants, and preserving materials with a view to improving and correcting such defects, and for use in recommending modifications of matériel.
3. This form will not be used for reporting failures, isolated material defects or malfunctions of matériel resulting from fair-wear-and-tear or accidental damage nor for the replacement, repair or the issue of parts and equipment. It does not replace currently authorized operational or performance records.
4. Reports of malfunctions and accidents involving ammunition will continue to be submitted as directed in the manner described in AR 750-10 (change No. 3).
5. It will not be practicable or desirable in all cases to fill all blank spaces of the report. However, the report should be as complete as possible in order to expedite necessary corrective action. Additional pertinent information not provided for in the blank spaces should be submitted as inclosures to the form. Photographs, sketches, or other illustrative material are highly desirable.
6. When cases arise where it is necessary to communicate with a chief of service in order to secure safety to personnel, more expeditious means of communication are authorized. This form should be used to confirm reports made by more expeditious means.
7. This form will be made out in triplicate by using or service organization. Two copies will be forwarded direct to the technical service; one copy will be forwarded through command channels.
8. Necessity for using this form will be determined by the using or service troops.

W.D., A.G.O. Form No. 468
20 August 1944

This form supersedes W. D., A. G. O. Form No. 468, 1 December 1943, which may be used until existing stocks are exhausted.

U. S. GOVERNMENT PRINTING OFFICE 16—41569-1

TL19589C

Figure 42. W.D., A.G.O. Form No. 468 with sample entries.

SECTION XV. REPAIRS

91. REPLACEMENT OF PARTS.

Careless replacement of parts often makes new faults inevitable. Note the following points:

a. Before a part to be replaced is removed, note the position of its leads. If any part has a number of connections to it, place tags on each lead to insure that it is returned to its proper place.

b. Be careful not to damage other leads or parts by carelessly pushing them out of the way. It may, however, be necessary to remove parts if the space is crowded in order to make room for replacing the defective part.

c. Do not allow drops of solder to fall into the chassis, since they may cause short circuits.

d. Use care in making a soldered joint. A poorly soldered joint is very difficult to find. the proper method is to heat the parts to be soldered with the soldering iron until solder will flow over them freely, thus forming a good electrical connection. Do not use excessive solder. Do not move the part until the solder has set.

e. When a part is replaced in r-f circuits, it must be placed in exactly the same position as the original. A part which has the same electrical characteristics, but different physical size may give trouble in r-f circuits and must be avoided if possible. Give particular attention to proper grounding when replacing a part. Use the same ground point as in the original wiring. Failure to observe these precautions may result in decreased gain or possibly in oscillation of the circuit.

92. UNSATISFACTORY EQUIPMENT REPORT.

a. When trouble in equipment used by Army Ground Forces or Army Service Forces occurs more often than repair personnel feel is normal, War Department Unsatisfactory Equipment Report, W.D., A.G.O. Form No. 468 should be filled out and forwarded through channels to the Office of the Chief Signal Officer, Washington 25, D. C.

b. When trouble in equipment used by Army Air Forces occurs more often than repair personnel feel is normal, Army Air Forces Form No. 54 should be filled out and forwarded through channels.

c. If either form is not available prepare the data according to the sample form reproduced in figure 42.

SECTION XVI. ALIGNMENT AND ADJUSTMENT

93. ADJUSTMENT FOR RADIO TRANSMITTERS (WILCOX ELECTRIC TYPES 96C AND 96C3).

A number of adjustments must be made inside the transmitter whenever it is desired to change the transmitter frequency. There are also a number of adjustments in connection with the relay system.

a. To operate the first-amplifier tank coil switch, insert a screwdriver in the hole marked S6 (fig. 14). To set switch in position 1, turn it counterclockwise to the stop. To set the switch in positions 2 and 3, turn it one and two stops, respectively, in the clockwise direction from position 1.

b. The first-amplifier tuning capacitors are adjusted by turning the slotted shafts marked C9 and C10 (fig. 46).

c. The second-amplifier tank coil switch is operated by inserting a screwdriver in the hole marked S7 (fig. 14). The setting is the same as described in subparagraph a above.

d. The second-amplifier tuning capacitors are adjusted by turning the slotted shafts marked C16 and C17 (fig. 46).

e. Third-amplifier tank coil L7 is not adjustable, but is replaced to tune to a new frequency band. Four coils are required to cover the frequency range of the transmitter.

f. Third-amplifier tuning capacitor C29 has a removable link for adjustment in addition to the dial on the control panel. The link is located at the back of the capacitor as indicated in figure 44. It is held in place by two small machine screws.

g. Final-amplifier tank coil L9 (fig. 44) is adjusted by shorting out turns of the coil with the adjustable strap connector.

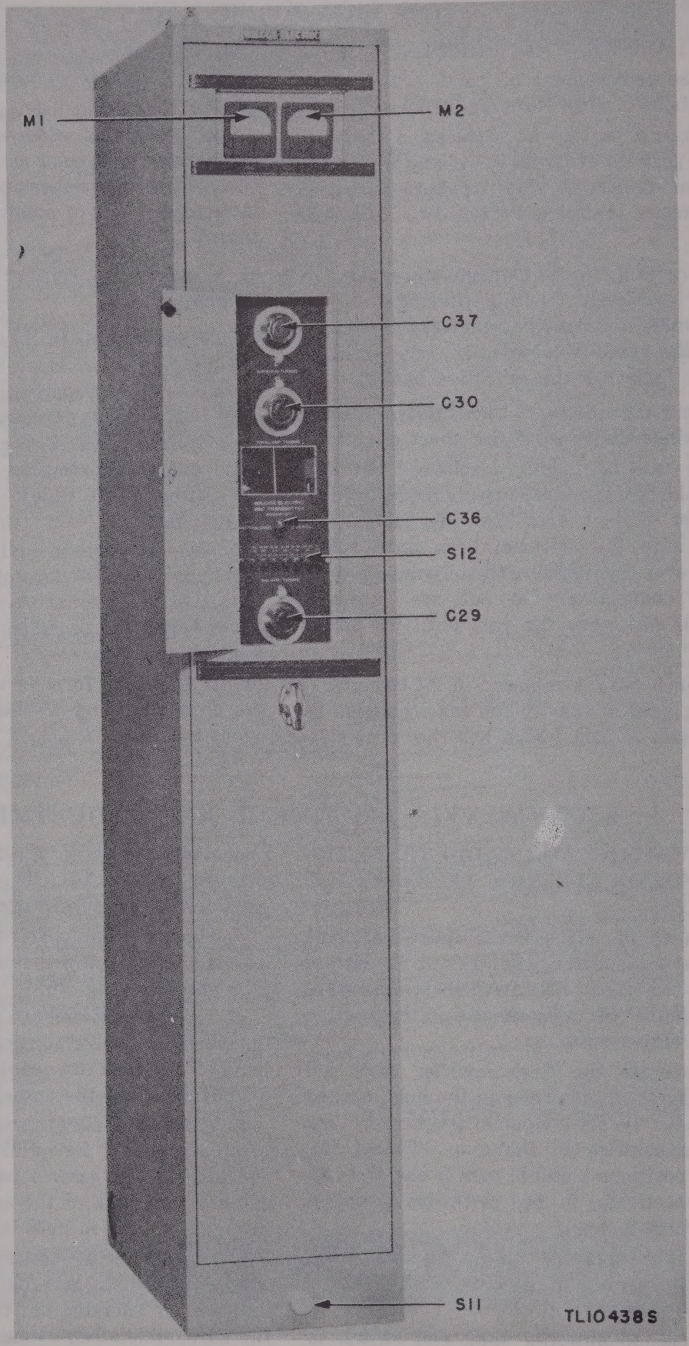


Figure 43. Radio transmitter (Wilcox Electric type 96C3), front view, showing tuning controls

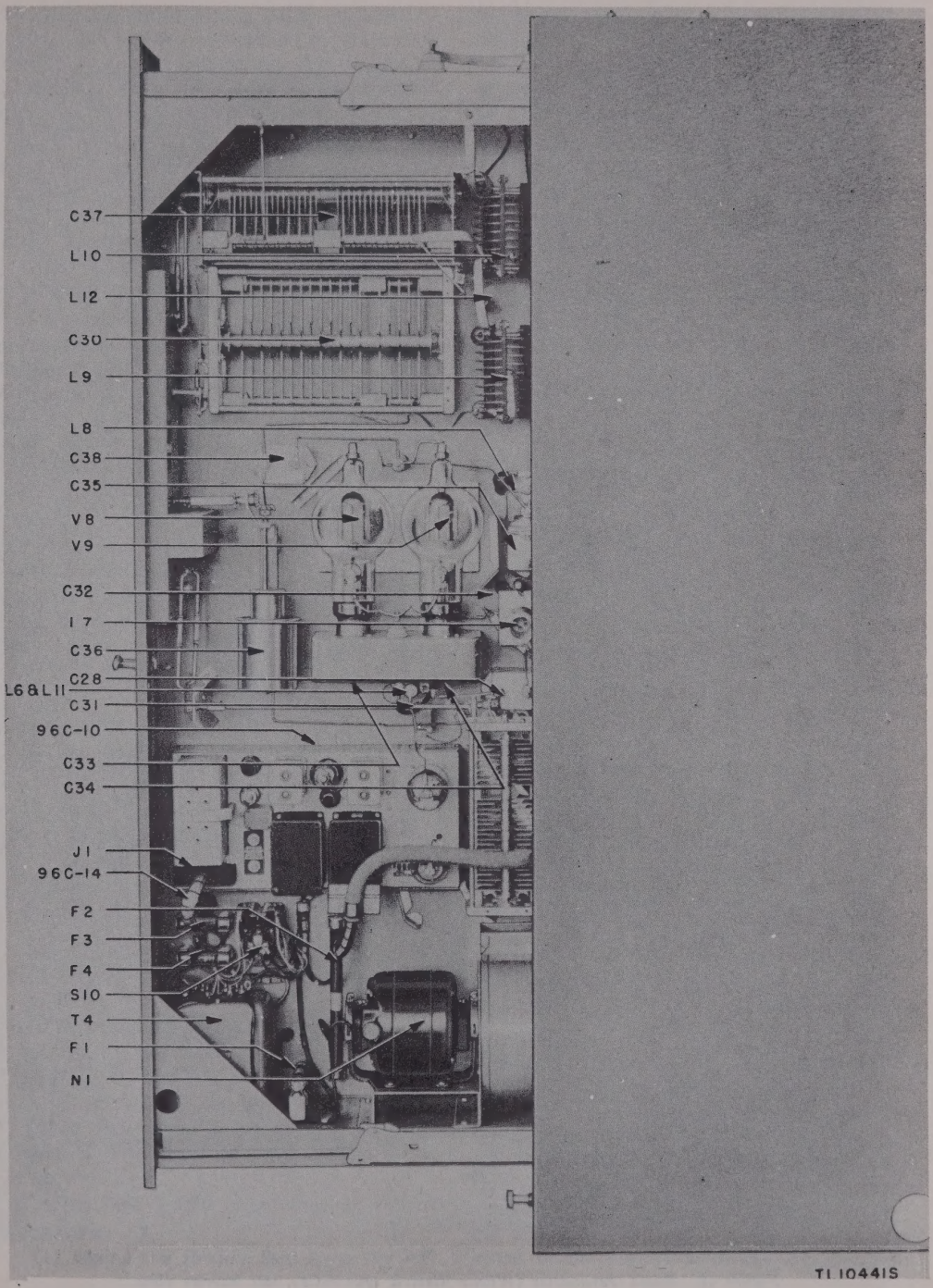


Figure 44. Radio transmitter (Wilcox Electric type 96C3), right interior view.

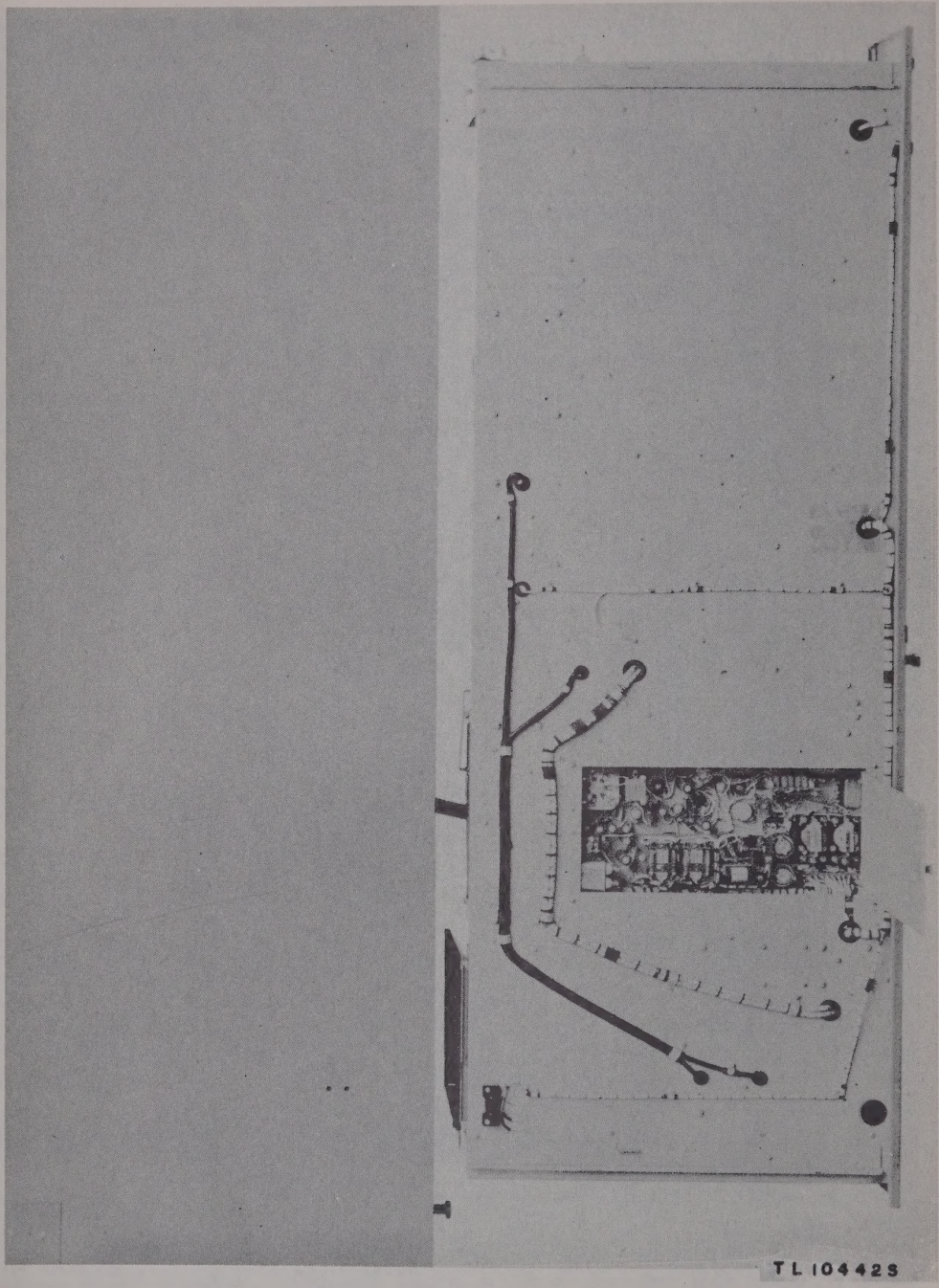


Figure 45. Radio transmitter (Wilcox Electric type 96C3), left interior view.

h. Final-amplifier tuning capacitor C30 has a removable link for adjustment in addition to the dial on the control panel. The position of the link is indicated in figure 44. It is held in place by two small machine screws.

i. Balanced antenna output coil L10 (figs. 44 and 51) is adjusted by clamping the flexible connections from the antenna and radio-frequency (r-f) ground bushings to various points on the coil. Refer to paragraph 70 for instructions for changing connections from unbalanced to balanced operation.

j. The overload and underload relay adjustments are made by turning the screws marked R38 and R39 (fig. 46). To increase the overload setting, turn screw R38 clockwise. To adjust the minimum operating current to a higher level, turn screw R39 clockwise. In other words. the resistances of R38 and R39 are both decreased by turning the screws clockwise.

k. The adjustment of the bias on keying control tube V5 is made by adjusting the slider on resistor R34 (fig. 50).

l. The sensitivity of the electronic keying circuit is controlled by adjusting rheostat R40. To adjust rheostat R40 turn the slotted shaft just to the left of transformer T3 (fig. 46).

94. ADJUSTMENTS FOR RADIO TRANSMITTER (WILCOX ELECTRIC 96A).

A number of adjustments must be made within the transmitter whenever it is desired to change the transmitter frequency. The relay system also requires some adjustments.

a. Adjust first-amplifier tuning capacitor by turning the slotted shaft marked C10 (fig. 47).

CAUTION: Use an insulated screwdriver. This adjusting screw has a potential difference of 300 volts to ground.

b. Adjust second-amplifier tuning capacitor by turning the slotted shaft marked C15 (fig. 47).

CAUTION: Use an insulated screwdriver. This adjusting screw has a potential difference of 500 volts to ground.

c. Adjust the fourth-amplifier plate coil as follows:

(1) Clamp the flexible lead from the left end of C26 (fig. 47) to the desired position on coil L4.

(2) Clamp center tap lead, the neutralizing capacitor lead, and the final-amplifier grid lead to plate coil L4 as illustrated in figure 52. The correct position for each of these connections is discussed in paragraph 99f.

d. Tune final-amplifier plate coil L5 (fig. 52) by shorting out various amounts of the coil with the flexible lead attached to the left end of the coil.

e. Adjust overload and underload relays by turning the screws marked R32 and R31 (fig. 52). To increase the overload setting turn screw R32 clockwise. To adjust the minimum operating current to a higher level turn screw R31 clockwise.

95. TUNING RADIO TRANSMITTERS (WILCOX ELECTRIC TYPES 96C and 96C3).

a. Frequency Coverage of Plate Coils.

(1) First-amplifier Plate Coil L2.

Switch position No. 1	1,825 kc to 3,350 kc
Switch position No. 2	3,100 kc to 5,700 kc
Switch position No. 3	5,550 kc to 10,500 kc

(2) Second-amplifier Plate Coil L3.

Switch position No. 1	1,770 kc to 3,300 kc
Switch position No. 2	3,100 kc to 5,600 kc
Switch position No. 3	5,400 kc to 10,000 kc

(3) Third-amplifier Plate Coil L7.

Coil No. 1	1,950 kc to 3,900 kc
Coil No. 2	3,800 kc to 7,200 kc
Coil No. 3	7,000 kc to 13,200 kc
Coil No. 4	10,000 kc to 19,000 kc

(4) Final-amplifier Plate Coil L9 and Antenna Coil L10.

Coils No. 1	2,000 kc to 7,000 kc
Coils No. 2	6,500 kc to 18,000 kc

b. Preparation of Transmitter for Tuning. Open high-voltage switch S11, then open the slide and remove high-voltage fuses F1 and F2 (fig. 44). Plug in the crystal corresponding to the desired frequency. Switch the first- and second-amplifier coils, and install the third- and final-amplifier coils for the desired frequency according to paragraph 95a. Clamp the shorting strip on final-amplifier coil L9 to correspond to the desired frequency range accord-

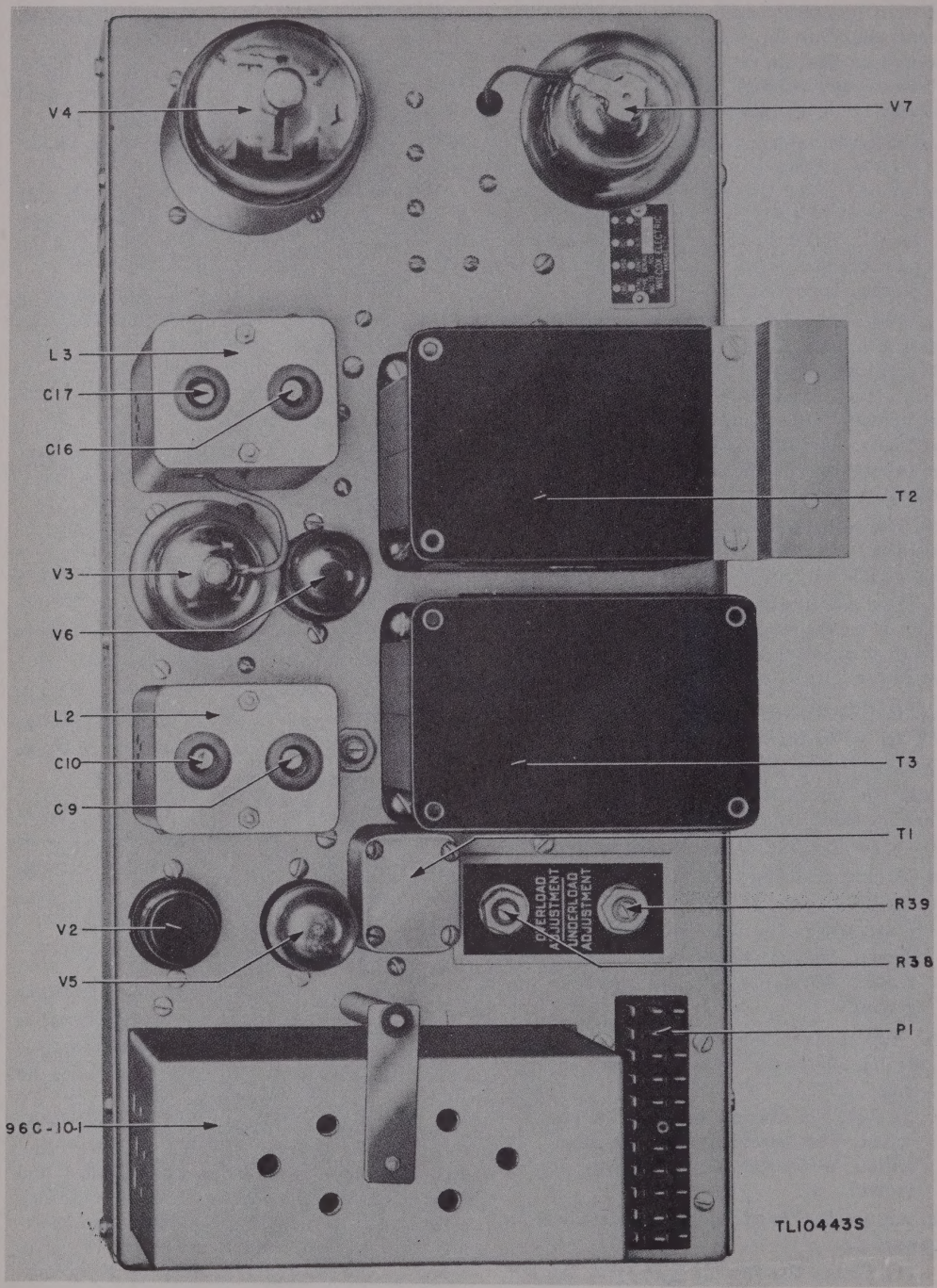


Figure 46. Exciter unit (Wilcox Electric type 96C-10), side view.

ing to figures 48 and 49. The turns given in figures 48 and 49 are active turns, not shorted turns. Connect the top end of coil L9 to the forward antenna post, using the bottom of coil L10 as a terminal point. If the antenna is connected for balanced output, refer to subparagraph i following for connections to the antenna-loading coil. Connect the antenna bushing to the antenna to be used, or to a dummy antenna load capable of dissipating 3 kilowatts (kw). If used, the dummy load should be a noninductive load with a known value of resistance in order to make a determination of power output. If a noninductive load is not available, a bank of carbon filament lamps may be used at frequencies below 12,000 kc. Close switch S11 and press the START button on the rectifier and the CHANNEL CONTROL button on the transmitter.

c. Tuning First Amplifier. Close the 2ND AMP TOTAL button and press the TEST KEY. The indication of meter M2 should be approximately 50 milliamperes (ma). See paragraph 98, for typical meter readings. With an insulated screwdriver rotate the slotted shafts of capacitors C9 and C10 of tank circuit L2 (fig. 46) until the current reading of meter M2 rises to a maximum. Release the TEST KEY.

