

DEPARTMENT OF THE ARMY TECHNICAL MANUAL
TM 11-897

RADIO
RECEIVER
R-274/FRR



DEPARTMENT OF THE ARMY

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WARNING

HIGH VOLTAGE

is used in the operation of
this equipment.

DEATH ON CONTACT

may result if operating personnel
fail to observe safety precautions.

Be careful not to contact 175-volt connections
or 115-volt a-c input connections when working
on or near this equipment.



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:

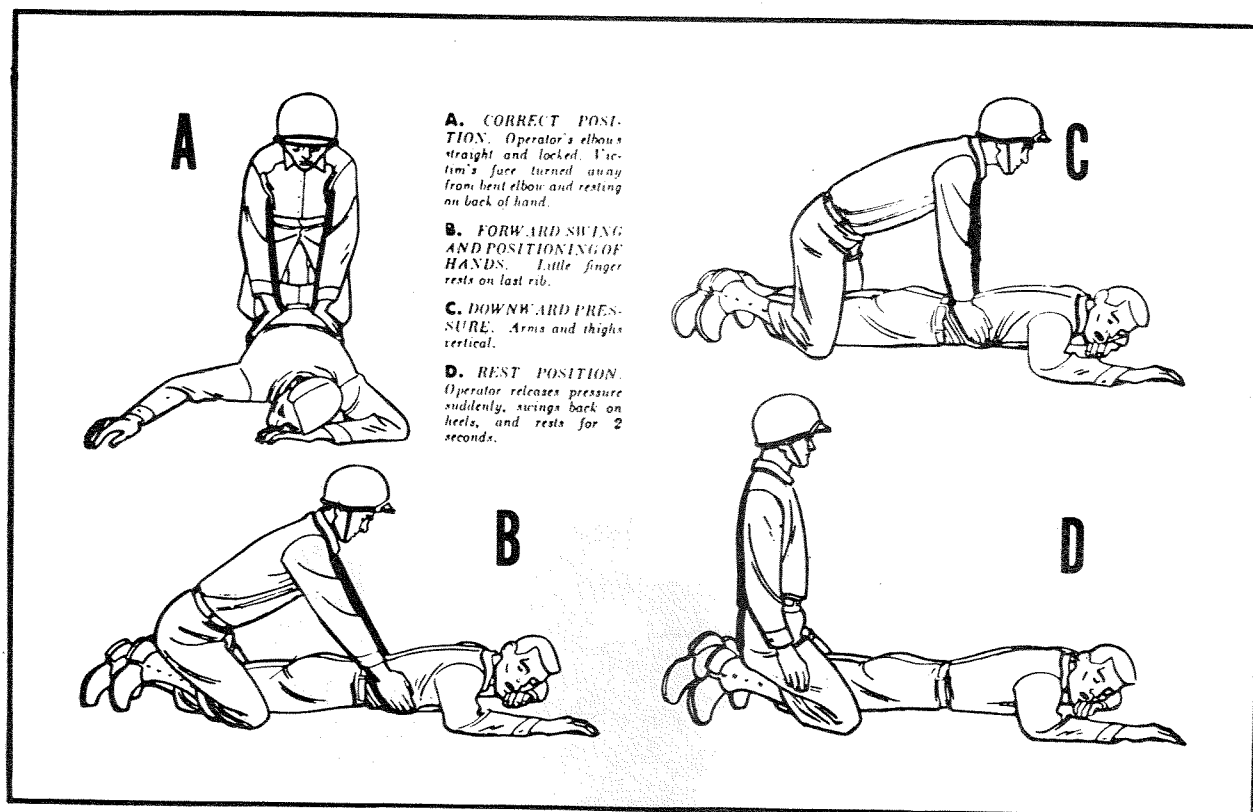
(1) Exert downward pressure, not exceeding 60 pounds, for 1 second.

(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

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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 $\frac{1}{2}$ 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.*

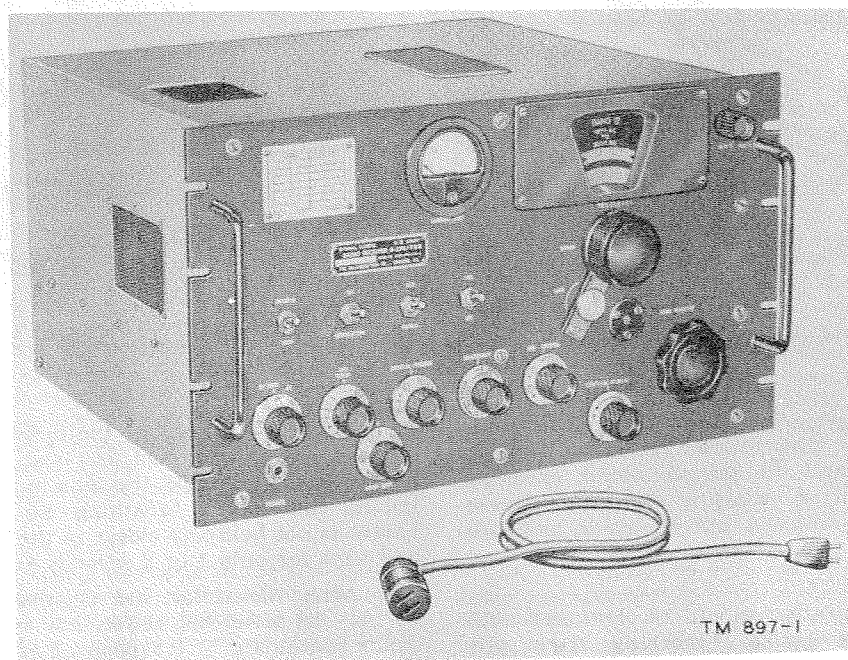


Figure 1. Radio Receiver R-274/FRR.

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

This technical manual contains the necessary instructions for the installation, operation, maintenance, and repair of Radio Receiver R-274/FRR. There are also two appendixes consisting of a list of references and an identification table of parts.

