L MULTIPLEX TERMINALS

LMX-1

ELECTRON TUBE TESTS AND PATCHING PROCEDURES

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1. GENERAL

1.01 This section describes the procedure for making electron tube tests on group, supergroup, and terminal equipment of the type L carrier telephone terminal. Also included are the patching procedures required, when necessary, for testing or trouble locating in transmitting or receiving group or supergroup equipment.

1.02 This section is reissued to correct 3.11, Step 7, and Fig. 6. BSP references in the test procedure and Fig. 1, 2, and 3 are also corrected. Marginal arrows are used to indicate changes. *Equipment Test Lists are not affected.*

1.03 In applying the procedures, the tester must be familiar with the available descriptive information on the terminal equipment and the available test equipment.

2. ELECTRON TUBE TESTS

A. Electron Tube Heater Circuit Operation

2.01 When inserting or removing any tube in the intermediate transmitting amplifier, auxiliary receiving amplifier, or intermediate receiving amplifier, the following precautions should be observed:

    (a) The amplifier should be out of service whenever tube replacements are made or whenever a heater circuit is opened.

    (b) Before inserting or removing a tube, the heater circuit should be opened.

2.02 Two 258C plugs comprise the required apparatus for electron tube heater circuit operation, which is delineated in the following procedure.

STEP	PROCEDURE

| 1 | To open the heater circuit of any tubes in the terminal equipment, insert a 258C plug in the FIL jack of the particular amplifier under test. |

STEP	PROCEDURE
2	To close the heater circuit, remove the 258C plug from the appropriate FIL jack.
3	After the heater circuit has been energized for at least 3 minutes, the circuit may be tested or returned to service.

B. Electron Tube Test Procedure

2.03 The 1R or 1AC tube test set enables the testing of tubes without interference to service. Circuit arrangements provide for measurements of heater current, space current, and cathode activity.

2.04 When tubes must be removed because of failure to meet requirements, the procedures given in the operating routines (Division 358 for an L1 system, or Division 359 for an L3 system) should be followed with respect to patching equipment out of service. Before any equipment is placed in service, a sufficient check of continuity and transmission should be made to ensure satisfactory operation.

2.05 Heater current adjustments should not be made using the 1R or 1AC tube test set. Adjustments should be made in accordance with the information in the appropriate A502 section of the central office maintenance practices and the adjustment values shown on the SD drawing covering the equipment.

2.06 Do not make tube tests when the battery voltage is changing rapidly or when battery voltage is outside the normal operating range. This condition will probably exist during and shortly after a power or rectifier failure.

Caution: When cathode activity tests are made during tube tests, time should be allowed for the heater current and space current to become stabilized before making the final reading. Discontinue cathode activity tests if, during the test, cathode activity exceeds the maximum allowable percentage drop.

2.07 Table A covers both 9-volt and nominal 10-volt operation of the tubes. When separate values are not given for the two types of operation, the same requirement applies to both types.

2.08 Tubes that do not meet the requirements in one socket should be tried in other sockets where the requirements are more lenient. Tubes removed from sockets operating at nominal 9 volts may be used in sockets operating at nominal 10 volts provided they meet the test requirements. Either new or used tubes can be used for routine replacements in circuits operating at 9 volts, provided they meet the test requirements. However, new tubes should be placed in service initially in 9-volt sockets whenever practicable.

2.09 The apparatus required for the electron tube tests consists of a 1R or 1AC tube test set and an M4T cord equipped with 306A and 307A plugs. The following procedure should be used for electron tube testing.

STEP	PROCEDURE
1	Make heater current, space current, and cathode activity tests on the amplifier as specified in the operating routines (Division 358 for an L1 system, or Division 359 for an L3 system). Refer to Table A for the order in which the tests should be made. *Requirement:* Refer to Table A.

STEP	PROCEDURE

TABLE A
TEST REQUIREMENTS — 310A TUBES
9- AND 10-VOLT OPERATION — REGULATED BATTERY SUPPLY

	TEST		TRANSMITTING INTERMEDIATE AMPLIFIER		GROUP DEMOD AUXILIARY RECEIVING AMPLIFIER		RECEIVING INTERMEDIATE AMPLIFIER		TYPE C1 SUPERGROUP CONNECTOR AMPLIFIER	
			1*	2*	1*	2*	1*	2*	1*	2*
			FIL†		FIL†		FIL†		FIL†	
Heater Current in Amperes	9-Volt Operation	Min Max	0.28 0.33		0.28 0.33		0.28 0.33		0.28 0.33	
	10-Volt Operation	Min Max	0.29 0.35		0.29 0.35		0.29 0.35		0.29 0.35	
Space Current	Switch on 1R or 1AC Set		P1	P2	P1	P2	P1	P2	P1	P2
	Space mv	Min Max	400 750	400 750	450 700	400 600	400 750	400 750	400 750	400 750
Cathode Activity	Switch on 1R or 1AC Set		P1	P2	P1	P2	P1	P2	P1	P2
	Decrease Heater Current Amperes 9-Volt Operation		0.015		0.015		0.015		0.015	
	Decrease Heater Current Amperes 10-Volt Operation		0.02		0.02		0.02		0.02	
	Max Percent Cathode Activity		25	25	25	25	25	25	25	25

* Tube designation
† Filament jack

Note: For nominal 9-volt operation of the heater circuits, the current in the heater circuit should be within the range of 0.295 to 0.310 ampere for the greatest proportion of heater circuits. The corresponding range for nominal 10-volt operation is 0.300 to 0.335 ampere.

