

NOT STANDARD FOR PNB
PS1 AND PS2 POWER SYSTEMS
EQUIPMENT UNIT REPLACEMENT PROCEDURES
AUXILIARY REPEATER STATIONS
L3 CARRIER

This section provides methods for removing and replacing plug-in and bay-mounted equipment (Fig. 1) at auxiliary repeater stations. Pilot signal measurement and adjustment procedures are also included. Repeaters for the L3 carrier system are described in Section 359-010-105.

This section is reissued to correct errors, to improve the test procedures, to expand the explanations, and to show test equipment connections. Arrows are used to indicate significant changes. **Equipment Test Lists are not affected.**

Section 359-020-513 explains power turndown and power turnup procedures.

DANGER: Upon entering and leaving auxiliary repeater stations, the safety measures should be followed at the locations specified in Table A.

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APPARATUS:

- 1 — Power Test Set J64001AL (Section 103-451-100), used in all charts
- 1 — Change Load J68815K, used in Chart 1
- 1 — Pilot Indicator J64007A (Section 103-450-100), used in Charts 4 and 5
- 1 — Selective Level Meter AT463 (Section 103-406-000), used in Charts 4 and 5
- 1 — Allen Head Set Screw Wrench for No. 8 Screw, used in Chart 5
- 1 — Key Assembly P35B398, used in Chart 5

NOTICE

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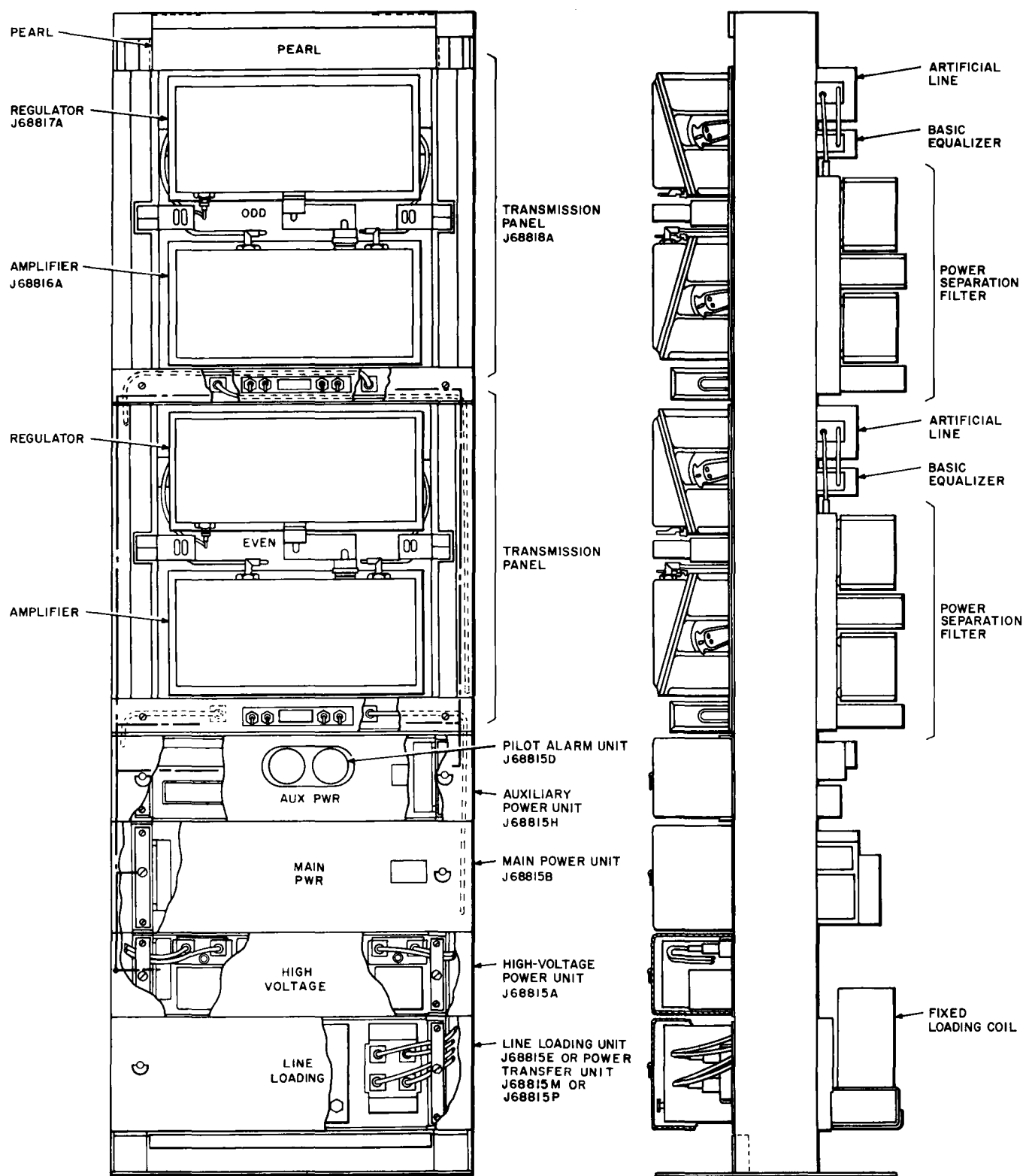