2. Forms and Records

The following forms will be used for reporting unsatisfactory conditions of Army matériel and equipment.

a. DD Form 6, Report of Damaged or Improper Shipment, will be filled out and forwarded as prescribed in SR 745-45-5 (Army), and AFR 71-4 (Air Force).

b. DA Form 468, Unsatisfactory Equipment Report, will be filled out and forwarded to the Office of the Chief Signal Officer as prescribed in SR 700-45-5.

c. AF Form 54, Unsatisfactory Report, will be filled out and forwarded to Commanding General, Air Matériel Command, Wright-Patterson Air Force Base, Dayton, Ohio, as prescribed in SR 700-45-5 and AFR 65-26.

d. DA AGO Form 11-238, Operator First Echelon Maintenance Check List for Signal Corps Equipment (Radio Communication, Direction Finding, Carrier, Radar), will be prepared in accordance with instructions on the back of the form.

e. DA AGO Form 11-239, Second and Third Echelon Maintenance Check List for Signal Corps Equipment (Radio Communication, Direction Finding, Carrier, Radar), will be prepared in accordance with instructions on the back of the form.

f. Use other forms and records as authorized

Section II. DESCRIPTION AND DATA

3. Purpose and Use

a. Radio Receiver R-274/FRR (fig 1) is a superheterodyne receiver intended for use in a semipermanent or fixed location. The receiver is adaptable for desk, table, or rack mounting. When used on a desk or table, the receiver may be installed within a metal case (Cabinet CY-699 ()/FRR). The rectifier power supply and filament supply are contained within the unit. The receiver does not have a built-in speaker; therefore, external equipment is necessary for reproducing the audio signal.

b. The receiver is designed to receive a-m (amplitude-modulated) signals. It can be adjusted for reception of both c-w (continuous-wave) and mcw (modulated continuous-wave) (voice or tone) signals. A connection is provided to allow a carrier-shift type of radioteletype signal to be

taken off and fed to terminal radioteletype equipment such as Radioteletype Terminal Equipment AN/FGC-(*) or Dual Diversity Converter CV-31(*)/TRA-7. Another connection can be made to inject audio signals into the a-f (audio-frequency) amplifiers to make use of only the audio section of the receiver. Stand-by operation is permitted when the receiver is used in conjunction with a radio transmitter or some other type of equipment.

c. The receiver frequency ranges are selected by means of a turret type switch. This permits frequencies from .54 to 54 mc (megacycles) to be received. The entire tuning range is divided into six bands selected by the turret.

d. The types of reception are c-w, icw (interrupted continuous-wave) (tone), and carrier-shift radioteletype signals. An automatic noise limiter

(ANL) is included for use in any type of operation for reduction of man-made electrical interference. Either age (automatic gain) control or manual gain may be used for all types of reception. Relative signal strengths can be determined by the use of the CARRIER LEVEL meter on the front panel of the receiver.

4. Technical Characteristics

Frequency range: .54 to 54 mc.

BAND I	540 to 1,270 kc (kilo-cycles).
BAND II	1.27 to 3 mc.
BAND III	3 to 7 mc.
BAND IV	7 to 13.8 mc.
BAND V	13.8 to 29.7 mc.
BAND VI	29.7 to 54 mc.
Crystal-controlled channels.	Six channels in 1.5- to 29.7-mc range.
Receiver type	Superheterodyne, single or double conversion.
Types of signals which can be used.	C-w, icw, mcw (tone and voice), and carrier-shift radioteletype.
Number of tubes	19.
Intermediate frequencies.	455 kc and 6 mc.
Dial calibration accuracy.	Within .2 percent.
Power input	95/105/117/130/190/210/234/260 volts, 50- to 60-cps (cycles per second), single-phase. Approximately 120 watts.
Antenna input	Balanced antenna input: 50 to 200 ohms.
Antenna	Balanced double or single wire and ground.
Weight	58 pounds.

5. Packaging Data

Radio Receiver R-274/FRR and its spare parts are packed for export shipment in a wooden box. Between the receiver and wooden box, protection from water, moisture, and vapors is obtained by two barrier packages and two cartons. The arrangement of these protective layers is shown in figure 4. The front panel of the receiver is protected by a padded wooden frame. All sides of the receiver are padded with corrugated cardboard. Bags of silica gel are placed within the

inner covering of the receiver to absorb any moisture locked in when the receiver is packed. Electrical Power Cable Assembly CX-1855/U (W1) also is placed within the inner carton with the receiver. A separate carton contains the spare parts, all of which are packed individually. The size, weight, and volume of the export crate are indicated in the following chart:

Number of crate	Height (in.)	Width (in.)	Length (in.)	Volume (cu ft)	Unit weight (lb)
1	13 3/4	21 1/2	27	4.64	105

6. Table of Components

Component	Required No.	Height (in.)	Depth (in.)	Length (in.)	Volume (cu ft)	Unit weight (lb)
Radio Receiver R-274/FRR	1	10 15/32	18 3/8	19	2.04	58
Electrical Power Cable Assembly, CX-1855/U	1			72		
Instruction book	2	8	3/4	10 1/2		
Total					2.04	58

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

7. Description of Radio Receiver R-274/FRR

Radio Receiver R-274/FRR is a 19-tube, superheterodyne receiver capable of receiving a-m radio signals in the frequency range of from .54 mc to 54 mc. This range is covered in six bands by a turret type band selector. The set is designed for reception of c-w, mcw (tone and voice), and carrier-shift radioteletype signals. On the h-f (high-frequency) bands, a double superheterodyne circuit is used to increase the image rejection ratio. An automatic noise limiter (ANL) is provided for reduction of impulse noise such as is caused by man-made interference. Variable selectivity is provided by use of a crystal filter circuit and variable bandwidth i-f (intermediate-frequency) stages. The audio output may be fed to either a speaker or headset, which is not provided with the radio receiver. The tuning controls are accessible on the front panel which is standard size for 19-inch relay rack

