

DEPARTMENT OF THE ARMY TECHNICAL MANUAL
DEPARTMENT OF THE AIR FORCE TECHNICAL ORDER

TM 11-5805-262-35
TO 31W1-2PT-372

FIELD AND DEPOT MAINTENANCE MANUAL

SWITCHBOARDS, TELEPHONE,

MANUAL SB-22/PT AND

SB-22A/PT



DEPARTMENTS OF THE ARMY AND THE AIR FORCE

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SWITCHBOARDS, TELEPHONE, MANUAL SB-22/PT AND SB-22A/PT

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*This manual, with TM 11-5805-262-12, 15 December 1960, supersedes TM 11-2202, 23 August 1956, including C1, 10 July 1957, C2, 7 November 1957, C3, 17 April 1959, C4, 7 January 1960, and C5, 7 April 1960.

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CHAPTER 1

THEORY

1. Scope

a. This manual covers field and depot maintenance for Switchboards, Telephone, Manual SB-22/PT and SB-22A/PT. It includes instructions appropriate to third, fourth, and fifth echelons for troubleshooting, testing, and repairing the equipment, replacing maintenance parts, and repairing specified maintenance parts. It also lists tools, material, and test equipment for third, fourth, and fifth echelon maintenance. Detailed functions of the equipment are covered in this chapter.

b. The complete technical manual for this equipment includes three other publications: TM 11-5805-262-12, TM 11-5805-262-20P, and TM 11-5805-262-35P.

c. Forward comments concerning this manual to the Commanding Officer, U. S. Army Signal Materiel Support Agency, ATTN: SIGMS-PA2d, Fort Monmouth, N. J.

2. General Theory

a. The SB-22(*)/PT is a monocord switchboard containing facilities for 12 local battery telephone lines. Each line is terminated in an individual line that contains a line signal, line jack, and a plug-ended cord. Telephones connected to each line pack are interconnected by inserting the plug of one line pack into the jack of another line pack.

b. The SB-22A/PT is supplied with a trunk pack that contains facilities to provide a one-way-automatic-one-way-ring-down trunk circuit to another central office. The trunk pack may be installed in place of one of the line packs.

c. The operator's pack contains the operator's cord, operator's jack, hand ringing generator, and the ringing switch. The operator's pack can be connected to the line and trunk packs by insertion of the operator's cord into the jack of the line or trunk packs. The opera-

tor's pack also contains the night alarm and the illuminating lamp circuits.

d. The switchboard case contains bus bars and plugs to interconnect the night alarm circuits of the line and trunk packs with the operator's pack and to interconnect the line and trunk packs with the line binding posts. The bus bars also interconnect the night alarm battery, transmission battery, and the emergency operator's binding posts with the operator's pack.

3. Incoming Line Signal

(fig. 1)

When a 20-cycle alternating current (ac) ringing signal from the calling party's telephone is applied to binding posts L1 and L2, it operates line signal I201 from *black* to *white* over the circuit shown in figure 1.

a. During one half-cycle of the ringing signal, the low forward resistance of rectifier CR201 allows sufficient current to flow through the circuit to energize the winding of line signal I201. Current in the winding of signal I201 sets up a magnetic flux in the winding core. A permanent magnet, imbedded in the plastic ball, is positioned so that the polarity of the end of the magnet nearest the winding core is the same as the magnetic flux. This repels the permanent magnet and causes the ball to turn, changing the signal from *black* to *white*.

b. During the other half-cycle of the ringing signal the high reverse resistance of rectifier CR201 effectively blocks the ringing signal from the winding of signal I201 to prevent the signal from being returned to *black*.

4. Operator Answers Incoming Call

When the line signal operates from *black* to *white* the operator inserts the plug of the operator's cord into the associated line jack. This mechanically restores signal I201 and es-

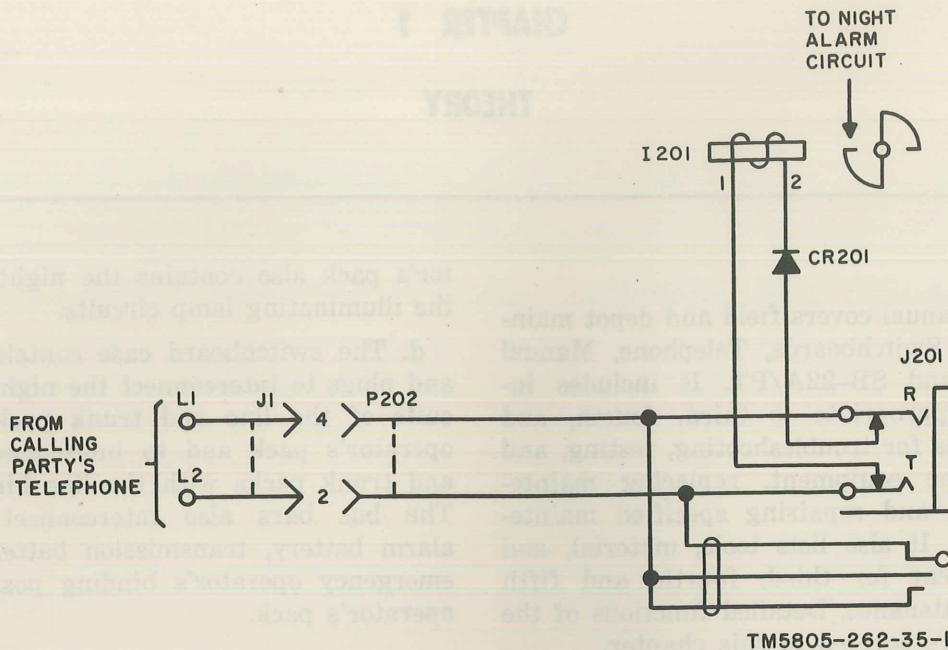


Figure 1. Line circuit, simplified schematic diagram.

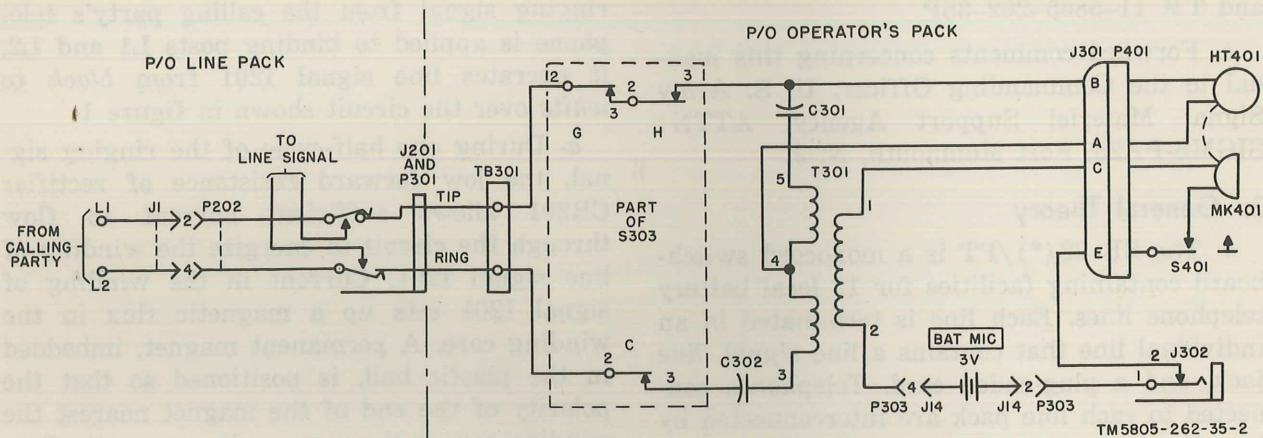
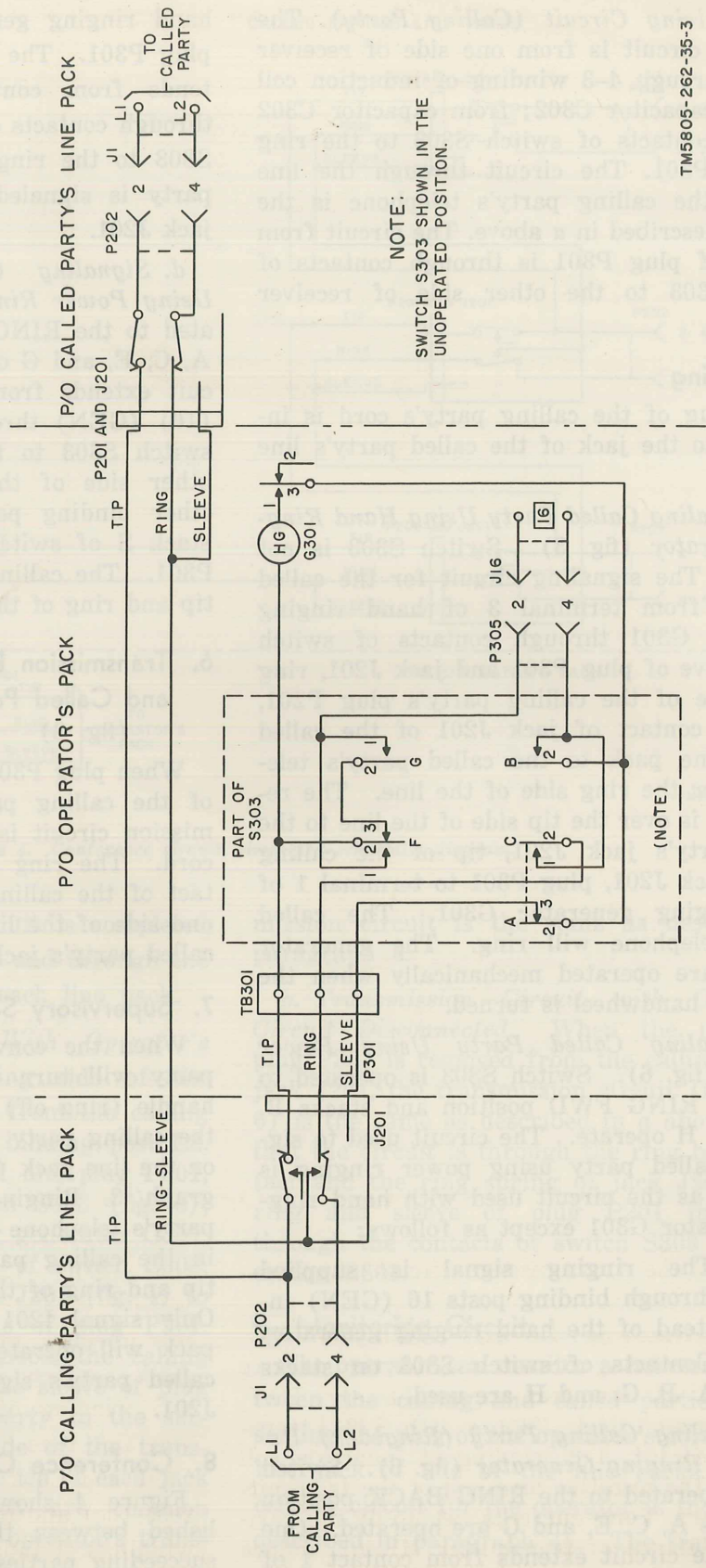


Figure 2. Operator's transmitting and receiving circuit, simplified schematic diagram.

establishes the transmission circuit shown in figure 2.

a. *Transmitting Circuit (Calling Party).* The transmitting circuit is from the positive terminal of the transmitter battery BAT. MIC. through jack J302, switch S401, transmitter MK401, 1-2 winding of induction coil T301 to the negative terminal of the transmitter battery. Voice currents, set up by the variable resistance of transmitter MK401, induce a voltage into the 3-5 winding of induc-

tion coil T301. The induced voltage causes voice current to flow to the line through contacts of switch S303 and jack J201. Receiver HT401 is connected across the 4-5 winding of induction coil T301 to provide side tone during transmission. Capacitors C301 and C302 open the circuit to direct current (dc) and to work in conjunction with the windings of induction coil T301 to provide an antisidetone network.



NOTE:
SWITCH S303 SHOWN IN THE
UNOPERATED POSITION.

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Figure 3. Signaling circuit, simplified schematic diagram.

b. Receiving Circuit (Calling Party). The receiving circuit is from one side of receiver HT401 through 4-3 winding of induction coil T301 to capacitor C302; from capacitor C302 through contacts of switch S303 to the ring of plug P301. The circuit through the line pack to the calling party's telephone is the same as described in *a* above. The circuit from the tip of plug P301 is through contacts of switch S303 to the other side of receiver HT401.

5. Signaling

The plug of the calling party's cord is inserted into the jack of the called party's line pack.

a. Signaling Called Party Using Hand Ringing Generator (fig. 3). Switch S303 is not operated. The signaling circuit for the called party is from terminal 3 of hand ringing generator G301 through contacts of switch S303, sleeve of plug P301 and jack J201, ring and sleeve of the calling party's plug P201, the ring contact of jack J201 of the called party's line pack to the called party's telephone over the ring side of the line. The return path is over the tip side of the line to the called party's jack J201, tip of the calling party's jack J201, plug P301 to terminal 1 of hand ringing generator G301. The called party's telephone will ring. The generator contacts are operated mechanically when the generator handwheel is turned.

b. Signaling Called Party Using Power Ringing (fig. 6). Switch S303 is operated to the PWR RING FWD position and stacks B, D, F, and H operate. The circuit used to signal the called party using power ringing is the same as the circuit used with hand ringing generator G301 except as follows:

- (1) The ringing signal is supplied through binding posts 16 (GEN) instead of the hand ringing generator.
- (2) Contacts of switch S303 on stacks A, B, G, and H are used.

c. Signaling Calling Party (Ringback) Using Hand Ringing Generator (fig. 6). Switch S303 is operated to the RING BACK position and stacks A, C, E, and G are operated. One side of the circuit extends from contact 1 of

hand ringing generator G301 to the tip of plug P301. The other side of the circuit extends from contact 3 of generator G301 through contacts on stacks B and A of switch S303 to the ring of plug P301. The calling party is signaled over the tip and ring of jack J201.

d. Signaling Calling Party (Ringback) Using Power Ringing. Switch S303 is operated to the RING BACK position and stacks A, C, E, and G operate. One side of the circuit extends from one of the binding posts (16) (GEN) through contacts on stack G of switch S303 to the tip of plug P301. The other side of the circuit extends from the other binding post 16 through contacts on stack S of switch S303 to the ring of plug P301. The calling party is signaled over the tip and ring of the jack J201.

6. Transmission Between Calling and Called Parties

(fig. 3)

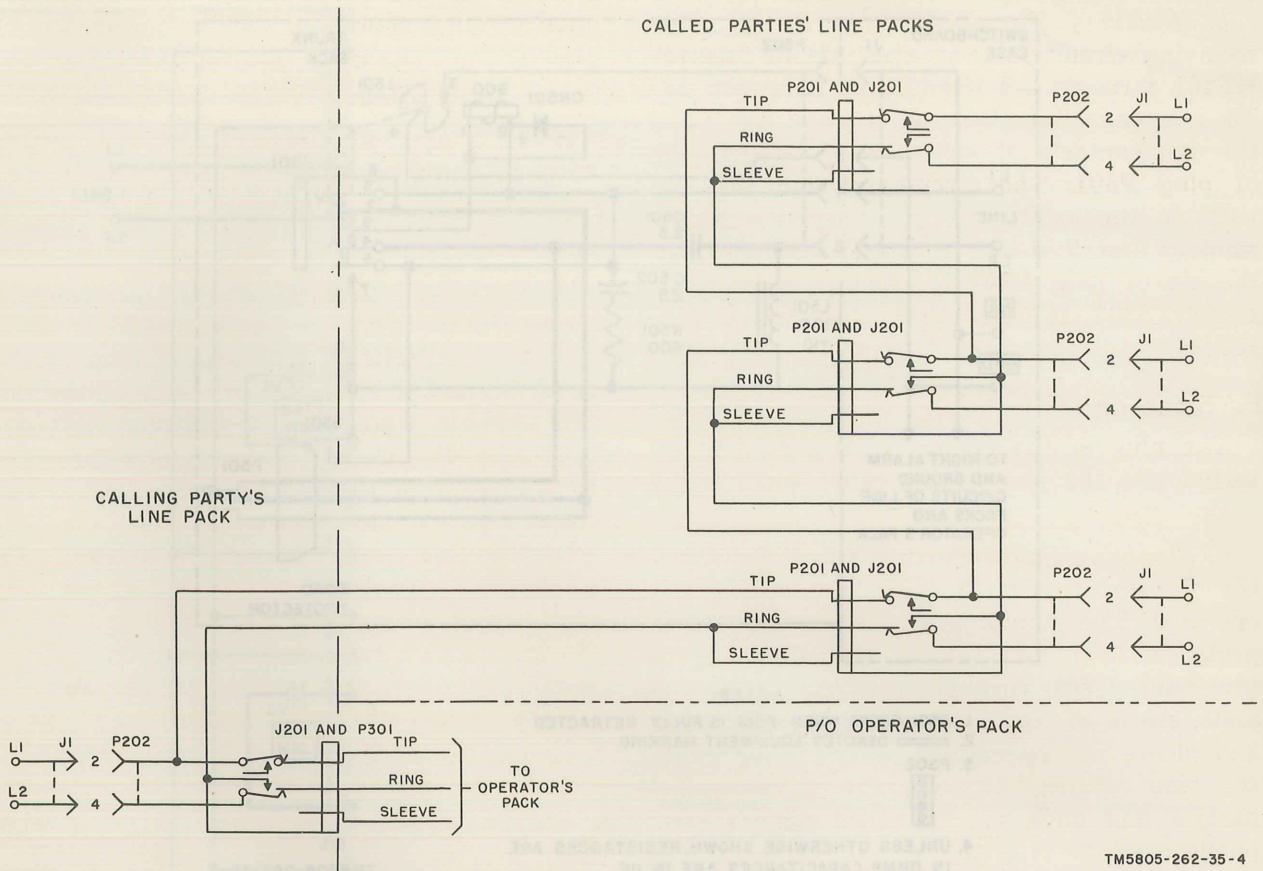
When plug P301 is removed from jack J201 of the calling party's line pack, the transmission circuit is through the calling party's cord. The ring spring and ring break contact of the calling party's jack J201 connect one side of the line to the ring spring of the called party's jack J201.

7. Supervisory Signal (Ring Off)

When the conversation is completed, each party will turn his hand ringing generator handle (ring off). The ringing current from the calling party will be applied to the signal on the line pack (fig. 1) as explained in paragraph 3. Ringing current from the called party's telephone will be applied to the signal in the calling party's line pack through the tip and ring of the calling party's plug P201. Only signal I201 in the calling party's line pack will operate because the circuit to the called party's signal I201 is opened at jack J201.

8. Conference Calls

Figure 4 shows a conference call established between the calling party and three succeeding parties. During the time the call



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Figure 4. Conference circuit, simplified schematic diagram.

is being established, the circuit is completed through the operator's circuit and through the cord and plug connected to each line pack.

