

76C TEST SET
DESCRIPTION AND MAINTENANCE
AND ESTABLISHING TALK AND/OR CALLING CIRCUIT

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1. GENERAL	1	1.01 This section covers the description, use, and maintenance of the 76C test set, the method of identifying conductors, and the method of establishing talk and/or "calling" circuits.
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NOTICE

Not for use or disclosure outside the
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2. DESCRIPTION

2.01 The 76-type test set is a vacuum tube oscillator producing a tone having a frequency of about 500 Hz with a 7 Hz warble. The resulting tone is easily recognized from noise in cables.

2.02 The 76-type test set (Fig. 1) is housed in a stamped sheet metal box with a removable hinge cover. It is furnished with two 6-foot transfer cords with insulation piercing clips at one end and battery clips at the other end.

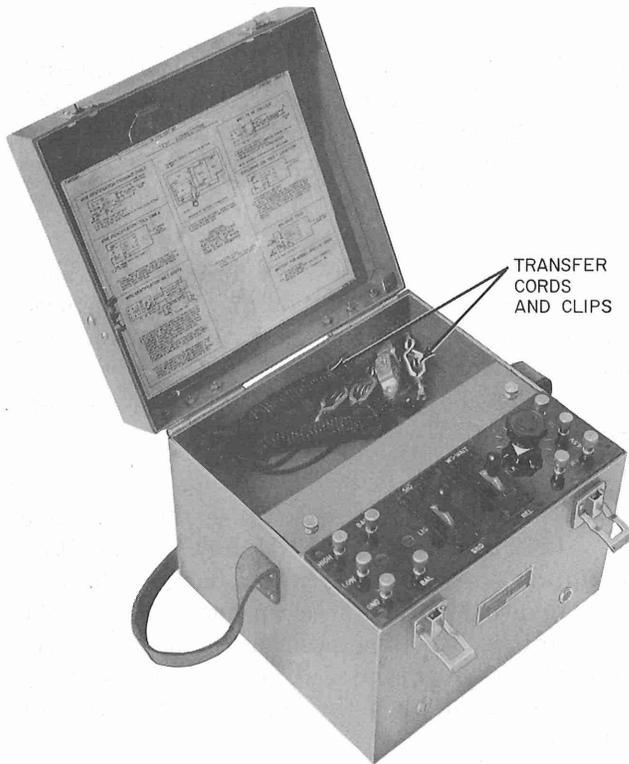


Fig. 1—76-Type Test Set

2.03 The 76-type test sets are equipped with two commercially available radio tubes. The chassis is stamped near the tube socket with the number of the tube to simplify field replacement of defective tubes. The set is operated by two 4-1/2 volt KS-6570 and two 24-volt KS-6571 batteries.

2.04 Figure 2 illustrates the equipment cover removed to show the location of tubes and batteries to facilitate replacement.

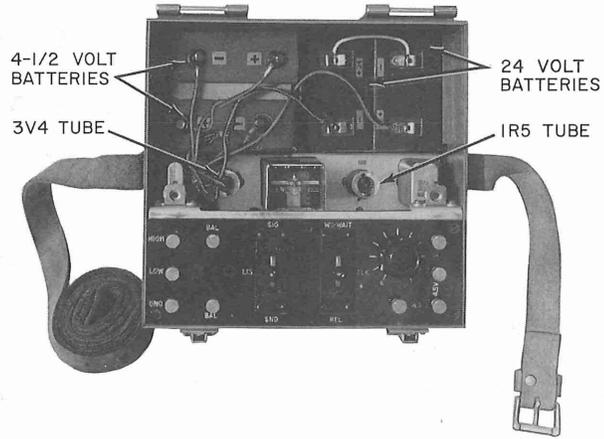
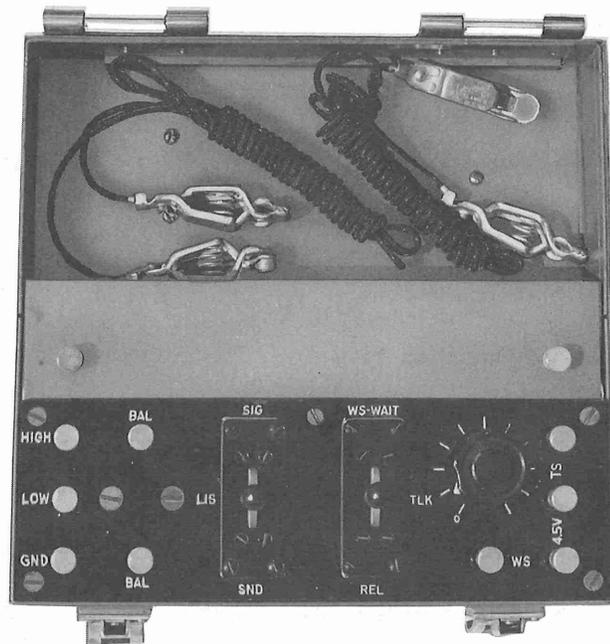


Fig. 2—Equipment Layout (Cover Removed)

2.05 The positions and markings of the keys and binding posts on the 76-type set are shown in Fig. 3.



ABBREVIATIONS

GND — GROUND	WAIT — WAIT
BAL — BALANCE	TLK — TALK
SIG — SIGNAL	REL — RELAY
LIS — LISTEN	L — LINE
SND — SEND	TS — TALKING SET
WS — WET SECTION	

