

**TL MICROWAVE RADIO**  
**TRANSMITTER-RECEIVER EQUIPMENT TESTS**  
**COMPONENT AND SUBASSEMBLY REPLACEMENT**

This section describes the procedures for replacing the J99262K meter and control panel, relay K1 in the J99262K meter and control panel, and the KS-16978, List 1 condenser bladder of the vapor phase cooler, and for maintaining the level of the FC-75 fluorochemical liquid in the vapor phase cooler. The necessity for replacement of any of the above shall be determined from tests outlined in other sections of this series. The maintenance interval for checking the level of the liquid in the vapor phase cooler shall be determined from Section 409-302-330.

*Caution: Service Interruption — Removing the J99262K meter and control panel and relay K1 in the J99262K meter and control panel from the transmitter-receiver will interrupt service on a working channel. Before removing any of these items, the transmitter and receiver shall be removed from service in accordance with Table A.*

The KS-16978, List 1 condenser bladder may be replaced while the equipment is in service. Likewise, the level of the fluorochemical liquid in the boiler of the vapor phase cooler may be maintained while the equipment is in service. Care should be taken to avoid disturbing the working equipment.

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**CHART 1**  
**REPLACING THE J99262K METER AND CONTROL PANEL**

**APPARATUS:**

KS-6854 Screwdriver

<b>STEP</b>	<b>PROCEDURE</b>
1	Remove the transmitter and receiver from service in accordance with Table A.

## CHART 1 (Cont)

STEP	PROCEDURE
2	Operate the meter selector switch on the meter and control panel to the XMTR RF PWR position; observe and record the lower meter reading.
3	Remove the klystron fuse from the front of the power supply and observe that the volt-meter indication has dropped to zero when the meter selector switch on the transmitter-receiver meter and control panel is set to -400.
4	Unlock the Camloc fastener at each of the four corners of the meter and control panel by turning it approximately one-half turn counterclockwise. (See Fig. 1.)
5	Using the two handles, pull the meter and control panel from its housing.
6	<p>Position the replacing meter and control panel so that relay K1 has its major axis within 30 degrees of vertical, and tap the metal shell of the relay several times.</p> <p><i>Note:</i> Relay K1 contains a mercury-wetted switch which must be mounted with its major axis within 30 degrees of vertical. If the relay has been tipped so that the contact elements are immersed in the mercury, the excess mercury must drain from the contacts before the relay will function normally. The excess mercury may be removed from the contacts by holding the relay in a vertical position and tapping the outer shell several times.</p>
7	Insert the replacing meter and control panel into the housing and feel the connectors into place.
8	Lock the Camloc fastener at each of the four corners of the meter and control panel by seating the fasteners against their spring action and turning them approximately one-half turn clockwise.
9	Turn the meter selector switch on the meter and control panel to -400.
10	Replace the klystron fuse in the front panel of the power supply.
11	Operate the meter selector switch on the meter and control panel to the XMTR RF PWR position.
12	Check the squelch circuit in accordance with Section 409-306-504, and retune controls R27 and BO RPLR on the front of the panel in accordance with Section 409-306-502 for the receiver. For the transmitter, retune the XMTR RPLR control in accordance with Section 409-304-501 and the R35, BIAS, and SENS controls in accordance with Section 409-304-504. R35 should be adjusted for the meter indication recorded in Step 2.
13	Return the transmitter and receiver to service in accordance with Table A.

