"PULSE* 80/120" – SG-1/1A

ELECTRONIC PRIVATE AUTOMATIC BRANCH EXCHANGE

POWER FAILURE AND POWER FAIL TRANSFER CIRCUIT

FAULT-CLEARING PROCEDURES FOR

QSP7L INTEGRATED POWER SUPPLY

CONTENTS PAGE

1. GENERAL

1.01 This section describes the procedure for correcting power failure faults on the QSP7L integrated power shelf used in PULSE 80 and PULSE 120 Electronic Private Automatic Branch Exchange (EPABX). All Light Emitting Diode (LED) indications must be correct on the QPJ47 power failure transfer control board before referring to other fault-clearing procedures.

For additonal information on the QSP7L refer to 553-5021-208.

1.02 The NS-14510 List 1 meter is not sufficiently accurate for carrying out some of the measurements in the voltage tests. For this reason both the absolute EPABX operating limits and the readings allowable on an NS-1451 List 1 meter are given.

1.03 Meter readings are normally well within the allowable limits, if there are no faults on the power shelves, or well outside the limits in the event of a component failure. However, intelligent use of the meter enables its user to defect marginal faults. For example; if the –48 V supply gives a meter reading of –55 V, examine the readings on all other dc supplies (+24, –24, +12, –12 V) using the same 0 through 60-V meter range.

If all these voltages are above or tend towards the high limits given, it can be assumed that the meter is damaged and the power supply is operating correctly.

1.04 For fault-clearing procedures on PULSE 120 systems equipped with power shelves QSP7E through QSP7H refer to 553-5011-516. For fault-clearing procedures on PULSE 80 systems equipped with QSP7A through QSP7D shelves refer to 553-5001-516. For fault-clearing procedures on PULSE 80 systems equipped with QSP7E through QSP7H shelves refer to 553-5001-517.

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2. CIRCUIT DESCRIPTION

QSP7L Integrated Power Supply

2.01 With all boards installed the shelf provides the +5, −48, −24, −12, +24, +12 V dc power required for the PULSE EPABX, as well as the 20-Hz ringing supply, ringing and dc distribution and power failure transfer control.

2.02 The QPJ14 control circuit in connector location No. 1 provides the regulating, drive and switching signals which, applied to the QPJ15 and QPJ16, form a dc-to-dc converter.

2.03 The QPJ15, 48/24/12-V converter in connector location 2 when interconnected with the QPJ14 and QPJ16, provides the −48, −24, +24 and +12 V as required by the PULSE EPABX.

2.04 The QPJ16, +5 V converter in connector location 3 when interconnected with the QPJ14 and QPJ15, provides +5 V as required for the entire PULSE system.

2.05 QPJ44 circuit pack in connector location 6 on the power shelf supplies the 86-V 20-Hz ringing which is distributed through the system from the QPJ46-type circuit pack in connector location 5.

2.06 The QPJ47 power failure transfer board in connector 4 monitors the 5 V on the output side of the fuses located on the QPJ16 +5 V converter board. For example; if the LED on the QPJ47 board designated as J7 is illuminated, the fuse designated as F3 (J7) on the QPJ16 board should be checked.

2.07 The characteristics and circuit served by the fuses on the QPJ16 are listed in Table A.

2.08 Failure of the LITTEL fuse F10 results in no output voltages from the shelf. This fuse must be checked by removing it because there is no visible indication of its having blown.

2.09 The characteristics and circuit served by the fuses on the fuse panel Fig. 1 are listed in Table B.

2.10 A blown or operated QFF-type fuse illuminates the fuse alarm. A blown QFF-type fuse is indicated by a colored marker protruding from the front of the fuse. A colored marker on any nonblown fuse is pressed to light the FA lamp and ensure the fuse alarm circuit is operative.

2.11 When a fuse is faulty, major alarm lamps and fuse alarm lamps on the power shelf light up simultaneously with the ET and FA lamps on the attendant console. The major (ET) alarm is accompanied by the release of the Power Fail Transfer (PFT) relays, bridging the emergency service.

2.12 The EPABX may be restored to normal operation either automatically or manually. For automatic reset the switch, located on the QPJ47-type circuit pack, is operated in the upper position; for manual reset the switch is operated in the lower position.

2.13 The reset button on the power shelf is used to restore the EPABX manually to normal operation from PFT operation. The reset button, when pressed, operates the PFT relays which remove the emergency connections. Normal operation can also be restored from the attendant console by depressing the Power Fail (PF) button on the console.

Note: Wait 5 seconds following a power fail transfer before attempting to reset the system.

2.14 When the EPABX is in the nite service mode, all lamps on the console are extinguished.

3. POWER TESTS

3.01 The power supply voltage tests described in Chart 1 use LED indications to detect the presence of voltages in the system.

3.02 Voltage outside the allowable limits given in Chart 2 Steps 1 through 9 release the PFT relays and set the system up for emergency service. The required voltage must be measured by a voltmeter. Steps 10, 11, 12 in Chart 2 stipulate voltages required on pins at connectors.

3.03 The precaution given in Chart 3, must be observed when making power tests or correcting faults.

4. FAULT-CLEARING PROCEDURES

4.01 Before commencing this fault-clearing procedure, ensure that the fault is within the PULSE EPABX and not with associated equipment, such as wiring, telephone set, paging amplifier, etc.

4.02 When the substitution of a circuit pack is required during the fault-clearing procedure, the contacts on the new circuit pack must be cleaned as described in 553-5001-500 or 553-5011-500 before inserting the circuit pack into the connector.

CHART 1
POWER SUPPLY VOLTAGES TESTS
(Required in Flowchart 1)

If the indications differ from those described in the verification column, the test has failed.

Refer to the flowchart for instructions. The QPJ47- and QPJ87-type circuit packs are described in 553-5001-502, and the QPJ40 is described in 553-5001-517. The QPJ40, QPJ47, QPJ97 packs are described in 553-5011-502.

STEP	ACTION	VERIFICATION
1	Check whether any of the QFF-type fuses on power shelf 2 are blown. Substitute any blown fuse on the fuse panel on power shelf with one having the same rating as that indicated by the color indicator above the fuse holder.	If the fuse blows again, refer to the flowchart for instructions.
2	With a pointed object press on the color indicator of one of the QFF-type fuses.	The fuse alarm lamp lights.
3	Check that all LED lamps are extinguished on the QPJ47-type circuit pack in connector 5 on power shelf .	All seven LED lamps are extinguished.
4	Insert the QPJ40-type circuit pack (Fig. 2) in a station line and trunk connector in each of the line and trunk shelves in the EPABX. When a single station of a station line tens group is faulty, insert the QPJ40-type circuit pack in the station line connector of the group concerned. The same operation applies to the faulty trunks. If QPJ40 is not available, perform Steps 11, 12 and 13 in Chart 2.	When inserted in a station line connector, all LED lamps, except for position 6, light. When in trunk connectors, LED lamps in positions 2 through 8 light.
5	Complete a visual inspection of the GRD connections in the EPABX and at the approved ground termination.	All connections are securely fastened.
6	Fuse FIO has no visual indication, if there are no output voltages from the power shelf check FIO fuse.	

IMPORTANT:

There must be some load on the +5 V supply when making voltage measurements, e.g., do *not* disconnect all +5 V leads or all packs from system and then measure voltages. If a problem exists with the +5 V distribution remove only those packs associated with the +5 V fuse which is giving the problem. Refer to Table A.

4.03 If a fault is cleared by circuit pack substitution and there is no visual evidence of burnt or damaged components on the original circuit pack, the contacts on this circuit pack and its associated connector must be cleared. The original circuit pack is then inserted in the connector and, if the fault reappears, the new circuit pack is reinserted.

4.04 If different or additional faults (or both) are created in the system by substituting a circuit pack, tag and return the replacement – it is defective.

4.05 If the fault is not cleared by substituting a circuit pack, the original circuit pack must be reinserted in the connector.

4.06 The instructions for substituting a shelf are given in 553-5021-208.

4.07 When the fault-clearing procedure has been completed, make a visual check to ensure that all circuit packs are well seated in their connector, and screws are tight in connector plugs and jacks. The EPABX internal cable arrangement is given in 553-5001-501 or 553-5011-501.

CHART 2
POWER SUPPLY VOLTAGE MEASUREMENT

STEP	ACTION	VERIFICATION
1	Measure the voltage at the commercial power outlet with the NS-14510 meter set to the 300-V ac range. If the measurement was taken during a previous test, ignore this instruction.	The voltage limits for satisfactory operation of the EPABX are: EPABX LIMITS: 115±21 V METER READING LIMITS: 115±21 V (on 300-V range)
2	Measure negative dc voltages by using the appropriate voltmeter ranges. Insert the positive lead in the ground (GRD) test point on the QPJ15 board in connector location 2.	
3	Insert the negative meter lead in the appropriate test points on the QPJ15 board. (a) –48 V (b) –24 V (c) –12 V	The voltage limits allowable for satisfactory operation of the EPABX are: (a) EPABX LIMITS: –48±4 V; METER READING LIMITS: –48±6 V (on 60-V range) (b) EPABX LIMITS: –24±2 V; METER READING LIMITS: –24±4 V (on 60-V range) (c) EPABX LIMITS: –12±1 V; METER READING LIMITS: –12±3 V (on 60-V range) *Note:* The meter readings include the EPABX limits plus allowance for normal meter inaccuracy. If the voltage readings obtained are beyond the specified limits or not present at test points, refer to flowchart.
4	Measure positive dc voltages using the appropriate voltmeter ranges. Insert the negative lead in the GRD test point on the QPJ15 board for positive voltage reading.	

Chart Continued

CHART 2 Continued
POWER SUPPLY VOLTAGE MEASUREMENT

STEP	ACTION	VERIFICATION
5	Insert the positive meter lead in the different test points on the QPJ15 in connector location 2. (a) +24 V (b) +12 V	The voltage limits and meter readings are: (a) +24±2 V — EPABX LIMITS; +24±4 V — METER READING LIMITS (b) +12 V limits: +10 and +13 V — EPABX LIMITS; +12 V limits: +8 and +15 V — METER READING LIMITS
6	Insert the positive meter +5 V measurement in test point on the QPJ16 in connector location 3.	±5.1±.25 V — EPABX LIMITS +5.1±.60 V — METER READING LIMITS ← Individual measurements should not differ by more than 0.5 V If the voltage readings obtained are beyond the specified limits or not present at test points, refer to flowchart.
7	Select appropriate ac voltmeter range. Connected one lead to the GRD test point on the fuse panel of the QPJ15. Use the other lead to check for 12 V, 20 Hz at the test point on the QPJ44-type circuit pack in connector location 6 on the power shelf.	The EPABX limit for the 20 Hz is 12.4±1.2 V and the meter reading is 12.4±3 V. If the voltages are beyond the specified limits or not present at test points, refer to flowchart. *Note:* Readings on the NS-14510 meter may be in error at 20 Hz.
8	Check the 86 V ac at the test points on the QPJ37-type circuit packs on the line shelves. For this test, ensure that the QPJ40-type circuit pack is not plugged into any of the line shelves.	The EPABX limits for the 86 V ac are between 76.5 and 93.5 V. *Note:* The reading on the NS-14510 meter will vary around 190 V since 86 V ac is superimposed on dc.

Chart Continued

CHART 2 Continued
POWER SUPPLY VOLTAGE MEASUREMENT

STEP	ACTION	VERIFICATION
9	Set meter set to the ohms scale (R × 1). Connect one lead from the meter to the ground lug on the connector panel in the base of the cabinet Connect the other lead to an approved ground other than the ground facility used by the EPABX. Refer to 553-5001-206 or 553-5011-206 for EPABX ground testing.	Any resistance of 3 ohms or greater should be investigated. *Note:* Correct ground faults before proceeding with the fault-clearing procedure.
10	With the meter connected as described in Step 2 and 4, check the −12-V and 12-V, 20-Hz Hz supplies on the control shelf at the following places: (a) −12 V on connector 21, pin 3B (b) 12 V, 20 Hz on connector pin 13B	The voltage limits allowable for satisfactory operation of the EPABX are: (a) −12±1 V — METER READING LIMITS: 12±3 V (on 60-V range) (b) 12.4±1.2 V — METER READING LIMITS: 12.4±3 V (on 60-V range) If the voltage readings obtained are beyond the specified limits or not present at the pin, refer to flowchart.
11	With the meter connected as described in Steps 2 and 4, check the +24 V; −24 V and −48 V supplies on trunk shelves 1 and 2 at the following places: (a) 48 V, on connector 9, pin 11 B, on both trunk shelves (b) −24 V, on connector 9, pin 31B, on both trunk shelves (c) +24 V on both trunk shelves on the following pins: (1) connector 9, pin 9B (2) connector 6, pin 8B (3) connector 15, pin 8B (4) connector 19, pin 8B	(a) −48±4 V — METER READING LIMITS: −48±6 V (on 60-V range) (b) −24±2 V — METER READING LIMITS: −24±4 V (on 60-V range) (c) +24±2 V — METER READING LIMITS: +24±4 V (on 60-V range) The voltage limits allowable for satisfactory operations of the EPABX are:

Chart Continued

CHART 2 Continued
POWER SUPPLY VOLTAGE MEASUREMENT

STEP	ACTION	VERIFICATION
12	With the meter connected as described in Steps 2 and 4, check the −24 V and +24 V supplies on both line shelves. Check for: (a) +24 V on both line shelves on the following pins: (1) connector 5, pin 9 (2) connector 19, pin 9 (3) connector 5, pin 33 (4) connector 4, pin 34 (5) connector 9, pin 34 (6) connector 18, pin 34 (7) connector 23, pin 34 (b) −24 V on both the line shelves on the following pins: (1) connector 5, pin 11 (2) connector 19, pin 11	EPABX LIMITS / METER READING LIMITS (a) +24±2 V / +24±4 V (on 60-V range) (b) −24±2 V / −24±4 V (on 60-V range) The voltage limits allowable for satisfactory operation of the EPABX are: If the voltage readings obtained are beyond the specified limits or not present at the pin, refer to Part 3.
13	Check for 86 V 20 Hz on test points PT1, TP2, TP3, and TP4 on QPJ37 connector 11 line shelf 1 and line shelf 2 if fitted.	The reading on the NS-14510 meter is approximately 190 V, but varies since 86 V 20 Hz is superimposed on dc.

CHART 3
PRECAUTIONS WHEN MAKING POWER TESTS OR CORRECTING POWER FAULTS

STEP	PROCEDURE
1	Select the lowest multiplier scale (R × 1) on the ohmmeter to perform resistance tests.
2	The commerical power switch must be operated to the OFF position when substituting any circuit pack in the power shelf.
3	When a power fault is cleared by a substitution of a circuit pack, do not reinsert the faulty circuit pack to prove fault.
4	A blown fuse must be substituted with a fuse of the same rating.
5	Do not attempt to correct wiring faults.
6	TB1 strap should be 2 to 3 for 115-V 60-Hz operation or 1 or 2 for 230 V 50 Hz.
7	Do not short-circuit connector pins with meter when taking voltage measurements, otherwise extensive circuit pack damage occurs.

TABLE A
FUSE DISTRIBUTION ON QPJ16 +5 V CONVERTER

FUSE NO.	ALARM INDICATOR	SUPPLY VOLTAGE (VOLTS)	FUSE RATING (AMPERES)	TYPE OF FUSE	CIRCUIT SERVED
F3 (J7)	Major Alarm and LED J7 on QPJ47 lit	+5	15	Bussman 3AG	The +5 V supply to the control shelf basic cards.
F4 (J1)	Fuse Alarm and LED J1 on QPJ47 lit	+5	15	Bussman 3AG	The +5 V supply to the control and option shelves.
F5 (J2)	Major Alarm and LED J2 on QPJ47 lit	+5	15	Bussman 3AG	The +5 V supply to the trunk shelf 1 and line shelf 1.
F6 (J3)	Fuse Alarm and LED J3 on QPJ47 lit	+5	15	Bussman 3AG	The +5 V supply to the trunk shelf 2 and line shelves 2 and 3.
F9 (J26)	Fuse Alarm and LED J26 on QPJ47 lit	+5	15	Bussman 3AG	The +5 V supply to the option shelf serving certain features on the shelf.

TABLE B
FUSE DISTRIBUTION ON INTEGRATED POWER SHELF

FUSE NO.	ALARM INDICATION	SUPPLY VOLTAGE (VOLTS)	FUSE RATING (AMPERES)	TYPE OF FUSE	COLOR INDICATOR	CIRCUIT SERVED
F1	Major Alarm and LED	−50	3	QFF1C	—	The −48 V (unfiltered supply) to the ringing generator QPJ44-type circuit pack.
F2	Major Alarm	+24	1 1/3	QFF1A	—	The +24 V supply to the 86-V, 20-Hz transformer, supplying generator to the ringing fuses.
F7	Fuse Alarm	+12	3	QFF1C	Blue	Powers the console lamps: The +12 V energizes a relay on the QPJ37-type circuit pack in line shelf No. 1 when the system is NITE service mode.
F8	Fuse Alarm	+12	3	QFF1C	Blue	Powers the console busy lamp field.
F10	NONE	—	−1/2	LITTEL	—	Provides fusing for the control circuit. *Note:* There will be no output voltages if this fuse is blown.
F11	FA	+24	3/4	QFF1H	Brown	The +24 V supply to the ringing control circuit for station line numbers (2)10 through (2)19 (2)50 through (2)59, and 310 through 319.
F12	FA	+24	3/4	QFF1H	Brown	The +24 V supply to the ringing control circuit for the station line numbers (2)20 through (2)29, (2)60 through (2)69, 320 through 329 and the QPJ37-type circuit packs on all line shelves.
F13	FA	+24	3/4	QFF1H	Brown	The +24 V supply to the ringing control circuit for the station line numbers (2)30 through (2)39, (2)70 through (2)79, and 330 through 339.
F14	FA	+24	3/4	QFF1H	Brown	The +24 V supply to the ringing control circuit for the station line numbers (2)40 through (2)49, (2)80 through (2)89, and 340 through 349.

Table Continued

TABLE B Continued
FUSE DISTRIBUTION ON INTEGRATED POWER SHELF

FUSE NO.	ALARM INDICATION	SUPPLY VOLTAGE (VOLTS)	FUSE RATING (AMPERES)	TYPE OF FUSE	COLOR INDICATOR	CIRCUIT SERVED
F15	FA	+24	3/4	QFF1H	Brown	The +24 V supply to the attendant console tone generator.
F16	FA	+24	3/4	QFF1H	Brown	The +24 V supply to the control circuits of the circuit packs in connector locations 5, 6, 7, 8 and 9 on trunk shelf No. 1.
F17	FA	+24	3/4	QFF1H	Brown	The +24 V supply to the control circuits of the circuit packs in connector locations 15, 16, 17, 18, and 10 on trunk shelf No. 1.
F18	FA	+24	3/4	QFF1H	Brown	The +24 V supply to the control circuits of the circuit packs in connector locations 20, 21, 22, 23, and 24 on trunk shelf No. 1.
F19	FA	+24	3/4	QFF1H	Brown	The +24 V supply to the control circuits of the circuit packs in connector locations 5, 6, and 7 on the trunk shelf No. 2.
F20	FA	+24	3/4	QFF1H	Brown	The +24 V supply to the control circuits of the circuit packs in connector locations 8, 9, 15, and 16 on the trunk shelf No. 2.
F21	FA	+24	3/4	QFF1H	Brown	The +24 V supply to the control circuits of the circuit packs in connector locations 17, 18, 19 and 20 on the trunk shelf No. 2.
F22	FA	+24	3/4	QFF1H	Brown	The +24 V supply to the control circuits of the circuit packs in connector locations 21, 22, 23 and 24 on the trunk shelf No. 2.
F23	FA	+24	3/4	QFF1H	Brown	The +24 V supply to the control circuits of the circuit packs in connector locations 2, 4 and 7 on the control shelf.
F24	FA	+24	1/4	QFF1F	Violet	The +24 V supply to the trunk answer from any station audible signal control circuit.

Table Continued

TABLE B Continued
FUSE DISTRIBUTION ON INTEGRATED POWER SHELF

FUSE NO.	ALARM INDICATION	SUPPLY VOLTAGE (VOLTS)	FUSE RATING (AMPERES)	TYPE OF FUSE	COLOR INDICATOR	CIRCUIT SERVED
F25	Major Alarm FA	+24	5	QFF1D	Green	The +24 V to all trunk and line shelves and DGT receivers.
F26	MA	+24	1 1/3	QFF1A	White	DIGITONE* receiver and hotel/motel services. ← ←
F27	FA	+24	1/4	QFF1F	Violet	The +24 V unfiltered ringing return to recorded telephone dictation external equipment.
F28	FA	−24	1/4	QFF1F	Violet	The −24 V unfiltered supply to the attendant console jack control circuit leads designated JKM.
F29	Major Alarm FA	−24	5	QFF1D	Green	The −24 V supply to all trunk and line shelves and DIGITONE receiver. ←
F30	—	24	1/2	OFF1G	Red	The −24 V which feeds the QPJ46 board.
F31	FA	−48	1/4	QFF1F	Violet	The −48 V supply to the power-fail transfer relays.
F32	FA	−48	1 1/3	QFF1A	White	The −48 V unfiltered supply to external equipment through connecting block P130.
F33	FA	−48	1/2	QFF1G	Red	The −48 V unfiltered supply to external equipment through connecting block P130.
F34	Major Alarm FA	−48	3	QFF1C	Blue	The −48 V to trunk shelves and power failure transfer relays. ←
F35	FA	86 V, 20 Hz	1/4	QFF1F	Violet	The 86-V, 20-Hz supply for station line numbers (2)10 through (2)19, (2)50 through (2)59, and 310 through 319. This supply appears at test point TP1 on the QPJ37-type circuit pack in connector location 11 on both line shelves.
F36	FA	86 V, 20 Hz	1/4	QFF1F	Violet	This fuse serves the 86-V, 20-Hz supply for the station line numbers (2) 20 through (2)29, (2)60 through (2)69, and 320 through 329. This supply appears at test point TP2 on the QPJ37- type circuit pack in connector location 11 on both line shelves.

Table Continued

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TABLE B Continued
FUSE DISTRIBUTION ON INTEGRATED POWER SHELF

FUSE NO.	ALARM INDICATION	SUPPLY VOLTAGE (VOLTS)	FUSE RATING (AMPERES)	TYPE OF FUSE	COLOR INDICATOR	CIRCUIT SERVED
F37	FA	86 V, 20 Hz	1/4	QFF1F	Violet	The 86-V, 20-Hz supply for the station line numbers (2)30 through (2)39, (2)70 through (2)79, and 330 through 339. This supply appears at test point TP3 on the QPJ37-type circuit pack in connector location 11 on both line shelves.
F38	FA	86 V, 20 Hz	1/4	QFF1F	Violet	The 86-V, 20Hz supply for the station line numbers (2)40 through (2)49, (2)80 through (2)89, and 340 through 349. This supply appears at test point TP4 on the QPJ37-type circuit pack in connector location 11 on both line shelves.
F39	FA	86 V 20 Hz	1/4	QFF1F	Violet	The 86-V, 20-Hz supply to recorded telephone dictation external equipment.
F40	–	–	–	–	–	Not used.
F41	FA	86 V, 20 Hz	1/4	QFF1F	Violet	The 86-V, 20-Hz supply to the trunk answer from any ringing or subscriber set (NE-592A).
F42	FA	105 V, 20 Hz	1/4	QFF1F	Violet	The 105-V, 20-Hz supply to dial long line external equipment.

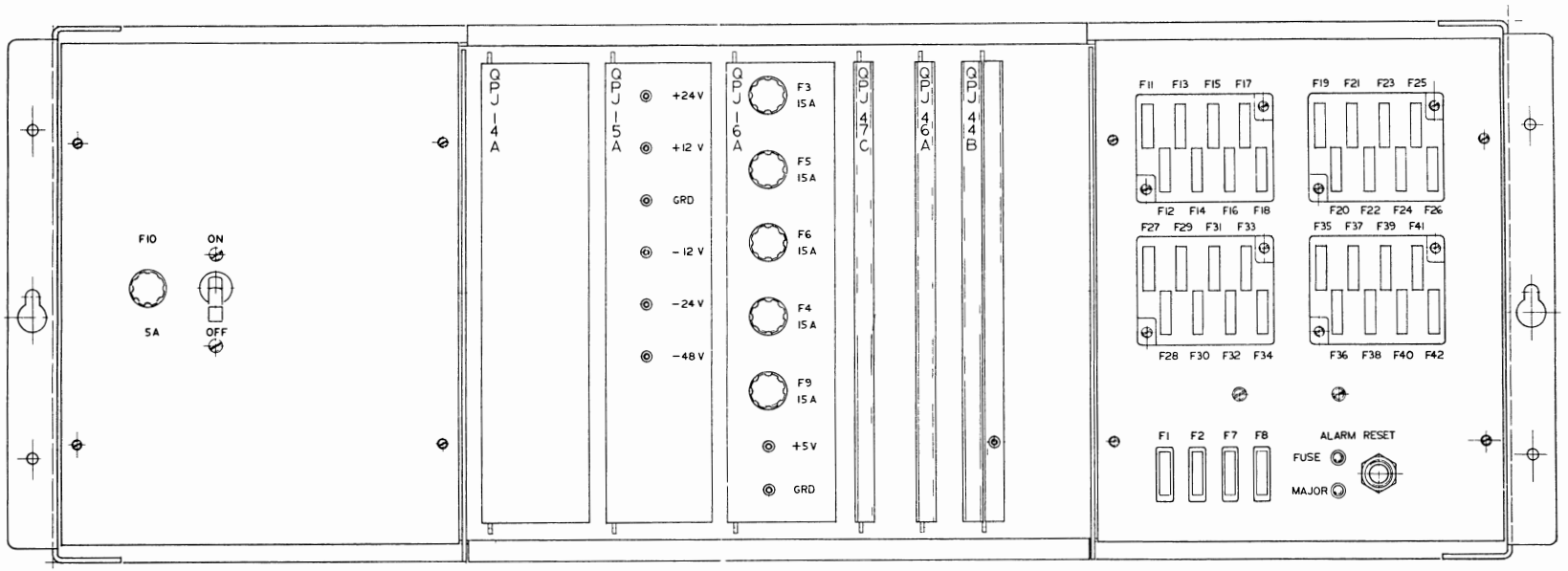


Fig. 1 — QSP7L Integrated Power Shelf

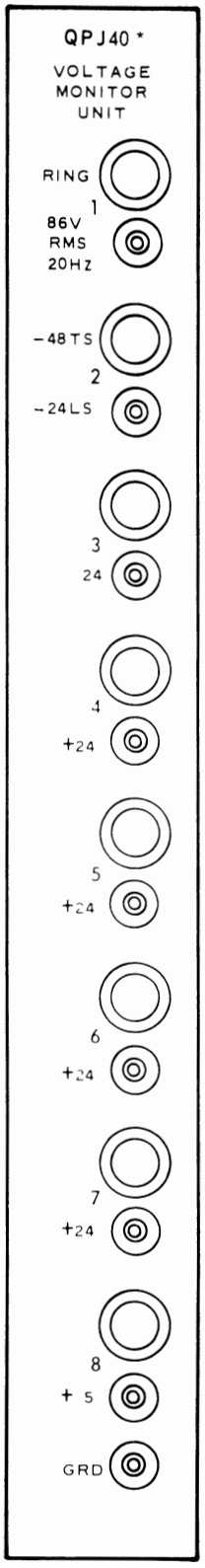
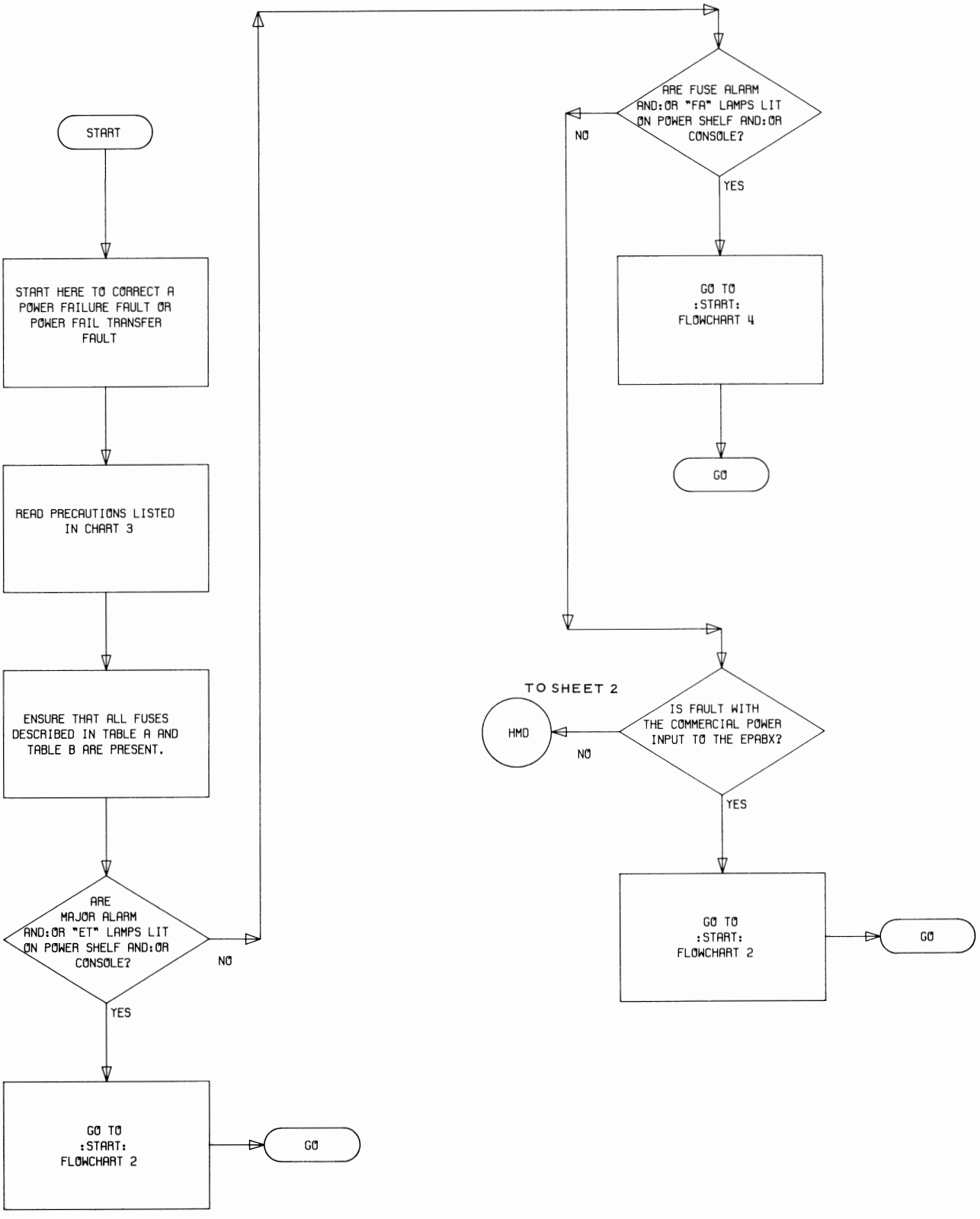
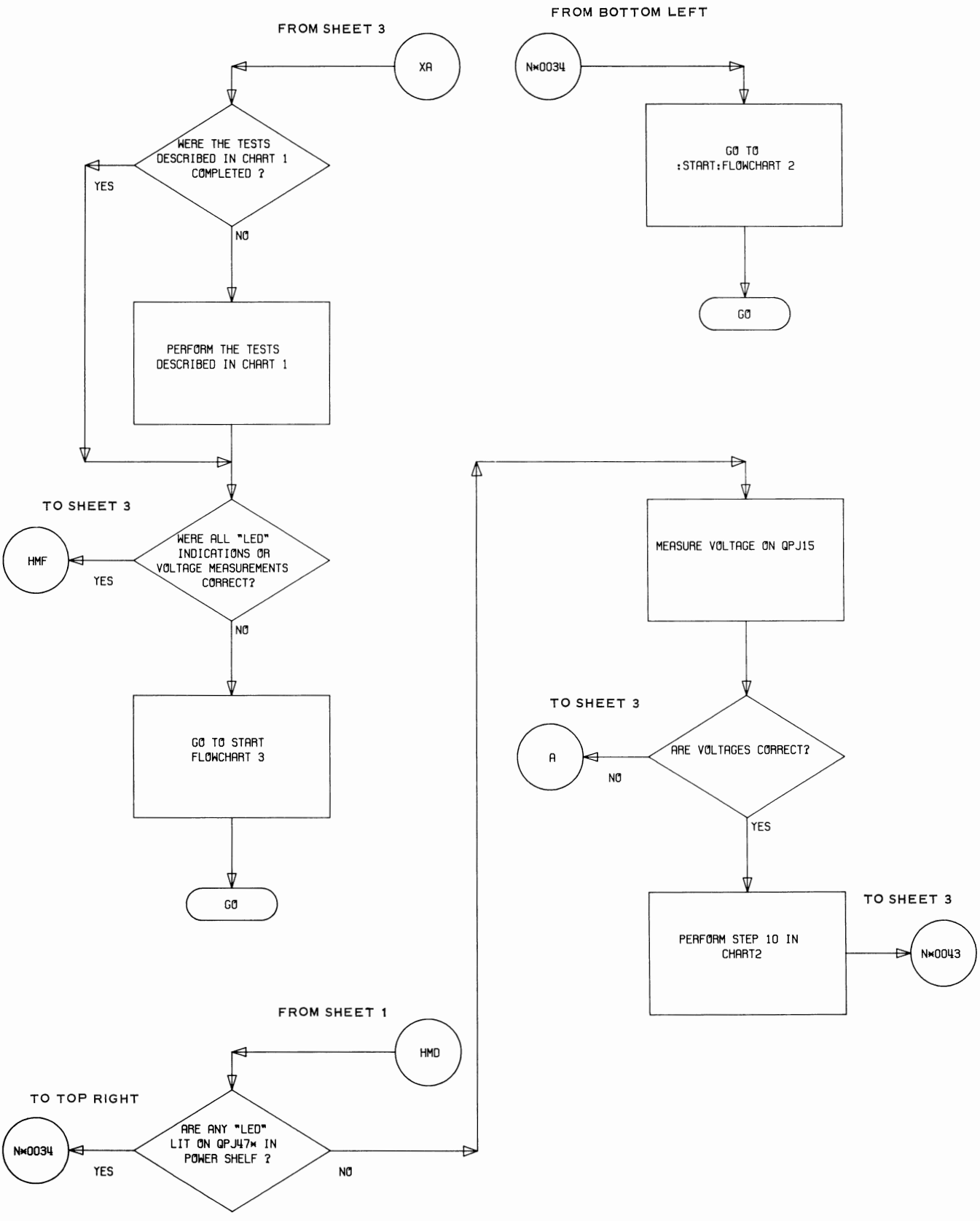


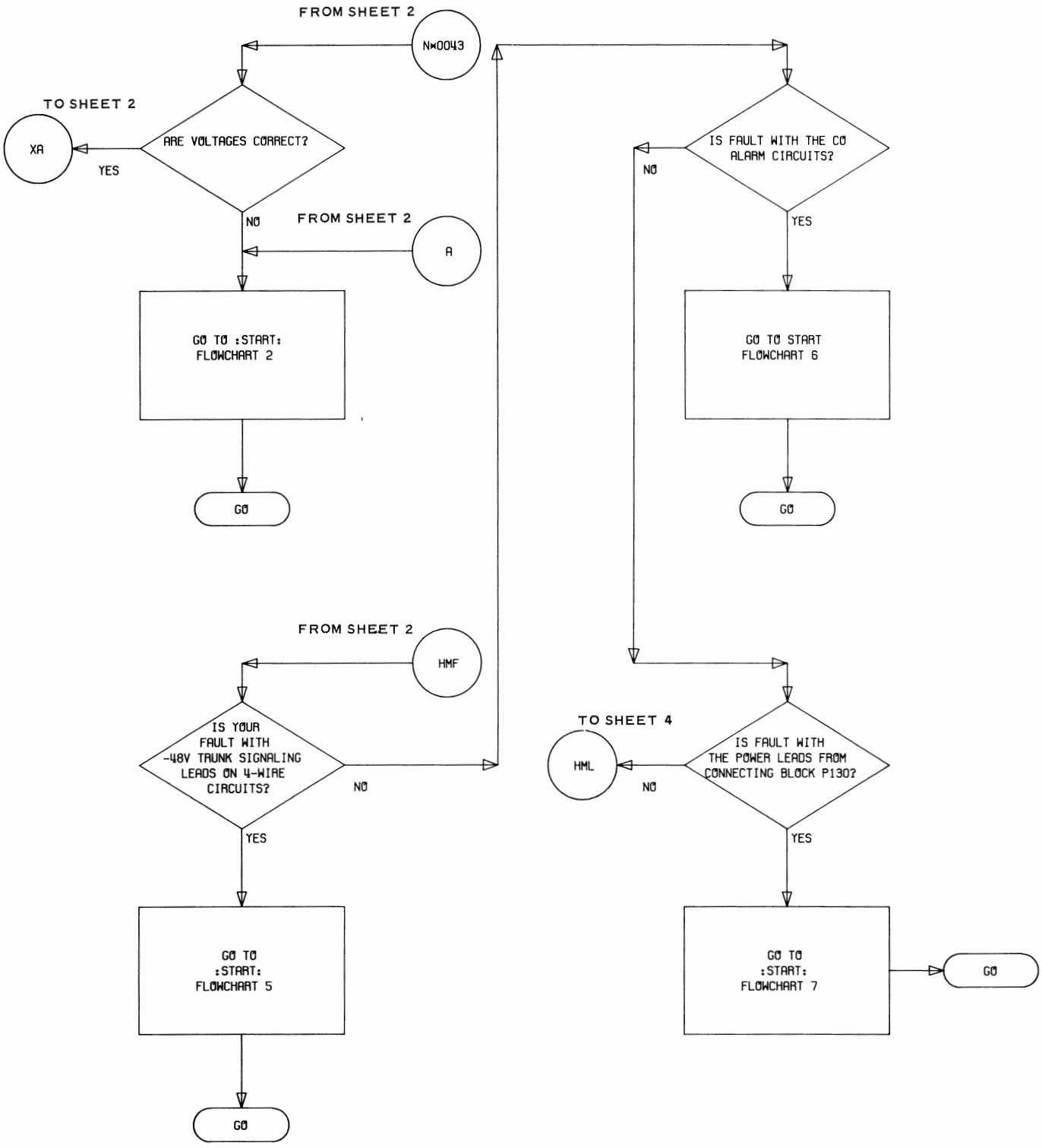
Fig. 2 — LED and Test Point Arrangement on QPJ40-Type Circuit Pack



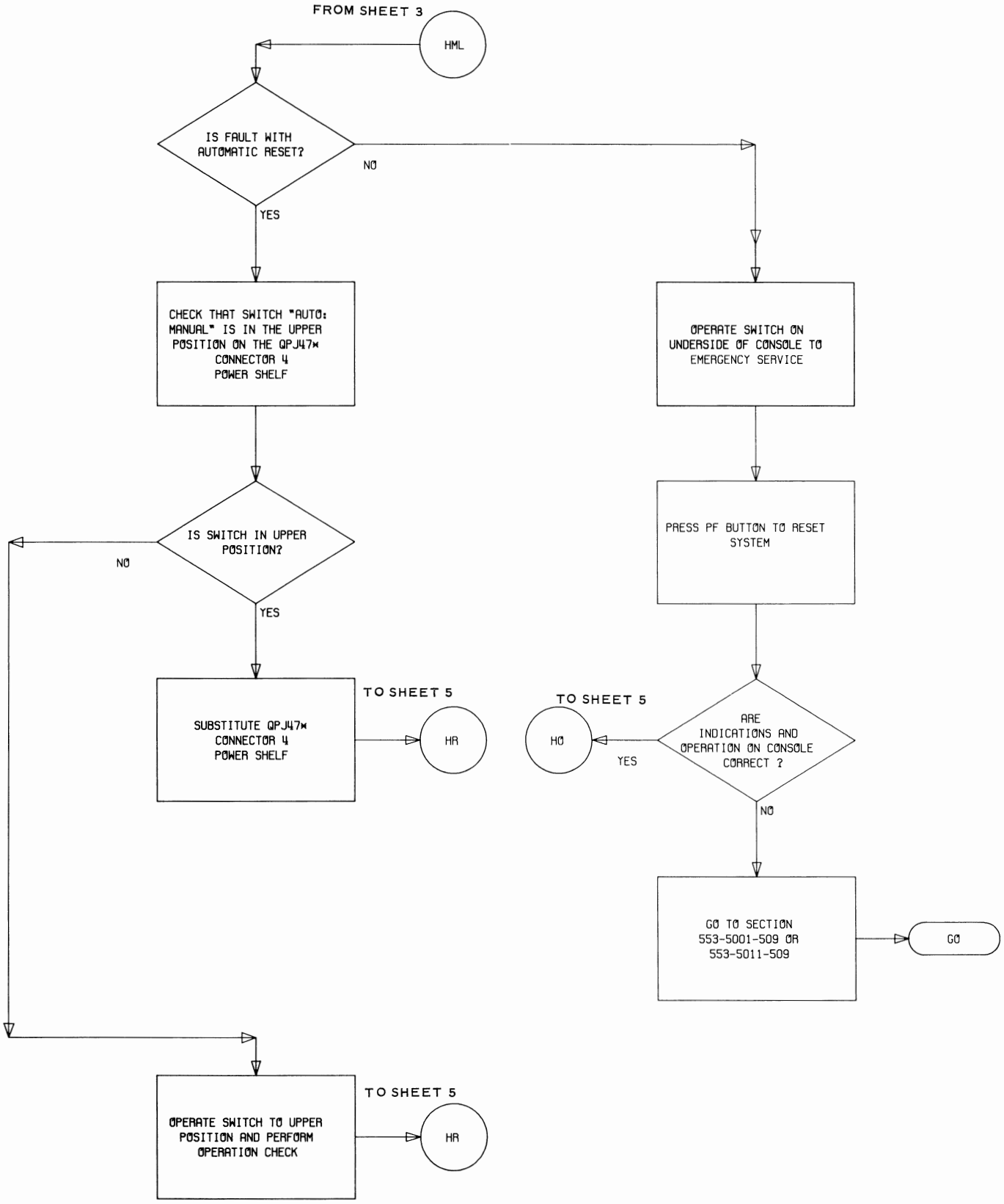
Flowchart 1 — Power Failure and PFT Fault Classification



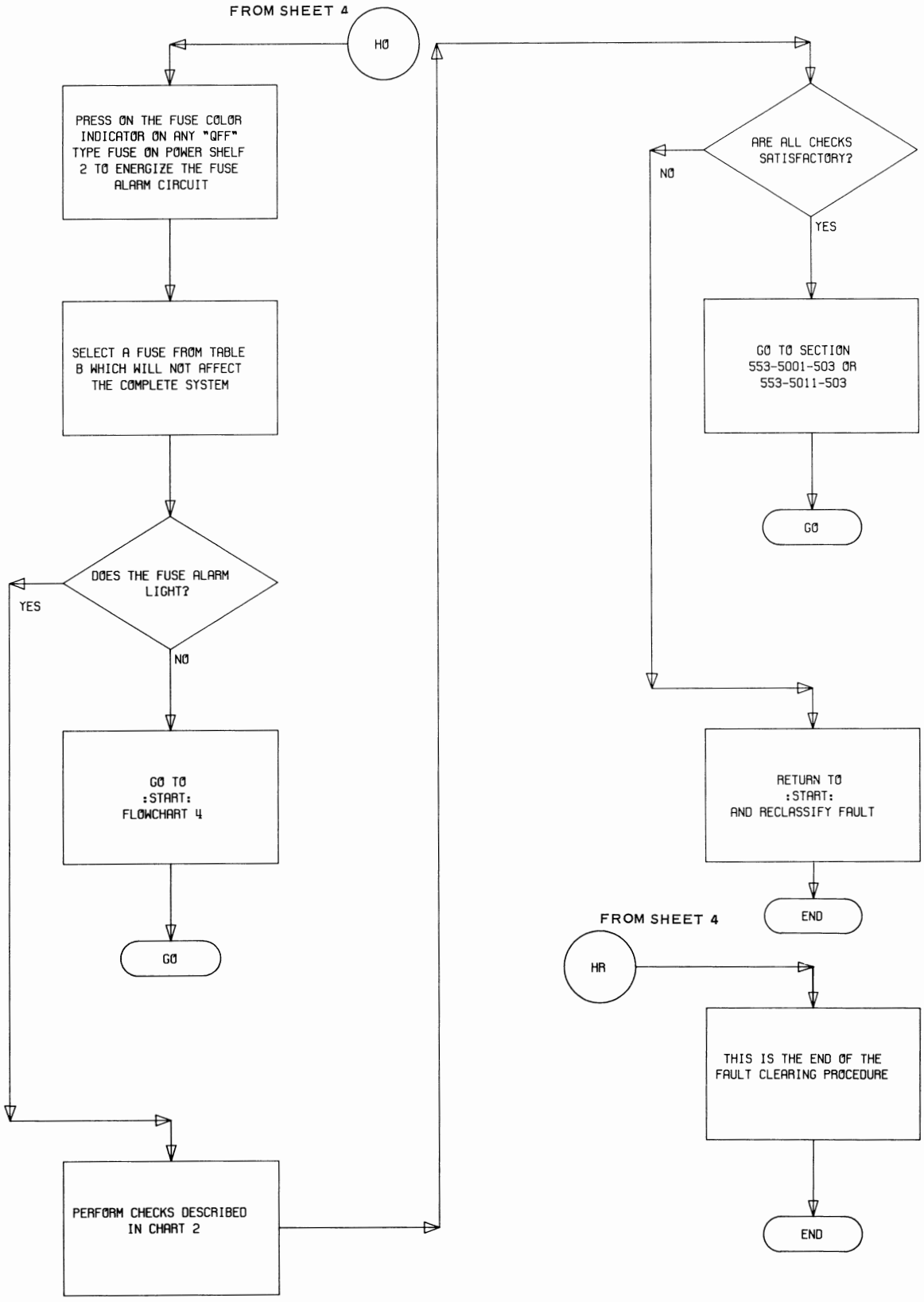
Flowchart 1 Continued – Power Failure and PFT Fault Classification