Fig. 3—Key and Post Designations

2.06 Figure 4 is a schematic circuit diagram of the 76-type test set.

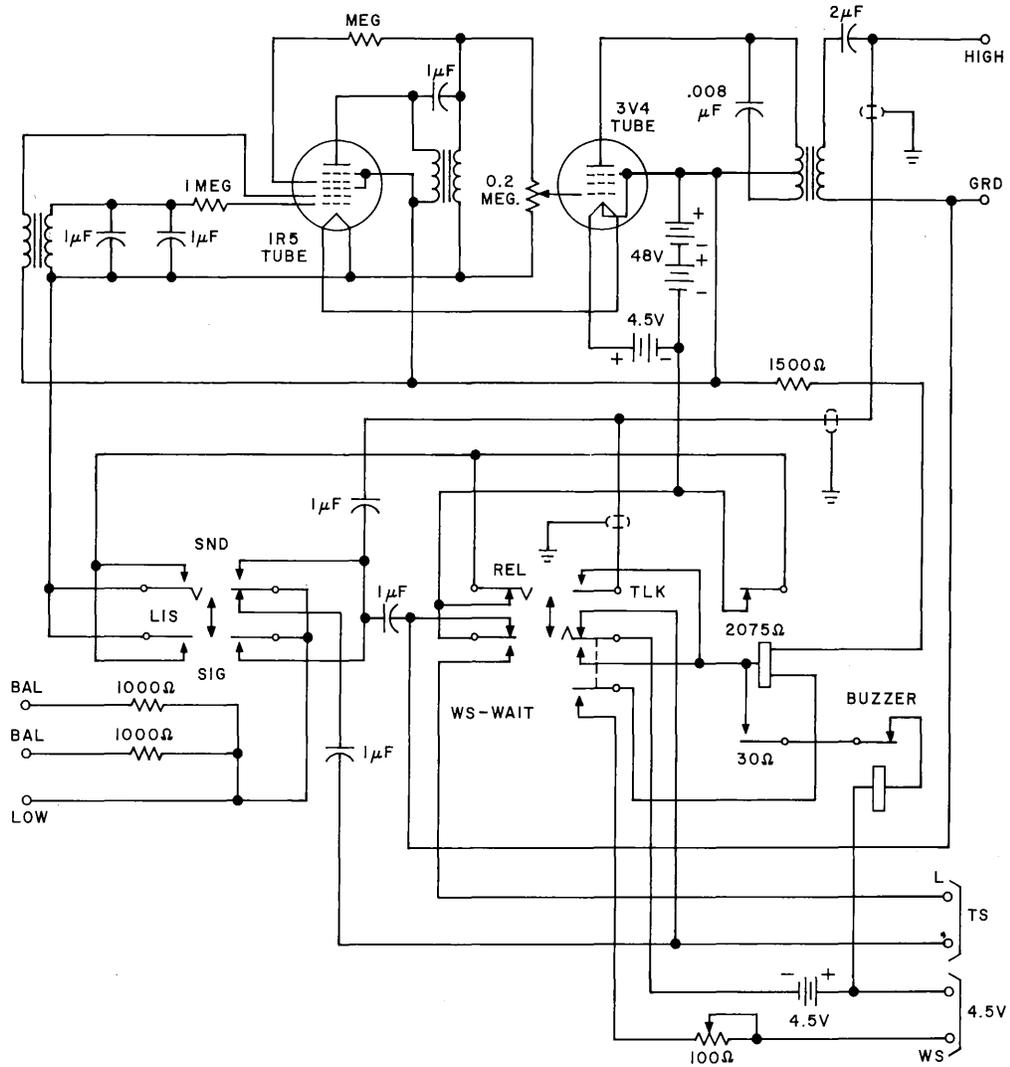


Fig. 4—Circuit Diagram of 76-Type Test Set

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2.07 The set has both LOW and HIGH amplitude tone outputs. The LOW tone is used to identify exchange cable pairs, in which case operation of the tone is applied from one conductor to ground. The HIGH tone is used to identify conductors in toll or exchange cable whenever tone is applied between two metallic wires of a pair or quad.

2.08 The HIGH tone is also used in exchange cables for fault locating by means of exploring coil tests. A 147-type amplifier or 91A test set is required with the 101B, 105D, 106A, and 111A test sets (exploring coils) to permit hearing the tone. Low tone from the 76-type test set should be used whenever practical in fault locating work to avoid interference with working lines.

3. IDENTIFYING CONDUCTORS

3.01 The use of the 76C test set to identify working subscriber lines should be limited

to those cases exceeding the range of the AT-8121 test set (two miles of nonloaded or 9.0 kft of H88 loaded cable), a 20 kHz identifier. Section 634-200-520 describes the use of the AT-8121 set.

3.02 The tone produced by the 400A tone generator, used in central offices to indicate to a subscriber that his receiver is off-hook, may be mistaken for the 76C tone. The use of the AT-8121 test set is unaffected by the tone produced by the 400A tone generator. If doubt exists whether the proper pair has been identified, it may be necessary to remove and reapply the 76C tone to the conductor under identification.

A. Nonworking Cables

3.03 Using Fig. 5, perform the following STEP, ACTION, VERIFICATION procedures to identify pairs in nonworking cables:

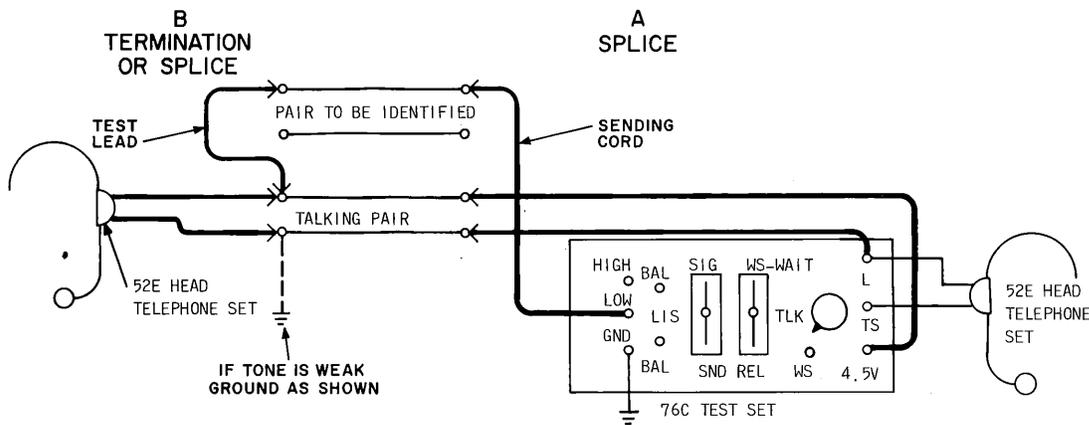


Fig. 5—Identifying Nonworking Conductors

STEP	ACTION	VERIFICATION
1	At the sending end (A) and receiving end (B), make the connections.	
2	At A, select a pair to be identified and connect the sending cord to one wire of the pair.	
3	With the right-hand key in the TLK (talking) position, operate the left-hand key to the SIG (signaling) position.	Identifying tone will be heard in the talking circuit, indicating to B that a pair is ready to be identified.
4	Operate the left-hand key to the SND (sending) position.	
5	At B, run over the conductors with an exploring coil until the pair with tone is located.	
6	Proceed with the identification of the other pairs in a similar manner.	