## CHART 2

REPLACING RELAY K1 (276U) IN THE  
J99262K METER AND CONTROL PANEL

## APPARATUS:

KS-6854 Screwdriver

STEP	PROCEDURE
1	Remove the transmitter and receiver from service in accordance with Table A.
2	Remove the klystron fuse from the front of the power supply and observe that the volt-meter indication has dropped to zero when the meter selector switch on the meter and control panel is set to -400.
3	Unlock the Camloc fastener at each of the four corners of the meter and control panel by turning it approximately one-half turn counterclockwise. (See Fig. 1.)
4	Using the two handles, pull the meter and control panel from its housing.
5	Release the tube clamp on relay K1 on the right side of the meter and control panel and remove the relay.
6	Install the replacing relay and adjust the tube clamp.
7	Position the meter and control panel so that relay K1 has its major axis within 30 degrees of vertical, and tap the metal shell of the relay several times.  <i>Note:</i> Relay K1 contains a mercury-wetted switch which must be mounted with its major axis within 30 degrees of vertical. If the relay has been tipped so that the contact elements are immersed in the mercury, the excess mercury must drain from the contacts before the relay will function normally. The excess mercury may be removed from the contacts by holding the relay in a vertical position and tapping the outer shell several times.
8	Insert the meter and control panel into the housing and feel the connectors into place.
9	Lock the Camloc fastener at each of the four corners of the meter and control panel by seating the fasteners against their spring action and turning them approximately one-half turn clockwise.
10	Turn the meter selector switch on the meter and control panel to -400.
11	Replace the klystron fuse in the front panel of the power supply.
12	Check the automatic frequency control squelch circuit in accordance with Section 409-306-504.
13	Return the transmitter and receiver to service in accordance with Table A.

**CHART 3**  
**MAINTAINING LEVEL OF FLUORO-CHEMICAL LIQUID**  
**IN BOILER OF VAPOR PHASE COOLER**

**APPARATUS:**

- P-13D070 Heat Sink
- Eye Dropper (P-30C127 Graduated Delivery Dropper)
- Heat-Resistant Gloves
- 3408 Spintite 1/4-inch Hexagon Socket Wrench, or equivalent
- FC-75 Fluorochemical Liquid
- P-43H319 Plug (Recommended as a spare part)
- P-43H320 Boiler Gasket (New item required each time liquid level is checked)

Under normal operating conditions, the fluorochemical liquid in the boiler of the vapor phase cooler is boiling and the resulting vapor changes back to a liquid in the condenser. In order to check the level of the liquid in the boiler and to replenish the liquid, if necessary, while the system is in operation, the boiler is cooled temporarily below the boiling point of the liquid. The technician shall be familiar with the steps described in this chart before beginning this operation so that a minimum of down time will be required for the boiler. Clinical studies of the FC-75 fluorochemical liquid have indicated no harmful effects from limited exposure to the vapors or from extensive contact with the skin.

**Warning 1: Regarding Hazardous Voltages Inside the P-43H343 Cover Assembly — Personnel are allowed to service the vapor phase cooler when the klystrons are energized only if the shells of the klystrons are mechanically grounded as follows:**

- (a) *The klystrons are securely clamped in place by the P-43H345 clamp assembly.*
- (b) *The klystrons are connected to the flanges of the flexible waveguide. (The hazardous voltages are on some of the leads connected to the pins in the octal base on each klystron. The insulation of these leads, the enclosed tube sockets, and the grounded outer shells of the klystrons are sufficient to protect personnel from electrical shock.)*

**Warning 2: Regarding High Temperatures Inside the P-43H343 Cover Assembly — Portions of the vapor phase cooler, the shells of the klystrons, and the P-43H345 clamp assembly are normally too hot to handle with bare hands. Gloves, a folded wiping cloth, or a handkerchief shall be used to protect personnel when handling any of these items.**

**Caution: Regarding Service Interruption — The transmitter and receiver may be in service when the vapor phase cooler is maintained. Care shall be taken not to disturb the tuning adjustments on the klystrons and the other in-service equipment.**

STEP	PROCEDURE
1	Remove the P-43H343 cover assembly. (See Fig. 1.)