CAUTION: Capacitor shafts are at +300 volts.

d. Tuning Second Amplifier. Do not change the meter button setting. Press the TEST KEY and adjust the slotted capacitor shafts of capacitors C16 and C17 of tank circuit L3 (fig. 46) until meter M2 indicates a minimum.

CAUTION: Use an insulated screwdriver. Capacitor shafts are at +500 volts.

Close the 3D AMP GRID button and again press the TEST KEY. Meter M2 should indicate between 4 ma and 12 ma. Check the first- and second-amplifier tuning by making slight changes in the capacitors of tank circuits L2 and L3 until the meter indicates a maximum. If this maximum reading is greater than 8 ma readjust the capacitor of tank circuit L3 until the current is reduced to 8 ma.

e. Tuning Third Amplifier. Replace 2,000-volt supply fuse F1 and close the slide. Do not replace 4,000-volt supply fuse F2. Close the PUSH-ON high voltage control button in rectifier type 36A4 and close the 3D AMP TOTAL button. Press the TEST KEY and adjust the THIRD AMP. TUNING dial at the bottom of the control panel until meter M2 indicates a sharp minimum. Close the test key only for short intervals until the adjustment for minimum current is found. Note this minimum value. Reference will be made to it in the process of neutralizing the final amplifier. See paragraph 98 for typical values of third-amplifier plate current. It will be necessary to remove the link from third-amplifier tuning capacitor C29 for the high-frequency range of the various coils L7.

f. Neutralizing Final Amplifier. Turn the ANTENNA TUNING capacitor dial until the reading 100 appears directly under the dial lock. Press the FINAL AMP. GRID button. Press the TEST KEY and observe meter M2 while rotating the dial of the FINAL AMP. TUNING capacitor. Fluctuation of the meter indicates lack of neutralization. Adjust the FINAL AMP. TUNING capacitor until the final-amplifier grid current indicates a minimum. When the transmitter is completely unneutralized the grid current will decrease to very nearly zero with adjustment of the final-amplifier tuning capacitor. Next rotate the NEUTRALIZING CONTROL knob in the direction to increase the final-amplifier grid current. Now the tuning of the third amplifier must be rechecked by pressing the 3D AMP TOTAL button and noting the meter reading. If the reading has changed from the minimum value observed previously retune by adjusting the THIRD AMP. TUNING dial. At the higher frequencies the third amplifier will be detuned rapidly and will have to be checked carefully at each neutralizing step. By rotating the FINAL AMP. TUNING dial, adjusting the NEUTRALIZING CONTROL, and readjusting the THIRD AMP. TUNING dial, a condition will occur at which the final-amplifier grid current will show no change when the FINAL AMP. TUNING capacitor is varied. When this condition occurs the transmitter is completely neutralized. As an aid to the above process a small neon tube may be attached to the plate circuit of the final amplifier in such a position that it may be viewed through the control panel window. With the transmitter unneutralized, an adjustment of the FINAL AMP. TUNING capacitor will cause the neon tube

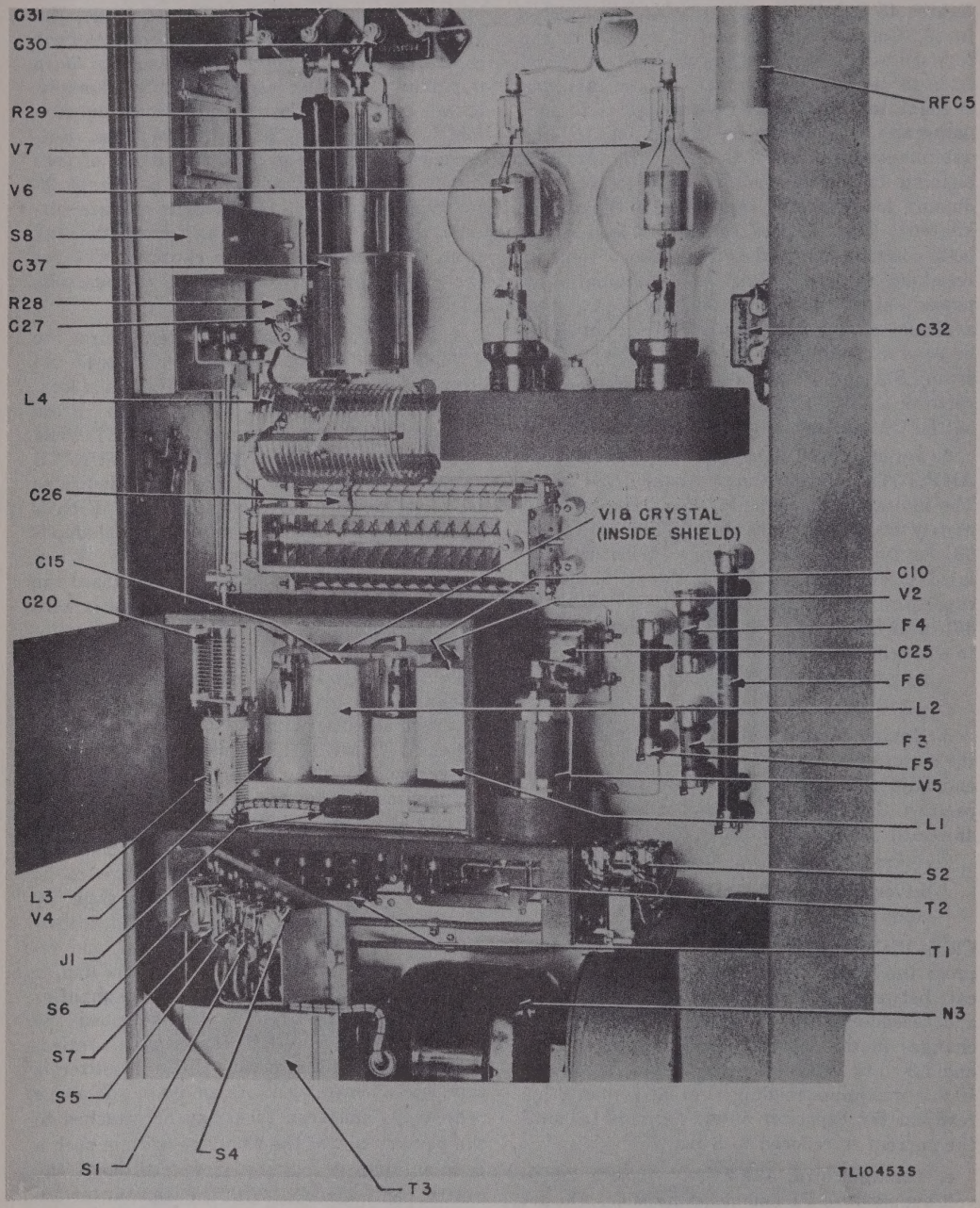


Figure 47. Radio transmitter (Wilcox Electric type 96A), exciter and final amplifier.

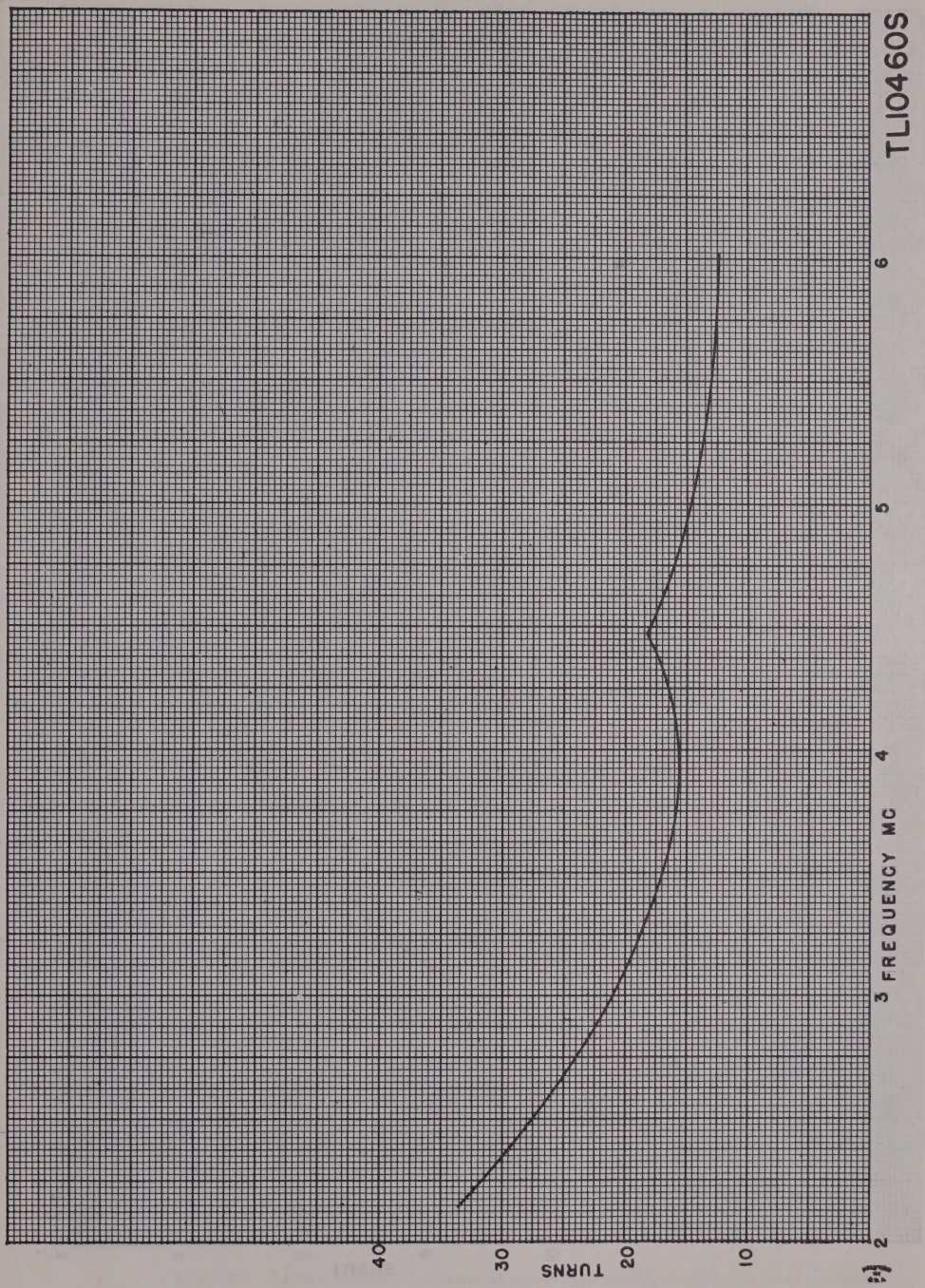


Figure 48. Radio transmitter (Wilcox Electric type 96C3), final plate coil No. 1, turns vs frequency.

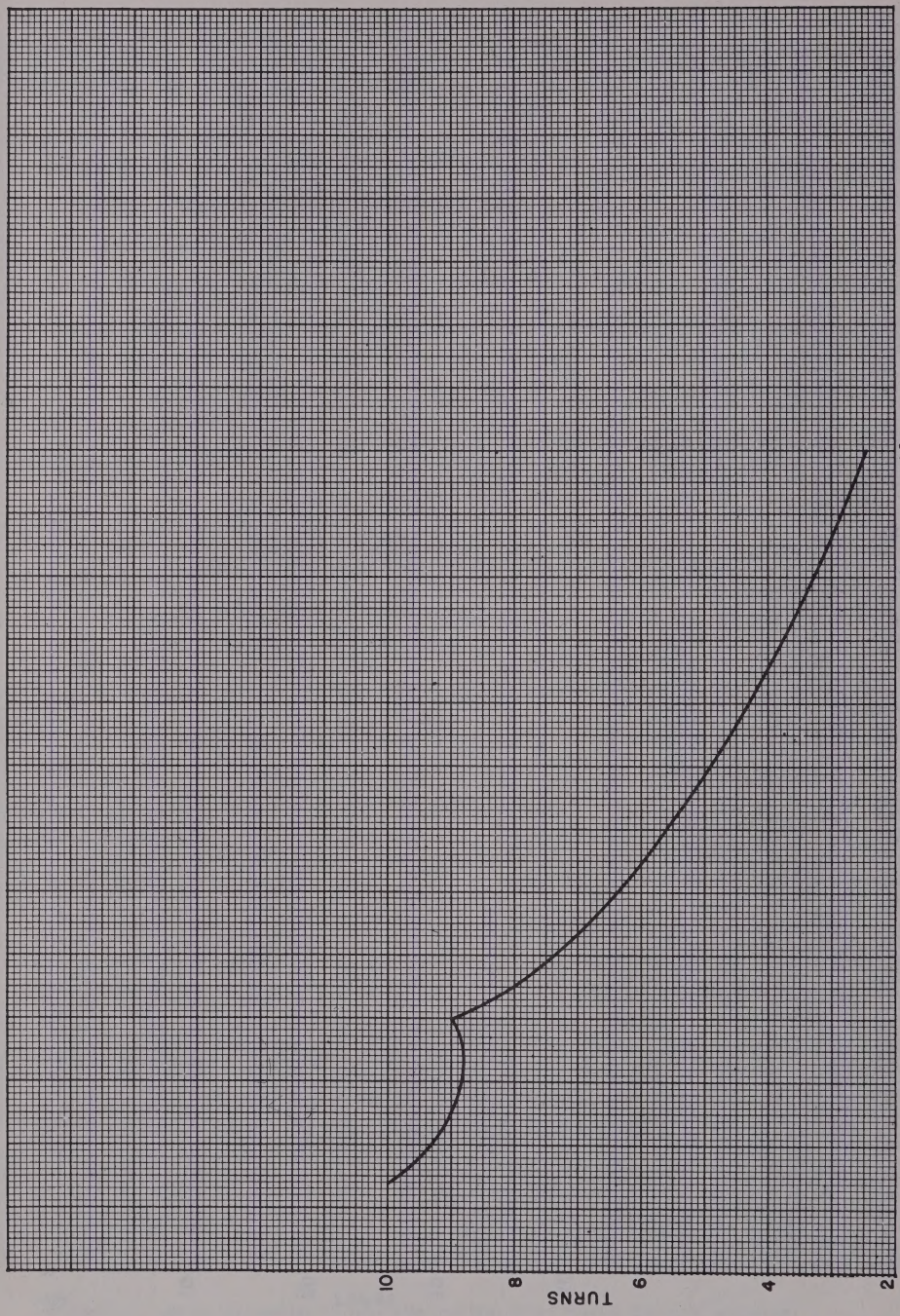


Figure 49. Radio transmitter (Wilcox Electric type 96C3), final plate coil No. 2, turns vs frequency.

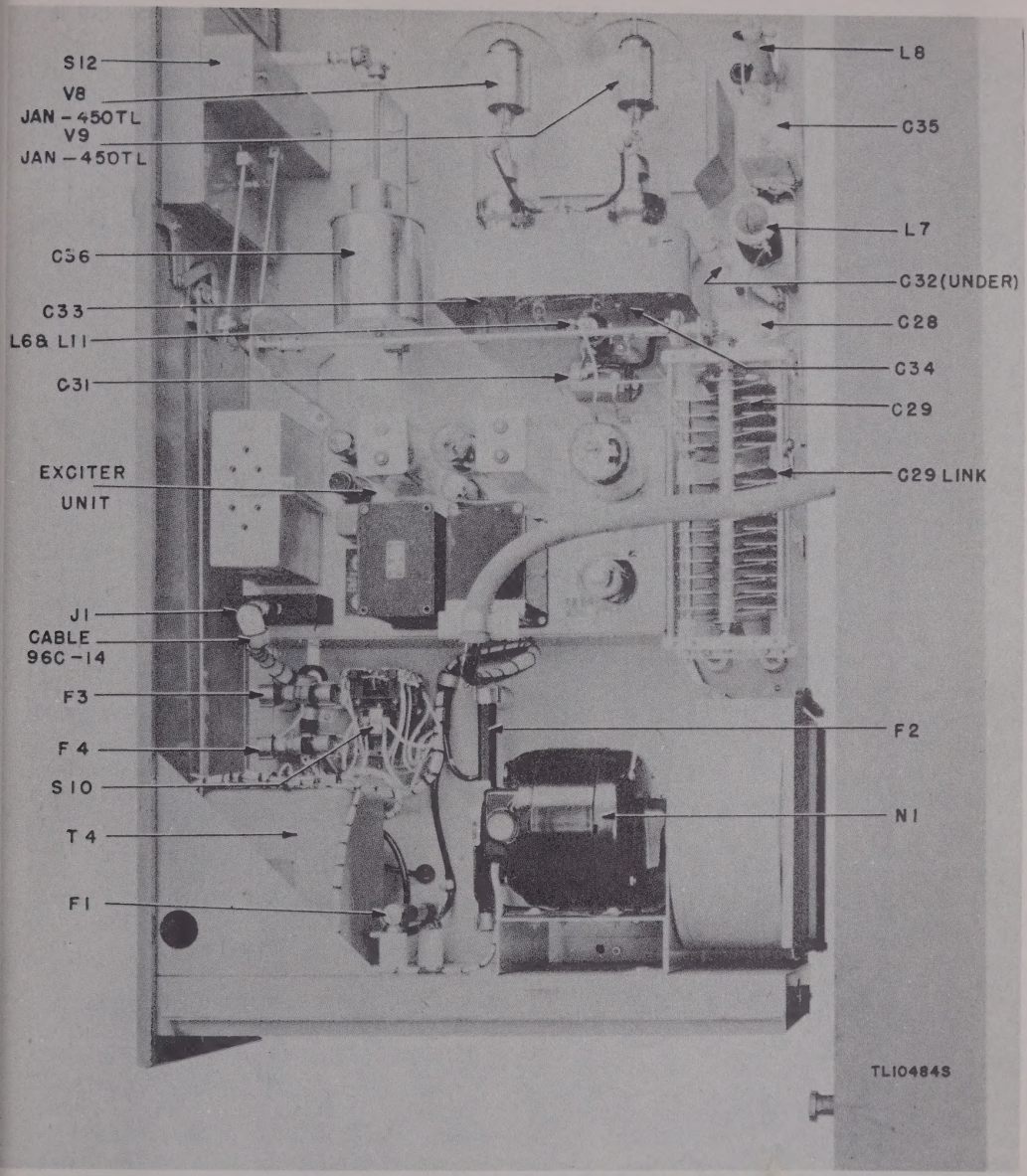


Figure 50. Radio transmitter (Wilcox Electric type 96C3), exciter and final amplifier.