3.04 If the cable is very short, the tone may be too weak to identify the conductors. In this event, the tone can be increased by placing a ground on the talking pair at end B on the side opposite the one to which the test lead is connected by the dotted line in Fig. 5.

B. Working Cables

3.05 In working cables, the method employed depends on the type of circuits working in the cable.

3.06 Cable or Group of Conductors in a Cable Containing No Special Circuits:

Tone may be sent from the splice and identified at a termination in a working cable that does not contain special circuits or in a group (or complement) that does not contain special circuits, provided the group (or complement) can be identified and segregated.

3.07 Using Fig. 6, perform the following STEP, ACTION, VERIFICATION procedures to identify pairs in working cables containing no special circuits:

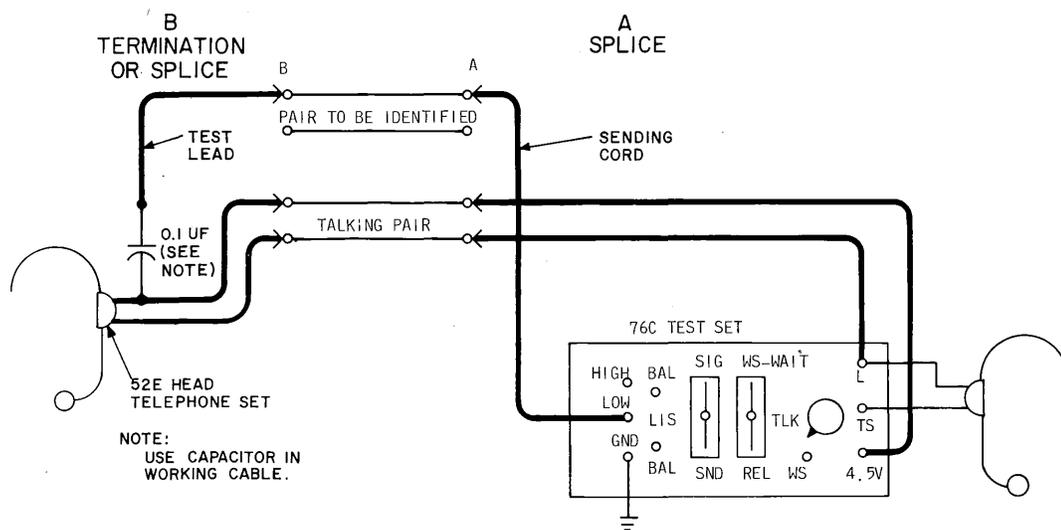


Fig. 6—Identifying Working Conductors—No Special Circuits

STEP	ACTION	VERIFICATION
1	Make the connections at the sending end (A) and at the identifying end (B).	
2	At A, select a pair to be identified.	
3	With the left-hand key in the LIS (listening) position, connect the sending cord to one wire of the pair and listen to determine if the pair is busy.	
4	If the pair is idle or spare, operate the left-hand key to the SIG position and then to the SND position.	In the SIG position, tone will be heard in the talking circuit indicating that the pair is ready to be identified.
5	At B, run over the conductors with an exploring coil, using the lead from the 0.1 μ F capacitor, until the pair with tone is located.	
6	After the first pair has been identified, proceed with the identification of other pairs in a similar manner.	

3.08 If the conductors are being identified at a main frame by a test point along the protector or connector, do not make contact between adjacent connectors. This will cross or short working circuits and will result in service interruption.

CAUTION: When identifying conductors in a cable containing working pairs, care must be exercised at A and B to avoid contact with any special circuits.

3.09 If the cable is short, the received tone may be weak, making identification difficult. In

this event, the tone can be increased by connecting the GND post to one side of the talking circuit instead of to ground as indicated in Fig. 7. The connection should be made at A to the side without the test lead connected at B.

3.10 Cable or Group of Conductors in a Cable Containing a Special Circuit:

Tone may be sent from a termination where the identity of the circuits is known after a listening test is made on conductors used for subscriber loops or interoffice trunks and after authorization has been obtained to turn down or open conductors that are assigned to special circuits.

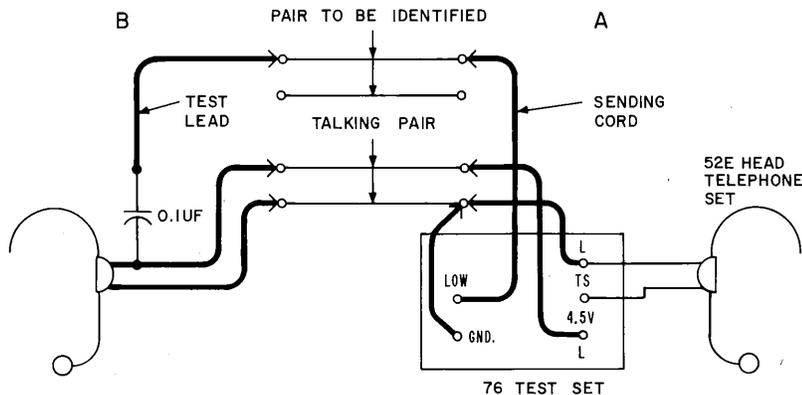


Fig. 7—Identifying Working Conductors—Special Connection—Weak Tone

3.11 Using Fig. 8, perform the following STEP, ACTION, VERIFICATION procedures to identify pairs at a splice (B):

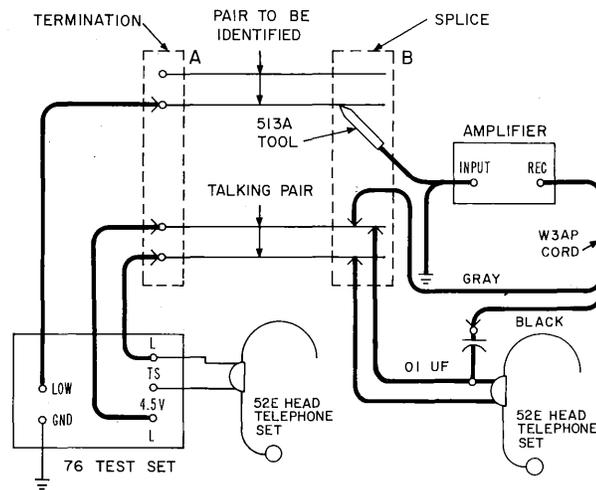


Fig. 8—Identifying Working Conductors—Special Circuits Present

STEP	ACTION	VERIFICATION
1	At the identifying end, the conductors must be identified by means of an amplifier and a probe.	
2	Make the connections at the sending end (A) and at the identifying point (B) as shown.	
3	The amplifier and talking set at B are operated with a single receiver. (The talking set and amplifier can be connected using separate receivers as shown in Fig. 9.)	