<b>CHART 3 (Cont)</b>	
<b>STEP</b>	<b>PROCEDURE</b>
2	Place the P-13D070 heat sink (copper block approximately 1-3/8 inches by 1-3/8 inches by 3 inches high) on top of the boiler of the vapor phase cooler (see Fig. 2) and wait 5 minutes. (The heat sink must be cool when it is placed on the boiler so that a sufficient amount of heat will be transferred from the boiler to the heat sink to cool the fluorochemical liquid below its boiling point. For hot outdoor installations, the heat sink should be at least as cool as the temperature in the shade.)
3	<p>Either during this 5-minute waiting period or before removing the P-43H343 cover assembly, do the following:</p> <p style="padding-left: 40px;">(a) Put 5 milliliters of FC-75 fluorochemical liquid in the eye dropper.</p> <p style="padding-left: 40px;">(b) Put a new P-43H320 boiler gasket on one of the spare P-43H319 plugs.</p>
4	At the end of the 5-minute waiting period, remove the P-43H319 plug (Fig. 3) using the Spintite wrench.
5	Using the eye dropper, transfer some of the fluorochemical liquid into the hole in the boiler until excess liquid runs out of the boiler.
6	Flatten the KS-16978, List 1 condenser bladder with the hand, and install the replacing P-43H319 plug with the new P-43H320 boiler gasket. Use the Spintite wrench to snug up the P-43H319 plug, but do not tighten enough to squeeze out the gasket.
7	Remove the heat sink and reinstall the P-43H343 cover assembly.
8	<p>Discard the old P-43H320 boiler gasket and store the P-43H319 plug with the spare parts.</p> <p>Note the amount of fluorochemical liquid which has been put into the boiler, and return the remaining liquid in the eye dropper to the storage bottle. In determining the amount of liquid which has been added to the boiler, make allowances for the amount which may have been spilled from the boiler during the filling operation.</p> <p>A record shall be kept of the amount of liquid added to the boiler. If it is necessary to record that more than 4 milliliters of the FC-75 liquid have been added, the condenser bladder and the P-43H349 condenser assembly shall be changed. (If a General Electric halogen leak detector, or equivalent, is available, the detector may be used to locate the leak so that only the defective part of the vapor phase cooling system need be changed. In this case, it will be necessary to provide a portable pressure can of No. 12 refrigerant equipped with a coupling tube, which is threaded to fit into the plug hole in the front of the boiler, and a shut-off valve. After removing the P-43H319 plug from the front of the boiler, the condenser bladder shall be collapsed by hand before the system is charged with refrigerant until the bladder bulges.)</p>

## CHART 4

## REPLACING THE KS-16978, LIST 1 CONDENSER BLADDER

**APPARATUS:**

11/16-inch Open-end Wrench  
 3/4-inch Open-end Wrench  
 P-13D070 Heat Sink  
 Heat-Resistant Gloves  
 FC-75 Fluorochemical Liquid  
 Eye Dropper (P-30C127 Graduated Delivery Dropper)  
 P-43H320 Boiler Gasket (New item required)  
 KS-16978, List 1 Condenser Bladder (New item required)  
 205A-6 Seal Ring Assembly (New item required)  
 P-43H319 Plug (Recommended as a spare part)  
 3408 Spintite 1/4-inch Hexagon Socket Wrench, or equivalent

Under normal conditions, the fluorochemical liquid in the boiler of the vapor phase cooler is boiling and the resulting vapor changes back to liquid in the condenser. In order to replace the KS-16978, List 1 condenser bladder while the system is in operation, the boiler is cooled temporarily below the boiling point of the liquid. The technician shall be familiar with the steps described in this chart before beginning this operation so that a minimum of down time will be required for the boiler.

The fluorochemical liquid is a stable material which is harmless to personnel.