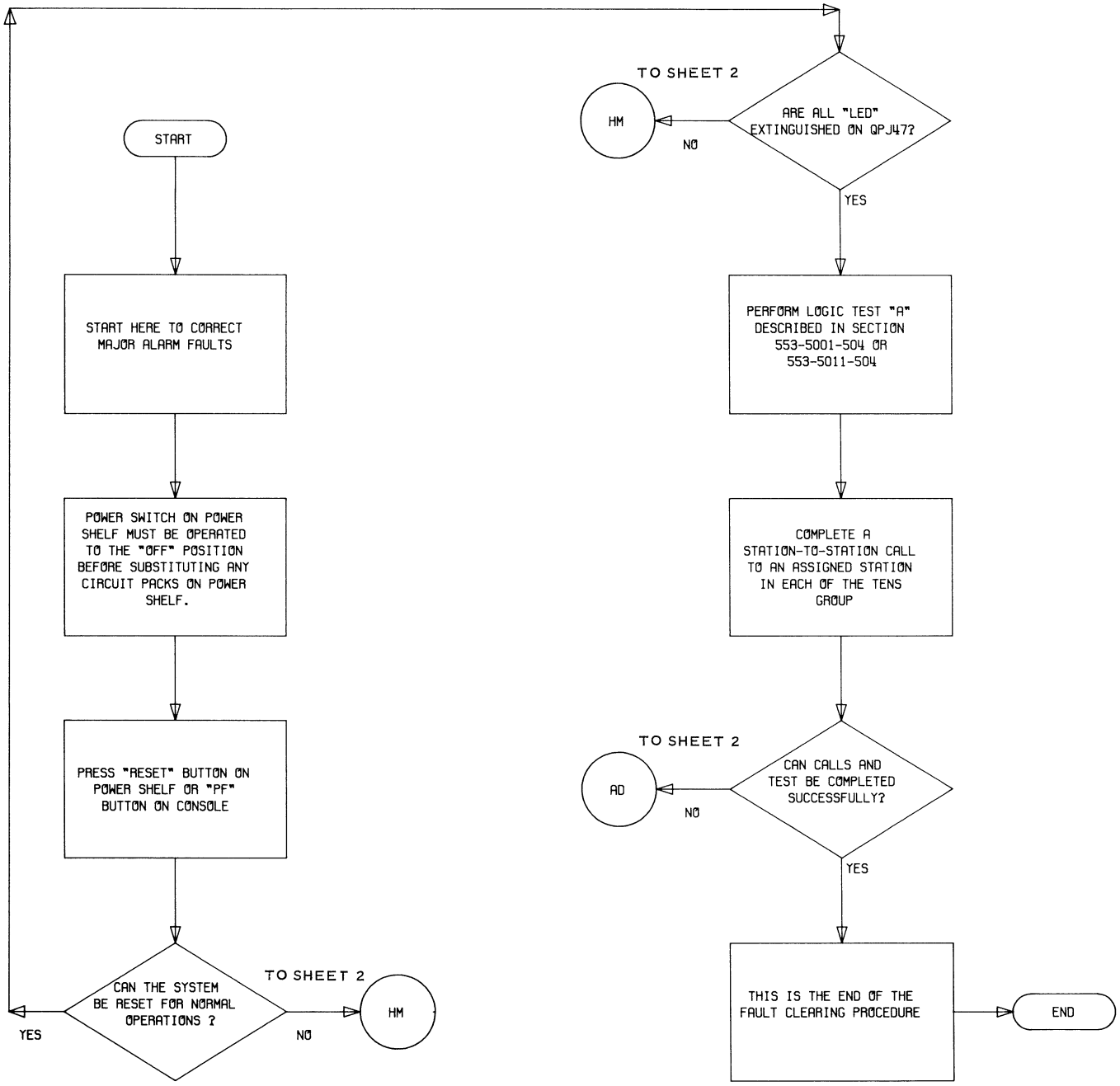
Flowchart 1 Continued — Power Failure and PFT Fault Classification



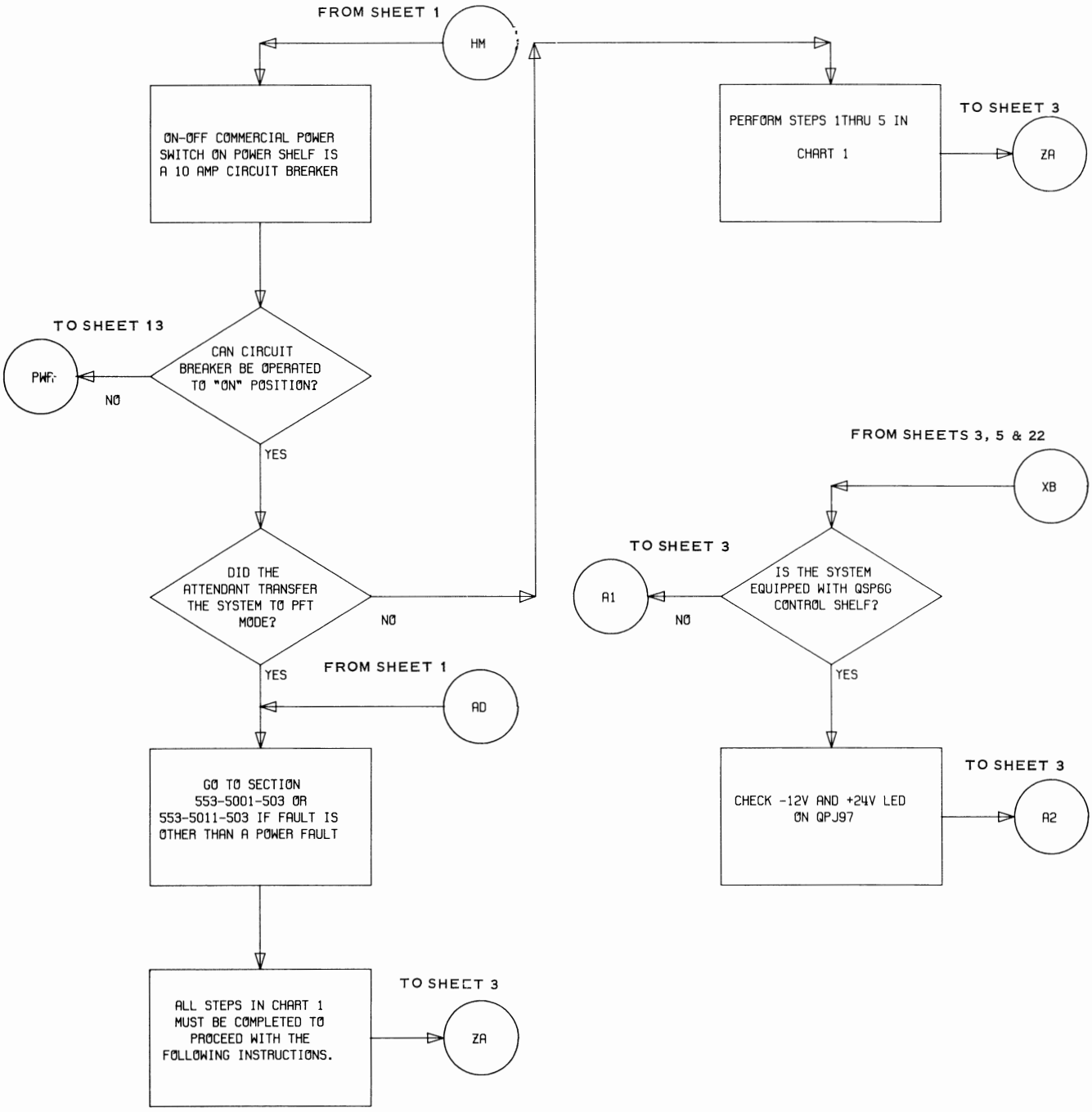
Flowchart 1 Continued — Power Failure and PFT Fault Classification



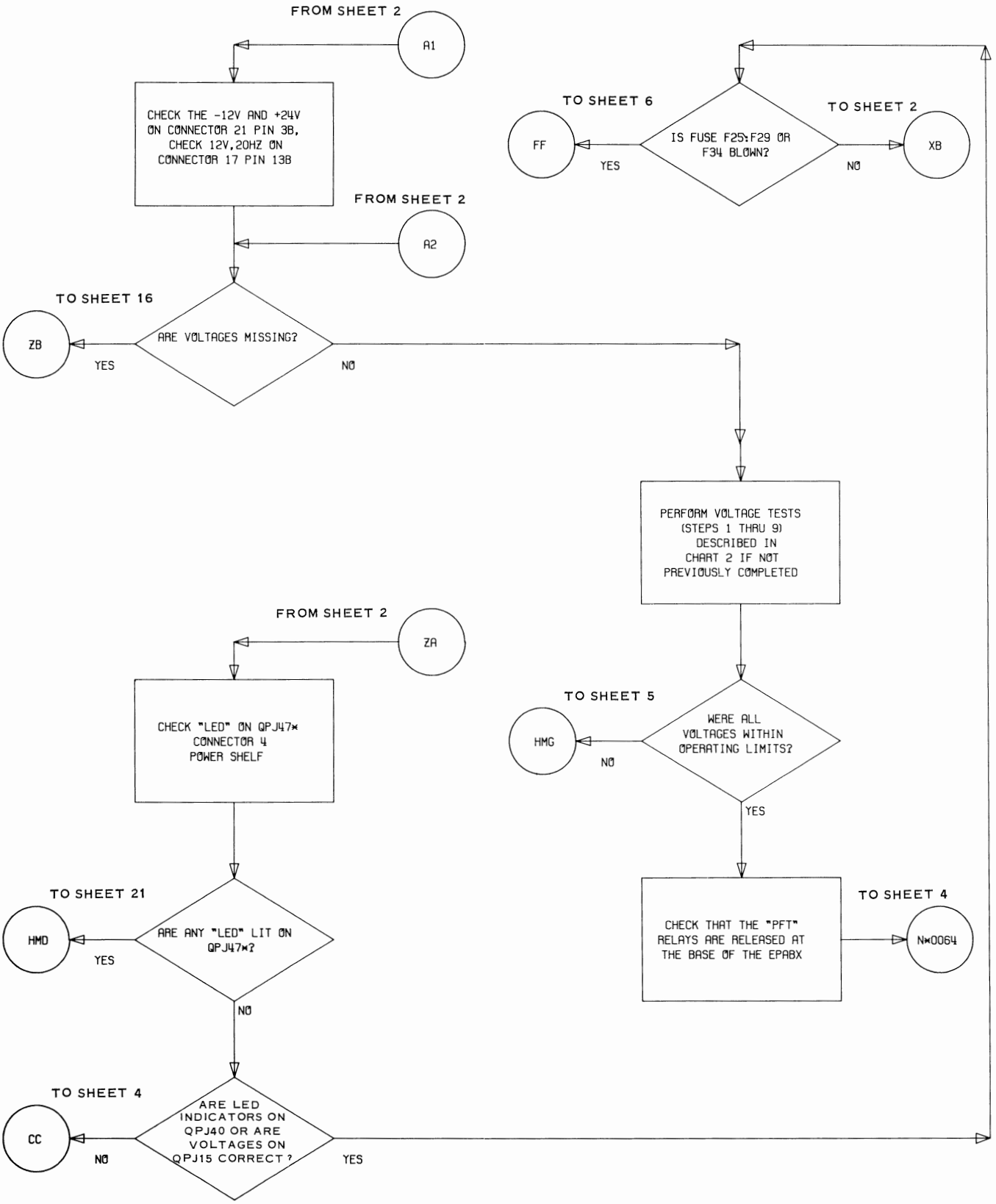
Flowchart 1 Continued — Power Failure and PFT Fault Classification



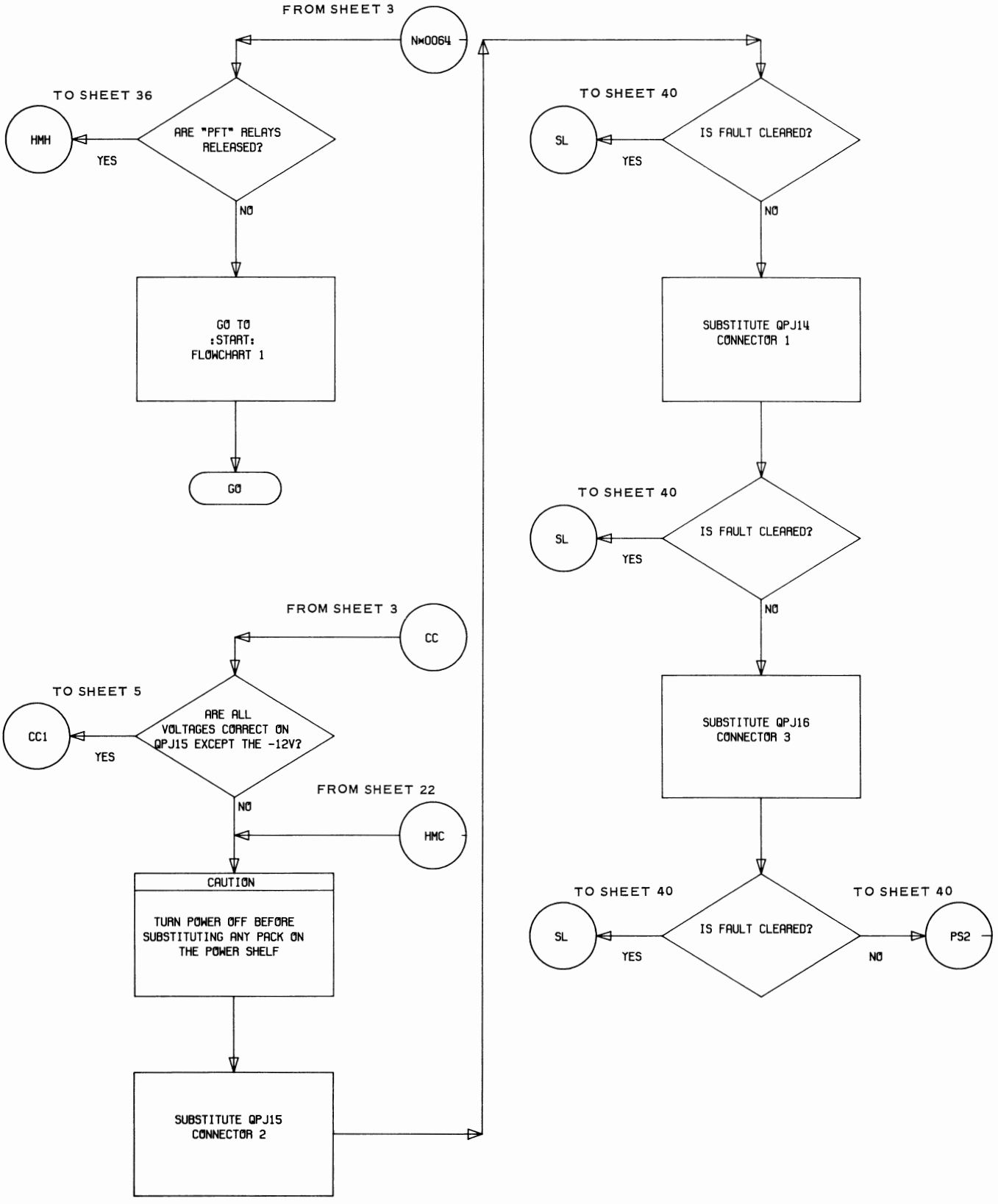
Flowchart 2 — Major Alarm Fault-Clearing Procedure



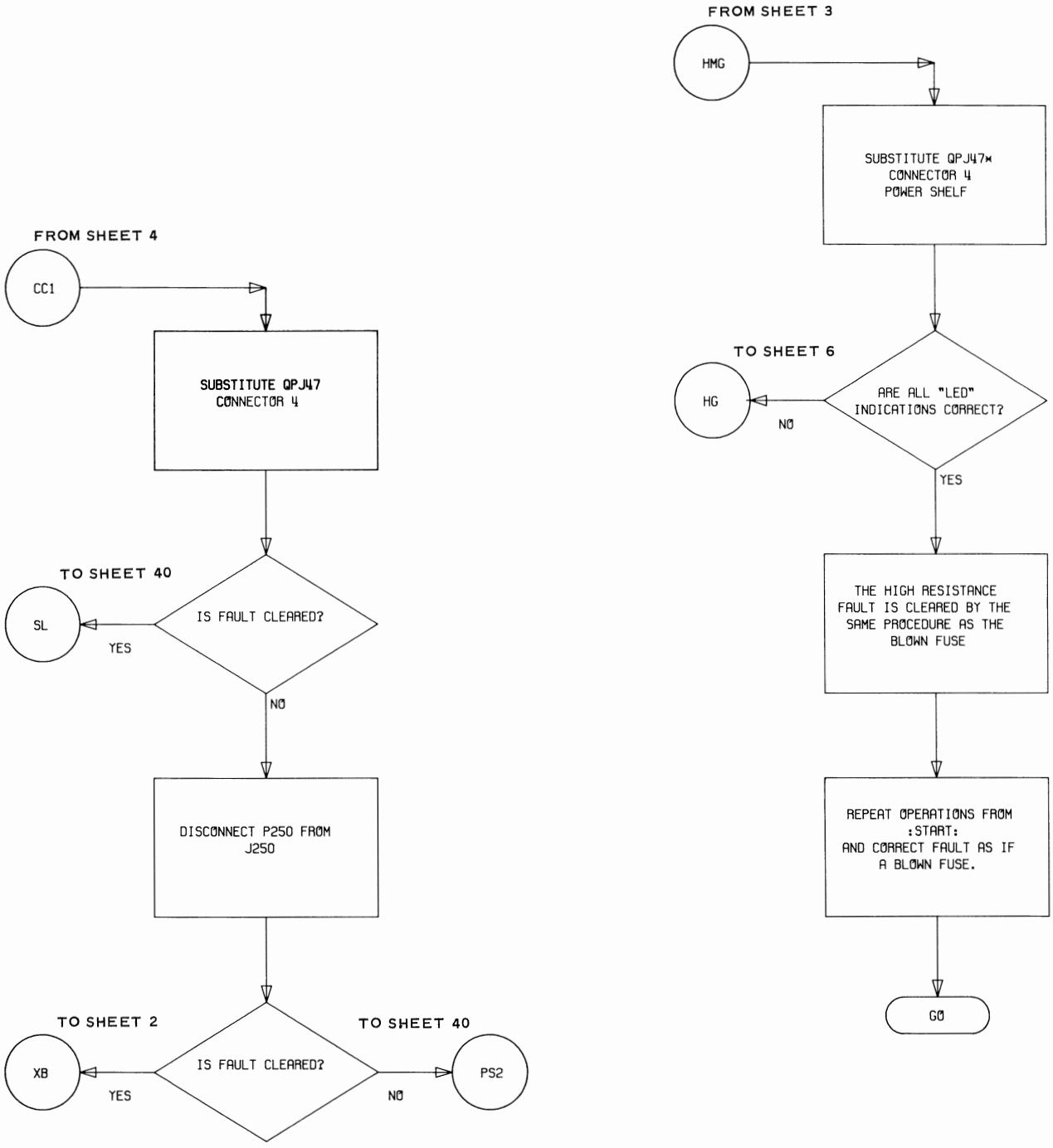
Flowchart 2 Continued — Major Alarm Fault-Clearing Procedure



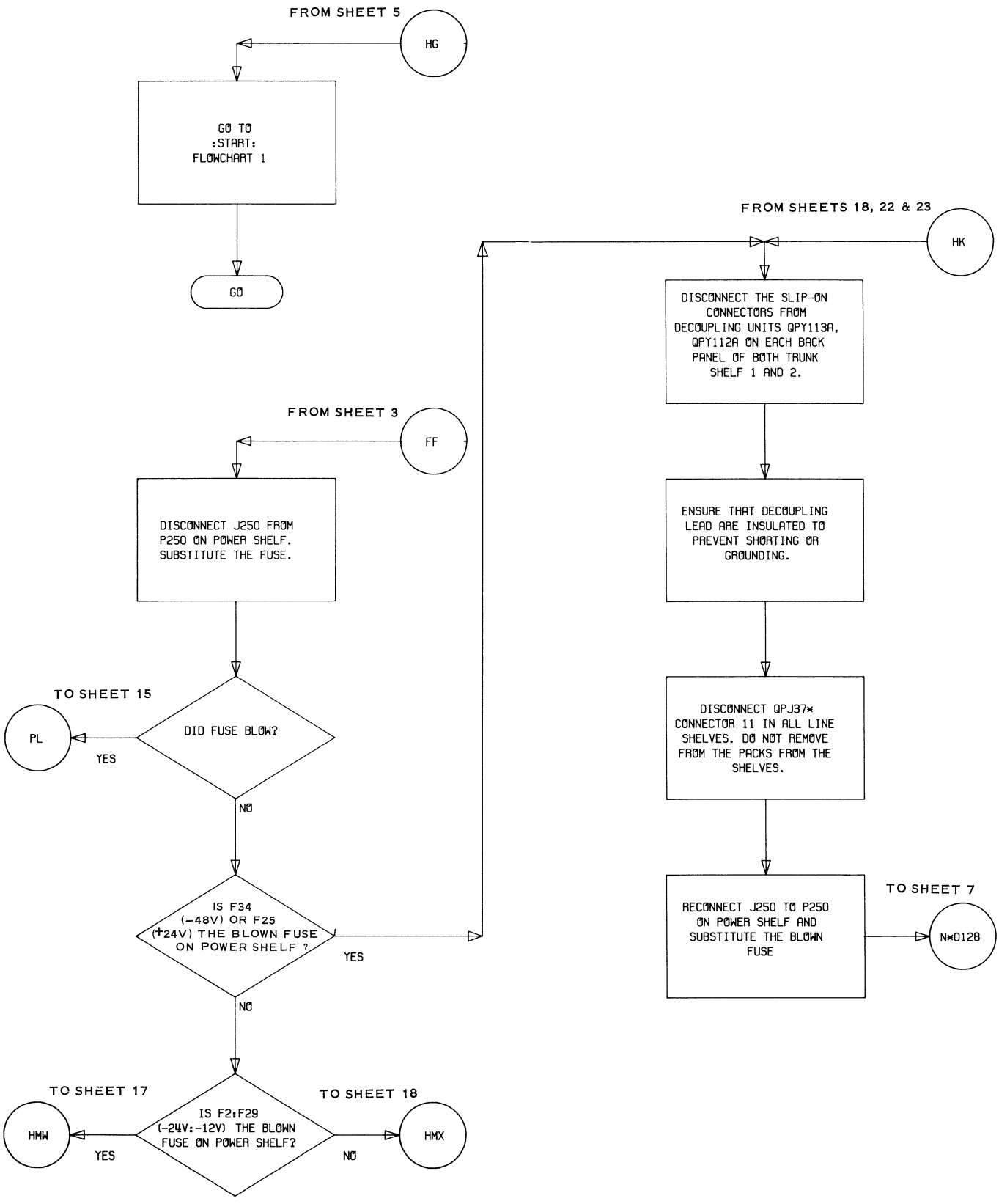
Flowchart 2 Continued — Major Alarm Fault- Clearing Procedure



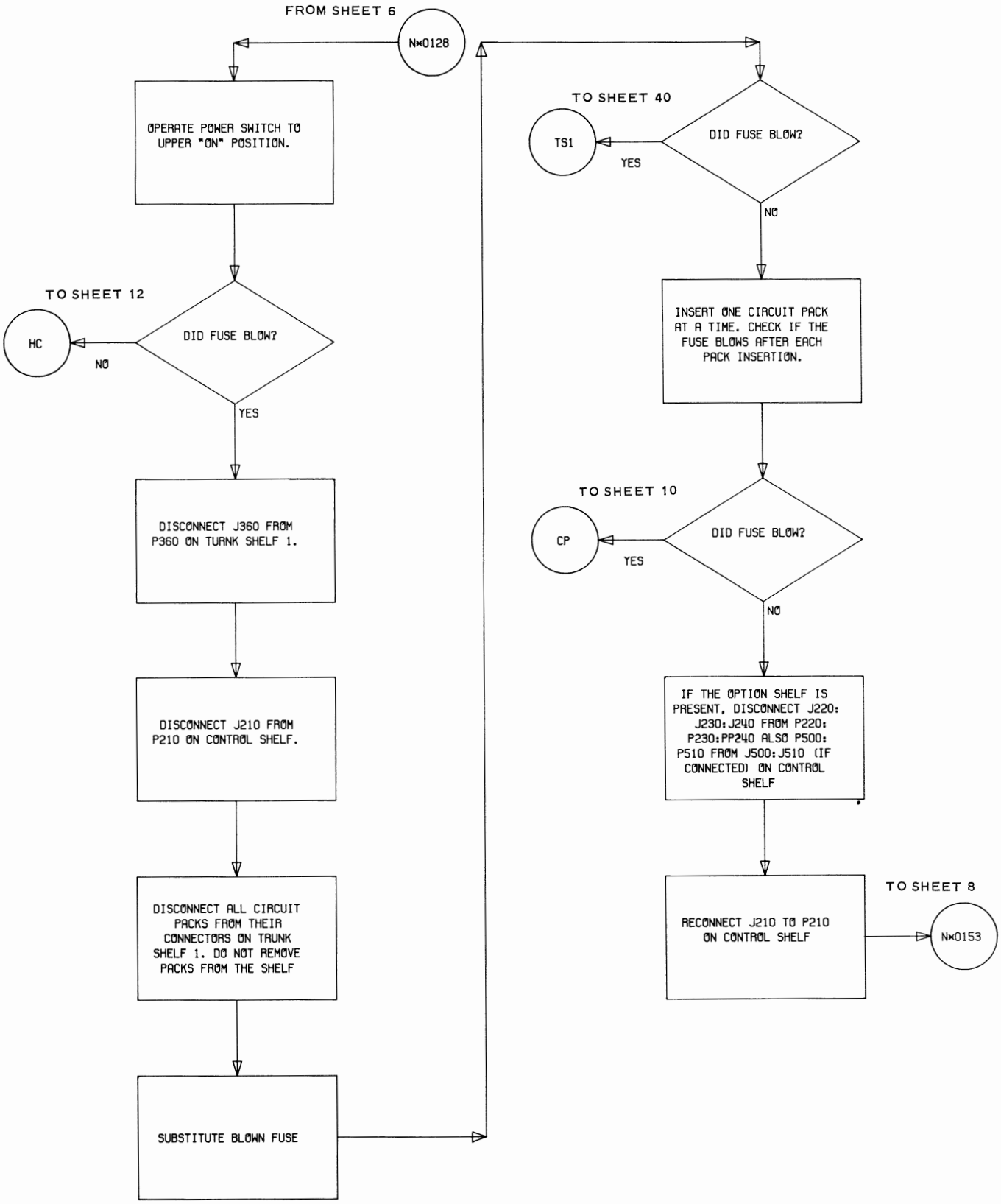
Flowchart 2 Continued — Major Alarm Fault- Clearing Procedure



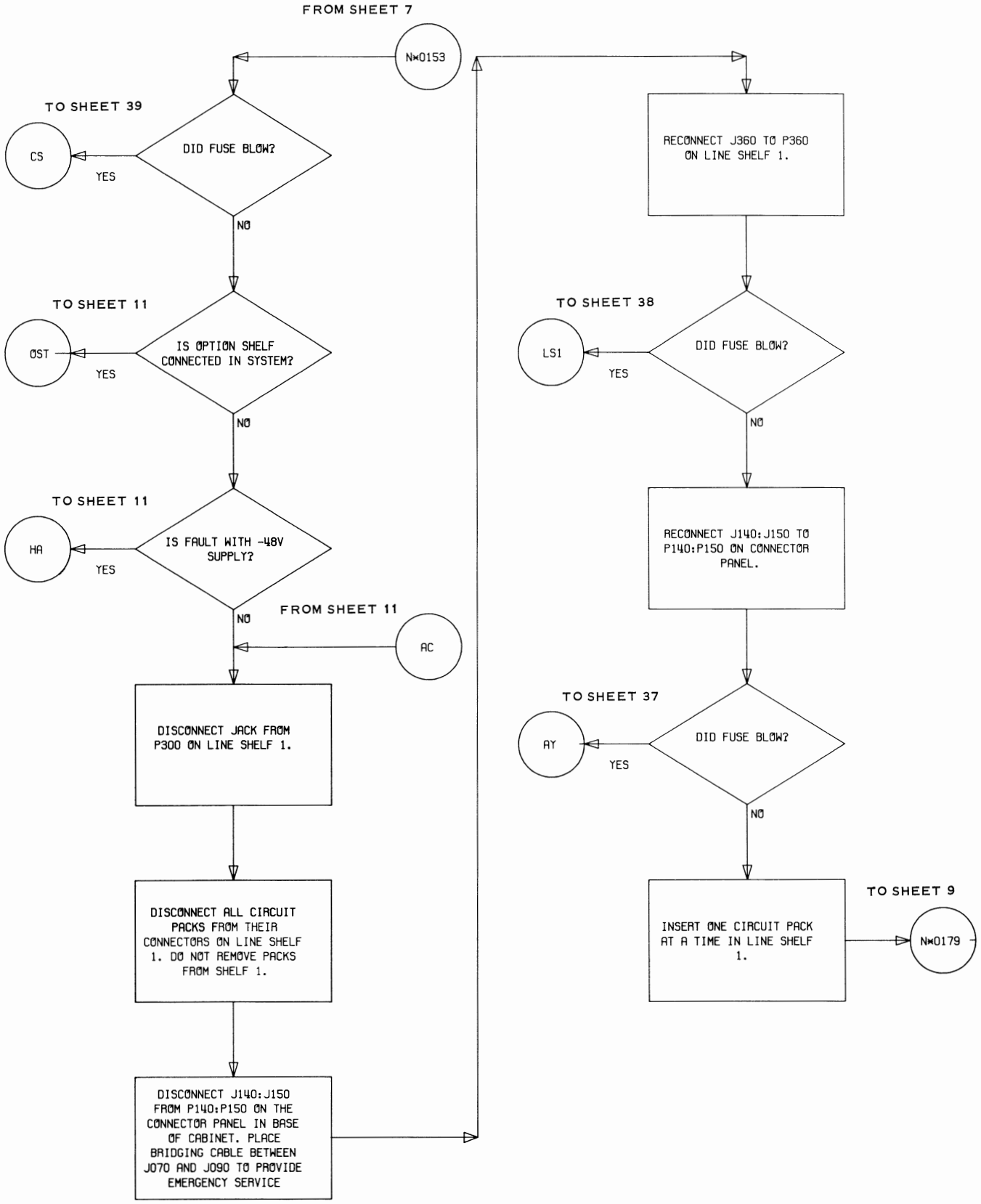
Flowchart 2 Continued — Major Alarm Fault-Clearing Procedure



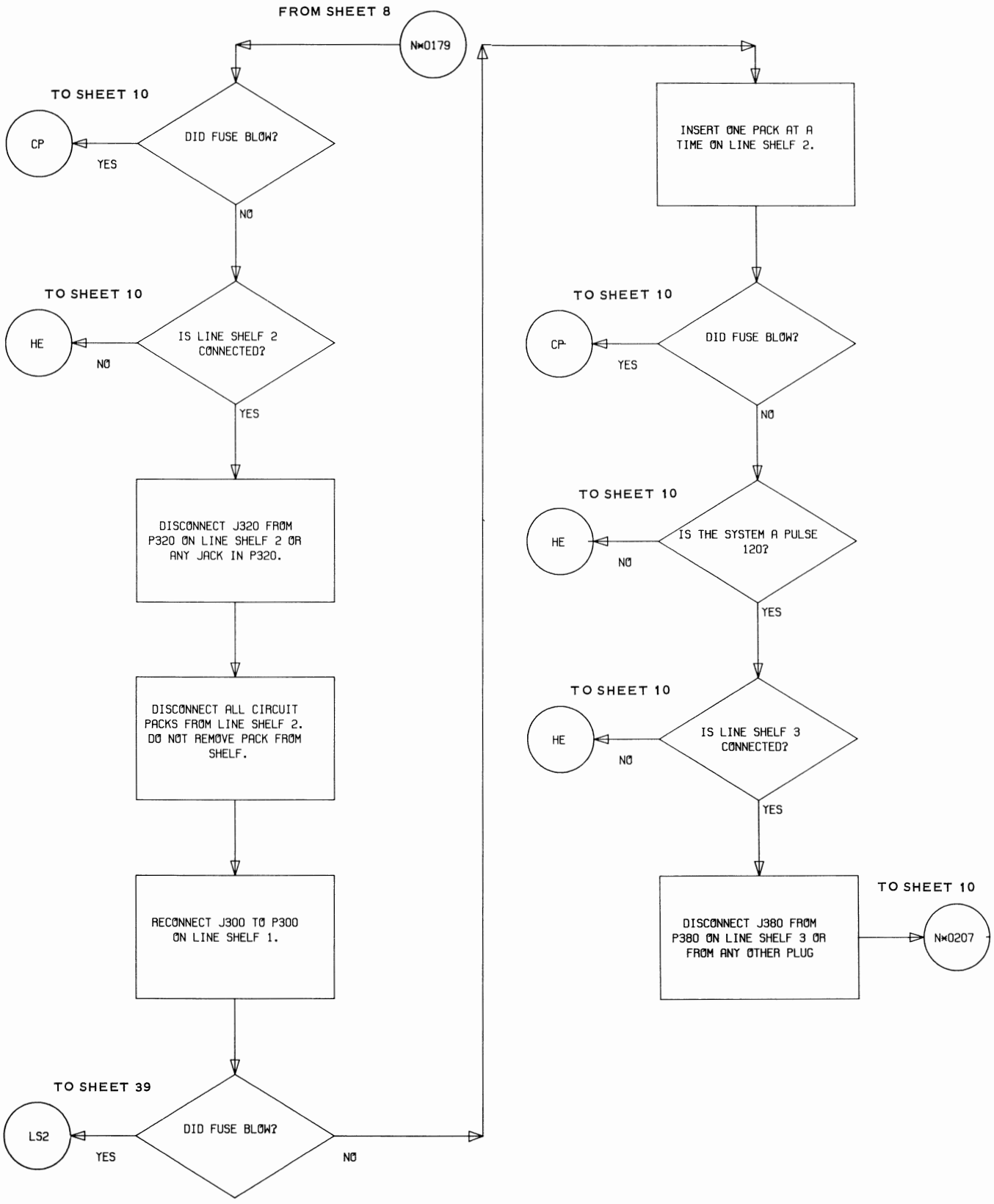
Flowchart 2 Continued — Major Alarm Fault-Clearing Procedure



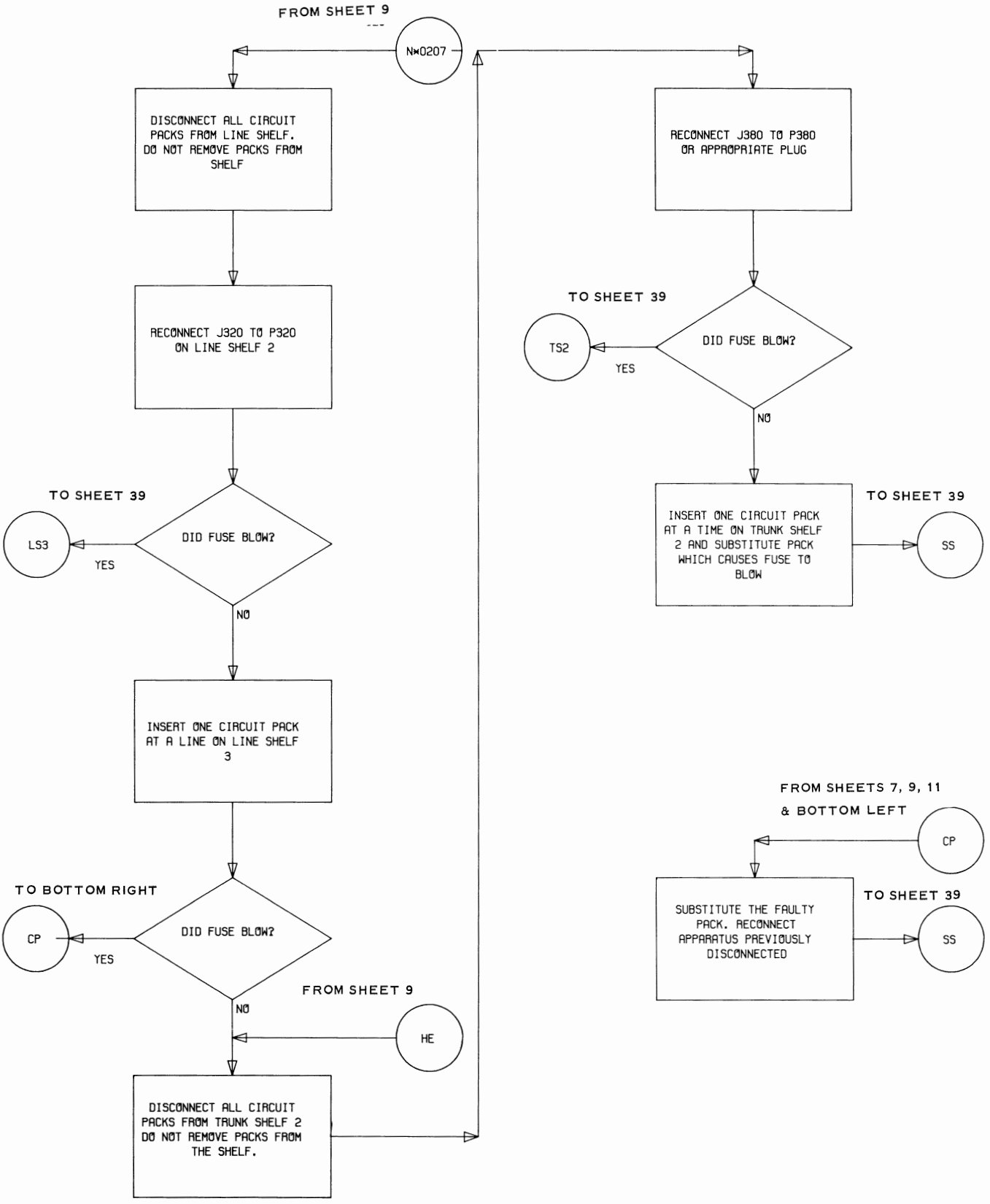
Flowchart 2 Continued — Major Alarm Fault-Clearing Procedure



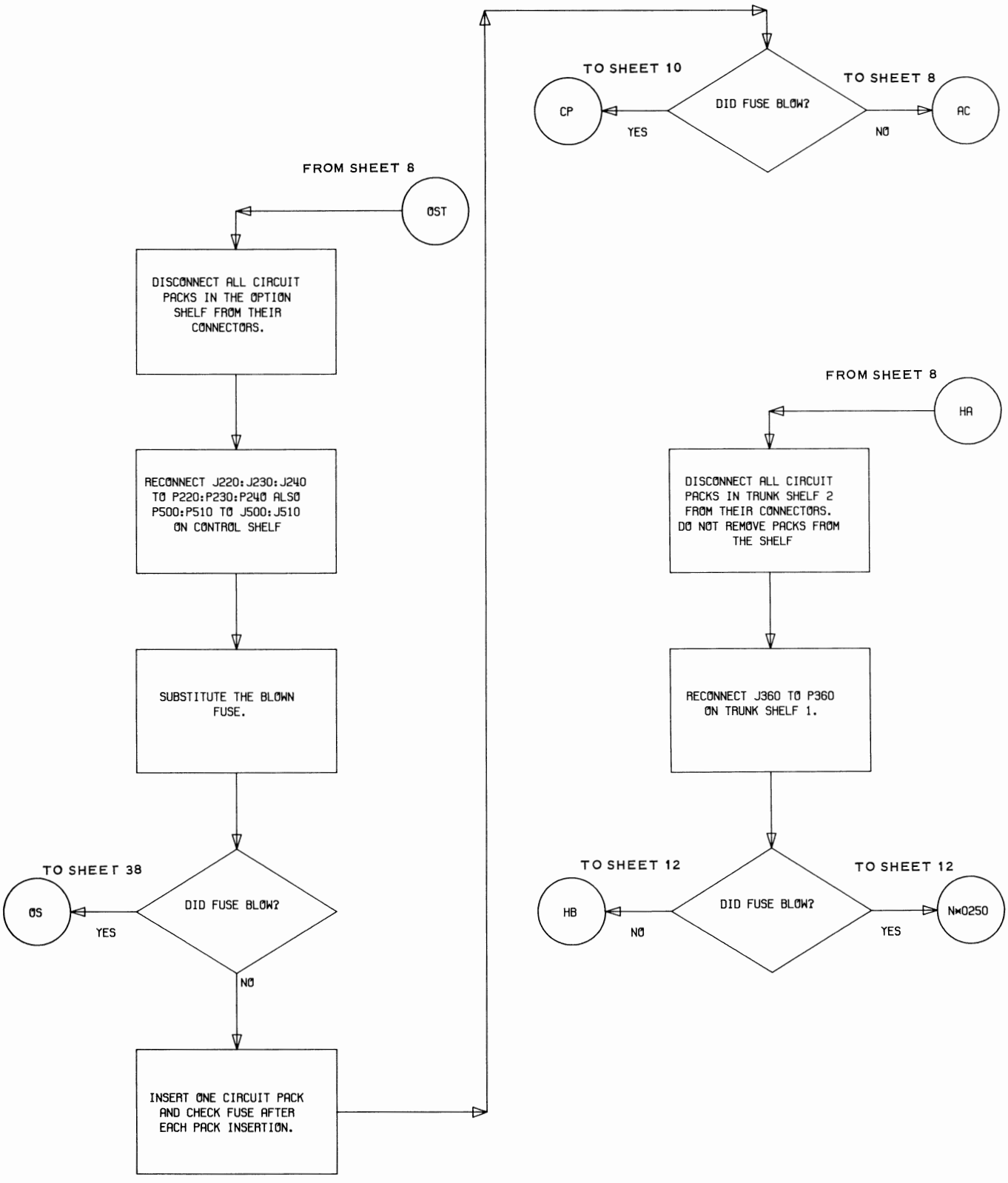
Flowchart 2 Continued — Major Alarm Fault-Clearing Procedure



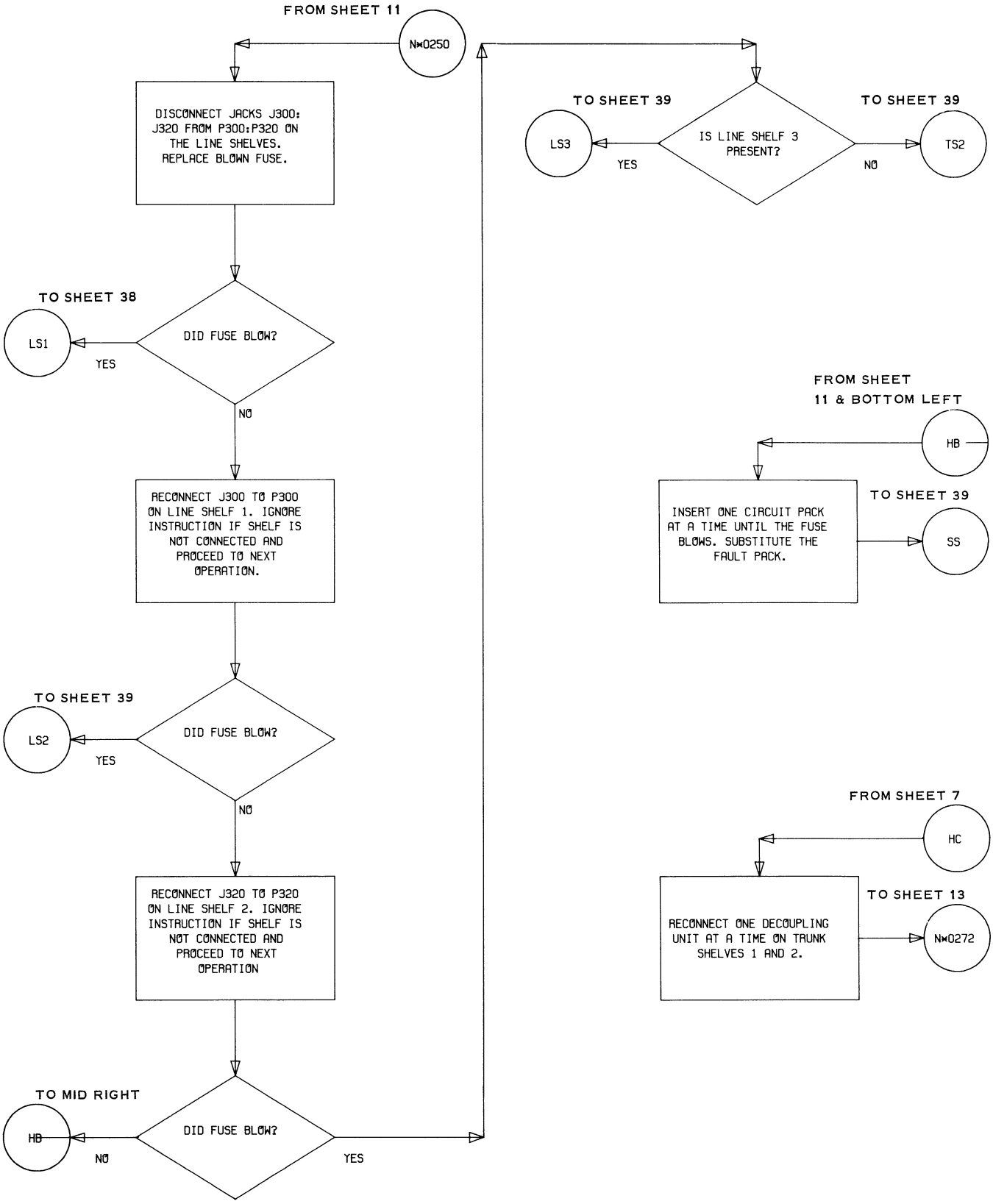
Flowchart 2 Continued — Major Alarm Fault-Clearing Procedure