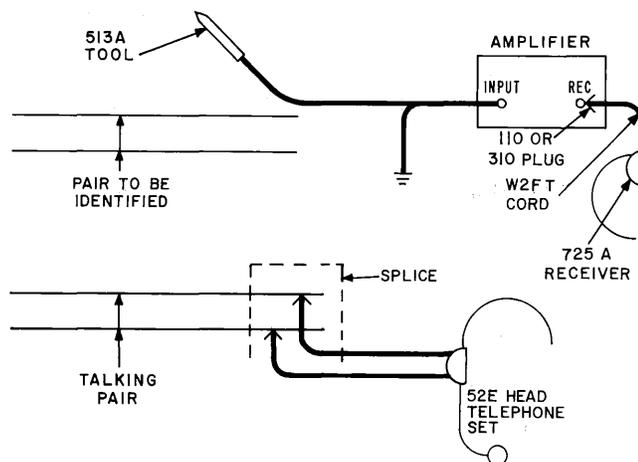


Fig. 9—Identifying Conductors—Using Separate Receivers

STEP	ACTION	VERIFICATION
4	At the sending end, select a conductor to be identified.	
5	With the left-hand key in the LIS position, connect the sending cord to one wire of the pair and make a listening test.	If the pair is idle or spare,—
6	Operate the key to the SIG position and then to the SND position.	In the SIG position, tone will be heard in the talking circuit, indicating that the pair is ready to be identified.
7	At the identifying end, probe through the conductors with the 513A tool until the conductor with tone is located.	After the first pair has been identified.
8	Proceed with the identification of the other pairs in a similar manner.	

3.12 If difficulty is experienced identifying conductors because of induced 60 Hz noise, the interference may be reduced by making one of the following changes in the connections:

(b) Disconnect the ground lead of the amplifier from ground and connect it and the ground lead of the 76 test set to the same side of the talking pair (Fig. 10).

(a) Either disconnect the ground lead of the amplifier from ground and allow it to hang free, or

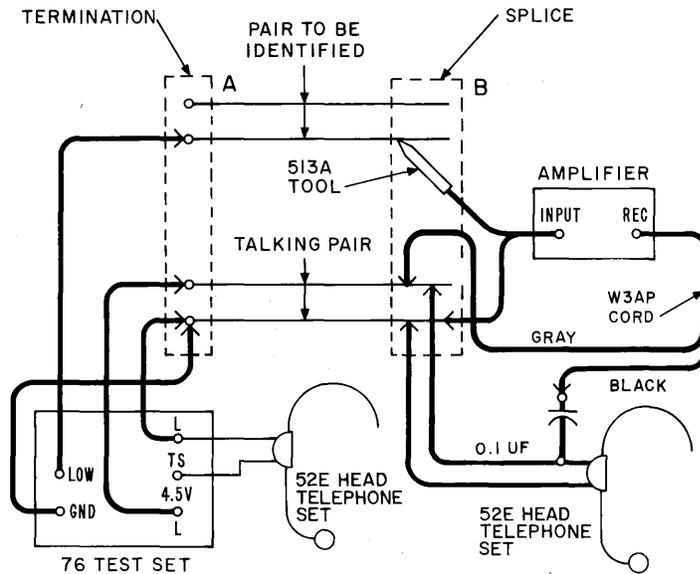


Fig. 10—Identifying Working Conductors—Noise Reduction

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A. Dead Cables

4.02 If a talk circuit is required in a dead cable from a distribution terminal to either a splice or a sheath opening nearby, it may be desirable

to select the pair at the terminal and identify it at the splice. If the test set is to remain at the splice, the pair should be grounded at the terminal and identified as a ground at the splice. The procedure is as follows:

STEP	ACTION	VERIFICATION
1	At the terminal, select a pair and connect a talk set across that pair and ground one side as shown in Fig. 12.	

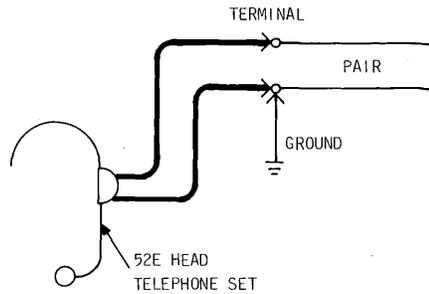


Fig. 12—Connecting *Talk Set at Terminal

2	At the splice or sheath opening, connect a talk set as shown in Fig. 13. Set the keys to LIS and WS-WAIT; then use test pick to make contact with the wires.	
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The buzzer in the set operates indicating that the pair has been located.

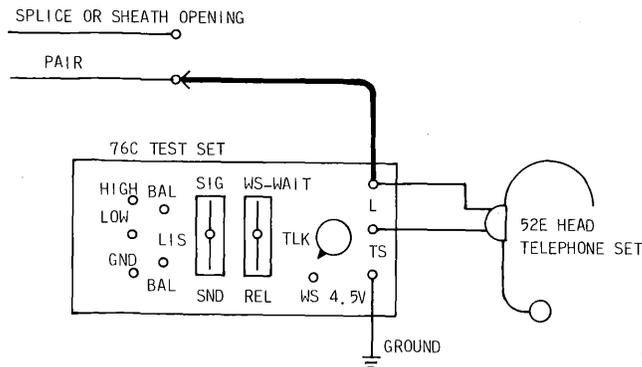


Fig. 13—Connecting Talk Set at Splice or Sheath Opening

STEP	ACTION	VERIFICATION
3	After the pair has been located at the sheath opening, clear the ground and connect the lower L post to the talk pair.	This will again operate the buzzer in the set.
4	Shift the key from WS-WAIT to TLK.	This will stop the buzzer.
5	Clear the ground at the terminal.	
6	The final connection is shown in Fig. 14.	