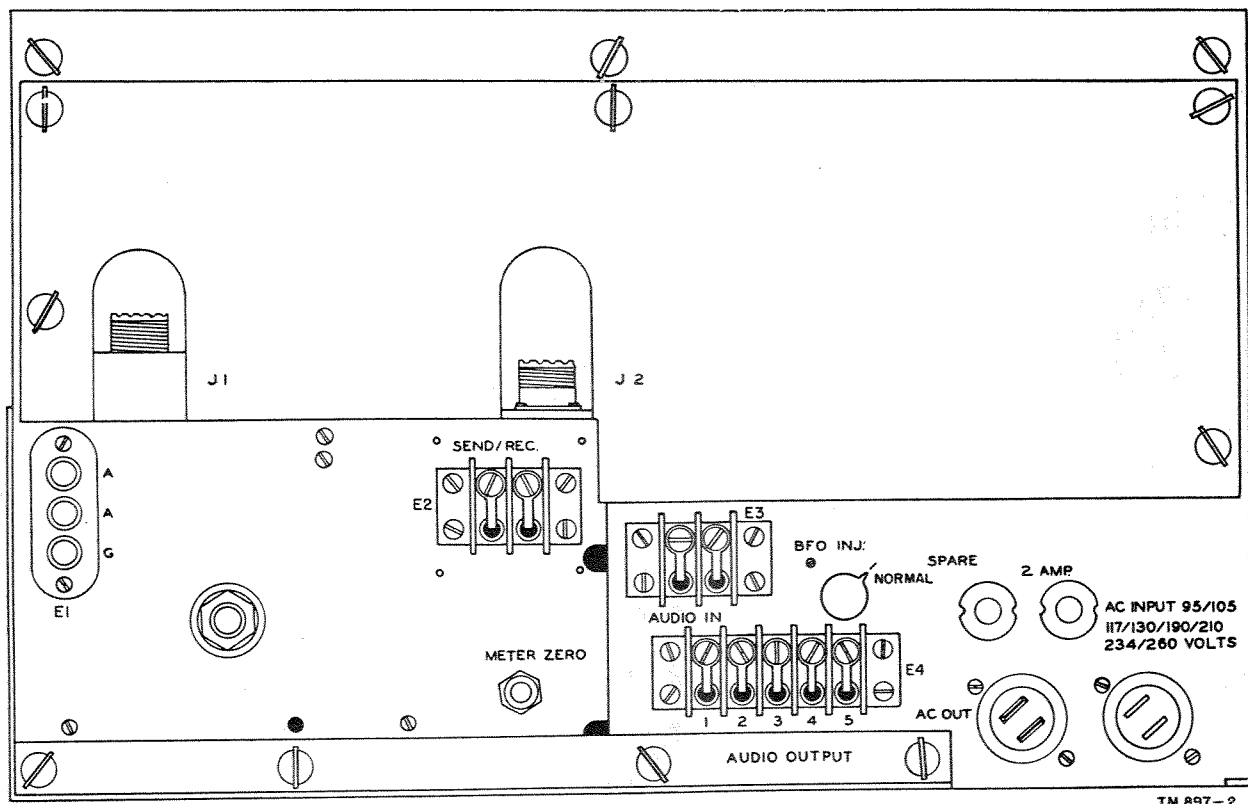


Figure 2. Radio Receiver R-274/FRR, rear view.

mounting. The panel has slots on the sides so that it may be mounted in the rack by means of machine screws. Two handles are provided on the front panel for easy carrying or handling. All connections, such as power, antenna, speaker, and terminals for connection to radioteletype equipment, are located at the rear of the receiver. Access to the tubes, internal controls, antenna, and terminals is made by removing the top and/or rear dust covers which are retained by the use of Dzus fasteners. Power is supplied to the receiver by means of Electrical Power Cable Assembly CX-1855/U which is attached to the rear of the receiver. An a-c (alternating-current) power receptacle is located on the rear of the receiver to supply power to associated equipment. The output of this outlet is not controlled by the line switch of the receiver.

8. Description of Electrical Power Cable Assembly CX-1855/U

Electrical Power Cable Assembly CX-1855/U is used to connect Radio Receiver R-274/FRR to a power source. The power end of cable W1 has

a standard male plug. The receiver end has a female receptacle which connects to plug P1 at the rear of the radio receiver. A heavy rubber covering on the outside of the cable prevents damage due to flexing and other abuse.

9. Running Spares

A group of running spares (fig. 3) is supplied with each Radio Receiver R-274/FRR. Spares are provided for normally expendable items, such as tubes, pilot lamps, and fuses. The following is a list of running spares:

2 tubes 6AG5	1 tube 5U4G
8 tubes 6BA6	1 tube 6C4
2 tubes 6BE6	1 tube OC3, VR105
2 tubes 6AL5	2 Lamps LM-52, 6.3-volt
1 tube 6AT6	2 lamps C7, 7-watt, 120-volt
1 tube 6Y6G	1 fuse, type 3AG, 2-ampere

10. Additional Equipment Required

Radio Receiver R-274/FRR does not have a built-in speaker. Therefore, it is necessary to provide an external speaker or headset when listening to c-w or mcw reception. Radioteletype terminal equipment is required to transfer signals from the receiver to the teletypewriter equipment.