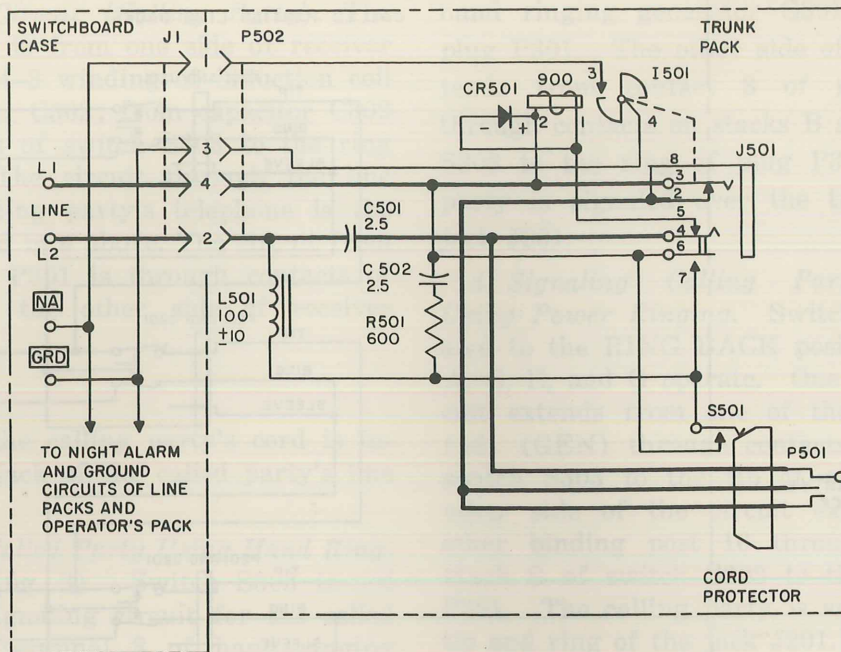
a. Transmission Circuit With Operator's Circuit Connected. The ring side of the transmission circuit (fig. 2) from the calling party's telephone is through binding post L2, the ring contact of jack J201 and plug P301, contact on stack C of switch S303 (fig. 6), contacts 2-3 of hand ringing generator G301, contacts on stacks B and A of switch S303, sleeve of plug P301 and jack J201 (fig. 4) to the ring and sleeve contacts of plug P201. The ring of plug P201 connects the calling party to the operator, and the sleeve of plug P201 connects the calling party to the succeeding parties. The tip side of the transmission circuit is through the tip of each jack J201 and plug P201 which are common throughout the circuit. The operator's trans-

mission circuit is the same as described in paragraph 4.



b. Transmission Circuit with Operator's Circuit Disconnected. When the operator's plug P301 is removed from the calling party's jack J201, the transmission circuit (fig. 4 and 6) is the same as described in *a* above except that the circuit is through the ring break contact and the ring spring of jack J201 to the ring and sleeve of plug P201 instead of through the contacts of switch S303 and generator G301.

9. Monitoring Circuit

The operator can monitor a conversation between the calling and called parties by inserting the plug of the operator's cord into the line jack of one of the line packs. The receiving circuit for the operator is the same as described in paragraph 4*b*. The transmission



NOTES:

1. S501 OPENS WHEN P501 IS FULLY RETRACTED
2.  DENOTES EQUIPMENT MARKING
3. P502 
4. UNLESS OTHERWISE SHOWN, RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UF.

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Figure 5. Telephone Circuit, Trunk Jack TA-326/PT, schematic diagram.

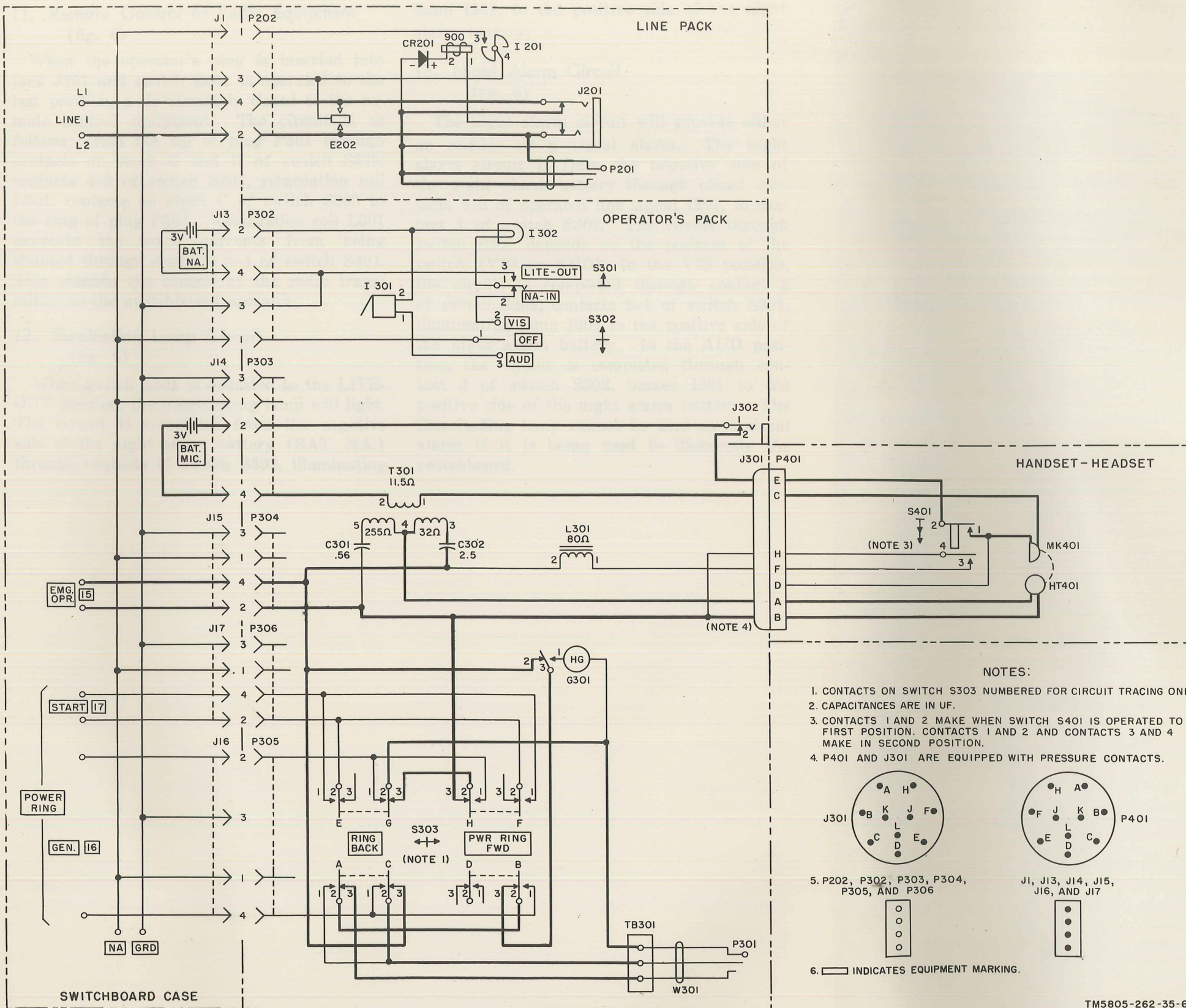
circuit between the calling and called parties is the same as the transmission circuit for the conference circuit described in paragraph 8a. If switch S401 is released, the conversation between the calling and called parties will not be disturbed.

10. Automatic Signaling and Supervision (Trunk Pack) (fig. 5)

The trunk pack can be connected only to a line terminated in a common battery line circuit at the distant central office. The trunk pack contains a dc circuit that provides automatic signaling and supervision to a distant common battery central office (a and b below). The transmission circuit is the same as the circuit in the line packs (para 3, 4, and 6). The incoming signaling circuit is the same except that rectifier CR501 shunts the ringing signal in the low resistance direction.

a. *Automatic Signaling.* When a line pack cord plug is inserted into jack J501, contacts 6 and 7 close a dc circuit across binding posts L1 and L2. This causes the line lamp at the common battery central office to light, indicating an incoming call.

b. *Automatic Supervision.* When the cord plug is removed from jack J501, contacts 6 and 7 open and light the supervisory lamp at the distant central office. Plug seat switch S501 contacts perform the same function as contacts 6 and 7 of jack J501. Capacitor C501 opens the circuit to dc through trunk signal I501. Capacitor C502 and resistor R501 connected across L1 and L2 offer 600-ohm impedance so that the trunk pack can be used to terminate carrier trunks. Retardation coil L501 prevents voice currents from being shunted through contacts 6 and 7 of jack J501 or contacts of plug seat switch S501.



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Figure 6. Switchboard, Telephone, Manual SB-22/PT, schematic diagram.

11. Remote Control of Radio Equipment (fig. 6)

When the operator's plug is inserted into jack J201 and switch S401 is operated to the last position, a dc circuit is closed to the remote control equipment. The circuit is as follows: from the tip of plug P301 through contacts on stack G and H of switch S303, contacts 4-3 of switch S401, retardation coil L301, contacts on stack C of switch S303 to the ring of plug P301. Retardation coil L301 prevents the voice currents from being shunted through contacts 3-4 of switch S401. This extends the control of the radio transmitter to the switchboard operator.

12. Illuminating Lamp Circuit (fig. 6)

When switch S301 is operated to the LITE-OUT position, the illuminating lamp will light. The circuit is completed from the negative side of the night alarm battery (BAT. NA.) through contacts of switch S302, illuminating

lamp I301, to the positive side of the night alarm battery.

13. Night Alarm Circuit (fig. 6)

The night alarm circuit will provide either an audible or a visual alarm. The night alarm circuit is from the negative side of the night alarm battery through closed contacts 4-3 of operated line signal I201, to contact 1 of switch S302. The circuit through switch S302 depends on the position of the switch (VIS or AUD). In the VIS position, the circuit is completed through contact 2 of switch S302, contacts 2-1 of switch S301, illuminating lamp I302 to the positive side of the night alarm battery. In the AUD position, the circuit is completed through contact 3 of switch S302, buzzer I301 to the positive side of the night alarm battery. The illuminating lamp cannot be used as a visual alarm if it is being used to illuminate the switchboard.

Lamp 1301 to the positive side of the night alarm battery.

11. Night Alarm Circuit (Fig. 8)

The night alarm circuit will provide either an audible or a visual alarm. The night alarm circuit is from the negative side of the night alarm battery through closed contacts 4-8 of switch 2801 to signal lamp 1301 to complete the circuit. The circuit through switch 2802 depends on the position of the switch (712 or A/D). In the 712 position, the circuit is completed through contact 2 of switch 2802, contacts 2-4 of switch 2801, illuminating lamp 1302 to the positive side of the night alarm battery. In the A/D position, the circuit is completed through contact 2 of switch 2802, buzzer 1301 to the positive side of the night alarm battery. The illuminating lamp cannot be used as a visual alarm if it is being used to illuminate the switchboard.

12. Remote Control of Radio Equipment (Fig. 9)

When the operator's plug is inserted into jack 1301 and switch 2801 is operated to the last position, a dc circuit is closed to the remote control equipment. The circuit is as follows: from the tip of plug 1301 through contacts on stack C and H of switch 2803, contacts 4-8 of switch 2801, retardation coil 1301, contacts on stack C of switch 2801 to the ring of plug 1301. Retardation coil 1301 prevents the voice currents from being shunted through contacts 2-4 of switch 2801. This extends the control of the radio transmitter to the switchboard operator.

13. Illuminating Lamp Circuit (Fig. 10)

When switch 2801 is operated to the A/D position, the illuminating lamp will light. The circuit is completed from the negative side of the night alarm battery (BAT. NA) through contacts of switch 2802, illuminating

CHAPTER 2

THIRD ECHELON MAINTENANCE

Section I. GENERAL TROUBLESHOOTING INFORMATION

14. General Instructions

a. Troubleshooting at field and depot maintenance level includes all techniques outlined for organizational maintenance and any special or additional techniques required to isolate the defective party. Troubleshooting may be performed while the equipment is operating as part of a system or, if necessary, after the switchboard, or the line, trunk, or operator's packs have been removed from service.

b. Use the troubleshooting chart (para 19) to localize trouble to a component, circuit, or part. Refer to the schematic and wiring diagrams for the line, trunk, and operator's packs to further check the circuit to which the trouble has been localized. Visually inspect the jack contacts, connections, lightning arrester, signal winding, and cord for defects. Check the entire circuit with a multimeter, arranged as an ohmmeter, to locate the defective part if the trouble is not located by inspection.

15. Tools and Test Equipment

The following chart lists the tools and test equipment required for third echelon maintenance of Switchboard, Telephone, Manual SB-22(*)/PT. The associated technical manuals are also listed.

Tools and test equipment	Technical manuals
Multimeter AN/URM-105 ^a -----	TM 11-6625-203-12
Tool Equipment TE-49.	

^a Use Multimeter TS-352/U when Multimeter AN/URM-105 is not available.

16. Additional Troubleshooting Data

a. *Schematic and Wiring Diagrams.* The

following schematic and wiring diagrams and the associated figure numbers will aid in the location of faults in the equipment:

Equipment	Type of diagram	Fig. No.
Switchboard, Telephone Manual SB-22/PT.	Schematic	6
Telephone Circuit, Trunk Jack TA-326/PT.	Schematic	5
Telephone Circuit, Operator's TA-221/PT.	Wiring	14
Telephone Circuit, Line Jack TA-222/PT.	Wiring	15
Telephone Circuit, Trunk Jack TA-326/PT.	Wiring	16
Handset-Headset H-81A/U, H-144/U, or H-144A/U.	Wiring	17

b. *Reference Designation Assignments.* The reference designations listed in the chart below have been assigned to the components of the SB-22(*)/PT.

Component	Reference symbol for parts between
Switchboard case -----	1 through 99.
Line pack -----	200 through 299.
Operator's pack -----	300 through 399.
Operator's telephone set --	400 through 499.
Trunk pack -----	501 through 599.

NOTE. Reference symbols between 100 and 199 are not used.

17. Preparation for Testing

a. General. A complete SB-22(*)/PT probably will not be returned by the using organization for repair; only the faulty component, operator's pack, line pack, trunk pack, or switchboard case, will be returned; however, for the following testing procedures, it is assumed that a complete SB-22/PT is available for testing the faulty components.

b. Assembling. Assemble the switchboard so that all components can be tested (TM 11-5805-262-12).

18. Performing Prerepair Tests

a. Line Pack. Make the following tests on each line pack and note each malfunction for further troubleshooting:

- (1) Connect the test telephone to the binding posts of the first line pack.
- (2) Operate the hand ringing generator on the test telephone. The line signal should operate to white.
- (3) Remove the plug of the operator's cord from the operator's jack and insert it into the line jack. The line signal should operate to black. Be sure that transmission is possible in both directions.
- (4) Operate the hand ringing generator on the test telephone while the plug of the operator's cord is in the line jack. The line signal should not operate to white.
- (5) Connect a second test telephone to the binding posts of another line pack. Insert the plug of the cord from the first line pack into the jack of the second line pack.
- (6) Operate the hand ringing generator on the operator's pack. The second test telephone should ring.
- (7) Check to see that transmission is possible from both test telephones and the operator's telephone set.
- (8) Remove the plug of the operator's cord from the line jack. Turn the hand ringing generator on each test telephone. The line signal of the

first line pack should operate to white.

- (9) Insert the plug of the operator's cord into the line jack to return the signal to black and remove the plug of the cord from the jack of the second line pack. Replace the plug of the operator's cord in the operator's jack.

b. Operator's Pack and Operator's Telephone Set.

- (1) Connect two test telephones to separate line packs, known to be in good condition.
- (2) Operate the night alarm switch to the VIS or AUD position.
- (3) Turn the hand ringing generator on one of the test telephones. The line signal should operate to white and the night alarm should operate. Make this test with each line pack.
- (4) Insert the operator's cord into the line jack associated with the operated line signal. The line signal should return to black and the night alarm should stop.
- (5) Check to be sure that transmission is possible in both directions.
- (6) Operate the hand ringing generator. No signal should be received at the test telephone.
- (7) Insert the plug of the cord from the first line pack into the line jack of the second line pack.
- (8) Turn the hand ringing generator on the operator's pack. The second test telephone should ring.
- (9) Check to be sure that transmission is possible from both test telephones and the operator's telephone set.
- (10) Operate the RING BACK-PWR RING FWD switch to the RING BACK position, and turn the hand ringing generator. The first test telephone should ring.
- (11) Remove the plug of the first line pack from the jack of the second line pack and allow it to retract. Remove the plug of the operator's

cord from the jack of the first line pack.

- (12) Make sure that sidetone can be heard in the operator's telephone set; then reinsert the plug of the operator's cord into the operator's jack. The sidetone should stop.
- (13) Pull the LITE-OUT—NA-IN switch to the *out* position. The illuminating lamp should light. Push the LITE-OUT—NA-IN switch to the *in* position. The illuminating lamp should be extinguished.

19. Localizing Troubles

a. General. If the proper results are not obtained by performing operational tests

(1) Line pack.

(para 18), the trouble should be localized to the individual circuit of the component by using the troubleshooting chart (*c* below). Depending on the operational symptoms, one or more of the localizing procedures will be necessary.

b. Use of chart. The troubleshooting chart is designed to supplement the equipment performance checklist in TM 11-5805-262-12 and the operational test (para 18).

c. Switchboards, Telephone, Manual SB-22/PT and SB-22A/PT, Troubleshooting Chart. The following chart is supplied as an aid in locating troubles in the SB-22/PT and SB-22A/PT. The chart lists the symptoms that the repairman observes while making the operational tests (para 18).

Symptom	Probable trouble	Correction
1. Line signal fails to operate to white on incoming signal.	Faulty line signal I201 -----	Higher echelon of maintenance required.
	Break contacts on jack J201 dirty or not properly adjusted.	Clean and readjust jack (para 43).
	Lightning arrester E202 dirty or defective.	Clean and readjust lightning arrester (para 43).
	Shorted conductor in cord or plug P201.	Replace cord and plug (para 22).
2. Line signal flutters on incoming signal.	Defective rectifier CR201 -----	Higher echelon of maintenance required.
3. Night alarm fails to operate.	Defective contacts in line signal I201. -	Higher echelon of maintenance required.
	Defective receptacle P202 -----	Replace connector (para 23).
4. Line signal fails to restore.	Defective line signal I201 -----	Higher echelon of maintenance required.
	Defective jack J201 -----	Adjust jack (para 43) or higher echelon of maintenance required.
5. No transmission through line pack.	Defective jack J201 -----	Adjust jack (para 43) or higher echelon of maintenance required.
	Defective cord reel, cord, or plug P201.	Replace cord and plug (para 22) or higher echelon of maintenance required.
6. Line signal operates to white with plug in line jack.	Defective jack J201 -----	Adjust jack (para 43) or higher echelon of maintenance required.

(2) Operator's pack.