2   If a large group of 310A tubes in any one office falls outside the range of 0.295 to 0.310 ampere, check the adjustment of the heater circuits for 9-volt operation. If restrapping is necessary, repeat the test before tubes are rejected.

3   When the requirements are not met, replace the appropriate tubes. (See Part 2,A and 2.04.)

STEP	PROCEDURE

4   If the range of the space percent zero adjustment rheostats of the 1R or 1AC tube test set will not permit adjustment of the space current to give a zero reference for the cathode activity tests, read the space millivolts at normal heater current and at the decreased heater current. Determine the percent cathode activity by taking the difference between the two space millivolt readings and basing the percent on the millivolts at normal heater current.

3. PATCHING PROBLEMS

3.01 This part outlines the procedures for patching group and supergroup equipment, when necessary, for testing or for trouble location. Because every patch made involves some risk of loss of service due to defective patch cords, out-of-sequence patching, or patching to defective spare equipment, it is advisable to establish communication with a distant station for monitoring purposes when large numbers of channels are to be switched. A 1000-cycle tone on a channel will provide this protection.

3.02 Before any spare equipment is switched into service, sufficient checks of continuity and transmission should be made to ensure satisfactory operation. When parallel patches are established, the length of time these patches are made should be minimized to avoid service reaction.

A. Patching Transmitting Group Banks

3.03 In order to change from regular to spare transmitting group equipment, the five transmitting channel bank alternate outputs must be patched to the spare group modulator inputs.

3.04 When program service is assigned to a group bank, the program is fed to the net side of the hybrid coil and appears out of phase at the channel bank output and the alternate channel bank output sides of the hybrid coil. This causes program cancellation at the supergroup modulator input during the period of time that parallel termination occurs. Therefore, group banks assigned with program circuit units (PGCU) should *not* be patched without obtaining a release from the carrier program control office.

3.05 Figure 1 illustrates a transmitting group bank that is not modified for in-service testing, and Fig. 2 illustrates a modified transmitting group bank. Both figures are included for reference to provide additional information for those sections referred to in the following procedure.

STEP	PROCEDURE

1   ◆Check each of the spare group modulators in accordance with Section 356-105-502.◀

2   If program services are being supplied, notify the program carrier control office and proceed under the latter's instructions.

3   Patch each SP GR MOD to each corresponding CH BANK OUT ALT jack (see Fig. 1 or 2) by first making patch (1) to the SP GR MOD IN jacks and then patch (2) to the CH BANK OUT ALT jacks.

Caution 1: Avoid turnover when making patches.