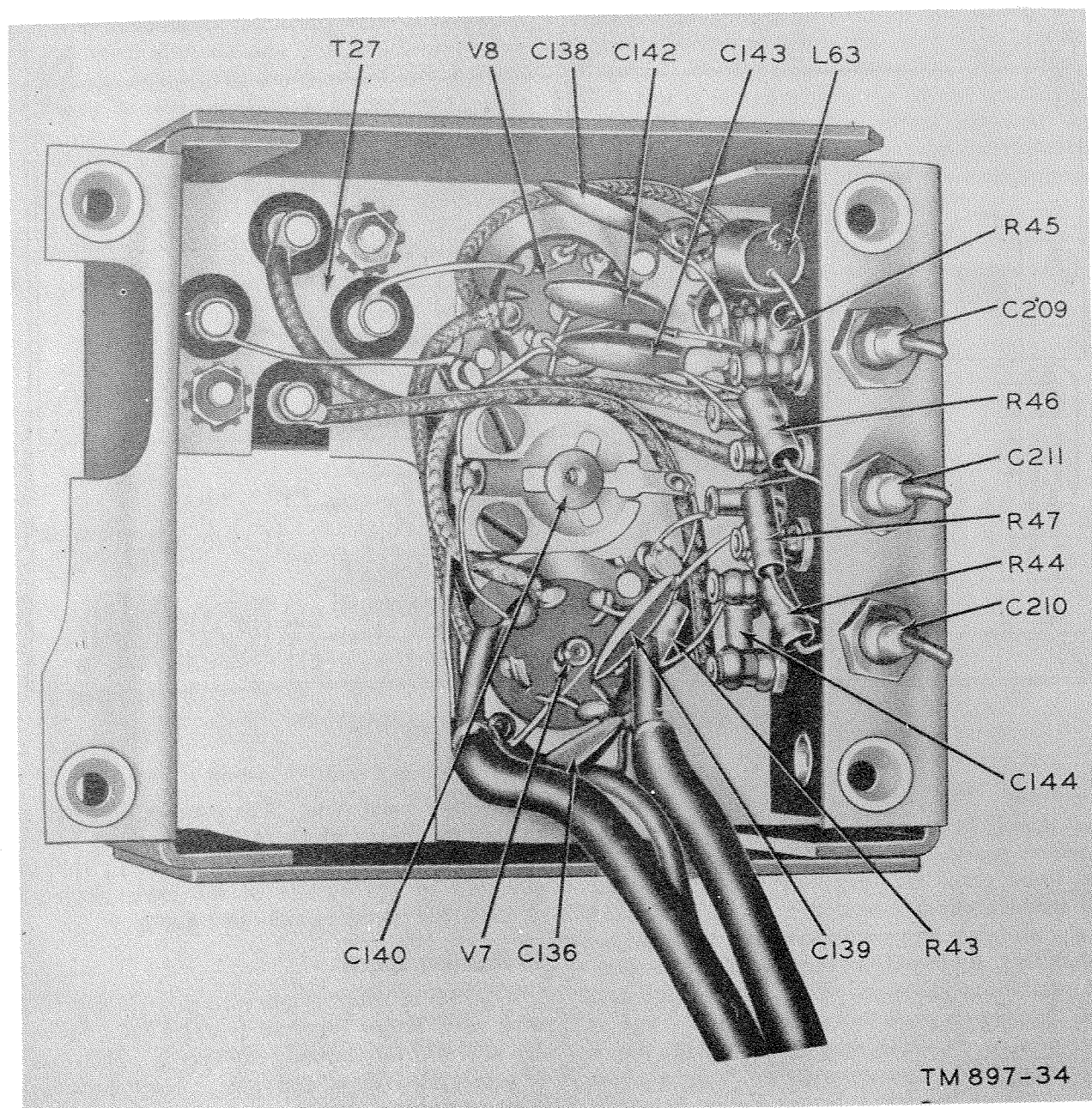


Figure 3. Running spares for Radio Receiver R-274/FRR.

The following equipment is required in the above instances:

- 1—Loudspeaker LS-3 (and matching transformer)
- 1—Loudspeaker LS-2
- 1—Headset HS-30

- 1—Headset Assembly CW-49507 (Navy) with Headset Extension Cord CW-49534
- 1—Radioteletype Terminal Equipment AN/FGC-(*)
- 1—Dual Diversity Converter CV-31(*)/TRA-7

CHAPTER 2

OPERATING INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF MATÉRIEL

11. Siting

The receiver should be located so that the front and rear panels are easily accessible. In a permanent installation where it is not necessary to change connections on the rear of the receiver frequently, the receiver may be located with just enough clearance to give adequate rear ventilation, leaving the front panel accessible. Unless an extension power cord is available, the rear of the receiver will have to be placed within 6 feet of the power source outlet. If possible, keep the receiver away from sources of electrical interference or mechanical vibration. Antenna location also will determine the receiver site. The receiver is designed for indoor or sheltered use. Protection should be given it when conditions of excessive moisture or extreme temperature exist. If the receiver is a component of a larger equipment, place the receiver in a convenient location for easy operation with the above factors considered.

12. Uncrating, Unpacking, and Checking New Equipment

Caution: Be extremely careful during the unpacking process so that no damage occurs to the receiver or spare parts. Dropping the unit (crate) or poking through the container with a sharp instrument could cause severe damage to the inclosed pieces. Take the packages apart in such a manner that no undue force is placed upon the contents. If possible, unpack the receiver in a location which is dry and free from dust and dirt. Figure 4 indicates the sequence in which the containers are placed around the receiver and spare parts. Follow the unpacking instructions in the order given to provide the most rapid means of safely removing the receiver and spare parts from the crate.

a. Unpacking.

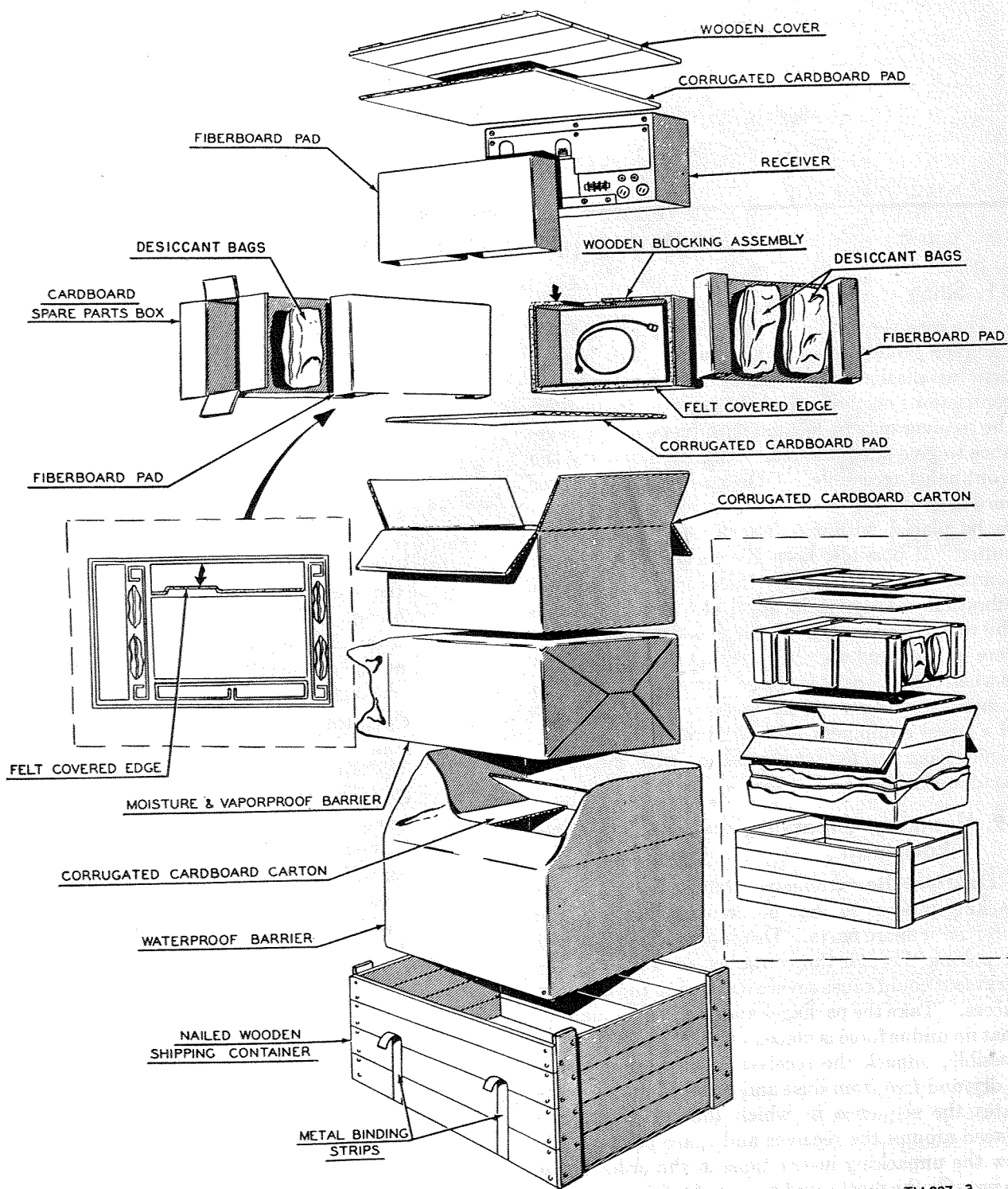
- (1) Cut the metal bands which encircle the wooden box. Use a pair of tin snips or a large pair of diagonal cutting pliers