**Warning 1: Regarding Hazardous Voltages Inside the P-43H343 Cover Assembly — Personnel are allowed to service the vapor phase cooler when the klystrons are energized only if the shells of the klystrons are mechanically grounded as follows:**

- (a) *The klystrons are securely clamped in place by the P-43H345 clamp assembly.*
- (b) *The klystrons are connected to the flanges of the flexible waveguide. (The hazardous voltages are on some of the leads connected to the pins in the octal base of each klystron. The insulation of these leads, the enclosed tube sockets, and the grounded outer shells of the klystrons are sufficient to protect personnel from electrical shock.)*

**Warning 2: Regarding High Temperatures Inside the P-43H343 Cover Assembly — Portions of the vapor phase cooler, the shells of the klystrons, and the P-43H345 clamp assembly are normally too hot to handle with bare hands. Gloves, a folded wiping cloth, or a handkerchief shall be used to protect personnel when handling any of these items.**

**Caution: Regarding Service Interruption — The transmitter and receiver may be in service when the vapor phase cooler is maintained. Care shall be taken not to disturb the tuning adjustments on the klystron and the other in-service equipment.**

## CHART 4 (Cont)

STEP	PROCEDURE
1	Remove the P-43H343 cover assembly. (See Fig. 1.)
2	Place the P-13D070 heat sink (copper block approximately 1-3/8 inches by 1-3/8 inches by 3 inches high) on top of the boiler of the vapor phase cooler (see Fig. 2) and wait 5 minutes. (The heat sink must be cool when it is placed on the boiler so that a sufficient amount of heat will be transferred from the boiler to the heat sink to cool the fluorochemical liquid below its boiling point. For hot outdoor installations, the heat sink should be at least as cool as the temperature in the shade.)
3	At the end of the 5-minute waiting period, remove the KS-16978, List 1 condenser bladder by loosening the coupling nut at the lower end of the bladder (when loosening the coupling, that portion of it which is attached to the P-43H349 condenser assembly shall be held in position so that the solder joint between the copper tube and the hexagon nut will not be overstressed) and removing the two mounting screws at the upper corners of the bladder. (See Fig. 1 and 3.)
4	Install a new KS-16978, List 1 condenser bladder and a new 205A-6 seal ring assembly. (See Fig. 3.) (Seat and align the tube of the condenser bladder into the fitting on the P-43H349 condenser assembly so that there is no residual stress in the rubber bladder before tightening the nut.)
5	<p>Either during the 5-minute waiting period or after replacing the bladder, do the following:</p> <p>(a) Put 5 milliliters of FC-75 fluorochemical liquid in the eye dropper.</p> <p>(b) Put a new P-43H320 boiler gasket on one of the spare P-43H319 plugs.</p>
6	Remove the P-43H319 plug using the Spintite wrench.
7	Using the eye dropper, transfer some of the fluorochemical liquid into the hole in the boiler until excess liquid runs out of the boiler.
8	Flatten the condenser bladder with the hand, and install the replacing P-43H319 plug with the new P-43H320 boiler gasket. Use the Spintite wrench to snug up the P-43H319 plug, but do not tighten enough to squeeze out the gasket.
9	Remove the P-13D070 heat sink and cool it.
10	Install the P-43H343 cover assembly.

<b>CHART 4 (Cont)</b>	
<b>STEP</b>	<b>PROCEDURE</b>
11	<p>Discard the old P-43H320 boiler gasket and store the P-43H319 plug with the spare parts.</p> <p>Note the amount of fluorochemical liquid which has been put into the boiler, and return the remaining liquid in the eye dropper to the storage bottle. In determining the amount of liquid which has been added to the boiler, make allowances for the amount which may have been spilled from the boiler during the filling operation.</p> <p>A record shall be kept of the amount of liquid added to the boiler. If it is necessary to record that more than 4 milliliters of the FC-75 liquid have been added, the condenser bladder and the P-43H349 condenser assembly shall be changed. (If a General Electric halogen leak detector, or equivalent, is available, the detector may be used to locate the leak so that only the defective part of the vapor phase cooling system need be changed. In this case, it will be necessary to provide a portable pressure can of No. 12 refrigerant, equipped with a coupling tube, which is threaded to fit into the plug hole in the front of the boiler, and a shut-off valve. After removing the P-43H319 plug from the front of the boiler, the condenser bladder shall be collapsed by hand before the system is charged with refrigerant until the bladder bulges.)</p>