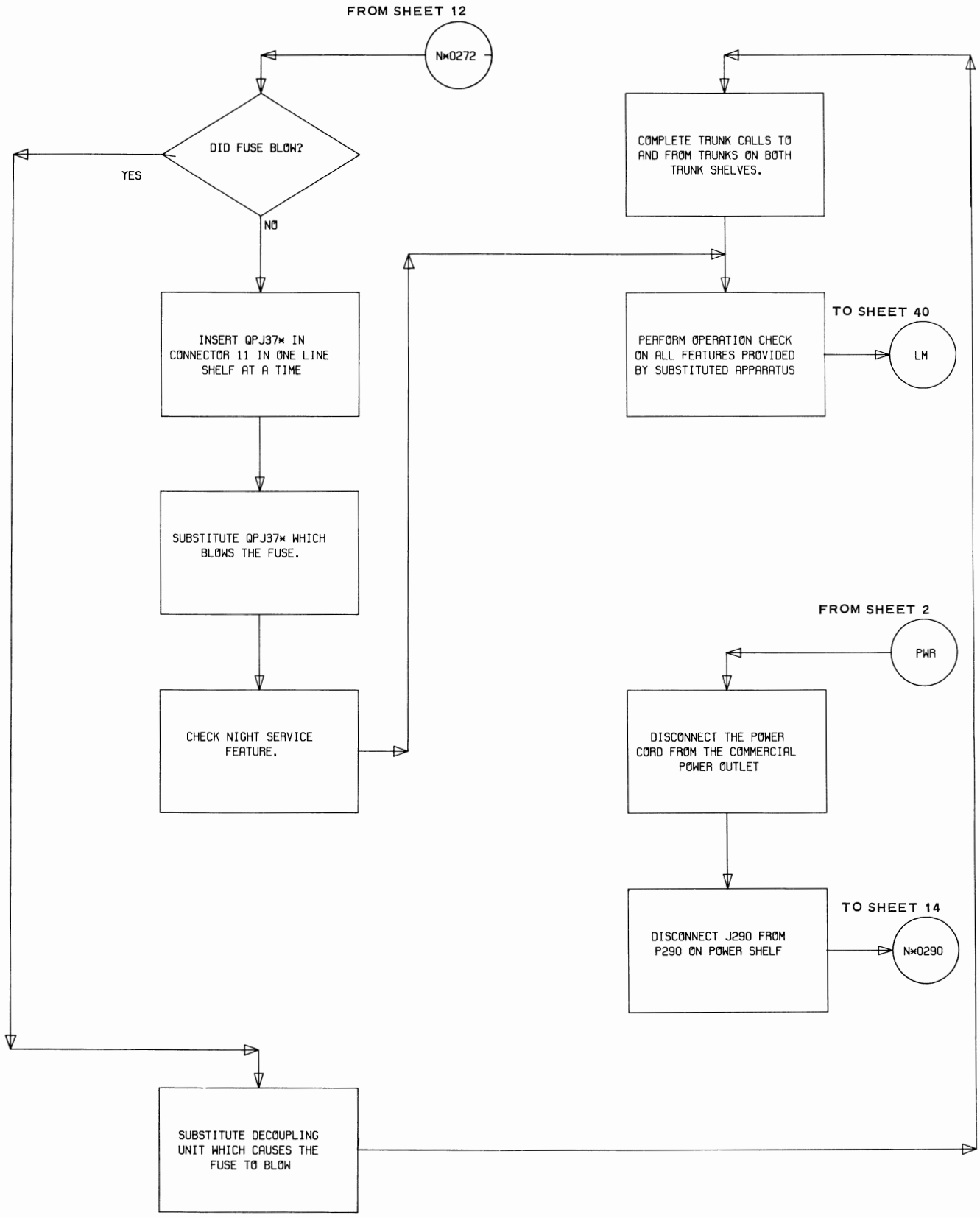
Flowchart 2 Continued — Major Alarm Fault-Clearing Procedure



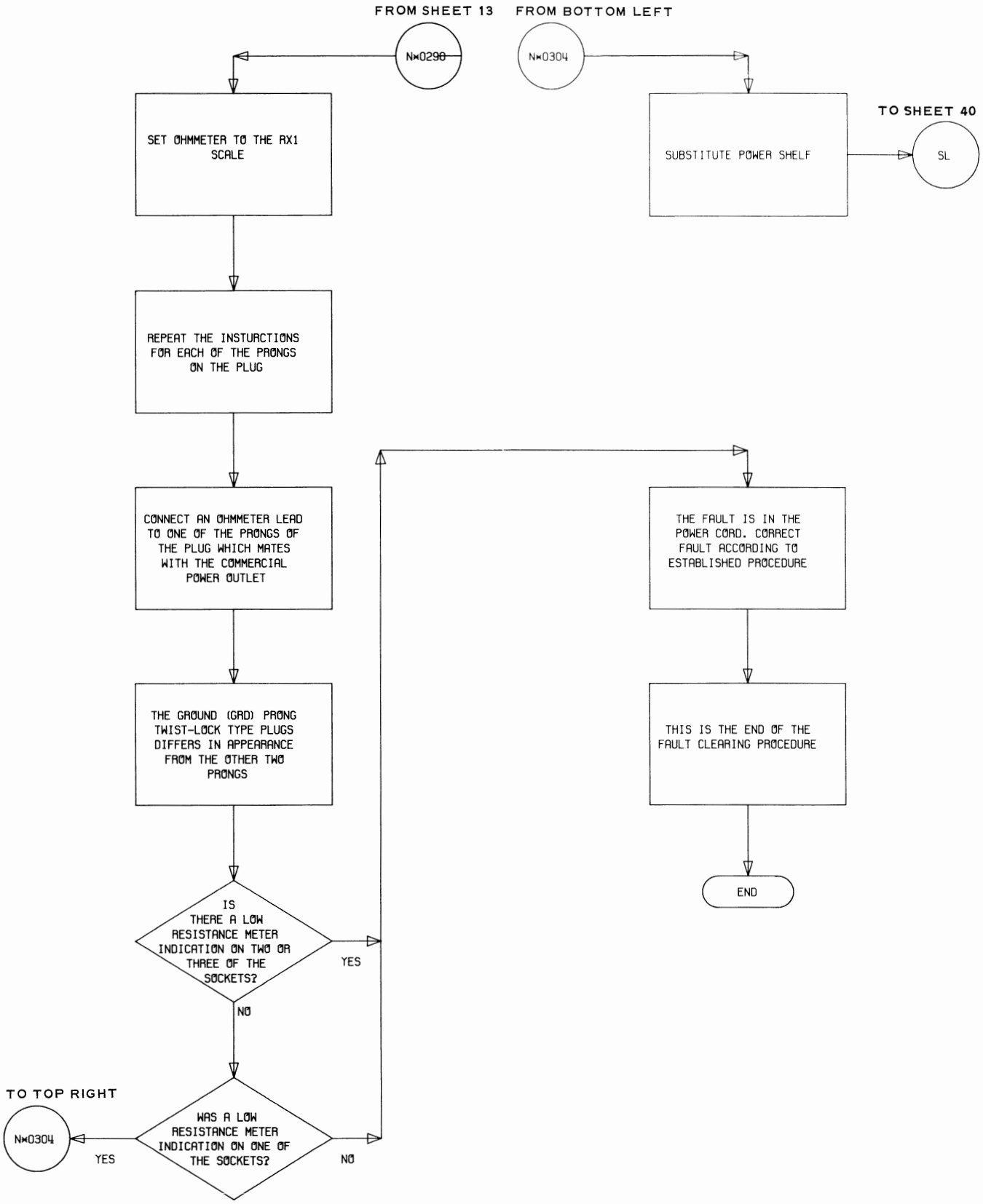
Flowchart 2 Continued — Major Alarm Fault-Clearing Procedure



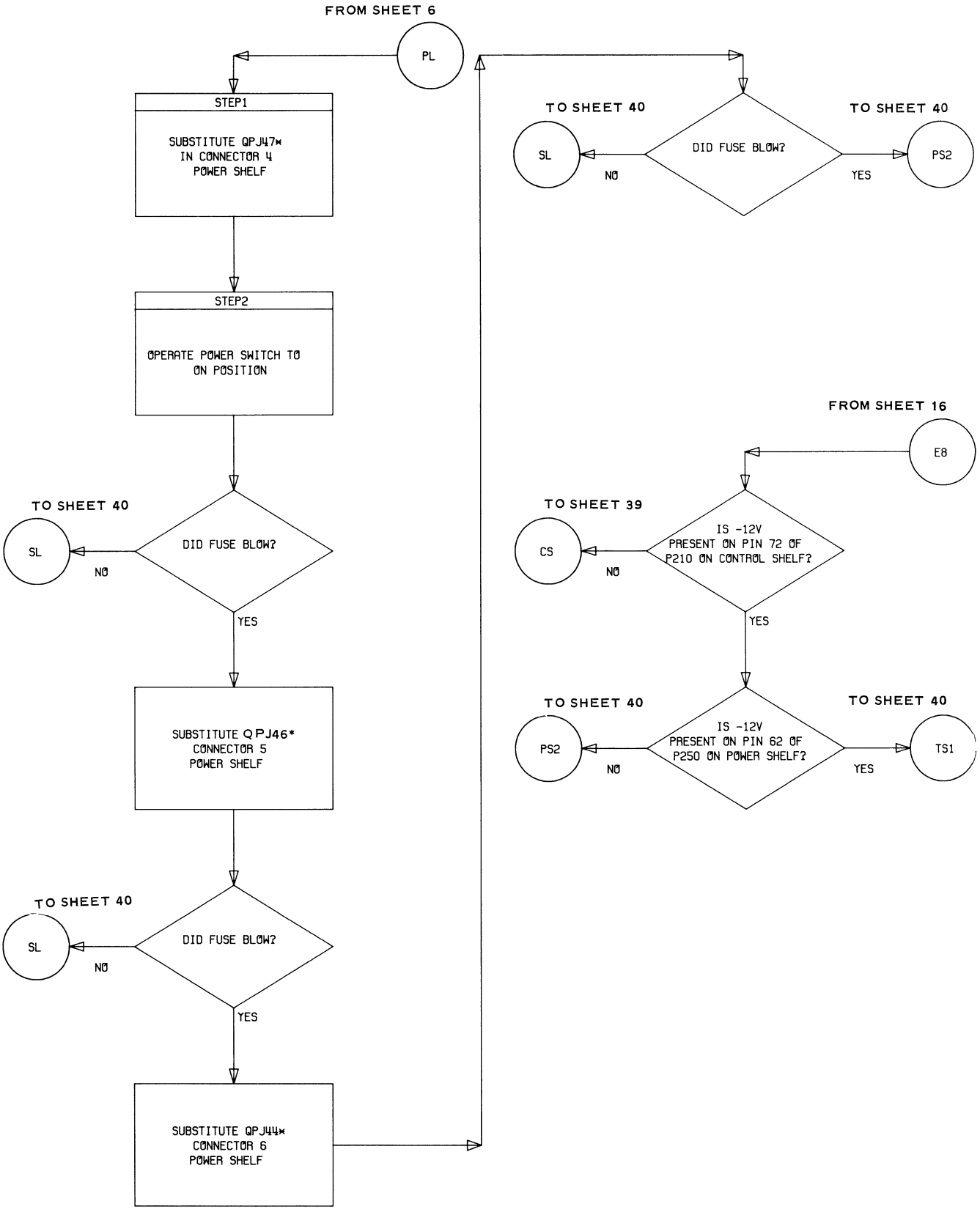
Flowchart 2 Continued — Major Alarm Fault-Clearing Procedure



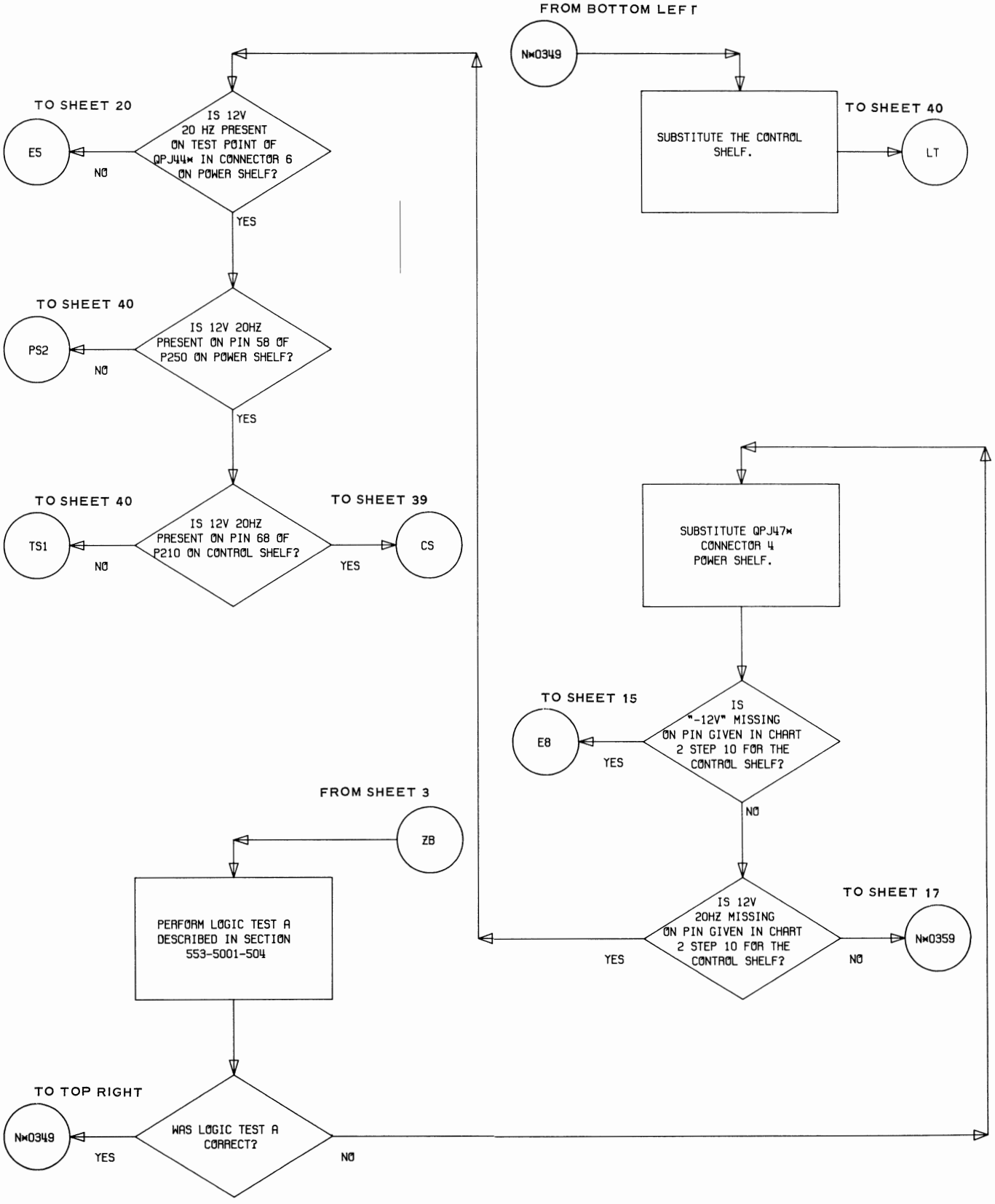
Flowchart 2 Continued — Major Alarm Fault-Clearing Procedure



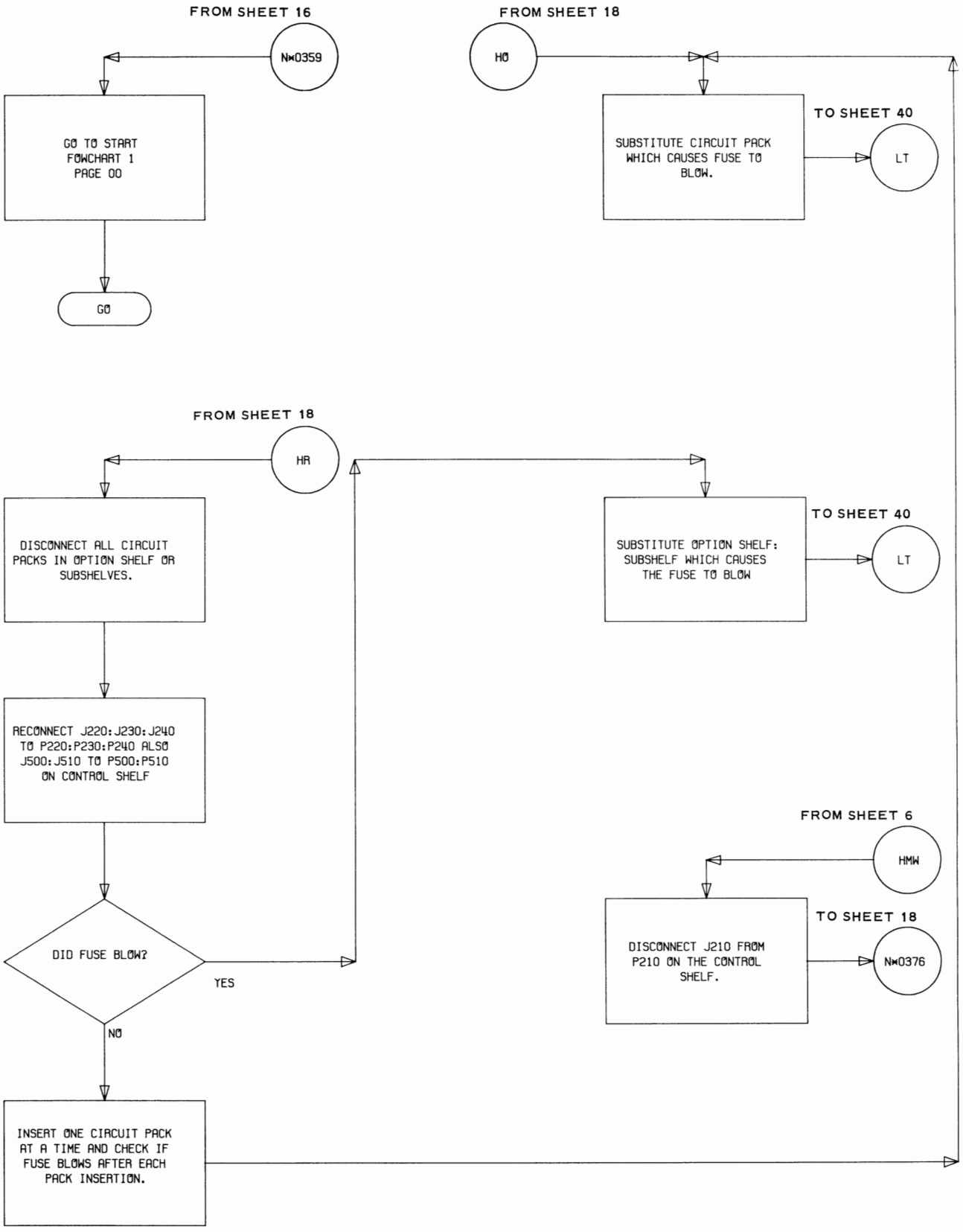
Flowchart 2 Continued — Major Alarm Fault-Clearing Procedure



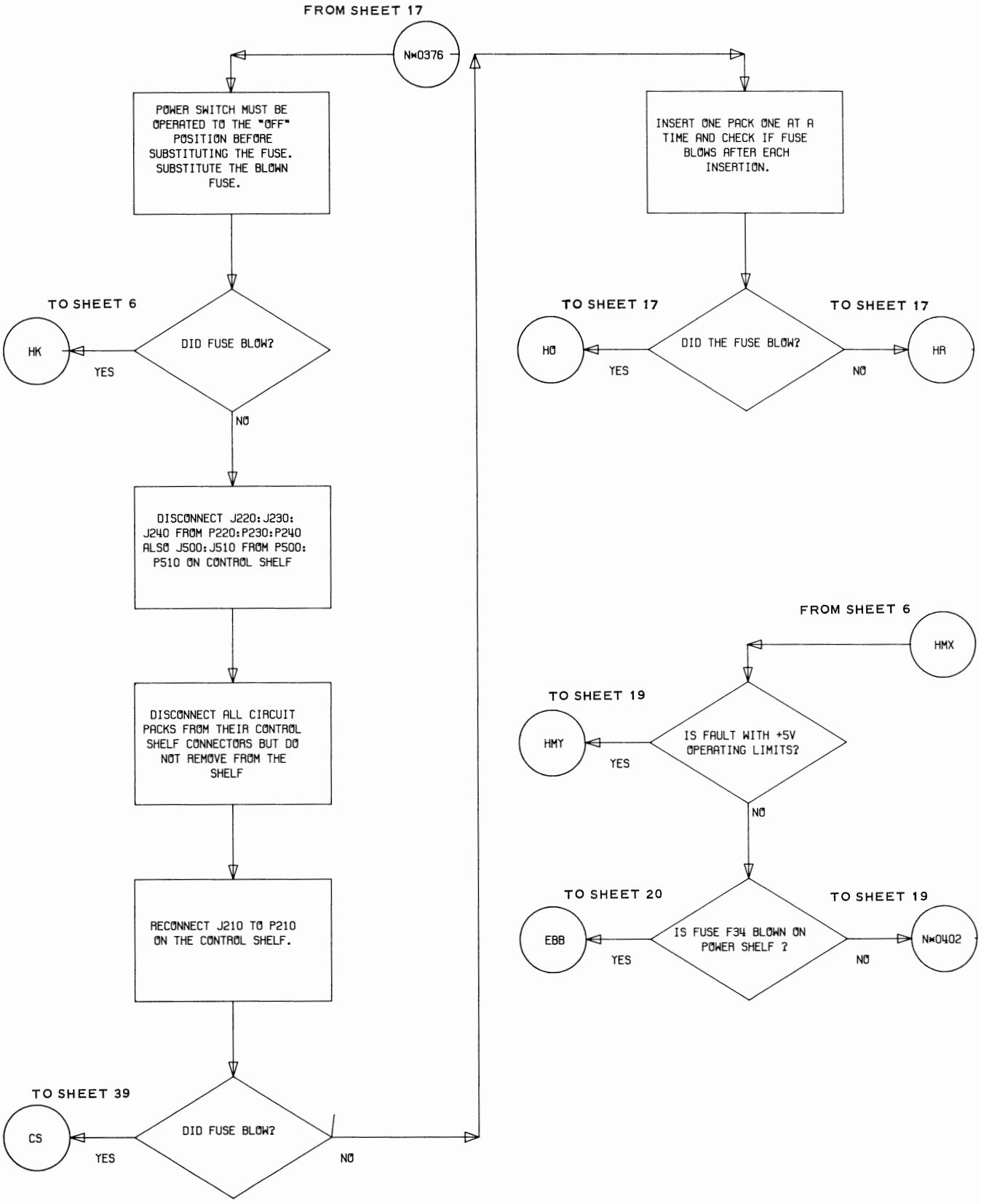
Flowchart 2 Continued — Major Alarm Fault-Clearing Procedure



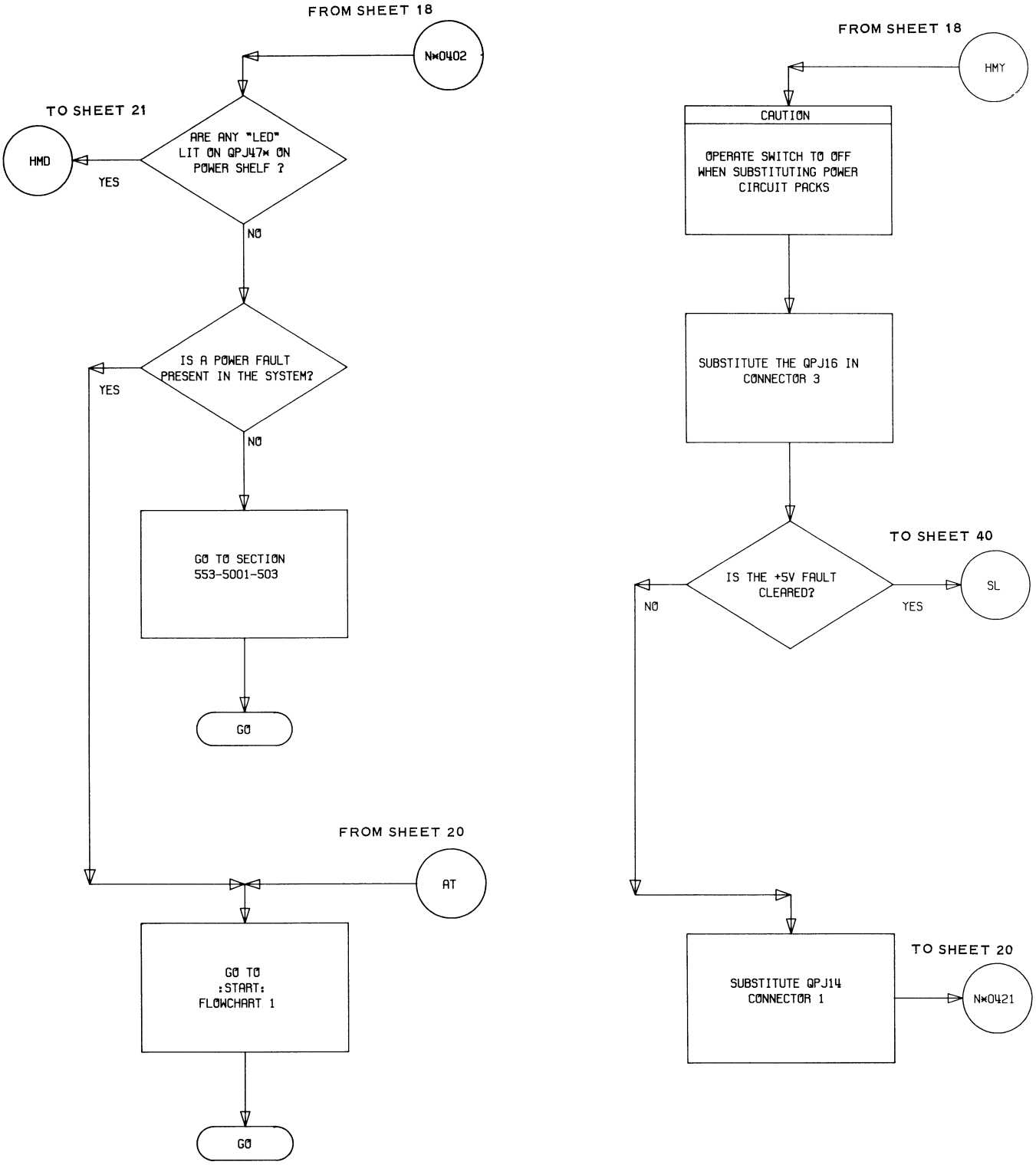
Flowchart 2 Continued — Major Alarm Fault-Clearing Procedure



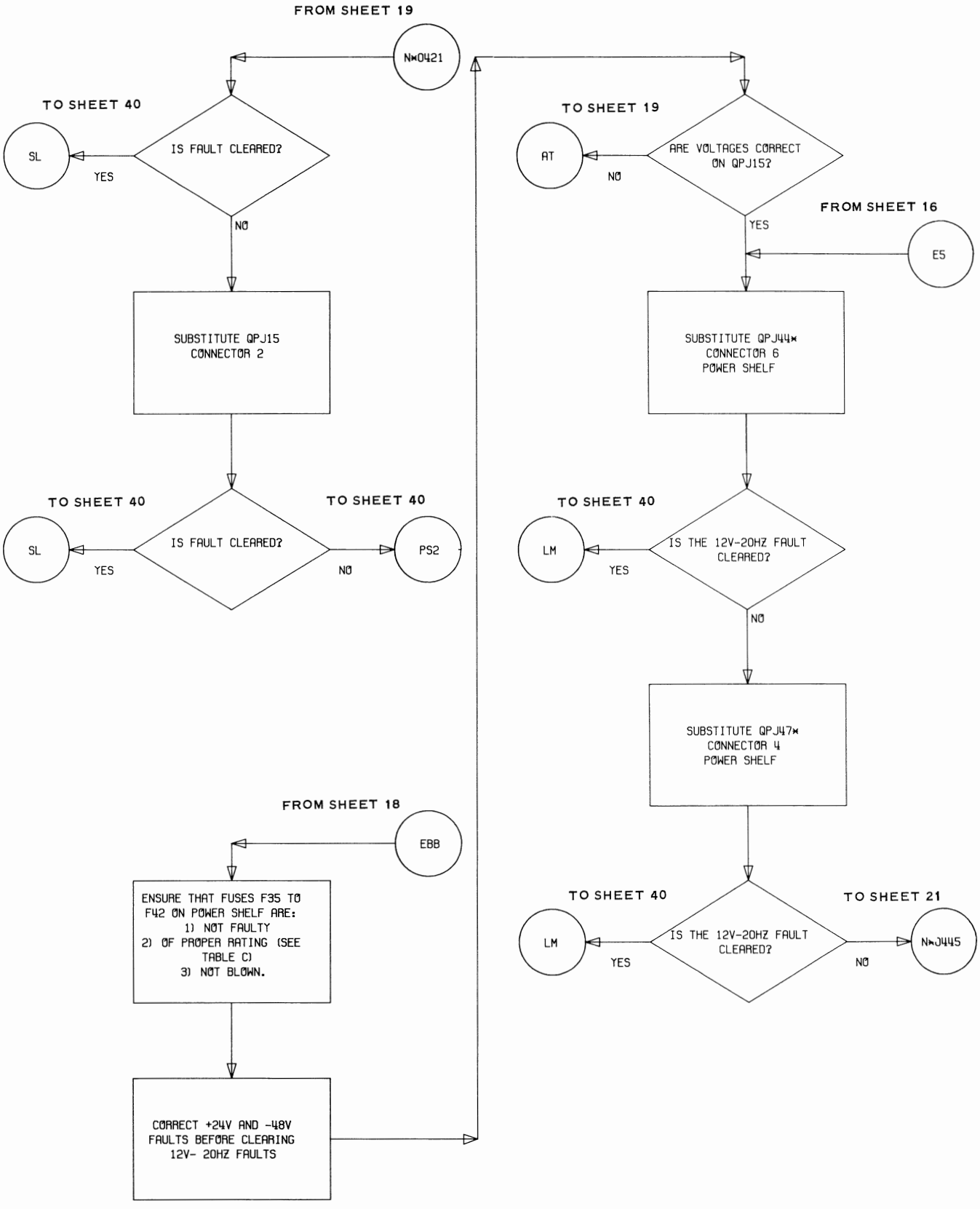
Flowchart 2 Continued — Major Alarm Fault-Clearing Procedure



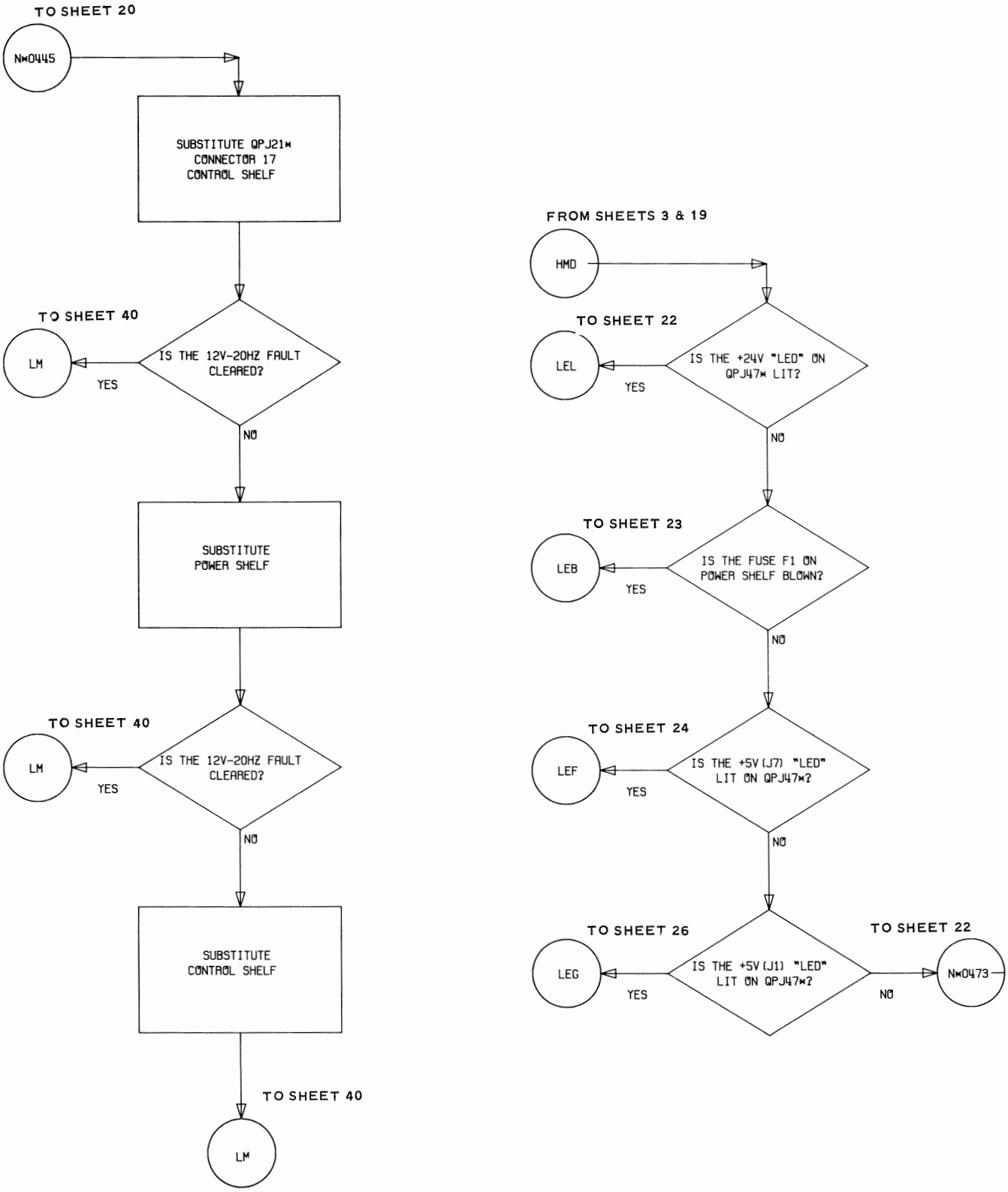
Flowchart 2 Continued — Major Alarm Fault-Clearing Procedure



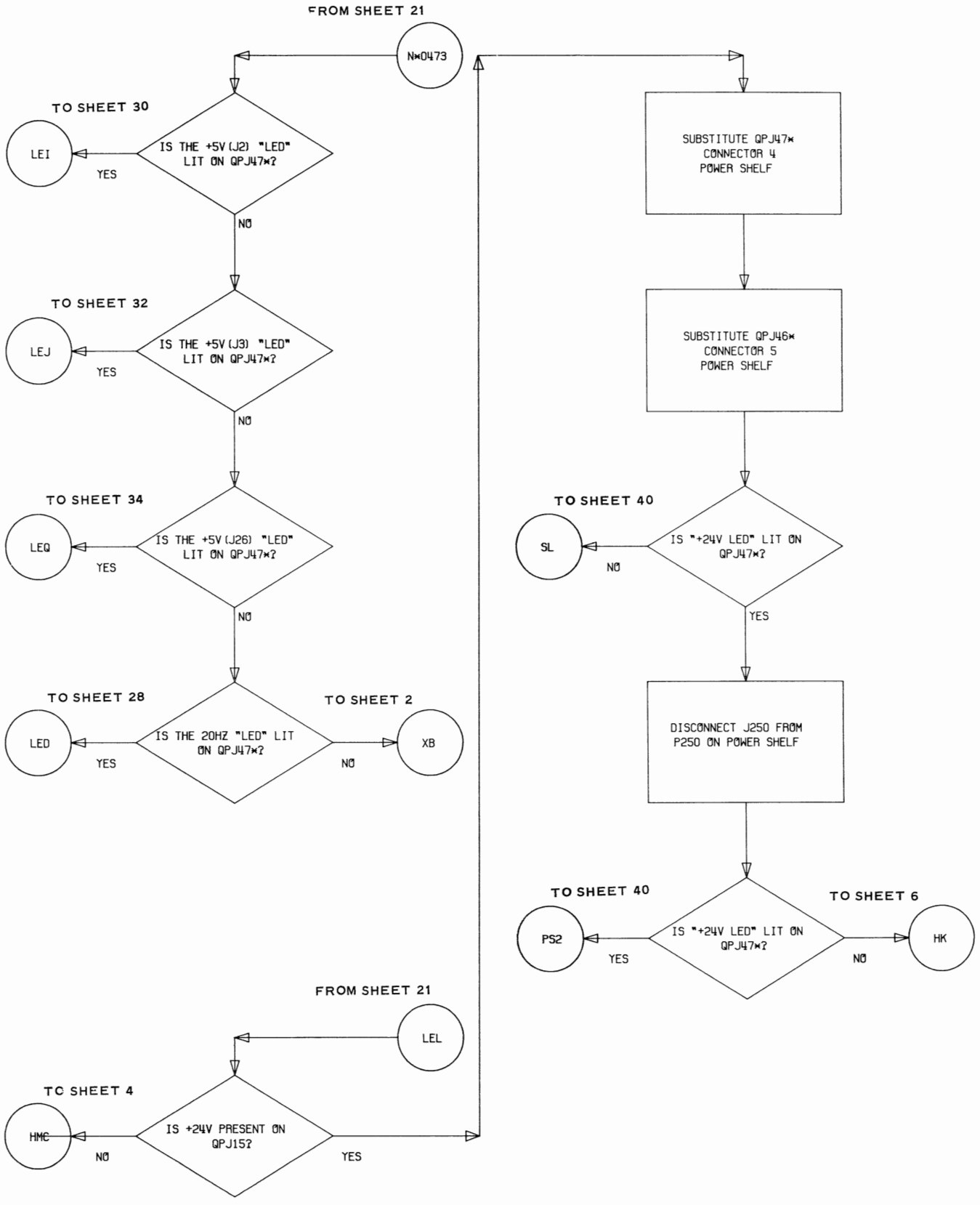
Flowchart 2 Continued — Major Alarm Fault-Clearing Procedure



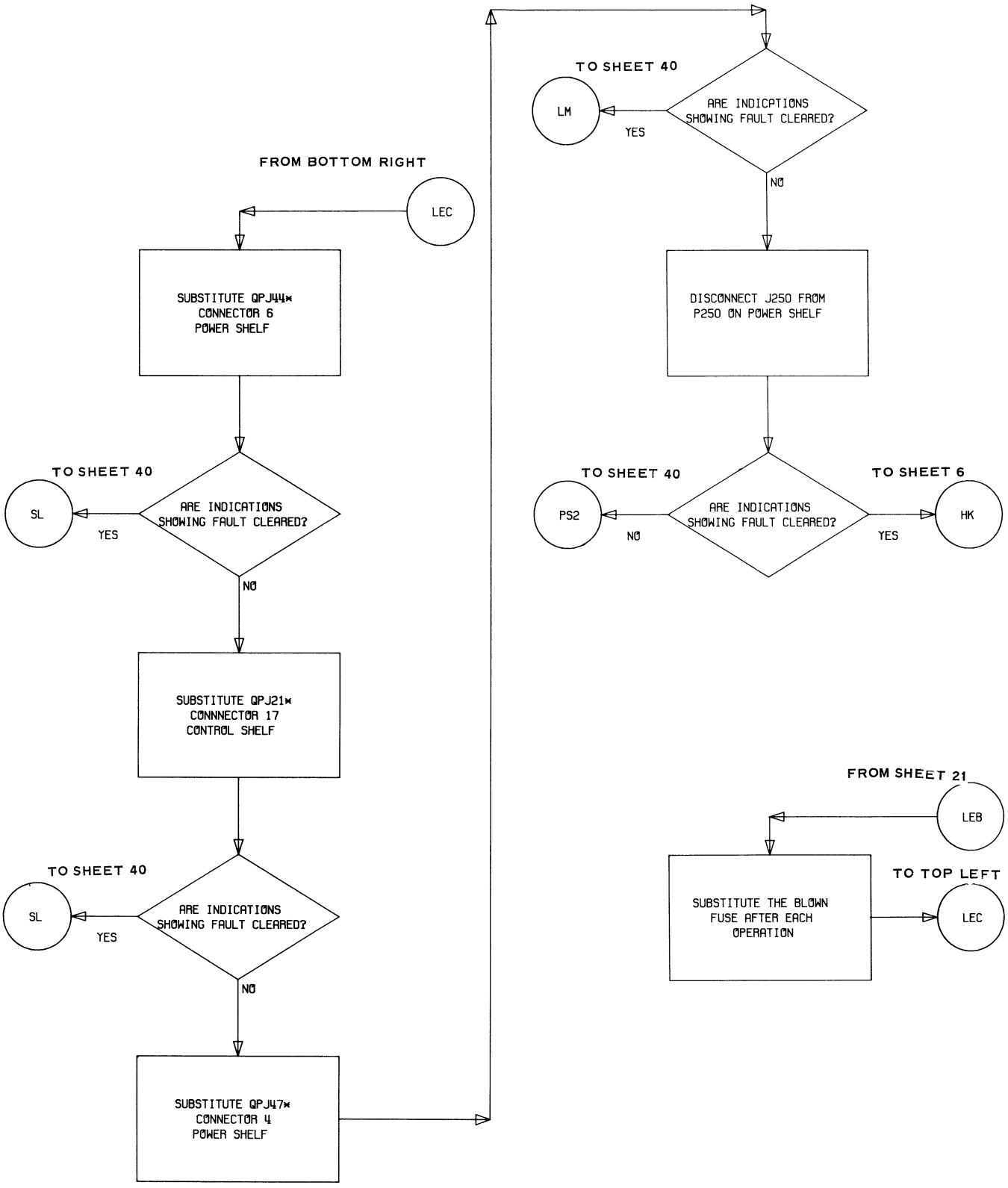
Flowchart 2 Continued — Major Alarm Fault-Clearing Procedure



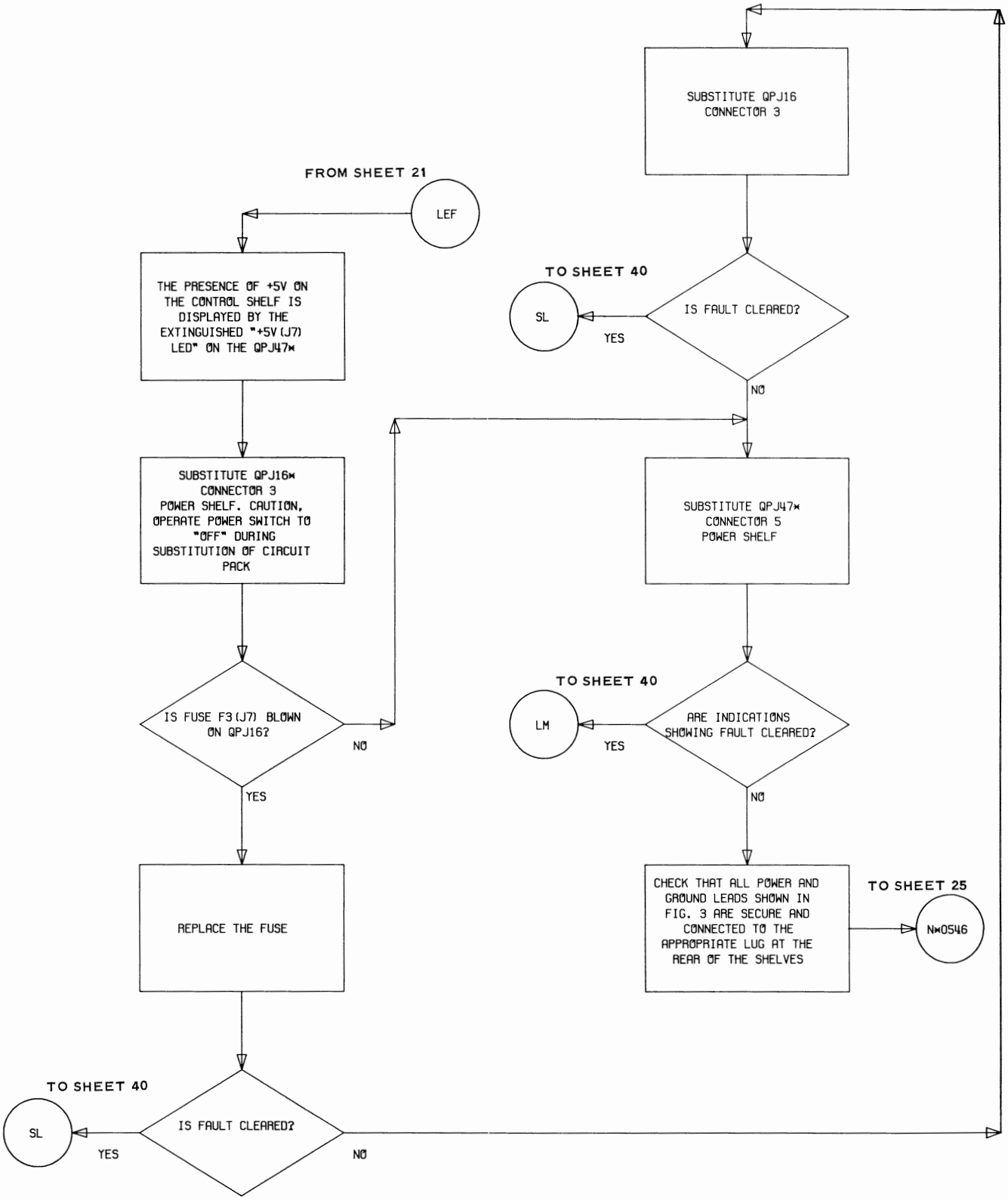
Flowchart 2 Continued — Major Alarm Fault-Clearing Procedure