rather than forcing the band off by some other method.

- (2) Pry open the top cover, being careful not to force the prying instrument too far into the package. Remove the top cover and save it for possible repacking (save *all* the packaging material for this reason).
- (3) Take out the package containing the two instruction books.
- (4) Lift out the waterproof bag containing the receiver and spare parts cardboard boxes. (The spare parts may be removed from their carton by opening the flaps at one end and taking out the spare parts packages.)
- (5) Open the gum seal on the waterproof bag and remove the spare parts carton and the outer carton containing the receiver.
- (6) Open the flaps on the top of the corrugated cardboard receiver carton.
- (7) Remove the moisture and vaporproof bag and slit it open along the edge of the seal.
- (8) Take out the inner corrugated cardboard carton and open the top flaps.
- (9) Remove the corrugated fiberboard pads from the top and sides of the receiver.
- (10) Remove the receiver from the carton.
- (11) Remove the wooden blocking assembly from the front panel of the receiver.
- (12) The power cord (W1) can be found coiled up and taped near the front of the receiver.
- (13) The unpacking procedure is complete and the receiver is ready for installation.

b. *Checking.* Always check equipment for possible damage which may have occurred during shipment. Make sure that all equipment that is listed on the packing slip has been unpacked.

c. *Repacking.* To repack the receiver and spare parts, reverse the procedure given for unpacking.



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Figure 4. Packaging and packing of Radio Receiver R-274/FRR.

13. Installation of Equipment

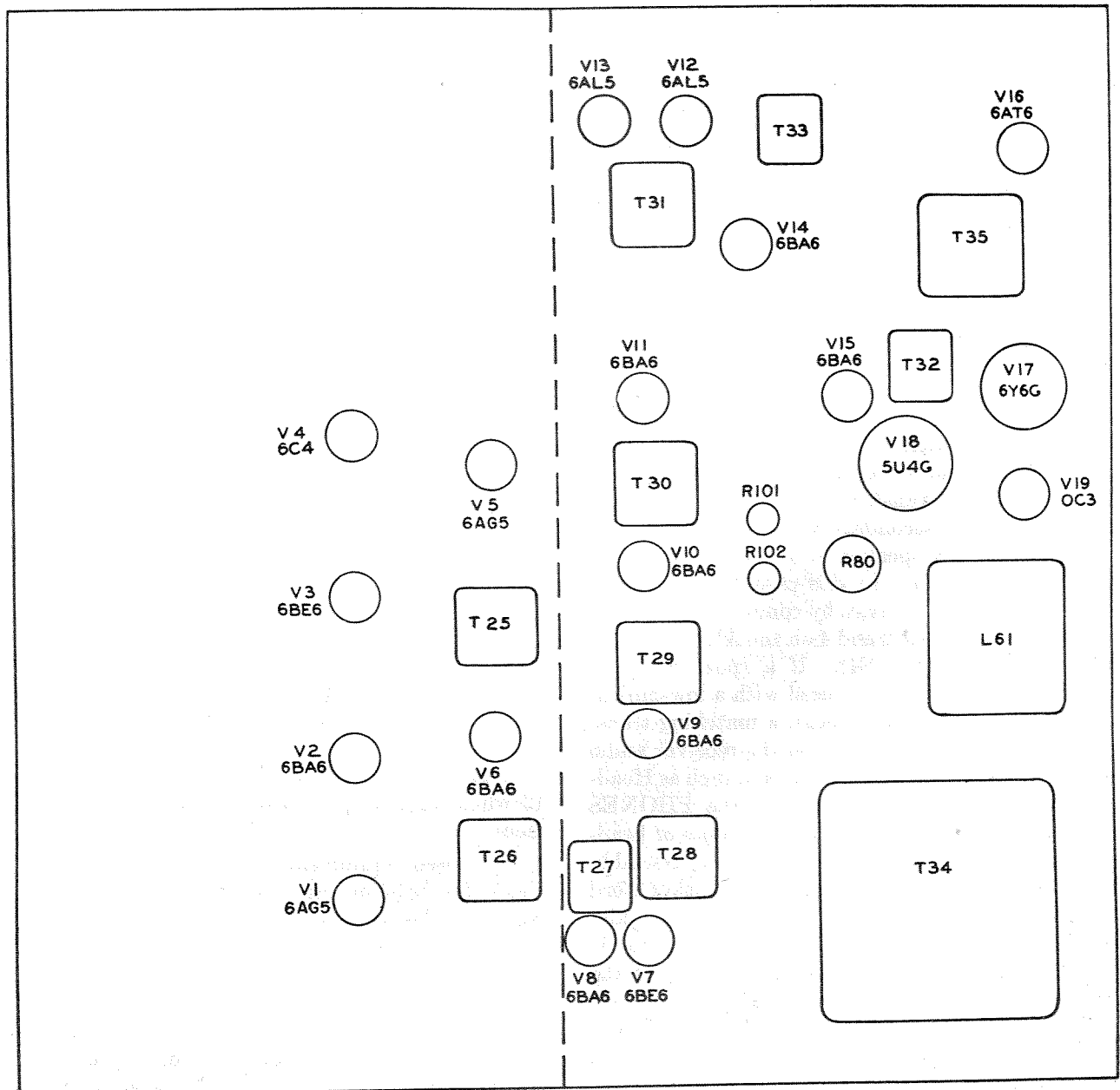
a. When unpacking Radio Receiver R-274/FRR and components, be careful not to drop or bend any part of the receiver. This could cause inaccuracy in the dial calibrations or binding of some of the controls.