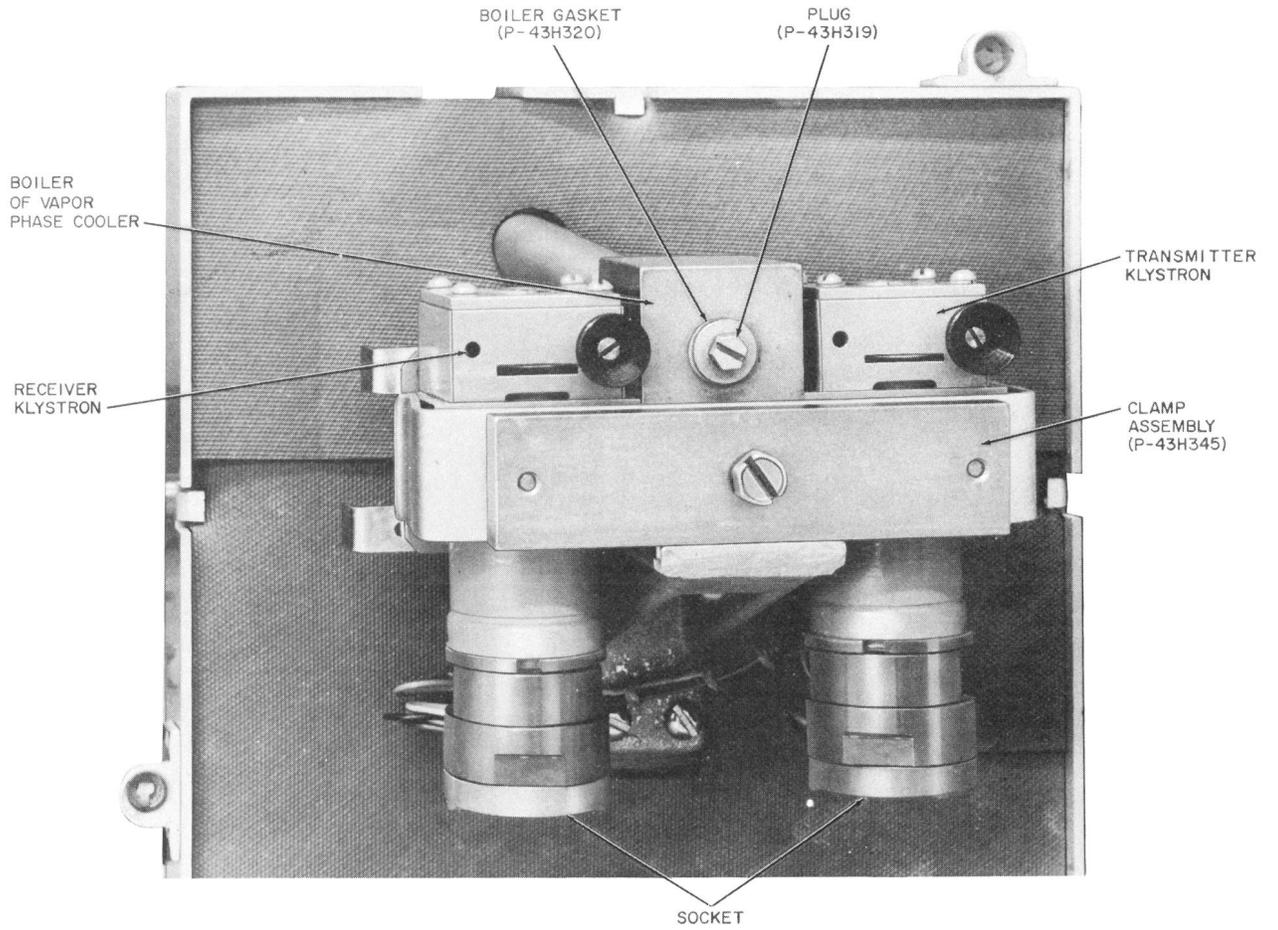