Symptom	Probable trouble	Correction
1. Operator cannot receive or transmit.	Connector P401 or receptacle J301 defective.	Replace connector (para 41) or higher echelon of maintenance required.
	Switch S303 contacts dirty or defective.	Clean and readjust switch contacts (para 44).
	Loose connections on terminal board TB301.	Tighten loose connections.
	Defective induction coil T301 -----	Replace induction coil (para 36).
	Defective cord W301 or plug P301 ---	Replace operator's cord and plug (para 29).
2. Operator cannot transmit ----	Defective batteries -----	Replace batteries.
	Defective transmitter element MK401 -	Replace transmitter element (TM 11-5805-262-12).
	Defective jack J302 -----	Clean and adjust jack (para 43).
	Defective push-to-talk switch S401 ---	Replace push-to-talk switch (para 42).
3. Operator cannot receive -----	Defective receiver element -----	Replace receiver element.
4. Operator cannot signal called or calling party.	Defective hand ringing generator G301.	Higher echelon of maintenance required.
	Defective cord W301 and plug P301 --	Replace operator's cord and plug (para 29).
5. Operator cannot signal called party.	Defective contacts on switch S303 ----	Clean and readjust switch (para 44).
6. Operator cannot signal calling party.	Defective contacts on switch S303 ----	Clean and readjust switch (para 44).
7. Illuminating lamp fails to light.	Defective lamp I302 -----	Replace lamp (TM 11-5805-262-12).
	Defective night alarm battery -----	Replace battery (TM 11-5805-262-12).
	Defective switch S301 -----	Replace switch (para 32).
	Defective contacts of jack J13 or plug P302.	Replace contacts or plug.
8. Night alarm fails to operate visual (VIS) signal.	Defective night alarm batteries -----	Replace batteries.
	Defective switch S301 -----	Replace switch (para 32).
	Defective switch S302 -----	Replace switch (para 33).

Symptom	Probable trouble	Correction
9. Night alarm fails to operate audible (AUD) signal.	Defective lamp I302 -----	Replace lamp.
	Defective contacts of jack J13 or plug P302.	Replace contacts of jack or plug.
	Defective night alarm batteries -----	Replace batteries.
	Defective switch S302 -----	Replace switch (para 33).
	Defective buzzer I301 -----	Replace buzzer (para 38).
10. No transmission from emergency operator's telephone binding posts.	Defective contacts of jack J13 or plug.	Replace contacts of jack or plug.
	Defective contacts of jack J15 or plug P305.	Replace contacts of jack or plug.
11. Cannot signal with power ringing.	Defective contacts of jack J16 or plug P305.	Replace contacts of jack or plug.

(3) *Trunk pack.*

Symptom	Probable trouble	Correction
Line lamp at distant switchboard does not light when cord is pulled out or when plug is inserted in trunk jack.	Open retardation coil L501 -----	Replace retardation coil.
	Defective switch S501 -----	Adjust or replace switch.
Supervisory line lamp at distant switchboard lights.	Shorted contacts 6 and 7 of jack J501.	Adjust jack (para 49) or higher echelon of maintenance.
	Shorted contacts of switch S501 -----	Replace or adjust switch (para 24 or 45).
	Shorted capacitor C501 or C502 -----	Replace capacitor.
Signal fails to operate to white on incoming signal.	Defective signal I501 -----	Higher echelon of maintenance required.
	Break contacts on jack J501 dirty or not properly adjusted.	Clean and readjust jack contacts (para 45).
	Shorted conductor in cord or plug P501.	Replace cord and plug (para 22).
	Shorted rectifier CR501 -----	Higher echelon of maintenance required.
Line signal flutters on incoming signal.	Open rectifier CR501 -----	Higher echelon of maintenance required.

Symptom	Probable trouble	Correction
Night alarm fails to operate.	Defective contacts on line signal I501	Higher echelon of maintenance required.
	Defective receptacle P502 -----	Replace receptacle (para 23).
Line signal fails to restore.	Defective line signal I501 -----	Higher echelon of maintenance required.
No transmission through trunk jack.	Defective jack J501 -----	Adjust contacts (para 45) or higher echelon of maintenance required.
	Defective cord reel, cord, or plug P501.	Replace cord and plug (para 22) or higher echelon of maintenance required.
Line signal operates to white with plug in line jack.	Defective jack J501 -----	Adjust contacts (para 45) or higher echelon of maintenance required.

Section III. REPAIR OF LINE AND TRUNK PACKS

20. Removal of Line or Trunk Pack from Switchboard Case

- a. Unscrew the captive screw at the top and bottom of the defective line pack.
- b. Insert the plug into the jack.
- c. Use the plug as a handhold and pull the line pack out of the switchboard case. Do not bend or twist the plug.
- d. Remove the plug from the jack.

21. Removal of Line or Trunk Pack Cover

Grasp the line pack cover near the rear of the line pack with one hand and the line pack case with the other hand. Pull the line pack cover from the line pack case to expose all the components. Do *not* pry the cover from the case.

22. Replacement of Cord and Plug, Line or Trunk Pack (fig. 7)

a. Removal of Cord Reel E201 or E501.

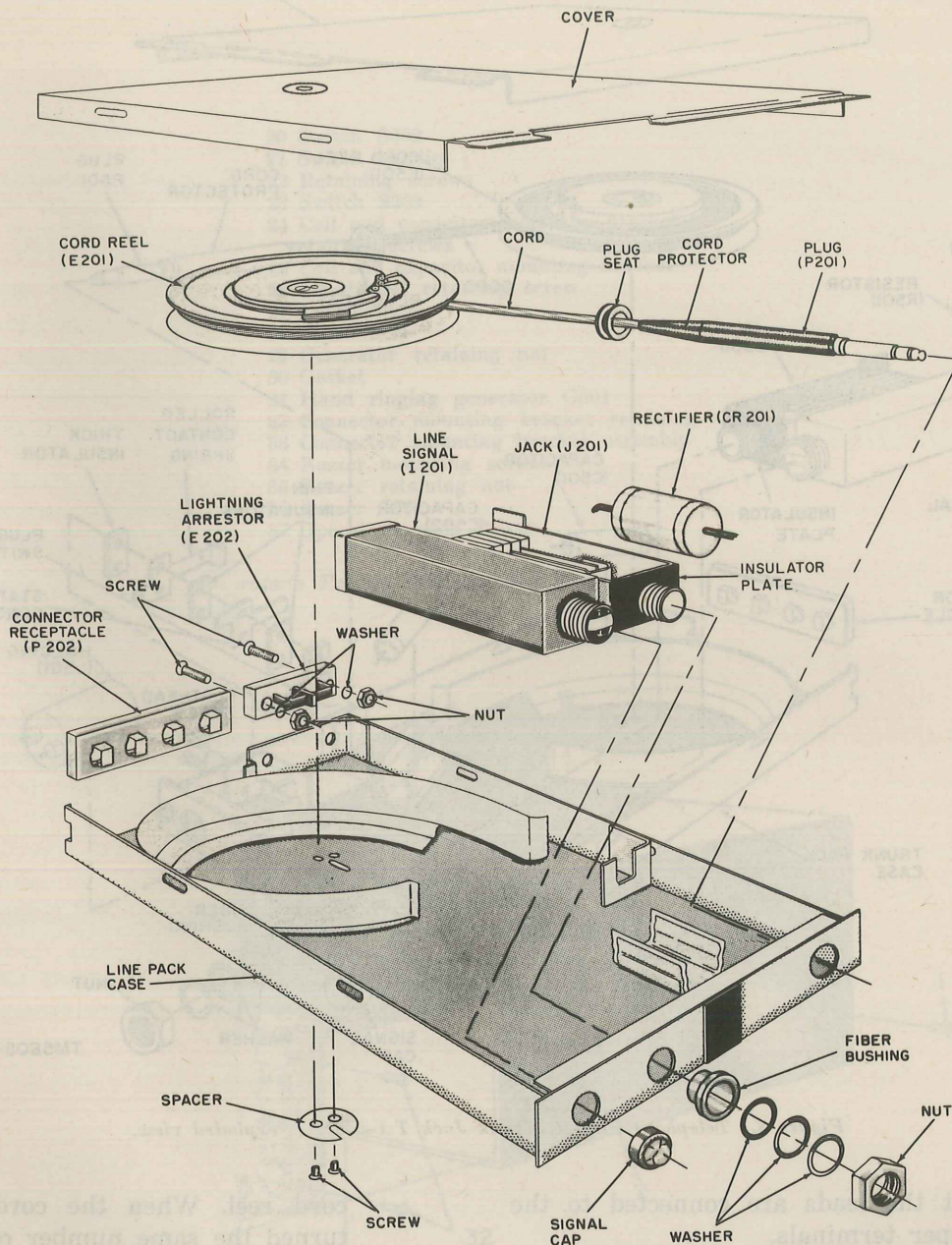
- (1) Pull the cord out of the line pack to its maximum length. Count and *record* the number of rotations made by the cord reel. Allow the cord to retract.
- (2) Pull a short length of cord off the

cord reel and slide the plug seat out of the U-shaped bracket in the line pack case.

- (3) Slide the cord and plug out of the hole in the front of the line pack. Allow the cord reel to unwind (release the spring tension).
- (4) Remove the two screws and the spacer from the opposite side of the line pack.
- (5) Lift the cord reel out of the line pack. Be very careful not to break the leads soldered to jack J201.
- (6) Note the position of the leads connected to the jack and unsolder the leads from the jack. Be careful not to burn the insulation on leads connected to adjacent terminals.

b. Removing Cord and Plug.

- (1) Unscrew the three screws that secure the cord to the cord reel. If necessary, hold the nuts on the opposite side of the reel with a wrench.
- (2) Note the position the leads and the stay cord on the cord reel. Unwind the cord from the reel and slide it out of the slot in the cord reel.
- (3) Slide the plug seat off the cord so that it can be reused.



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Figure 7. Telephone Circuit, Line Jack TA-222/PT, exploded view.

c. Installing New Cord.

- (1) Slide the plug seat on the new cord.
- (2) Slide the terminal end of the new cord into the slot in the cord reel.
- (3) Connect the new cord to the terminals on the cord reel (fig. 15). Be sure to position the stay cord on the proper screw and see that each lead

- (4) Replace the nuts on the three screws. Do not tighten the nuts so that the screws or the cord reel are damaged.

d. Replacing Cord Reel E201 or E501.

- (1) Connect and solder the leads from the cord reel to the jack. Be sure

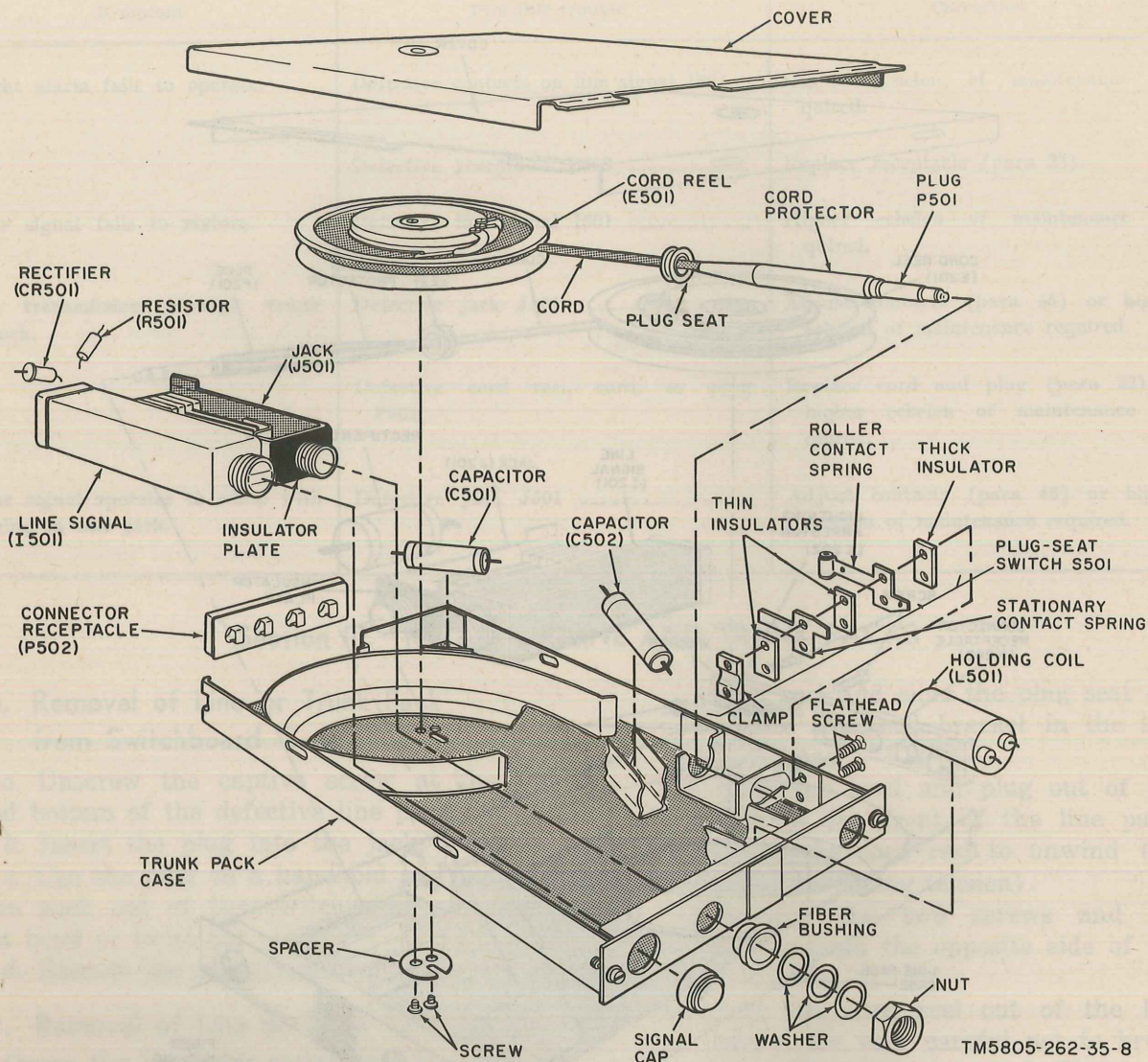


Figure 8. Telephone Circuit, Trunk Jack TA-326/PT, exploded view.

that the leads are connected to the proper terminals.

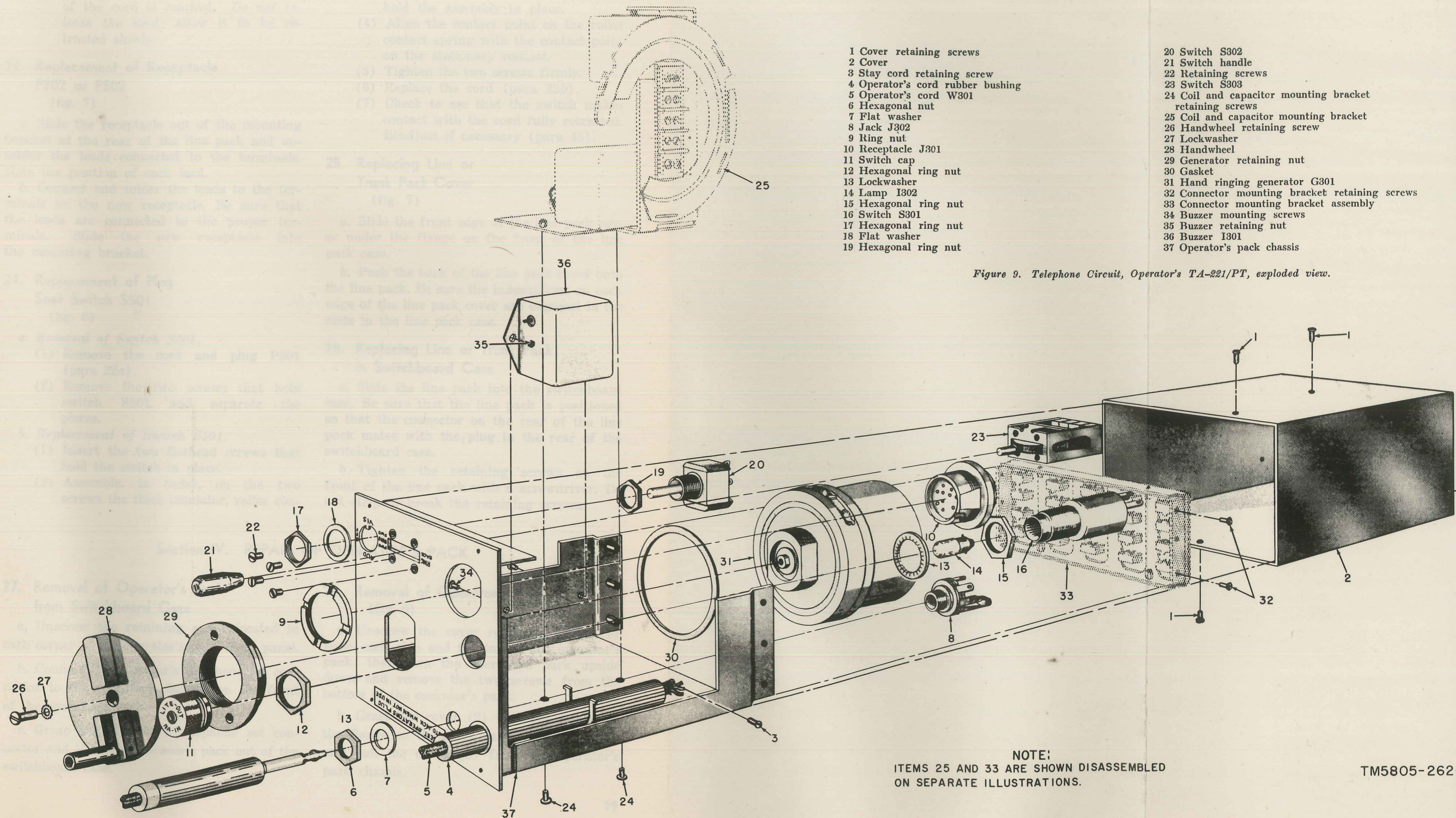
- (2) Position the cord reel in the line pack. The leads from the cord reel must be correctly positioned in the slot in the line pack case.
- (3) Replace the spacer and the two screws on the opposite side of the line pack.

e. Retensioning Cord Reel E201 or E501.

- (1) Wrap the cord around the cord reel in a clockwise direction.
- (2) Pull the cord off the reel, counting the number of turns made by the

cord reel. When the cord reel has turned the same number of times as the reel that was removed, stop the reel.

- (3) Hold the cord reel and rewind the cord on the reel.
- (4) Slide the plug and part of the cord through the hole in the front of the line pack case and replace the plug seat.
- (5) Check the tension on the cord reel. Pull a short length of cord off the cord reel and release it. The cord reel should retract the cord easily.



- 1 Cover retaining screws
- 2 Cover
- 3 Stay cord retaining screw
- 4 Operator's cord rubber bushing
- 5 Operator's cord W301
- 6 Hexagonal nut
- 7 Flat washer
- 8 Jack J302
- 9 Ring nut
- 10 Receptacle J301
- 11 Switch cap
- 12 Hexagonal ring nut
- 13 Lockwasher
- 14 Lamp I302
- 15 Hexagonal ring nut
- 16 Switch S301
- 17 Hexagonal ring nut
- 18 Flat washer
- 19 Hexagonal ring nut
- 20 Switch S302
- 21 Switch handle
- 22 Retaining screws
- 23 Switch S303
- 24 Coil and capacitor mounting bracket retaining screws
- 25 Coil and capacitor mounting bracket
- 26 Handwheel retaining screw
- 27 Lockwasher
- 28 Handwheel
- 29 Generator retaining nut
- 30 Gasket
- 31 Hand ringing generator G301
- 32 Connector mounting bracket retaining screws
- 33 Connector mounting bracket assembly
- 34 Buzzer mounting screws
- 35 Buzzer retaining nut
- 36 Buzzer I301
- 37 Operator's pack chassis

Figure 9. Telephone Circuit, Operator's TA-221/PT, exploded view.