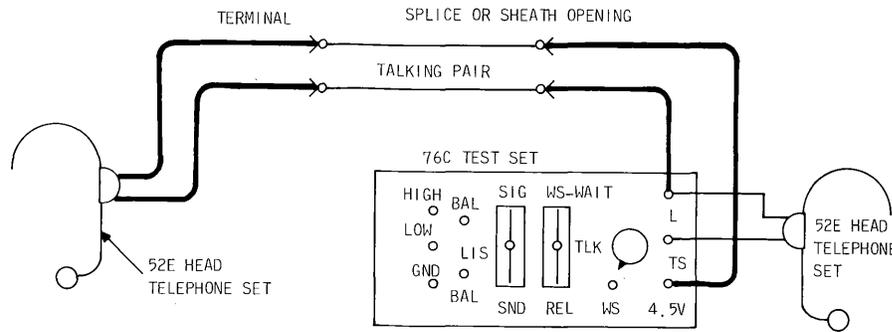


Fig. 14—Final Connection

4.03 If the talk pair is to be selected from a splice or a large terminal, it is generally desirable to use tone to identify the pair at the other end. Designating the two places as A and B, each of which may be a splice, sheath opening, or termination, the general procedure is:

SELECTING PAIR BY TONE

STEP	ACTION	VERIFICATION
1	At the sending end (A), make the connections as illustrated in Fig. 15 and send tone on the talking pair with the keys in the SND and WS-WAIT positions.	

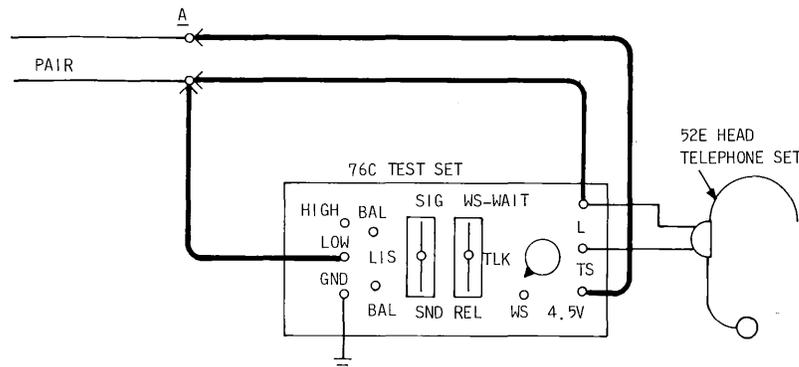


Fig. 15—Connection at Sending End

STEP	ACTION	VERIFICATION
2	At the identifying end (B), ground one side of the talk set (Fig. 16) and run over the wires or binding posts until the pair with the tone is located.	Pair with tone has been located.

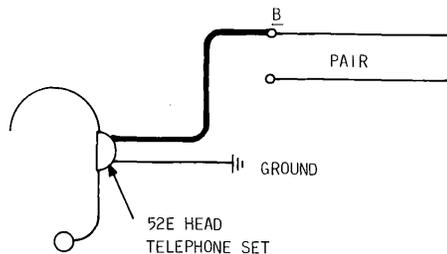


Fig. 16—Grounding One Side of Talk Set

3	At B, connect the talk set across the pair.	This operates the buzzer at A.
4	At A, shift the keys to LIS and TLK positions and remove the connection to the LOW post. The talk circuit should be as shown in Fig. 17.	

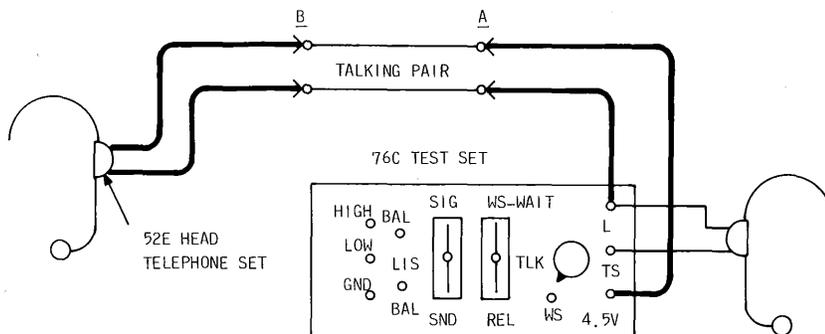


Fig. 17—Talk Connection at A Position

B. Working Cables

4.04 In working cables or complements (provided they can be identified and segregated from other working complements) that do not contain special circuits, a talk circuit may be established using the following methods:

CABLE OR COMPLEMENT NOT CONTAINING SPECIAL CIRCUITS

STEP

PROCEDURE

- At the sending end (A) connect the set as illustrated in Fig. 18 and with the keys in the LIS and TLK positions, select a pair.

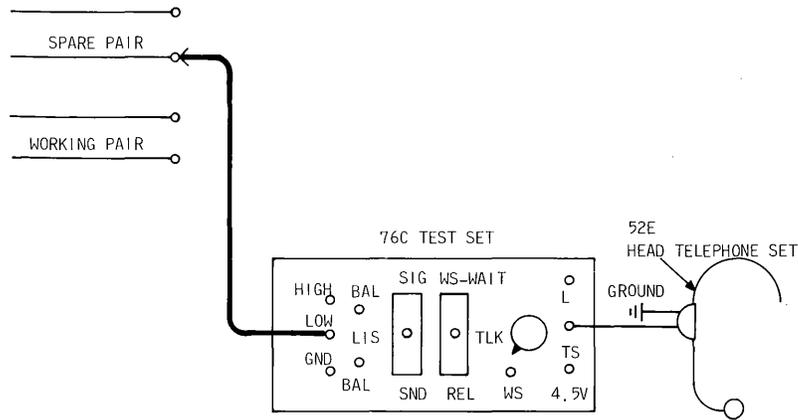


Fig. 18—Test Connections at Sending End

- Test the spare pair for defects by means of the battery and receiver tests. Set up the talk circuit at the sending end as shown in Fig. 19 and send tone on the talk pair with the keys in the SND and WS-WAIT positions.