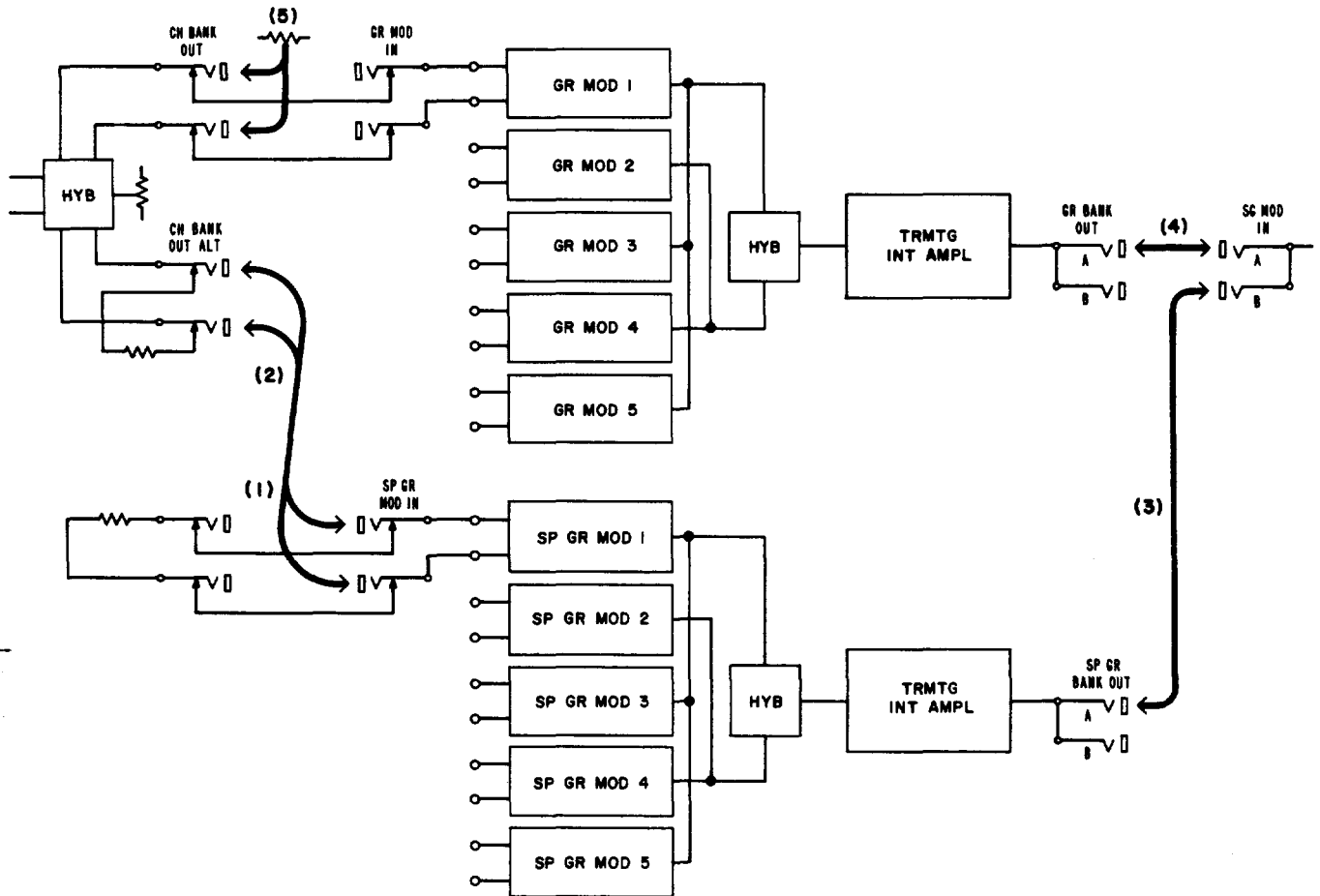| STEP	PROCEDURE

Fig. 1—▶Patching Unmodified Transmitting Group Banks◀

Caution 2: Make all five group patches before proceeding to Step 4.

4   Make patch (3) between the SP GR BANK OUT A jack and the SG MOD IN B jack, and quickly remove patch (4) between the SG MOD IN A jack and the GR BANK OUT A jack.

5   Using a 372A plug, make patch (5) to terminate the CH BANK OUT jacks.

6   To restore the regular group modulators to service, remove the patches made and restore the patches removed in Steps 5, 4, and 3, in that order. Reassign program services to their normal circuits, if necessary.
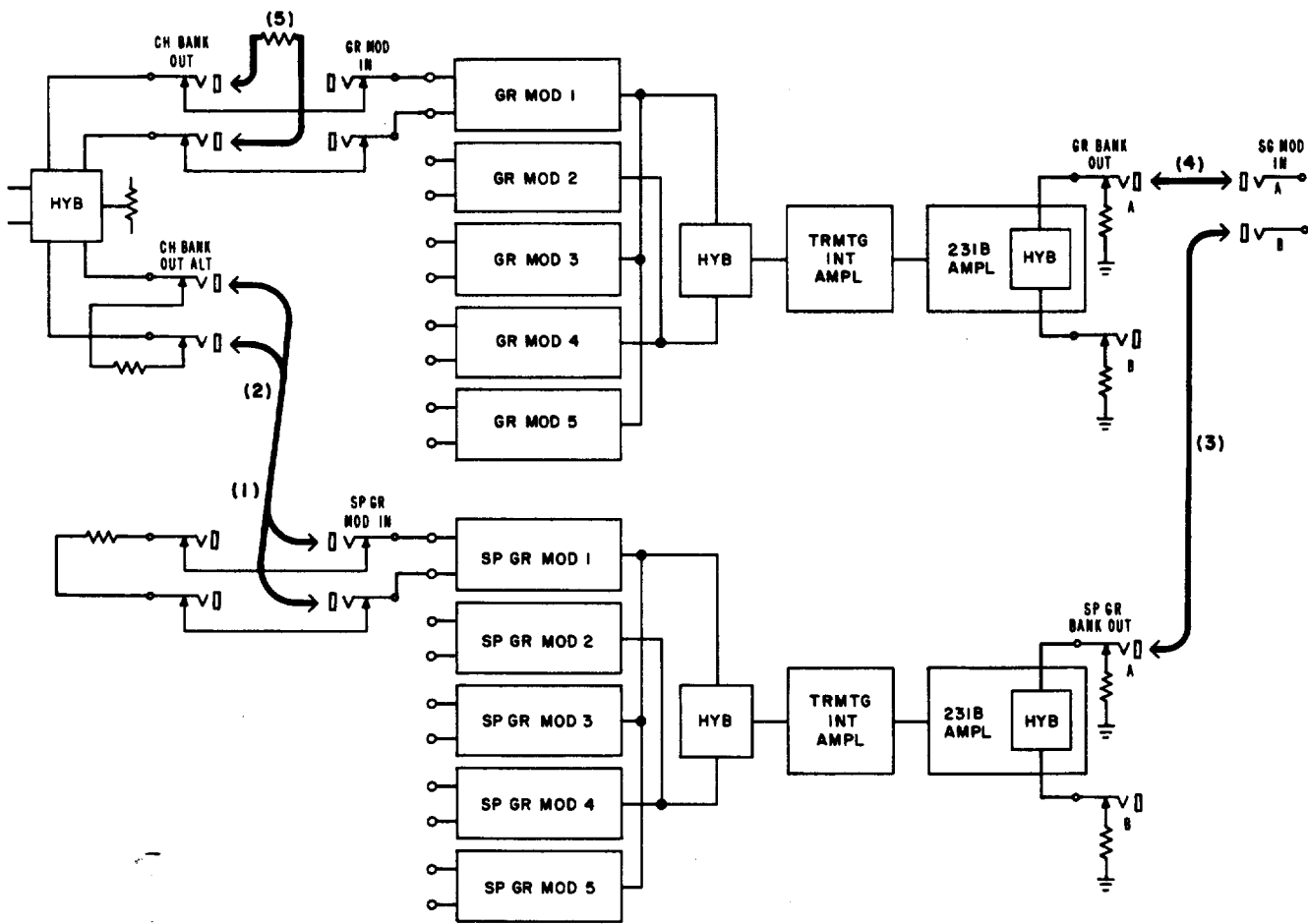
Fig. 2—♦Patching Transmitting Group Banks Modified for In-Service Testing♦