Fig. 1—Auxiliary Repeater J68819A in 6-Foot Bay

TABLE A

LOCATIONS	SAFETY MEASURES
MANHOLE	Before entering, follow procedures for testing and ventilating manholes as covered in Outside Plant Series of Bell System Practices and any local instructions which may apply.
HUT	(1) Before entering, remove key from lock and retain. Door cannot close when key is removed. This is to ensure ventilation while working inside. (2) Gas—Before entering, leave door wide open to ensure escape of natural, artificial, or SF₆ gas that may accumulate in unattended hut. (3) Grounding Switch—Upon entering hut where such a switch is installed, close switch immediately to reduce possibility of hazardous shocks from cable sheath and apparatus cases. When leaving, open switch to provide protection against lightning damage to the apparatus and cable conductors.

CHART 1

REPLACEMENT OF PLUG-IN AMPLIFIER

Note: An amplifier may be replaced only when the line in which the amplifier is operating is out of service. The associated line for the opposite direction of transmission need not be removed from service.

STEP	PROCEDURE
1	Verify that the line is out of service.
2	Connect the change load unit to the V TST jack on the transmission panel containing the amplifier to be replaced.
3	Disconnect power plug on amplifier and disconnect the coaxial plugs from the AMP IN and AMP OUT jacks on the amplifier.
	Warning: Care should be taken to minimize mechanical shock while handling or transporting amplifiers because these contain delicate apparatus.
4	Lift the catches at the end of the unit and slide unit off mounting rails.

CHART 1 (Contd)

STEP	PROCEDURE
5	Put replacing unit onto mounting rails and slide into place.
6	◆Check that the catches on the amplifier are engaged properly.
7	Connect the coaxial plugs to the AMP IN and AMP OUT jacks, and connect the power plug on amplifier.
8	Connect the power test set to the TEST plug of the amplifier.
9	Operate the power test set METER switch to the TUBE TEST BIAS position.
10	Observe the tube bias voltage indications on the power test set.
11	Disconnect the change load after all tube bias voltages have reached an up-scale indication.
12	Allow approximately 5 minutes warmup time.
13	Check and adjust the 7266-kHz pilot power per Chart 5.
14	Adjust the PEARL signal per Section 359-060-500.
15	Measure and adjust pilot power per Chart 5.◆

◆CHART 2◆**REPLACEMENT OF PLUG-IN REGULATOR**

Note: A regulator can be replaced only on an out-of-service basis. The associated line for the opposite direction of transmission need not be removed from service.

STEP	PROCEDURE
1	Connect the change load to the V TST jack on the transmission panel containing the regulator to be replaced.
2	Disconnect the plugs from the PWR and REG IN jacks on the regulator.
Warning: Care should be taken to minimize mechanical shock while handling or transporting regulators because these contain delicate apparatus.	