b. Remove the top and rear dust covers by unfastening the Dzus fasteners.

c. Place tubes V17, V18, V19, and ballast tube R80 in their respective sockets (fig. 5). The tubes

have octal bases making it necessary to position the tubes correctly while inserting them. To do this, place the tube locating key lightly against the tube socket and rotate the tube. When the tube locating key is aligned with the socket keyway, the tube may be pushed into the socket. The tube retaining spring clips will firmly hold the tube in place.

d. Remove the crystal cover located in front of V5 (fig. 31) by taking out the two cover screws.



TM 897-5

Figure 5. Radio Receiver R-274/FRR, tube location.

Insert crystals Y1 through Y6, covering the six desired frequencies between 1.5 and 29.7 mc.

e. Make connections for the antenna, ground, power, and external equipment (par.14).

14. Connections

The external connections to Radio Receiver R-274/FRR are determined by the equipment with which it is being used. However, there are certain connections that will have to be made, such as the antenna and power input, no matter what type of equipment is being used in conjunction with the radio receiver. For radioteletype operation, the output of the receiver is fed to radioteletype terminal equipment. This connection can be made with a coaxial cable that is not supplied with the radio receiver. For listening purposes, a speaker or headset may be connected to the receiver. The following instructions should be followed as nearly as possible in making the receiver connections:

a. Determine whether a speaker (such as Loudspeaker LS-2 or LS-3) and/or some other type equipment is required to be connected to the output of the receiver. Connect the speaker, if used, to the AUDIO OUTPUT terminal strip (E4) on the rear of the chassis (fig. 2). The audio output is designed to match either a 150- or 600-ohm load by connecting the secondary speaker windings of the audio output transformer, T35, in series or just using one of the secondary windings. Normally, when matching a speaker to a line, the 600-ohm output is preferred. In this case, the secondary may be connected in series by connecting a jumper wire across terminals 2 and 4 on the AUDIO OUTPUT terminal strip (E4). If a speaker of the permanent magnet type is used with a low-impedance voice coil (3 to 50 ohms), a matching transformer should be used between the receiver audio output and the speaker. A headset, such as Headset HS-30, may be plugged into the PHONES jack J3 on the front panel. Other types of headsets may be used, such as Headset Assembly CW-49507 (Navy) and Headset Extension Cord CW-49534. Radioteletype equipment is connected through RF Cable Assembly CG-562/U (not supplied) to jack J2 on the top rear of the chassis. Connect a 600-ohm 2-watt load resistor across terminals 1 and 5 of the AUDIO OUTPUT strip E4 if no external equipment is to be connected to this output, and place a jumper wire across terminals 2 and 4.

b. Attach a single wire antenna and ground or

a balanced antenna and ground to antenna terminal strip E1. A coaxial cable connector J1 is provided for use with twin coaxial cable lead-ins. The external ground connection should consist of a good earth ground, approximately 6 feet below the surface. To satisfy this requirement, a metallic pipe or stake driven into the earth or a connection to a part of a metallic underground water system should be used.

c. To provide a remote connection for a standby switch, the connecting wires must be connected to the SEND/REC. terminal strip E2 on the rear of the chassis (fig. 2). To make connections to this terminal strip, the terminal strip cover must be removed by taking out the two retaining screws.

d. Sometimes it will be desirable to use the audio amplifier of the receiver without using the rest of the receiver. To do this, the audio signal is fed into the AUDIO IN terminal strip E3, which is the audio input to the 1st a-f amplifier. Hum reduction can be accomplished by using a shielded lead for this connection.

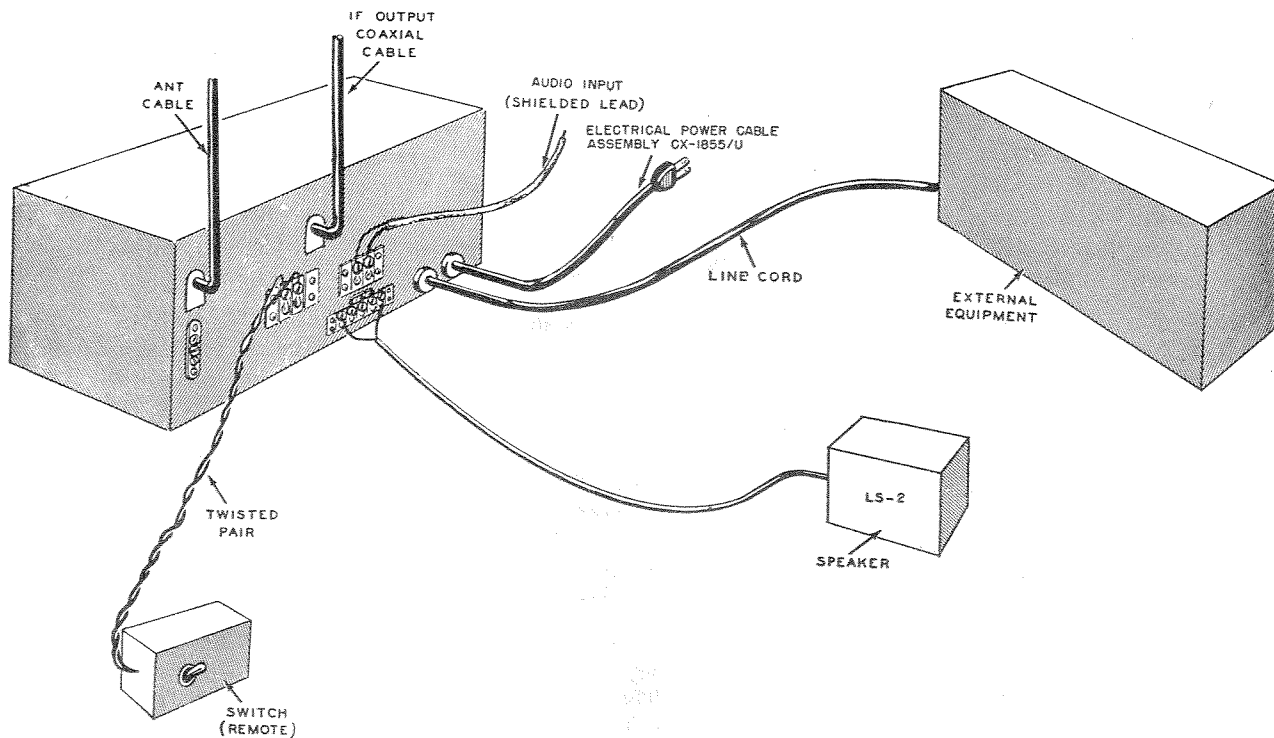
e. Plug the female receptacle of power cord W1 to the AC INPUT plug P1 located on the rear of the chassis. Connect the other end of the power cord to a single-phase 50- to 60-cps power source which can supply the correct voltage for the receiver input. The receiver can be used with the following voltages: 95/105/117/130/190/210/234/260 volts.