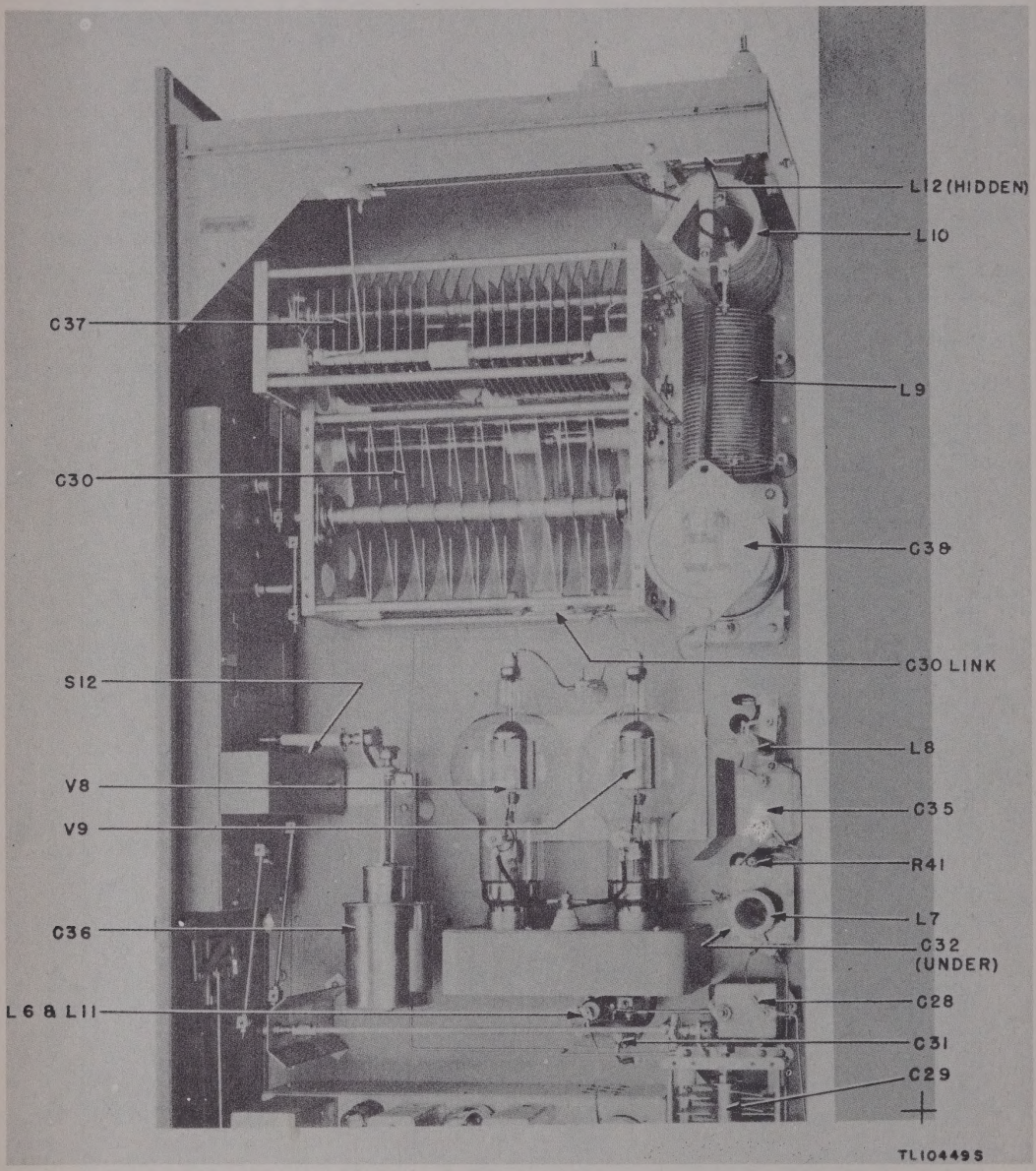


Figure 51. Radio transmitter (Wilcox Electric type 96C3), modification of final-amplifier and antenna circuits.

to light up to the point of maximum brilliance. As the transmitter is neutralized and the FINAL AMP. TUNING capacitor is rotated through the point which produces maximum brilliance of the tube, the maximum brilliance of the neon tube will decrease until it is practically extinguished at all positions of the final-amplifier tuning capacitor. The neon bulb must be removed before applying plate voltage to the final amplifier.

g. Tuning Final Amplifier. Press the stop button on the rectifier, open switch S11, and withdraw the transmitter slide. Insert 4,000-volt supply fuse F2 in its clips and reclose the slide and switch S11. Press the START button on the rectifier and allow the time-delay relay to recycle. Now close the TEST KEY and adjust the FINAL AMP. TUNING capacitor to produce a minimum indication of final-amplifier plate meter M1. At all frequencies it is highly desirable to adjust final-amplifier tuning capacitor C30 as nearly as possible to a minimum. The link on the capacitor should be opened when necessary to obtain a minimum capacitance.

h. Adjusting Antenna - tuning Capacitor. Close the TEST KEY and adjust the ANTENNA TUNING capacitor by decreasing the dial reading from 100. Rotate the dial until the final plate current has increased about 0.1 ampere. Next adjust the FINAL AMP. TUNING capacitor until meter M1 again indicates a minimum. Repeat this process until the final-amplifier current is approximately 0.85 ampere. It may be necessary to retune the third amplifier slightly to obtain sufficient final-amplifier grid current to produce the desired output.

i. Adjustment for Balanced Output. Connect the two halves of antenna-tuning capacitor C37 across part of balanced antenna output coil L10. The connection should be made at a point to include one more turn in the coil for the desired frequency than the value indicated in figures 48 and 49. Connect the two antenna bushing leads to include about 40 percent of coil L10. See figure 28 for details of these connections. Connect an r-f meter in each side of the transmission line to determine when the line is balanced. Adjust the antenna connection taps until the currents are balanced.

96. KEYING SENSITIVITY ADJUSTMENT OF RADIO TRANSMITTERS (WILCOX ELECTRIC TYPES 96C AND 96C3).

Withdraw the slide from the cabinet to its full travel and open the exciter unit cover door at the back of the slide. The electronic keying circuit has been adjusted for a short line at the factory and must be readjusted in case of a long keying line. The bias of the electronic keying tube is determined by the adjustment of tapped resistor R34 (figs. 40 and 41). Adjust the tap until the potential difference between the left end of the resistor and the tap is 2.65 volts. After this bias is properly set apply a 1,000-cycle tone to the input of the electronic keying circuit by means of the Remote Control Console CY-161/FRC (TM 11-2622). Adjust the input level of the tone at the remote control console to 0 decibels (db). Now adjust the keying sensitivity by turning rheostat R40 (fig. 40). The slotted shaft or rheostat R40 extends through the exciter chassis between transformer T3 and tank circuit L2 (fig. 46). The correct sensitivity is the adjustment just above the setting at which the grid current of the third amplifier starts to fall off because of incomplete keying. It is not desirable to adjust the input level of the keying signal above 2 db at the remote control position because of crosstalk between the different keying and telephone lines. Therefore the keying sensitivity may have to be increased for installations involving long lines.

97. OVERLOAD AND UNDERLOAD RELAY ADJUSTMENT OF RADIO TRANSMITTERS (WILCOX ELECTRIC TYPES 96C AND 96C3).

The overload relay should be adjusted to trip out at about 0.95 ampere when the transmitter is operating at the normal power of an 0.85-ampere final plate current. The underload relay should be adjusted to operate at about 0.5 ampere under the same operating conditions. If the transmitter is operating at reduced power both settings should be reduced accordingly.

98. TYPICAL METER READINGS OF RADIO TRANSMITTERS (WILCOX ELECTRIC TYPES 96C AND 96C3).

The accompanying table gives typical meter readings and plate coil adjustments for operation of the transmitter at various frequencies.

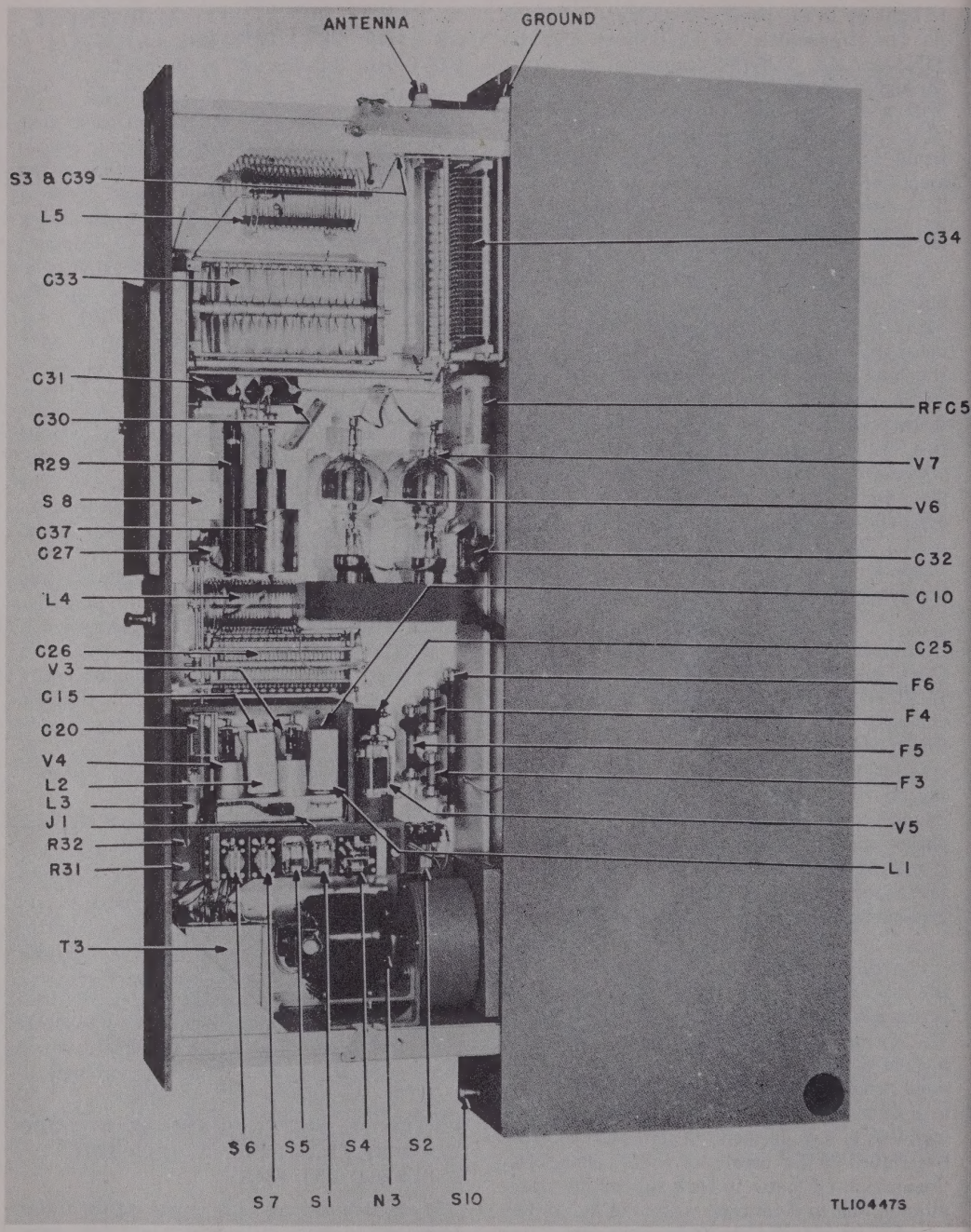


Figure 52. Radio transmitter (Wilcox Electric type 96A), right interior view.

FREQ	2ND AMP TOTAL (MA)	3RD AMP GRID (MA)	3RD AMP TOTAL (MA)	FINAL AMP GRID (MA)	FINAL AMP TOTAL (MA)	PLATE VOLTAGE (V)	L2 SWITCH POSITION	L3 SWITCH POSITION	L7	C29 LINK	L9	TURNS USED L9	C30 LINK
2,100	53	7.5	102	50	850	4,000	1	1	1	in	1	33½	in
3,000	45	4.3	84	70	850		1	1	1	in	1	28	in
3,500	45	4.3	83	60	850		2	2	1	out	1	18	in
4,500	43	4.6	90	65	850		2	2	2	in	1	18¼	out
5,700	57	3.8	80	60	850		1	3	2	in	1	13	out
6,500	54	4.8	90	60	850		2	3	2	out	2	10	in
8,000	61	7.0	124	50	850		2	3	3	in	2	8¾	in
9,000	65	7.6	124	55	850		2	3	3	in	2	9	out
10,000	50	7.7	140	50	850		1	2	3	in	2	7⅛	out
13,000	62	6.1	116	60	850		1	3	3	out	2	5	out
14,000	58	8.2	136	55	850		2	3	4	in	2	4¼	out
18,000	60	6.0	120	50	850		2	3	4	out	2	3¼	out

99. TUNING RADIO TRANSMITTER (WILCOX ELECTRIC TYPE 96A).

a. Frequency Coverage of Plate Coils.

(1) Fourth-amplifier Plate Coil L4.

Coil No. 1	2,200 kc to 3,400 kc
Coil No. 2	3,400 kc to 5,900 kc
Coil No. 3	5,900 kc to 10,000 kc
Coil No. 4	10,000 kc to 18,000 kc

(2) Final-amplifier Plate Coil L5.

Coil No. 1	2,200 kc to 3,400 kc
Coil No. 2	3,400 kc to 5,900 kc
Coil No. 3	5,900 kc to 10,000 kc
Coil No. 4	10,000 kc to 18,000 kc

b. Preparation of Transmitter for Tuning. Open high-voltage switch S10, then open the slide and remove high-voltage fuses F5 and F6 (fig. 52). Plug in the crystal corresponding to the desired frequency and install the proper fourth- and final-amplifier plate coils (L4 and L5). Connect to the antenna to be used, or to a dummy antenna load capable of dissipating 3 kw to the forward antenna bushing. If used, the dummy load should be a noninductive load with a known value of resistance in order to make a determination of power output. If a noninductive load is not available a bank of carbon filament lamps may be used at frequencies below 12,000 kc. Close switch S11 and press the START button on the rectifier and the CHANNEL CONTROL button on the transmitter.

c. Tuning First Amplifier. Close the 2ND AMP. TOTAL button and press the TEST KEY. Rotate capacitor C10 (fig. 52) until right-hand meter M2 indicates a maximum.

CAUTION: Use an insulated screwdriver. Potential of capacitor shaft is +300 volts.

d. Tuning Second Amplifier. Press the TEST KEY again, but do not change the meter key. Rotate capacitor C15 until right-hand meter M2 indicates a minimum current.

CAUTION: Use an insulated screwdriver. Potential of capacitor shaft is +500 volts.

Now press the 3RD AMP. GRID button and note the meter reading. The grid current should be about 2 ma.

e. Tuning Third Amplifier. Close the 3RD AMP. TOTAL button and press the test key. Rotate capacitor C20 with the 3RD AMP. PLATE dial until meter M2 indicates a minimum current. Close the 4TH AMP. GRID button. Right-hand meter M2 should indicate about 7 ma.

f. Tuning Fourth Amplifier. Remove all power from the transmitter by pulling high-voltage, switch S10, and throwing the 220-volt switch in the back of the cabinet to the OFF position. The adjustment of the number of turns in coil L4 (figs. 52 and 47) is made by attaching the flexible lead from the left end of capacitor C26 to the coil. Clip this flexible connection a few turns from the left end of the coil. Next connect the flexible lead from the stand-off insulator just above coil L4 to the midpoint of the active part of the coil. Connect

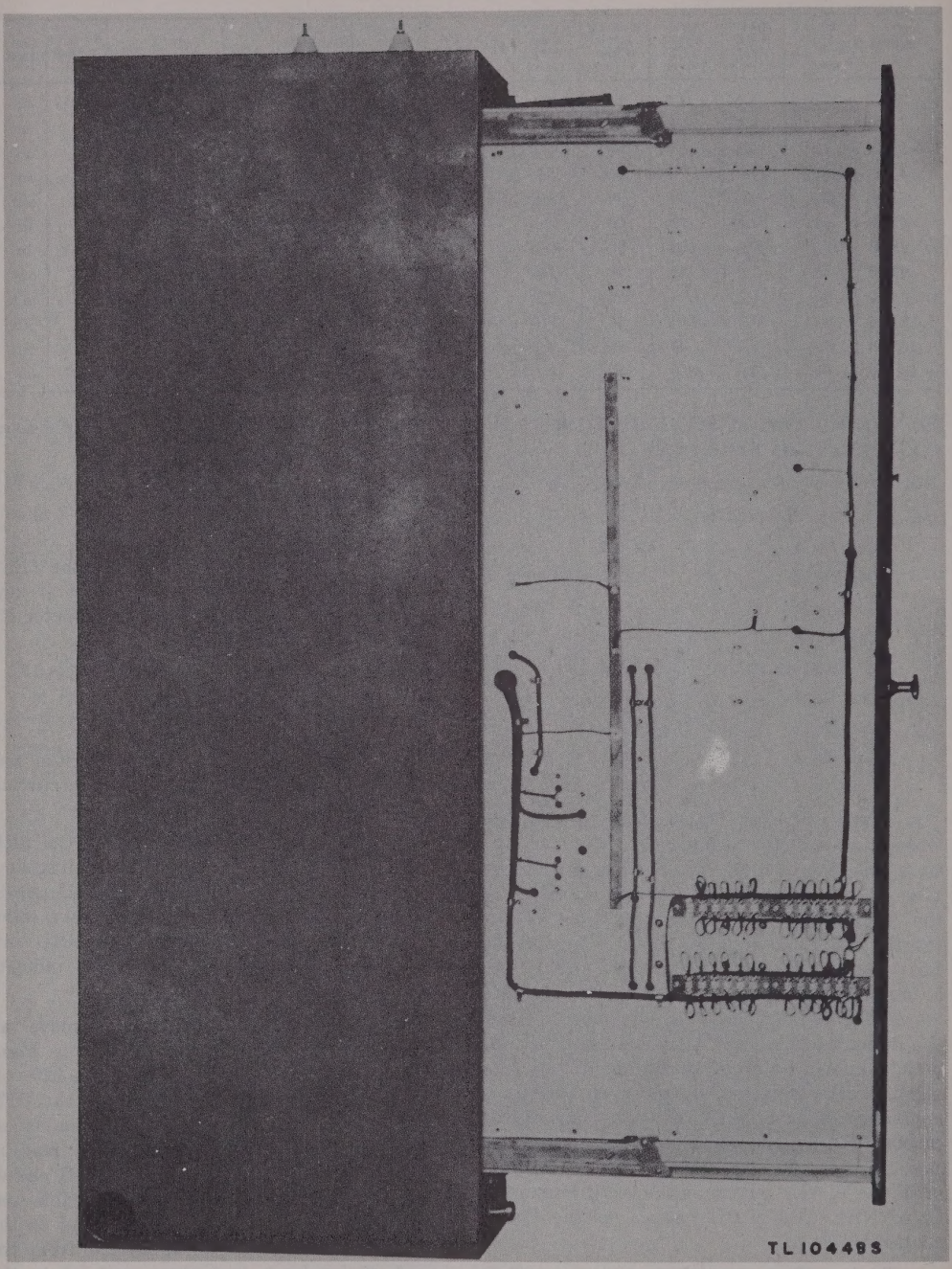


Figure 53. Radio transmitter (Wilcox Electric 96A), left interior view.

the flexible lead from the bottom of neutralizing capacitor C37 about three-quarters of the way from the center toward the left end of the active part of the coil; and connect the final-amplifier grid lead about three-fourths of the way from the center toward the right end of the coil. Rotate the FINAL AMP. NEUT. dial until neutralizing capacitor C37 is adjusted to minimum capacitance. Install the +2000-volt supply fuse, close the 220-volt switch, and close the slide. Next close high-voltage switch S10. Close the 4TH AMP. TOTAL button and press the TEST KEY. Rotate the 4TH AMP. TOTAL button and press the TEST KEY. Rotate the 4TH AMP. PLATE dial until a minimum current is indicated by the right-hand meter M2. This stage tunes sharply and care should be taken to be sure that it is tuned to the exact point at which minimum current is indicated. If the 4TH AMP. PLATE dial is turned to either end of its range without going through a minimum current, the plate coil connections will have to be changed. If the lowest current was obtained with capacitor C26 adjusted to near its maximum capacitance, the number of active turns in coil L4 should be increased and vice versa. All of the coil connections should be changed in proportion. The best operation will be obtained if the coil is connected so that minimum plate current is obtained with capacitor C26 rotated to slightly below its midposition.

g. Neutralizing Final Amplifier. Rotate the ANTENNA LOADING dial until the number 100 is under the dial lock. This adjusts antenna tuning capacitor C34 to its maximum capacitance. Close the FINAL AMP. GRID button, push the TEST KEY, and note the indication of right-hand meter M2. Now rotate the FINAL AMP. PLATE dial and adjust the tap on coil L5 until a minimum in final amplifier grid current is noted when the FINAL AMP. PLATE dial is about in the mid position. Next rotate the FINAL AMP. NEUT. dial a few turns in the direction to increase the final-amplifier grid current. The tuning of the fourth amplifier should now be rechecked by pressing the 4TH AMP. TOTAL button, and adjusting the 4TH AMP. PLATE dial until meter M2 indicates a minimum. At the higher frequencies the fourth ampilfier will be detuned rapidly and will have to be rechecked carefully at each neutralizing step. By a process of rotating the FINAL AMP. PLATE dial, adjusting the FINAL AMP. NEUT. dial and readjusting the 4TH AMP. PLATE dial a condition will occur at which the final amplifier grid current will show no change when the FINAL AMP. PLATE dial is adjusted. When this condition occurs the transmitter is completely neutralized.

h. Tuning Final Amplifier. Open high-voltage switch S10, pull the slide forward and open the 220 volt switch in the back of the cabinet. Insert 2-ampere fuse F6 (fig. 52) and reclose the switches and cabinet. Press the TEST KEY and rotate the FINAL AMP. PLATE dial until left-hand meter M1 indicates a minimum.

i. Adjusting Antenna - loading Capacitor. Press the TEST KEY and decrease the antenna loading capacitance until the final plate current has been raised about 100 ma above the unloaded value. Next adjust the FINAL AMP. PLATE dial until left-hand meter M1 indicates a minimum. If the antenna is properly connected this minimum will be slightly higher than the value with maximum antenna-loading capacitance. Repeat this loading in increments of about 100 ma until the final amlifier is operating at the desired power output. The transmitter is designed to operate at 800 ma final-amplifier plate current.

j. Typical Meter Readings. For typical meter readings on the various circuits see paragraph 27.