CHART 2 (Contd)

STEP	PROCEDURE
3	Lift the catches at the ends of the regulator and slide off mounting rails.
4	Put replacing unit onto mounting rails and slide into place.
5	Connect the plugs to the PWR and REG IN jacks on the regulator.
6	Connect the power test set to the TEST plug on the regulator under test.
7	Operate the power test set METER switch to the TUBE TEST BIAS position.
8	Observe the tube bias voltage indications on the power test set.
9	Disconnect the change load after all tube bias voltages have reached an up-scale indication.
10	Allow approximately 5 minutes warmup time.
11	Adjust the PEARL signal per Section 359-060-500.
12	Measure and adjust pilot power per Chart 5.

CHART 3**REPLACEMENT OF PILOT ALARM UNIT**

Note: This chart explains the procedure for removal and replacement of a pilot alarm unit, and may be performed on an in-service basis.

STEP	PROCEDURE
DANGER: Avoid touching base plugs since one of the prongs will remain at +190 volts to chassis until Step 3 is performed. This condition does not apply to systems arranged with two alarm pairs.	
1	Remove the cover from the auxiliary power unit.
2	Use a screwdriver to loosen the fastener at each end of the pilot alarm unit and pull straight out to disengage the connecting base plug.

CHART 3 (Contd)

STEP	PROCEDURE
3	Discharge the electrolytic capacitor through the reset windings of the meter/relays by operating the RESET switch (<i>for one alarm pair only</i>).
4	Align the base plug of the replacing unit with the connecting jack on the panel and push the unit into place operating the fastener at each end to secure the unit.
5	Allow sufficient time for the electrolytic capacitor to charge.
6	Operate the RESET switch to clear the meter/relays.
7	Perform the following steps <i>only</i> when the 7266-kHz pilot for each direction of transmission is $-16.0 \text{ dBm} \pm 0.1 \text{ dB}$ at the AMP OUT jack.
8	Remove the dust cover.
9	Adjust the PIL controls associated with the ODD and the EVEN alarm relays mounted on the unit to meet the requirement.
Requirement: Each meter/relay indicates $0 \pm 0.2 \text{ dB}$.	

CHART 4

REPLACEMENT OF BAY-MOUNTED EQUIPMENT

Note: ♦The replacement procedures explained in this chart can be performed only with power removed from the repeater. Procedures for turning power off are explained in Section 359-020-500. The repeater must be disconnected from the cable terminals on the power feed side, so that accidental application of power at the main repeater station will not energize any portion of the repeater where work is to be performed. For a junction repeater, the repeater must be disconnected from the cable terminals on both sides. Parts A and B in this chart are precautionary in nature and give assurance that power is off.

STEP	PROCEDURE
1	Proceed to Part A to replace bay-mounted equipment at a junction repeater, or proceed to Part B at an intermediate repeater.♦

CHART 4 (Contd)

STEP	PROCEDURE
A. Junction Repeater—Observation That Power Is Turned Off	
2	Connect the 1AL power test set for measurement of HTR 1 voltage.
	Note: Power must be turned off at a junction repeater both in the power section which feeds the repeater and the one which is merely looped at that point. In order to make sure of power turn off, pilot coming from the looped section, that is, from east or north, is measured while power is turned off in that section. A measurement of heater voltage then shows that power is on from the west or south, and that heater voltage drops to zero as power is turned off.
3	Remove one of the parallel patch plugs from the even AMP OUT and LINE IN jacks.
4	Plug the bridging transformer of the 7A pilot indicator into one of the jacks vacated.
5	Arrange the 7A pilot indicator for measurement of the 7266-kHz pilot; observe the 5-dB scale.
	Note: As long as an indication of pilot is obtained, the indicator need not be calibrated.
6	Observe that the meter indication on the pilot indicator decreases as power is being turned off at the main repeater to the east or north.
7	Measure the heater voltage with the 1AL power test set.
	Requirement: Power test set indicates approximately normal HTR 1 voltage.
8	Observe that heater voltage decreases to zero while power is being turned off to the west or south.
9	Disconnect the LINE A, LINE B, LINE C, and LINE D cords from the correspondingly designated cable terminals.
	Note 1: Cords can be disconnected at the line bay in the power feed station, if desired.
	Note 2: These cords are accessible after removing the cable terminal cover. At underground repeater locations, these cords may be disconnected at the jacks on the bay duct cover plates. Work may now proceed on the repeater components.
B. Intermediate Repeater—Observation That Power Is Turned Off	
10	Connect the 1AL power test set for measurement of HTR 1 voltage.
	Note: This procedure covers the method of observing that power supplied to an intermediate repeater has been turned off. These repeaters may be fed from either direction; one procedure fitting either case.