NOTE:
ITEMS 25 AND 33 ARE SHOWN DISASSEMBLED
ON SEPARATE ILLUSTRATIONS.

Now pull the cord out to its full length. It should pull out easily and should not be stopped before the end of the cord is reached. *Do not release the cord*; allow it to be retracted slowly.

23. Replacement of Receptacle

P202 or P502

(fig. 7)

a. Slide the receptacle out of the mounting bracket at the rear of the line pack and unsolder the leads connected to the terminals. Note the position of each lead.

b. Connect and solder the leads to the terminals on the new receptacle. Be sure that the leads are connected to the proper terminals. Slide the new receptacle into the mounting bracket.

24. Replacement of Plug

Seat Switch S501

(fig. 8)

a. *Removal of Switch S501.*

(1) Remove the cord and plug P501 (para 22a).

(2) Remove the two screws that hold switch S501 and separate the pieces.

b. *Replacement of Switch S501.*

(1) Insert the two flathead screws that hold the switch in place.

(2) Assemble, in order, on the two screws the thick insulator, roller con-

tact, thin insulator, stationary contact, thin insulator, and clamp.

(3) Tighten the screws just enough to hold the assembly in place.

(4) Align the contact point on the roller contact spring with the contact point on the stationary contact.

(5) Tighten the two screws firmly.

(6) Replace the cord (para 22b).

(7) Check to see that the switch makes contact with the cord fully retracted. Readjust if necessary (para 45).

25. Replacing Line or Trunk Pack Cover

(fig. 7)

a. Slide the front edge of the line pack cover under the flange on the front of the line pack case.

b. Push the back of the line pack cover onto the line pack. Be sure the indentations on each edge of the line pack cover are engaged in the slots in the line pack case.

26. Replacing Line or Trunk Pack in Switchboard Case

a. Slide the line pack into the switchboard case. Be sure that the line pack is positioned so that the connector on the rear of the line pack mates with the plug in the rear of the switchboard case.

b. Tighten the retaining screws on the front of the line pack with a screwdriver. Do not strip or break the retaining screws.

Section IV. REPAIR OF OPERATOR'S PACK

27. Removal of Operator's Pack from Switchboard Case

a. Unscrew the retaining screw located in each corner of the operator's pack front panel.

b. Connect the operator's telephone set connector to the receptacle located on the front of the operator's pack.

c. Grasp the operator's telephone set connector and slide the operator's pack out of the switchboard case.

28. Removal of Operator's Pack Cover (fig. 9)

a. Unscrew the cover retaining screw (1) from each side and the top of the operator's pack; then turn the operator's pack upside down and remove the two screws from the bottom of the operator's pack.

b. Grasp the cover (2) with one hand and the flange on the front panel with the other, and pull the cover (2) from the operator's pack chassis.

Section IV. REPAIR OF OPERATOR'S PACK

IX. Removal of Operator's Pack from Switchboard Case

a. Insert the retaining screw located in each corner of the operator's pack into panel.

b. Connect the operator's telephone set connector to the receptacle located on the front of the operator's pack.

c. Grasp the operator's telephone set connector on the front panel with the other hand and slide the operator's pack out of the switchboard case.

X. Removal of Operator's Pack Cover

a. Remove the cover retaining screw (1) from each side and the top of the operator's pack. Then turn the operator's pack upside down and remove the two screws from the bottom of the operator's pack.

b. Grasp the cover (2) with one hand and the flange on the front panel with the other and pull the cover (2) from the operator's pack chassis.

XI. Replacement of Plug

(Fig. 8)

(1) Remove the cover and plug from (part 220).

(2) Remove the two screws that hold switch 2201 and separate the pieces.

XII. Replacement of Station Key

(1) Insert the two station screws that hold the switch in place.

(2) Assemble in order on the two screws the first transistor station connector.

XIII. Replacement of Receptacle

(Fig. 9)

a. Slide the receptacle out of the mounting bracket at the rear of the line pack and note the position of each lead.

b. Connect and solder the leads in the bracket on the new receptacle. Be sure that the leads are connected to the proper terminals. Slide the new receptacle into the mounting bracket.

XIV. Replacing Line or Trunk Pack Cover

(Fig. 10)

a. Slide the front edge of the line pack cover under the flange on the front of the line pack case.

b. Push the back of the line pack cover into the line pack. Be sure the indentations on each edge of the line pack cover are engaged in the slots in the line pack case.

XV. Replacing Line or Trunk Pack in Switchboard Case

a. Slide the line pack into the switchboard case. Be sure that the line pack is positioned so that the connector on the rear of the line pack mates with the plug in the rear of the switchboard case.

b. Tighten the retaining screws on the front of the line pack with a screwdriver. Do not stop to break the retaining screws.

30. Test the line pack assembly and control opening with the contact point on the stationary contact.

(1) Align the contact point on the stationary contact opening with the contact point on the line pack.

(2) Tighten the screws just enough to hold the assembly in place.

(3) Repeat the above just enough to hold the assembly in place.

31. Test the line pack assembly and control opening with the contact point on the stationary contact.

(1) Align the contact point on the stationary contact opening with the contact point on the line pack.

(2) Tighten the screws just enough to hold the assembly in place.

(3) Repeat the above just enough to hold the assembly in place.

Note. The operator's pack must be inverted to remove any of the parts, since all of the parts are mounted on the underside of the operator's pack chassis.

29. Replacement of Operator's Cord (fig. 9)

a. Removal of Operator's Cord.

- (1) Unscrew the stay cord retaining screw (3) from the bottom of terminal board TB301 on the coil and capacitor mounting bracket (25).
- (2) Loosen the three screw terminals that secure the three conductors to the terminals on terminal board TB301.
- (3) Hold the operator's pack chassis with one hand and pull the operator's cord rubber bushing (4) and operator's cord (5) toward the rear of the operator's pack chassis until the rubber bushing clears the front panel. Slide the cord out of the front panel.
- (4) Grasp the operator's cord rubber bushing (4) in one hand and pull the operator's cord (5) out of the rubber bushing. Slide the bushing over the cord stay and the cord terminals.

b. Installing New Operator's Cord.

- (1) Tie a short piece of string to each cord terminal.
- (2) Slide the three pieces of string through the rubber bushing (4).
- (3) Pull the cord conductors through the rubber bushing *one at a time* by pulling on the short piece of string tied to each terminal.
- (4) Slide the rubber bushing (4) over the stay cord and onto the cord (5).

Note. If insertion of the cord into the rubber bushing is difficult, rub the cord with a bar of paraffin.

- (5) Slide the plug and cord (5) through the operator's pack panel from the rear. Force the bushing (4) into the hole in the panel. The bushing (4) should extend about 1 inch in front of the panel.
- (6) Fasten the stay cord to the bottom of terminal board TB301.
- (7) Reconnect the cord terminals to terminal board TB301.

30. Replacement of Jack J302 (fig. 9)

a. Removal of Jack J302.

- (1) Remove the hexagonal nut (6) and the flat washer (7) from the front of the jack (8) with a wrench.
- (2) Slide the jack (8) out of the front panel and pull it out to the side of the operator's pack chassis.
- (3) Note the position of the leads connected to the jack (8). Disconnect the leads.

b. Installing New Jack J302.

- (1) Connect and solder the leads to the jack (8).
- (2) Slide the jack (8) into the hole in the front panel from the rear.
- (3) Replace the flat washer (7) and the hexagonal nut (6). Tighten the nut (6) with a wrench.

31. Replacement of Connector Receptacle U-79/U (fig. 9)

a. Removal of Receptacle.

- (1) Unscrew the ring nut (9) from the front of the receptacle (10) with a spanner wrench.
- (2) Slide the receptacle (10) out of the front panel toward the rear of the operator's pack chassis (37).
- (3) Disconnect and tag each of the leads connected to the rear of the receptacle.

b. Installing New Receptacle.

- (1) Position the new receptacle (10) beside the operator's pack chassis (37) and connect the leads to the solder terminals. Check the terminal markings. Be sure that the leads are properly connected (fig. 14).
- (2) Slide the receptacle (10) into the hole in the front panel from the rear. Be sure to position the flat portion of the receptacle (10) against the flat portion of the hole in the front panel.
- (3) Replace the ring nut (9) on the receptacle (10). Tighten the nut with a spanner wrench. Be careful not to scratch the front panel.

32. Replacement of Switch S301

(fig. 9)

a. Removal of Switch S301.

- (1) Pull the switch cap (11) out and unsolder the three leads connected to the switch terminals. Be sure other leads in the operator's pack are clear of the switch so that they are not burned.
- (2) Turn the switch cap (11) counterclockwise to unscrew it from the front of the switch S301 (16).
- (3) Remove the hexagonal ring nut (12) from the front of switch S301 (16) with a wrench.
- (4) Slide the switch S301 (16) out of the hole in the front panel and remove the lockwasher (13).
- (5) Push in on the lamp I302 (14) and turn it counterclockwise; pull the lamp from the socket.
- (6) Unscrew the hexagonal ring nut (15) from the switch S301 (16).

b. Installing New Switch S301.

- (1) Replace the hexagonal ring nut (15) and lockwasher (13) on the new switch (16) and slide the switch (16) into the hole in the front panel from the rear.
- (2) Replace the hexagonal ring nut (12) on the front of the switch (16). Tighten the nut (12) with a wrench.
- (3) Connect and solder the three leads to the terminals behind the switch (16).
- (4) Insert the lamp (14) into the socket in the front of switch S301, line up the bayonet clips, and turn the lamp clockwise to lock it in position.
- (5) Screw the switch cap (11) onto the front of the switch (16).

33. Replacement of Switch S302

(fig. 9)

a. Removal of Switch S302.

- (1) Disconnect the three leads from the switch (20). Be sure to note the position of the leads.
- (2) Remove the hexagonal ring nut (17) and the flat washer (18) from the front of the switch (20) with a

wrench. Be careful not to scratch the front panel with the nut or wrench.

- (3) Slide the switch (20) out of the hole in the front panel.
- (4) Unscrew the hexagonal ring nut (19) from the switch (20).

b. Installing New Switch S302.

- (1) Replace the hexagonal ring nut (19) on the switch (20).
- (2) Align the guide slot in the switch (20) with the guide in the hole in the front panel and slide the new switch (20) into the hole.
- (3) Replace the flat washer (18) and the hexagonal ring nut (17). Tighten the nut (17) with a wrench.
- (4) Reconnect the three leads to the switch (fig. 14). Be sure to reconnect the leads to the same terminals from which they were disconnected.

34. Replacement of Switch S303

a. Removal of Switch S303.

- (1) Tag and disconnect the leads connected to the terminals of switch S303 (23, fig. 9).
- (2) Unscrew the switch handle (21) from switch S303 (23). Turn the switch handle (21) counterclockwise.
- (3) Unscrew the four retaining screws (22) from the front panel. Use a small screwdriver.
- (4) Slide the switch (23) out of the front panel.

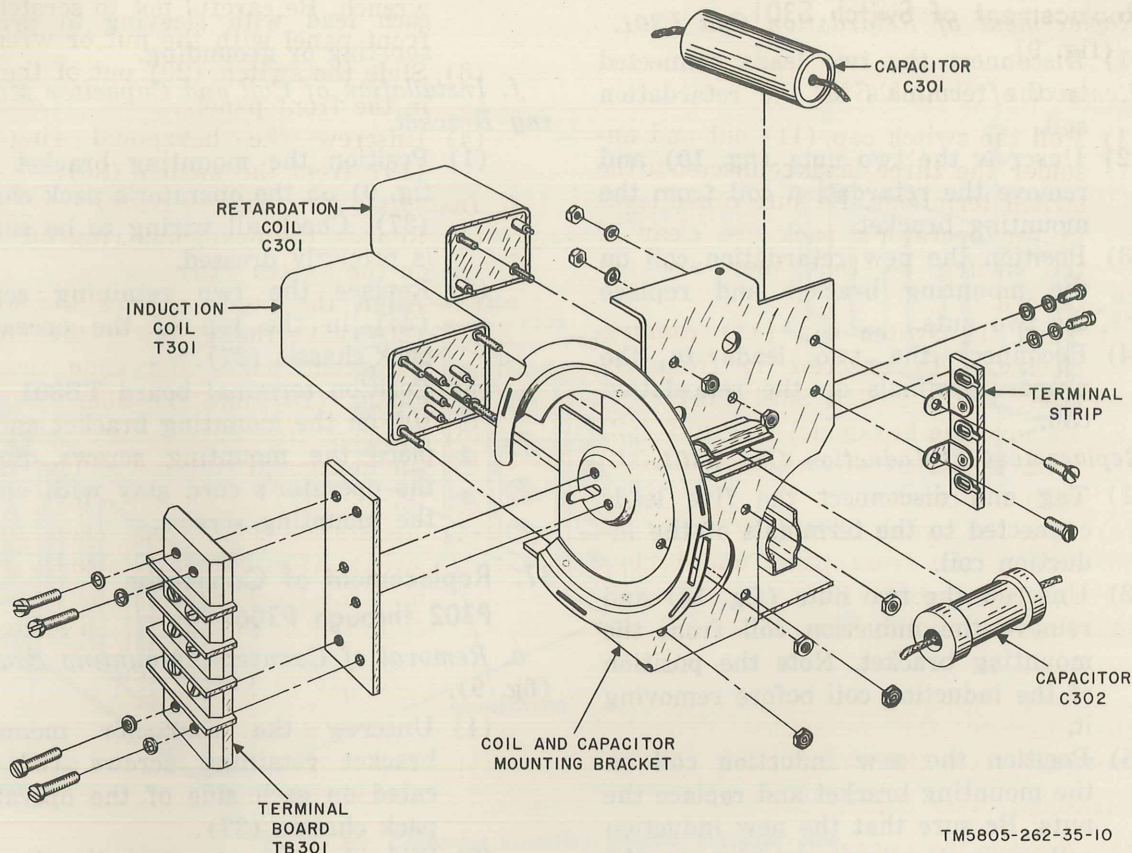
b. Installation of Switch S303.

- (1) Connect and solder the strapping on the switch terminals. Check figure 14 to be sure that the strapping is connected to the correct terminals.
- (2) Slide switch S303 (23, fig. 9) into the hole in the front panel and replace the four retaining screws (22).
- (3) Replace the switch handle (21).
- (4) Connect and solder the leads to the terminals. Refer to figure 14 to be sure that the leads are connected to the proper terminals.

35. Replacement of Terminal Board TB301

(fig. 10)

a. Removal of Terminal Board TB301.



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Figure 10. Coil and capacitor mounting bracket, exploded view.

- (1) Loosen the three terminal screws and disconnect the operator's cord conductors from the terminal board.
- (2) Disconnect the three leads from the other side of the terminal board.
- (3) Unscrew the four mounting screws and remove the terminal board from the mounting bracket.

b. Installation of Terminal Board TB301.

- (1) Position the terminal board on the mounting bracket and replace the four mounting screws.
- (2) Connect and solder the three leads to the solder terminals on the terminal board.
- (3) Connect the operator's cord conductors to the terminal screws on terminal board TB301. Be sure to tighten the terminal screws.

36. Replacement of Retardation Coil L301, Induction Coil T301, and Capacitors C301 and C302

a. Removal of Coil and Capacitor Mounting Bracket.

- (1) Unscrew the four mounting screws and remove terminal board TB301 from the mounting bracket (fig. 10). Do not disconnect any of the leads from the terminal board.
- (2) Unscrew the two coil and capacitor mounting bracket retaining screws (24, fig. 9) from the top of the operator's pack chassis and lift the coil and capacitor mounting bracket out of the chassis (37). Be careful not to break any leads or connections when lifting the bracket out of the chassis.
- (3) Replace the components on the mounting bracket as explained in *b* through *e* below.

b. Replacement of Retardation Coil L301.

- (1) Disconnect the two leads connected to the terminals on the retardation coil.
- (2) Unscrew the two nuts (fig. 10) and remove the retardation coil from the mounting bracket.
- (3) Position the new retardation coil on the mounting bracket and replace the two nuts.
- (4) Reconnect the two leads to the proper terminals on the retardation coil.

c. Replacement of Induction Coil T301.

- (1) Tag and disconnect the five leads connected to the terminals of the induction coil.
- (2) Unscrew the two nuts (fig. 10) and remove the induction coil from the mounting bracket. Note the position of the induction coil before removing it.
- (3) Position the new induction coil on the mounting bracket and replace the nuts. Be sure that the new induction coil is in the same position as the induction coil that was removed.
- (4) Reconnect the five leads to the terminals on the new induction coil. Be sure they are connected to the proper terminals (fig. 14). Remove the tags.

d. Replacement of Capacitor C301.

- (1) Disconnect the capacitor leads. Note the terminals to which the leads were connected.
- (2) Slide the capacitor out of the clip (fig. 10).
- (3) Slide the new capacitor into the clip.
- (4) Reconnect the capacitor leads to the proper terminals. If necessary, cover each capacitor lead with sleeving to prevent shorting or grounding.

e. Replacement of Capacitor C302.

- (1) Disconnect the capacitor leads. Note the terminals to which the leads are connected.
- (2) Slide the capacitor out of the clip (fig. 10).
- (3) Slide the capacitor into the clip.
- (4) Reconnect the capacitor leads to the proper terminals. If necessary, cover

each lead with sleeving to prevent shorting or grounding.

f. Installation of Coil and Capacitor Mounting Bracket.

- (1) Position the mounting bracket (25, fig. 9) on the operator's pack chassis (37). Check all wiring to be sure it is properly dressed.
- (2) Replace the two retaining screws (24) in the top of the operator's pack chassis (37).
- (3) Position terminal board TB301 (fig. 10) on the mounting bracket and replace the mounting screws. Secure the operator's cord stay with one of the mounting screws.

37. Replacement of Connector P302 through P306

a. Removal of Connector Mounting Bracket (fig. 9).

- (1) Unscrew the connector mounting bracket retaining screws (32) located on each side of the operator's pack chassis (37).
- (2) Slide the connector mounting bracket assembly (33) off the operator's pack chassis (37). Do not pull the leads.

b. Removal and Installation of Connectors P302 through P306 (fig. 11).

- (1) Unscrew the retaining screws on the top and bottom of the mounting bracket.
- (2) Disconnect the leads connected to the defective connector. Check the position of the leads.
- (3) Separate the two parts of the mounting bracket and remove the defective connector.
- (4) Slide the new connector into the mounting bracket.
- (5) Connect the leads to the new connector (fig. 14).
- (6) Slide the two parts of the mounting bracket together and replace the screws.

c. Installation of Connector Mounting Bracket (fig. 9).