B. Patching Receiving Group Banks

3.06 In order to change from regular to spare receiving group equipment, the regular supergroup demodulator must be patched to the spare group bank. The five receiving spare group demodulators must then be patched to the five regular channel bank inputs. Rapid patch changes are not required on receiving group banks since the establishment of the channel bank input patch terminates the output of the regular group demodulator and establishes the alternate path through the spare group demodulator. It is important, however, that patches be made in the correct sequence. When a PGCU is assigned to a group bank, GR DEM OUT BR jacks are usually provided. The path through the GR DEM OUT BR patch jacks must be patched in addition to the GR DEM OUT jacks.

3.07 The following procedure is applicable when changing from regular to spare receiving group equipment.

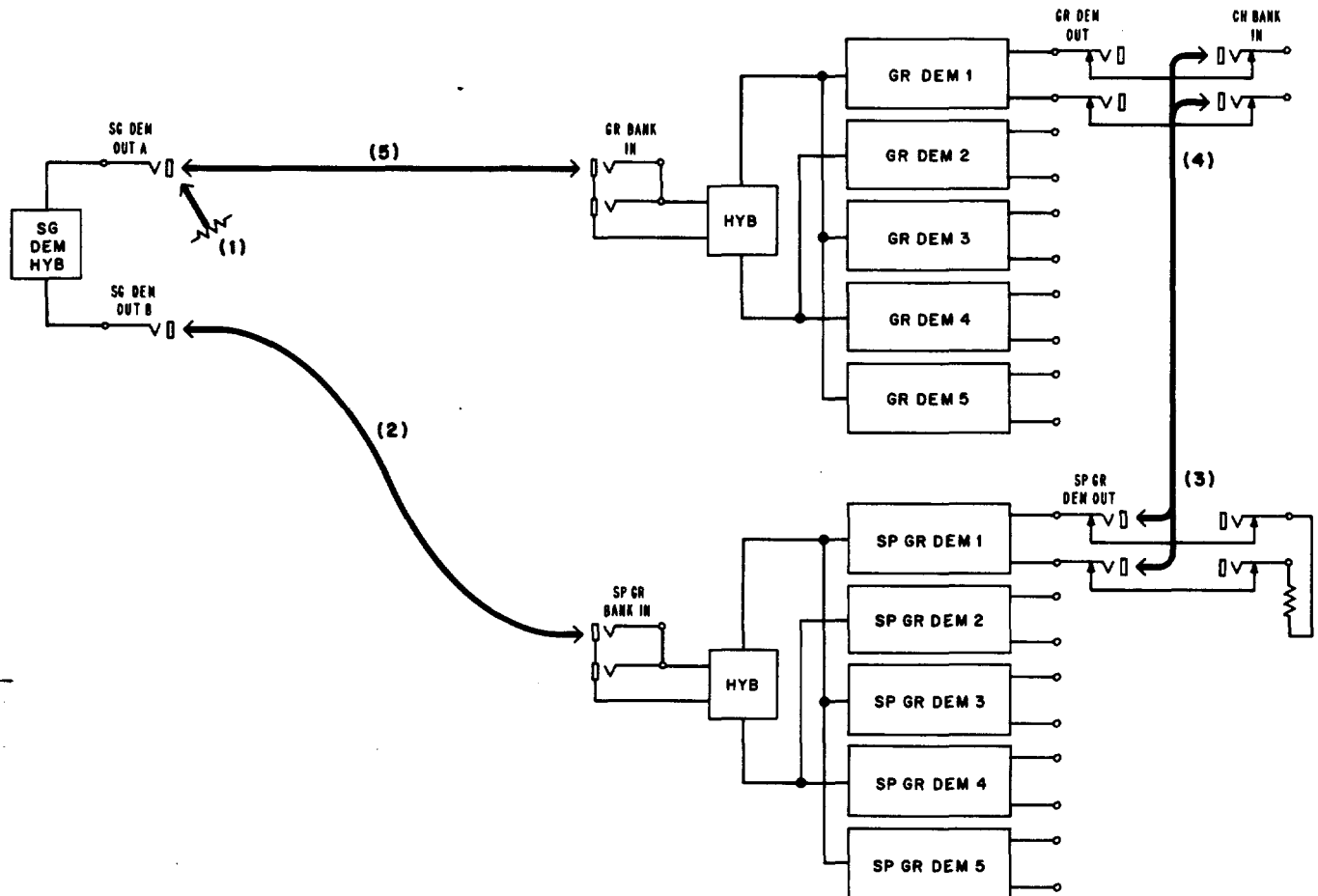| STEP	PROCEDURE
1	Make patch (2) in Fig. 3 from the SG DEM OUT B jack to the SP GR BANK IN jack.