Caution: Make sure the receiver power transformer T34 primary is set to the same voltage as the power source. Refer to the schematic diagram (fig. 43) for the proper connections. The location of transformer T34 is shown in figure 33.

15. Service Upon Receipt of Used or Reconditioned Equipment

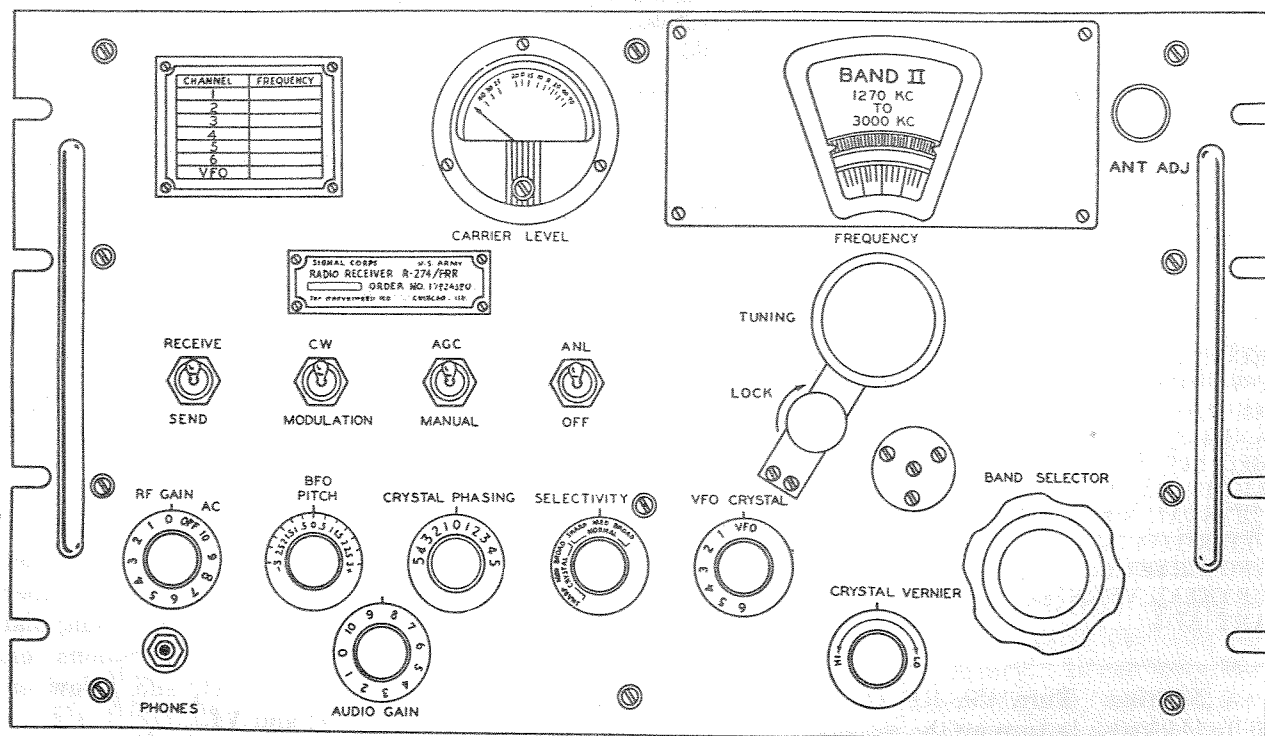
a. Refer to the instructions given in paragraph 12 when unpacking used or reconditioned equipment.

b. If used equipment is received for service, check for tags or other sources of information regarding the condition of the equipment. When the condition is doubtful and no information is available, submit the equipment to the final testing procedures described in chapter 5, section IV. A thoroughly reconditioned piece of equipment may be considered to be in the same condition as new equipment, and the instructions for the operation given in chapter 2 may be followed.



TM 897-6

Figure 6. Connections for operating Radio Receiver R-274/FRR.



TM 897-7

Figure 7. Radio Receiver R-274/FRR, front panel view.