100. HIGH-FREQUENCY TUNING OF RADIO TRANSMITTER (WILCOX ELECTRIC TYPE 96A).

a. General. Radio transmitter type 96A was designed to operate in the range of 2 to 12 megacycles (mc). If care is used in the tuning procedure the range can be extended to 18 mc. At frequencies above 12 mc the efficiency of the transmitter is somewhat reduced. Therefore, the transmitter should be operated at about three-fourths of the power input of lower frequency units, or approximately 600 ma at 4,000 volts. Less audio-frequency power is required for 100 percent modulation. All units have been tested at the factory on the frequency at which they were intended to be used, and the taps on the coils are left in this position to aid the operator in the tuning procedure. However, the antenna system supply voltage, and vacuum tubes may produce changes in this setting. The

meter readings obtained at the higher frequencies will be slightly different from the values given in paragraph 27. However, these values will serve as a *general* guide to the operator. The adjustments for high-frequency operation are much more critical than those for operation in the 2- to 12-megacycle range. These adjustments are given in detail below.

b. Preliminary Steps. The first operation in tuning the transmitter for high-frequency operation is to adjust the taps on coil L4 (which is the common plate coil of the fourth-amplifier stage and the grid coil of the final-amplifier stage) so that the final amplifier will neutralize when the neutralizing capacitor is at about one-fourth its maximum capacitance. This will require that the final-amplifier grid lead be placed about one-fourth the way down from the plate side of coil L4. The neutralizing capacitor clip should be placed at the same point as the clip from the front end of capacitor C26. This point will vary with frequency, but will ordinarily be about one-fifth of the way back from the front end of coil L4. The bias (ground) lead should be placed about one-third of the way from the rear end of coil L4 which is the plate end of the coil. A part of the front end of coil L4 will remain unused. The exact position for the tap to the final-amplifier grids must be determined by test. Variations in antennas and transmission line feeders make the adjustment of the L-C ratio of the final tank circuit very critical. The efficiency will be very low if the adjustment of the L-C ratio is incorrect, and will cause excessive plate dissipation and hot loads in the final tank (antenna-loading) circuit. A slight change in the inductance ($\frac{1}{8}$ turn at 18 mc) is sufficient to detune the final-amplifier stage. The operator should set the overload relay setting close to the final-amplifier current at which he is operating while making the adjustments (par. 101). This lessens the possibility of damage to tubes and equipment when overloads occur. When the operator has tuned the final stage, the correctness of the tuning may be checked as follows: Place the transmitter on the air for about 15 minutes. Turn the transmitter off and short the high-voltage tank capacitors with a shorting stick. Determine the temperature of the leads by feeling them. The leads will be too hot to feel with comfort, but should not be hot enough to discolor or smoke. This applies to leads to capacitors C33 and C34, and coil L5. The leads to capacitors C30 and C31 should operate cold, or slightly warm. If the leads are too hot the L-C ratio of the final tank is incorrect and a readjustment must be made.

c. Neutralization. With the transmitter turned off and voltage removed, clip a small neon bulb onto the junction of the plate leads to the final-amplifier tubes, placing the tip of the bulb close to the antenna-loading capacitor drive shaft. Turn on all power to the transmitter except the 4,000-volt supply to the final-amplifier stage. This is accomplished by removing the 4,000-volt fuse. With the neutralizing capacitor set at its minimum value, rotate the FINAL AMP. PLATE dial for maximum brilliance of the neon tube. Then rotate the FINAL AMP. NEUT. dial for minimum brilliance. Then, again, rotate the FINAL AMP. PLATE dial for maximum brilliance of the neon tube. The brilliance should be less than in the first trial. Now rotate the FINAL AMP. NEUT. dial for minimum brilliance of the neon bulb. If the neon bulb goes out at this trial set the FINAL AMP. NEUT. dial at the middle of the range over which the neon bulb is extinguished. Repeat until the stage is neutralized.

NOTE: The neon tube must be removed before applying plate voltage to the final amplifier stage.

Replace the 4,000-volt fuse (F6 in fig. 52) and re-close the cabinet slide. An alternative method of neutralizing the final-amplifier stage is discussed in paragraph 99g.

d. Tuning Final Amplifier. Close high-voltage switch S10. Press the TEST KEY and rotate the FINAL AMP. PLATE dial until left-hand meter M1 indicates a minimum. The power input should not be greater than about 600 ma at 4,000 volts.

e. Alternative Methods of Tuning. Since the second-, third-, fourth-, and final-amplifier stages may all be used either as conventional amplifiers or as frequency-doubling amplifiers, there are several alternative methods of tuning to a desired frequency in the higher ranges. The operator will determine by test which is most effective for securing a desired frequency. The operation of the final-amplifier stage as a frequency doubler is described below.

f. Doubling in Final Amplifier. At frequencies above 12 or 13 mc it may be desirable to

use the final-amplifier stage as a frequency doubler. Above 17 mc this method of operation must be used. The lead on the neutralizing capacitor which connects to coil L4 should be disconnected and folded up out of the way into the neutralizing capacitor. Since the fourth-amplifier V5 plate circuit does not have to furnish neutralizing voltage to the final-amplifier stage, the ground lead should be moved to the front end of coil L4. The tap on L4 to the grids of tubes V6 and V7 should be set to give 100 ma (or less) grid current. This point will be in about the center of L4. In adjusting coil L4 for resonance with capacitor C26 keep the 4TH AMP. PLATE dial at about its midposition. If C26 has much less than this value of capacitance the circuit tends to be unstable.

101. OVERLOAD AND UNDERLOAD RELAY ADJUSTMENT OF RADIO TRANSMITTER (WILCOX ELECTRIC TYPE 96A).

The overload relay should be adjusted to trip out at about 0.9 ampere when the transmitter is operating at the normal power of 0.8 ampere final plate current. The underload relay should be adjusted to operate at about 0.5 ampere under the same operating condition. If the transmitter is operating at reduced power both settings should be reduced accordingly.

APPENDIX

SECTION XVII. REFERENCES

NOTE: For availability of items listed, check FM 21- 6, and ASF Catalog SIG 2. Also see FM 21-6 for applicable technical bulletins, supply bulletins, modification work orders, and changes.

102. SUPPLY PUBLICATIONS.

SIG 1	Introduction to ASF Signal Supply Catalog.
SIG 3	List of Items for Troop Issue.
SIG 4—1	Allowances of Expendable Supplies.
SIG 4—2	Allowances of Expendable Supplies for Schools, Training Centers, and Boards.
SIG 5	Stock List of all Items.
SIG 7	Organizational Spare Parts.
SIG 8	Higher Echelon Spare Parts.
SB 11-8	Chests for Running Spares.
SB 11-10	Signal Corps Kit and Materials for Moisture and Fungi-Resistant Treatment.

103. TECHNICAL MANUALS ON AUXILIARY EQUIPMENT.

TM 11-472	Repair and Calibration of Electrical and Measuring Instruments.
TM 11-820	Radio Transmitter T-4/FRC, Radio Transmitter T-5/FRC, Power Rectifier PP-1/FRC, Modulator MD-1/FRC, Switch Panel SA-2/FRC, Oscillator O-2/FRC, Amplifier AM-2/FRC.
TM 11-853	Radio Receivers (Wilcox Electric types CW3 and F3) and Receiver Bay (Wilcox Electric type 113A).
TM 11-866	Radio Receivers BC-779-B, BC-794-B, and BC-1004-C and Power Supply Units RA-74-C, RA-84-B, and RA-94-A.
TM 11-2520	Dual Channel Amplifier AM-43/FRC.
TM 11-2622	Remote Control Console CY-161/FRC and Control Equipment (Wilcox Electric type CS390).
TM 11-2650	Modulator (Wilcox Electric types 50A, 50A3).
TM 11-2666	Rectifier (Wilcox Electric types 36A, 36A4).

104. CAMOUFLAGE.

FM 5-20	Camouflage, Basic Principles.

105. SHIPPING INSTRUCTIONS.

U. S. Army Spec. No. 100-14A.	Army-Navy General Specifications for Packaging and Packing for Overseas Shipment.

106. DECONTAMINATION.

TM 3-220	Decontamination.

107. OTHER PUBLICATIONS.

FM 21-7	List of Training Films, Film Strips, and Film Bulletins.
FM 21-8	Military Training Aids.
FM 21-40	Defense Against Chemical Attacks.
FM 24-6	Radio Operator's Manual, Army Ground Forces.
TB SIG 13	Moistureproofing and Fungiproofing Signal Corps Equipment.
TM 1-455	Electrical Fundamentals.
TM 11-453	Shop Work.
TM 11-454	The Radio Operator.
TM 11-455	Radio Fundamentals.
TM 11-462	Reference Data.
TM 37-250	Basic Maintenance Manual.

108. FORMS.

W. D., A. G. O. Form No. 468 (Unsatisfactory Equipment Report).
Army Air Forces Form No. 54 (Unsatisfactory Report).

109. ABBREVIATIONS.

a-f	audio-frequency
a-c	alternating-current
amplr	amplifier
amp	ampere
ant	antenna
approx	approximately
c-w	continuous-wave
db	decibel
d-c	direct-current
diam	diameter
dwg	drawing
fil	filtered
gnd	ground
int	interlock
JAN	Prefix designation for radio electron tubes procured under joint Army-Navy Specification JAN-1A.
kc	kilocycle
kw	kilowatt
M	1,000 ohms
ma	milliampere
min	minimum
mc	megacycle
mod	modulation
mf	microfarad
mmf	micromicrofarad
r-f	radio-frequency
sel	selector
unfil	unfiltered
v	volt
w	watt
Ω	ohms

110. GLOSSARY.

See Glossary in TM 11-455, Radio Fundamentals.

SECTION XVIII. MAINTENANCE PARTS

111. MAINTENANCE PARTS FOR RADIO TRANSMITTER (WILCOX ELECTRIC TYPE 96A).

The following information was compiled on 23 July 1945. The appropriate pamphlet of the ASF Signal Supply Catalog for Radio Transmitter (Wilcox Electric type 96A) is:

Fixed Plant Maintenance List
SIG 10-20, Radio Transmitter 96-A.

For an index of available catalog pamphlets, see the latest issue of ASF Signal Supply Catalog SIG 2.

Ref Symbol	Signal Corps stock No.	Name of part and description	Mfr's part and code No.
	2C6840.1	RADIO TRANSMITTER: freq range 2 to 12 mc, 2.5 kw, r-f channel only, usually installed in groups of 8 each.	96-A (W9)
C1, 2, 3, 4, 6, 7, 8, 9, 12, 17, 40	3DA100-26.2	CAPACITOR, paper: 0.1 mf, 600 vdcw.	XTA1 (S5) XTA1M6-.1
C5, 11, 14, 16, 21, 39	3DA2-105	CAPACITOR, mica: 0.002 mf, 1,000 vdcw.	XB-1-22 (S5)
C10, 15	3D9074V-2	CAPACITOR, variable: 5-74 mmf, 1,200 v peak.	75J12 (J4)
C13, 18, 19	3DA5-63	CAPACITOR, mica: 0.005 mf, 1,000 vcdw.	XB-1-25 (S5)
C20	3D9156V	CAPACITOR, variable: 12-156 mmf, 1,750 v peak.	150F20 (J4)
C26	3D9149V	CAPACITOR, variable: 43-149 mmf, 7,400 v peak.	150D90 (J4)
C33	3D9150V-19	CAPACITOR, variable: 18-150 mmf, 12,200 v peak.	150B150 (J4)
C34	3D9500V-1	CAPACITOR, variable: 18-500 mmf, 9600 v peak.	500B90 (J4)
C22, 23, 24, 27, 28, 29, 35, 36	3DA1-80.1	CAPACITOR, mica: 0.001 mf, 2,500 vdcw.	4L52010 (C15)
C25, 30, 31, 32	3DA2-106	CAPACITOR, mica: 0.00s mf, 12,500 vdcw.	XA-12-22 (S5)
C37	3D9017V-3	CAPACITOR, variable: 17 mm, 7,500 v peak.	TN750 (J4)
C38	3DA500-57.1	CAPACITOR, paper: 0.5 mf, 400 vdcw.	S-0263 (S5)
RFC1	3C348-2	CHOKE, RF: 1.7 to 30 mc, 150 ma.	750 (J4)
RFC4	3C348	CHOKE, RF: 2.5 mh, 1.7 to 30 mc, 500 ma.	752 (J4)
RFC5	2C6840/C4	CHOKE, RF: 82 microhenry, 2 amp.	38515 (W9)
	2Z3549-(freq)	CRYSTAL HOLDER: with crystal (freq as specified).	FT-249
	3H1938	FAN, blower: for M4.	7843 (E28)
	3H1936-1	FAN, blower: for M3.	A-601 (T5)
F3, 4	3Z2601.18	FUSE, cartridge: 1 amp, 1,000 v.	2018 (L3)
F5	3Z2601.17	FUSE, cartridge: 1 amp, 5,000 v.	HVJ (B9)
F6	3Z2602.9	FUSE, cartridge: 2 amp, 10,000 v.	HVL-2 (B9)
F1, 2	3Z2010	FUSE, plug: 10 amp, 125 v.	(B9)
	3G1000-8	INSULATOR, conical: porcelain, stand-off, 1″ high.	601 (J4)
	3G100-8.1	INSULATOR, conical: porcelain, stand-off, 1½″ high.	602 (J4)
	3G1000-10	INSULATOR, conical: porcelain, stand-off, 2″ high.	603 (J4)
	3G1050-48	INSULATOR, conical: porcelain, stand-off, 3″ high.	604 (J4)
M1	3F1002-20	METER, 0-2 amp: dc	301 (W6)
M2	3F950-37	METER, multiscale: 0/25/250/500 ma, dc.	301 (W6)
M4	3H3000-25	MOTOR, blower: 1/500 hp.	JS3-59 (S4)
M3	3H3000A16-4	MOTOR, blower: 1/6 hp.	5KH43AB27B (G3)
S1	2Z7683	RELAY, DPDT: channel control, 12 vdc.	1037 (L2)
S2	2Z7684	RELAY, channel: 220 vac, 4PST, NO.	B-407 (A5)
S3	2Z9725	RELAY, ant.: 12 vdc	1601-SMX (L2)
S4	2Z7585-7	RELAY, keying: 12 vdc, 300 ohm, coil, SPDT.	223C34 (K5)
S5	2Z7589-14	RELAY, bias protection: 32 vdc, DPST, NO.	1024 (L2)
S6, 7	2Z7636	RELAY, overload and underload: 12 vdc 95 ohm coil, SPDT.	1015 (L2)

111. MAINTENANCE PARTS FOR RADIO TRANSMITTER (WILCOX ELECTRIC TYPE 96A) (contd)

Ref Symbol	Signal Corps stock No.	Name of part and description	Mfr's part and code No.
R1	3Z4608	RESISTOR: 100,000 ohm, 1 watt, RS-208.	BT-1 (I2)
R2	3Z6725	RESISTOR: 250,000 ohm, 1 watt.	BT-1 (I2)
R3, 18	3Z6625-2	RESISTOR: 25,000 ohm, 1 watt.	BT-1 (I2)
R4	3Z6660	RESISTOR: 60,000 ohm, 1 watt.	BT-1 (I2)
R5, 9, 17, 38	3Z6650-8	RESISTOR: 50,000 ohm, 1 watt.	BT-1 (I2)
R6	3Z6050-9	RESISTOR: 500 ohm, 1 watt.	BT-1 (I2)
R7	3Z6625-3	RESISTOR: 25,000 ohm, 2 watt.	BT-2 (I2)
R8	3Z6675-10	RESISTOR: 75,000 ohm, 2 watt.	BT-2 (I2)
R10, 13, 14, 35	3Z6005-27	RESISTOR: 50 ohm, 1 watt.	BT-1 (I2)
R11, 15, 28	3Z5994-11	RESISTOR: 4.3 ohm, ±1%, 1 watt, wire-wound.	WW4 (12)
R12, 16	3Z6620-54	RESISTOR: 20,000 ohm, 10 watt, wire-wound.	A-10-F (C10)
R19	3Z6580-11	RESISTOR: 8,000 ohm, 10 watt, wire-wound.	A-10-F (C10)
R20	3Z6612-28	RESISTOR: 12,000 ohm, 10 watt, wire-wound.	A-10-F (C10)
R21, 26	3Z6011-B2	RESISTOR: 112.8 ohm, ±1%, 1 watt, wire-wound.	WW4 (I2)
R22	3Z6080-20	RESISTOR: 800 ohm, 10 watt, wire-wound.	A-10-F (C10)
R23	3Z6100-6	RESISTOR: 1,000 ohm, 10 watt, wire-wound.	A-10-F (C10)
R24	3Z6610-68	RESISTOR: 10,000 ohm, 20 watt, wire-wound.	A-20-J (C10)
R25	3Z6700-3	RESISTOR: 100,000 ohm, 20 watt, wire-wound.	A-20-J (C10)
R27	3Z6560-11	RESISTOR: 6,000 ohm, 10 watt, wire-wound.	A-10-F (C10)
R29	3Z6500-84	RESISTOR: 5,000 ohm, 200 watt, wire-wound.	A-200-W (C10)
R30	3Z5992-10	RESISTOR: 2 ohm, ±1%, 1 watt, wire-wound.	WW4 (12)
R31, 32	3Z7025-4	RHEOSTAT: 25 ohm, 25 watt, wire-wound.	H-0147 (02)
R33	3Z6625-57	RESISTOR: 25,000 ohm, 10 watt, wire-wound.	A-10-F (C10)
R34	3Z6615-4	RESISTOR: 15,000 ohm, 1 watt, wire-wound.	BT-1
R36, 37	3Z1891-2	FILTER: 50 ohm, 10 watt, wire-wound.	P-300 (02)
811	2Z8674.8	SOCKET, tube: standard 4-prong.	S4 (A13)
1852	2Z8795.10	SOCKET, tube: octal.	RSS-8 (A13)
807	2Z8763.4	SOCKET, tube: 5-prong.	RSS-5 (A13)
813	2Z8690-3	SOCKET, tube: 7-prong, giant	237 (J4)
Crystal	2Z8673.24	SOCKET, special: 3-prong.	29525 (W9)
450TL	2Z8759.3-1	SOCKET, tube: 4-prong.	211 (J4)
S8	3Z9824-261.3	SWITCH, push-button: 8 each DPDT (meter selector).	17930 (01)
S9	3Z9559	SWITCH: cabinet interlock.	3592 (A17)
S10	3Z9903A-8	SWITCH, double-throw: 1 amp, 5,000 v, 4-pole.	95007 (W9) Special
S11	3Z9503-20	SWITCH, safety: 2-pole, 30 amp, 230 v.	93211 (S9)
T1	2Z9600.9	TRANSFORMER, fil: pri, 220 v, tapped 210/220/230; 3-sec windings: 6.3 v @ 4 amp ct.	S-12769 (K3)
T2	2Z9600.10	TRANSFORMER, fil: pri, 220 v, tapped 210/220/230; 2-sec windings: 5 v @ 8 amp ct.	S-17054 (K3)
T3	2Z9975-27	TRANSFORMER, fil: pri, 220 v, tapped 210/215/220/225 230/235/240, sec: tapped at 5/7½/10/11 v ct, 385 va.	S-10768 (K3)
1852	2T112	TUBE: VT-112.	1852/6AC7 (R2)
807	2T100	TUBE: VT-100.	807 (R2)
813	2T144	TUBE: VT-144.	813 (R2)
811	2T217	TUBE: VT-217.	811 (R2)
450TL	2V450TL	TUBE: type 450TL.	450TL (E2)

112. MAINTENANCE PARTS FOR RADIO TRANSMITTER (WILCOX ELECTRIC TYPE 96C3).

The following information was compiled on 23 July 1945. The appropriate pamphlets of the ASF Signal Supply Catalog for Radio Transmitter (Wilcox Electric type 96C3) is:

Fixed Plant Maintenance List

SIG 10-22.1, Radio Transmitter Station 96C3.

For an index of available catalog pamphlets, see the latest issue of ASF Signal Supply Catalog SIG 2.