STEP	PROCEDURE

Fig. 3—♦Patching Receiving Group Banks♦

2   Set the scanner control circuit switches to the bay, supergroup, and spare group positions and depress the SELECT key.

3   Measure the ouput power of each spare group demodulator.

     Requirement: 0 ±0.2 dB

4   ♦If the requirement of Step 3 is not met, perform the tests in Section 356-120-502.♦

5   Make patch (3) to the SP GR DEM OUT jacks and then make patch (4) to the CH BANK IN jacks.

STEP	PROCEDURE

Caution: Before proceeding with the following steps, determine if PGCU service is involved as described in 3.06. If PGCU service is involved, obtain a release from the program control office.

6   Repeat Step 5 for the remaining spare group demodulators.

7   If PGCU service is involved, patch from the SP GR DEM OUT BR jack to the GR BR IN jack of each group so equipped.

8   Remove patch (5) between the GR DEM OUT A jack and the GR BANK IN jack.

9   Make patch (1) in Fig. 3 to terminate the SG DEM OUT A jack.

10   To restore the regular group demodulators to service, remove the patches made and restore the patches removed in Steps 9 through 1, in that order.

C. Patching Transmitting Supergroup Equipment

3.08 In order to change from regular to spare transmitting supergroup equipment, the ten transmitting spare supergroup modulators must be patched to their corresponding group bank outputs. Figures 4 and 5 illustrate the various arrangements which may be present. In some cases, an unmodified group bank output may be feeding an L1860A supergroup transmitter and, in this arrangement, it is not possible to avoid patching hits. Because of the difference in equipment arrangements, two different patching procedures must be used when patching L600A and L1860A equipment. The possibility of a hit occurring because of turnover prohibits the use of the TST jack for equipment patching.

3.09 One of the following procedures, whichever is applicable, should be employed when changing from regular to spare transmitting supergroup equipment.

STEP	PROCEDURE

L600A Patching

1   Verify that the indicator lamp on the transmitting high-frequency patch bay is lighted. (This indicates that the spare supergroup bank is available for use.)

2   ▶Check each of the spare supergroup modulators in accordance with Section 356-110-502 before proceeding with Step 3.◀

3   Make patch (1) in Fig. 4 from the SP SG BK OUT B jack to the XMTG HY IN B jack.

4   Make patch (2) from the SP SG MOD IN B jack to the GR BK OUT B jack, and quickly remove patch (3) between the GR BK OUT A jack and the REG SG MOD IN A jack.