Section II. OPERATION UNDER USUAL CONDITIONS

16. Controls and Their Uses

Control	Function
BAND SELECTOR (turret)---	Selects the band containing the desired frequency.
TUNING (C1)-----	Selects desired frequency by means of a dial mechanism and ganged tuning capacitor. A scale indicates the frequency. It has a dial LOCK to prevent any change in frequency after once set.
ANT ADJ (C22)-----	Tunes secondary of antenna transformer.
ANL-OFF (S3)-----	Switches a series type automatic noise limiter into the circuit to reduce noise peaks of electrical interference.
AGC-MANUAL (S4)-----	Selects either AGC or MANUAL operation and places CARRIER LEVEL meter in operation in the AGC position.
CW-MODULATION (S5)-----	Turns the bfo (beat-frequency oscillator) on in the CW position to provide a beat note which can be heard when receiving an unmodulated carrier.
RECEIVE-SEND (S6)-----	Stand-by switch which makes or breaks screen B+ to the r-f (radio-frequency) and i-f sections of the receiver.
RF GAIN AC (R83, S7)-----	Turns the AC power on and OFF and also controls the r-f gain of the receiver.
BFO PITCH (C183)-----	Varies the bfo signal +3,000 cps, consequently varying the audio signal from 0 to 3,000 cps.
CRYSTAL PHASING (C161)---	Tunes out unwanted interference of signals when the SELECTIVITY switch is in any of the crystal positions.
SELECTIVITY (S1)-----	A gang switch selects different degrees of i-f expansion in band-width and also inserts an i-f crystal filter in the crystal positions.
VFO CRYSTAL (S2)-----	Switches to either vfo or crystal h-f oscillator, and also selects one of six crystals in the crystal position.
CRYSTAL VERNIER (C125) -	Varies the frequency of the crystal hfo slightly ($\pm .005\%$) to compensate for crystal tolerances.
AUDIO GAIN (R94)-----	Adjusts the audio level to the audio amplifiers.
PHONES (J3)-----	Provided to allow the use of a headset when desired.
CARRIER LEVEL meter (M1) -	Indicates in db (decibels) the input signal strength. (Zero reference is 50-uv (micro-volt) input signal.)

17. Starting Procedure

a. *Preliminary.* Set the front panel controls as follows:

Control	Position
RECEIVE-SEND-----	RECEIVE
CW-MODULATION-----	MODULATION
AGC-MANUAL-----	AGC
ANL-OFF-----	OFF
BFO PITCH-----	0
AUDIO GAIN-----	5
CRYSTAL PHASING-----	0
SELECTIVITY-----	NORMAL MED
VFO CRYSTAL-----	VFO
CRYSTAL VERNIER-----	mid
ANT ADJ-----	As required

b. *Starting.* Turn the RF GAIN-AC control fully clockwise to turn on the receiver. The pilot lights will light, and in approximately 2 minutes noise will be heard from the headset or speaker.

If no noise is heard or the pilot lights do not light, refer to the equipment performance checklist (par. 37), and determine the reason. When indications are obtained that the receiver is in proper working order, operate with the reception desired.

18. Radiophone Reception

a. *VFO Operation.*

- (1) Turn the VFO-CRYSTAL switch to the VFO position.
- (2) Set the BAND SELECTOR to the band which contains the frequency range of the signal to be received. When the desired band is selected, the band number will appear at the top of the tuning dial above the frequency calibrations on BANDS I, II, and III, and below on BANDS IV, V, and VI.
- (3) Place the CW-MODULATION switch in the MODULATION position.

- (4) The desired frequency is tuned in by turning the TUNING control. The frequencies for each band are read directly from the dial scale. Tune the ANT ADJ until the maximum output is obtained from the receiver. (The CARRIER LEVEL meter will indicate peak if the AGC-MANUAL switch is in the AGC position.)
- (5) The AGC-MANUAL switch may be used as desired with this type of operation. When the switch is in the AGC position, the CARRIER LEVEL meter is connected in the circuit; but when the switch is in the MANUAL position, the meter circuit is open. The CARRIER LEVEL meter gives an approximate indication of the input level of various tuned signals as they are received from the antenna. The meter is graduated in db and adjusted so that a 50-uv input at the antenna will produce a reading of 0 db on the meter. An adjustment for 0 db is obtained by setting METER ZERO potentiometer R87 (par. 87). Reference levels of other r-f signal inputs may then be read directly on the meter. With no signal being received, the CARRIER LEVEL meter needle will have a tendency to move off the left-hand side of the scale. An input level of 3 uv will produce a sufficient d-c (direct-current) voltage change in the agc circuit to bring the needle on the CARRIER LEVEL meter up to the beginning of its scale. Other indications on the scale will be dependent on the amount of voltage developed in the agc circuit and, therefore, on the incoming r-f signal strength.
- (6) If noise is present along with the received signal, place the ANL-OFF in the ANL position.
- (7) Bandwidth of the receiver may be varied by means of the SELECTIVITY switch. The crystal positions should not be used for anything but c-w operation; otherwise, the bandwidth will be so narrow that speech will be unintelligible.
- (8) When the receiver is used in conjunction with a transmitter, the RECEIVE-SEND switch (S6) can be used as a stand-by switch for the receiver during

transmission; therefore, the receiver is always ready for instant use. For convenience, a remote control switch may be used for this action. Connect the SPST (single-pole, single throw) switch across the SEND/REC. terminal board E2 and maintain RECEIVE-SEND switch S6 in the SEND position.

- (9) Adjust the AUDIO GAIN control, R94, to obtain the desired output for the headset, loudspeaker, or other external equipment being used.

b. Crystal Operation.

- (1) Turn the VFO CRYSTAL switch from the VFO position to one of the six crystal positions.
- (2) Six crystal channels may be used to facilitate receiver tuning to regularly assigned frequencies for any particular area of operation. The frequencies which will be assigned lie within the range of 1,500 kc to 29.7 mc. When a frequency is assigned, choose a crystal which will produce a beat frequency with the incoming frequency to set up the desired i-f in the output of the 1st mixer (V3). The crystal oscillator frequency to be used, whether it is the fundamental or a second or third harmonic, always must be above the incoming signal frequency by a difference equal to the i-f. For example, if the incoming signal frequency is between 1.5 mc and 7 mc, the crystal oscillator must produce a frequency 455 kc higher than the signal frequency. If the incoming signal frequency is between 7 mc and 29.7 mc, the crystal oscillator must produce a frequency 6 mc higher than the incoming frequency. The maximum fundamental Crystal Unit CR-18/U frequency used is 11.9 mc. See paragraph 45b for further details on choosing a crystal.
- (3) Continue with the same procedure used for vfo (variable frequency oscillator) operation, starting with a(2) above.
- (4) The CRYSTAL VERNIER control is used to tune the crystal oscillator to the correct frequency. It can vary the crystal frequency slightly, either higher or lower than the resonant frequency of the crystal. The correct procedure in using the control is to get the desired