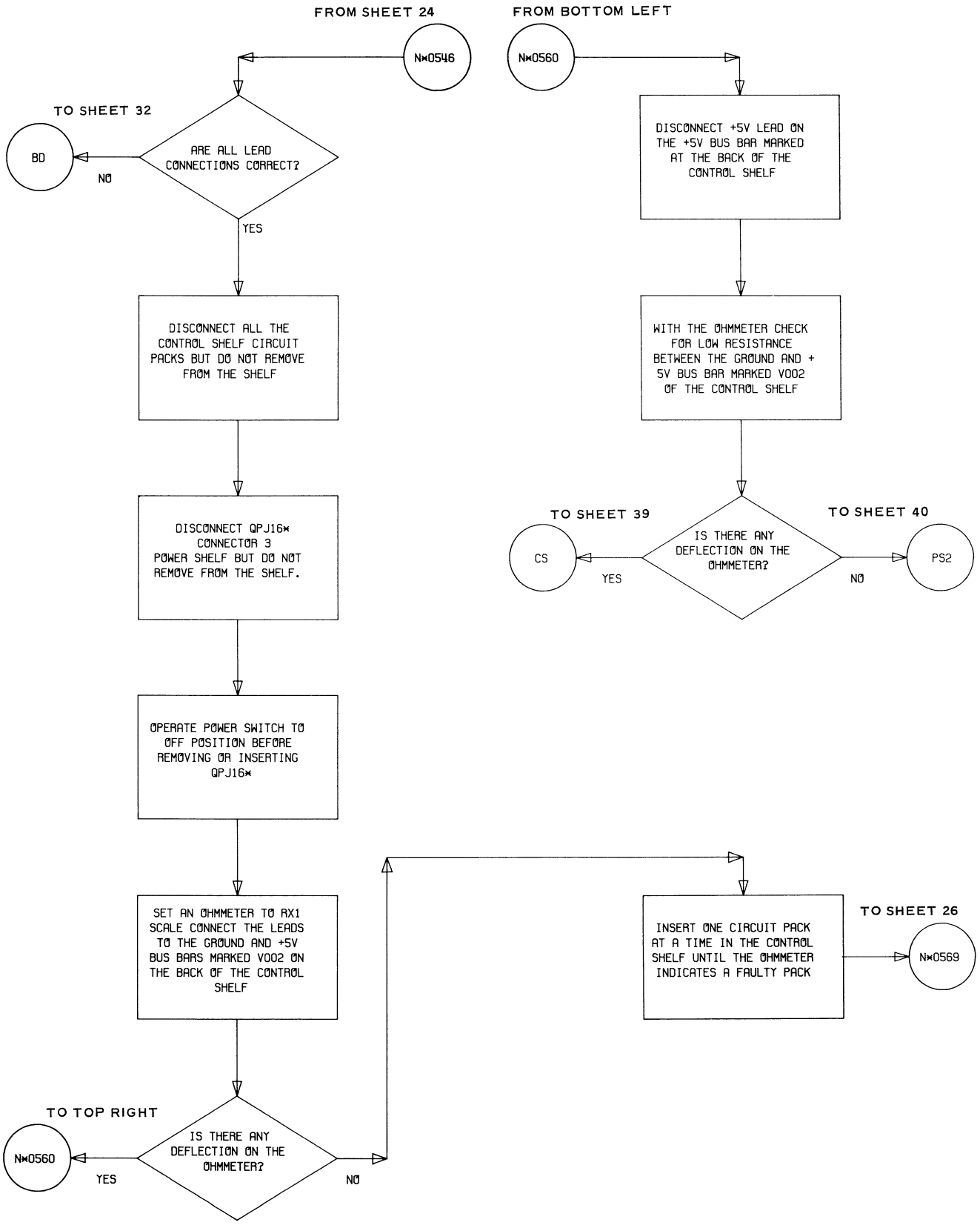
Flowchart 2 Continued — Major Alarm Fault-Clearing Procedure



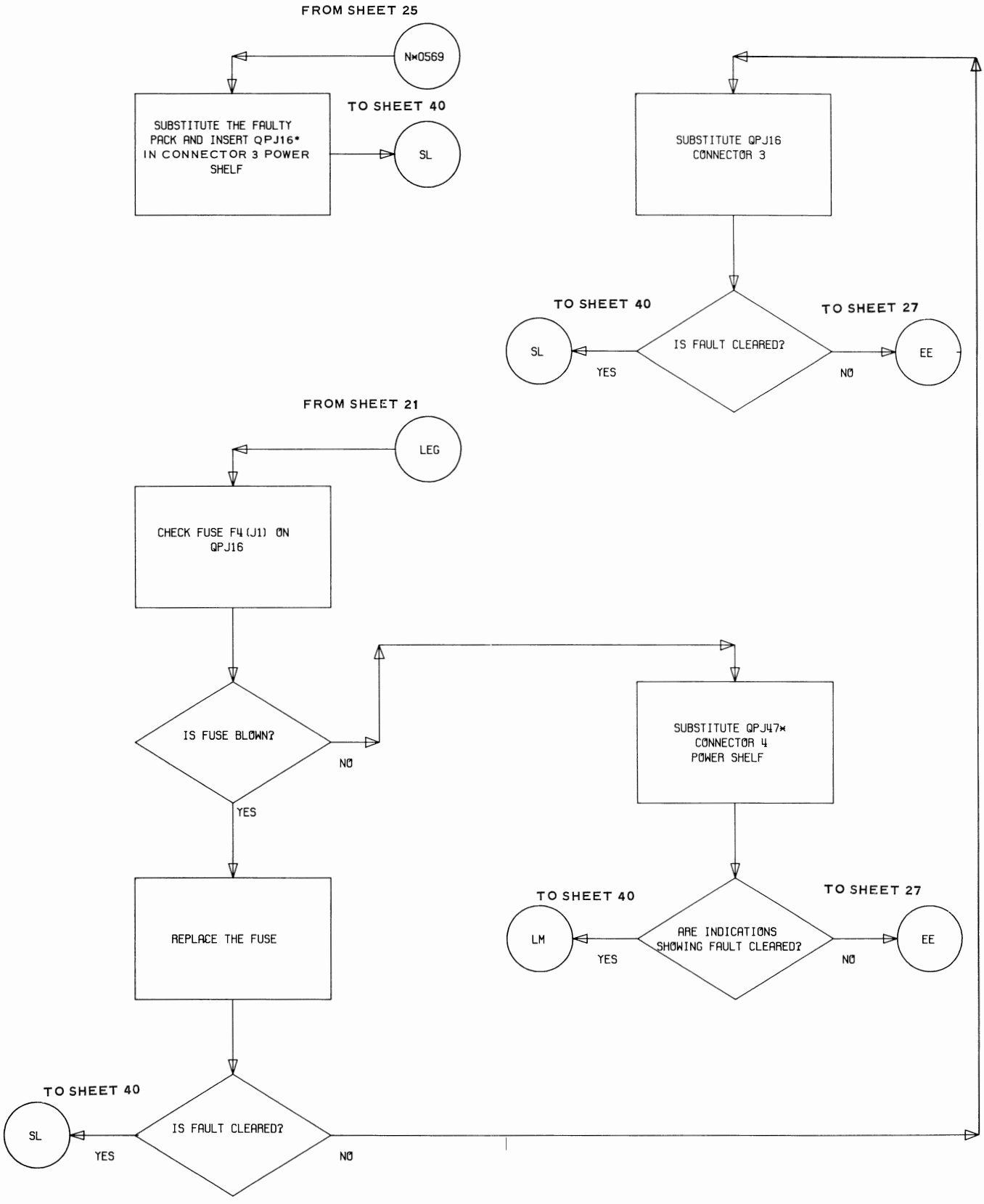
Flowchart 2 Continued — Major Alarm Fault-Clearing Procedure



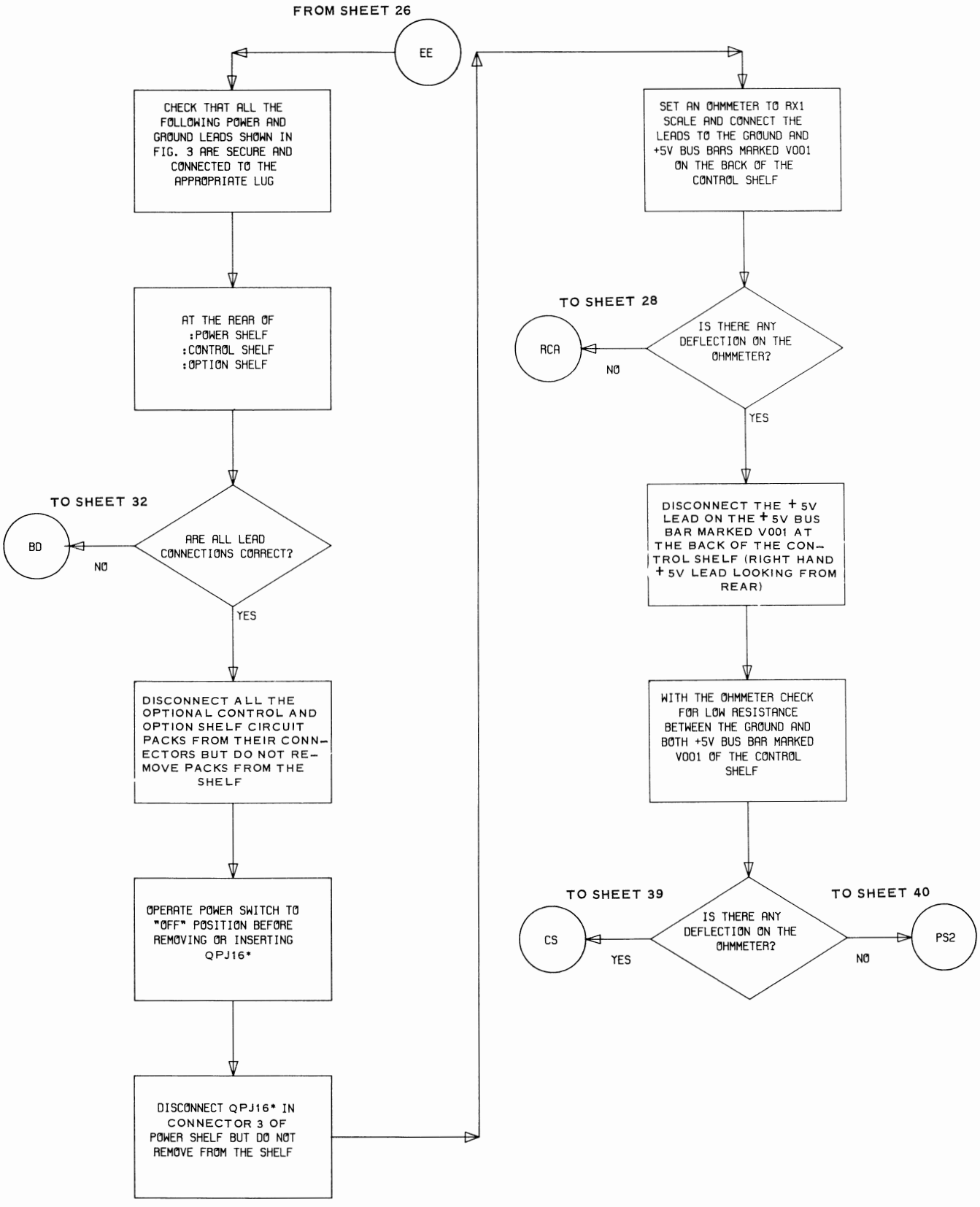
Flowchart 2 Continued — Major Alarm Fault-Clearing Procedure



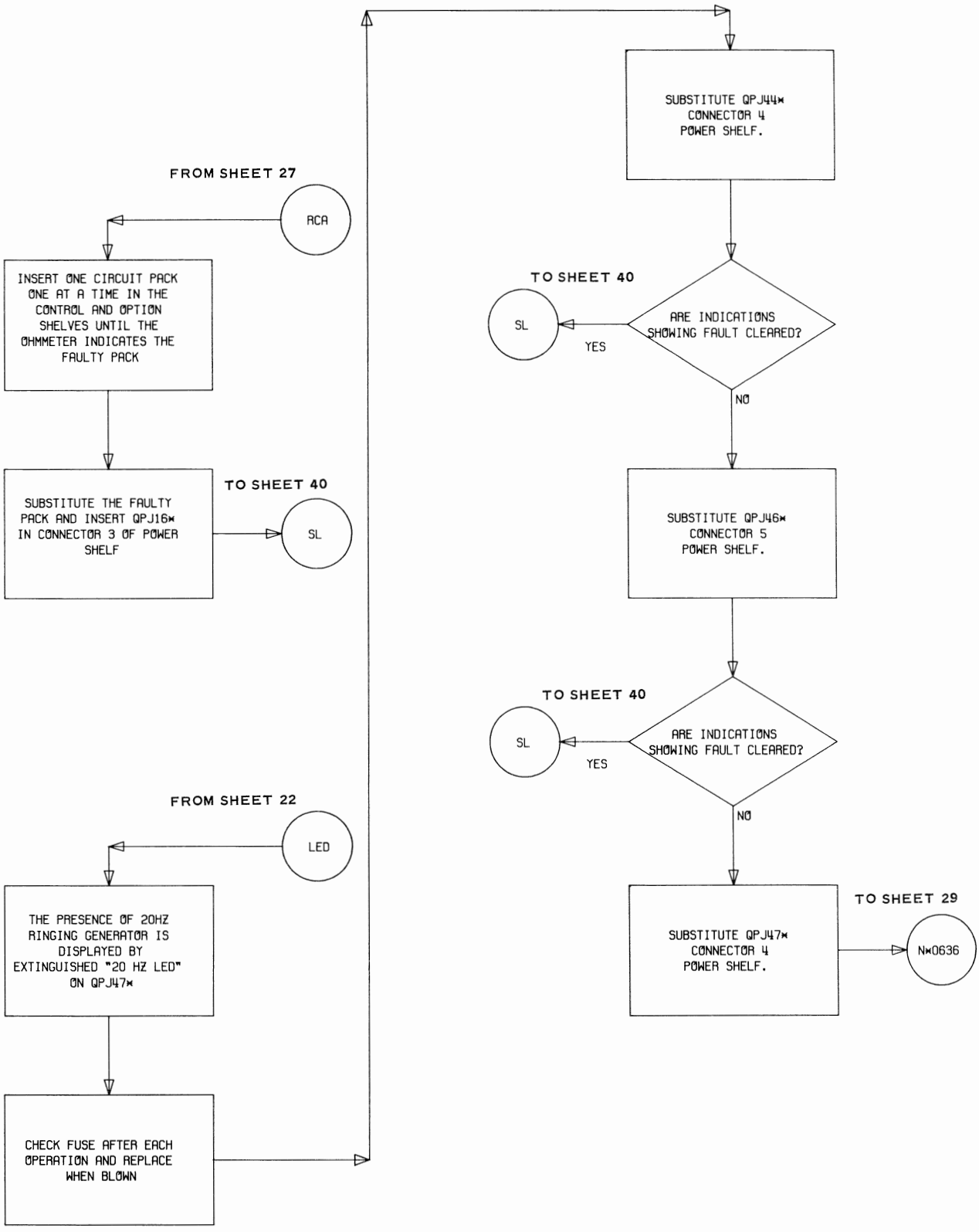
Flowchart 2 Continued — Major Alarm Fault-Clearing Procedure



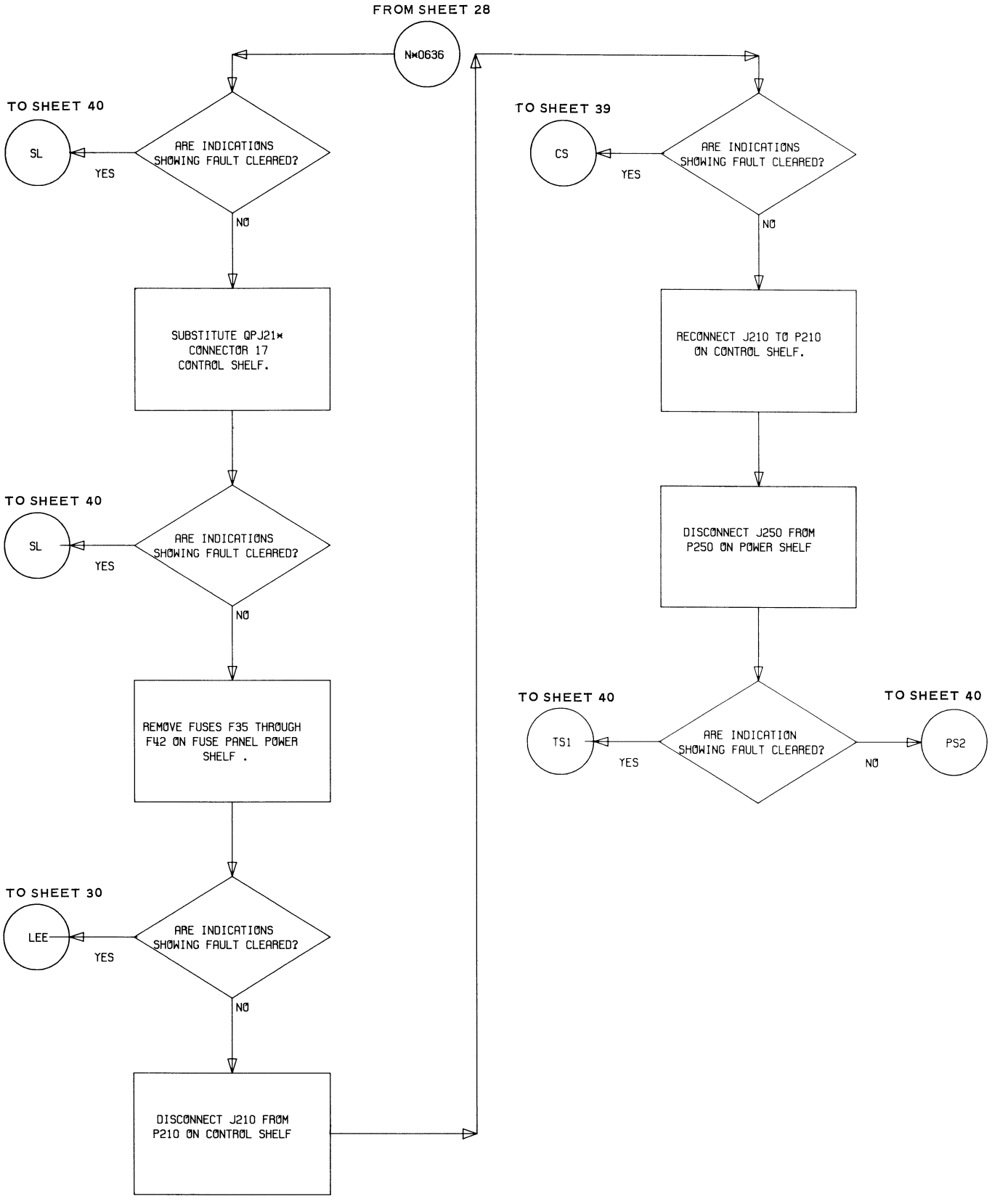
Flowchart 2 Continued — Major Alarm Fault-Clearing Procedure



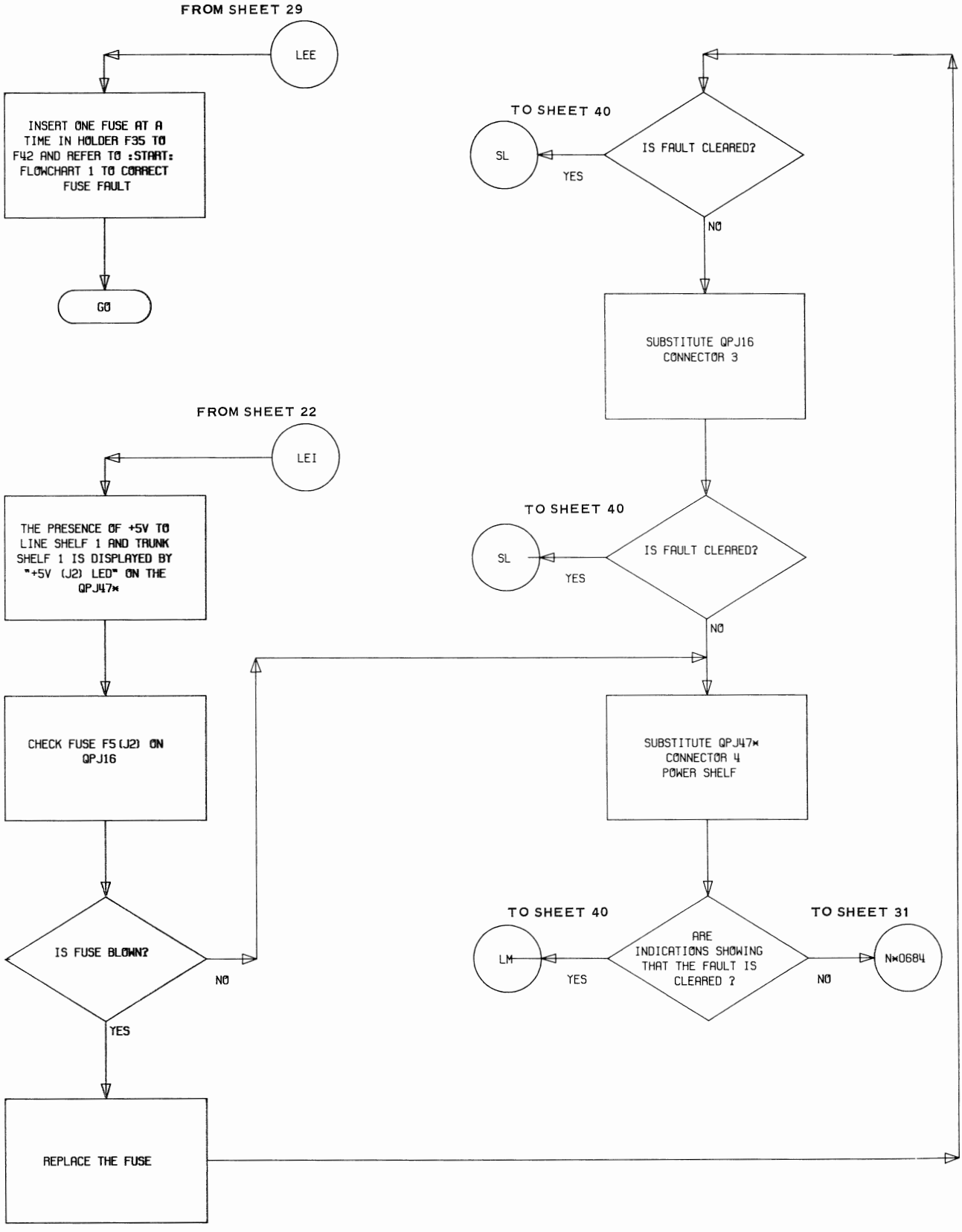
Flowchart 2 Continued — Major Alarm Fault-Clearing Procedure



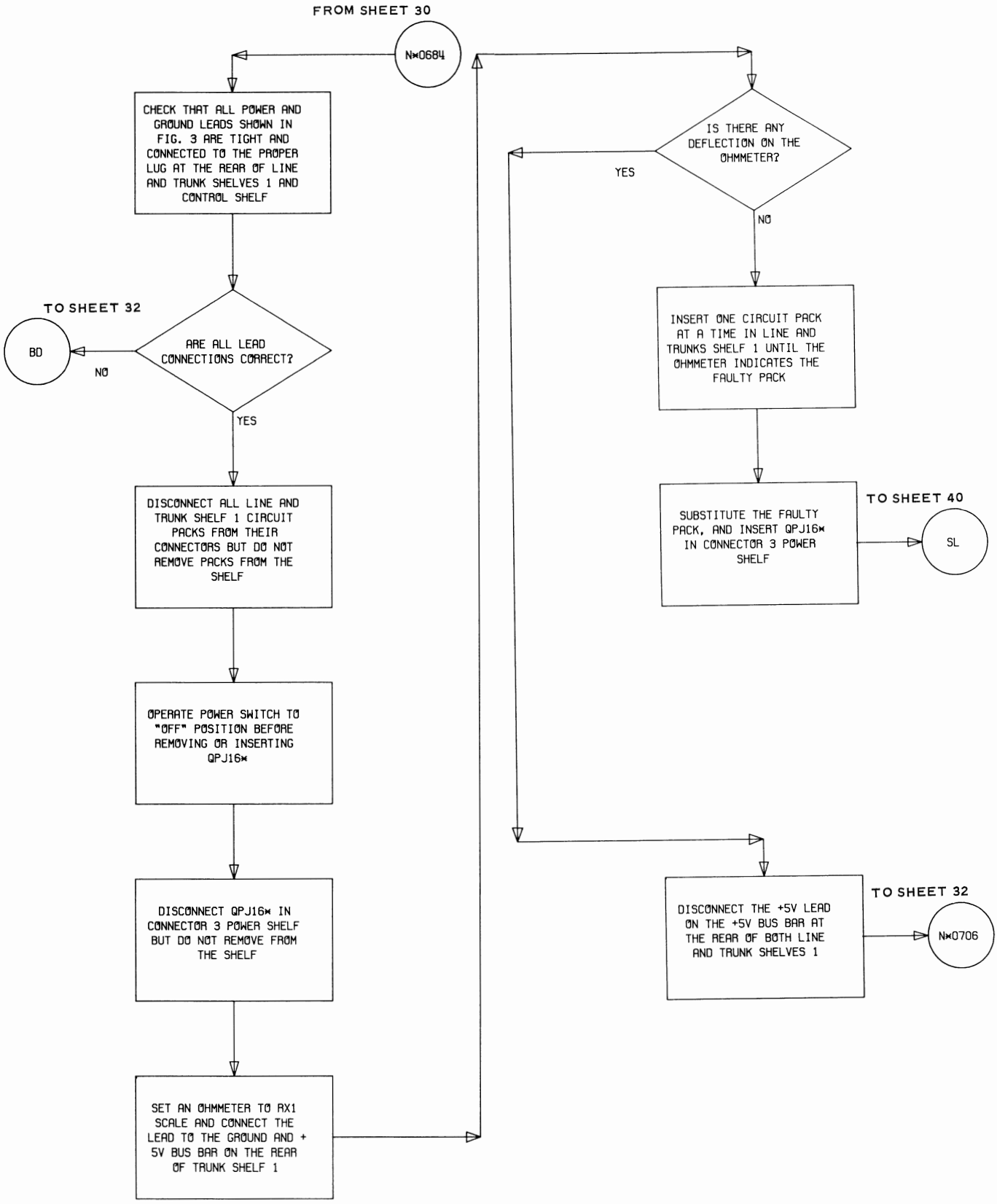
Flowchart 2 Continued — Major Alarm Fault-Clearing Procedure



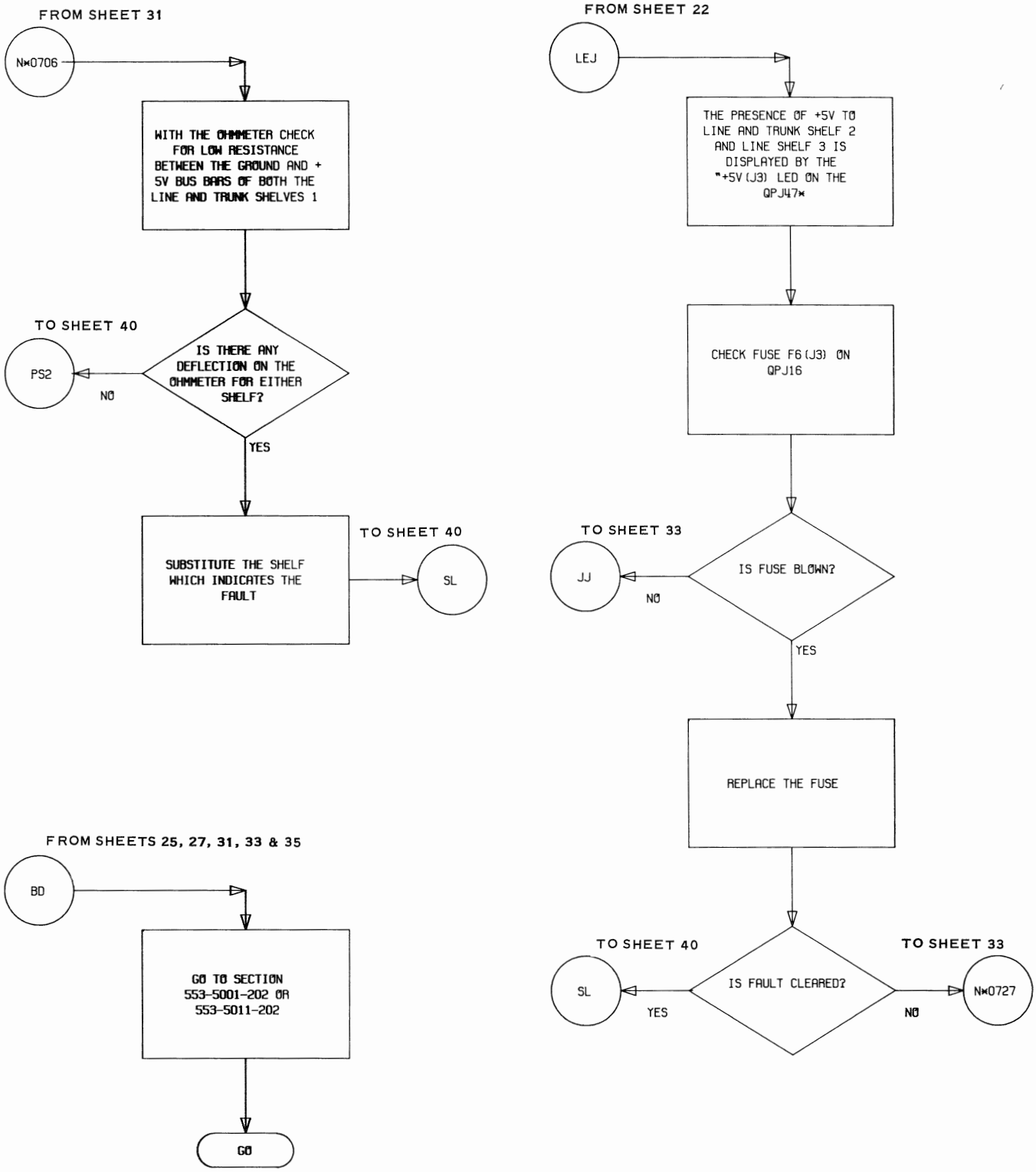
Flowchart 2 Continued — Major Alarm Fault-Clearing Procedure



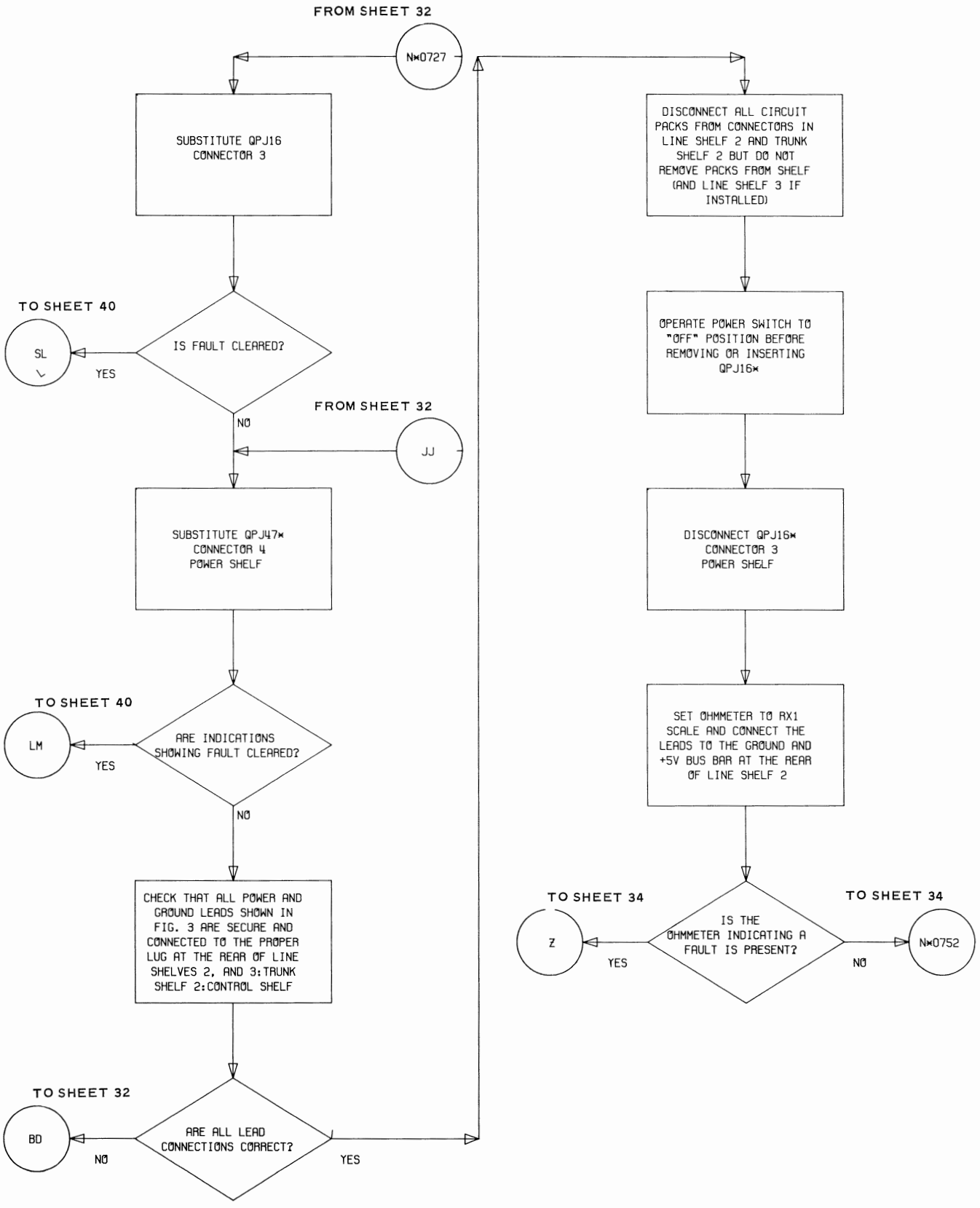
Flowchart 2 Continued — Major Alarm Fault-Clearing Procedure



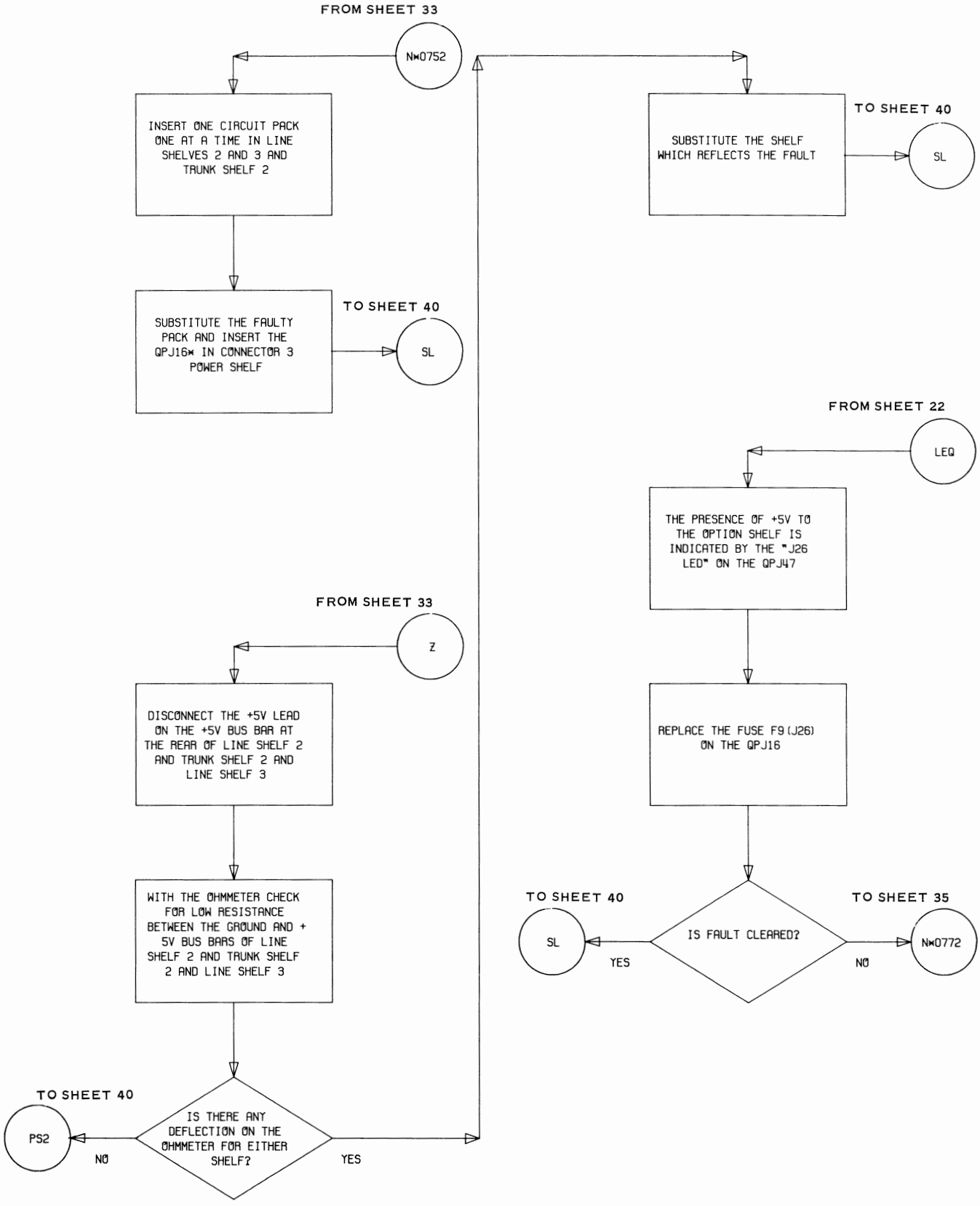
Flowchart 2 Continued — Major Alarm Fault-Clearing Procedure



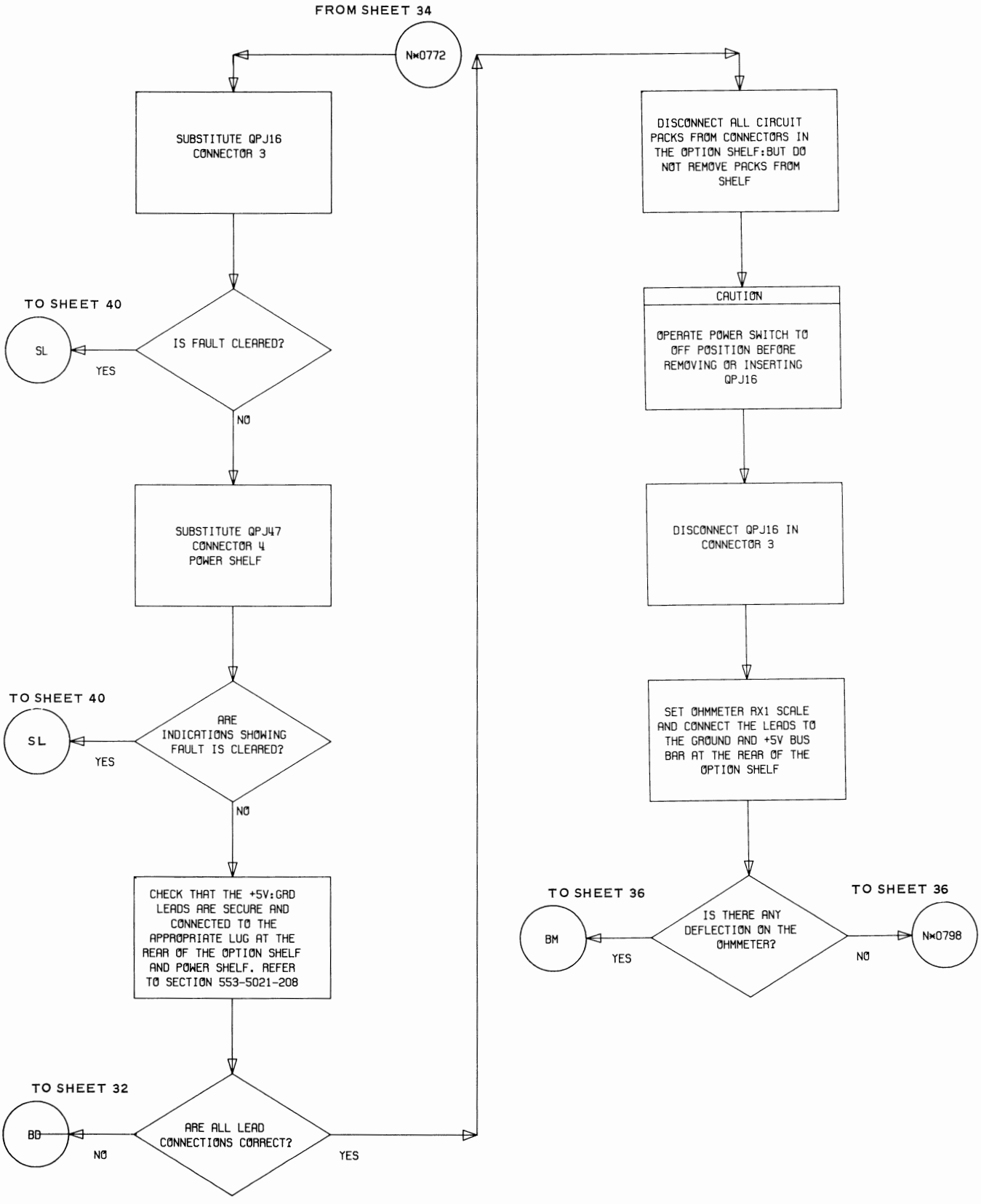
Flowchart 2 Continued — Major Alarm Fault-Clearing Procedure



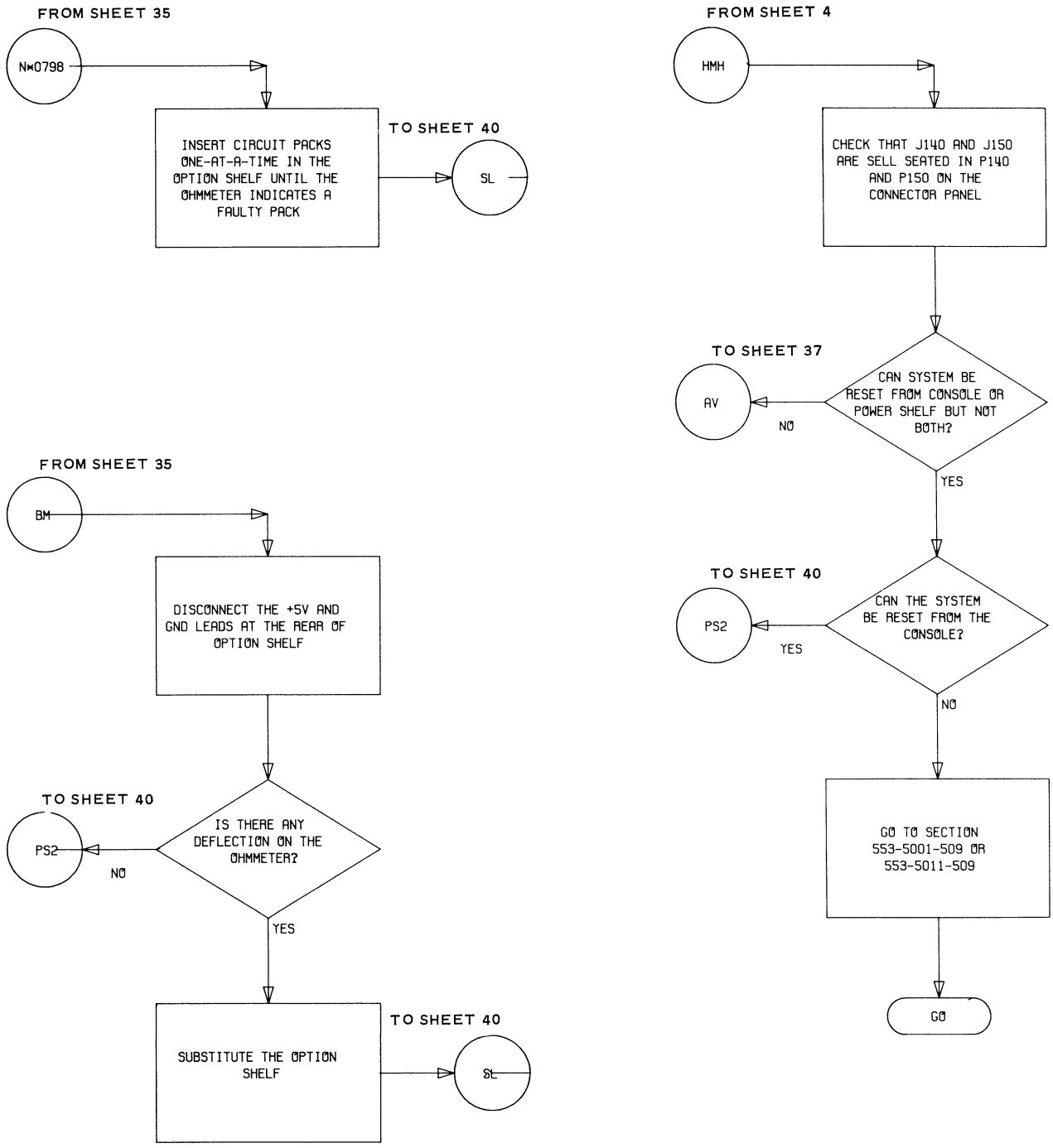
Flowchart 2 Continued — Major Alarm Fault-Clearing Procedure