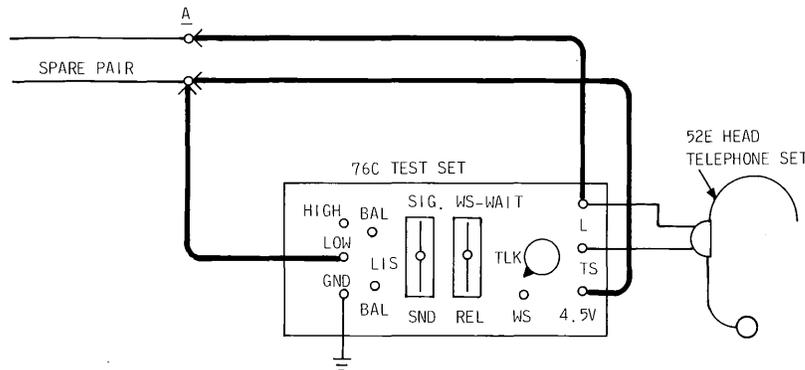


Fig. 19—Testing for Spare Pair

- At the receiving end (B), the talk pair is identified with the talk set connected as shown in Fig. 20. (The talking set should be equipped with a 0.1 μ F capacitor to avoid interference on working lines.)

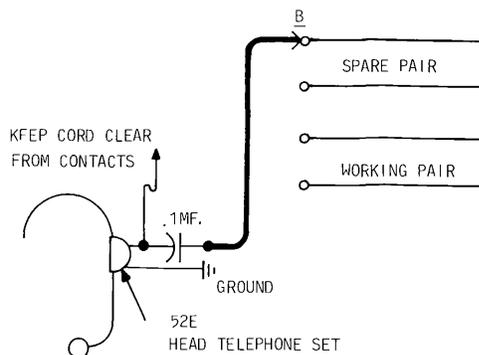


Fig. 20—Talk Pair Identified at Receiving End

STEP	PROCEDURE
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- After the talk pair has been identified, the connections to the talk set at the identifying end (B) should be arranged as shown in Fig. 21.

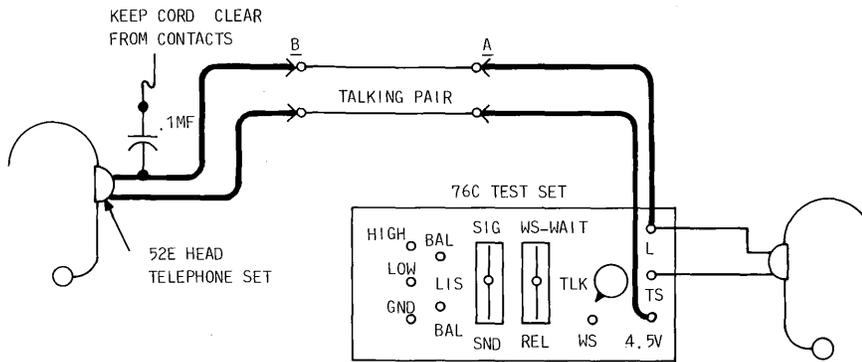


Fig. 21—Connection at Identifying End

4.05 In a cable or complement containing special circuits, the talk circuit must be established by sending tone from a termination where the identity of the circuits is known. At the identifying end, the conductors must be identified by means of an amplifier and probe using the following procedures:

IN PAIRED OR SHORT QUADDED CABLE

STEP	PROCEDURE
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- Select a good spare pair at the termination and connect the talking set as shown in Fig. 22.

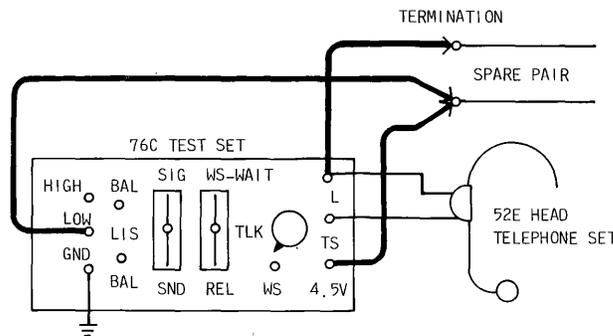


Fig. 22—Selecting Good Spare Pair

- Send tone on the talk pair with the keys in the SND and WS-WAIT positions.

IN LONG QUADDED CABLE

STEP

PROCEDURE

- 1 Select a good spare quad at the termination and connect the talk set as shown in Fig. 23.

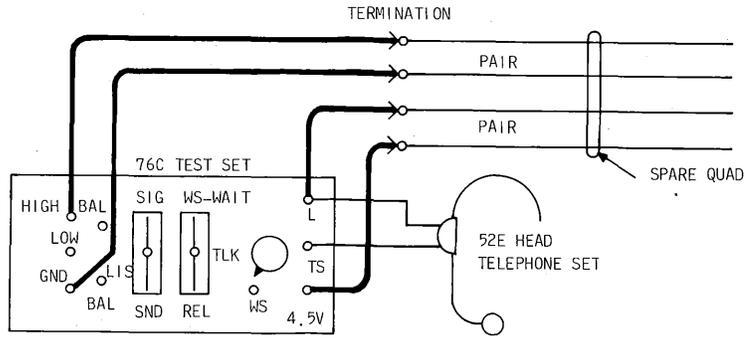


Fig. 23—Connecting Talk Set to Good Spare Pair

- 2 With the keys at SND and WS-WAIT, send nongrounded tone on the pair.
- 3 At the splice or sheath opening, a 147-type amplifier or the audio-frequency circuit of the 115A test set, and a 513A probe must be used to identify the pair or quad to which tone is connected, as shown in Fig. 24.

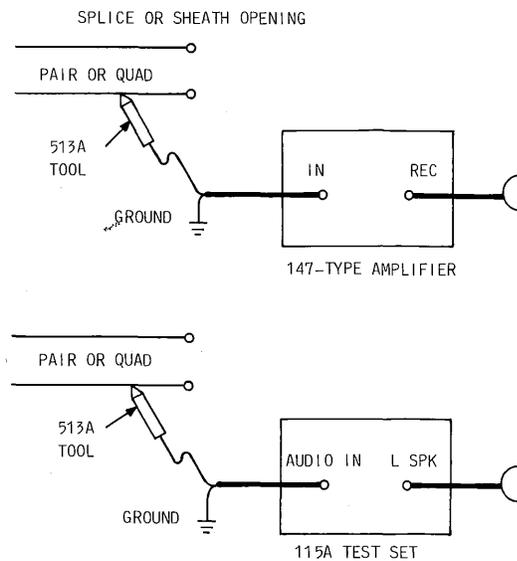


Fig. 24—Identifying Pair or Quad

STEP

PROCEDURE

- 4 After the pair with the tone has been identified, at the splice or sheath opening, connect a talk set across the pair. In the case of a quad, connect the talk set across the pair that has the weaker tone. This will operate the buzzer of the test set at the termination and signal that the pair has been located. At the termination, shift the keys to the LIS and TLK positions and remove the tone sending connections. The talk pair should be as shown in Fig. 25.