CHART 4 (Contd)

STEP	PROCEDURE
11	Observe that the meter indication drops to zero while power is being turned off.
12	Disconnect the LINE A, LINE B, LINE C, and LINE D cords from the correspondingly designated cable terminals.
	Note 1: ♦Cords can be disconnected at the line bay in the power feed station, if desired.♦
	Note 2: These cords are accessible after removing the cable terminal cover. At underground repeater locations in PS2 power systems, these cords may be disconnected at the jacks on the bay duct cover plates.
	Note 3: The four cords are disconnected to ensure that accidental application of power, regardless of the direction of power feed, will not energize the repeater. Work may now proceed on the repeater components.
	C. Replacement of Transmission and Control Panel
	DANGER: <i>This procedure may be performed only with power off and only after checking this fact per Part A or B of this chart.</i>
13	Verify that the power has been turned off per Part A or B.
	Note: Since the ODD and EVEN transmission and control panels are the same except for designations, any spare panel may be connected in place of the other. However, where an artificial line is mounted in the panel to be replaced and none is available for the replacing panel, install the artificial line. Since artificial line and basic equalizer are permanently connected, remove the LINE OUT jacks from their mountings, and disconnect the plug and jack between the artificial line and the power separation filter. The artificial line and basic equalizer may then be removed from the panel. If a panel designated ODD is to replace one designated EVEN or vice versa, the designations should be changed as well as the designations on the cords which connect to cable terminals or to plugs at duct cover plate jacks.
14	Disconnect the PWR A and PWR B, or PWR C and PWR D plugs from the correspondingly designated jacks on the panel to be removed.
	At underground repeaters,
15	Disconnect the cords equipped with the LINE A and LINE B, or LINE C and LINE D plugs from the cable terminals or from the duct cover jacks.
16	Disconnect the bay wiring at the terminal strips mounted under the control panel cover.
17	Remove the amplifier and regulator from the panel to be replaced as outlined in Charts 1 and 2.
18	Remove the mounting screws and remove the panel from the bay.

CHART 4 (Contd)

STEP	PROCEDURE
19	Mount the replacing panel, restore the coaxial plug connections, and install amplifier and regulator.
20	Connect bay wiring to terminal strips.
	Note: Leads bear numbers of terminals to which the leads connect.
21	Connect cords to cable terminal plugs or duct cover jacks bearing the same designations.
	Note: Power may be turned on. Power supply voltages should be measured per Section 359-020-514.
	D. Replacement of High-Voltage Unit
	DANGER: <i>This procedure may be performed only with power off and only after checking this fact per Part A or B of this chart.</i>
22	◆ Proceed to Step 23 for pilot regulator control or proceed to Step 27 for thermometer regulator control.
	Note: The high-voltage unit normally has two resistors in addition to transformers and, therefore, will require replacement very infrequently. The resistance in the HTR 2 leads must be changed for either a pilot or thermometer regulator. Resistance is strapped out to increase the HTR 2 voltage for the thermometer-regulator case.◆
	Pilot regulator control,
23	Check that the inner conductor of the A jack is connected to terminal 3 on transformer T1 in the replacing unit.
24	Check that the inner conductor of the C jack is connected to terminal 3 on transformer T2 in the replacing unit.
25	Check that there is no strap across resistor R3.
26	Proceed to Step 30.
	Thermometer regulator control,
27	Check that the inner conductor of the A jack is connected to terminal 2 on transformer T1 in the replacing unit.
28	Check that the inner conductor of the C jack is connected to terminal 2 on transformer T2 in the replacing unit.