Ref Symbol	Signal Corps stock No.	Name of part and description	Mfr's part and code No.
Dwg. #E138-2	2C6840C	RADIO TRANSMITTER (Wilcox Electric Type 96C-3).	96C-3 (W9)
N1	3H392-1	BLOWER ASSEMBLY: 210/230 v, 60 cps, 1725 rpm (includes motor, fan, and housing).	KH (W9)
N1	3H3000A16-4	MOTOR, blower, 1/6 hp, 210/230 v, 50/60 cps, single ph, 1725 rpm.	5KH43AB27 (G3)
C1, 2, 5, 6	3DA100-168	CAPACITOR, paper: dual, 0.1 mf x 0.1 mf, 600 vdcw.	6BA11 (I8)
C3, 4, 8, 23, 24	3DA10-27	CAPACITOR, mica: 0.01 mf, 300 vdcw.	1WS (C15)
C7, 11, 12, 14, 15, 18	3DA2-105	CAPACITOR, mica: 0.002 mf, 1,000 vdcw.	XB1-22 (S5)
C9, 10, 16, 17	3D9074V-2	CAPACITOR, variable: 5-74 mmf.	75J12 (J4)
C13	3DA100-112	CAPACITOR, paper: 0.1 mf, 400 vdcw.	345-21 (M2)
C19, 20, 21, 22, 31, 32, 33, 34	3K4510221	CAPACITOR, mica: 0.001 mf, 2,500 vdcw.	4L (C15)
C25	3D9250-39	CAPACITOR, mica: 0.00025 mf, 500 vdcw.	5W-5T25 (C15)
C26	3DB1.1124	CAPACITOR, paper: oil, 1 mf, 1,000 vdcw.	TJU-100 10 (C15)
C27	3DA500-97.10	CAPACITOR, paper: oil, 0.5 mf, 600 vdcw.	XDCRT (S5)
C28, 35, 38	3DA2-106	CAPACITOR, mica: 0.002 mf, 12,500 vdcw.	XA12-22 (S5)
C29	3D9196V	CAPACITOR, variable: 2 sect 57-196 mmf, 20-60 mmf.	144-A
C30	3D9195V	CAPACITOR, variable: 2 sect 60-195 mmf, 20-50 mmf.	141-A
C31		CAPACITOR, mica: 0.002 mf, 2,500 vdcw.	
C36	3D9017V-3	CAPACITOR, variable: 7.5 mmf.	TN750 (J4)
C37	3D9350V-3	CAPACITOR, variable: 2 sect, 55-350 mmf each sect.	140-A
L1	2C6840C/C8	COIL, RF: choke.	38506 (W9)
L2	2C6840C/C6	COIL ASSEMBLY: r-f tank 1,800 to 19,000 kc.	96C-10.2 (W9)
L3	2C6840C/C5	COIL ASSEMBLY: r-f tank 1,800 to 19,000 kc.	96C-10.3 (W9)
L4	2C6840C/C9	COIL, RF: choke.	38507 (W9)
L5	3C323-10C	COIL, RF: choke.	A-547 (W9)
L6, 11	2C6840C/C7	COIL, RF: choke, dual.	38511 (W9)
L7	2C6840C/C1	COIL, RF: plate tank (1,950 to 3,900 kc).	41512 (W9)
L7	2C6840C/C2	COIL, RF: plate tank (3,800 to 7,200 kc).	41513 (W9)
L7	2C6840C/C3	COIL, RF: plate tank (7,000 to 13,200 kc).	41514 (W9)
L7	2C6840C/C4	COIL, RF: plate tank (10,000 to 19,000 kc).	41515 (W9)
L8, 12	2C6840C/C11	COIL, RF: choke.	96C-23 (W9)
L9, 10	3C302P	COIL, RF: final tank (2-7 mc).	622 (J4)
L9, 10	3C1084M-1	COIL, RF: final tank (6-18 mc).	2113-1/4L8 (J4)
	2Z9049.34	CONNECTOR, ant.: flexible, laminated, 4-ply, silver pl, 16" lg x ½" wd x 0.028" thk.	(W9)
	2Z8202.31	COUPLING, flexible: 2½" lg for ¼" shaft.	TX2 (N1)
	6Z3856-10	FILTER, air: 10" x 10" x 2".	2 (04)
F1	3Z2601.17	FUSE, cartridge: 1 amp, 5,000 v.	HVJ (B9)
F2	3Z2602.9	FUSE, cartridge: 2 amp, 10,000 v.	HVL (B9)
F3, 4	3Z1918A	FUSE, cartridge: 1 amp, 1,000 v.	HVE (B9)

112. MAINTENANCE PARTS FOR RADIO TRANSMITTER (WILCOX ELECTRIC TYPE 96C3) (contd).

Ref Symbol	Signal Corps stock No.	Name of part and description	Mfr's part and code No.
C36	3G1100-160	INSULATOR, mycalex bar: for C36, 10" lg x 1" wd x ⅜" thk, 4 mtg holes, C to C of outer pr: 9"; inner pr: 7".	(J4)
	3G1250-24	INSULATOR, ceramic: round post, 1½" lg x 1" diam, tapped #¼-20.	348 (I6)
	3G1250-16.12	INSULATOR, ceramic: round, 1" lg x ¾" diam, tapped for #10-32.	1010 (A12)
	3GK1250-32.8	INSULATOR, ceramic: conical, 2" x ⅝" x 1⅛" tapped #10-32.	1052 (A12)
	3G1000-8.4	INSULATOR, ceramic: conical, 1" x ½" x ¾", tapped #8-32.	501 (J4)
	3G112-52	INSULATOR, ceramic: 13/16 h x ⅝" top diam x 1¼" bottom.	51 (J4)
	3G1050-18	INSULATOR, feed-through: 1⅛" h x 1¾" bottom diam, x ⅞" top diam.	52 (J4)
M1	3F1002-16	METER: 0-2 amp, dc.	RX-35 (W4)
M2, 3	3F950-39	METER: 0/25/250/500 ma, dc.	RX-35 (W4)
S1	2Z7585-7	RELAY, keying: SPDT.	223C34 (K5)
S1	2Z7585-7/2	COIL, relay, 12 v dc, 300 ohm d-c resistance.	(K5)
S1	2Z3191-6	CONTACTS, relay, 2 amp @ 110 v ac.	(K5)
S2	2Z7635.1	RELAY: DPST.	1024 (L2)
S2	2Z7585-3/2	COIL, relay, 12 v dc, 95 ohm d-c resistance.	(L2)
S2	2Z3191-3	CONTACTS, relay, 4 amp @ 115 v ac.	(L2)
S3	2Z7589-14	RELAY: DPST.	1024 (L2)
S3	2Z7587-10/2	COIL, relay, 32 v dc, 675 ohm d-c resistance.	(L2)
S3	2Z7589-14/1	CONTACTS, relay, 4 amp @ 115 v ac.	1024 (L2)
S4, 5	2Z7585-3	RELAY: SPST.	1015 (L2)
S4, 5	2Z7585-3/2	COIL, relay, 12 v dc, 95 ohm d-c resistance.	(L2)
S4, 5	2Z7585-3/1	CONTACTS, relay, 2 amp @ 115 v ac/5 amp @ 6 v ac.	(L2)
S10	2Z7593-5	RELAY: 4PST, double-break.	B400 (A5)
S10	2Z7593-5/1	COIL, relay, 220 v ac, 60 cps.	(A5)
S10	2Z3191-13	CONTACTS, relay, 10 amp @ 600 v ac.	X52121 (A5)
R1, 16, 36	3RC31BE104K	RESISTOR, carbon: 100,000 ohm, 1 w.	BT-1 (I2)
R2, 17, 18, 20	3RC31BE244J	RESISTOR, carbon: 250,000 ohm, 1 w.	
R3	3RC31BE243J	RESISTOR, carbon: 25,000 ohm, 1 w.	BT-1 (I2)
R4	3RC31BE623J	RESISTOR, carbon: 60,000 ohm, 1 w.	BT-1 (I2)
R5, 9	3RC31BE513K	RESISTOR, carbon: 50,000 ohm, 1 w.	BT-1 (I2)
R6	3RC31BE511J	RESISTOR, carbon: 500 ohm, 1 w.	BT-1 (I2)
R7	3RC41BE243J	RESISTOR, carbon: 25,000 ohm, 2 w.	BT-2 (I2)
R8	3RC41BE753J	RESISTOR, carbon: 75,000 ohm, 2 w.	BT-2 (I2)
R10	3RC31BE510J	RESISTOR, carbon: 50 ohm, 1 w.	BT-1 (I2)
R11, 37	3Z5994-11	RESISTOR, WW: 4.3 ohm, 1 w.	WW4 (I2)
R12, 19	3Z6650-101	RESISTOR, WW: 50,000 ohm, 20 w.	2R (H3)
R13	3RC31BE100K	RESISTOR, WW: 10 ohm, 1 w.	WW1 (I2)
R14	3RC30BE102K	RESISTOR, carbon: 1,000 ohm, 1 w.	GB (A5)
R15	3RC30BE103K	RESISTOR, carbon: 10,000 ohm, 1 w.	GB (A5)
R21	3RC30BE203J	RESISTOR, carbon: 20,000 ohm, 1 w.	GB (A5)
R22	3RC30BE474K	RESISTOR, carbon: 500,000 ohm, 1 w.	GB (A5)
R24	3Z6050-102	RESISTOR, WW: 500 ohm, 10 w.	A115 (H3)
R25	3Z6580-11	RESISTOR, WW: 8,000 ohm, 10 w.	A115 (H3)
R26	3Z6612-24	RESISTOR, WW: 12,000 ohm, 10 w.	A10F (C10)

112. MAINTENANCE PARTS FOR RADIO TRANSMITTER (WILCOX ELECTRIC TYPE 96C3) (contd).

Ref Symbol	Signal Corps stock No.	Name of part and description	Mfr's part and code No.
R27	3Z6225-3	RESISTOR, WW: 2,250 ohm, 10 w.	1¾G (H3)
R28	3Z6625-78	RESISTOR, WW: 25,000 ohm, 10 w.	A130 (H3)
R29	3Z6011-B2	RESISTOR, WW: 112.8 ohm, 1 w.	WW4 (I2)
R30	3Z6610-138	RESISTOR, WW: 10,000 ohm, 10 w.	1¾GK (H3)
R31	3Z6620-95	RESISTOR, WW: 20,000 ohm, 10 w.	1¾GK (H3)
R32	3Z5992-10	RESISTOR, WW: 2 ohm, 1 w.	WW4 (I2)
R33	3Z6610-128	RESISTOR, WW: 10,000 ohm, 20 w.	2A2 (H3)
R34	3Z6010-94	RESISTOR, WW: 100 ohm, 10 w.	1¾G (H3)
R35	3Z6100-134	RESISTOR, WW: 1,000 ohm, 10 w.	1¾G (H3)
R38, 39	3Z7025-4	RESISTOR, rheostat: WW, 25 ohm, 25 w.	RH1 (C10)
R40	2Z7271-5	RESISTOR, pot: carbon, 100,000 ohm.	H2672 (C10)
R41	3Z6500-143	RESISTOR, WW: 5,000 ohm, 20 w.	
	2C4529/S1	SOCKET, tube: octal, ceramic.	CIR-8 (N1)
	2Z8711	SOCKET, tube: 5 prong, ceramic.	CIR-5 (N1)
	2Z8663-1	SOCKET, tube: 7 prong, ceramic.	247 (J4)
	2Z8795.11	SOCKET, tube: octal, bakelite.	RS-8 (A13)
S8	3H900-15-12	SWITCH, ckt breaker: DPST, 220 v ac, 15 amp.	111611 (S9)
S9	3Z9559	SWITCH, interlock: SPST.	3592 (A17)
S10	3Z9903A-8	SWITCH: 6PDT.	119A (W9)
S12	3Z9824-38	SWITCH: 8 push button, DPDT.	17930-80 (01)
T1	2Z9631.54	TRANSFORMER, input: 500 ohm line to single/PP grids.	7442 (C8)
T2	2Z9600.10	TRANSFORMER, fil: pri 220 v ac, secd #1, 5 v ct @ 8 amp, secd #2, 5 v ct @ 8 amp.	S10754 (K3)
T3	2Z9600.9	TRANSFORMER, fil: pri 220 v ac, secd #1, 6.3 v ct @ 4 amp, secd #2, 6.3 v ct @ 4 amp, secd #3, 6.3 v ct @ 4 amp.	S12769 (K3)
T4	2Z9975-27	TRANSFORMER, fil: pri 220 v ac, secd tapped 5, 7½, 10, 11 v.	S10768 (K3)
V1, 2	2J6AC7/1852	TUBE: JAN-6AC7/1852.	6AC7-1852 (R2)
V3	2J807	TUBE: JAN-807.	807 (R2)
V4	2J813	TUBE: JAN-813.	813 (R2)
V5	2J6SN7GT	TUBE: JAN-6SN7GT.	6SN7GT (R2)
V6	2J6J5	TUBE: JAN-6J5.	6J5 (R2)
V7	2J811	TUBE: JAN-811.	811 (R2)
V8, 9	2J450TL	TUBE: JAN-450TL.	450TL (R2)
R41		RESISTOR, WW: 5,000 ohm, 50 w.	
X1	2Z8795.11	SOCKET, tube: octal, bakelite.	RS-8 (A13)
X2	2Z8678.53	SOCKET, tube: octal, ceramic.	CIR-8 (N1)
X3	2Z8763.4	SOCKET, tube: 5 prong, ceramic.	RSS5 (A13)
X4	2Z8663-1	SOCKET, tube: 7 prong, ceramic.	237 (J4)
X5, 6	2Z8650.5	SOCKET, tube: octal, bakelite.	9950
X7	2Z8762.1	SOCKET, tube: 4 prong, ceramic.	RSS4 (A13)
X8, 9	2Z8759.3-1	SOCKET, tube: 4 prong, ceramic.	211 (J4)
S8	3H900-15-12	SWITCH, ckt breaker: DPST, 220 v ac, 15 amp.	111611 (S9)
S9	3Z9559	SWITCH, interlock: SPST	3592 (A17)
S10	3Z9903A-8	SWITCH: 6PDT.	119A (W9)
S12	3Z9824-38	SWITCH: 8 push button, DPDT.	17930-80 (01)
T1	2Z9631.54	TRANSFORMER, input: 500 ohm line to single/PP grids.	7442 (C8)
T2	2Z9600.10	TRANSFORMER, fil: pri 220 v ac, secd #1, 5 v ct @ 8 amp, secd #2, 5 v ct @ 8 amp.	S10754 (K3)

113. MAINTENANCE PARTS FOR RADIO TRANSMITTER (WILCOX ELECTRIC TYPE 96C).

The following information was compiled on 23 July 1945. The appropriate pamphlet of the ASF Signal Supply Catalog for Radio Transmitter (Wilcox Electric type 96C) is:

Fixed plant maintenance list

SIG 10-22, Radio Transmitter 96-C.

For an index of available catalog pamphlets, see the latest issue of ASF Signal Supply Catalog SIG 2.

NOTE: Maintenance parts for Radio Transmitter (Wilcox Electric type 96C) are identical with those listed in paragraph 112 except that R19 is changed and R23 is added.

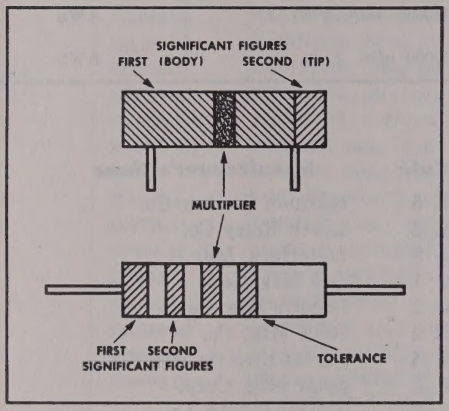
REF SYMBOL	SIGNAL CORPS STOCK NO.	NAME OF PART AND DESCRIPTION	MFR'S PART AND CODE NO.
		Changed	
R19	3RC41BF513J	RESISTOR, carbon: 50,000 ohm, 2 w.	AWS
		Added	
R23	3RC31BF302J	RESISTOR, carbon: 3,000 ohm, 1 w.	AWS

114. LIST OF MANUFACTURERS.

Code	Manufacturer's Name	Code	Manufacturer's Name
A 5	Allen-Bradley Co.	K 5	Kurman Electric Co.
A 13	American Phenolic Corp.	L 2	Leach Relay Co.
A 17	Arrow, Hart & Hegeman Electric Co.	L 3	Littelfuse, Inc.
B 9	Bussman Mfg. Co.	O 1	Oak Mfg. Co.
C 10	Clarostat Mfg. Co., Inc.	O 2	Ohmite Mfg. Co.
C 15	Cornell-Dubilier Electric Corp.	R 2	RCA Mfg. Co.
E 2	Eitel-McCullough, Inc.	S 4	Signal Electric Mfg. Co.
E 28	Excel Auto Radiator Corp.	S 5	Solar Mfg. Corp.
G 3	General Electric Co.	S 9	Square D Mfg. Co.
I 2	International Resistance Co.	T 5	Torrington Co.
J 4	Johnson, E. F., Co.	W 6	Weston Electric Instrument Corp.
K 3	Kenyon Transformer Co., Inc.	W 9	Wilcox Electric Co.

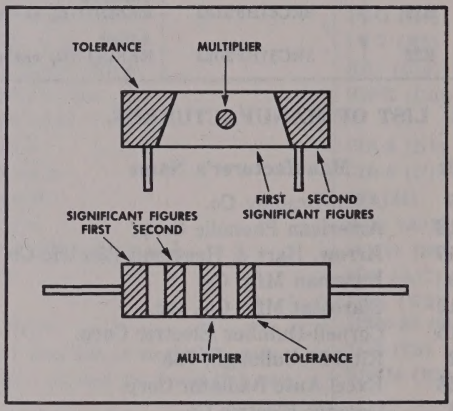
RESISTOR COLOR CODES

RMA COLOR CODE FOR FIXED COMPOSITION RESISTORS



Insulated fixed composition resistors with axial leads are designated by a natural tan background color. Non-insulated fixed composition resistors with axial leads are designated by a black background color.

JAN COLOR CODE FOR FIXED COMPOSITION RESISTORS



Resistors with axial leads are insulated. Resistors with radial leads are uninsulated.

COLOR	SIGNIFICANT FIGURE	MULTIPLIER	TOLERANCE (PERCENT)
BLACK	0	1	
BROWN	1	10	
RED	2	100	
ORANGE	3	1,000	
YELLOW	4	10,000	
GREEN	5	100,000	
BLUE	6	1,000,000	
VIOLET	7	10,000,000*	
GRAY	8	100,000,000*	
WHITE	9	1,000,000,000*	
GOLD		0.1*	5
SILVER		0.01*	10
NO COLOR			20

*JAN ONLY

Example: A 50,000-ohm resistor with a standard tolerance of 20 percent (no color) would be indicated by a green ring (5), a black ring (0), and an orange ring (000)

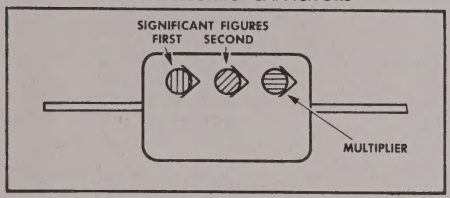
RMA: Radio Manufacturers Association
JAN: Joint Army-Navy

TL 13418 A

Figure 54. Resistor color code.

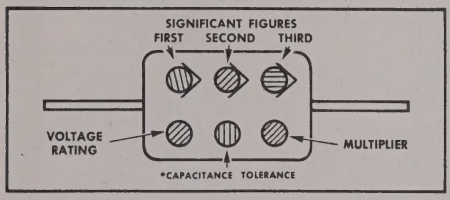
CAPACITOR COLOR CODES

RMA 3-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS

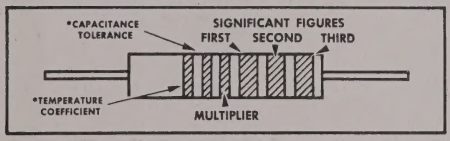


Capacitors marked with this code have a voltage rating of 500 volts.

RMA 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



RMA COLOR CODE FOR TUBULAR CERAMIC-DIELECTRIC CAPACITORS



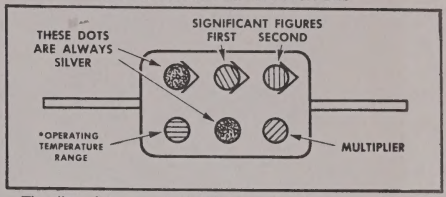
Capacitors marked with this code have a voltage rating of 500 volts.

RMA Radio Manufacturers Association JAN Joint Army-Navy

Note These color codes give all capacitances in micromicrofarads.

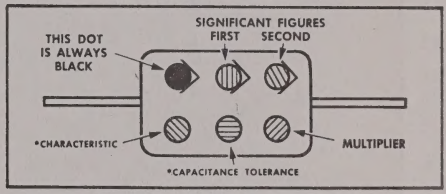
*Items marked with an asterisk are of interest primarily to depot and higher echelon repair personnel

JAN 6-DOT COLOR CODE FOR PAPER-DIELECTRIC CAPACITORS



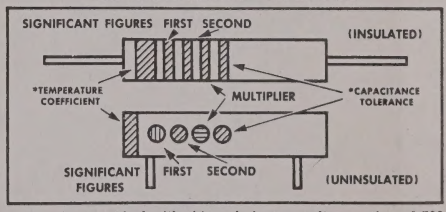
The silver dots serve to identify this marking. For working voltages see JAN type designation code.

JAN 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



The black dot serves to identify this code. For working voltages see JAN type designation code.

JAN COLOR CODE FOR FIXED CERAMIC-DIELECTRIC CAPACITORS



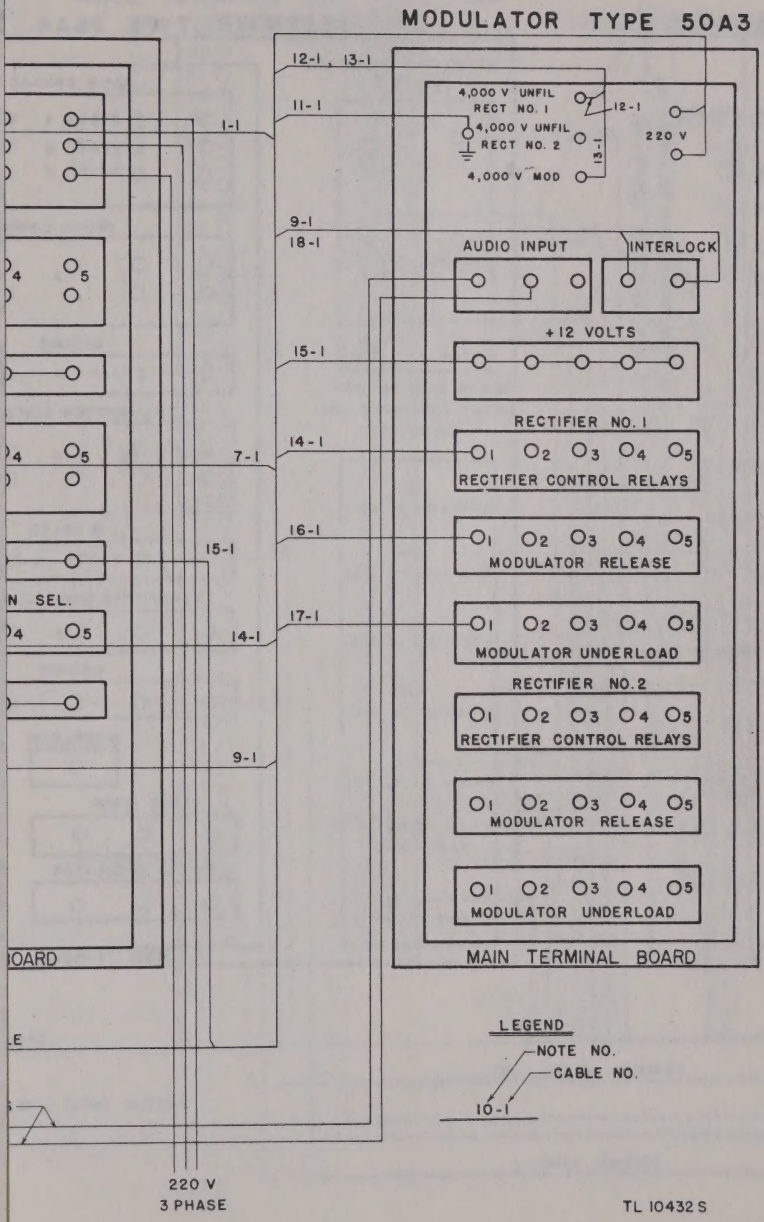
Capacitors marked with this code have a voltage rating of 500 volts. Either the band or dot code may be used.