- (1) Slide the connector mounting bracket assembly (33) into position on the

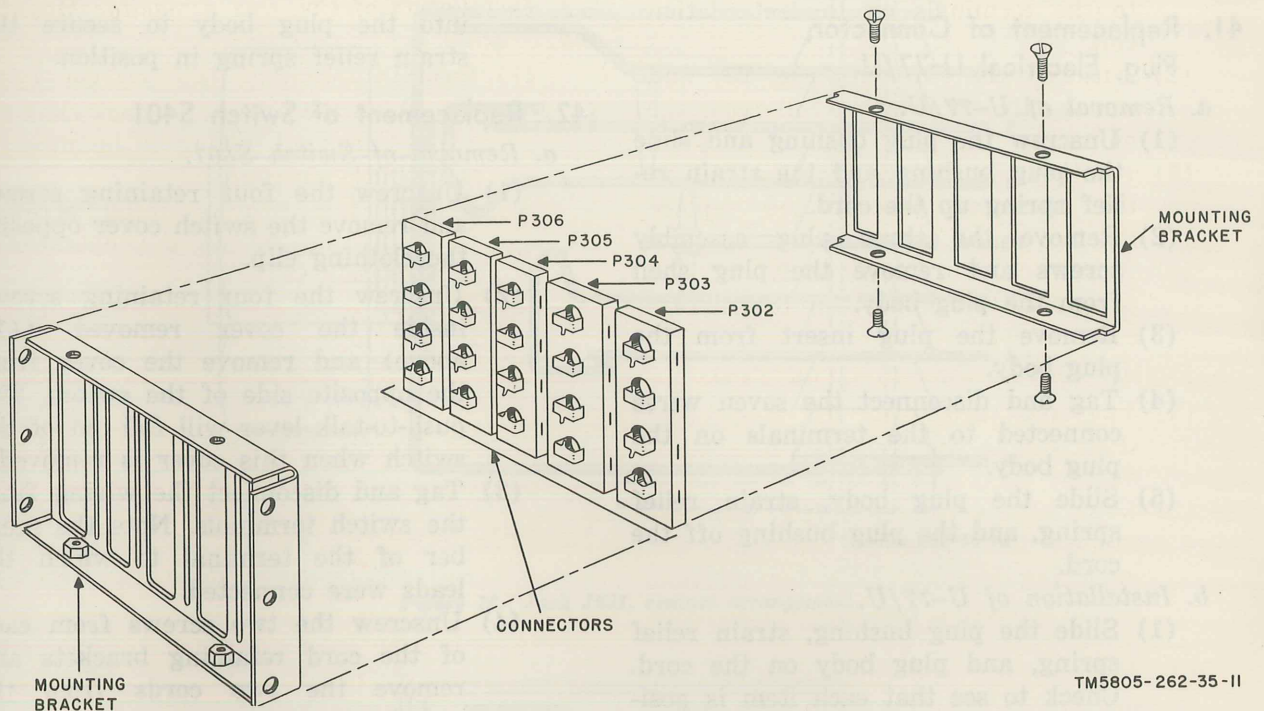


Figure 11. Connector mounting bracket, exploded view.

operator's pack chassis (37). Be sure to dress all the wiring.

- (2) Replace the retaining screws (32) in each side of the operator's pack chassis (37).

38. Replacement of Buzzer I301 (fig. 9)

a. Removal of Buzzer I301.

- (1) Unscrew the two buzzer mounting screws (34) from the buzzer retaining nuts (35) and remove the buzzer (36) from the operator's pack chassis (37).
- (2) Unsolder the three wires from the buzzer terminals.

b. Installing New Buzzer I301.

- (1) Connect and solder the three wires to the buzzer terminals. Be sure they are connected to the correct terminal.
- (2) Slide the buzzer (36) into the operator's pack chassis (37) and replace the two buzzer retaining nuts (35)

and buzzer mounting screws (34).

39. Replacing Operator's Pack Cover (fig. 9)

a. Slide the operator's pack cover (2) onto the operator's pack chassis (37). Be sure it is positioned properly.

b. Replace the cover retaining screws (1) in the bottom of the operator's pack; then replace the cover retaining screw (1) in each side and in the top of the operator's pack.

40. Installing Operator's Pack in Switchboard Case

a. Slide the operator's pack into the switchboard case in the space provided. Position it so that the connectors in the rear of the operator's pack mate with the plugs in the rear of the switchboard case.

b. Tighten the retaining screw located in each corner of the panel on the operator's pack.

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Section V. REPAIR OF HANDSET-HEADSETS H-81A/U, H-144/U AND H-144A/U

41. Replacement of Connector, Plug, Electrical U-77/U

a. Removal of U-77/U.

- (1) Unscrew the plug bushing and slide the plug bushing and the strain relief spring up the cord.
- (2) Remove the three plug assembly screws and remove the plug shell from the plug body.
- (3) Remove the plug insert from the plug body.
- (4) Tag and disconnect the seven wires connected to the terminals on the plug body.
- (5) Slide the plug body, strain relief spring, and the plug bushing off the cord.

b. Installation of U-77/U.

- (1) Slide the plug bushing, strain relief spring, and plug body on the cord. Check to see that each item is positioned properly on the cord.
- (2) Connect the seven leads to the terminals on the plug insert. Check to see that the leads are connected to the proper terminals (fig. 17).
- (3) Replace the plug insert in the plug body and replace the plug shell on the plug body. Secure the plug shell in position with the plug assembly screws.
- (4) Slide the strain relief spring and the plug bushing down the cord to the plug body. Screw the plug bushing

into the plug body to secure the strain relief spring in position.

42. Replacement of Switch S401

a. Removal of Switch S401.

- (1) Unscrew the four retaining screws and remove the switch cover opposite the clothing clip.
- (2) Unscrew the four retaining screws inside the cover removed ((1) above) and remove the cover from the opposite side of the switch. The push-to-talk lever will fall out of the switch when this cover is removed.
- (3) Tag and disconnect the wiring from the switch terminals. Note the number of the terminal to which the leads were connected.
- (4) Unscrew the two screws from each of the cord retaining brackets and remove the two cords from the switch.

b. Installation of Switch S401.

- (1) Slide the two cords into the switch and secure the brackets in position with the screws. See that the cords are inserted into the correct end of the switch.
- (2) Connect the leads from each of the cords to the proper terminals. Refer to figure 17 and to the tags for the number of the terminal to which the leads should be connected.
- (3) Reassemble the switch.

Section VI. ADJUSTMENTS

43. Line Pack Adjustments

a. *Lightning Arrester E202.* Adjust the contacts on the lightning arrester so that they are positioned 0.005 ± 0.001 inch from the ground terminal. Adjust the contacts with a spring bender; do not use long-nosed pliers.

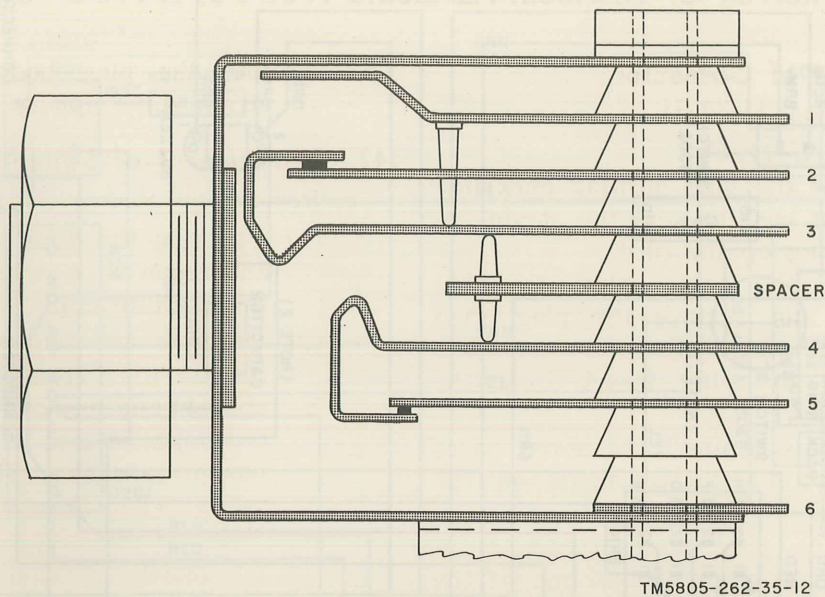
b. *Jack J201* (fig. 12).

- (1) Insert plug P201 into jack J201.

- (2) Adjust contacts 3 and 4 so that between 200 and 400 grams are required to move the contact away from the plug.

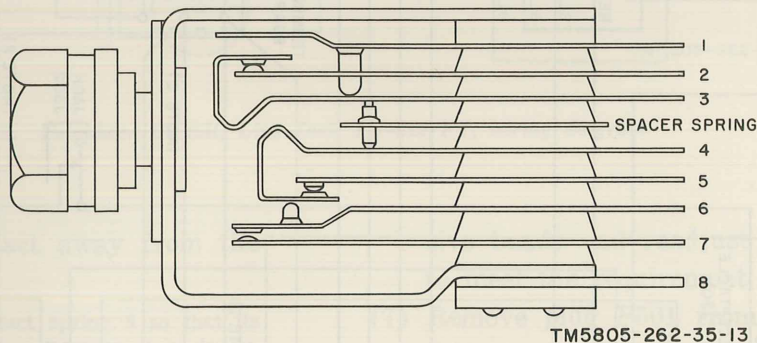
Note. Operate spring 1 so that the contact insulator is clear of contact 3.

- (3) There should be a minimum of 0.010 inch between contacts 4-5 and contacts 2-3. The spacer should be straight.



TM5805-262-35-12

Figure 12. Jack J201, contact arrangement.



TM5805-262-35-13

Figure 13. Jack J501, contact arrangement.

- (4) Remove plug P201 from jack J201. Adjust contacts 5 and 2 so that they have a minimum of 80 grams tension toward contacts 4 and 3 respectively.

44. Operator's Pack Adjustments

Check the spring tension on the contacts of switch S303 by applying the gram gage near the contact point. The following spring tensions and airgap clearances must be met on switch S303:

- a. The center contact on stack K1 through K8 must be adjusted to withstand 45 grams before the normally made contacts break.
- b. The make contacts must be 0.008 ± 0.001

inch from the center contact when the break occurs.

- c. The break contact must clear the center contact 0.008 ± 0.001 inch when the switch is fully operated.

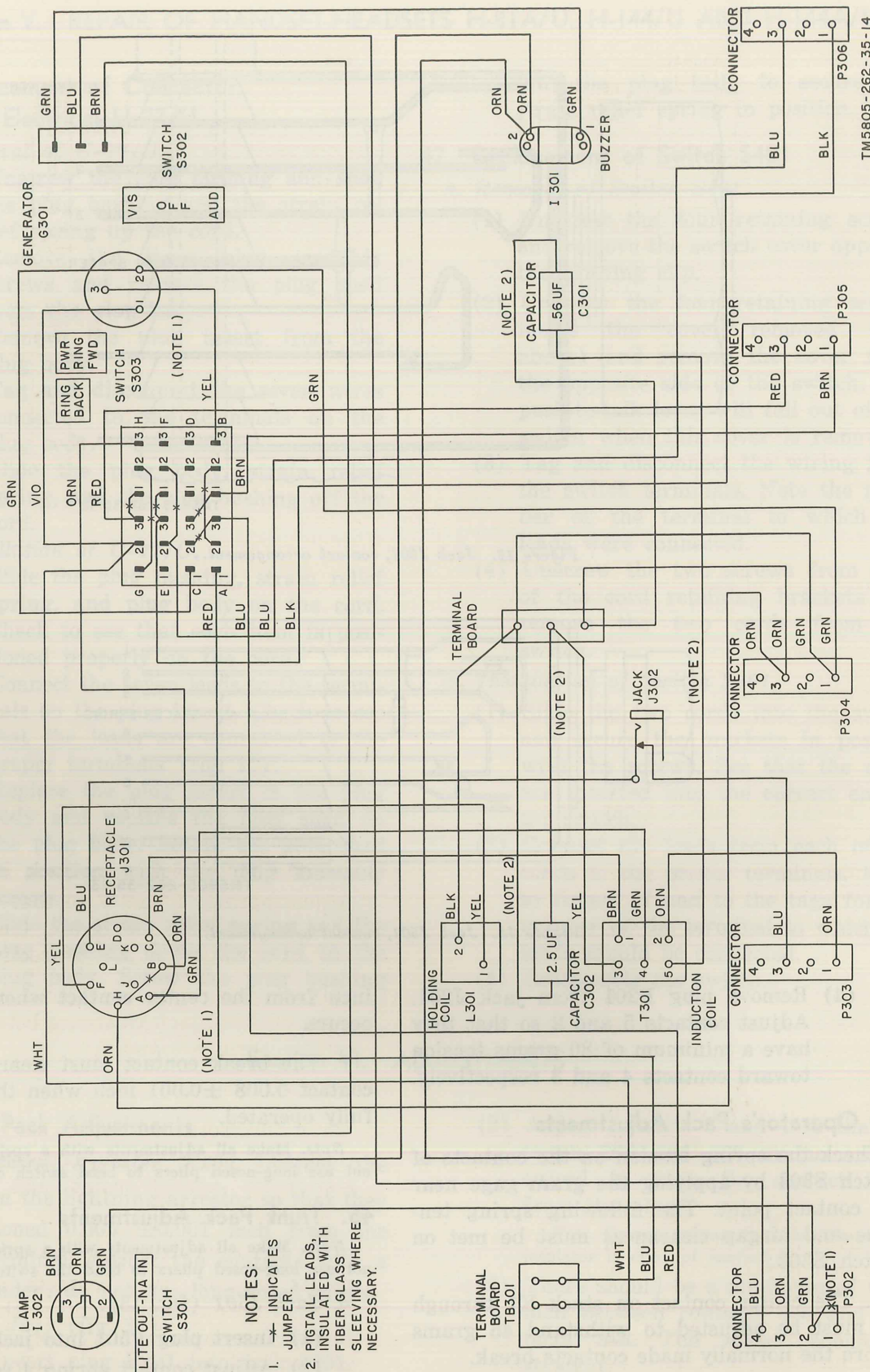
Note. Make all adjustments with a spring bender; do not use long-nosed pliers to bend switch contacts.

45. Trunk Pack Adjustments

Note. Make all adjustments with a spring bender. Do not use long-nosed pliers to bend the switch contacts.

- a. Jack J501 (fig. 13).

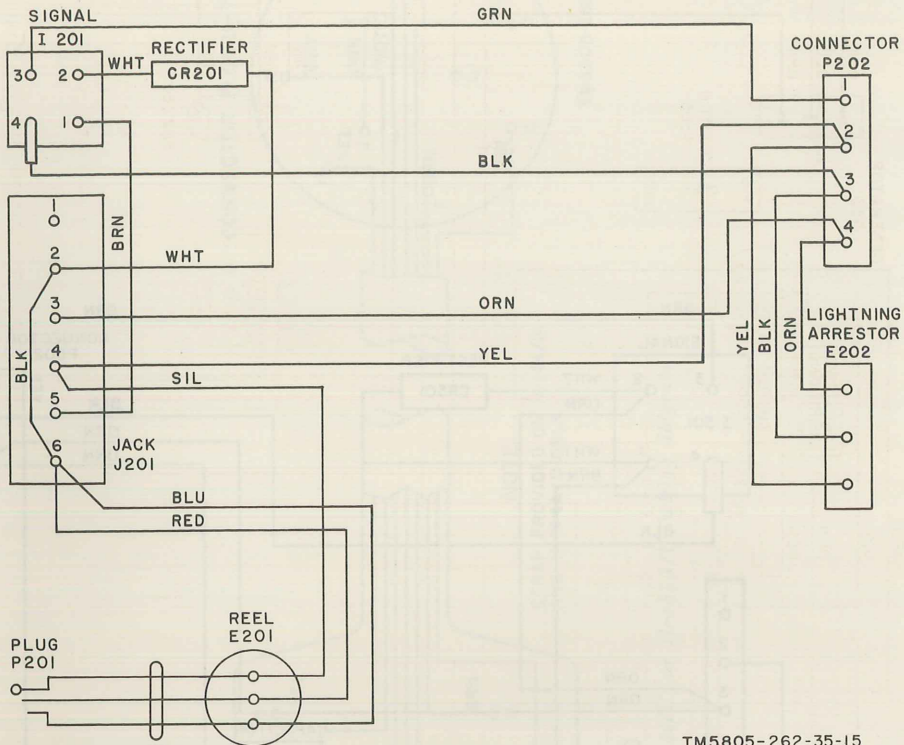
- (1) Insert plug P501 into jack J501.
- (2) Adjust contact spring 4 so that from 1,000 to 1,600 grams are necessary



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Figure 14. Telephone Circuit, Operator's TA-221/PT, wiring diagram.

- NOTES:
- 1. —*— INDICATES JUMPER.
 - 2. PIGTAIL LEADS, INSULATED WITH FIBER GLASS SLEEVING WHERE NECESSARY.



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Figure 15. Telephone Circuit, Line Jack TA-222/PT, wiring diagram.

to move the contact away from the plug.

Note. Operate contact spring 6 so that its contact insulator is clear of contact spring 4.

- (3) Adjust contact spring 3 so that 1,000 to 1,200 grams are necessary to move the contact from the plug.

Note. Operate contact spring 1 so that its contact insulator is clear of contact spring 3.

- (4) Adjust contact springs 5 and 2 to provide a minimum of 0.012 inch between contacts 4-5 and 2-3. The spacer should be straight.
- (5) Adjust contact spring 7 so that at least it has a minimum of 80 grams tension toward contact spring 6.
- (6) Check to see that there is a minimum of 0.015 inch clearance between springs 4-5, 2-3, and 6-7 at other than contact points. Remove excess

sive bends and readjust as required to meet the requirement.

- (7) Remove plug P501 from jack P501. Adjust springs 5 and 2 so that they have a minimum of 80 grams tension toward springs 4 and 3, respectively.
- (8) Adjust spring 7 to provide a minimum of 0.012 inch clearance between contact springs 6 and 7.

b. Switch S501 (fig. 8).

- (1) With the cord retracted, see that there is a noticeable gap between the stationary contact point and the roller contact point.
- (2) With the cord extended, the contact points on the two contacts must meet. The stationary contact should follow the roller contact noticeably. Adjust both contacts as required to meet these conditions.