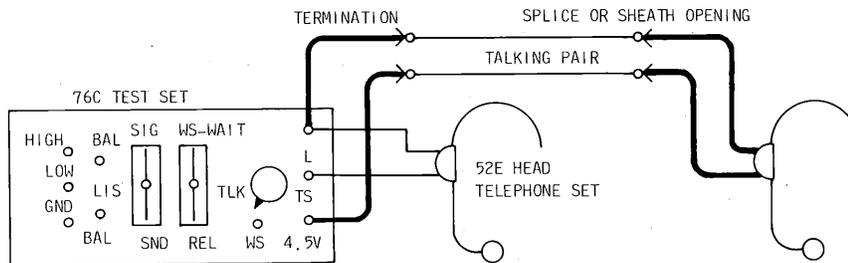


Fig. 25—Connecting Test Set at Splice or Sheath Opening

5. ESTABLISHING A CALLING CIRCUIT

5.01 When making cable transfers or cut-overs involving large cables, it may be necessary to have a "calling" circuit from the main frame to the splice or sheath opening. The 76-type set is equipped with a buzzer for this purpose.

5.02 The method of identifying a spare pair for the "calling" circuit is the same as that for establishing a talk circuit (Part 4). It is assumed that the talk pair has been identified, then proceed as follows:

STEP

ACTION

VERIFICATION

- 1 Connect the "calling" circuit pair to the L posts as shown in Fig. 26 and throw the keys to the LIS and WS-WAIT positions.

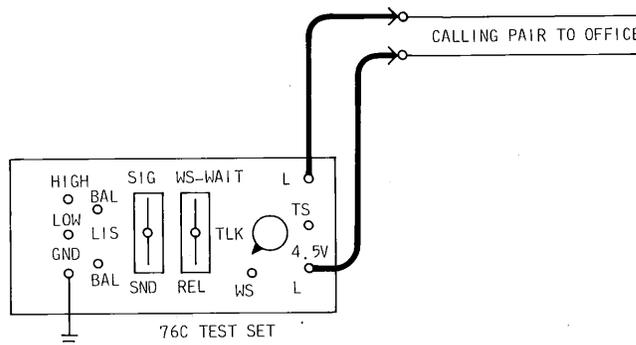


Fig. 26—Connecting Calling Circuit Pair

STEP	ACTION	VERIFICATION
2	Connect the talk set across the "calling" pair at the office.	If the circuit contains about 2000 ohms loop resistance or more, the buzzer will operate.
3	Move the right-hand key from WS-WAIT to TLK. If the talking circuit battery is being supplied from the office, connect a talk set to the L posts as shown in Fig. 27.	If talk circuit battery is not being supplied from the office.

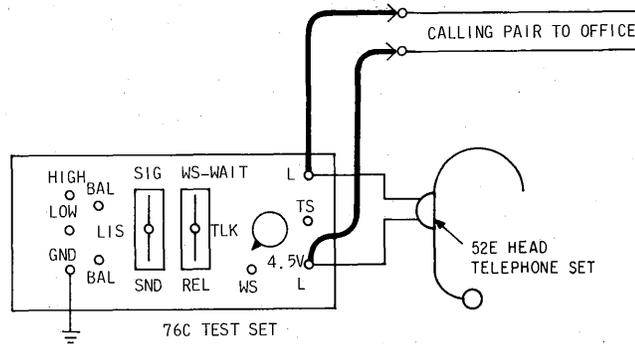


Fig. 27—Connecting Talk Set to L Posts

4	Move the right-hand key from WS-WAIT to TLK.	The buzzer will operate.
5	Connect the talk set to the TS post (Fig. 28). This will make use of the talking battery in the test set.	

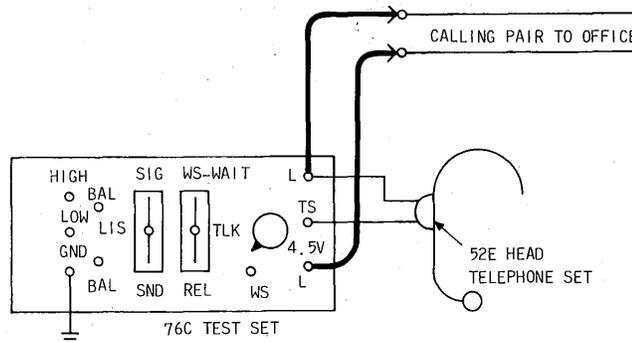


Fig. 28—Connecting Talk Set to TS Post

6. MAINTENANCE

6.01 The 76-type test set is of sturdy construction and should require relatively little maintenance aside from battery and vacuum tube replacements and an occasional check to ensure that the control relay is operating satisfactorily.

A. Operating Tests

6.02 Since the 500 Hz tone delivered by the 76-type set is produced by a vacuum tube oscillator, there is no sound audible when the set is in operation. However, operation of the tone generator can be checked by:

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STEP	ACTION	VERIFICATION
1	Connect a talk set to the binding posts marked LOW and GND with the keys set at LIS and TLK.	
2	Turn the tone on and off by moving the tone key slowly from LIS to SND several times.	Warble tone should be heard each time the key is at SND. If the operation of the tone seems to be erratic, the batteries are low or one of the vacuum tubes is defective.
3	Replace batteries or tubes.	If no tone is heard the batteries are low or connected incorrectly, or one of the tubes has failed.
4	Replace batteries or tubes and/or check wiring.	If steady tone is heard instead of warble, it is likely that the connections to the filament battery B1 (KS-6570) are reversed.
5	Check the filament battery conditions and correct if necessary.	

B. Batteries

6.03 The test set makes use of two 4-1/2 volt, KS-6570 batteries, and two 24-volt, KS-6571 batteries. For ordinary pair identification operations, the batteries should be discarded when their voltages (measured while in operation) are found to be below the following values:

KS-6570 battery—3.5 volts

KS-6571 battery—19 volts

However, when the set is used in locating faults with the exploring coil, the battery voltages should not be allowed to fall below 4 volts and 20 volts, respectively. The life of the batteries, with intermittent use of the set as a tone source, is about 100 hours of operation; when the relay or buzzer is being used, the life of the batteries is somewhat shorter.