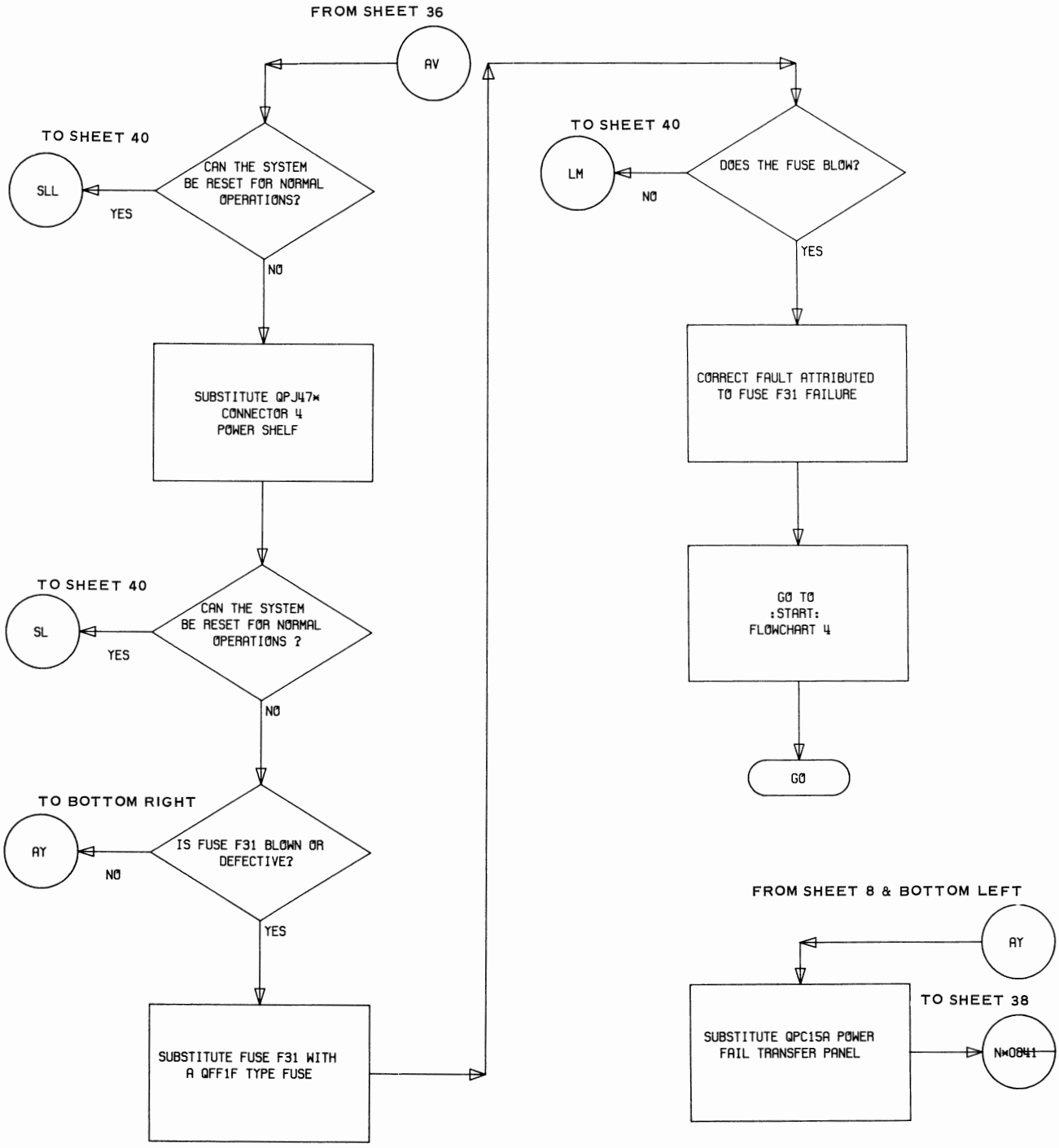
Flowchart 2 Continued — Major Alarm Fault-Clearing Procedure



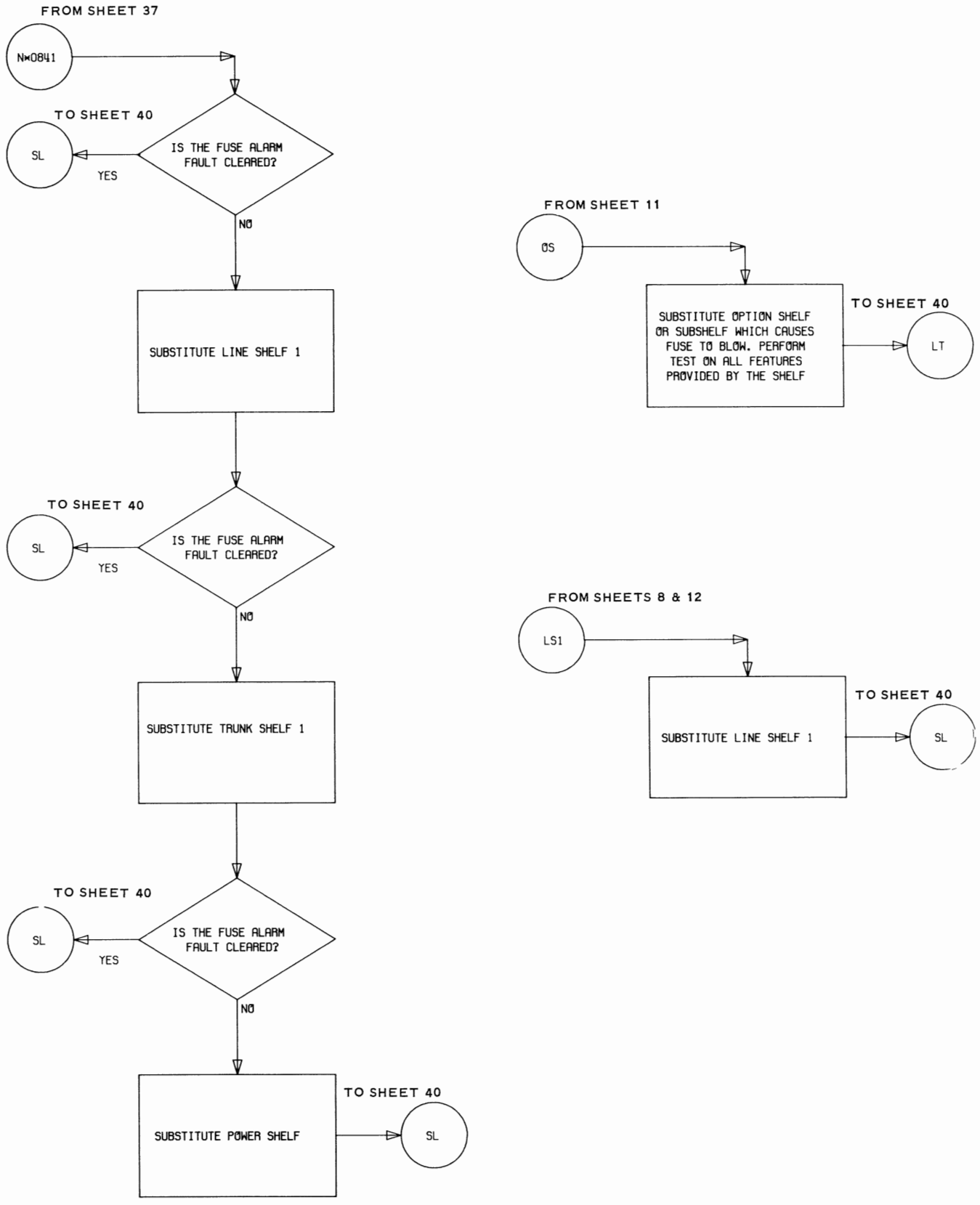
Flowchart 2 Continued — Major Alarm Fault-Clearing Procedure



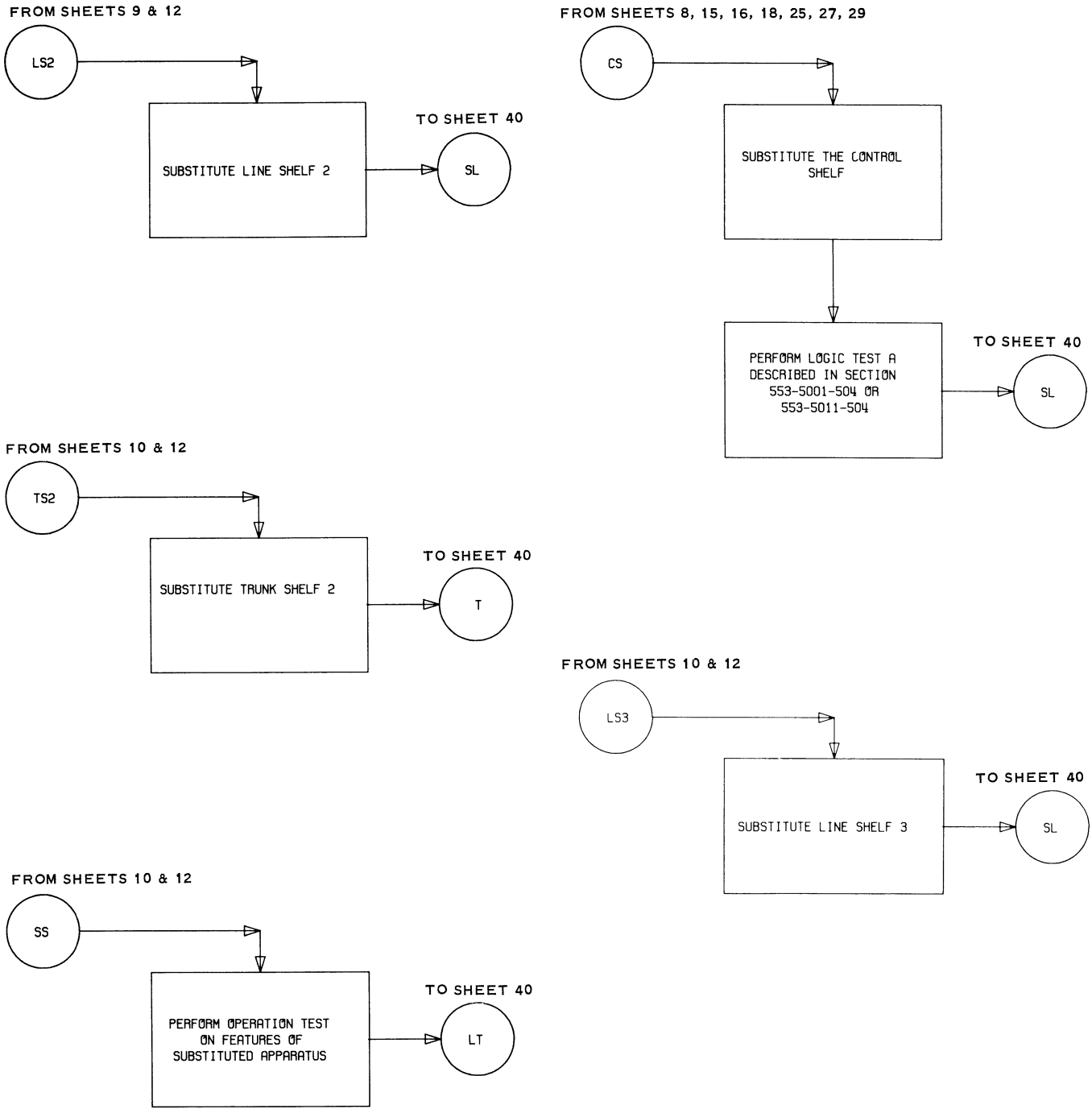
Flowchart 2 Continued — Major Alarm Fault-Clearing Procedure



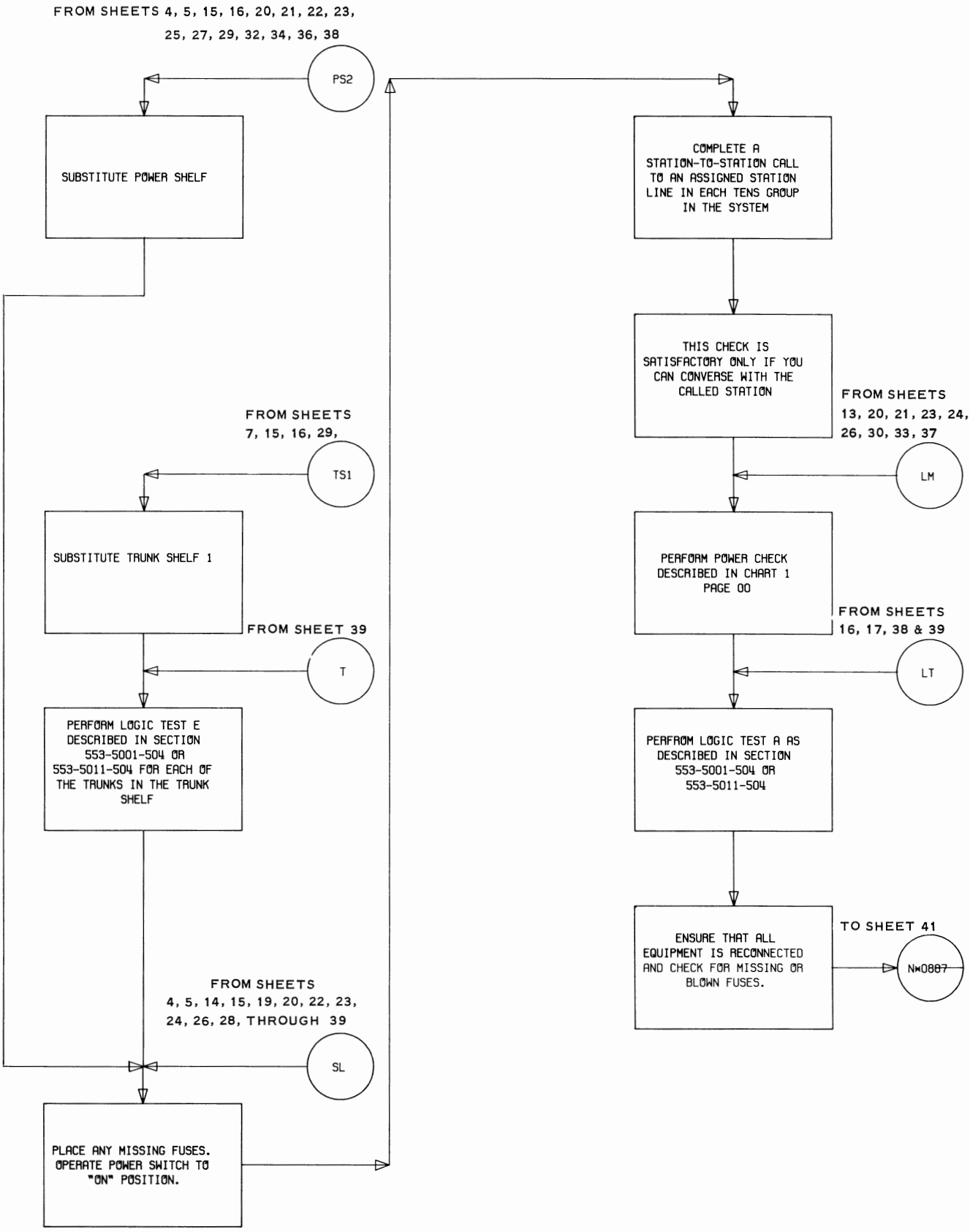
Flowchart 2 Continued — Major Alarm Fault-Clearing Procedure



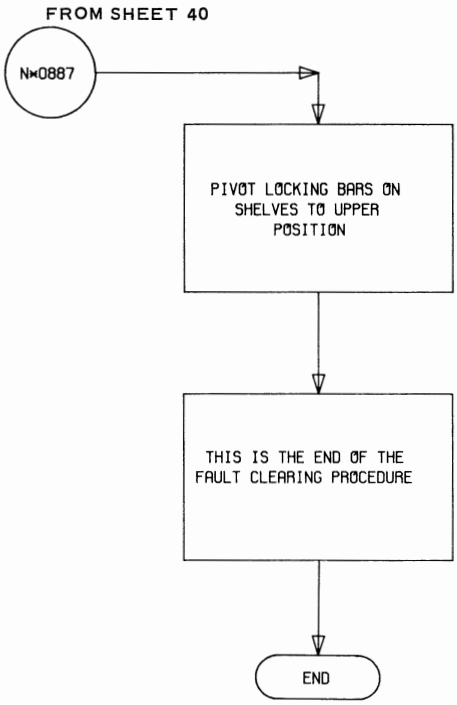
Flowchart 2 Continued — Major Alarm Fault-Clearing Procedure



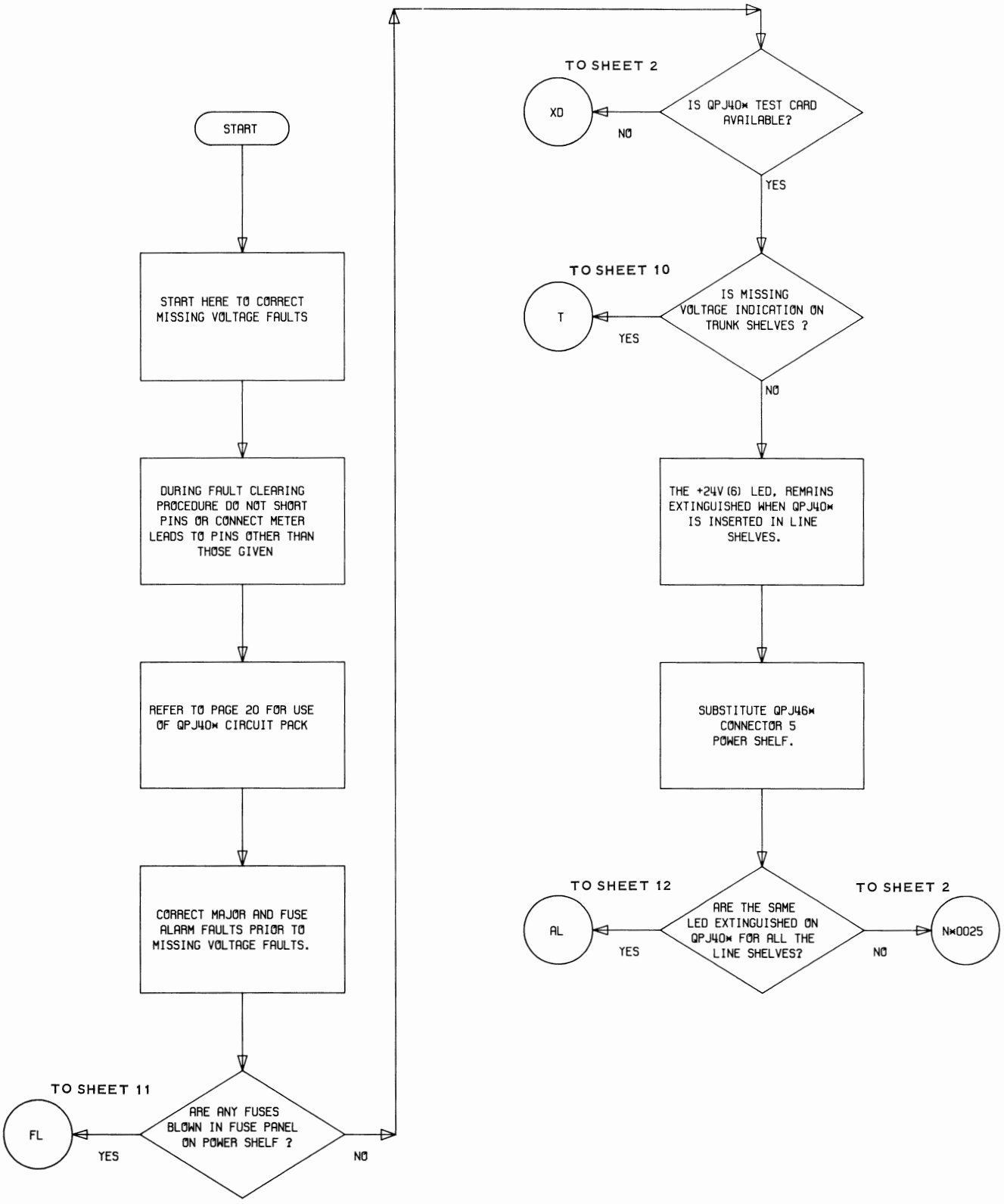
Flowchart 2 Continued — Major Alarm Fault-Clearing Procedure



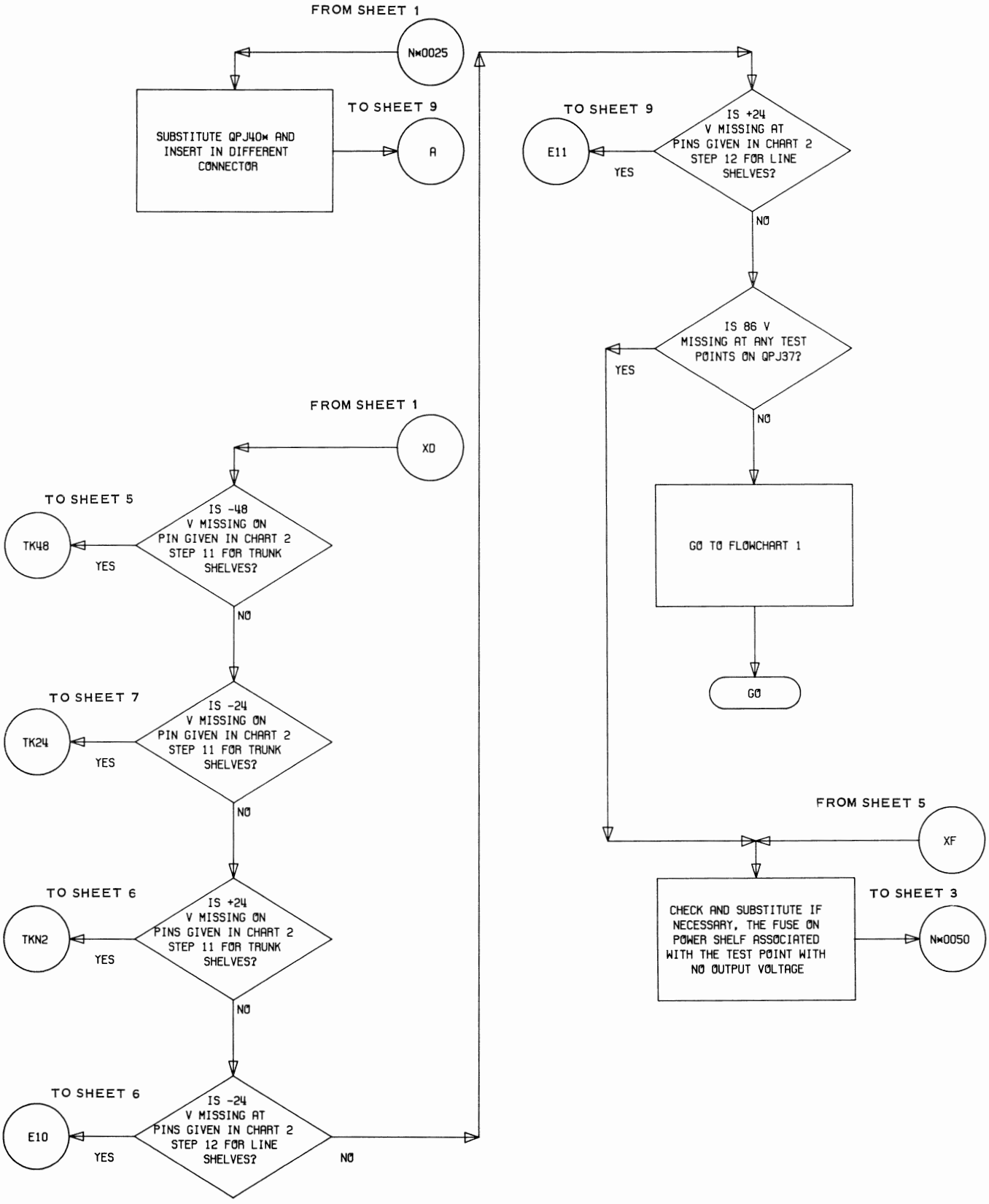
Flowchart 2 Continued — Major Alarm Fault-Clearing Procedure



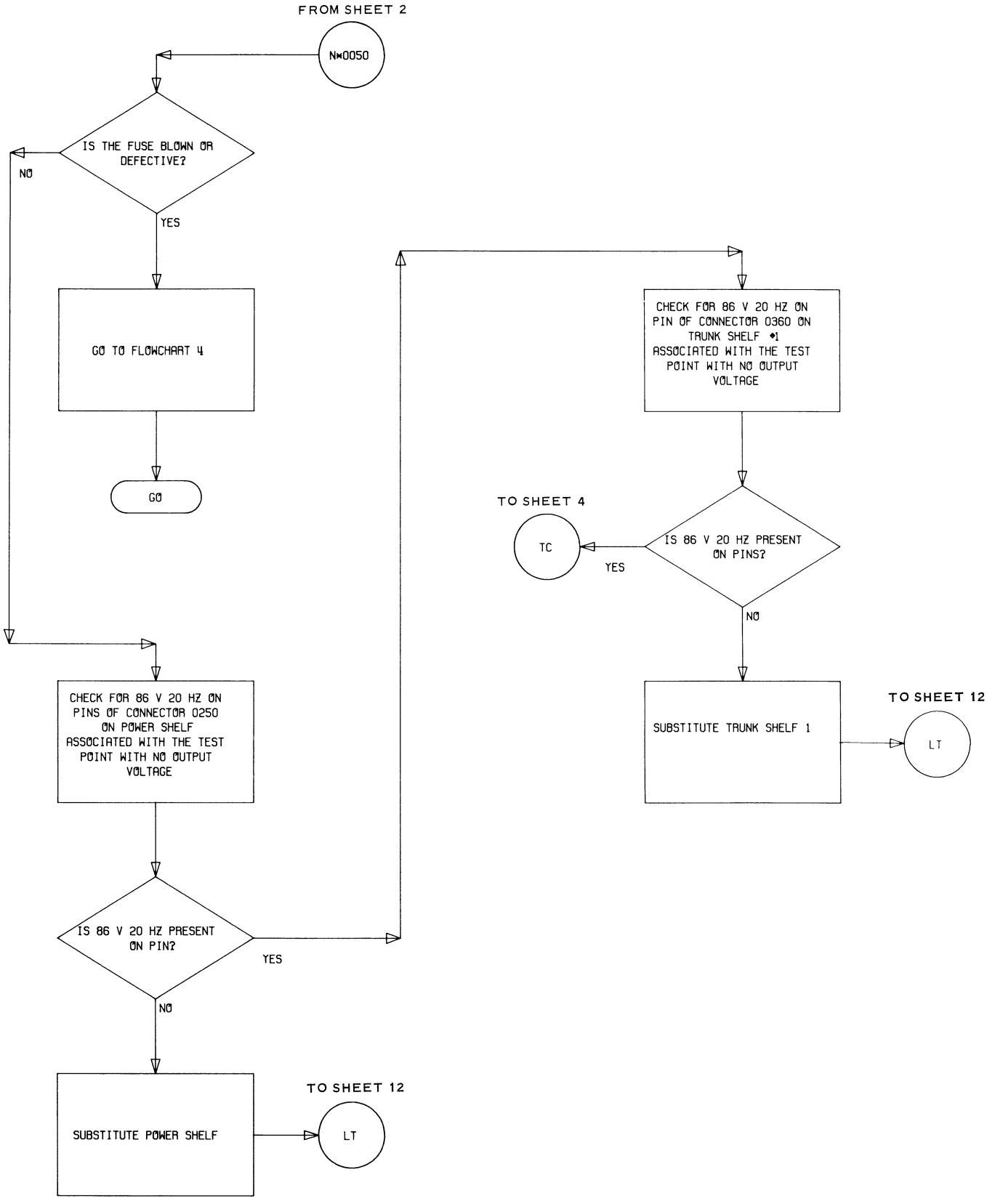
Flowchart 2 Continued — Major Alarm Fault-Clearing Procedure



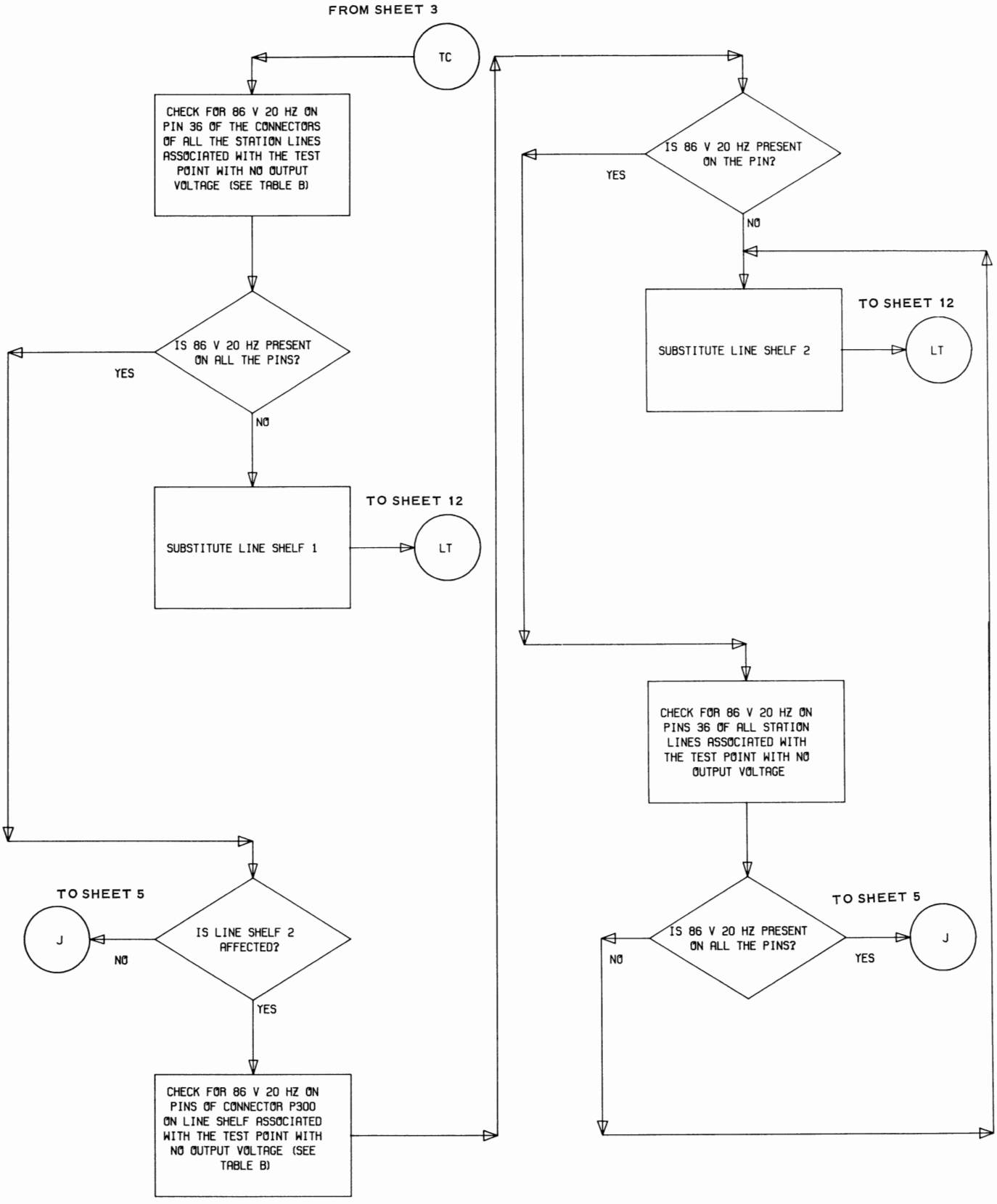
Flowchart 3 — Missing Voltage Faults



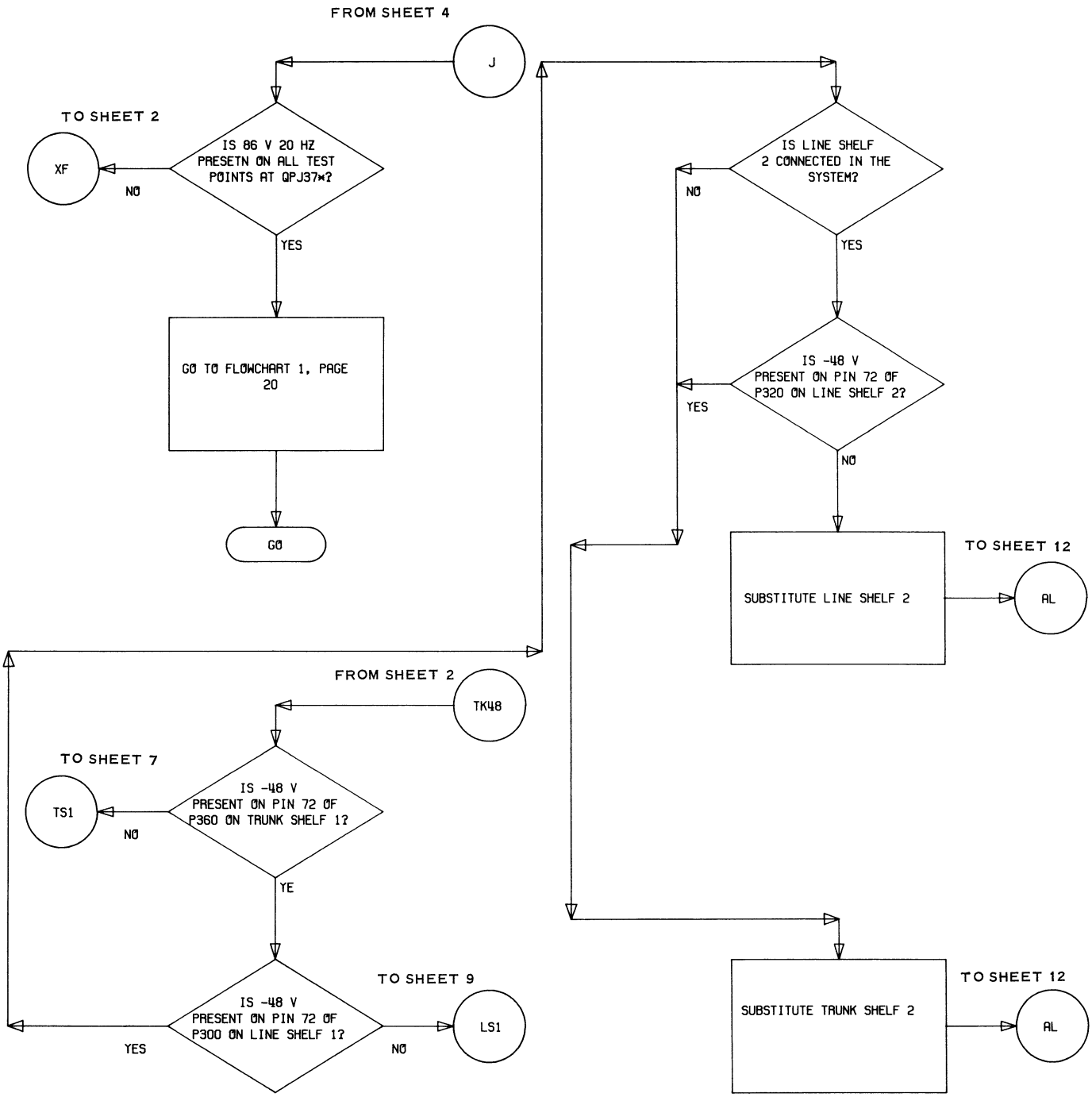
Flowchart 3 Continued — Missing Voltage Faults



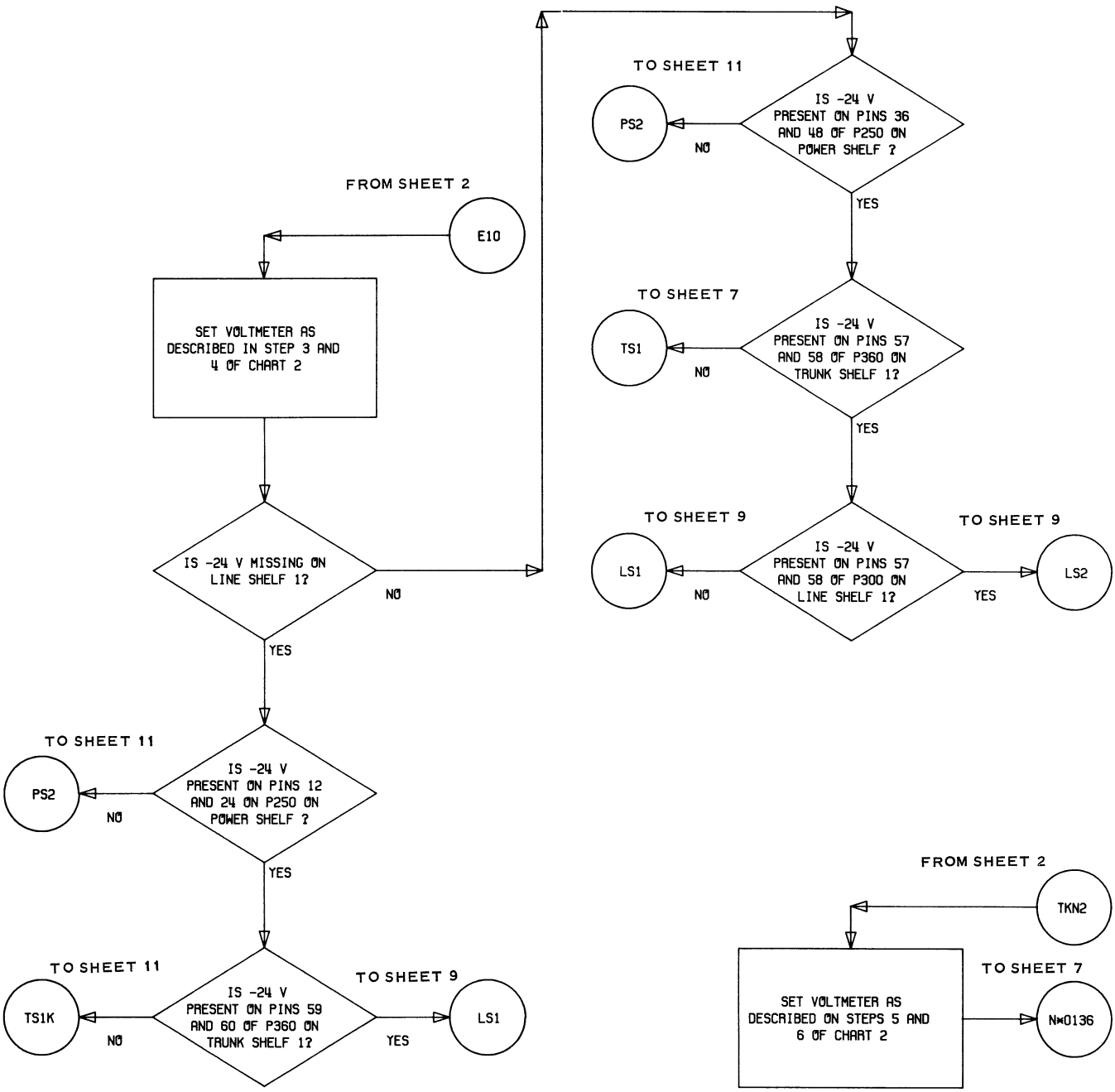
Flowchart 3 Continued — Missing Voltage Faults



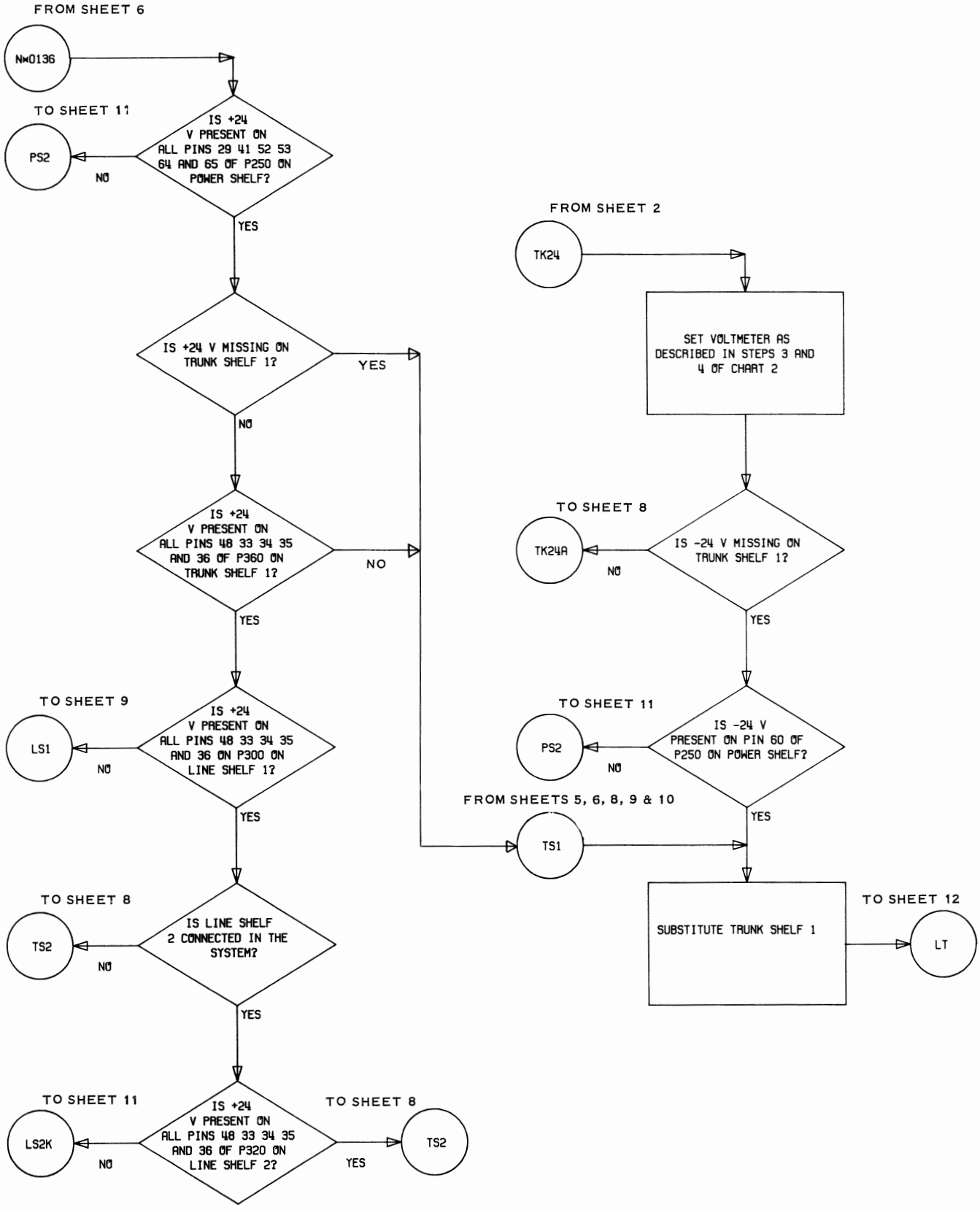
Flowchart 3 Continued — Missing Voltage Faults