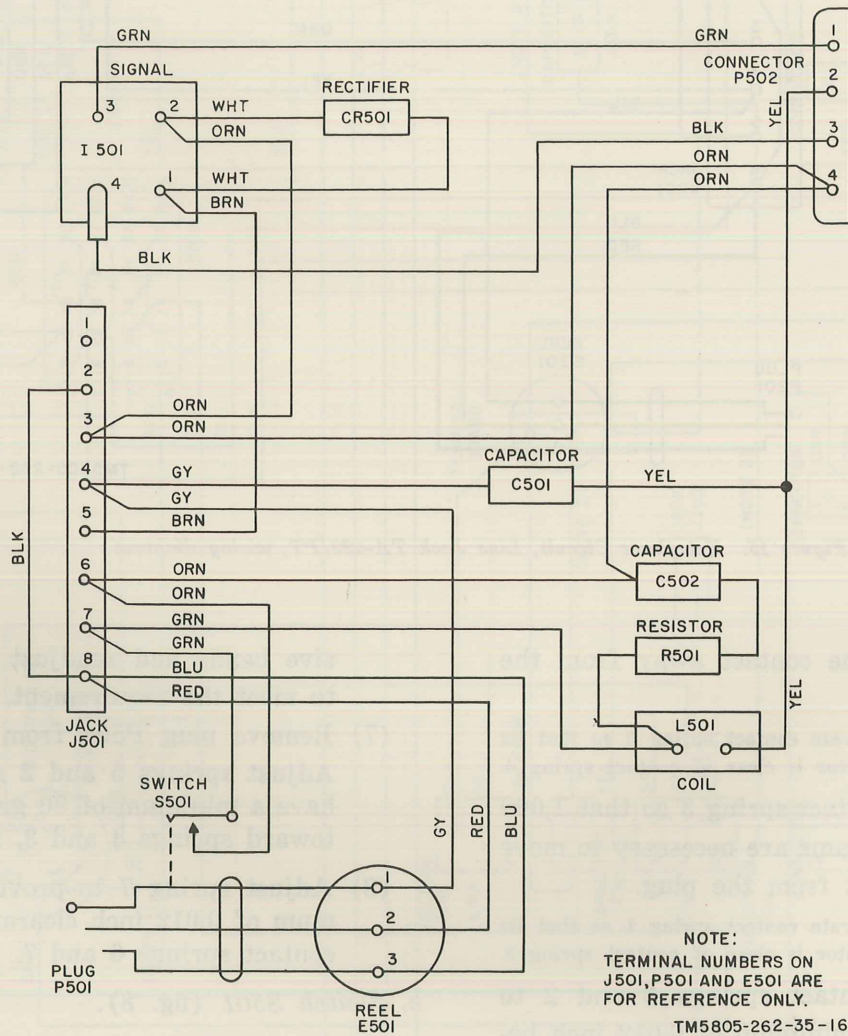


Figure 16. Telephone Circuit, Trunk Jack TA-326/PT, wiring diagram.

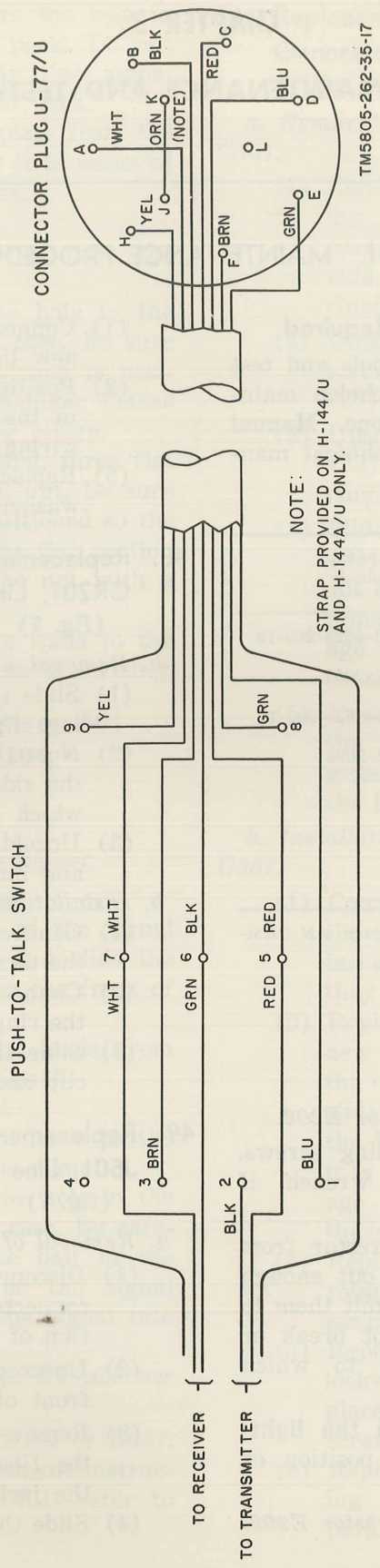


Figure 17. Handset-Headset H-81A/U, H-144/U, or H-144A/U, wiring diagram.

CHAPTER 3

FOURTH ECHELON MAINTENANCE AND TESTING PROCEDURES

Section I. MAINTENANCE PROCEDURES

46. Tools and Test Equipment Required

The following chart lists the tools and test equipment required for fourth echelon maintenance of Switchboard, Telephone, Manual SB-22(*)/PT. The associated technical manuals are also listed.

Tools and Test equipment	Technical manuals
Multimeter AN/URM-105 ^a	TM 11-6625-203-12
Test Set AN/PTM-6	TM 11-2062
Test Set I-181	TM 11-6625-202-10
Test Set TS-140/PCM	TM 11-2096
Test Set TS-190	
Tool Equipment TE-49	
Tool Equipment TE-112	

^aUse Multimeter TS-352/U when Multimeter AN/URM-105 is not available.

47. Replacement of Lightning Arrestor E202, Line Pack (fig. 7)

a. Removal of Lightning Arrestor E202.

- (1) Unscrew the two retaining screws. Hold the nuts with a wrench, if necessary.
- (2) Remove the lightning arrestor from the line pack case. Pull out enough slack on the wires to permit them to be unsoldered, but do not break or damage the components to which they are connected.
- (3) Unsolder the leads from the lightning arrestor. Note the position of the leads.

b. Installing New Lightning Arrestor E202.

- (1) Connect and solder the leads to the new lightning arrestor (fig. 15).
- (2) Position the new lightning arrestor in the line pack case and dress the wiring.
- (3) Replace the retaining screws, lock-washers, and nuts.

48. Replacement of Rectifier CR201, Line Pack (fig. 7)

a. Removal of Rectifier CR201.

- (1) Slide the rectifier out of the retaining clip.
- (2) Note the position of the leads. Check the side of the rectifier to determine which lead is positive (+).
- (3) Unsolder the leads from jack J201 and line signal I201.

b. Installation of New Rectifier CR201.

- (1) Connect the positive rectifier lead to the terminal on line signal I201.
- (2) Connect the other rectifier lead to the ring break contact on jack J201.
- (3) Slide the rectifier into the retaining clip and dress the wiring.

49. Replacement of Jack J201 or J501, Line or Trunk Pack (fig. 7)

a. Removal of Jack.

- (1) Disconnect and tag all of the leads connected to the jack. Note the position of each lead.
- (2) Unscrew the hexagonal nut from the front of the jack.
- (3) Remove the three flat washers and the fiber bushing from the front of the jack.
- (4) Slide the jack toward the rear of the

line pack until it clears the hole in the front of the line pack. Do not damage the plunger in line signal I201 when removing the jack.

- (5) Remove the insulator plate from the front of the jack after it is removed from the line pack case.

b. Installing New Jack.

- (1) Slide the insulator plate onto the front of the jack.
- (2) Slide the jack into the hole in the front of the line pack case. Be sure the hole in the jack frame is positioned so the signal plunger makes contact with the spring pileup.
- (3) Replace the fiber bushing, three flat washers, and hexagonal nut. Be sure the fiber bushing is positioned so the flat portion fits into the flat portion of the hole. Tighten the nut with a wrench.
- (4) Connect and solder the leads to the jack terminals and dress the wiring.

50. Replacement of Signal I201 or I501 and Cord Reel E201 or E501, Line or Trunk Pack
(fig. 7)

a. Removal of Line or Trunk Signal.

- (1) Unscrew the signal cap.
- (2) Lift the terminal end of the signal to clear the cord reel and slide the signal out of the hole in the front of the line pack case.
- (3) Disconnect and tag the leads from the terminals on the signal.

b. Installation of New Signal.

- (1) Connect and solder the leads to the proper terminals on the signal.
- (2) Slide the signal into the hole in the front of the line pack case. Be careful not to damage the ball in the front of the signal or the signal plunger when sliding the signal into position.
- (3) Replace the signal cap. *Do not use pliers.*

c. Replacement of Cord Reel E201 or E501.

For detailed removal and replacement instructions for cord reel E201 or E501, refer to paragraph 22 *a*, *d*, and *e*.

51. Replacement of Hand Ringing Generator G301, Operator's Pack
(fig. 9)

a. Removal of Hand Ringing Generator G301.

- (1) Remove the coil and capacitor mounting bracket (25) as explained in paragraph 36*a*(1) and (2) to provide clearance for removing the hand ringing generator.
- (2) Unscrew the handwheel retaining screw (26); remove the lockwasher (27) and handwheel (28).
- (3) Unscrew the generator retaining nut (29) from the front of the hand ringing generator (31).
- (4) Slide the hand ringing generator (31) out of the front panel, lift it out of the operator's pack (37), and remove the gasket (30). Do not damage the leads in the operator's pack chassis.
- (5) Unsolder the four leads connected to the terminals on the hand ringing generator (31). Note the position of the leads.

b. Installation of Hand Ringing Generator G301.

- (1) Connect and solder the four leads to the terminals on the new hand ringing generator (31). Check to see that they are positioned correctly.
- (2) Replace the gasket (30), position the new hand ringing generator (31) in the operator's pack chassis (37), and slide the hand ringing generator into the hole in the front panel. Be sure it is positioned properly. Do not damage the wiring and components in the operator's pack chassis.
- (3) Replace the hand ringing generator retaining nut (29) and tighten it securely.
- (4) Replace the handwheel (28) and lockwasher (27); secure them in place with the handwheel retaining screw (26).
- (5) Replace the coil and capacitor mounting bracket (25) as explained in paragraph 36*f*.

Section II. FOURTH ECHELON TESTING PROCEDURES

52. General

a. Testing procedures are prepared for use by Signal Field Maintenance Shops and Signal Service Organizations responsible for fourth echelon maintenance to determine the acceptability of repaired signal equipment. These procedures set forth specific requirements that repaired signal equipment *must* meet before it is returned to the using organizations or returned to stock for issue through supply channels. The testing procedures may also be used as a guide for making tests on equipment that has been repaired at third echelon if the proper tools and test equipment are available. The testing procedures may be used as a guide for final testing at fifth echelon. A summary of the performance standards is given in paragraph 61.

b. Comply with the instructions preceding the chart before proceeding to the chart. Perform each test in sequence. Do not vary the sequence. For each step, perform all the actions required in the *Test equipment control settings* and *Equipment under test control settings* columns; then perform each specific test procedure and verify it against its performance standard.

53. Test Equipment and Materials Required

All test equipment and materials required to perform the testing procedures given in this section are listed in the following charts and are authorized under TA 11-17, Signal Field Maintenance Shops, and TA 11-100 (11-17), Allowances of Signal Corps Expendable Supplies for Signal Field Maintenance Shop, Continental United States.

a. Test Equipment.

Nomenclature	Federal stock No.	Reference
Test Set AN/PTM-6	6625-229-1048	TM 11-2062
Multimeter AN/URM-105 ^a	6625-581-2036	TM 11-6625-203-12
Test Set I-181-(*) ^b	6625-229-1042	TM 11-6625-202-10
Test Set TS-140/PCM	6625-243-4888	TM 11-2096
Battery BB-46	6140-126-1544	

^aUse TS-352/U if the AN/URM-105 is not available.

^b(*)Indicates Test Set I-181, I-181-A, or I-181-B.

b. Materials.

Nomenclature	No. required (ea)	Federal stock No.
Battery BA-2	1	6135-120-1028
Battery BA-23	2	6135-120-1024
Battery BA-26	3	6135-120-1023
Battery BA-30	4	6135-120-1020
Battery BA-210/U	4	6135-100-0475
Clip, battery (p/o TE-113)	4	5940-117-1719
Connector, Receptacle U-79/U	1	5935-405-0501
Connector, Electrical Plug U-77/U	1	5935-283-2950
Resistor, 250-ohm, 10-watt	1	5905-247-7943
Resistor, 40-ohm, 10-watt	1	5905-100-8861
Wire, stranded, #20 AWG	20 ft	6145-179-2409 (or equivalent)
Battery BA-34 (3 volts required)	1	6135-120-1017 (or equivalent)
Clip, alligator	2	5940-186-8933

54. Modification Work Orders

The performance standards listed in the tests (para 55 through 60) assume that the modification work order listed below has been performed. A listing of current modification work orders will be found in DA Pamphlet 310-4.

MWO No.	Date	Priority	Echelon	Location of MWO markings	Remarks
11-5805-262-35/1	11 Mar 59	Urgent	3	Front panel below RING BACK-PWR RING FWD switch.	Applied to all Telephone Circuits, Operator's TA-221/PT' having retractable cords. Also all Telephone Circuits, Operator's TA-221/PT' equipped with Handringing Generator G-41/PT.

55. Physical Tests and Inspection

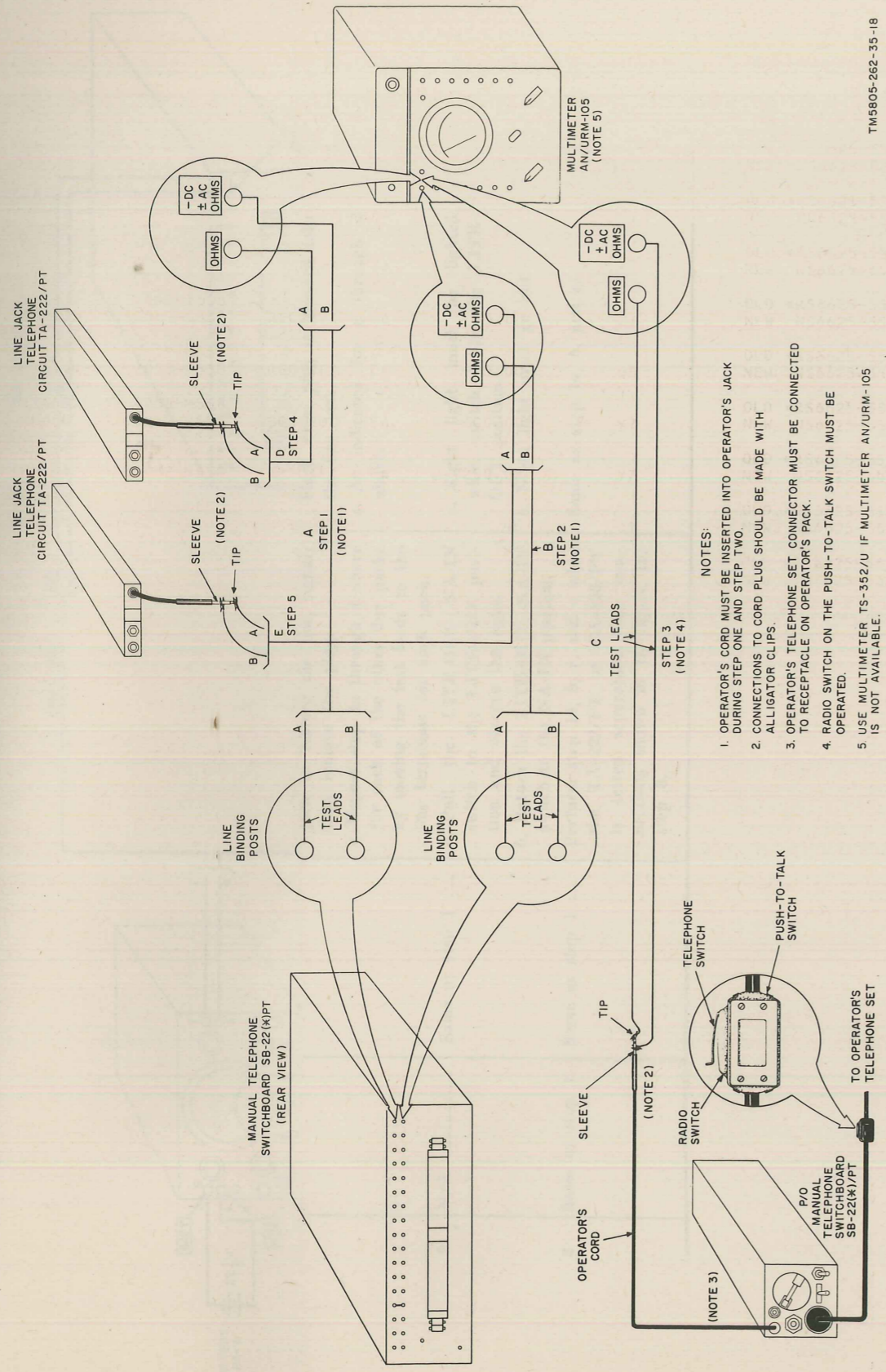
a. *Test Equipment and Materials.* None.

b. *Test Connections and Conditions.* Remove the front cover of the switchboard and remove the H-81A/U, H-144/U, or H-144A/U. Open the rear cover and remove the battery case. Step 2 pertains to the TA-222/PT or TA-326/PT, step 3 pertains to the TA-221/PT, and step 4 pertains to the H-81A/U, H-144/U, or H-144A/U when tested separately.

c. *Procedure.*

Step No.	Test equipment control settings	Equipment under test control setting	Test procedure	Performance standard
1	N/A -----	N/A -----	<p>a. Inspect both front and rear of the, SB-22(*)/PT for loose screws or nuts.</p> <p>b. Inspect operator's cord for excessive wear.</p> <p>c. Extend all line cords to their limits and inspect for excessive wear, breaks, and proper retraction into line packs.</p> <p>d. Inspect all plugs for wear, dirt, corrosion, or bent plugs.</p> <p>e. Inspect all binding posts for looseness and ability to secure wire tightly.</p> <p>f. Inspect battery case spring contacts for possible broken contacts, corrosion, or dirt.</p> <p>g. Inspect battery case for corrosion, dirt, or broken parts. Insert battery case into the SB-22(*)/PT and check retaining springs for proper retention of the case and spring contacts for solid contact with battery case contacts.</p> <p>h. Inspect Handset-Headset H-81A/U, H-144/U, or H-144A/U for broken parts, loose screws, worn cord.</p> <p>i. Inspect the hand ringing generator crank, RING BACK-PWR RING FWD and AUD-OFF-VIS switches for normal operation.</p> <p>j. Inspect Headset-Handset H-81A/U, H-144/U, or H-144A/U connector and plug for dirty contacts and proper connection.</p>	<p>a. All screws and nuts must be tight, none missing.</p> <p>b. Operator's cord must have no breaks in the outside insulation or must show no evidence of dry rot.</p> <p>c. Line cords must be free of breaks or frayed insulation. All line cords must extend easily to their limits and retract fully without binding.</p> <p>d. All plugs must be free of dirt and corrosion. Plugs must not be worn or bent.</p> <p>e. All binding posts must be tight and be capable of securing wire firmly.</p> <p>f. Battery case spring contacts must be free of dirt, corrosion, and broken contacts.</p> <p>g. Battery case must be free of dirt, corrosion, and broken parts. Battery case spring contacts must make solid contact with the battery case contacts.</p> <p>h. The H-81A/U, H-144/U or H-144A/U must have no broken parts or loose screws. The H-81A/U, H-144/U, or H-144A/U cord must show no evidence of dry rot or breaks in the outer covering.</p> <p>i. The generator crank and switches must operate freely without binding.</p> <p>j. Handset-headset connector and plug must be free of dirt and corrosion and must connect properly.</p>

Step No.	Test equipment control settings	Equipment under test control setting	Test procedure	Performance standard
			<p><i>k.</i> Inspect the H-81A/U, H-144/U, or H-144A/U push-to-talk switch for proper operation, tight cover screws, and secure clamping of the cord.</p> <p><i>l.</i> Inspect the night alarm and light switch for secure mounting, proper operation, and broken or chipped lens or switch knob.</p> <p><i>m.</i> Inspect the operator's telephone set receptacle for dirty contacts and proper connection.</p>	<p><i>k.</i> The push-to-talk switch must operate in two steps, with proper locking action in the first step. Cover screws must be tight, none missing, and the cord must be secure in each end of the switch.</p> <p><i>l.</i> The night alarm and lamp switch must be securely mounted in the panel. It should operate smoothly without binding, and the lens and switch knob must be free of chips or cracks.</p> <p><i>m.</i> The operator's telephone set receptacle must be free of dirt and corrosion and must mate properly with the plug.</p>
2	N/A -----	N/A -----	<p><i>a.</i> Inspect case and cover for broken latches, and condition of the retaining straps and cover gasket.</p> <p><i>b.</i> Inspect case and cover for missing parts, and for condition of the paint. NOTE. Touchup painting is recommended instead of refinishing, whenever practicable. Screw heads, binding posts, receptacles, and plated fastener parts should neither be painted nor polished with abrasives.</p> <p><i>c.</i> Inspect lettering on front and rear of the SB-22(*)/PT.</p> <p><i>d.</i> Check BAT MIC and BAT NA leads for proper connection.</p>	<p><i>a.</i> All latches must operate properly; the retaining straps and cover gasket must be serviceable.</p> <p><i>b.</i> Latches must secure the covers tightly and there must be no missing parts. External surfaces intended to be painted must not show bare metal.</p> <p><i>c.</i> Panel lettering must be legible.</p> <p><i>d.</i> Battery connections must be as shown in figure 6.</p>
3	N/A -----	N/A -----	Perform the procedures in step 1 <i>c</i> and <i>d</i> for the TA-222/PT or TA-326/PT when tested separately.	Same as step 1 <i>c</i> and <i>d</i> .
4	N/A -----	N/A -----	Perform the following procedures for the TA-221/PT when tested separately: Step 1 <i>b</i> , <i>d</i> , <i>i</i> , <i>l</i> , and <i>m</i> , and step 2 <i>c</i> .	Same as step 1 <i>b</i> , <i>d</i> , <i>i</i> , <i>l</i> , and <i>m</i> , and step 2 <i>c</i> .
5	N/A -----	N/A -----	Perform the following procedures for the H-81A/U, H-144/U, or H-144A/U when tested separately: Step 1 <i>h</i> , <i>j</i> , and <i>k</i> .	Same as step 1 <i>h</i> , <i>j</i> , and <i>k</i> .