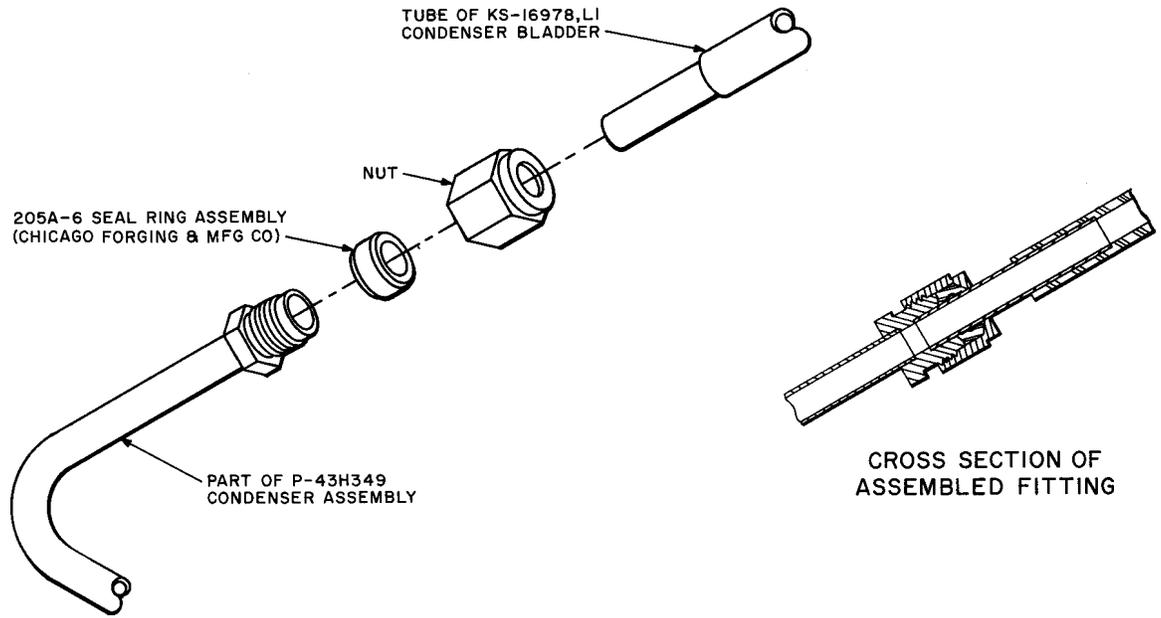