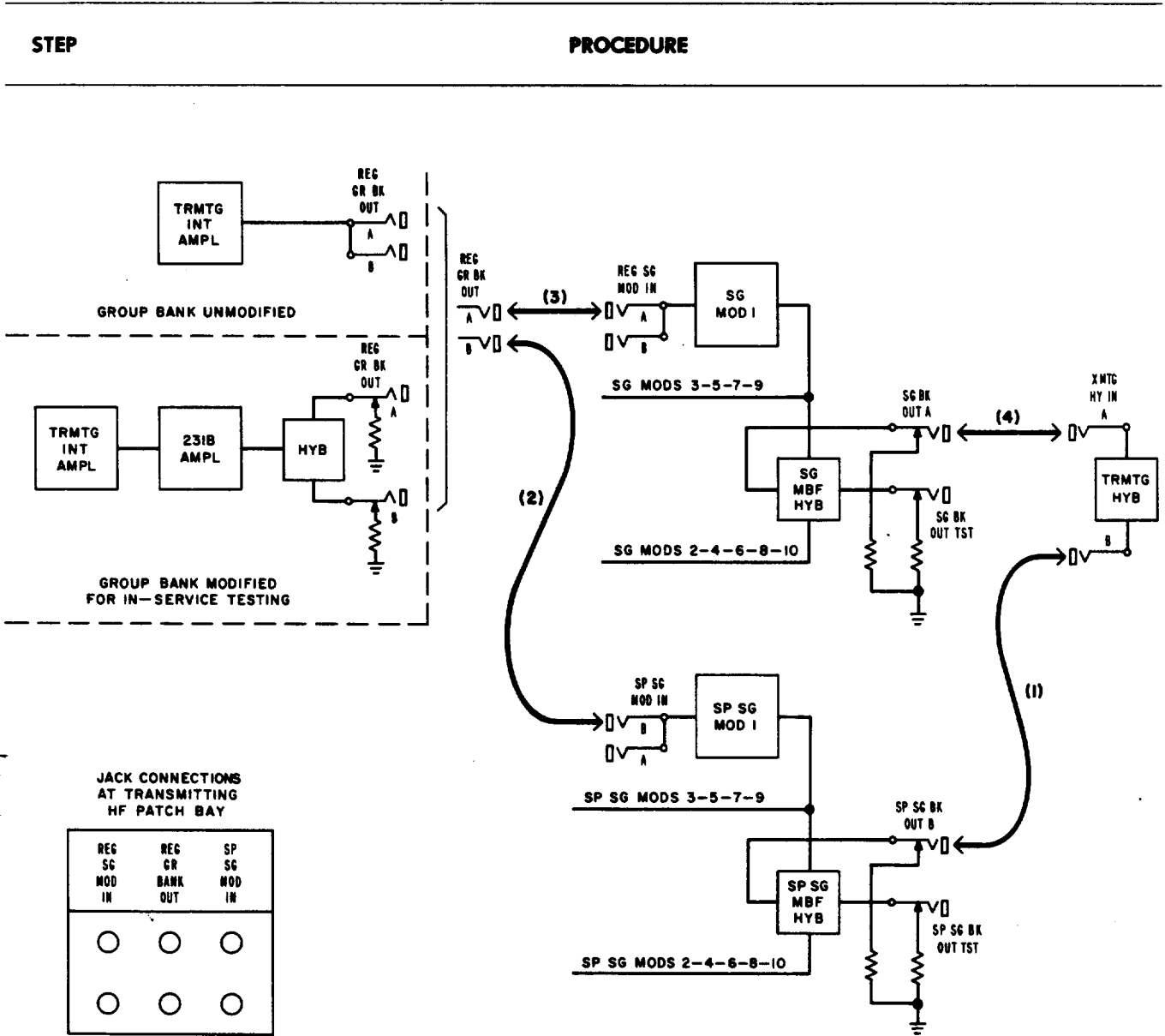5   Repeat Step 4 for the remaining supergroup modulators.