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Figure 18. Rectifier and push-to-talk switch tests.

56. Rectifier and Push-to-Talk Switch Tests

- a. *Test Equipment and Materials.*
 - (1) Multimeter AN/URM-105.
 - (2) Battery BA/30 (4).
- b. *Test Connections and Conditions.*
 - (1) Remove the front cover and open the rear cover.
 - (2) Remove Handset-Headset H-81A/U, H-144/U, or H-144A/U from the front cover.
 - (3) Connect the H-81A/U, H-144/U, or H-144A/U to the operator's telephone set receptacle on the operator's pack.
 - (4) Install four Batteries BA-30.
- c. *Initial Test Equipment Calibration.*
 - (1) Set the selector switch to OHMS XK position.
 - (2) Short the test leads and adjust the OHMS ADJ. control until the meter indicates 0 ohms.
- d. *Procedure.*

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	AN/URM-105 Selector switch OHMS XIK.	Set AUD-OFF-VIS switch to OFF.	Measure and record the resistance indicated on the multimeter when the test leads are connected to the terminals of each of the 12 line packs as shown in A, figure 18, step 1.	a. None. b. Resistance must be 10,000 ohms \pm 4,000 ohms.
2	AN/URM-105 Selector switch: OHMS X10K.	Same as step 1 --	a. Reconnect the multimeter as shown in B, figure 18, step 2. b. Measure and record the resistance of each of the 12 line pack terminals; use the method of step 1 except for the reversed multimeter leads.	a. None. b. The meter should indicate infinity.
3	AN/URM-105 Same as step 2.	a. Remove the operator's cord from operator's jack and connect equipment as shown in C, figure 18, step 3.	a. Depress the telephone switch, on the push-to-talk switch, to the locked and unlocked positions while blowing or talking into the handset-headset transmitter.	a. Sidetone must be heard each time the telephone switch is depressed.
4	TA-222/PT Same as step 1.	No control settings.	b. Depress the radio switch on the push-to-talk switch and observe the multimeter.	b. Multimeter needle must deflect to less than 100 ohms.
5	Same as step 2.	Same as step 4 --	Perform step 1 for the TA-222/PT when tested separately; use connections shown in D, figure 18, step 4. Perform step 2 for TA-222/PT when tested separately; use connections shown in E, figure 18, step 5.	Same as step 1. Same as step 2.

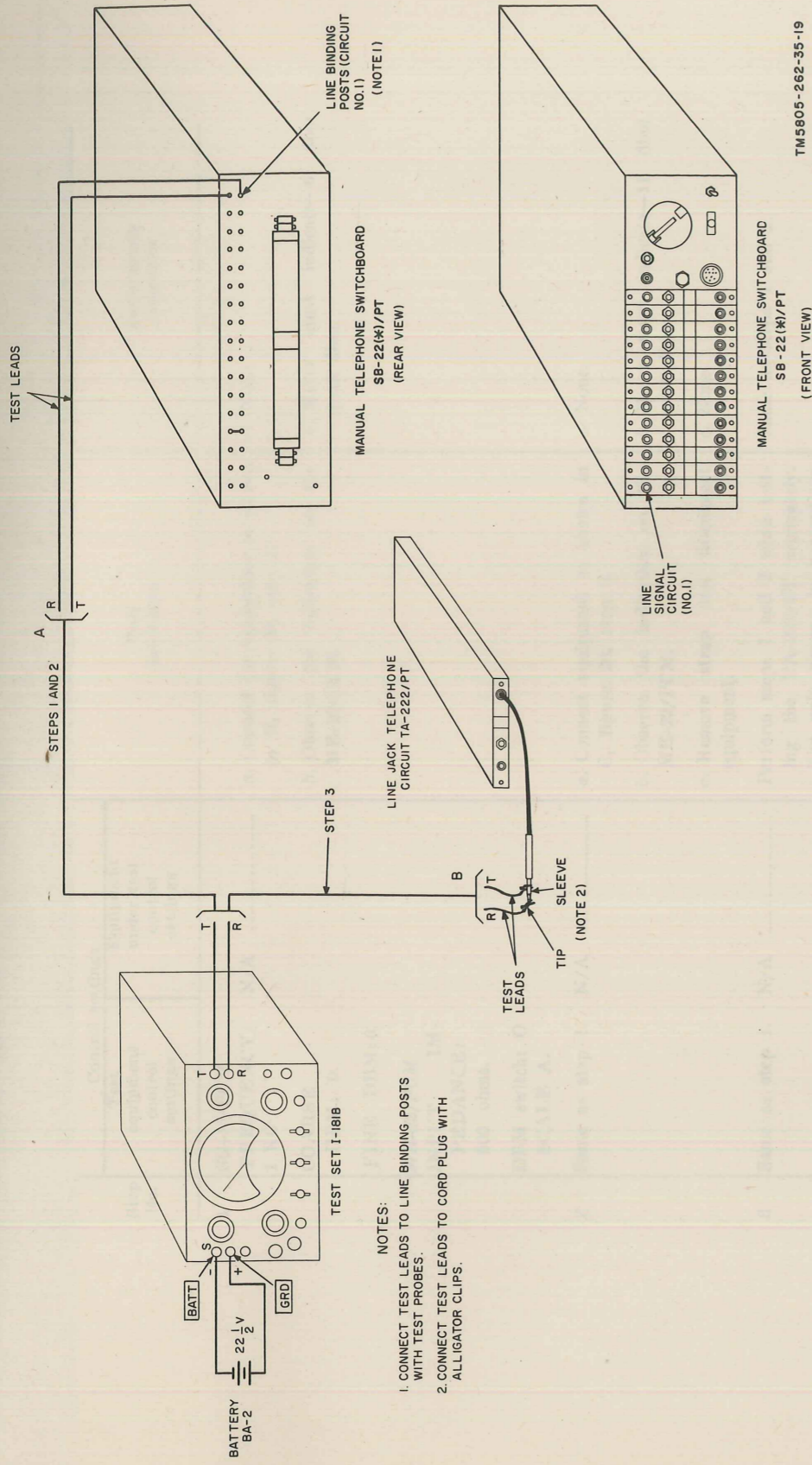


Figure 19. Line and trunk signal efficiency test.

57. Line and Trunk Signal Efficiency Test, TA-222/PT or TA-326/PT

a. Test Equipment and Materials.

- (1) Test Set I-181-(*).
- (2) Battery BA-2 (1).
- (3) Battery BA-30 (4).

b. Test Connections and Conditions.

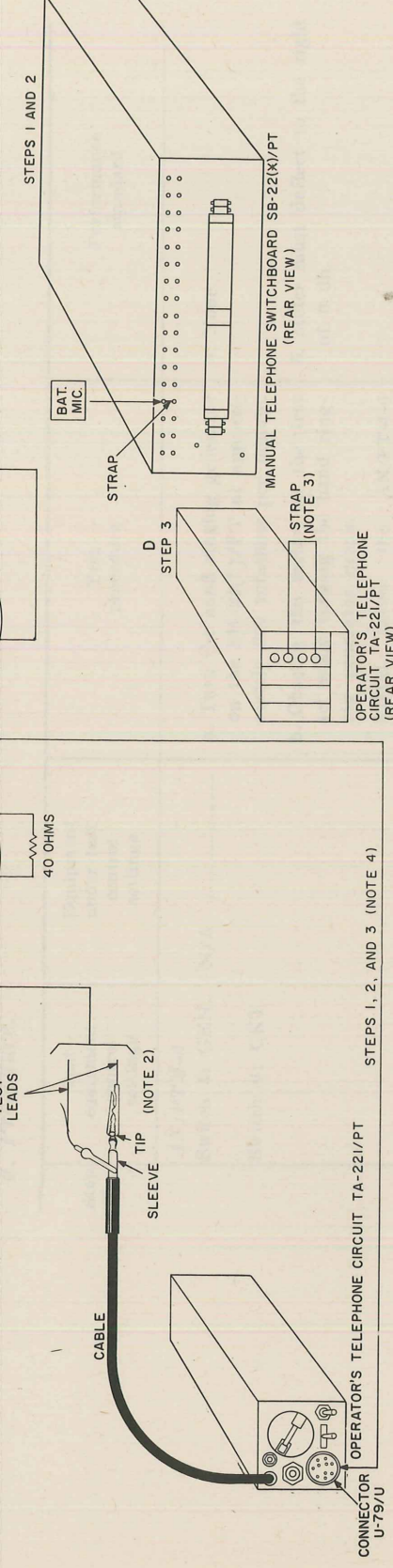
- (1) Remove the front cover and open the rear cover.
- (2) Install Batteries BA-30 in the SB-22(*)/PT.
- (3) Connect the I-181-(*) to the SB-22(*)/PT as shown in A, figure 19.

c. Initial Test Equipment Calibration.

- (1) Install Battery BA-2 in the I-181.
- (2) Set the No. 1 FINE and COARSE controls to the MAX RES position.
- (3) Set the 3000-6000-0 switch to the 0 position.
- (4) Set the 75-150-15 MA switch to the 15 MA position. The meter must indicate a maximum of 2 ma.

d. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	I-181-(*) No. 1 FINE and COARSE: MAX RES positions. 75-150-15 MA switch: 150 MA. 3000-6000-0 switch: 0. REV switch: depressed position.	Plug operator's cord into operator's jack. VIS-OFF-AUD switch set to OFF. All signals on line packs must be black.	a. Operate the SOAK-1 switch to the I position and hold both this switch and the 75-150-15 MA switch operated. b. Slowly adjust the COARSE control clockwise while holding the two switches until the line signal operates. Record the meter indication when the signal operates. c. Operate the VIS-OFF-AUD switch to both positions and observe the audible and visual alarms with the LITE-OUT-NA-IN knob placed in the NA-IN position. d. Plug the line cord into the line jack to restore the line signal; then remove the plug. e. Repeat step 1a through d above for each of the other line packs by moving the test leads to the line terminals for each pack.	a. None. b. Meter must indicate not more than 12 ma when the signal operates. c. Buzzer must sound and the red light must glow when the line signal is white. d. Line signals must restore to black when plug is inserted into the line jack. e. As indicated for a through d above.
2	N/A -----	Same as step 1 ---	a. Pull the LITE-OUT-NA-IN switch to the LITE-OUT position and observe the light. b. Return the LITE-OUT-NA-IN switch to the NA-IN position. Perform step 1a, b, c, and e when the TA-222/PT or TA-326/PT is tested separately. Use connections shown in B, figure 19, step 3.	a. Night light must be lighted when switch is in the LITE-OUT position. b. Night light must go out.
3	Same as step 1.	Same as step 1 ---		Same as step 1a, b, and c.



NOTES:

1. SPARE CONNECTOR U-77/U MUST BE USED FOR THESE CONNECTIONS.
2. ALLIGATOR CLIPS SHOULD BE USED FOR THESE CONNECTIONS.
3. A SPARE CONNECTOR, FROM AN SB-22/PT CASE, MAY BE USED FOR THIS CONNECTION.
4. CONNECTOR U-77/U CONNECTED TO CONNECTOR U-79/U FOR STEPS 1, 2, AND 3.

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Figure 20. Operator's pack, transmission efficiency test.

58. Operator's Pack, Transmission Efficiency

a. Test Equipment and Materials.

- (1) Test Set TS-140/PCM.
- (2) Test leads (2).
- (3) Resistor, 40 ohms.
- (4) Resistor, 250 ohms.
- (5) Clip, battery (2).
- (6) Connector, Plug, Electrical U-77/U.
- (7) Clip, alligator (2).

b. Test Connections and Conditions.

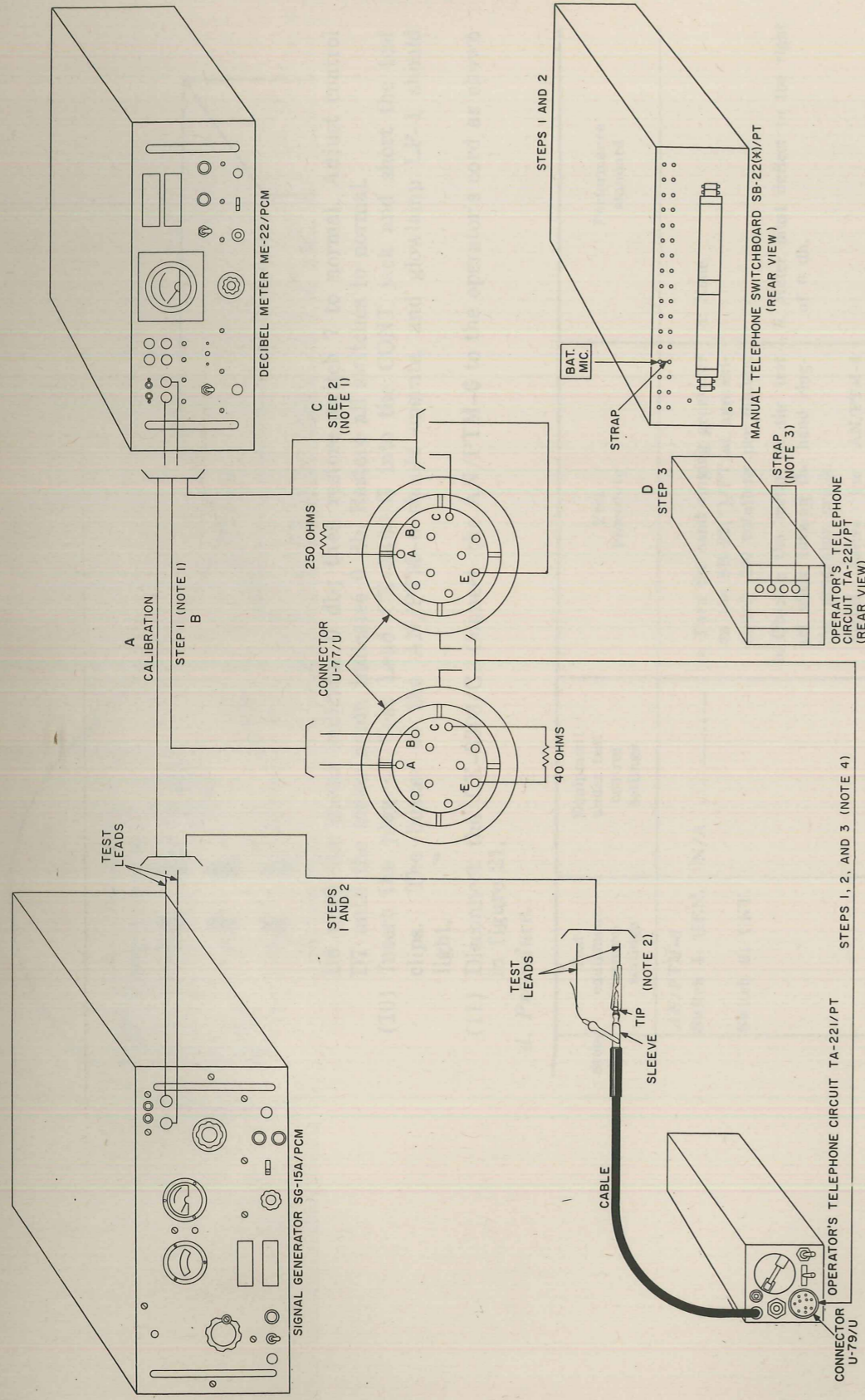
- (1) Remove the battery case from the rear of the SB-22(*)/PT.
- (2) Connect a strap between the BAT.MIC. binding posts on the rear of the SB-22(*)/PT.
- (3) Connect the 40-ohm resistor across terminals E and C of the U-77/U.
- (4) Connect the U-77/U to the operator's telephone set receptacle on the front of the operator's pack.

c. Initial Test Equipment Calibration.

- (1) Connect the test equipment to the power source and allow a 10-minute warmup period before starting the calibration procedures. Connect the SG-15/PCM to the ME-22/PCM as shown in A, figure 20.
- (2) On the SG-15/PCM, set the frequency control to 0.2 KC, the FINE DBM control to its midposition, and the COARSE DBM control to -20.
- (3) On the ME-22/PCM, set the INPUT IMPEDANCE switch to 600 OHMS and the DBM switch to +10, SCALE A.
- (4) Adjust the FINE DBM control on the SG-15/PCM for an indication of +6 dbm on the OUTPUT LEVEL meter.
- (5) Set the FREQUENCY control to ZERO as indicated on the KILOCYCLES dial and adjust the ZERO BEAT ADJ control for a zero indication on the OUTPUT LEVEL meter.
- (6) Set the FREQUENCY control to 1 KC, the COARSE DBM to 0, and adjust the FINE DBM control for an indication of 0 db on the OUTPUT LEVEL METER.
- (7) On the ME-22/PCM, set the DBM switch to 0 SCALE B, and adjust the CAL ADJ for an indication of 0 db on the db meter.
- (8) Reset the DBM switch to 0 SCALE A; the db meter must indicate 0 ± 0.5 db.
- (9) Disconnect the SG-15/PCM from the ME-22/PCM.

d. Procedure.