CHART 4 (Contd)

STEP	PROCEDURE
29	Check that resistor R3 is strapped out of the circuit.
30	Disconnect the coaxial plugs from the A, B, C, and D jacks on the unit to be replaced.
31	◆ Disconnect the bay wiring from the terminal strips and remove the high-voltage unit from the bay.
32	Mount the replacing unit in the bay and reconnect the bay wiring. Warning: <i>Leads bear numbers of terminals to which the leads connect. These number tags may disintegrate at touch due to deterioration because of heat and age. Replace disintegrated tag with a temporary tag, if required.</i>
34	Complete any other work requiring that power is off. Warning: <i>Reconnect the cords only finger tight. Excessive pressure will crack the ceramic bead in the cable head.</i>
35	Reconnect the cords to cable terminal plugs or duct cover jacks bearing corresponding designations: LINE A, LINE B, LINE C, and LINE D. Note: Power now may be turned on. Power supply voltages should be measured per Section 359-020-514.
E. Replacement of Main Power Unit	
DANGER: <i>This procedure may be performed only with power off and only after checking this fact per Part A or B of this chart.</i>	
Warning: <i>Leads bear numbers of terminals to which the leads connect. These number tags may disintegrate at touch due to deterioration because of heat and age. Replace disintegrated tag with a temporary tag, if required.</i>	
36	Disconnect bay wiring from the terminal strips and remove the unit from the bay.◆ Note: When trouble cannot be isolated definitely to the main power unit, both this unit and the auxiliary power unit should be removed to a maintenance center for service since these units do not operate independently. No special instructions are needed for replacement of this unit, and the procedure is given merely to emphasize the following danger.
37	Mount new unit and reconnect bay wiring.
38	Complete any other work requiring that power is off. Warning: <i>Reconnect the cords only finger tight. Excessive pressure will crack the ceramic bead in the cable head.</i>

CHART 4 (Contd)

STEP	PROCEDURE
39	Reconnect the cords to cable terminal plugs or duct cover jacks bearing corresponding designations: LINE A, LINE B, LINE C, and LINE D. Note: Power may be turned on. Power supply voltages should be measured per Section 359-020-514.
	F. Replacement of Auxiliary Power Supply Unit
	DANGER: <i>This procedure may be performed only with power off and only after checking this fact per Part A or B of this chart.</i>
40	Remove the pilot alarm unit per Chart 3, which provides for discharge of the internal capacitor when only one alarm pair is provided. Note: When trouble cannot be isolated definitely to this unit, both this unit and the main power unit should be removed to a maintenance center for service since these units do not operate independently. No special instructions are needed for this unit, and this procedure is given merely to emphasize the danger.
41	◆ Disconnect bay wiring from the terminal strips and remove the unit from the bay.◆
42	Mount the new unit and reconnect bay wiring. Warning: <i>Leads bear numbers of terminals to which the leads connect.◆ These number tags may disintegrate at touch due to deterioration because of heat and age. Replace disintegrated tag with a temporary tag, if required.</i>
43	Complete any other work requiring that power is off. Warning: <i>Reconnect the cords only finger tight. Excessive pressure will crack the ceramic bead in the cable head.</i>
44	Reconnect the cords to cable terminal plugs or duct cover jacks bearing corresponding designations: LINE A, LINE B, LINE C, and LINE D. Note: Power now may be turned on. Power supply voltages should be measured per Section 359-020-514.◆
	G. Replacement of Line Loading Unit
45	Make certain that the same tap connections on fixed load coils are used in both replacing and replaced units. Note: The replacing unit should be equipped with the same loading coils as the unit that is to be replaced.