STEP	PROCEDURE

Fig. 4—Patching L600A Transmitting Supergroup Equipment

6   Remove patch (4) from the XMTG HY IN A jack to the SG BK OUT A jack.

7   Terminate the XMTG HY IN A jack using a 368A plug.

8   To restore the regular transmitting supergroup bank to service, remove the patches made and restore the patches removed in Steps 7 through 3, in that order.
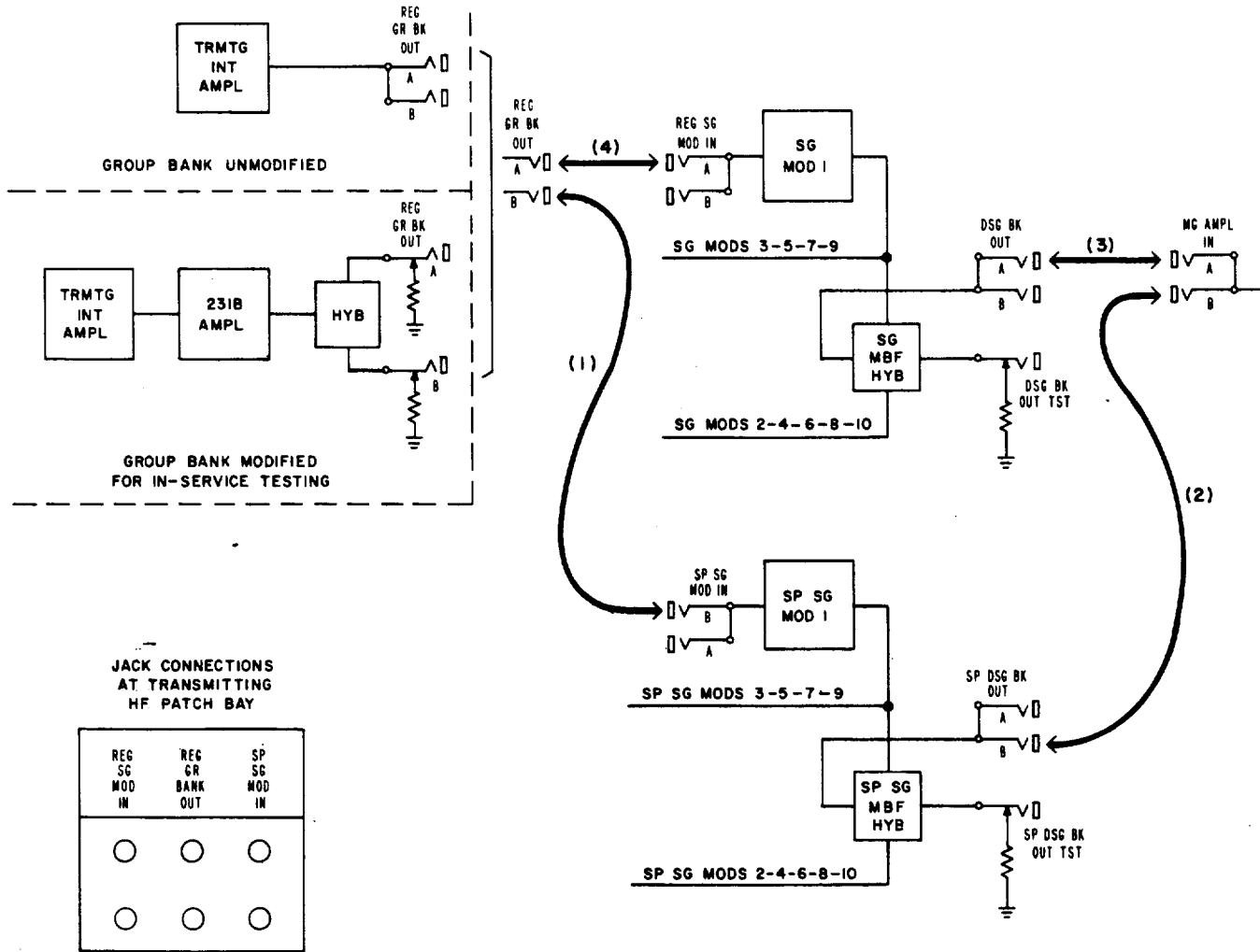
STEP	PROCEDURE

Fig. 5—Patching L1860A Transmitting Supergroup Equipment

L1860A Patching

Caution: A spare transmitting supergroup bank should never be patched to more than one transmitting patch bay. Multiple patches at the tandem jack circuit will cause abnormal frequency losses and service interruptions.

9   ♦Check each of the spare supergroup modulators in accordance with Section 356-110-502♦ before proceeding with Step 10.

STEP	PROCEDURE
10	Make patch (1) in Fig. 5 by patching to the SP SG MOD IN B jack and then to the GR BK OUT B jack.
11	Repeat Step 10 for all other spare supergroup modulator inputs and group bank outputs.
12	Make patch (2) from the SP DSG BK OUT B jack to the MG AMPL IN B jack, and quickly remove patch (3) between the MG AMPL IN A jack and the DSG BK OUT A jack.
13	Remove patch (4) from the GR BK OUT A jack to the REG SG MOD IN A jack.
14	Repeat Step 13 for all of the remaining group bank output jacks to the supergroup modulator inputs.
15	To restore the regular supergroup modulators to service, remove the patches made and restore the patches removed in Steps 14 through 10, in that order.

D. Patching Receiving Supergroup Equipment

3.10 When several supergroup banks occur in one office, an indicator lamp is provided; a lighted lamp indicates that the spare supergroup equipment is available for use. In order to change from regular to spare supergroup equipment, the receiving submastergroup output B jack or the receiving B hybrid jack must be patched to the spare supergroup demodulator input. Each spare demodulator output B jack is then patched to the appropriate regular group bank input B jack. The patch between the regular supergroup demodulator output A jack and the regular group bank input jack is then quickly removed to minimize double termination time. The patch between the regular supergroup demodulator input and the receiving submastergroup output A jack or receiving A hybrid jack is removed, and the hybrid output jack is terminated to provide the B path with the correct load impedance.

3.11 The following procedure should be performed when changing from regular to spare receiving supergroup equipment.

| STEP	PROCEDURE
1	Verify that the indicator lamp on the receiving high-frequency patch bay is lighted. (This indicates that the spare supergroup bank is available for use.)
2	Remove patch (1) in Fig. 6 to remove the termination plug from the REC SM OUT B or REC B HYB jack.
3	Make patch (2) from the REC SM OUT B or REC B HYB jack to the SP SG DEM IN jack.
4	Set the scanner control circuit switches to the bay and spare supergroup position, and depress the SELECT key.