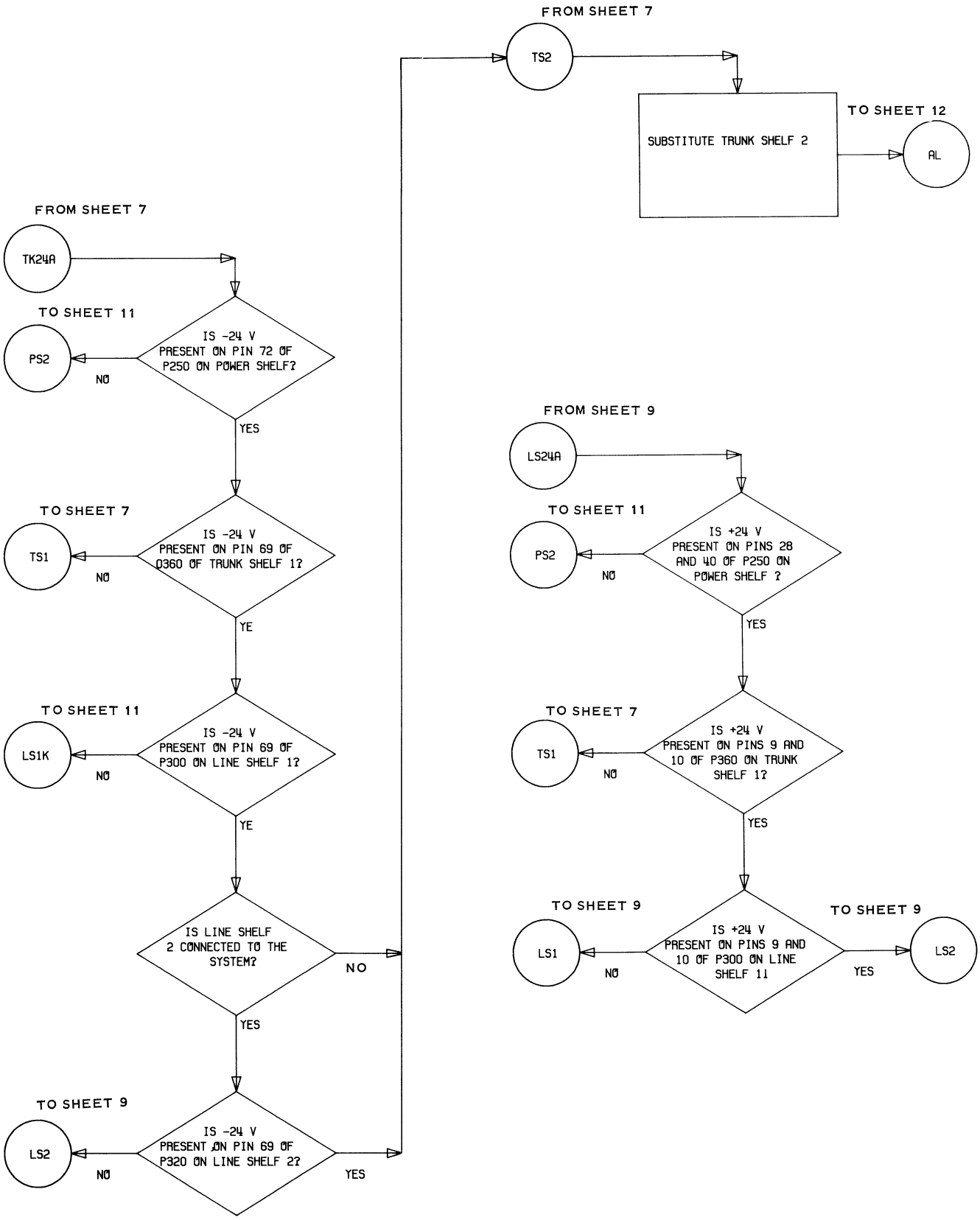
Flowchart 3 Continued — Missing Voltage Faults



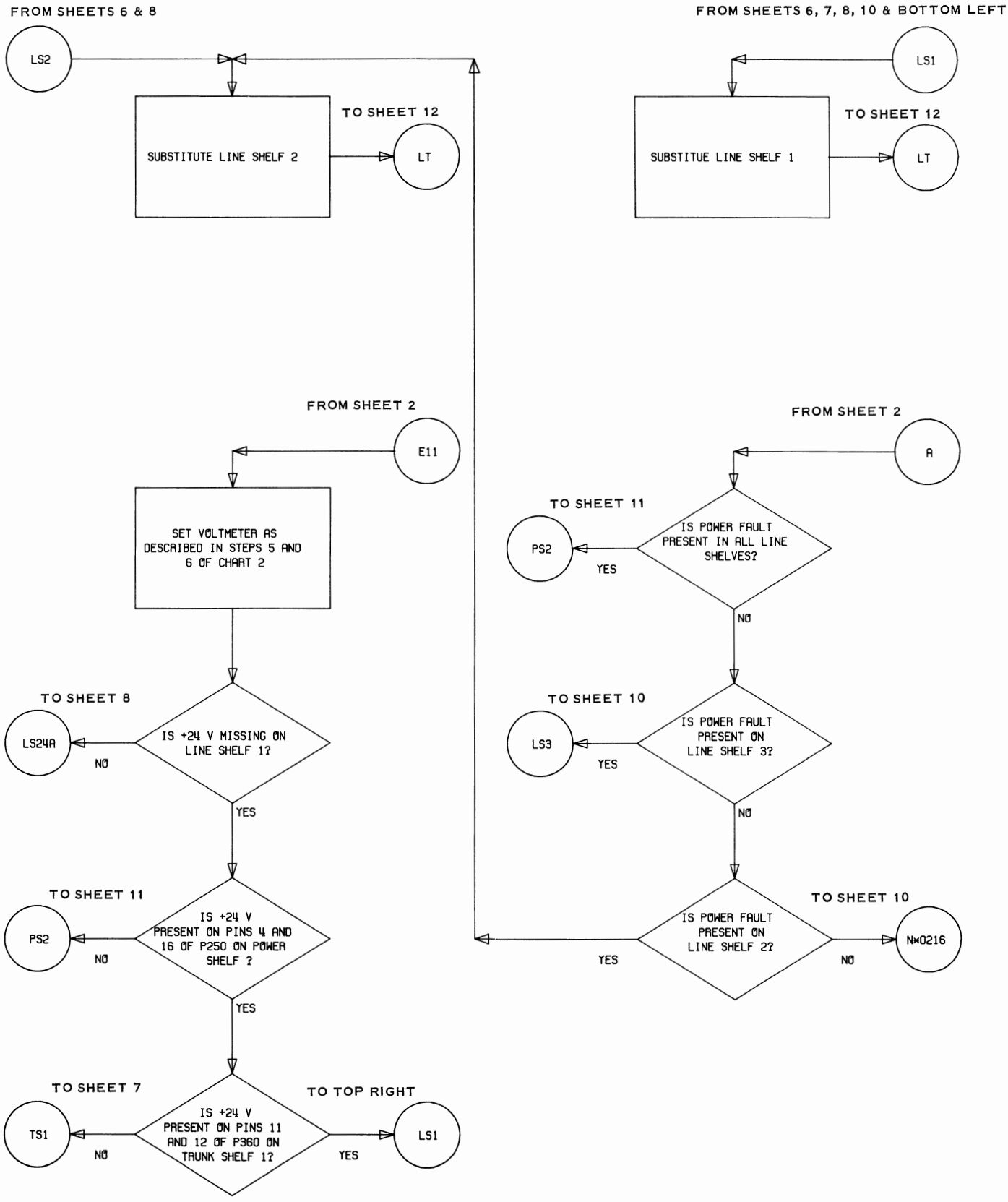
Flowchart 3 Continued — Missing Voltage Faults



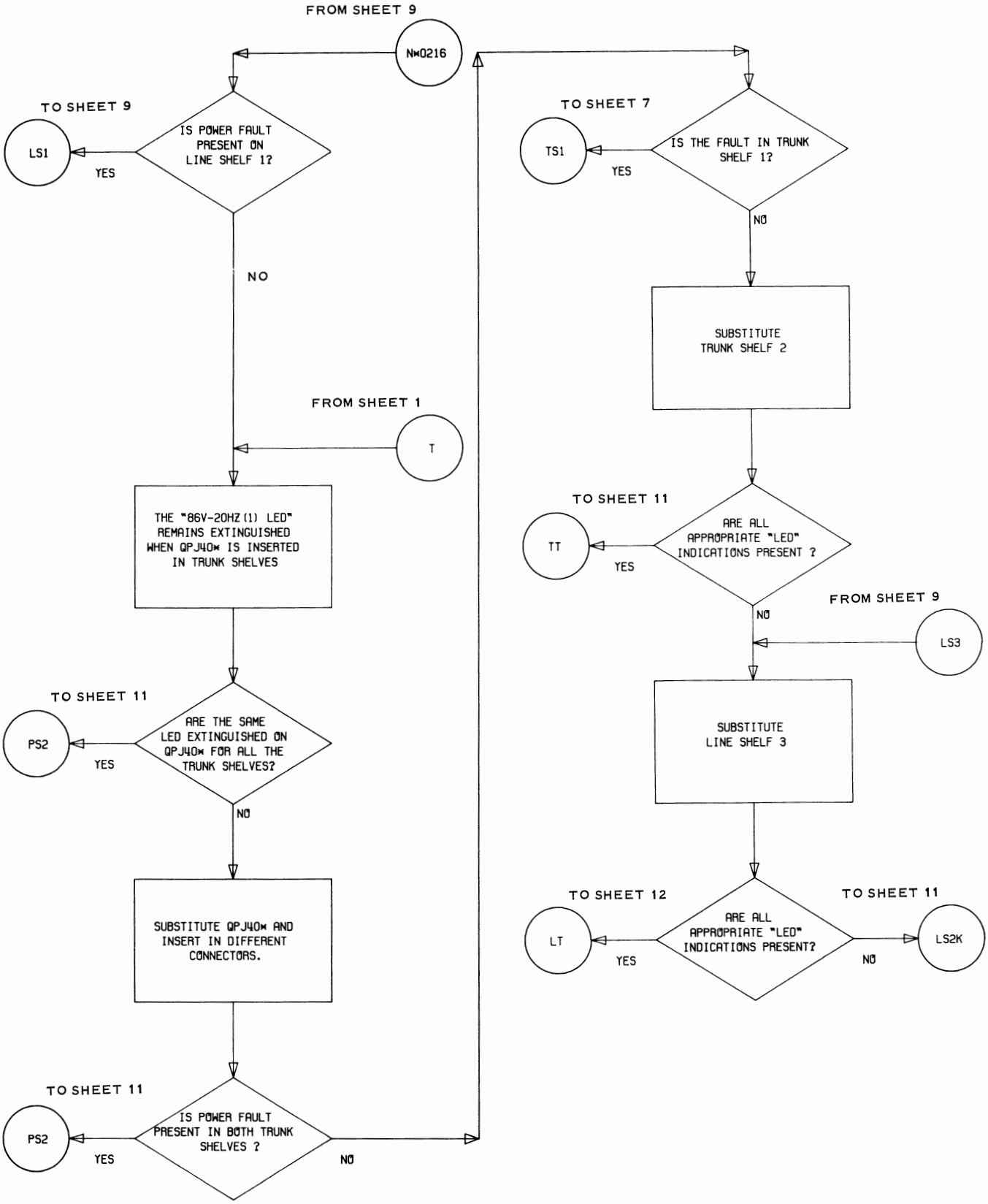
Flowchart 3 Continued — Missing Voltage Faults



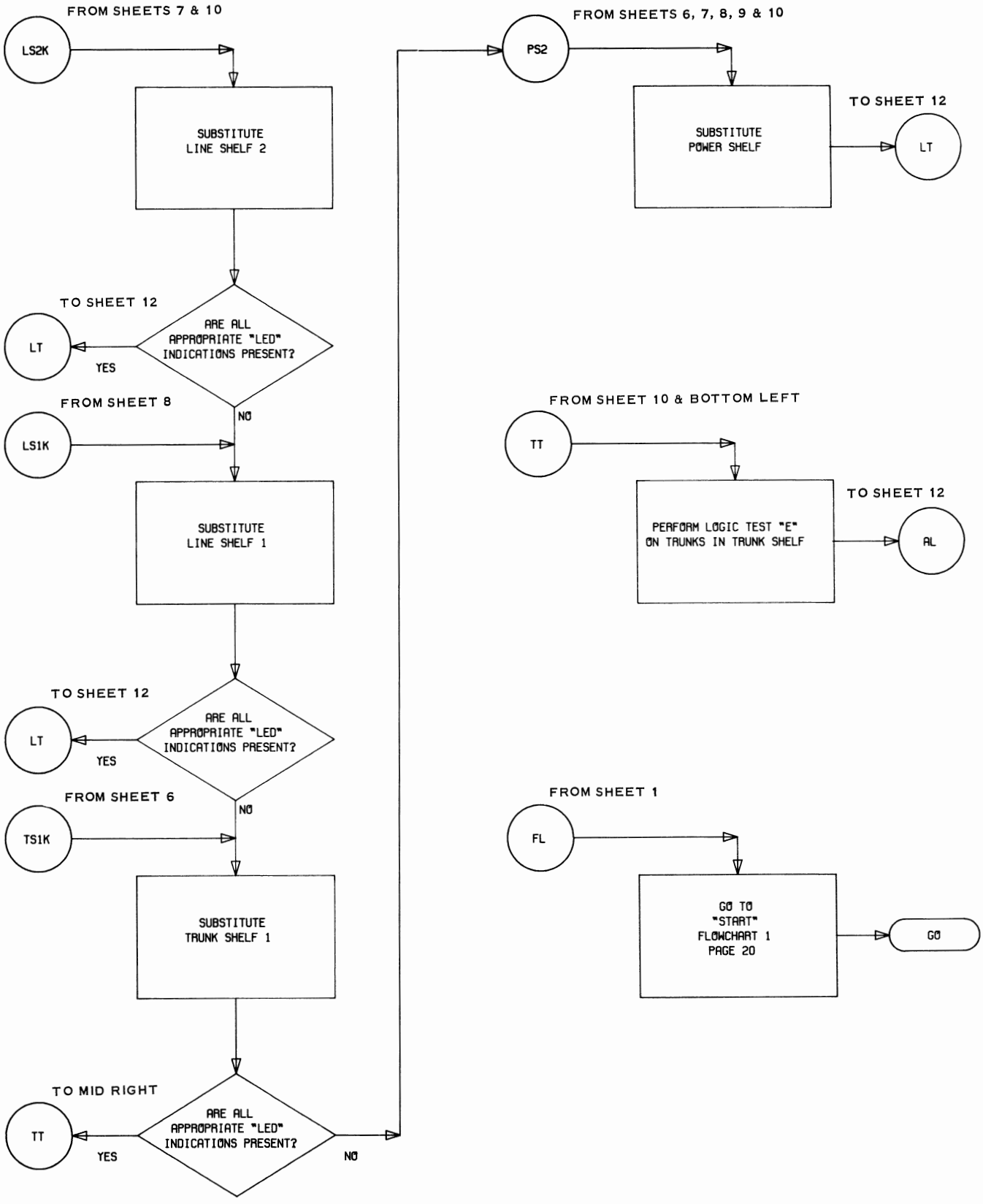
Flowchart 3 Continued — Missing Voltage Faults



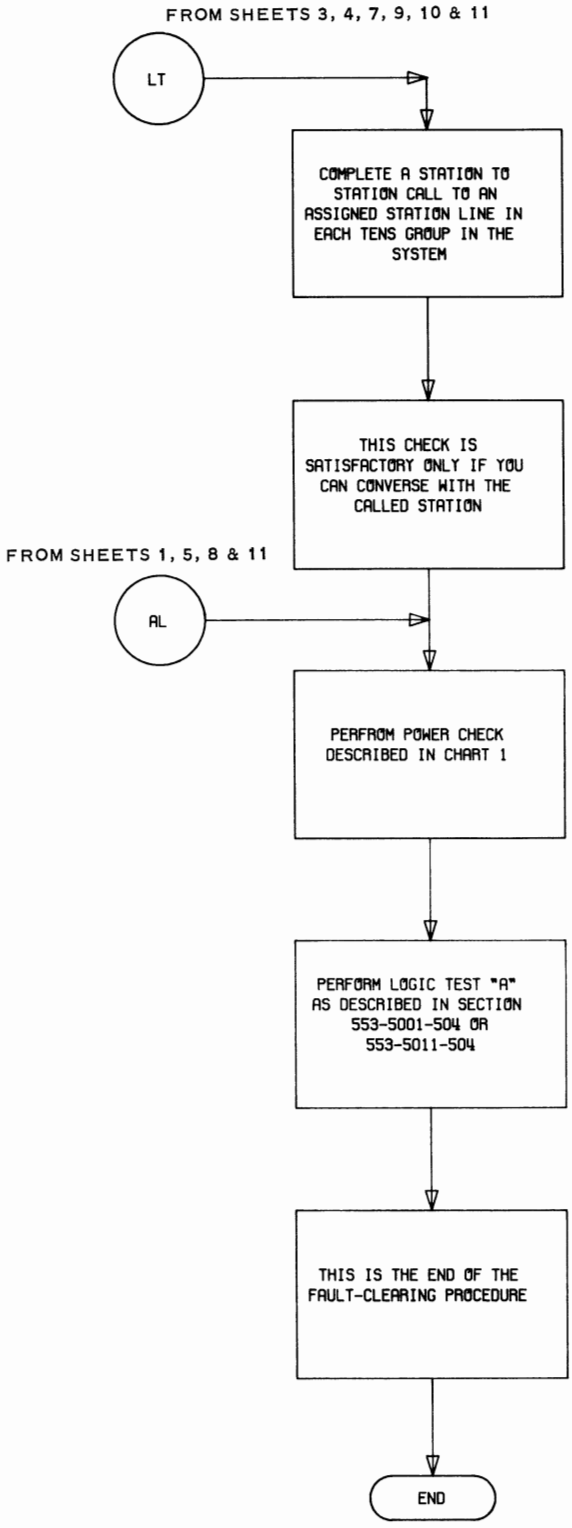
Flowchart 3 Continued — Missing Voltage Faults



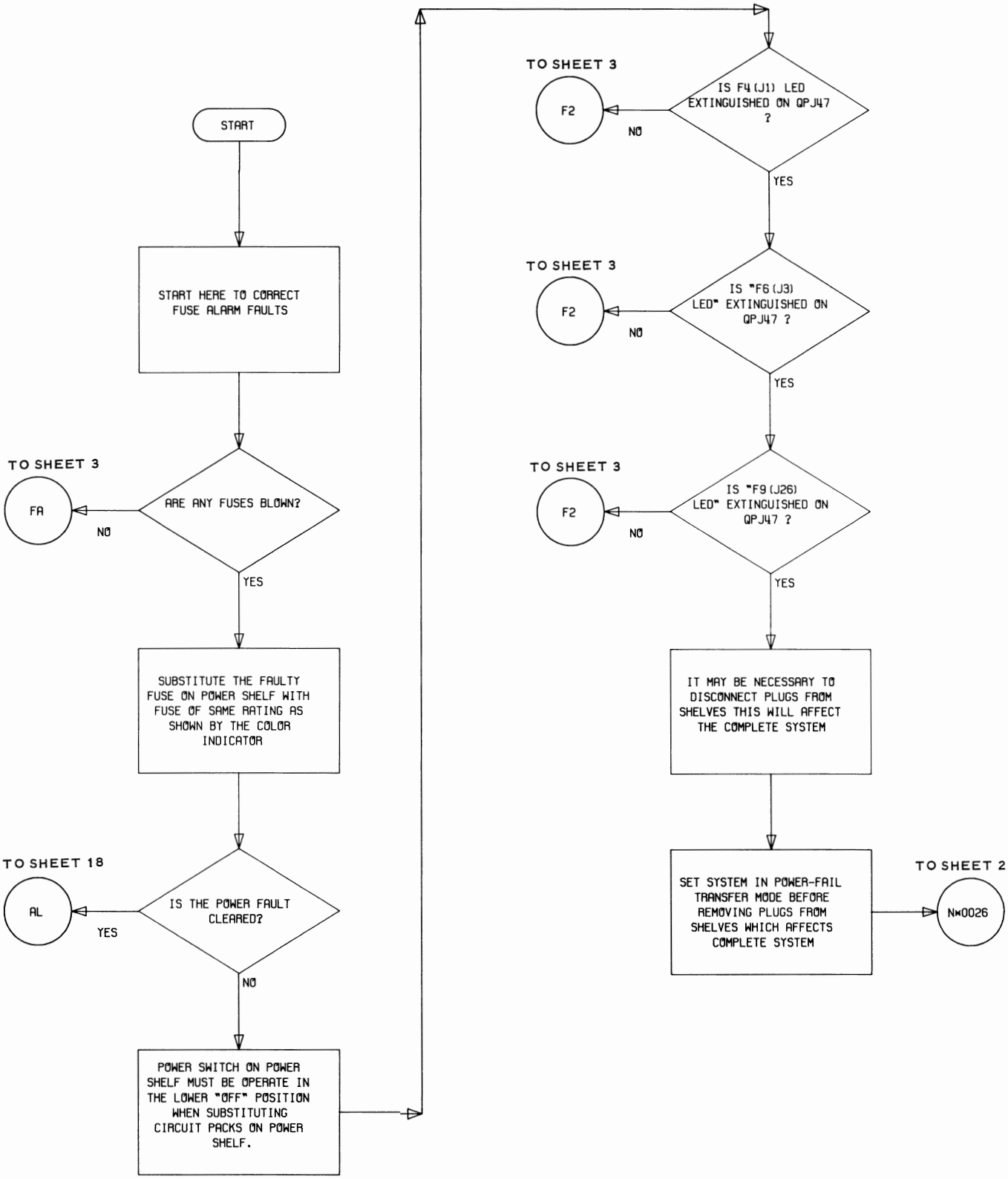
Flowchart 3 Continued — Missing Voltage Faults



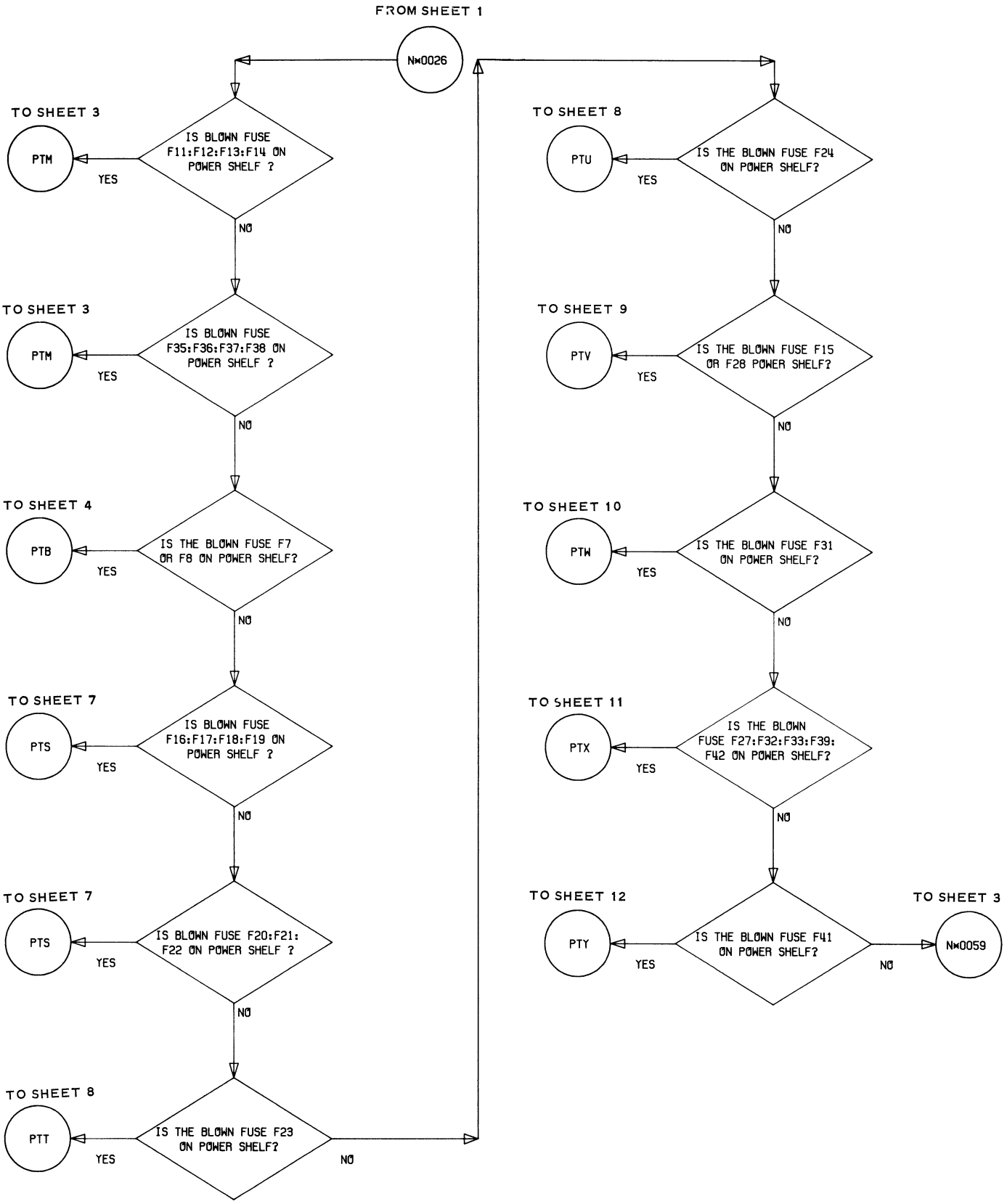
Flowchart 3 Continued — Missing Voltage Faults



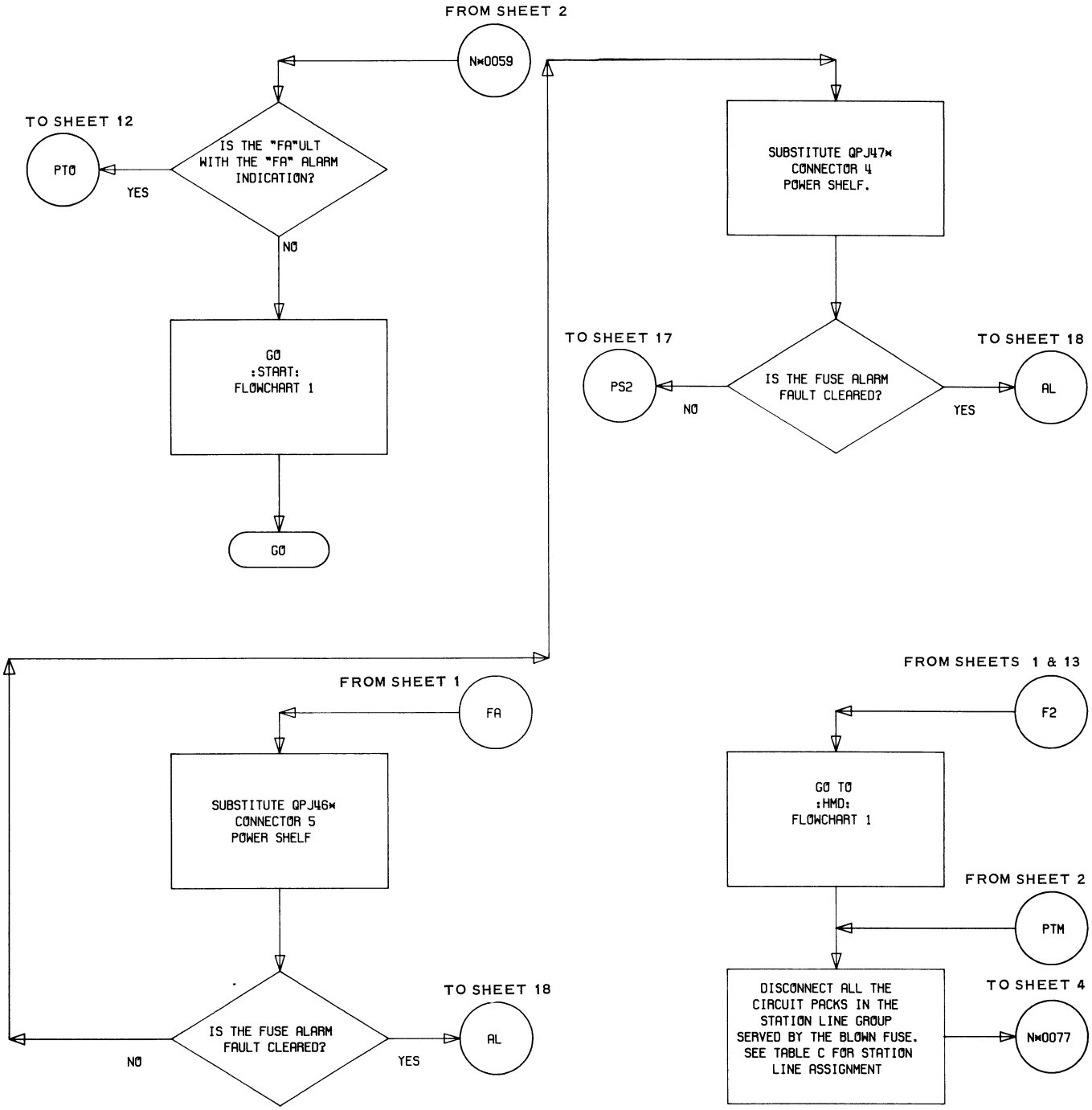
Flowchart 3 Continued — Missing Voltage Faults



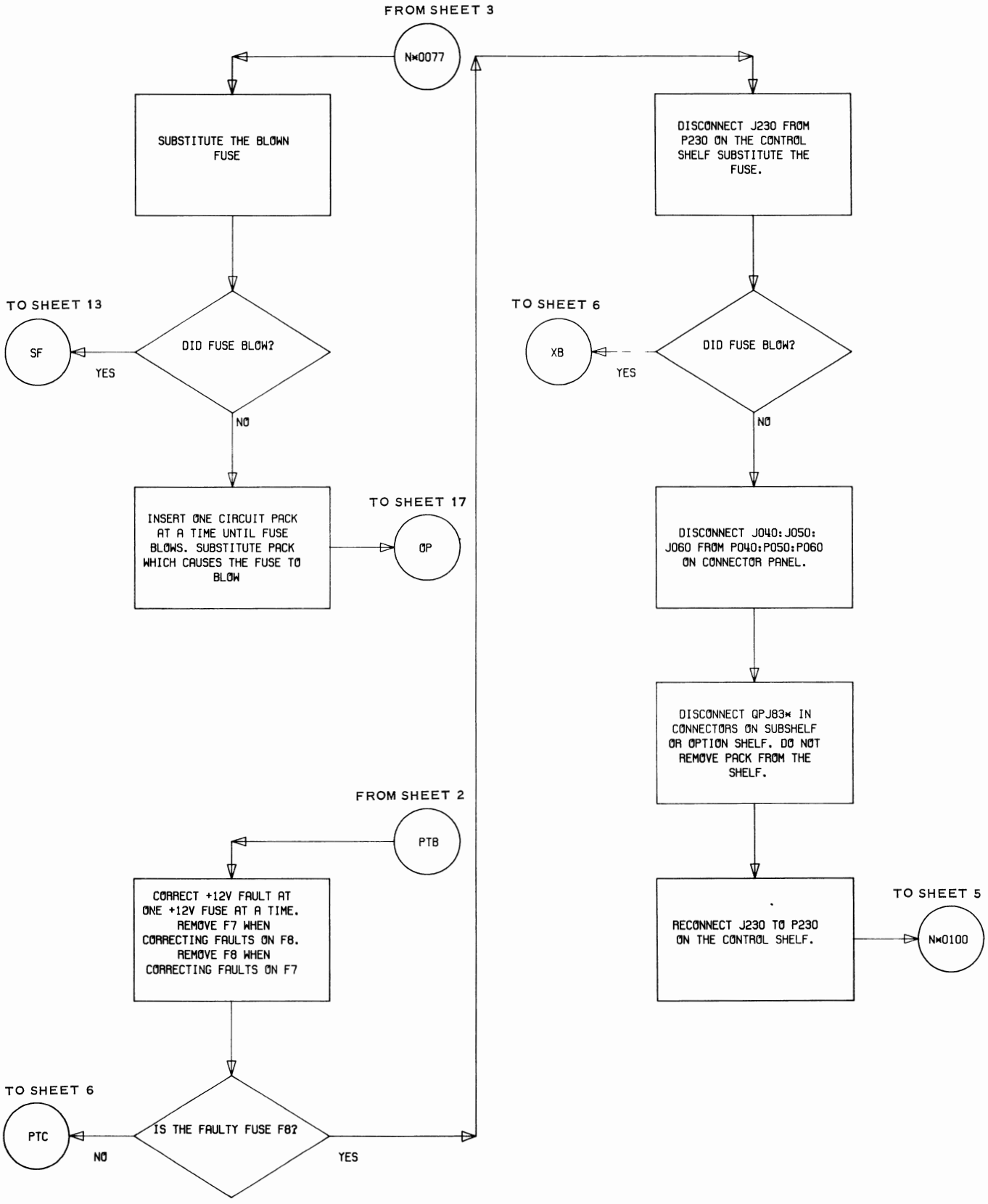
Flowchart 4 — Fuse Alarm Fault-Clearing Procedure



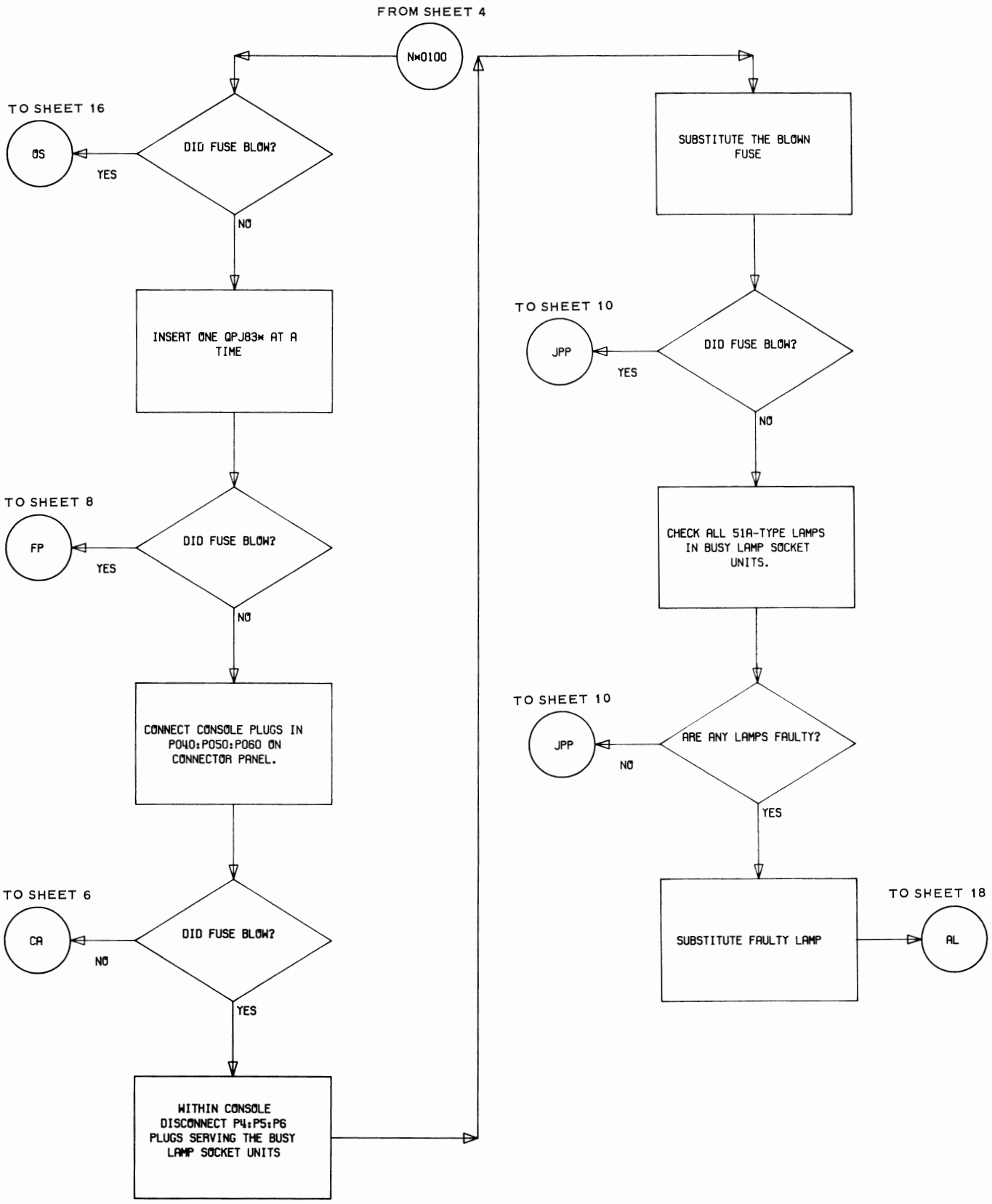
Flowchart 4 Continued — Fuse Alarm Fault-Clearing Procedure



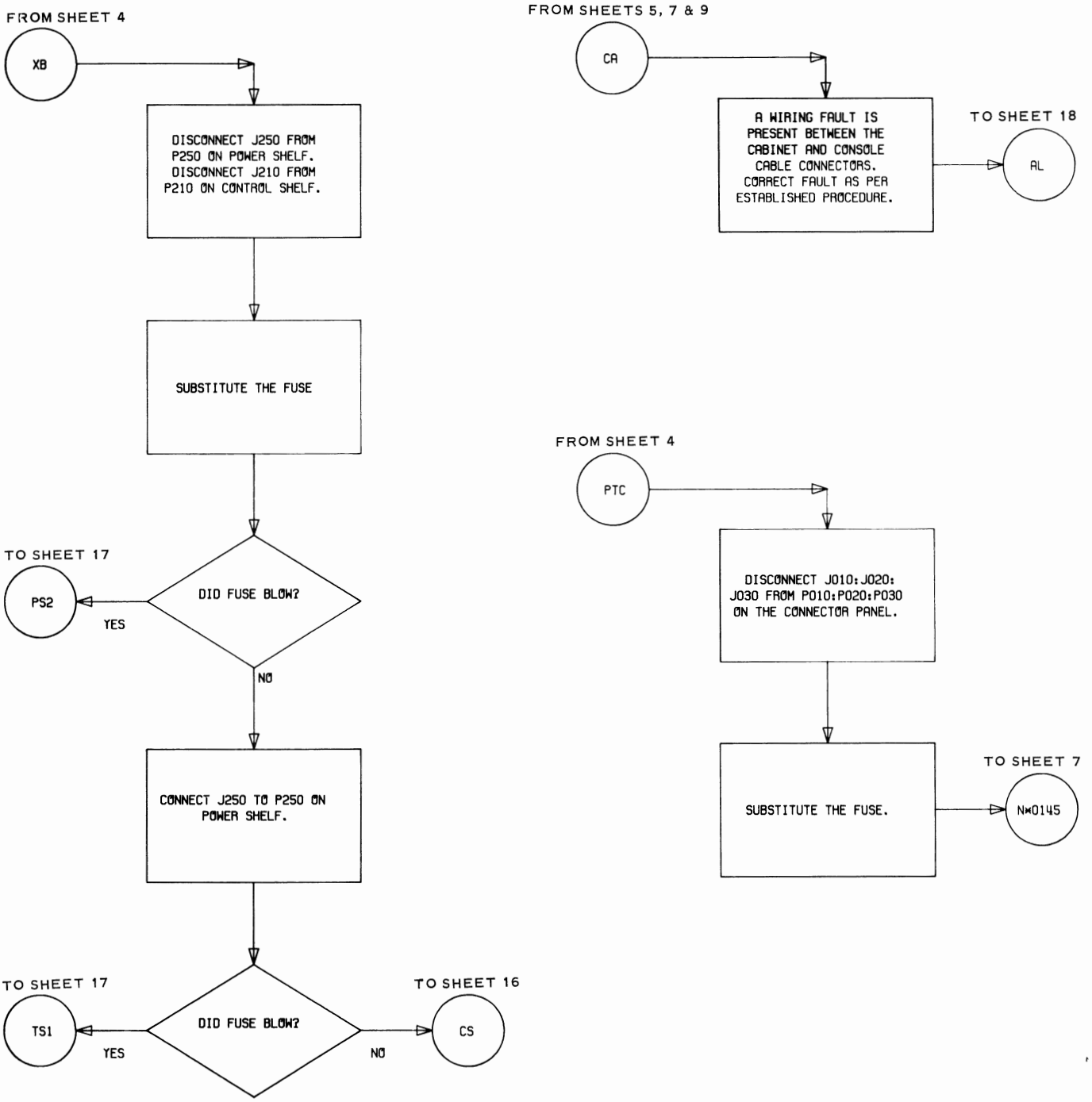
Flowchart 4 Continued — Fuse Alarm Fault-Clearing Procedure



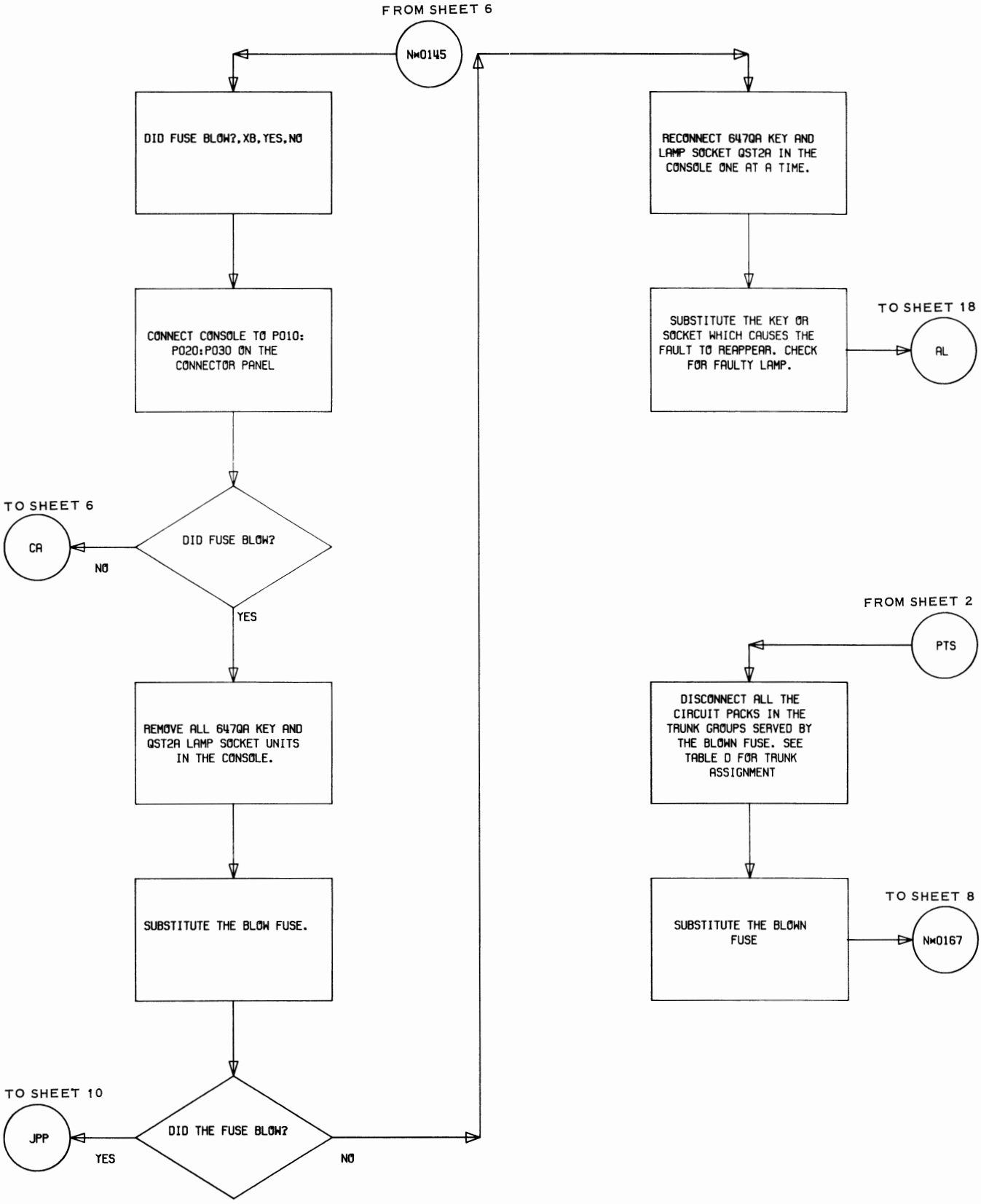
Flowchart 4 Continued — Fuse Alarm Fault-Clearing Procedure



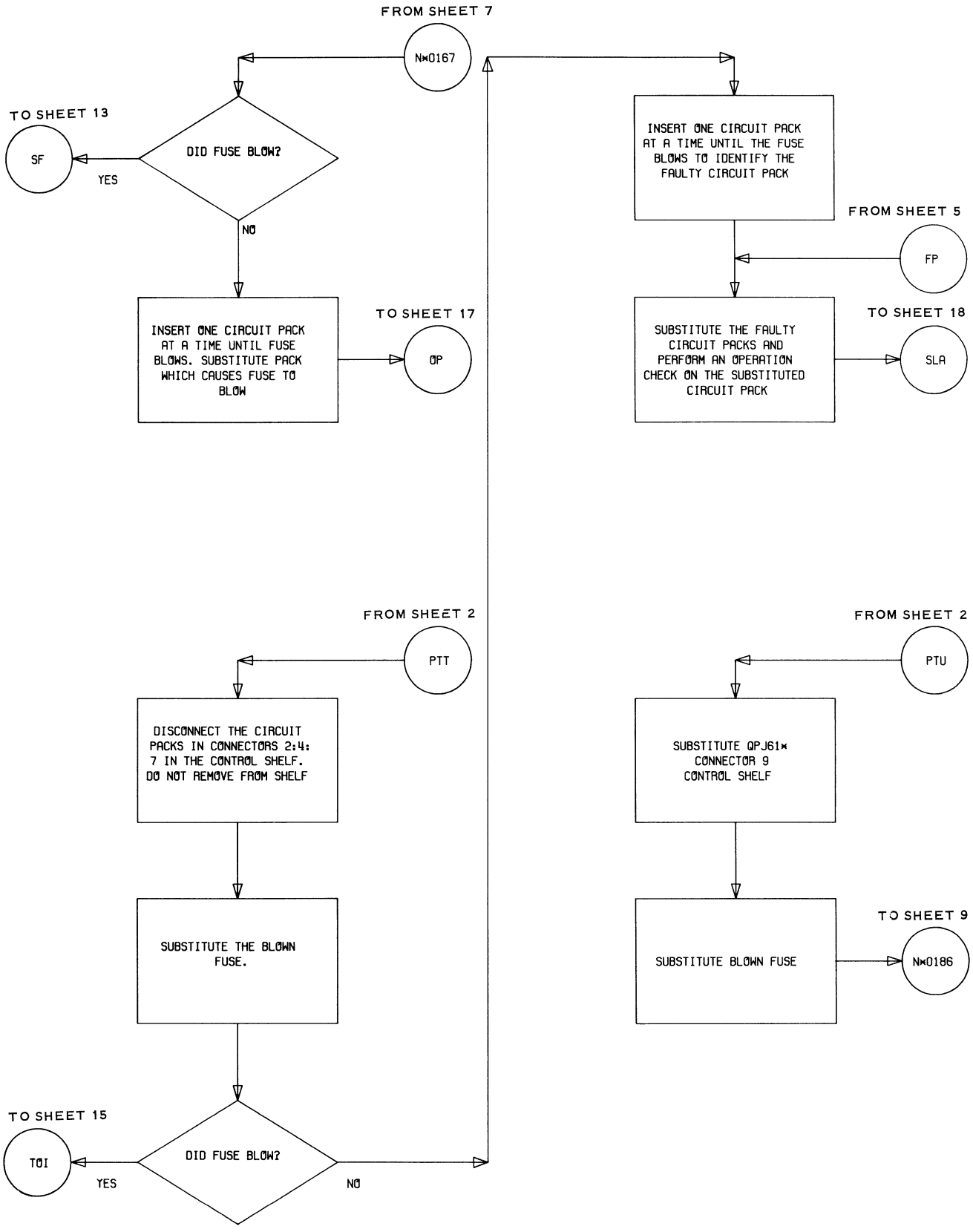
Flowchart 4 Continued — Fuse Alarm Fault-Clearing Procedure