Step No.	Control settings		Test procedure	Performance standard
	Test equipment control settings	Equipment under test control settings		
1	SG-15/PCM FREQUENCY: N/A 1 KC COARSE DBM: 0. FINE DBM: 0. ME-22/PCM INPUT IMPEDANCE: 600 ohms. DBM switch: 0 SCALE A.	N/A	a. Connect the equipment as shown in B, figure 20, step 2. b. Observe the indication on the ME-22/PCM.	a. None. b. Meter must indicate—6 dbm ± 0.5 dbm.
2	Same as step 1.	N/A	a. Connect equipment as shown in C, figure 20, step 3. b. Observe the indication on the ME-22/PCM. c. Remove strap and disconnect equipment.	a. None. b. Meter must indicate—11 dbm ± 0.5 dbm. c. None.
3	Same as step 1.	N/A	Perform steps 1 and 2 when testing the TA-221/PT separately. The only change in connections is shown in D, figure 20, step 3.	Same as steps 1 and 2.



- NOTES:
1. SPARE CONNECTOR U-77/U MUST BE USED FOR THESE CONNECTIONS.
 2. ALLIGATOR CLIPS SHOULD BE USED FOR THESE CONNECTIONS.
 3. A SPARE CONNECTOR, FROM AN SB-22/PT CASE, MAY BE USED FOR THIS CONNECTION.
 4. CONNECTOR U-77/U CONNECTED TO CONNECTOR U-79/U FOR STEPS 1, 2, AND 3.

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Figure 20. Operator's pack, transmission efficiency test.

58. Operator's Pack, Transmission Efficiency

a. Test Equipment and Materials.

- (1) Test Set TS-140/PCM.
- (2) Test leads (2).
- (3) Resistor, 40 ohms.
- (4) Resistor, 250 ohms.
- (5) Clip, battery (2).
- (6) Connector, Plug, Electrical U-77/U.
- (7) Clip, alligator (2).

b. Test Connections and Conditions.

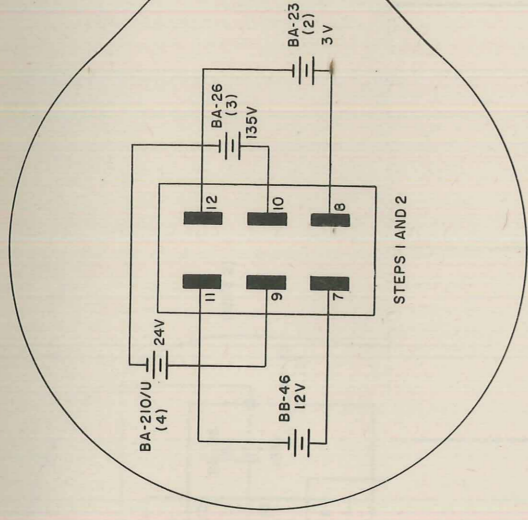
- (1) Remove the battery case from the rear of the SB-22(*)/PT.
- (2) Connect a strap between the BAT.MIC. binding posts on the rear of the SB-22(*)/PT.
- (3) Connect the 40-ohm resistor across terminals E and C of the U-77/U.
- (4) Connect the U-77/U to the operator's telephone set receptacle on the front of the operator's pack.

c. Initial Test Equipment Calibration.

- (1) Connect the test equipment to the power source and allow a 10-minute warmup period before starting the calibration procedures. Connect the SC-15/PCM to the ME-22/PCM as shown in A, figure 20.
- (2) On the SG-15/PCM, set the frequency control to 0.2 KC, the FINE DBM control to its midposition, and the COARSE DBM control to -20.
- (3) On the ME-22/PCM, set the INPUT IMPEDANCE switch to 600 OHMS and the DBM switch to +10, SCALE A.
- (4) Adjust the FINE DBM control on the SG-15/PCM for an indication of +6 dbm on the OUTPUT LEVEL meter.
- (5) Set the FREQUENCY control to ZERO as indicated on the KILOCYCLES dial and adjust the ZERO BEAT ADJ control for a zero indication on the OUTPUT LEVEL meter.
- (6) Set the FREQUENCY control to 1 KC, the COARSE DBM to 0, and adjust the FINE DBM control for an indication of 0 db on the OUTPUT LEVEL METER.
- (7) On the ME-22/PCM, set the DBM switch to 0 SCALE B, and adjust the CAL ADJ for an indication of 0 db on the db meter.
- (8) Reset the DBM switch to 0 SCALE A; the db meter must indicate 0 ± 0.5 db.
- (9) Disconnect the SG-15/PCM from the ME-22/PCM.

d. Procedure.

Step No.	Control settings		Test procedure	Performance standard
	Test equipment control settings	Equipment under test control settings		
1	SG-15/PCM			



NOTES:

1. ALLIGATOR TYPE CLIPS SHOULD BE USED FOR THESE CONNECTIONS.
2. CONNECTIONS FOR STEPS 1 AND 2 ARE IDENTICAL. THE TA-221/PT IS SEPARATE FOR STEP 2.
3. A SPARE CONNECTOR, FROM AN SB-22/PT CASE, MAY BE USED FOR THESE CONNECTIONS.

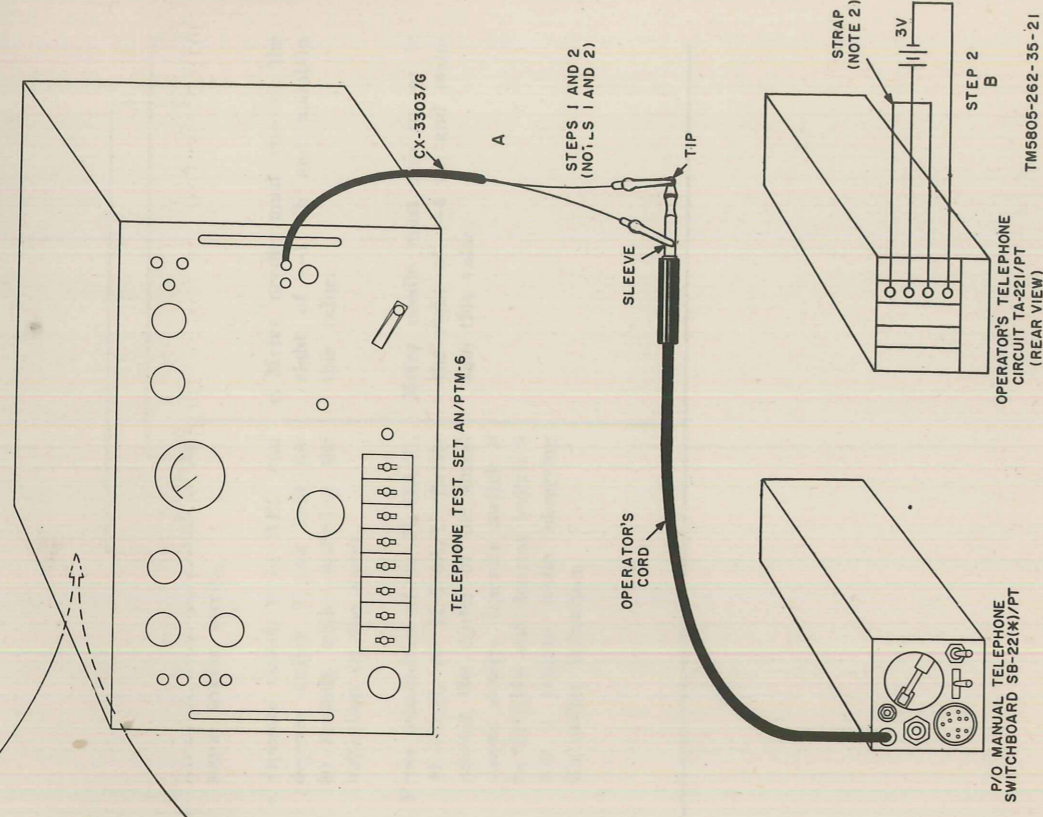


Figure 21. Operator's pack, hand ringing generator efficiency test.

59. Hand Ringing Generator Efficiency Test

a. Test Equipment and Materials.

- (1) Test Set AN/PTM-6.
- (2) Battery BA-23 (2).
- (3) Battery BA-26 (3).
- (4) Battery BA-210/U (4).
- (5) Battery BB-46 (2).
- (6) Clip, battery (2).

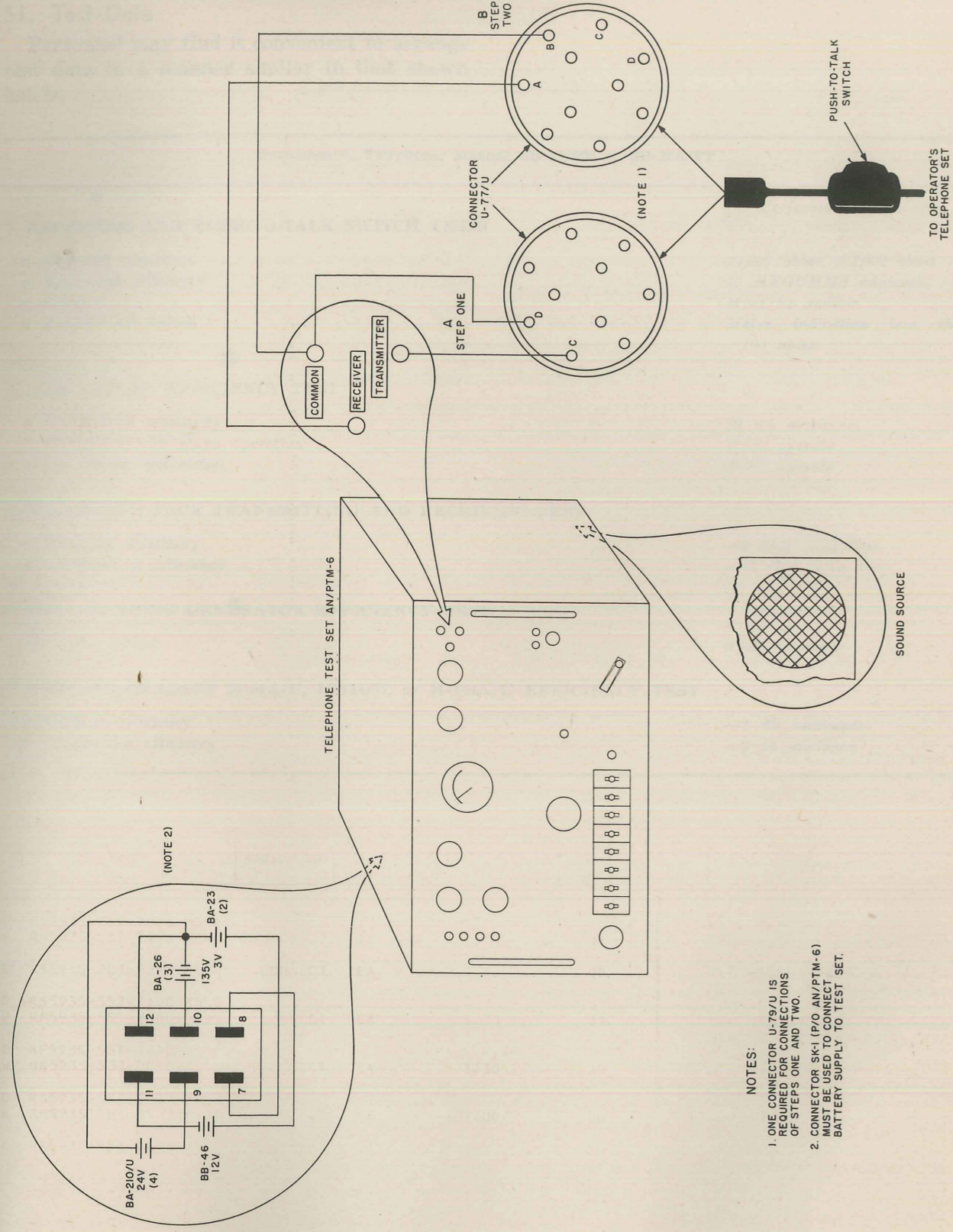
b. Test Connections and Conditions. The procedures for performing the ringing generator efficiency test are the same whether the operator's pack is installed in the SB-22(*)/PT or tested separately.

c. Initial Test Equipment Calibration.

- (1) Turn the test equipment on and allow it to warm up for at least 5 minutes before starting the calibration procedures.
- (2) Operate switch 7 to DC and rotate control D5 to the 135, 24, and 12 VOLTS positions. The meter must indicate in the blue at each switch position.
- (3) With control D5 in the 12 VOLTS position, depress switch 9. The meter must indicate in the blue.
- (4) Restore switch 7 to the normal position (center) and rotate control D5 to RINGER CUR 1.
- (5) Rotate control D9 to its maximum counterclockwise position; operate switch 6 to COND and switch 5 to CHK.
- (6) Rotate control D9 clockwise until LP-2 begins to glow. Restore switches 5 and 6.
- (7) Operate switch 7 to DC, switch 6 to %BRK, and adjust control D6 for a full scale deflection on the meter.
- (8) Operate switch 3 to DIAL SPEED. The meter must indicate slowly to above or near full scale. Restore switches 3, 6, and 7 to the normal position.
- (9) Operate switch 5 to CHK, switch 7 to CHK, and depress switch 9. Adjust control D8 until the meter indicates 0 db; then restore switch 7 to normal. Adjust control D7 until the meter again indicates 0 db. Restore all switches to normal.
- (10) Insert the plug of Test Lead CX-3303/G into the CONT jack and short the test clips. The buzzer in the AN/PTM-6 should operate, and glowlamp LP-1 should light.
- (11) Disconnect the CX-3303/G. Connect the AN/PTM-6 to the operator's cord as shown in figure 21.

d. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
AN/PTM-6 Switch 4: GEN. Switch 6: CKT.	N/A	-----	<p>a. Turn the hand ringing generator on the SB-22(*)/PT at approximately 200 rotations per minute.</p> <p>b. Observe the meter on the test set while turning the hand ringing generator crank.</p> <p>NOTE. Leave the AN/PTM-6 turned on for use in the following test.</p>	<p>a. None.</p> <p>b. Meter must deflect to the right of 0 db.</p>



NOTES:

1. ONE CONNECTOR U-79/U IS REQUIRED FOR CONNECTIONS OF STEPS ONE AND TWO.
2. CONNECTOR SK-1 (P/O AN/PTM-6) MUST BE USED TO CONNECT BATTERY SUPPLY TO TEST SET.

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Figure 22. Handset-Headset H-81A/U, H-144/U, or H-144A/U, efficiency test.

60. Handset-Headset H-81A/U, H-144/U, or H-144A/U Efficiency Test

a. Test Equipment and Materials.

- (1) Test Set AN/PTM-6.
- (2) Battery BA-23 (2).
- (3) Battery BA-26 (3).
- (4) Battery BA-210/U (4).
- (5) Battery BB-46 (2).
- (6) Connector, Receptacle U-79/U.

b. Test Connections and Conditions. The H-81A/U, H-144/U, or H-144A/U is tested separately. Connect the equipment as shown in A, figure 22.

c. Initial Test Equipment Calibration. The AN/PTM-6 should be calibrated and in operation.

d. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	AN/PTM-6 Switch 1: CBPE.	N/A	<p>a. Operate control D2 to position 2, control D4 to position 6, and EQUALIZER to OUT.</p> <p>b. Operate switch 2 to RCT and hold the receiver of the H-81A/U, H-144/U, or H-144A/U firmly against the center of the sound source screen.</p> <p>c. Operate switch 8 to REC and depress switch 9 and hold for 30 seconds while observing the indication on the meter.</p>	<p>a. None.</p> <p>b. None.</p> <p>c. Meter needle must rise to the right of -1 db and maintain this value.</p>
2	AN/PTM-6 Switch 1: CBPE. D1: 2. D3: 2. Switch 2: RCT	Push-to-talk switch operate and locked.	<p>Press transmitter of the H-81A/U, H-144/U, or H-144A/U firmly against the center of the sound source screen. Operate switch 8 to TRANS and depress switch 9 for 1 minute while observing the meter indication.</p>	<p>Meter needle must rise to, or to the right of, -4 db and maintain this value.</p>

61. Test Data

Personnel may find it convenient to arrange test data in a manner similar to that shown below.

Switchboard, Telephone, Manual SB-22/PT or SB-22A/PT

	<i>Performance standard</i>
1. RECTIFIER AND PUSH-TO-TALK SWITCH TESTS	
a. Forward resistance	10,000 ohms \pm 4,000 ohms
b. Backward resistance	10 MEGOHMS minimum
c. Sidetone	Must be audible
d. Push-to-talk switch	Meter indication less than 100 ohms.
2. LINE SIGNAL EFFICIENCY TEST	
a. Line signal sensitivity	12 ma maximum
b. AUD-OFF-VIS alarm operation	Must operate
c. Line signal restoration	Must operate
3. OPERATOR'S PACK TRANSMITTING AND RECEIVING TEST	
a. Receiving efficiency	-6 dbm \pm 0.5 dbm
b. Transmitting efficiency	-11 dbm \pm 0.5 dbm
4. HAND RINGING GENERATOR EFFICIENCY TEST	
Generator output	0 db minimum
5. HANDSET-HEADSET H-81A/U, H-144/U, or H-144A/U EFFICIENCY TEST	
a. Receiver efficiency	-1 db minimum
b. Transmitter efficiency	-4 db minimum

CHAPTER 4

FIFTH ECHELON MAINTENANCE

62. Fifth Echelon Tools and Test Equipment

Tools and test equipment required for fifth echelon maintenance of the SB-22(*)/PT are the same as listed in paragraph 46.

63. Fifth Echelon Maintenance Procedure

The fifth echelon maintenance procedures are the same as the fourth echelon maintenance procedures and may be performed at either echelon. Refer to the procedures given in paragraphs 46 through 51 for detailed repair procedures. For final testing information refer to paragraphs 52 through 61.

APPENDIX

REFERENCES

-
- TM 11-2062 Test Sets I-142, I-142-A, I-142-B, and Telephone Test Set AN/PTM-6.
- TM 11-2096 Test Set TS-140/PCM; Signal Generators SG-15/PCM and SG-15A/PCM; and Decibel Meters ME-22/PCM and ME-22A/PCM.
- TM 11-5540 Electric Light Assembly MX-1292/PAQ.
- TM 11-5805-262-12 Operator's and Organizational Maintenance Manual, Switchboards, Telephone, Manual SB-22/PT and SB-22A/PT.
- TM 11-5805-262-20P Organizational Maintenance Repair Parts and Special Tools List for Switchboard, Telephone, Manual SB-22/PT and SB-22A/PT.
- TM 11-5805-262-35P Field and Depot Maintenance Repair Parts and Special Tools List for Switchboards, Telephone, Manual SB-22/PT and SB-22A/PT.
- TM 11-6625-202-10 Operator's Manual: Test Sets I-181, I-181-A, and I-181-B.
- TM 11-6625-203-12 Operation and Organizational Maintenance: Multimeter AN/URM-105, Including Multimeter ME-77/U.

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USAR: None.

For explanation of abbreviations used, see AR 320-50.

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