COLOR	SIGNIFICANT FIGURE	MULTIPLIER			RMA VOLTAGE RATING
		RMA MICA-AND CERAMIC-DIELECTRIC	JAN MICA-AND PAPER-DIELECTRIC	JAN CERAMIC-DIELECTRIC	
BLACK	0	1	1	1	
BROWN	1	10	10	10	100
RED	2	100	100	100	200
ORANGE	3	1,000	1,000	1,000	300
YELLOW	4	10,000			400
GREEN	5	100,000			500
BLUE	6	1,000,000			600
VIOLET	7	10,000,000			700
GRAY	8	100,000,000		0.01	800
WHITE	9	1,000,000,000		0.1	900
GOLD		0.1	0.1		1,000
SILVER		0.01	0.01		2,000
NO COLOR					500

TL 13417 A

Figure 55. Capacitor color code.

☆U.S. GOVERNMENT PRINTING OFFICE: 1951 O - 936987



A3); interconnection diagram.

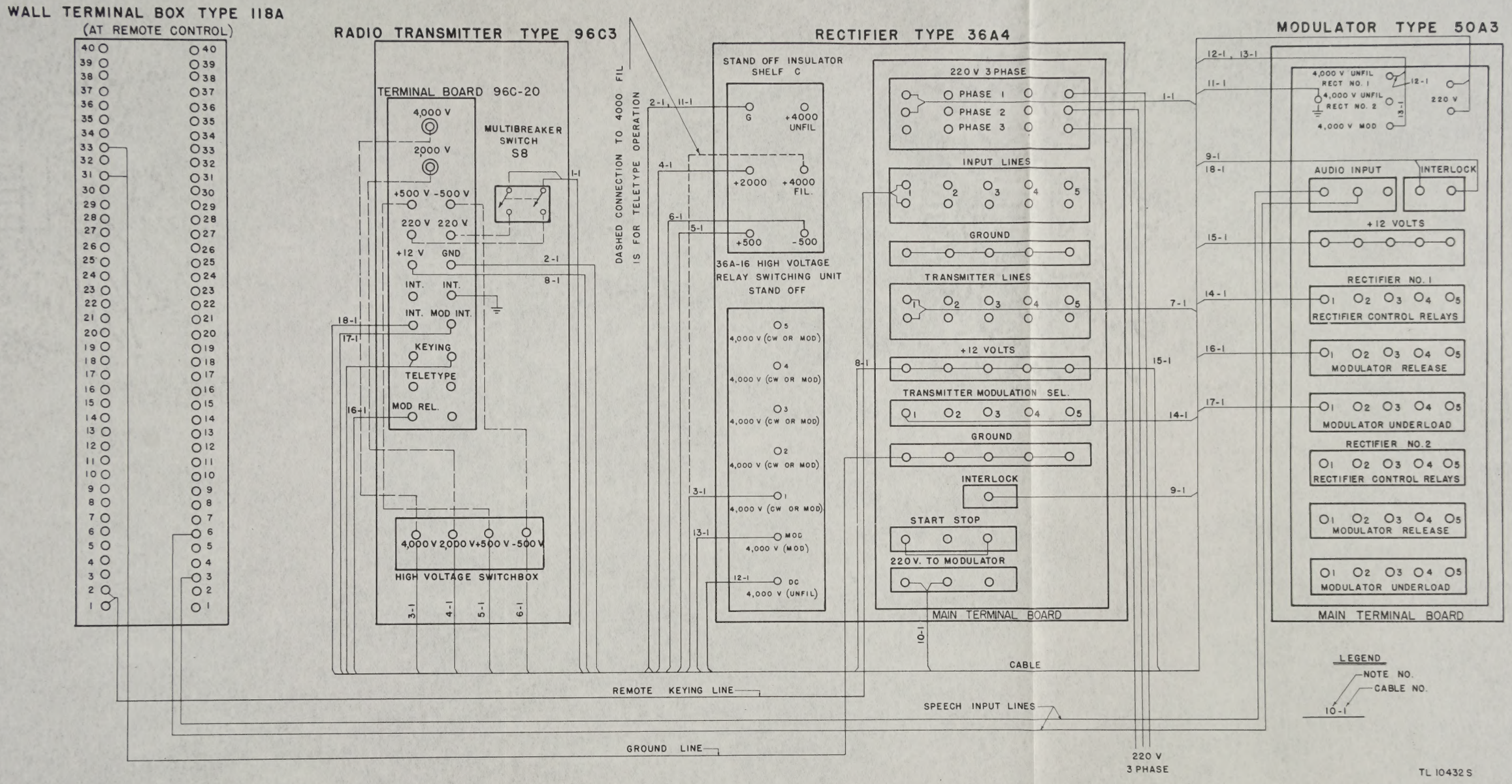
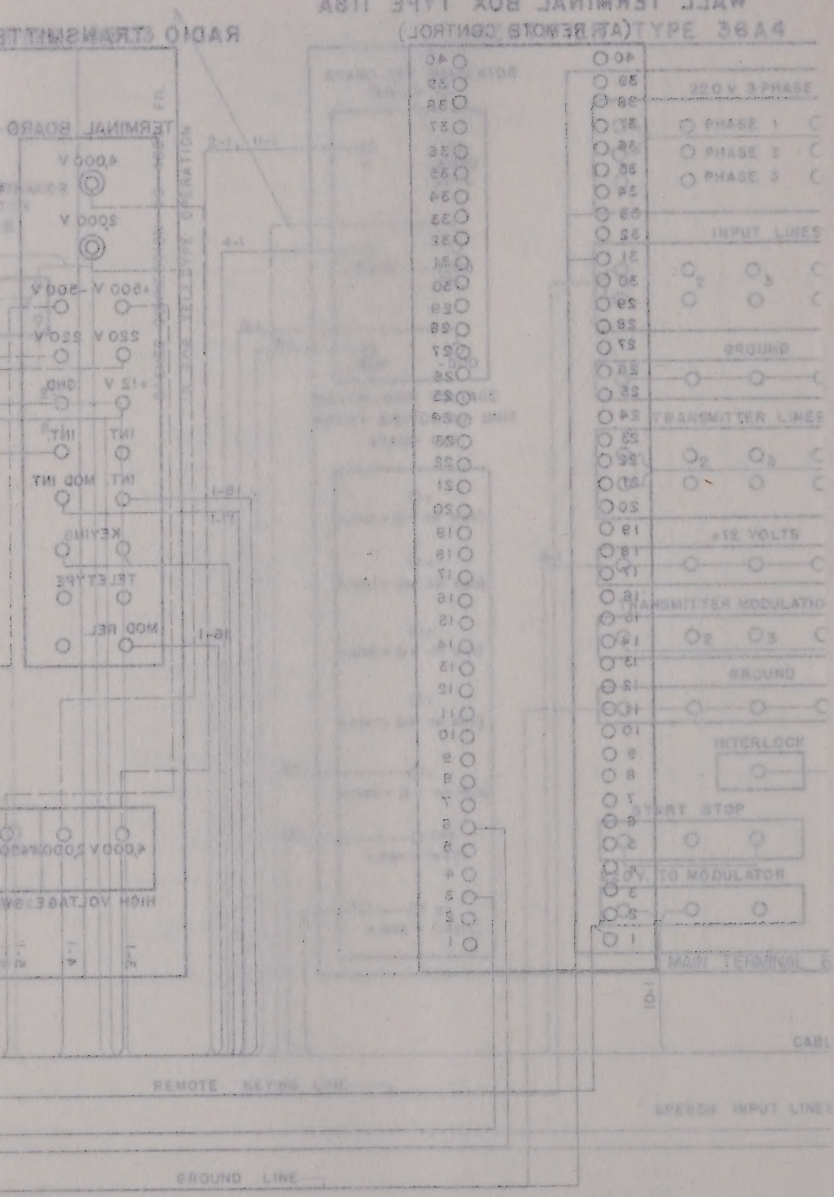
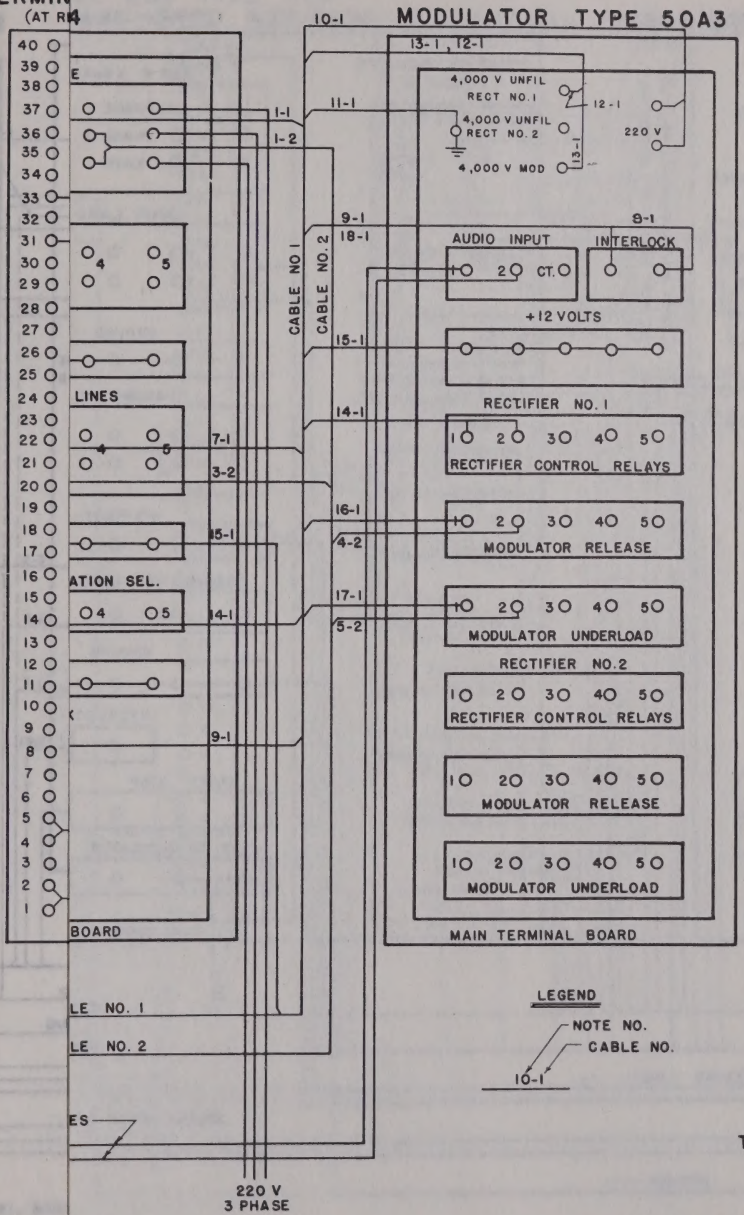
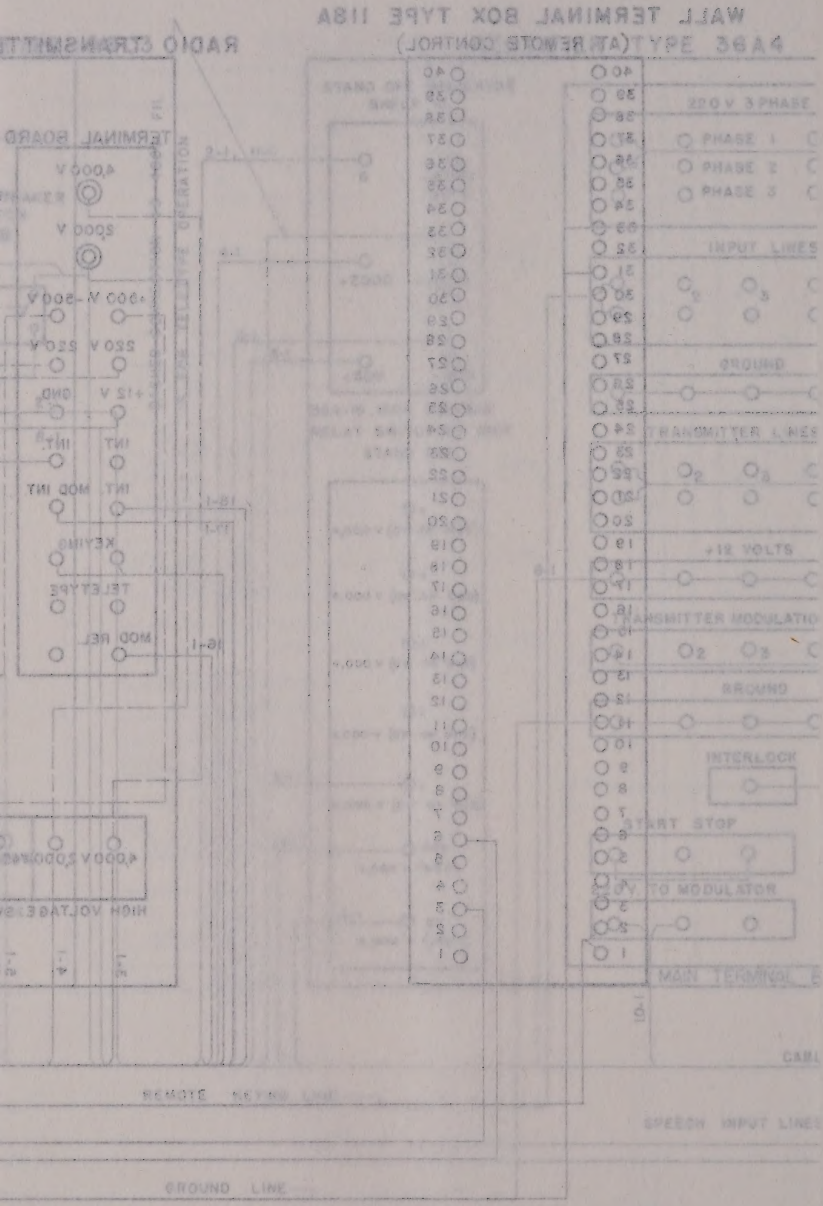


Figure 56. One radio transmitter (Wilcox Electric type 96C3), one rectifier (Wilcox Electric type 36A4), and one modulator (Wilcox Electric type 50A3); interconnection diagram.


WALL TERMINAL BOX TYPE 118A
(AT REMOTE CONTROL)
TYPE 36A4
RADIO TRANSMITTER
TERMINAL BOARD
4,000 V
2000 V
500 V
220 V
+12 V
GND
INT
MOD INT
KEYING
TELETYPE
MOD REL
HIGH VOLTAGE
400 V 3-PHASE
PHASE 1
PHASE 2
PHASE 3
INPUT LINES
GROUND
TRANSMITTER LINES
+12 VOLTS
TRANSMITTER MODULATION
GROUND
INTERLOCK
START STOP
MOV. TO MODULATOR
MAIN TERMINAL
CABL
REMOTE KEYING LINE
SPEECH INPUT LINES
GROUND LINE



3); interconnection diayram.


WALL TERMINAL BOX TYPE 118A
(AT REMOTE CONTROL) TYPE 36A4
200 V 3 PHASE
PHASE 1
PHASE 2
PHASE 3
INPUT LINES
GROUND
TRANSMITTER LINES
+12 VOLTS
TRANSMITTER MODULATIO
GROUND
INTERLOCK
START STOP
TO MODULATOR
MAIN TERMINAL
CABL
SPEECH INPUT LINES
GROUND LINE