Fig. 2 — Transmitter and Receiver Klystrons and Boiler of Vapor Phase Cooler



**Fig. 3 — Coupling Between Condenser Bladder and Condenser Assembly**

TABLE A — PROCEDURES FOR REMOVING AND RESTORING SERVICE

STEP	FUNCTION	ACTION	NOTES
<b>DIVERSITY SYSTEM</b>			
<i>Note:</i> Steps 1 through 4 cover manual switch operation, Steps 5 and 6 cover removal and restoral of transmitter, and Steps 7 and 8 cover removal and restoral of receiver.			
1	Coordinate with alarm center	Obtain permission to perform manual switch at receiving station of section under test. (a) If Note 1 applies, go to Step 3. (b) If Note 2 applies, go to Step 2.	<ol style="list-style-type: none"> <li>If no diversity alarm from station under test, proceed to Step 3.</li> <li>If diversity alarm from station under test, find which pair involved (Step 2). <ol style="list-style-type: none"> <li>If one of pair under test, locate and clear trouble before switching.</li> <li>If one of another pair terminating at same station, manual switch permissible on pair under test.</li> </ol> </li> </ol>
2	Find source of diversity alarm	Measure dc due to pilot in each J99262L diversity switch panel in station under test until source is located: <ol style="list-style-type: none"> <li>Remove dust cover.</li> <li>With KS-14510 VOM measure dc on PIL MON LEV jacks for each channel in turn (see Note 2). <ol style="list-style-type: none"> <li>Tone present if <math>-5</math> to <math>-10</math> volts.</li> <li>Tone absent if <math>-3</math> volts or less.</li> </ol> </li> <li>Close hinged panel and restore dust cover.</li> </ol>	<ol style="list-style-type: none"> <li>Diversity alarm conditions: <ol style="list-style-type: none"> <li>Tone present on both, no alarm.</li> <li>Tone absent on both, no <i>diversity</i> alarm (but major alarm due to total absence of pilot).</li> <li>Tone present on one, absent on other diversity alarm.</li> </ol> </li> <li>PIL MON LEV jacks for regular channel accessible on left side of panel behind dust cover; those for diversity channel accessible behind hinged panel on right.</li> </ol>
3	Find active channel	With KS-14510 VOM (on 3-volt dc scale) measure from K4 jack to ground, diversity switch panel under test. <ol style="list-style-type: none"> <li>If no voltage, regular channel active.</li> <li>If between <math>-2</math> and <math>-3</math> volts, diversity channel active.</li> </ol>	
4	Manual switch	Operate the MAN switch from AUTO to the MAN position desired, regular or diversity.	The <i>idle</i> channel may now be removed from service for maintenance. <ol style="list-style-type: none"> <li>Perform Steps 5 and 6 to remove and restore transmitter from service.</li> <li>Perform Steps 7 and 8 to remove and restore receiver from service.</li> </ol>

Table A — Procedures for Removing and Restoring Service

TABLE A — PROCEDURES FOR REMOVING AND RESTORING SERVICE (Cont)

STEP	FUNCTION	ACTION	NOTES
<b>DIVERSITY SYSTEM (Cont)</b>			
5	Remove transmitter from service. <i>Caution: Steps 1 through 4 must be performed first.</i>	<ol style="list-style-type: none"> <li>1. Remove patch to transmitter baseband IN jack.</li> <li>2. Terminate open patch at once. (See notes.)</li> </ol>	<ol style="list-style-type: none"> <li>1. Open output of diversity split pad must be terminated to minimize effects of change of level on working line.</li> <li>2. A terminating jack for this purpose provided with TL test set.</li> </ol>
6	Restore transmitter to service	<p>When maintenance complete:</p> <ol style="list-style-type: none"> <li>1. Remove terminating jack applied in Step 5.</li> <li>2. Restore transmitter input patch to IN jack of transmitter baseband amplifier.</li> <li>3. At receiving location verify that service is now being received on the idle channel. (See note.)</li> <li>4. Restore the MAN switch to the AUTO position if no further maintenance required, or to other MAN position if the other channel is to be maintained.</li> </ol>	Determine from the alarm center that a diversity alarm is not being received from the receiving location.
7	Remove receiver from service. <i>Caution: Steps 1 through 4 must be performed first.</i>	No special action required.	
8	Restore receiver to service	<ol style="list-style-type: none"> <li>1. Verify that service is now being received on idle channel. (See note.)</li> <li>2. Restore the MAN switch to the AUTO position if no further maintenance is required, or to other MAN position if the other channel is to be maintained.</li> </ol>	Determine from the alarm center that a diversity alarm is not being received from the receiving location.
<b>NONDIVERSITY SYSTEM</b>			
		<ol style="list-style-type: none"> <li>1. Secure permission from alarm and control center.</li> <li>2. Perform needed maintenance.</li> <li>3. Restore service.</li> <li>4. Verify service restoral with alarm and control center.</li> </ol>	Determine from the alarm center that no alarms are present.

Table A — Procedures for Removing and Restoring Service (Cont)