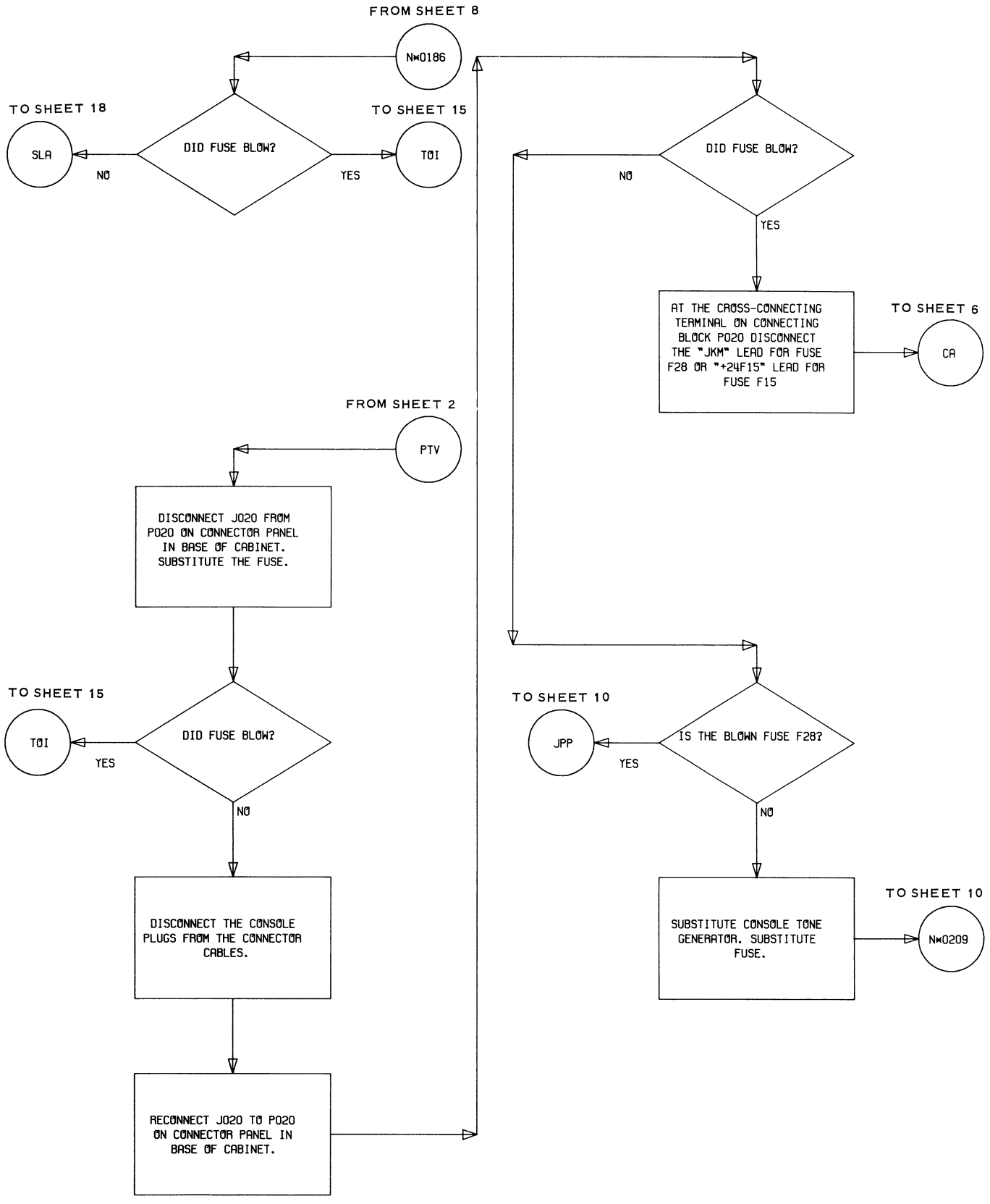
Flowchart 4 Continued — Fuse Alarm Fault-Clearing Procedure



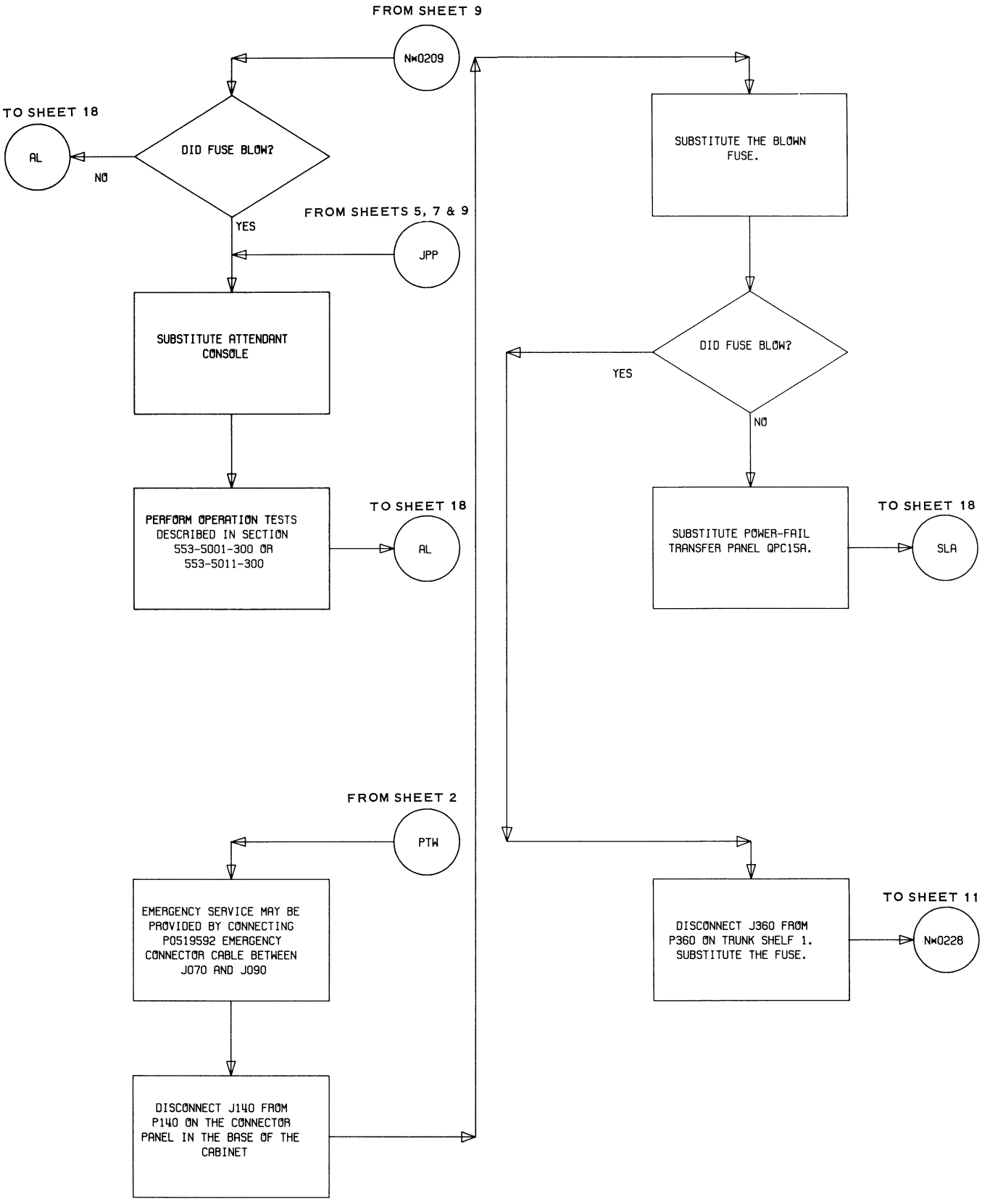
Flowchart 4 Continued — Fuse Alarm Fault-Clearing Procedure



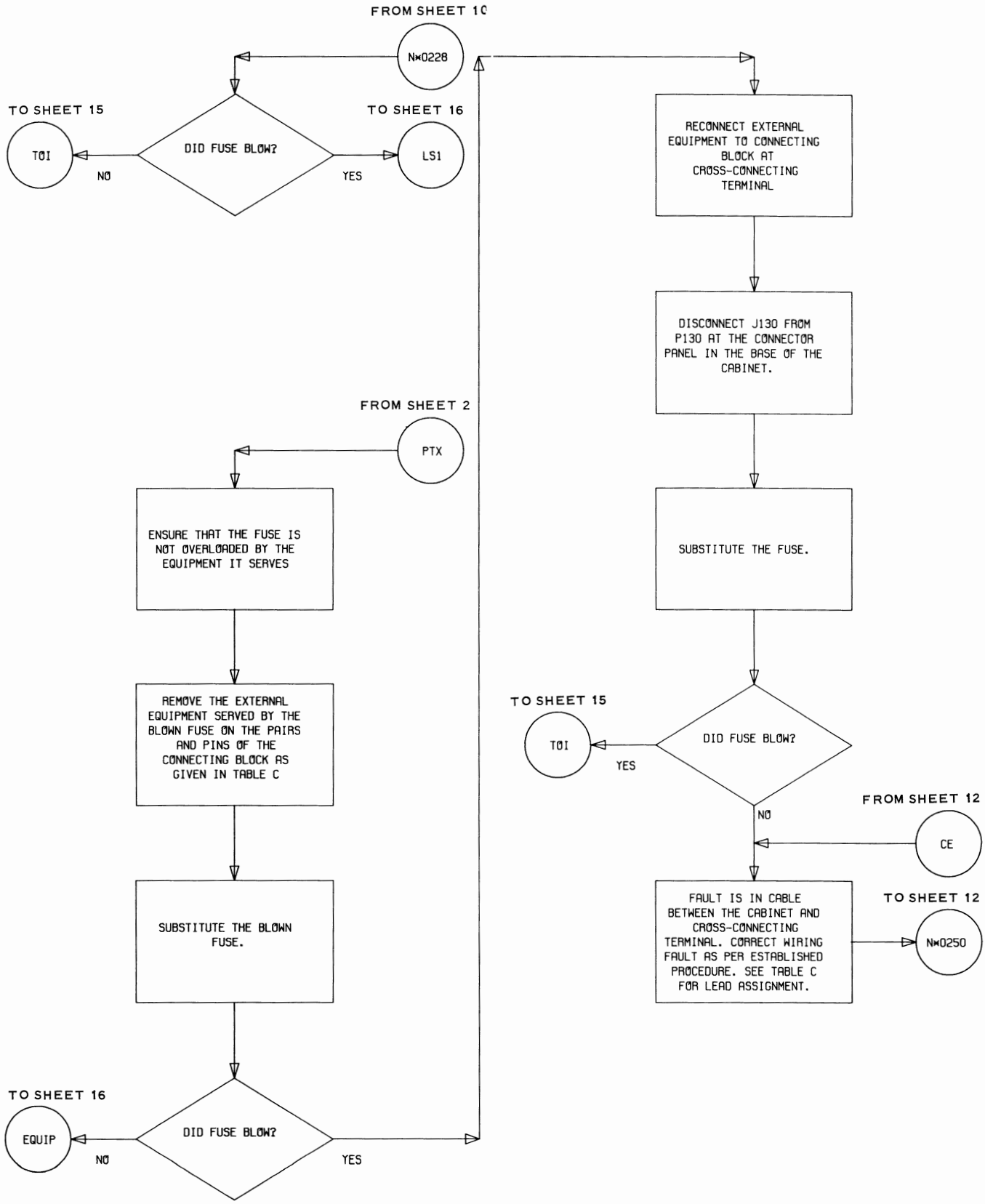
Flowchart 4 Continued — Fuse Alarm Fault-Clearing Procedure



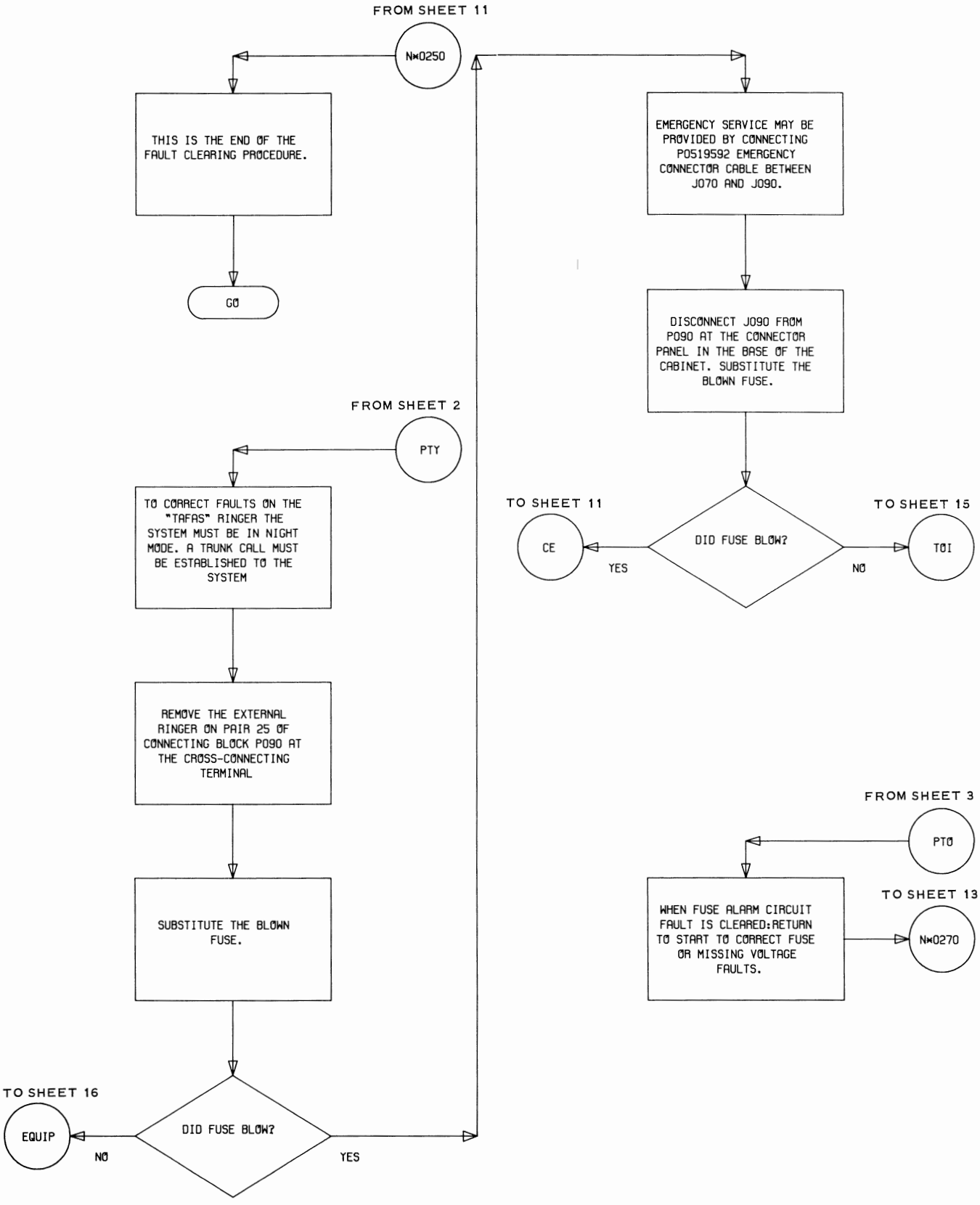
Flowchart 4 Continued — Fuse Alarm Fault-Clearing Procedure



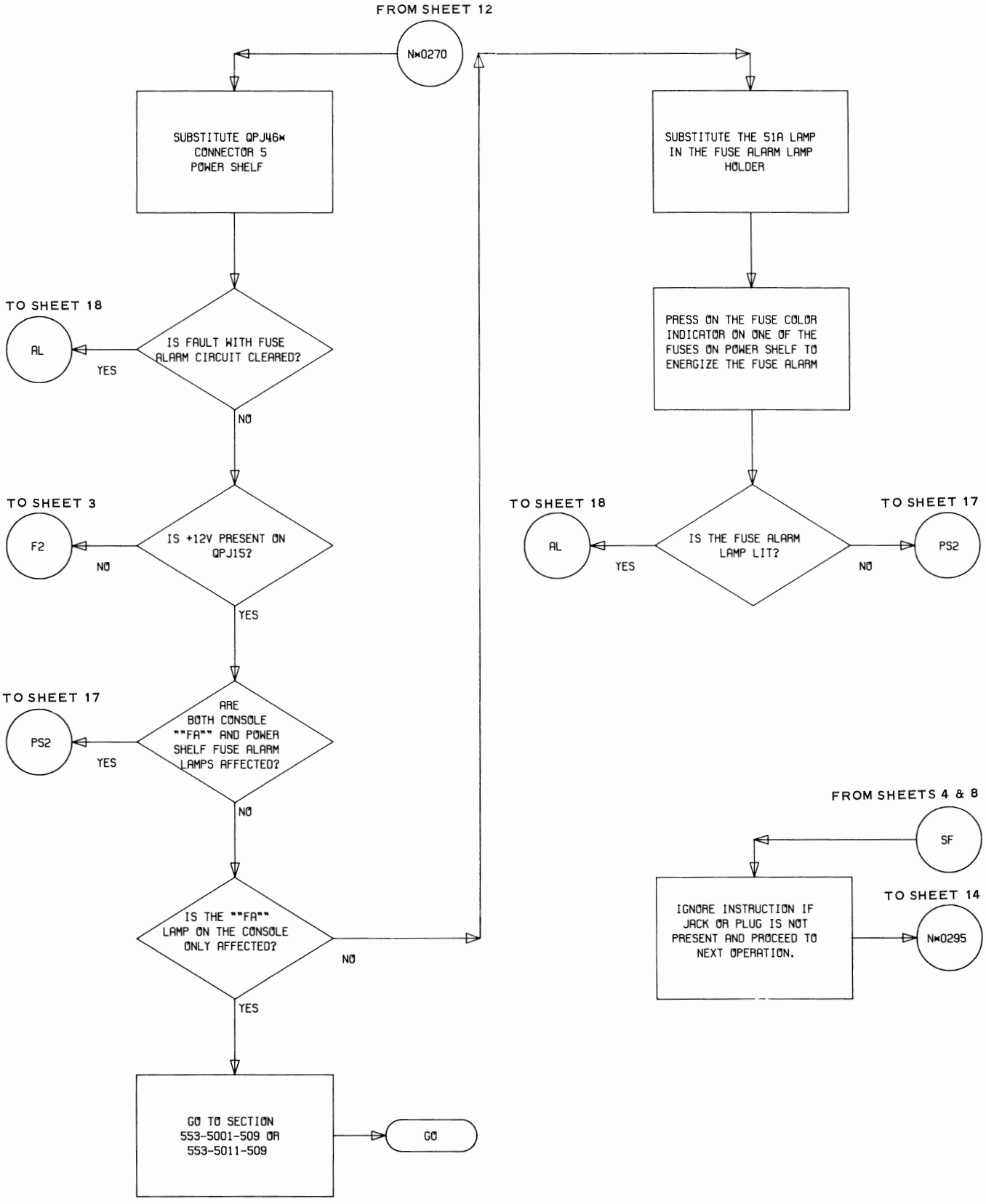
Flowchart 4 Continued — Fuse Alarm Fault-Clearing Procedure



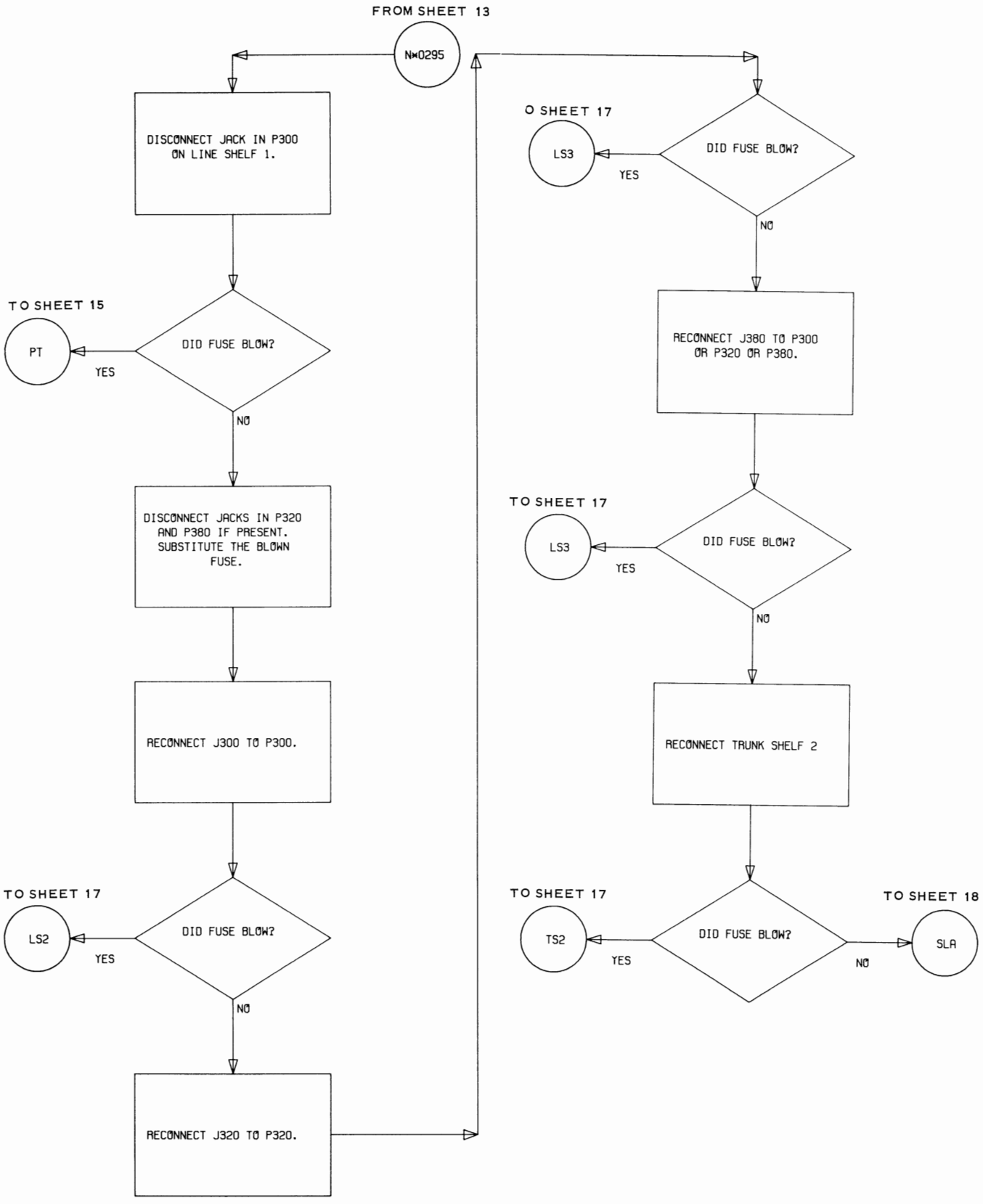
Flowchart 4 Continued — Fuse Alarm Fault-Clearing Procedure



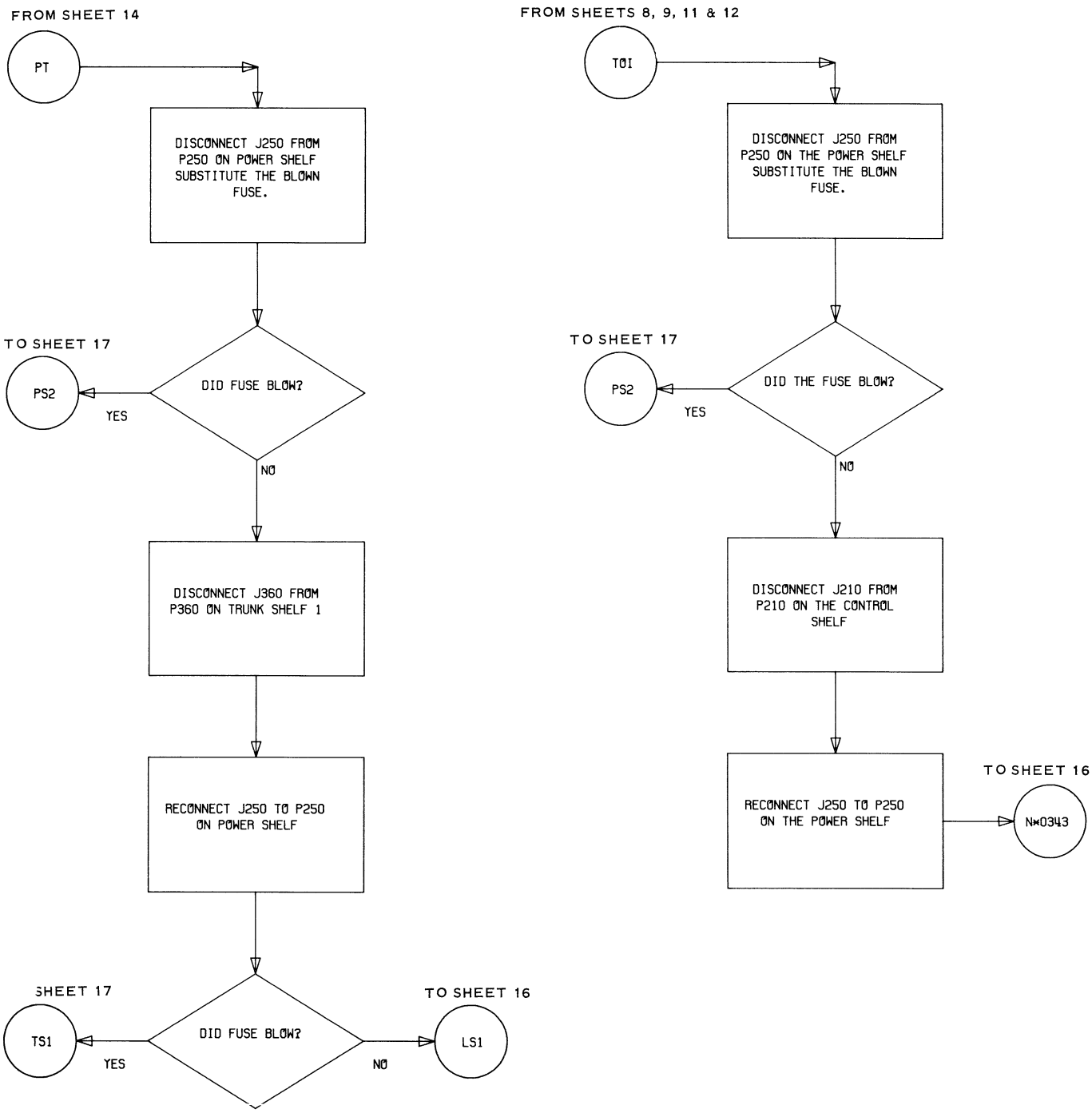
Flowchart 4 Continued — Fuse Alarm Fault- Clearing Procedure



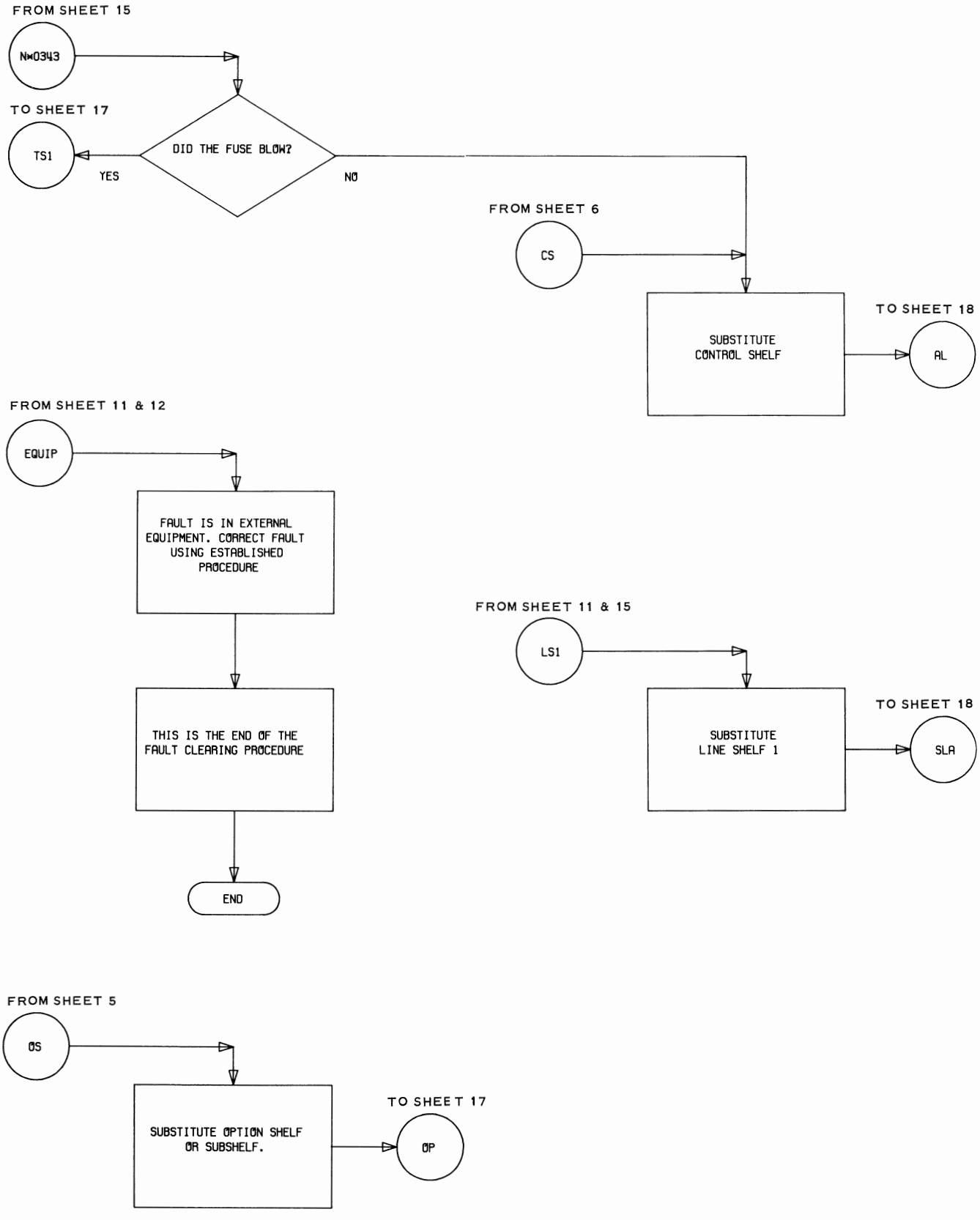
Flowchart 4 Continued — Fuse Alarm Fault- Clearing Procedure



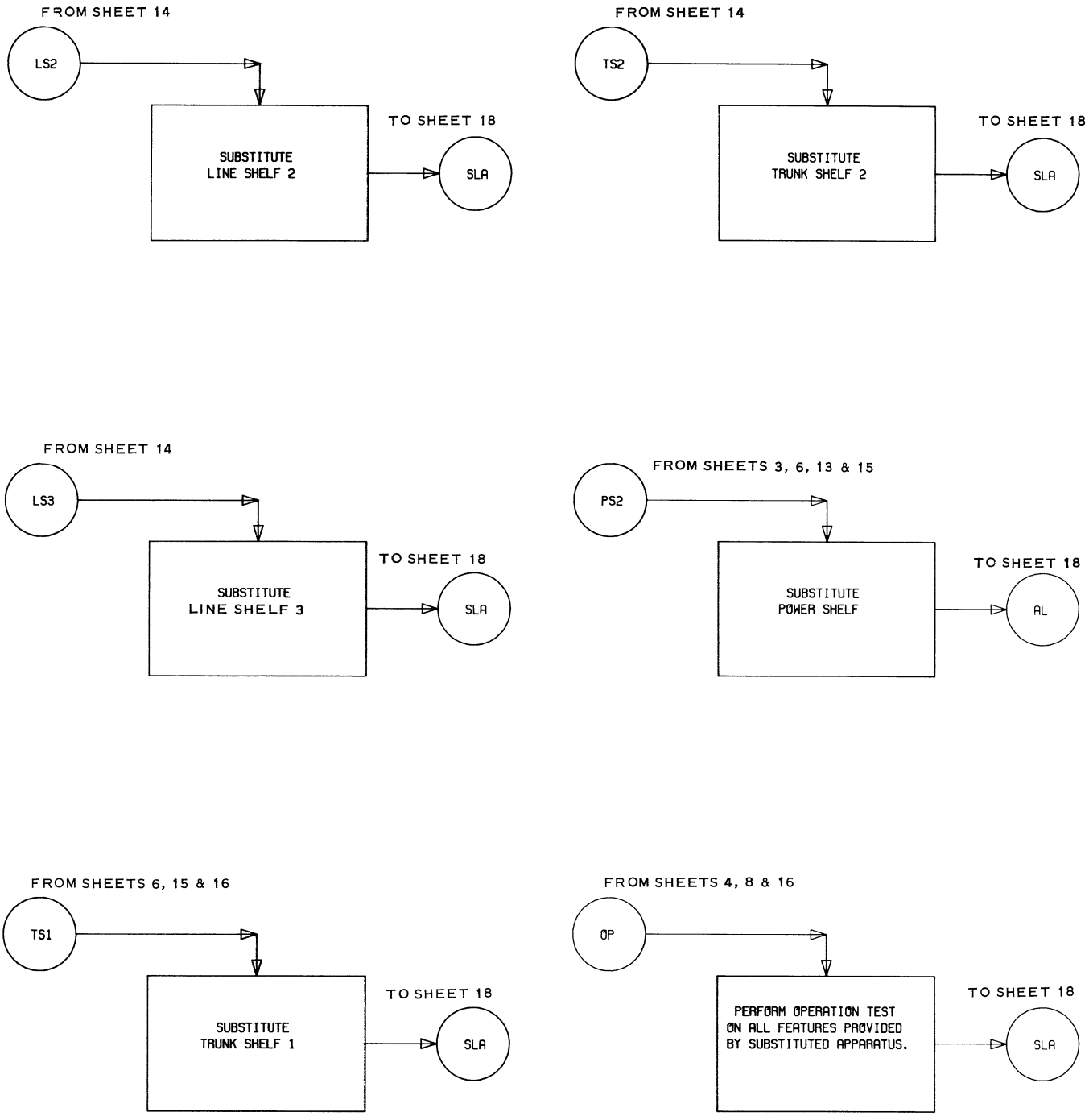
Flowchart 4 Continued — Fuse Alarm Fault-Clearing Procedure



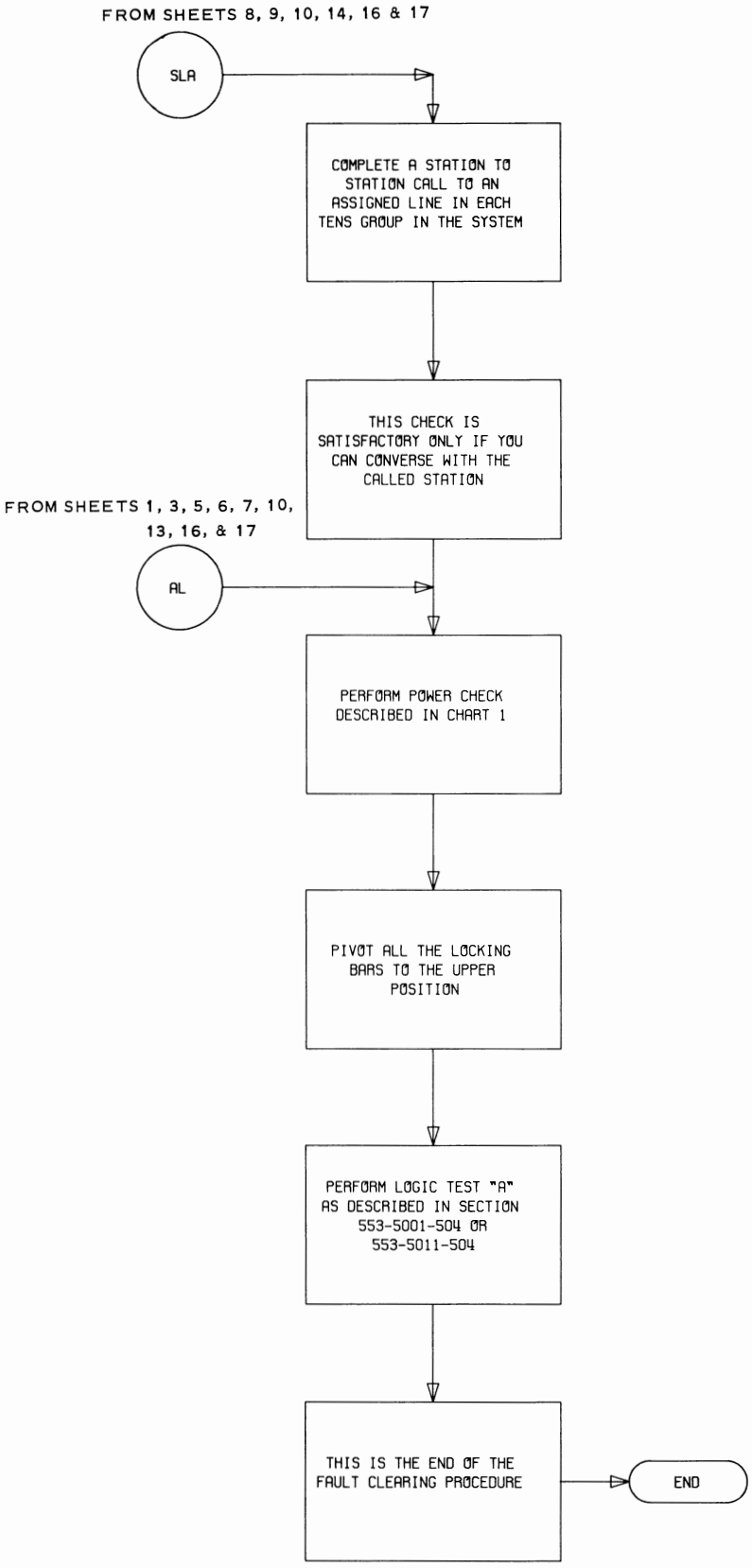
Flowchart 4 Continued — Fuse Alarm Fault-Clearing Procedure



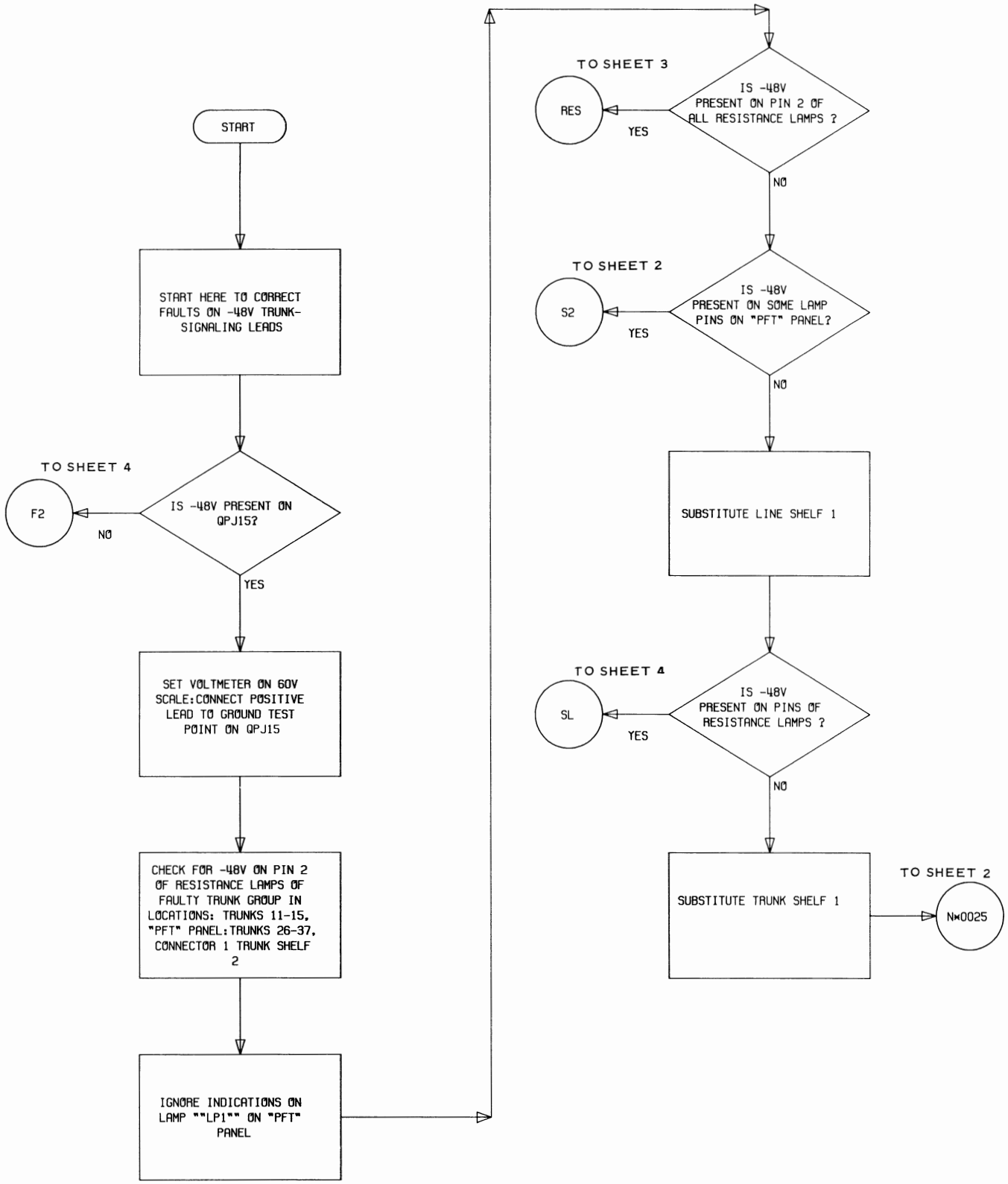
Flowchart 4 Continued — Fuse Alarm Fault-Clearing Procedure



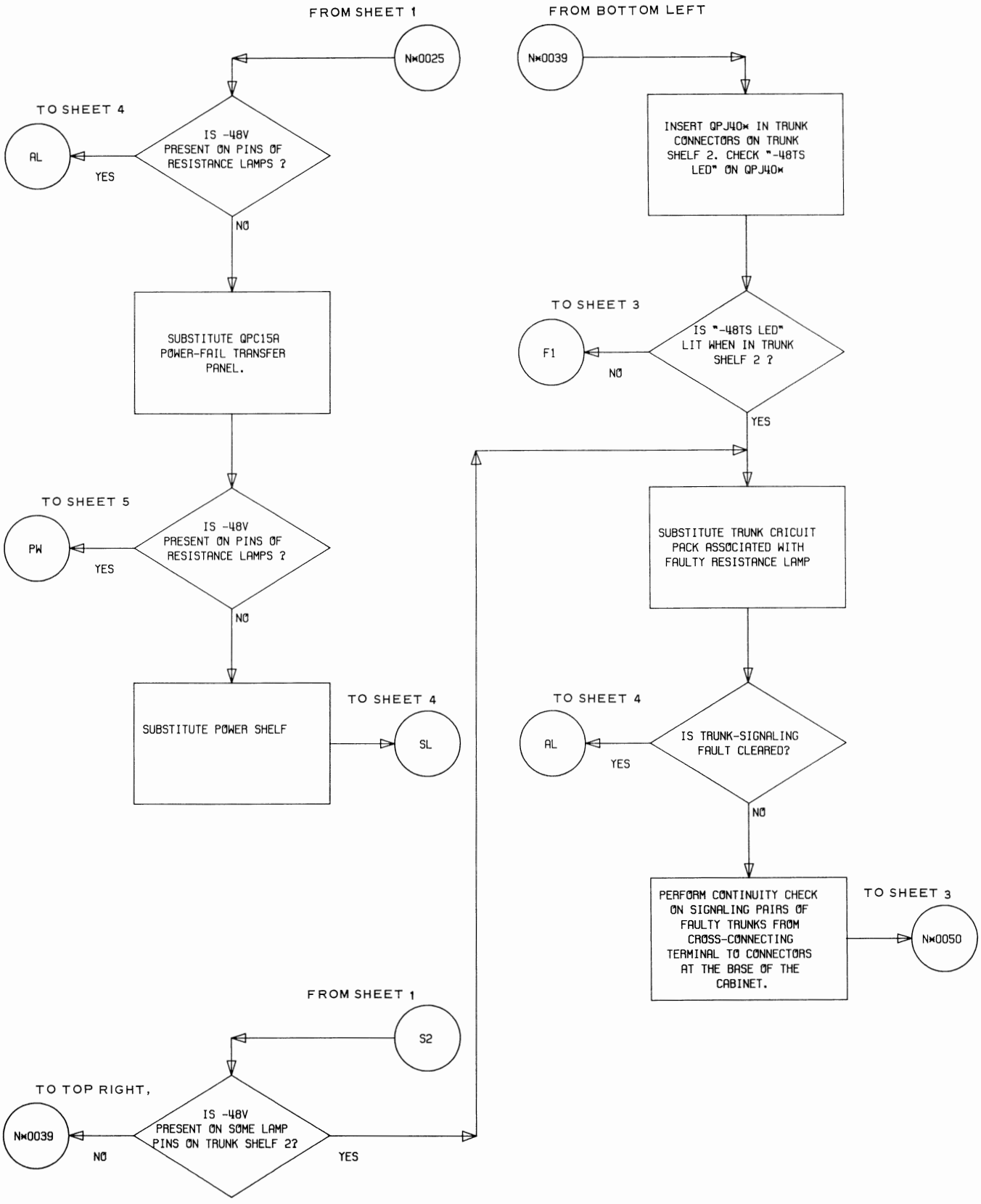
Flowchart 4 Continued — Fuse Alarm Fault-Clearing Procedure