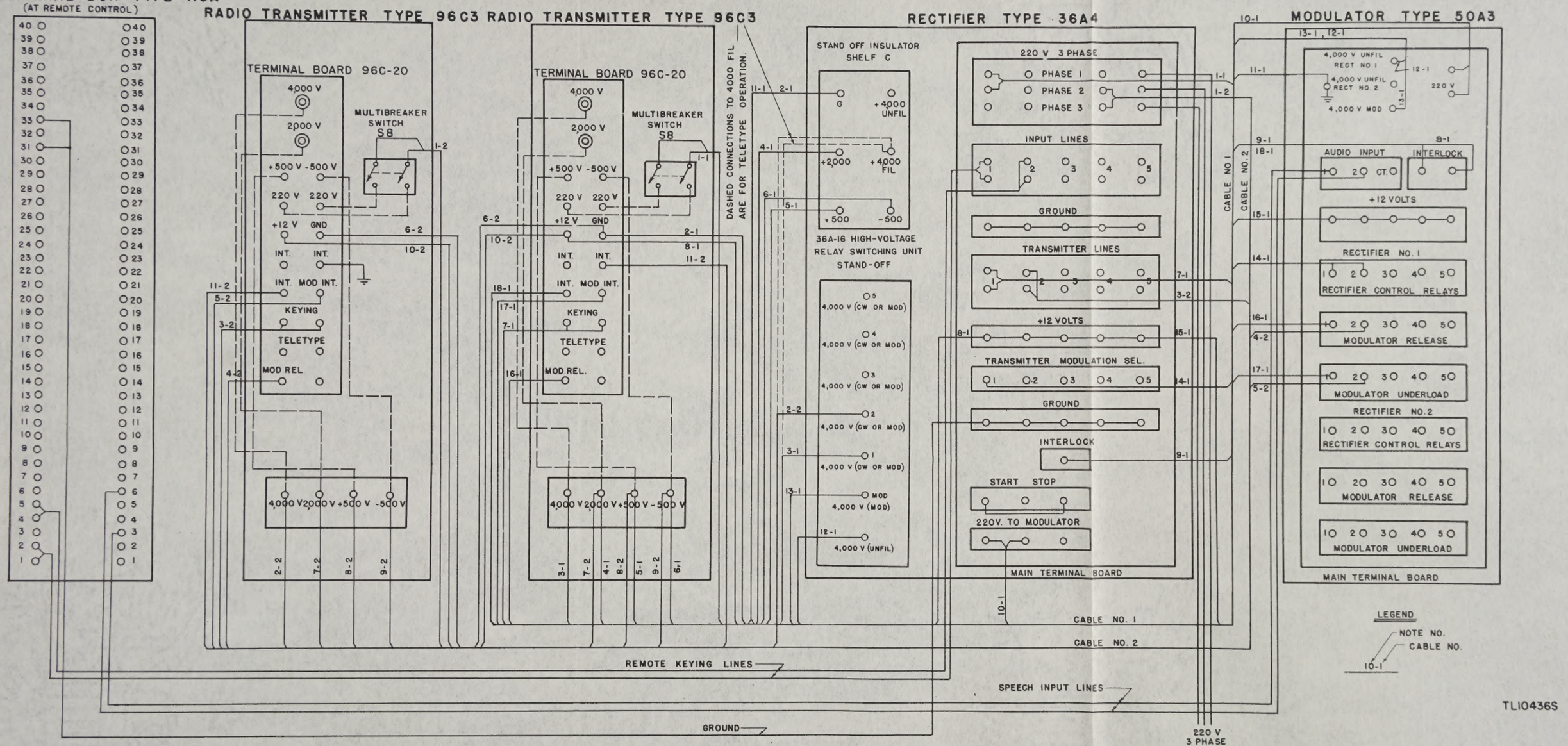
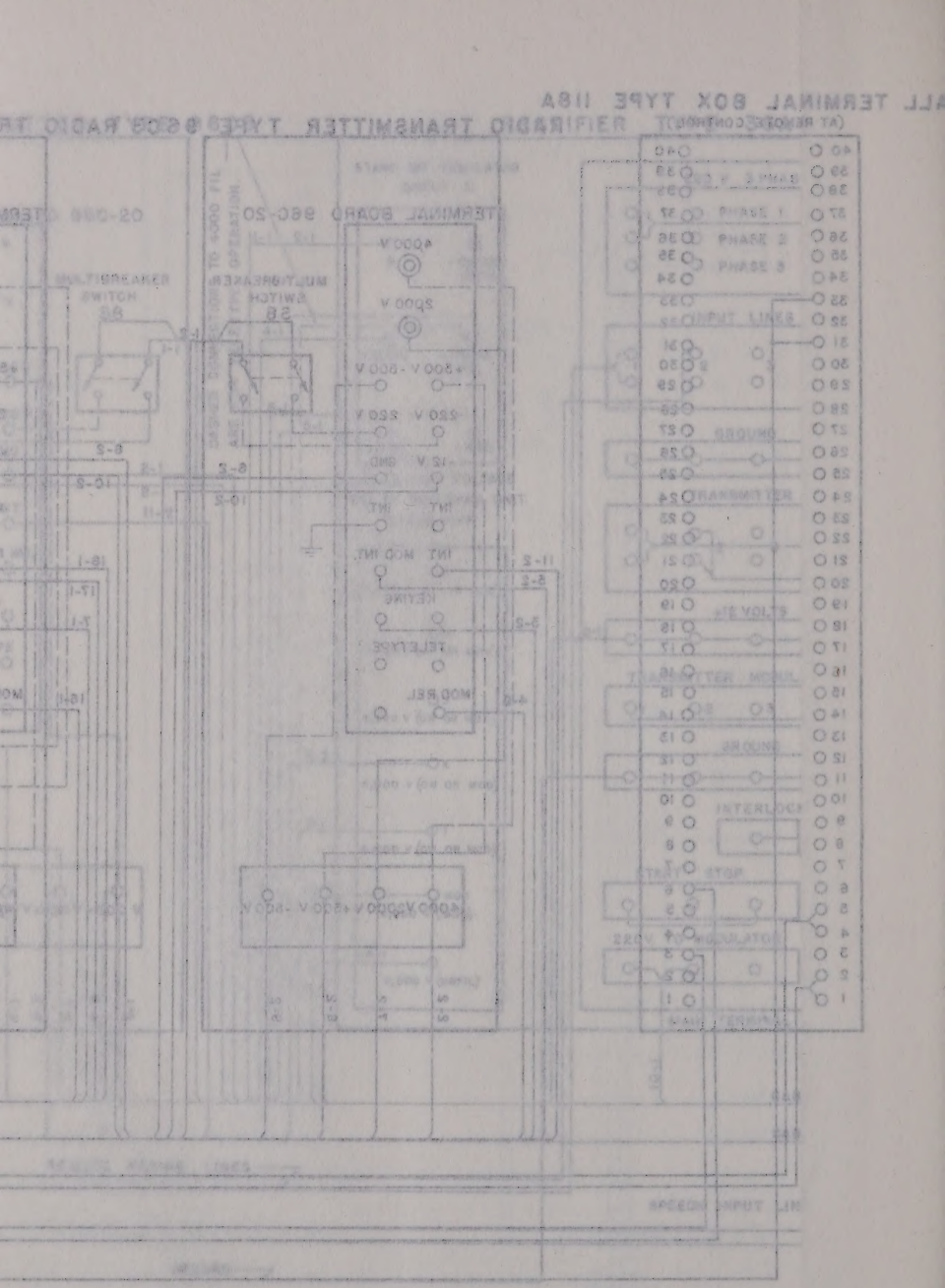
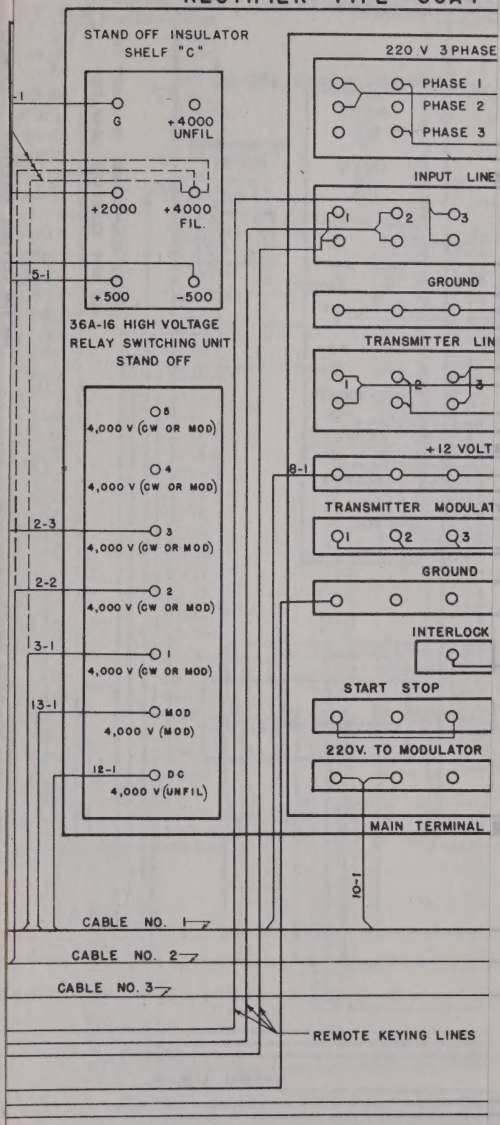
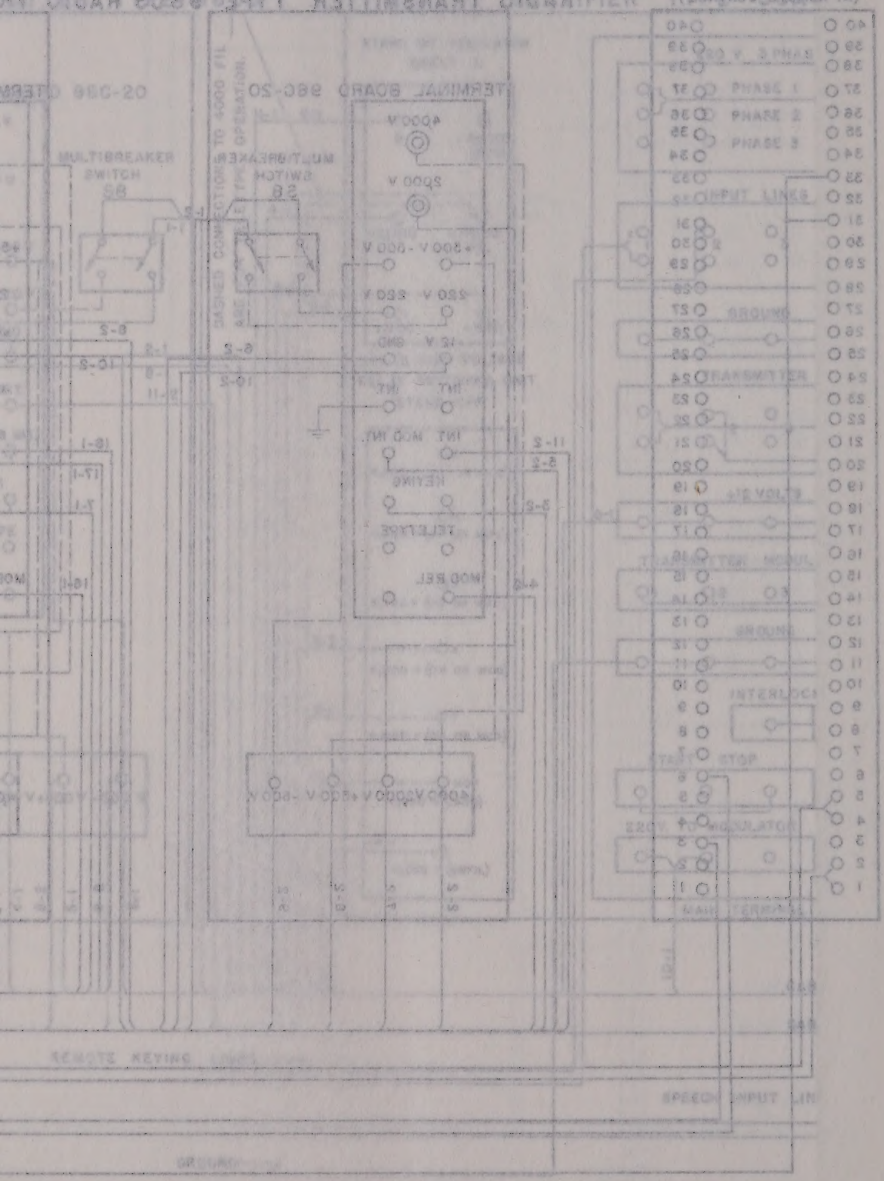


Figure 57. Two radio transmitters (Wilcox Electric 96C3), one rectifier (Wilcox Electric type 36A4), and one modulator (Wilcox Electric type 50A3); interconnection diagram.





3); interconnection diagram.


MULTIBREAKER SWITCH
TERMINAL BOARD
INPUT LINKS
PHASE 1
PHASE 2
PHASE 3
INTERLOCK
GROUND
SPEED INPUT LINES

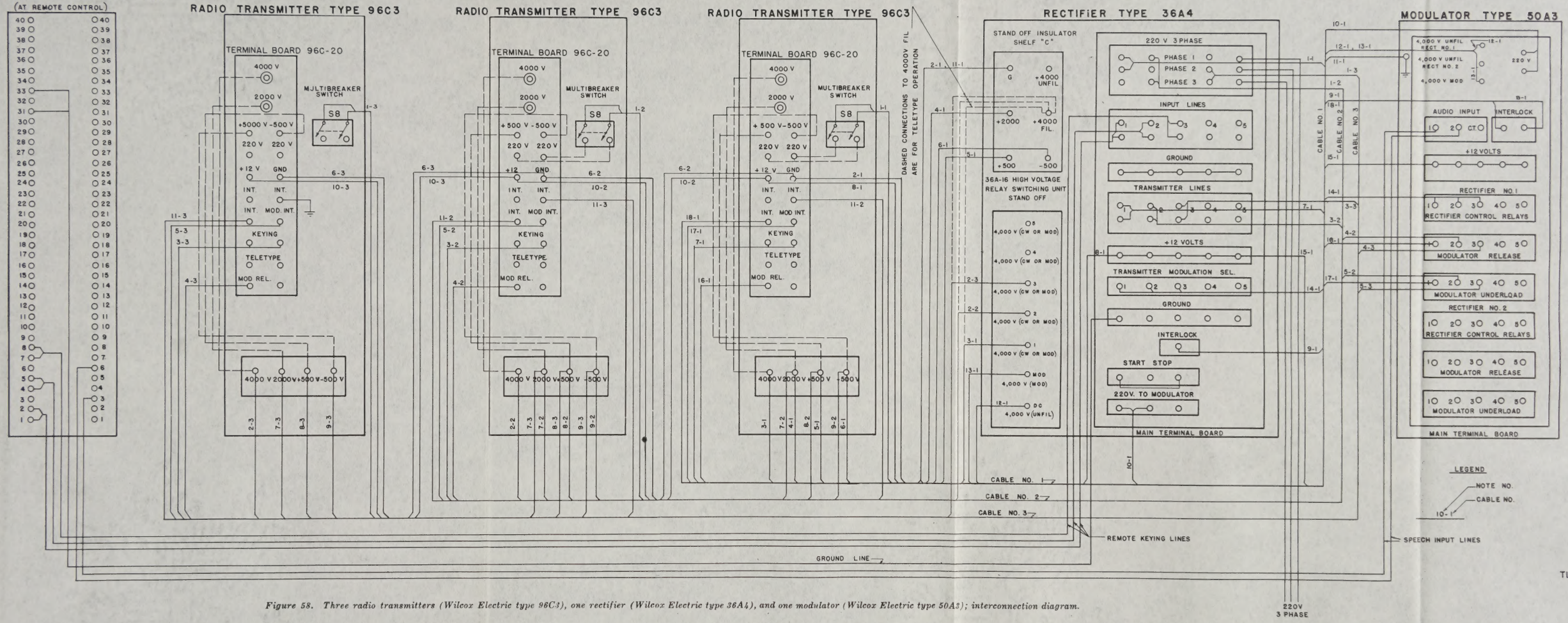
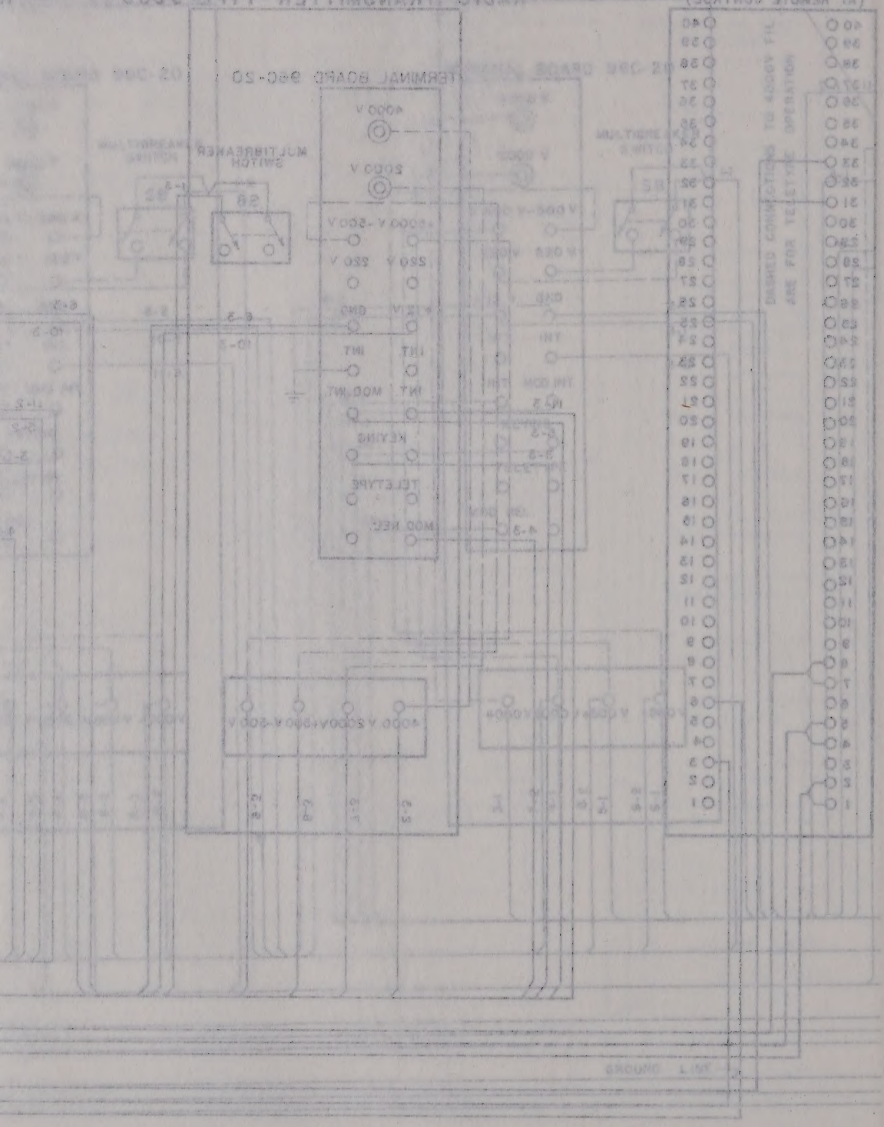
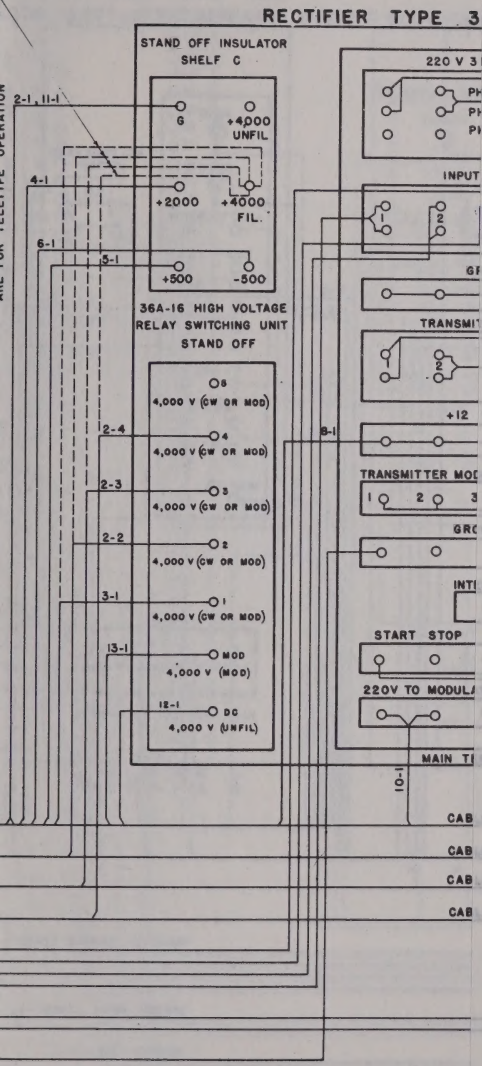
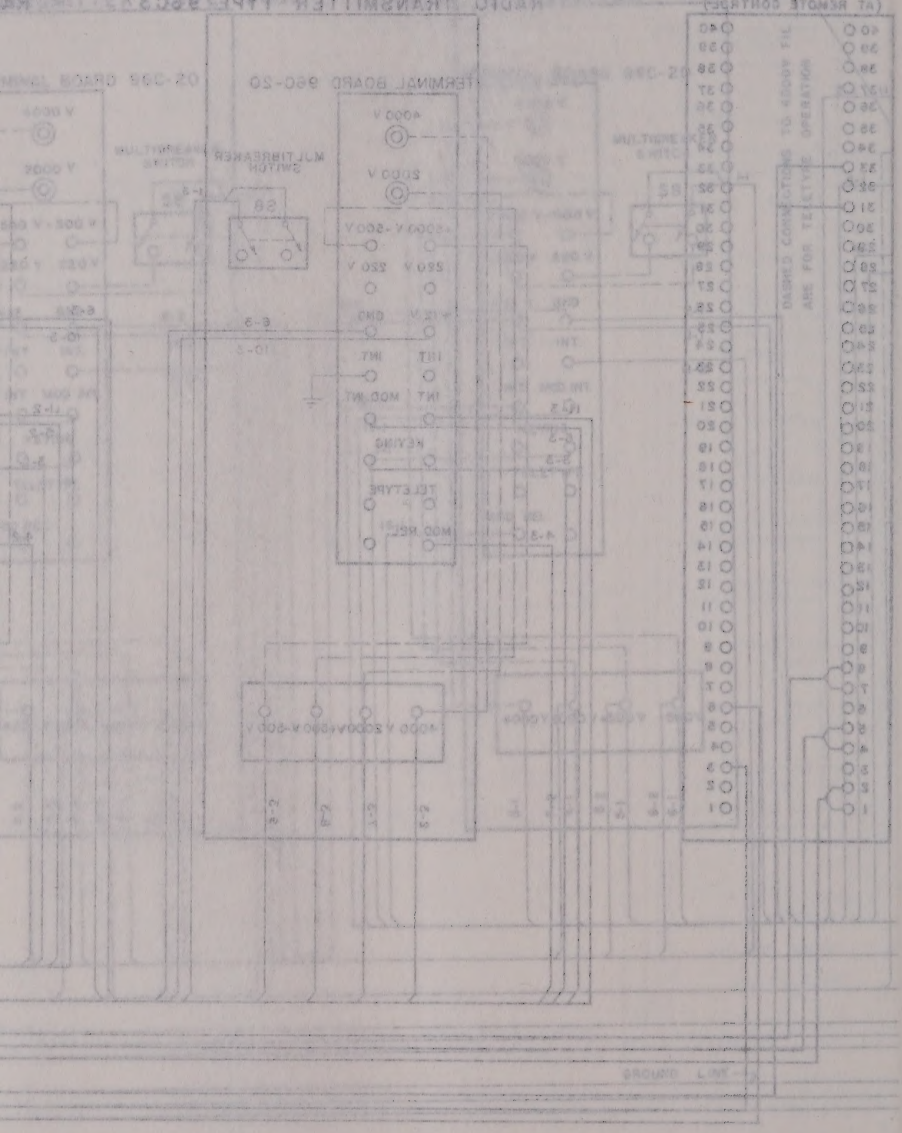


Figure 58. Three radio transmitters (Wilcox Electric type 96C3), one rectifier (Wilcox Electric type 36A4), and one modulator (Wilcox Electric type 50A3); interconnection diagram.




RECTIFIER TYPE 3
STAND OFF INSULATOR
SHELF C
G
+4,000
UNFIL
+2000
+4000
FIL.
+500
-500
2-1, 11-1
4-1
6-1
5-1
36A-16 HIGH VOLTAGE
RELAY SWITCHING UNIT
STAND OFF
8
4,000 V (CW OR MOD)
4
4,000 V (CW OR MOD)
3
4,000 V (CW OR MOD)
2
4,000 V (CW OR MOD)
1
4,000 V (CW OR MOD)
MOD
4,000 V (MOD)
DC
4,000 V (UNFIL)
2-4
2-3
2-2
3-1
13-1
12-1
220 V 3
INPUT
+12
TRANSMITTER MOD
START STOP
220V TO MODUL
MAIN T
10-1
CAB
CAB
CAB
CAB