CHART 4 (Contd)

STEP**PROCEDURE**

DANGER: *This procedure may be performed only with power off and only after checking this fact per Part A or B of this chart.*

- 46 Disconnect the cords from the B1, B, C1, and C jacks on the unit to be replaced.
- 47 Remove the unit from the bay.
- 48 Mount the new unit and reconnect the cords to correspondingly designated jacks.
- 49 Adjust the variable load coil to the same dial setting as on the one replaced.
- 50 ♦Complete any other work requiring that power is off.

Warning: *Reconnect the cords only finger tight. Excessive pressure will crack the ceramic bead in the cable head.*

- 51 Reconnect the cords to cable terminal plugs or duct cover jacks bearing corresponding designations; LINE A, LINE B, LINE C, and LINE D.

Note: Power may be turned on. Power supply voltages should be measured per Section 359-020-514.♦

CHART 5**TESTS AND ADJUSTMENTS**

Note: The procedure in this chart may be performed on an in-service basis.

STEP**PROCEDURE****A. Measurements of Pilots**

Caution: *The 7A pilot indicator should be calibrated per Section 103-450-100 immediately before making each measurement.*

- 1 Remove one of the parallel patch plugs between the AMP OUT and LINE IN dual jacks for the line under test.

CHART 5 (Contd)

STEP	PROCEDURE
	Note: ♦The 3096-kHz and 7266-kHz pilot signals can be measured using the 7A pilot indicator or a transmission measuring set, such as Wandel-Goltermann selective level meter AT463 or AT611. Test equipment connections for pilot signal measurements are shown in Fig. 2.♦
2	Calibrate the test equipment to measure the 7266-kHz pilot power at the AMP OUT jack. Requirement: ♦The 7266-kHz pilot power is $-16.0 \text{ dBm} \pm 0.1 \text{ dB}$ at the AMP OUT jack.♦ Note: Refer to Fig. 2. For a transmission measuring set, the 30-dB loss in the 11B attenuator or the 20-dB loss in the Wandel-Goltermann TK9 probe must be considered. For the 7A pilot indicator, the meter should indicate 0.
3	Adjust the GAIN ADJ control on the regulator, if required, to obtain the correct 7266-kHz pilot power.
4	Calibrate the test equipment to measure the 3096-kHz pilot power. Requirement: The 3096-kHz pilot power is $-36.0 \text{ dBm} \pm 0.1 \text{ dB}$ at the AMP OUT jack. Note: For a transmission measuring set, the 20-dB or 30-dB loss in the bridging attenuator must be considered. For the 7A pilot indicator, the meter should indicate 0.