6.04 If the batteries must be replaced on short notice and the above type standard batteries are not available, commercial batteries of corresponding voltage may be employed. Where obtainable, the Eveready* No. 714, 4-1/2 volt, and Eveready No. 763, 22-1/2 volt, should be used as they will fit into the battery compartment.

*Registered trademark of Union Carbide Corp.

C. Vacuum Tubes

6.05 If a vacuum tube is defective, it should be replaced using a tube having the same designation. These are commercially available and when replacement must be made on short notice in the field, they can be obtained from a local radio store. Normal replacements should be made in accordance with local routine.

6.06 Difficulty has been experienced in obtaining sufficient 1A7-GT and 3Q5-GT vacuum tubes for use in the 76-type test sets. As miniature type tubes became more readily available, the 76B test set was redesigned to provide sockets in which the miniature tubes can be used. The modified set has been coded—the 76C test set.

6.07 The 76C test set is electrically and mechanically the same as the 76A and 76B sets except for the sockets and tubes. The 76B is similar to the 76A except for the type of key employed. The 76C employs a 1R5 tube instead of a 1A7-GT and a 3V4 instead of a 3Q5-GT tube.

6.08 Orders for tubes for replacement purposes in 76C test sets should specify 1R5 or 3V4 tubes depending on which tube is required.

6.09 Some 76B sets have been supplied equipped with a 1R5 tube and a BA-259863 adapter instead of the 1A7-GT tube. When it becomes necessary to replace a 1R5 tube in one of those sets, the 1A7-GT tube should be used. In this situation, the adapter will no longer be required.

6.10 *Western Electric Company* maintains a stock of 1A7-GT and 3Q5-GT tubes to take

care of replacement needs in 76A and 76B test sets. These tubes should be ordered for replacement purposes in the 76A and 76B sets.

D. Relay Test

6.11 The 76-type sets employ a U-6106 relay. The proper functioning of this relay can be ascertained as follows:

STEP	ACTION	VERIFICATION
1	Check the batteries.	If the batteries have subnormal potential,—
2	Replace the batteries.	
3	Set the keys to LIS and TLK.	
4	Connect a wire from each BAL post to one of the L posts as shown in Fig. 29.	This simulates connecting the set to a 2000 ohm line.

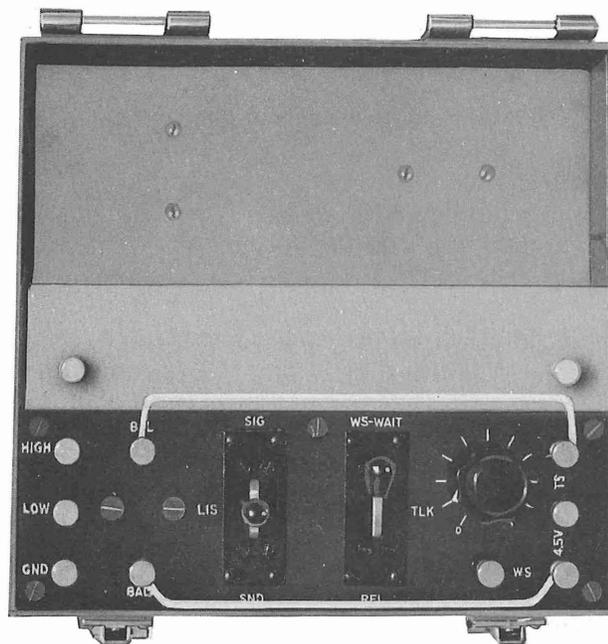


Fig. 29—Relay Strapping Test

- | | | |
|---|---|--|
| 5 | Slowly move the TLK key from TLK to WS-WAIT position several times. | The buzzer in the set should operate steadily each time the key is in the WS-WAIT position. If the buzzer does not operate each time, or if the operation is slow or erratic,— |
| 6 | Check the batteries. | If the batteries are satisfactory it indicates a faulty relay operation. |

- | STEP | ACTION | VERIFICATION |
|------|--|--------------|
| 7 | In this event, the set should be returned for adjustment in accordance with local routine. | |
| 8 | If it is impracticable to defer operations until a new set is available, the relay can be adjusted by one of the central office equipment maintenance forces in accordance with Division 040 of the Bell System Practices. | |
| 9 | Using the test circuits shown in Fig. 30, adjust the relay to operate at the current values indicated below. | |

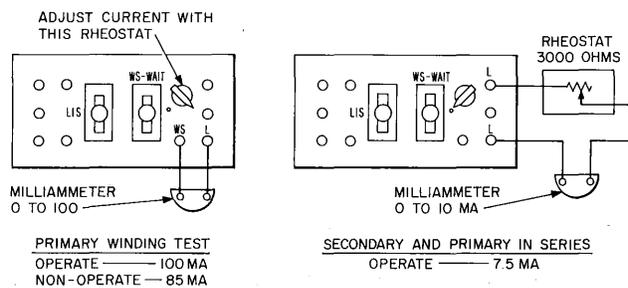


Fig. 30—Relay Adjustment Circuit Diagrams

- | | | |
|----|--|---|
| 10 | In testing the operation with the primary winding of the relay, connect a 0-100 millimeter at the location shown and set the keys to LIS and WS-WAIT. | |
| 11 | Adjust the rheostat in the set to 100 milliamperes. Move the key from TLK to WS-WAIT several times. | The relay should close and operate the buzzer when the key is in the WS position. |
| 12 | Repeat the test with current set at 85 milliamperes through the relay. | The buzzer should not operate. |
| 13 | Check the operation with the primary and secondary windings in series. An external rheostat of 2500 to 3000 ohms is needed to limit the current flow and a milliamperer is needed capable of reading 0 to 10 mils. | |
| 14 | Set the current to 7.5 mils and operate the keys as in the previous test (Step 10). | The buzzer should operate on each movement of the key to the WS-WAIT position. |

7. CLEANING AND OILING STRAPS

7.01 The leather strap on the 76-type test set requires cleaning with saddle soap and oiling with Neatsfoot Oil about every six months to keep it in good condition.