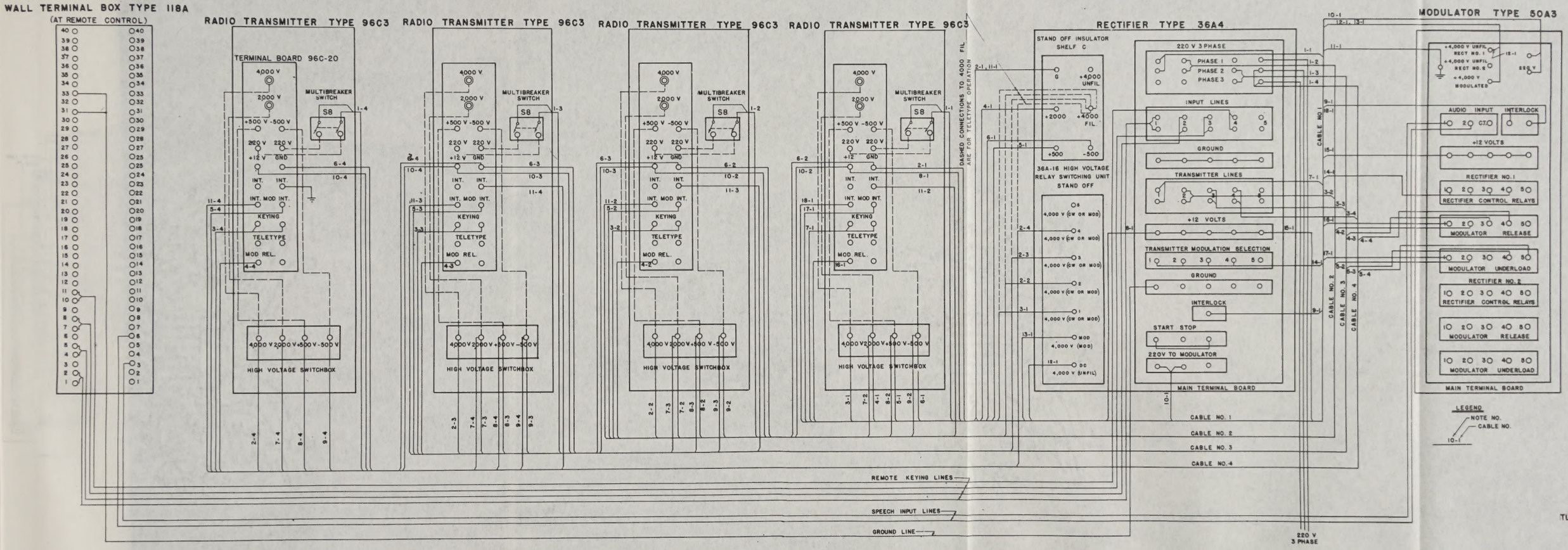
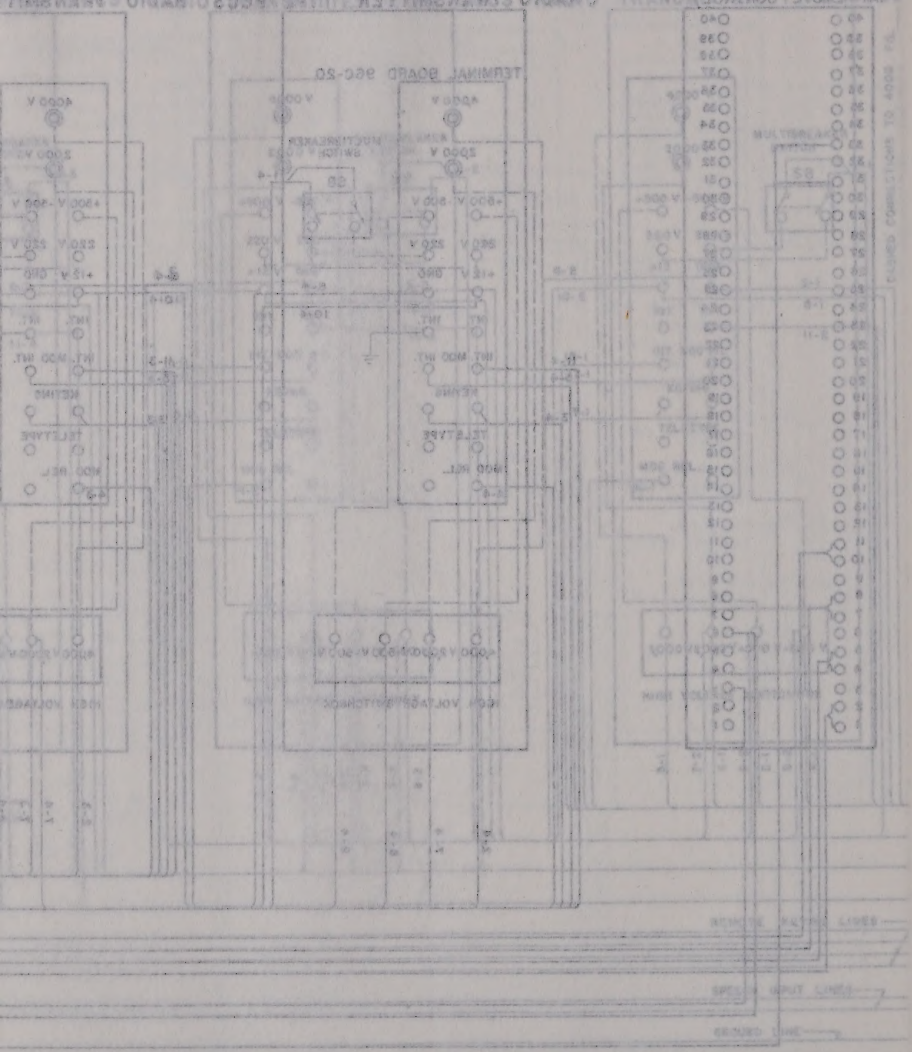
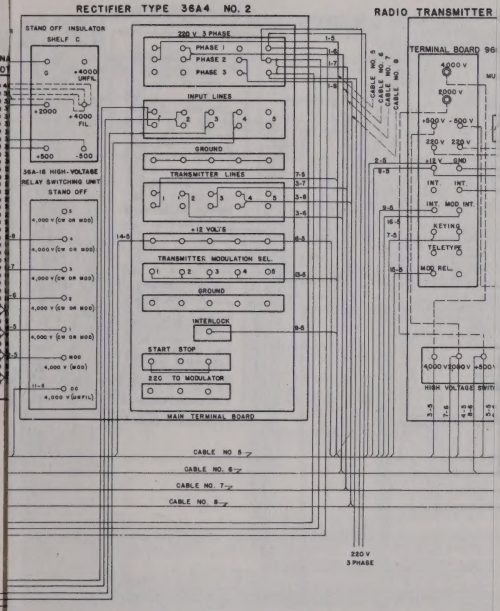
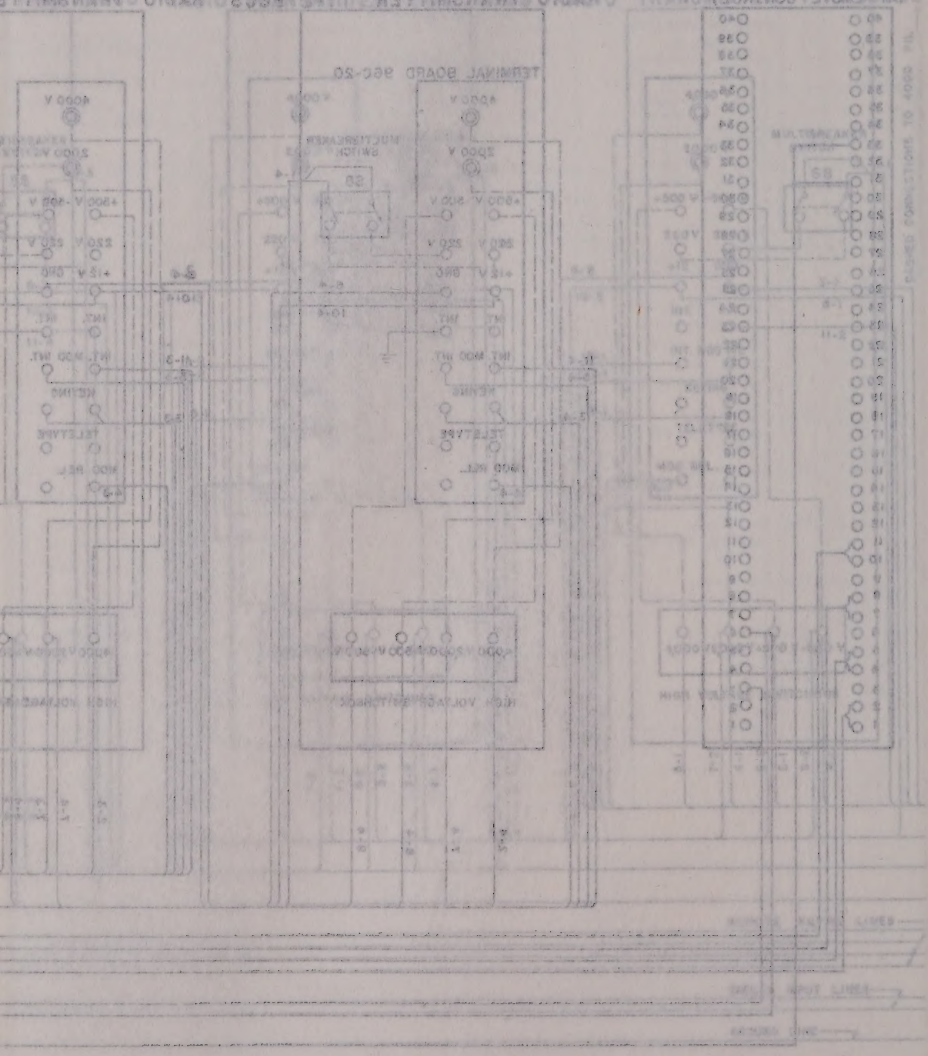


Figure 59. Four radio transmitters (Wilcox Electric type 96C3), one rectifier (Wilcox Electric type 36A4), and one modulator (Wilcox Electric type 50A3); interconnection diagram.





connection diagram.



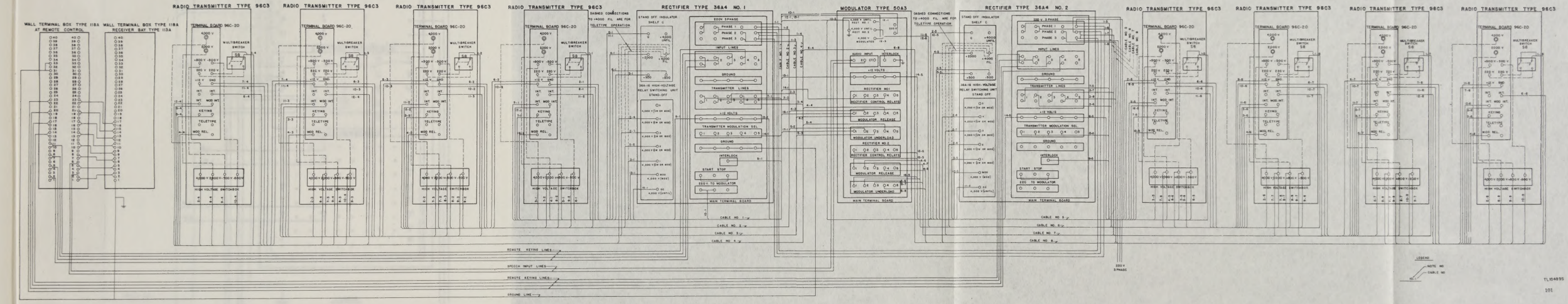
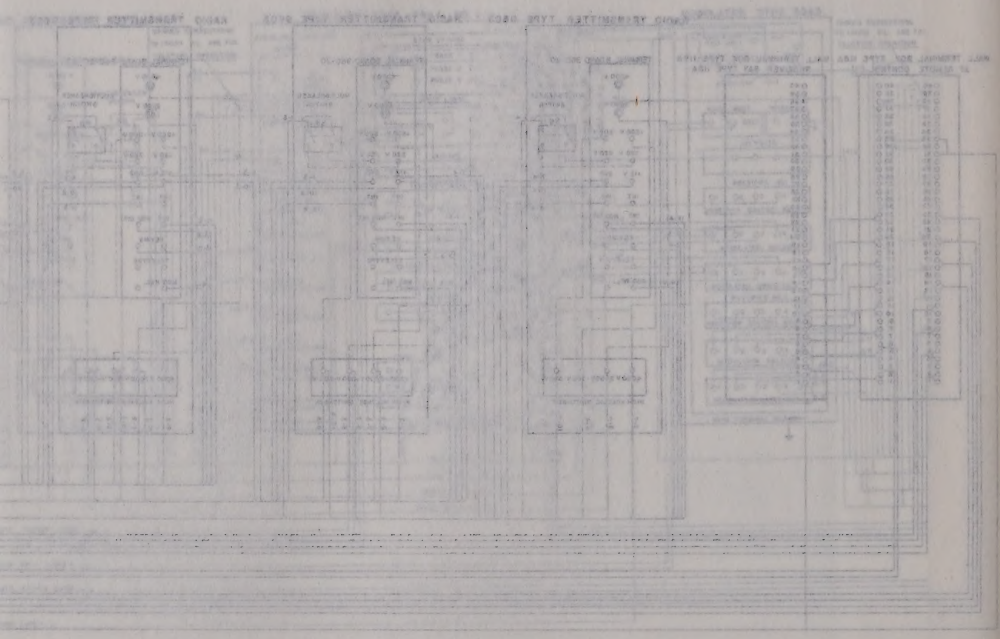
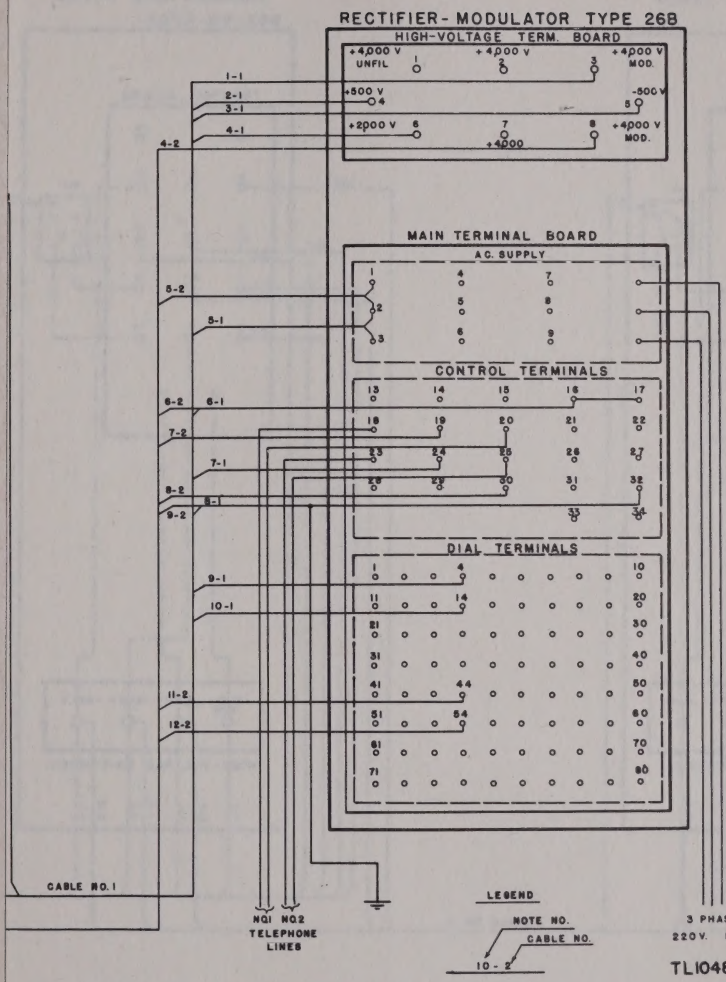
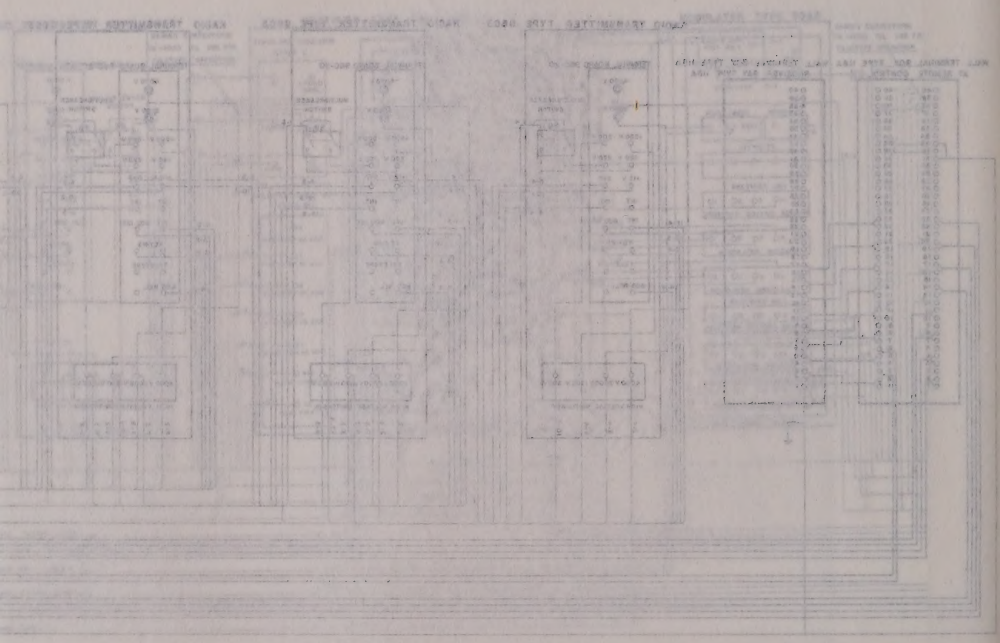


Figure 40. Eight radio transmitters (Wilcox Electric type 96C3), two rectifiers (Wilcox Electric type 36A4), and one modulator (Wilcox Electric type 50A3); interconnection diagram.





tric type 26B); interconnection diagram.



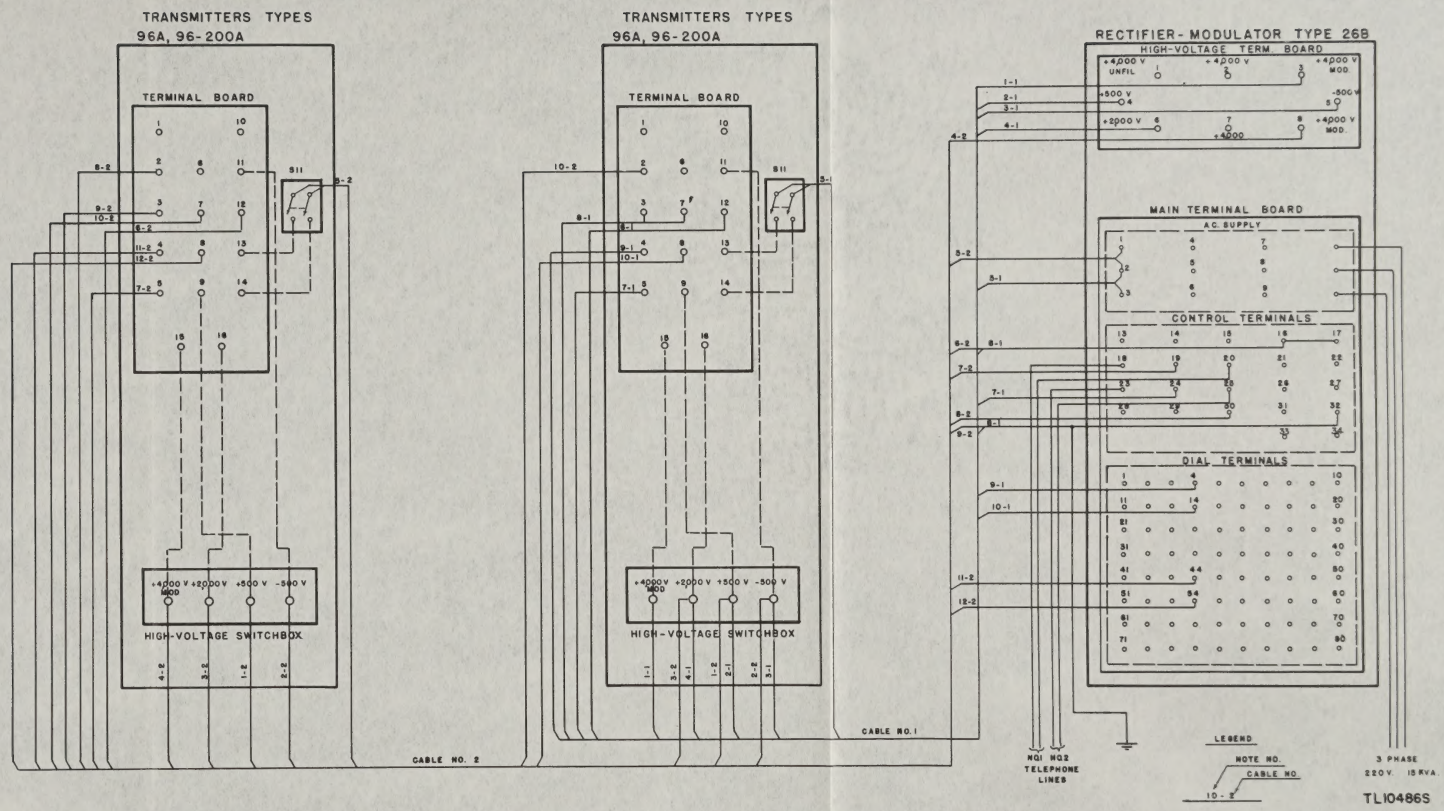
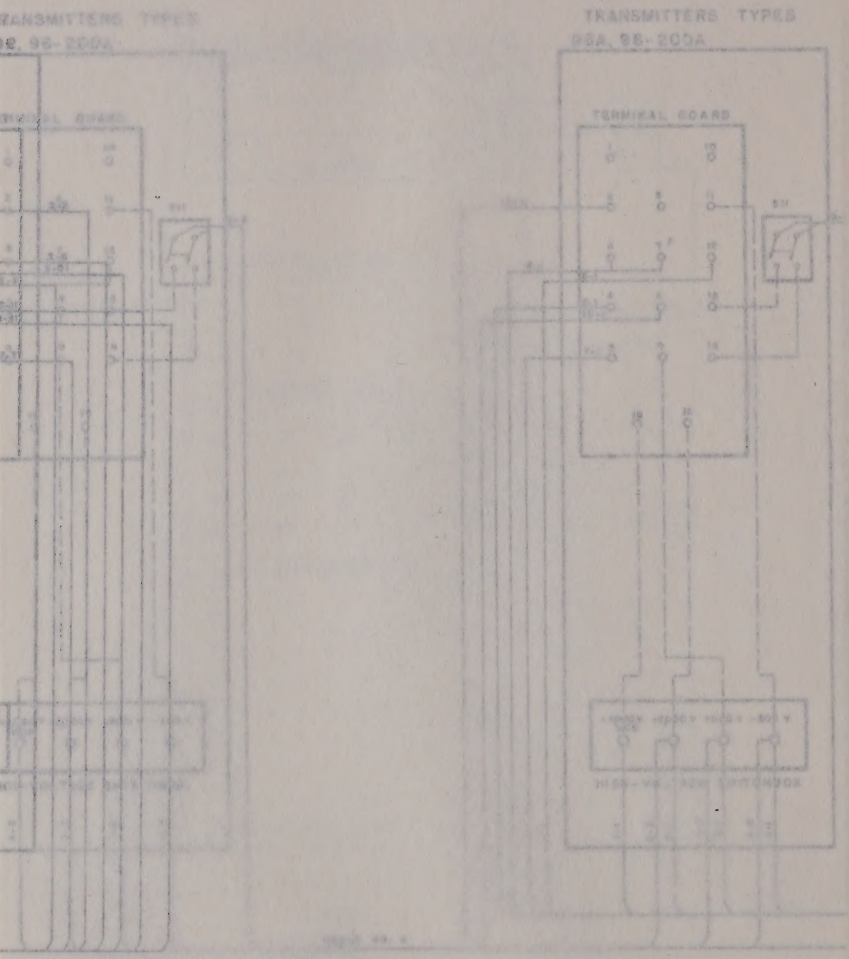


Figure 61. Radio transmitters (Wilcox Electric type 96A) and rectifier-modulator (Wilcox Electric type 26B); interconnection diagram.


TRANSMITTERS TYPES
95A, 96-200A
TERMINAL BOARD