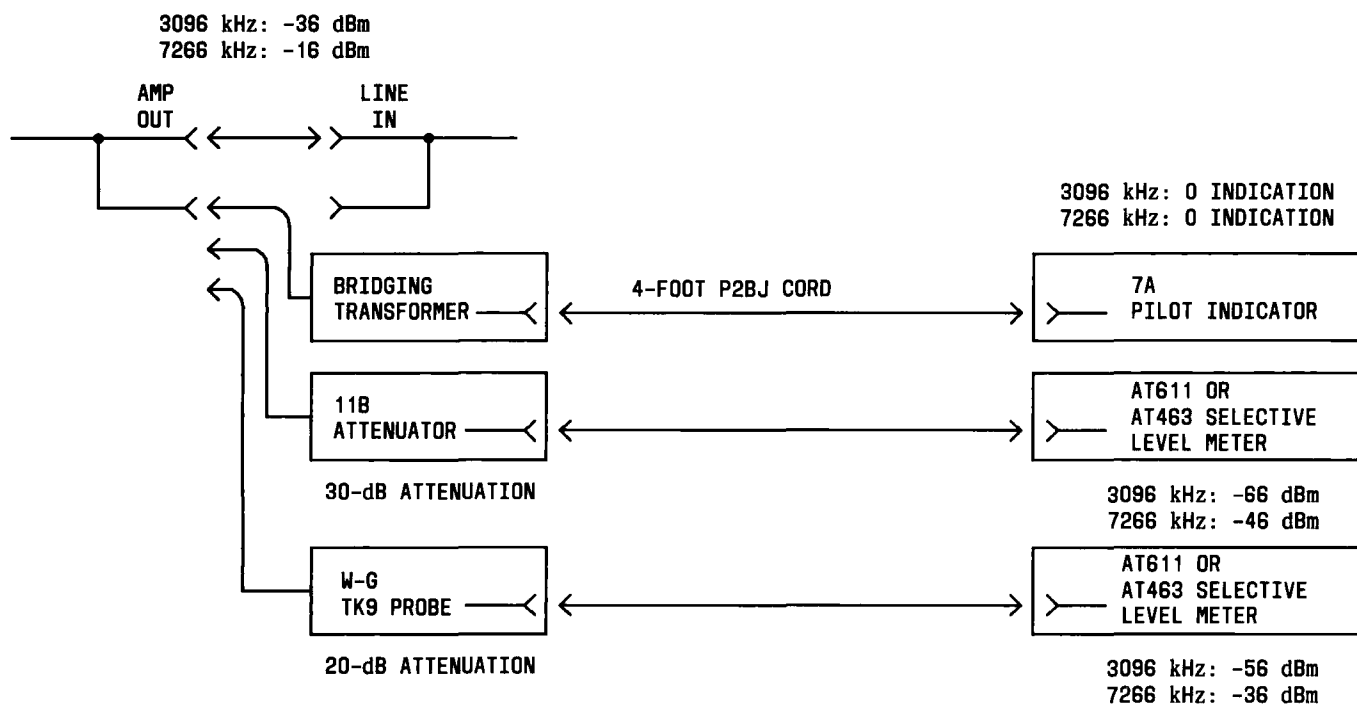


Fig. 2—♦Test Equipment Connections♦

CHART 5 (Contd)

STEP	PROCEDURE
5	Adjust the GAIN ADJ control on the line amplifier, if required, to obtain the correct 3096-kHz pilot power. <i>At an auxiliary repeater,</i>
6	Replace the parallel patch plug between the AMP OUT and LINE IN jacks. B. Adjustments of Pilots
7	Use the power test set to measure HTR 1 voltage. Note: As the 7266-kHz pilot power is changed by adjustment of either an auxiliary or thermometer regulator, thermistor current drawn from the PLT 1 supply changes. This change causes the impedance reflected into the primary of the power transformers to change and, therefore, changes the primary voltage. Primary voltage affects the heater voltage. Repeat the pilot and heater voltage measurements as the regulator is adjusted. Requirement: Voltage is between 6.0 and 6.3 volts.
8	Turn the LOAD ADJ switch, if necessary, to meet the requirement.
9	Measure the 7266-kHz pilot power and adjust the GAIN ADJ control on the regulator to meet the Step 2 requirement: $-16.0 \text{ dBm} \pm 0.1 \text{ dB}$. Note: Pilot power changes slowly when the GAIN ADJ control is adjusted. If the adjustment to be made is in the order of 0.1 to 0.2 dB, the smallest perceptible change should be made in the position of the control. Allow time for the change to appear on the test equipment.
10	Measure the 3096-kHz pilot power, and adjust the GAIN ADJ control on the line amplifier to meet the Step 4 requirement: $-36.0 \text{ dBm} \pm 0.1 \text{ dB}$.
11	Adjust the regulator GAIN ADJ control, the line amplifier GAIN ADJ control, and the LOAD ADJ switch until the requirements in Steps 2, 4, and 7 are met. Note: There will be some interaction between the 3096-kHz and 7266-kHz adjustments, so the adjustment of one will require recheck of the other.
12	Adjust both the 3096-kHz and 7266-kHz pilot signals to the correct power, if a line amplifier is replaced on a trouble basis. Note: If the range of the GAIN ADJ control is insufficient to adjust the 3096-kHz pilot power with the 7266-kHz pilot power correctly adjusted, trouble at a preceding repeater is indicated. Clear the trouble before final adjustment of the replacement amplifier. Warning: The seal plugs in the regulator and amplifier must be replaced in order to prevent failure of the unit due to moisture.

CHART 5 (Contd)

STEP	PROCEDURE
13	Replace the seal plugs in the amplifier and regulator.