STEP	PROCEDURE
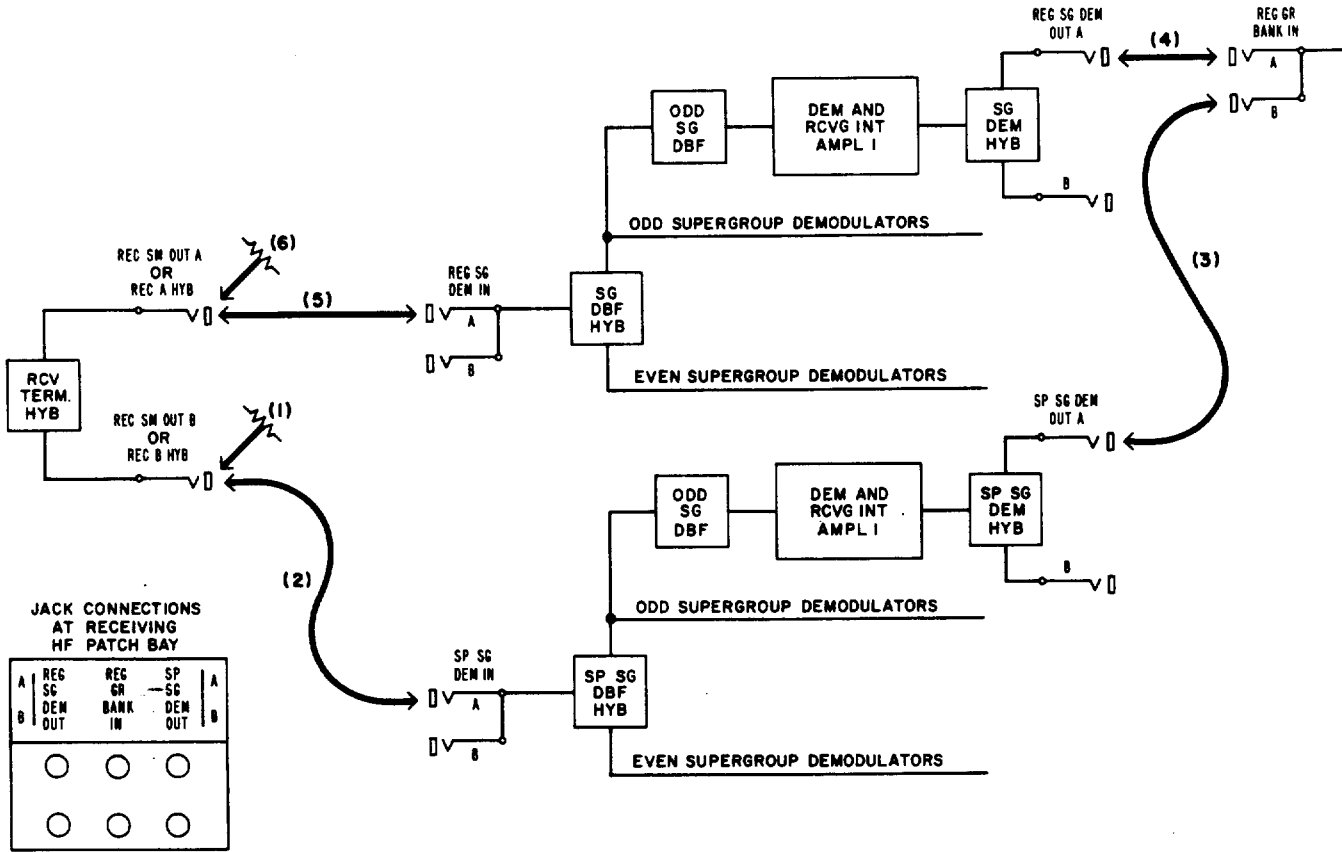
Fig. 6—♦Patching Receiving Supergroup Equipment♦

5   Measure the output power of each spare supergroup demodulator using the scanner equipment.

Requirement: 0 ±0.05 dB

6   ♦If the requirement of Step 5 is not met, perform the tests described in Section 356-115-502.♦

7   ♦Make patch (3) from the SP SG DEM OUT A jack to the REG GR BANK IN B jack, and quickly remove patch (4) between the REG SG DEM OUT A jack and the REG GR BANK IN A jack.

8   Repeat Step 7 for all of the remaining SP SG DEM OUT A jacks to the REG GR BANK IN jacks.♦

STEP	PROCEDURE
9	Remove patch (5) from the REC SM OUT A or REC A HYB jack to the REG SG DEM IN A jack.
10	Make patch (6) in Fig. 6 to terminate the REC SM OUT A or REC A HYB jack. Use the termination plug removed in Step 2.
11	To restore the regular receiving supergroup bank to service, remove the patches made and restore the patches removed in Steps 9 through 7 and Steps 3 and 2, in that order.