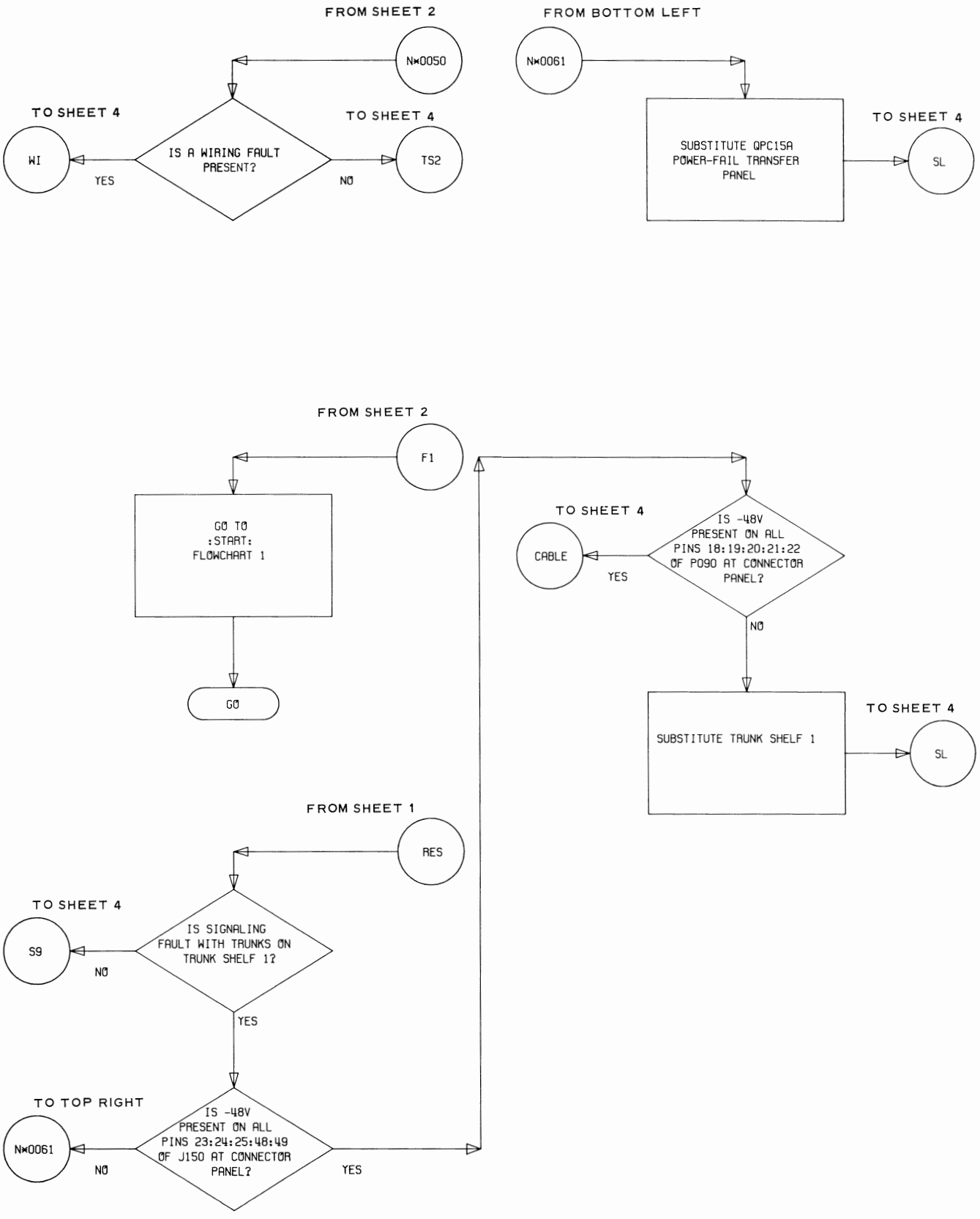
Flowchart 4 Continued — Fuse Alarm Fault-Clearing Procedure



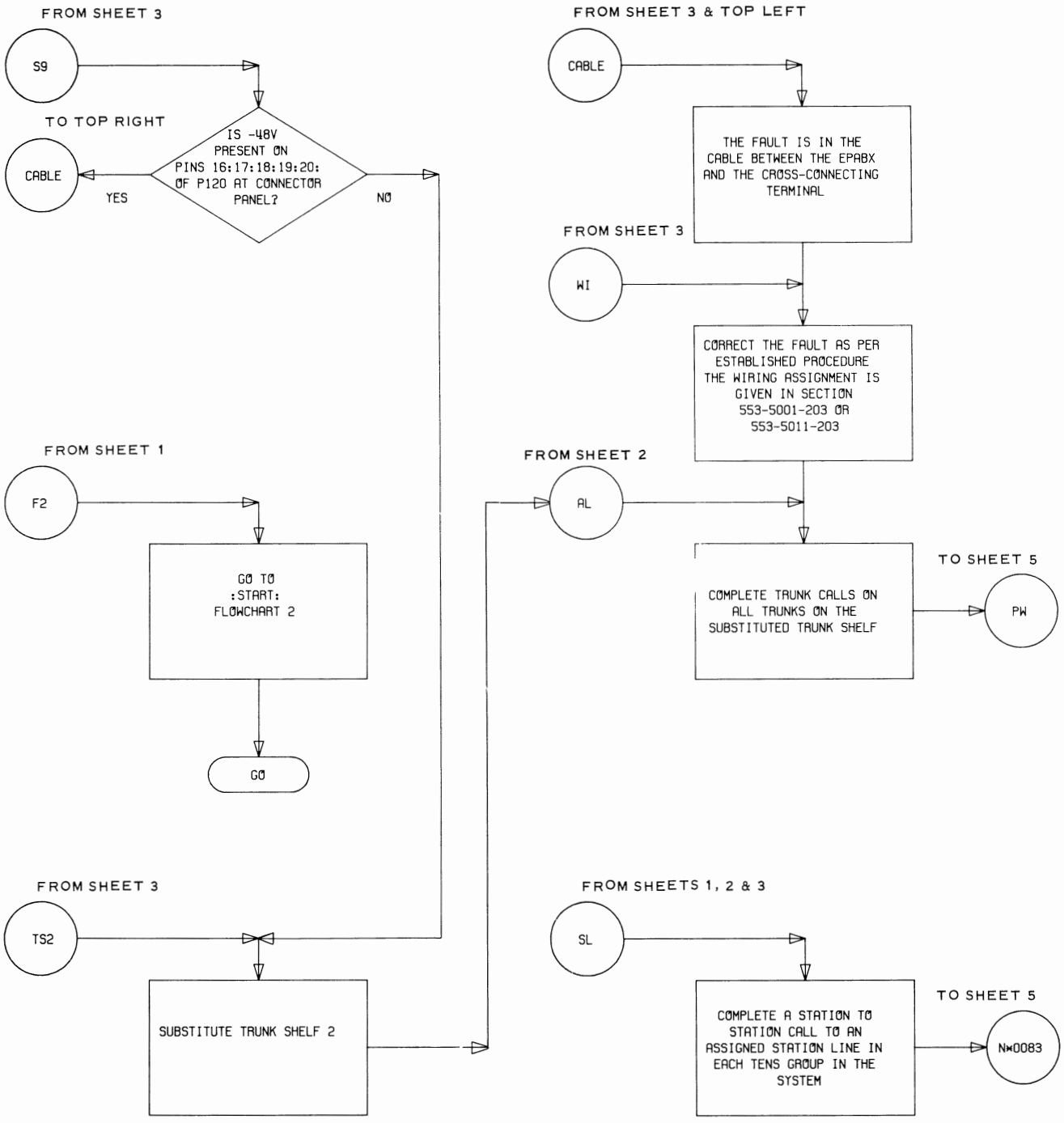
Flowchart 5 — —48 V Trunk-Signaling Lead Fault-Clearing Procedure



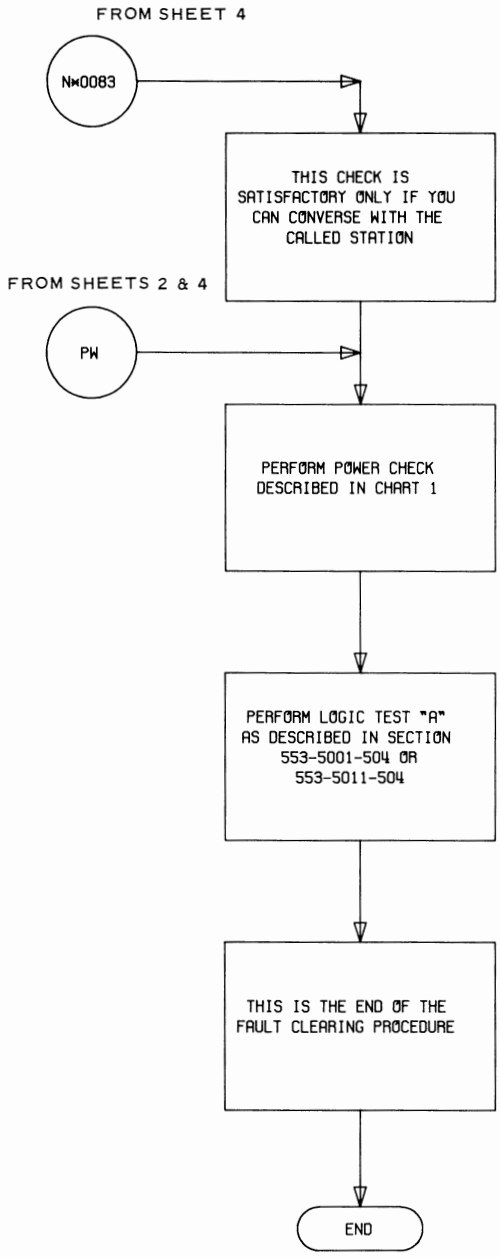
Flowchart 5 Continued — —48 V Trunk-Signaling Lead Fault-Clearing Procedure



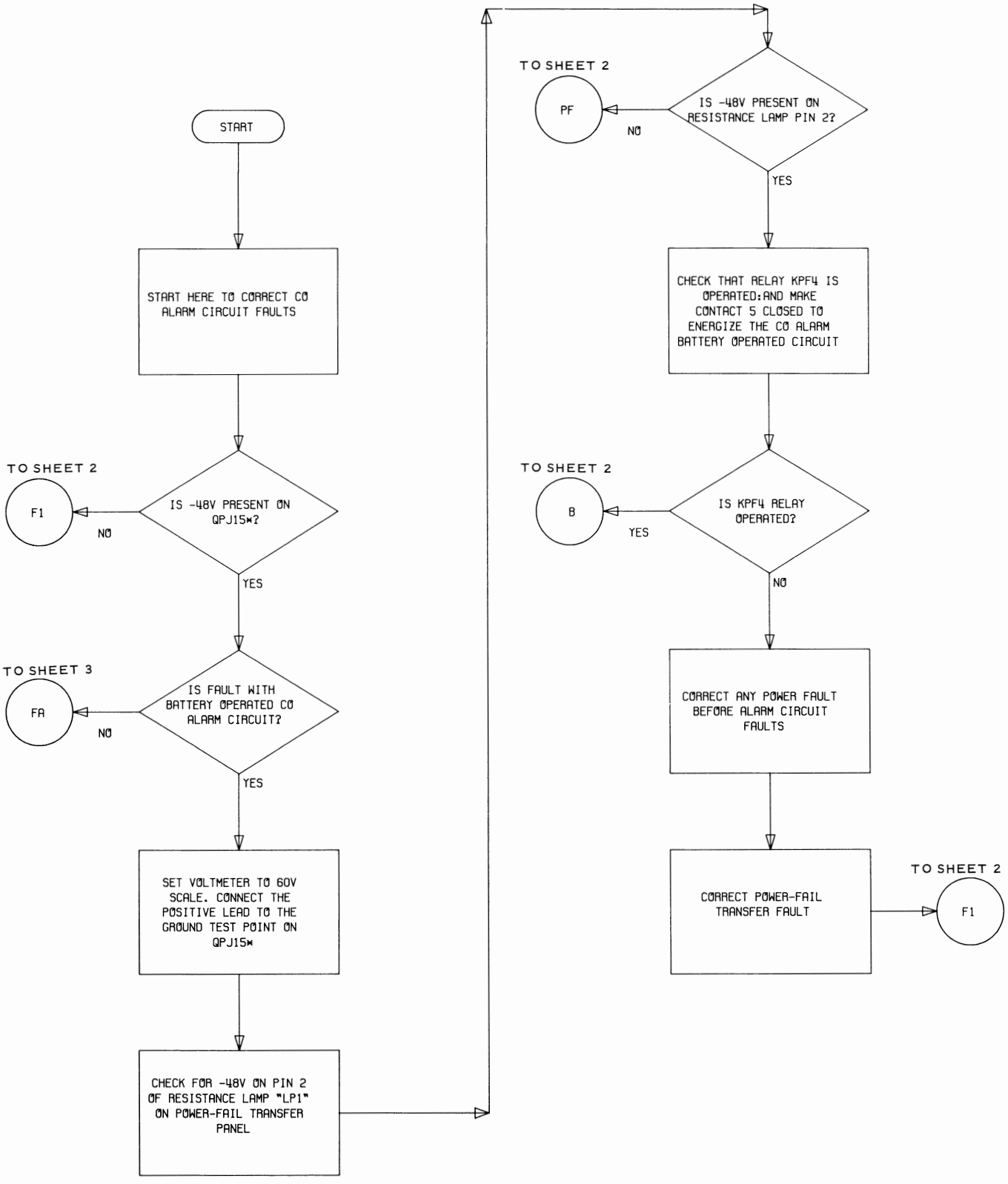
Flowchart 5 Continued — —48 V Trunk-Signaling Lead Fault-Clearing Procedure



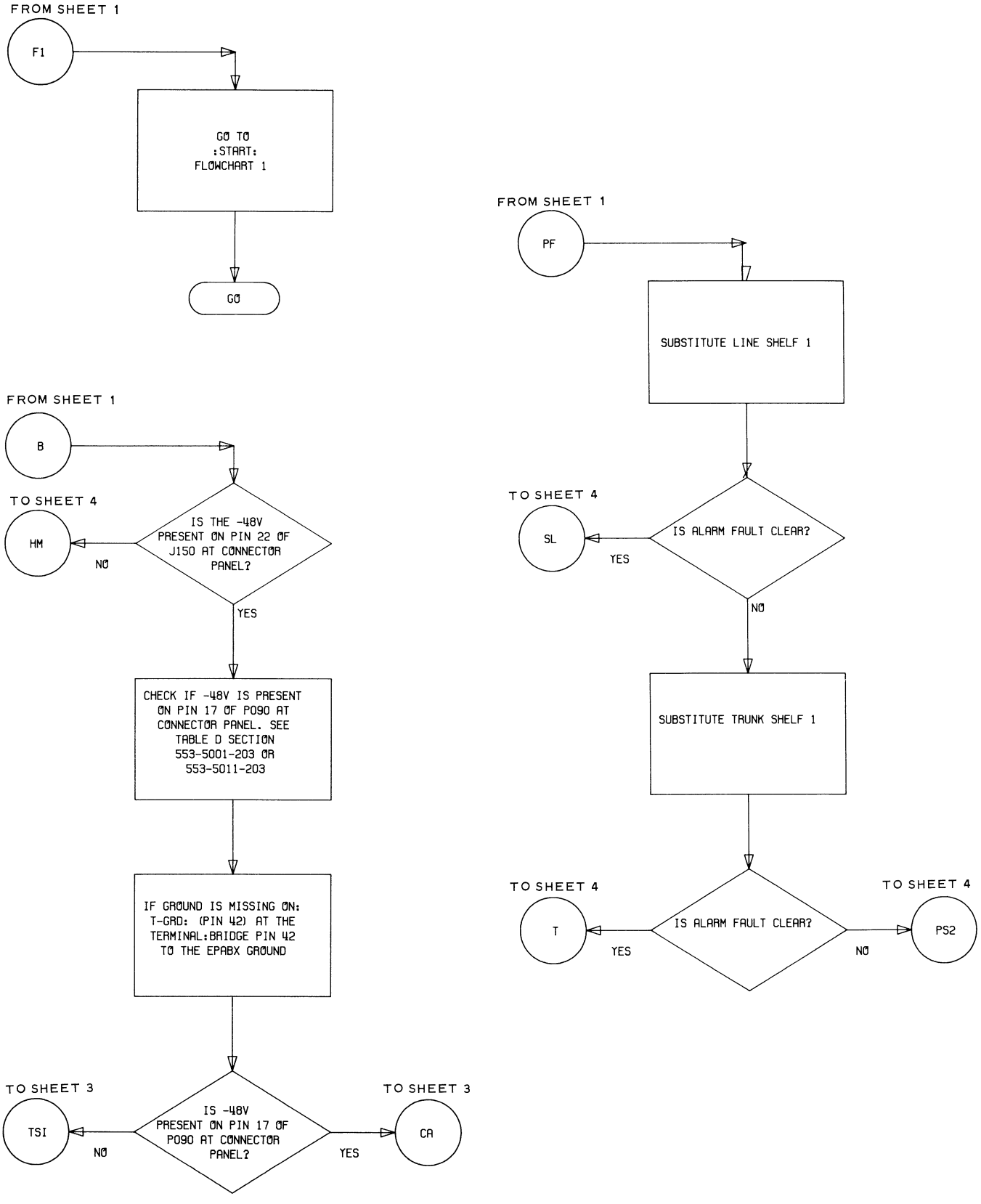
Flowchart 5 Continued — –48 V Trunk-Signaling Lead Fault-Clearing Procedure



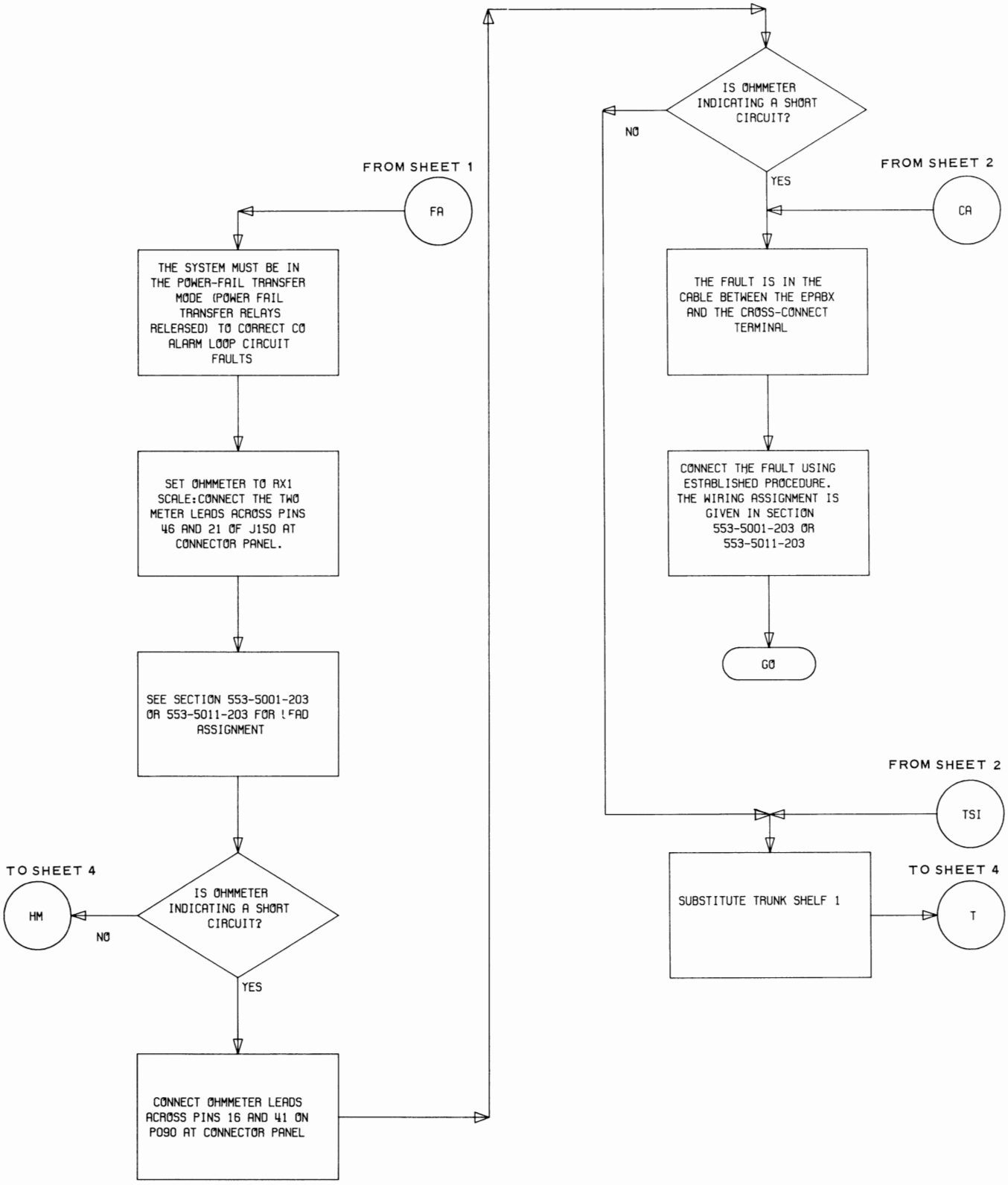
Flowchart 5 Continued — –48 V Trunk-Signaling Lead Fault-Clearing Procedure



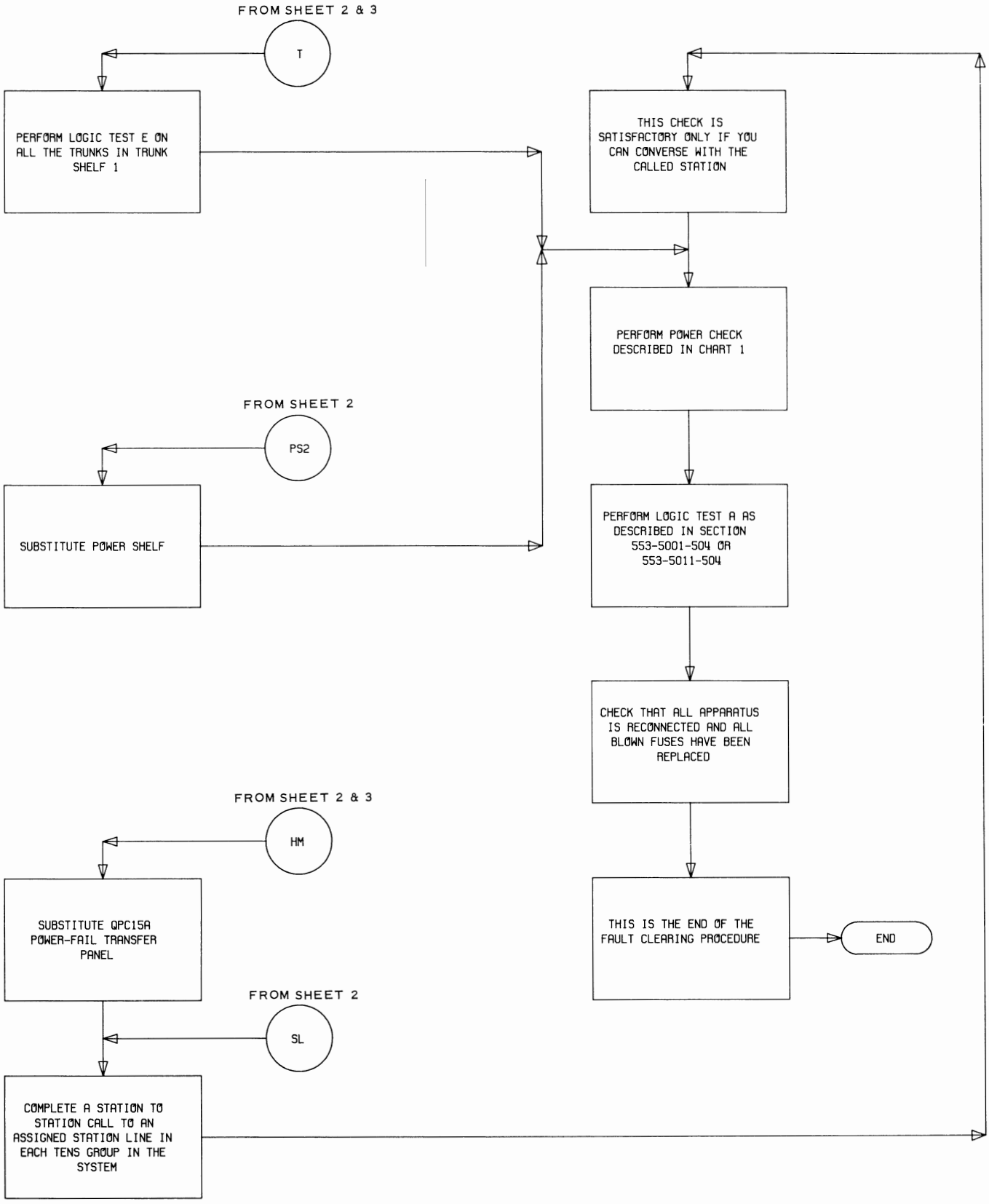
Flowchart 6 — CO Alarm Circuit Fault-Clearing Procedure



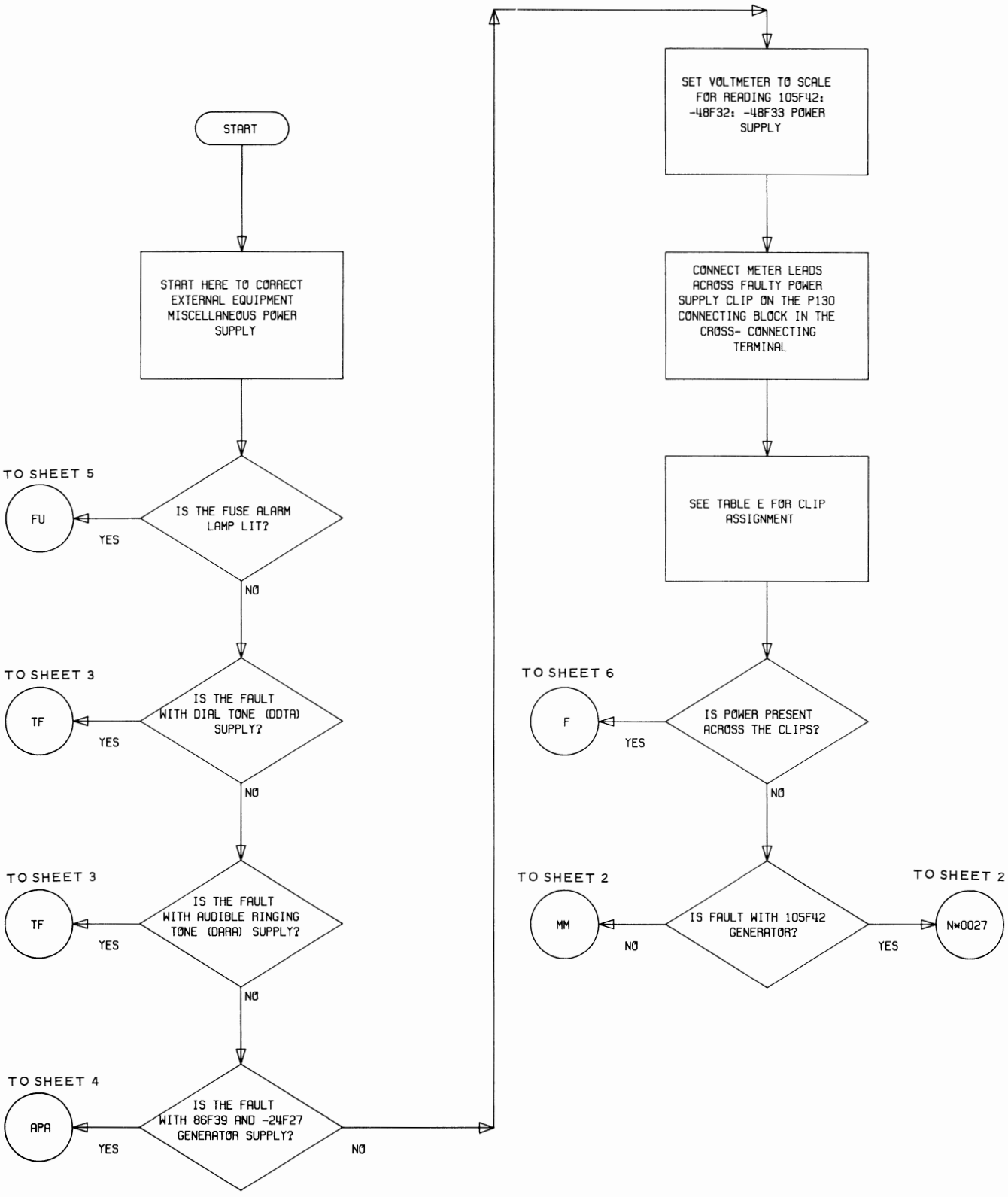
Flowchart 6 Continued — CO Alarm Circuit Fault-Clearing Procedure



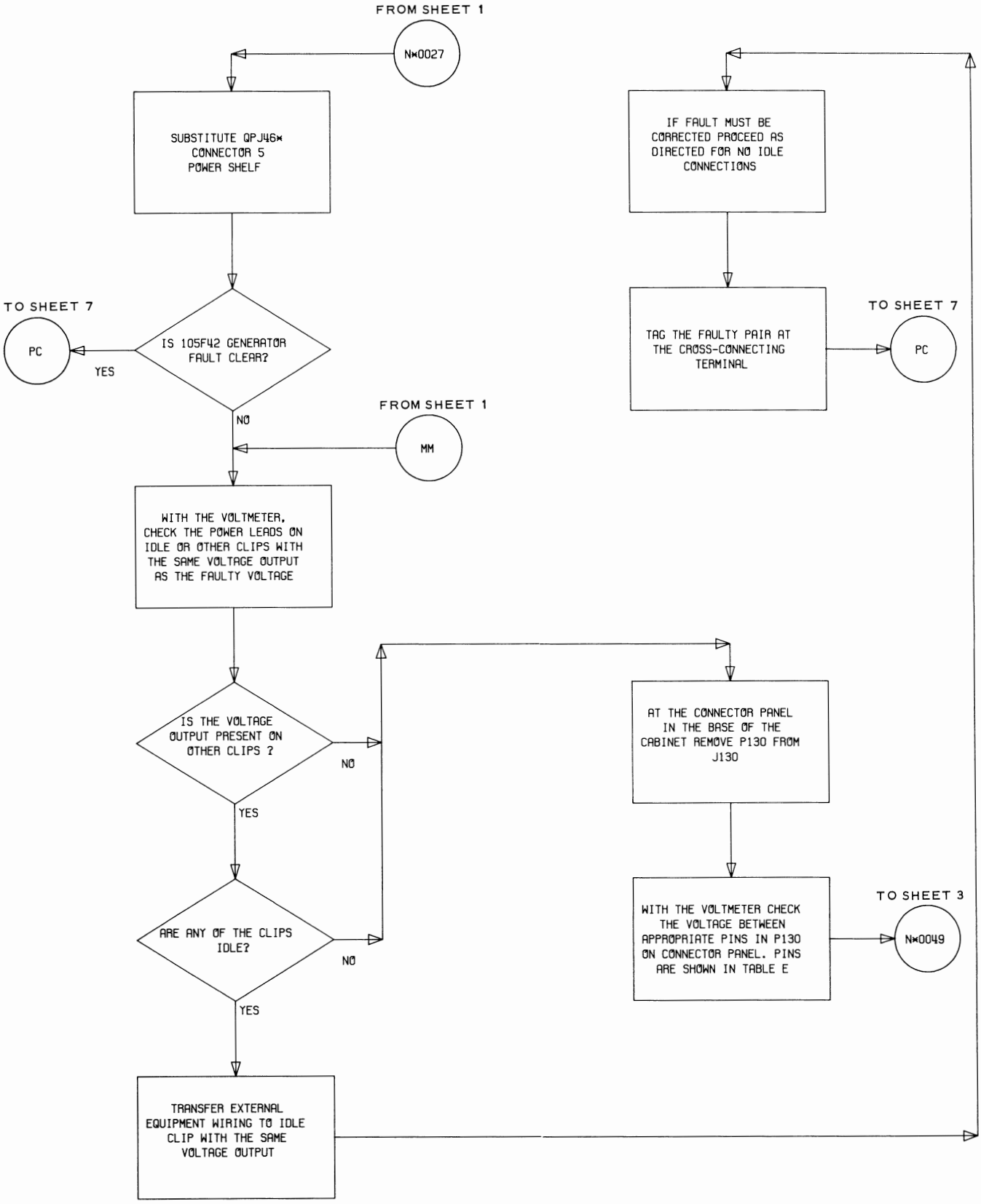
Flowchart 6 Continued — CO Alarm Circuit Fault-Clearing Procedure



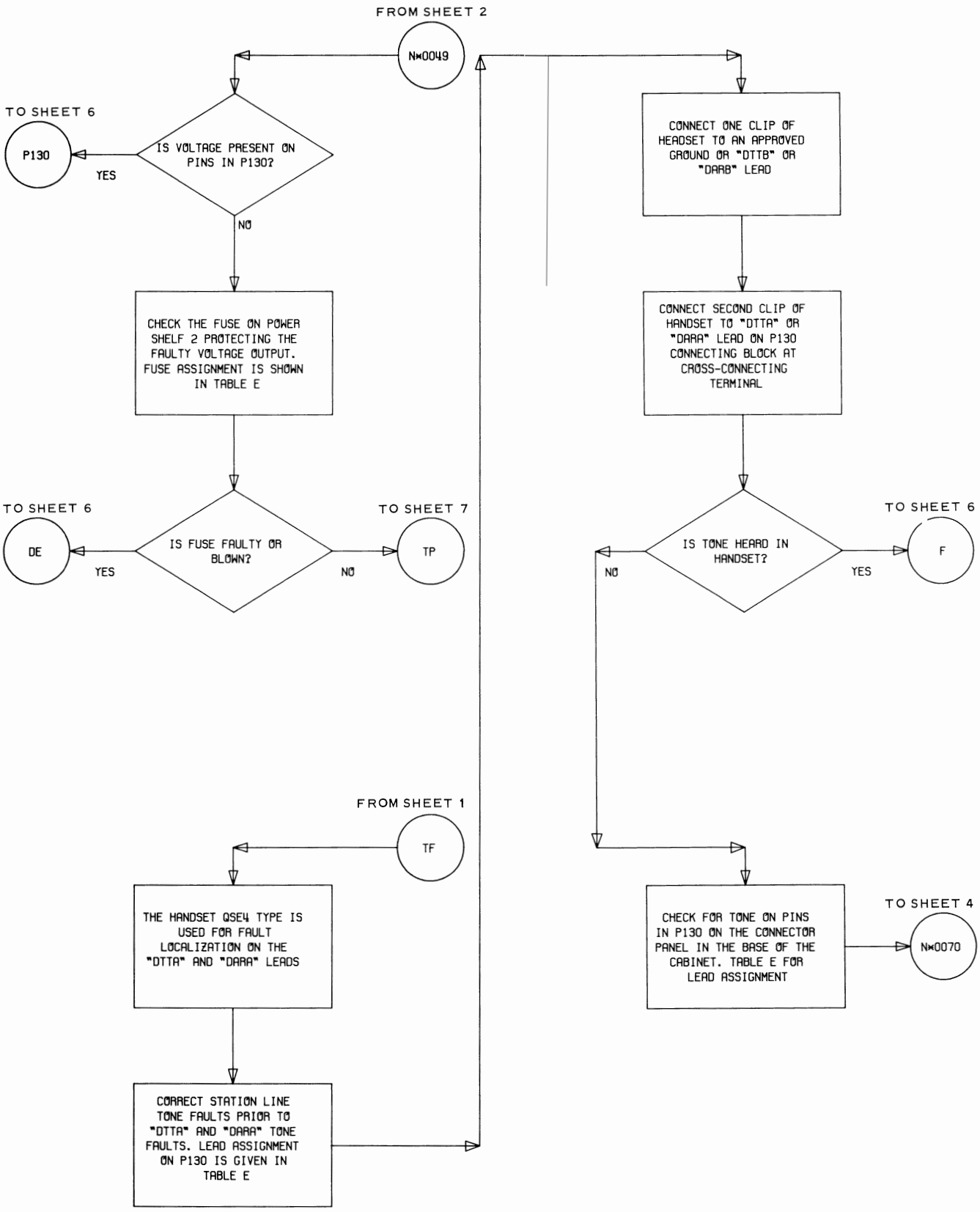
Flowchart 6 Continued — CO Alarm Circuit Fault-Clearing Procedure



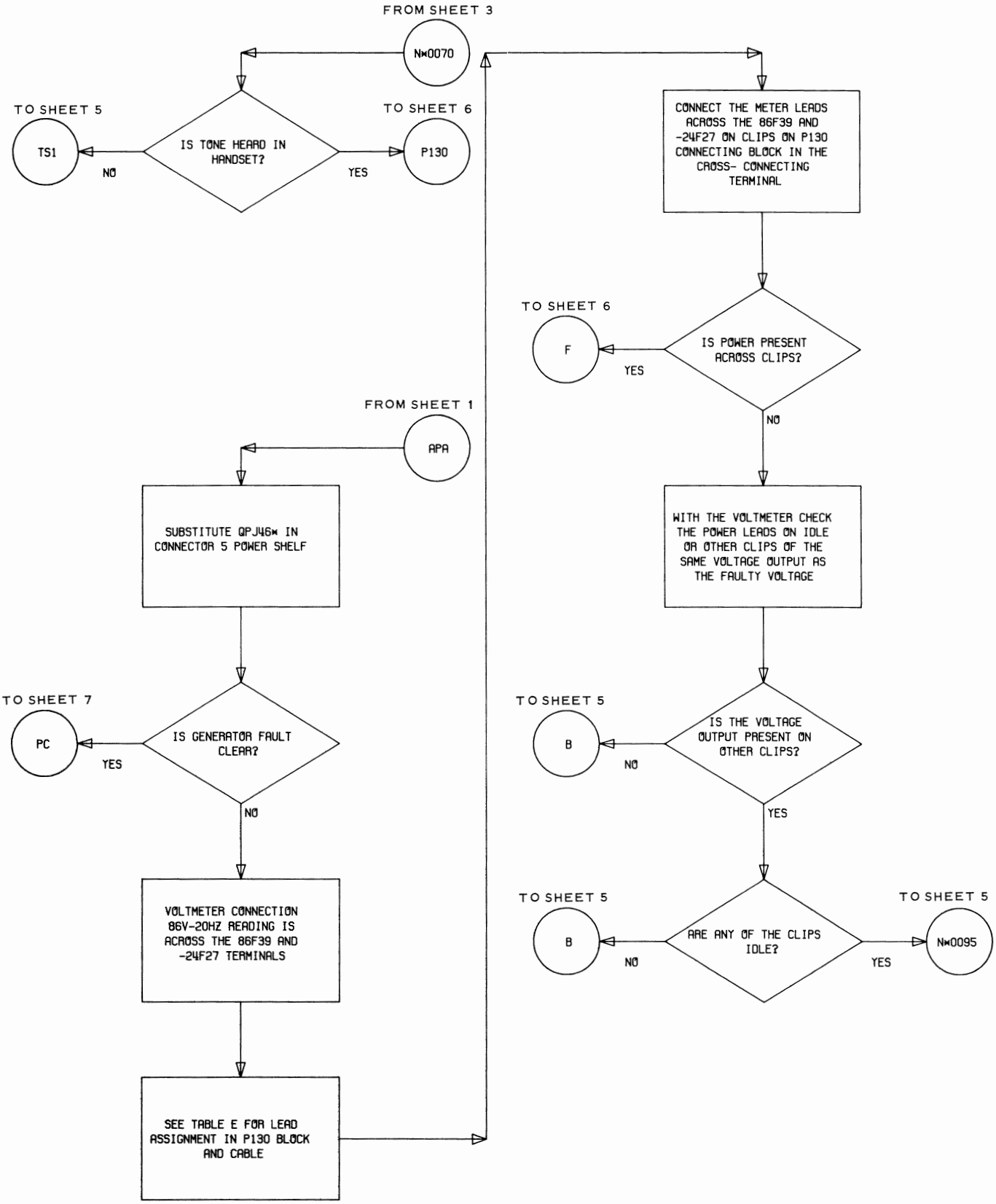
Flowchart 7 — External Equipment and Miscellaneous Power Supply Fault-Clearing Procedure



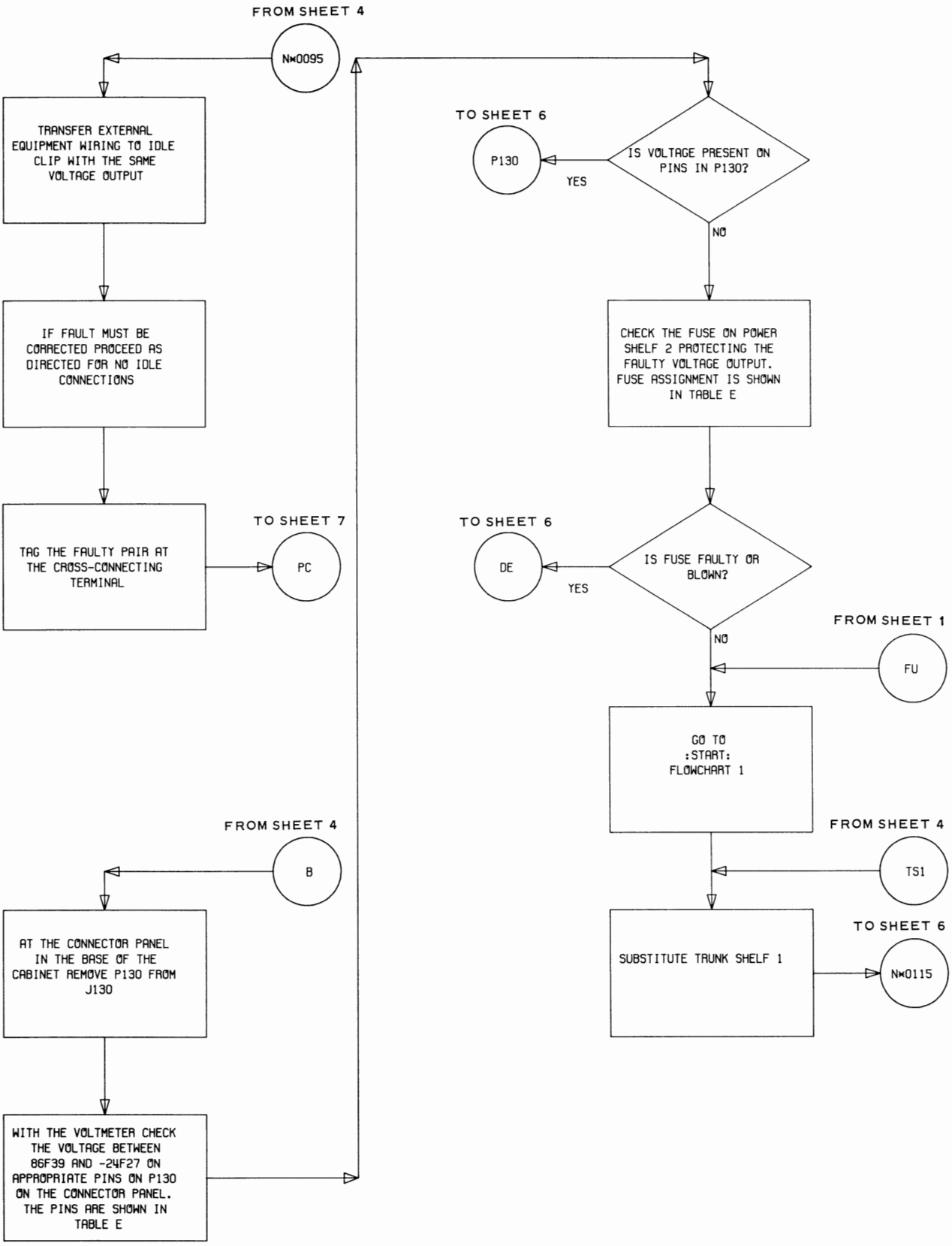
Flowchart 7 Continued — External Equipment and Miscellaneous Power Supply Fault-Clearing Procedure



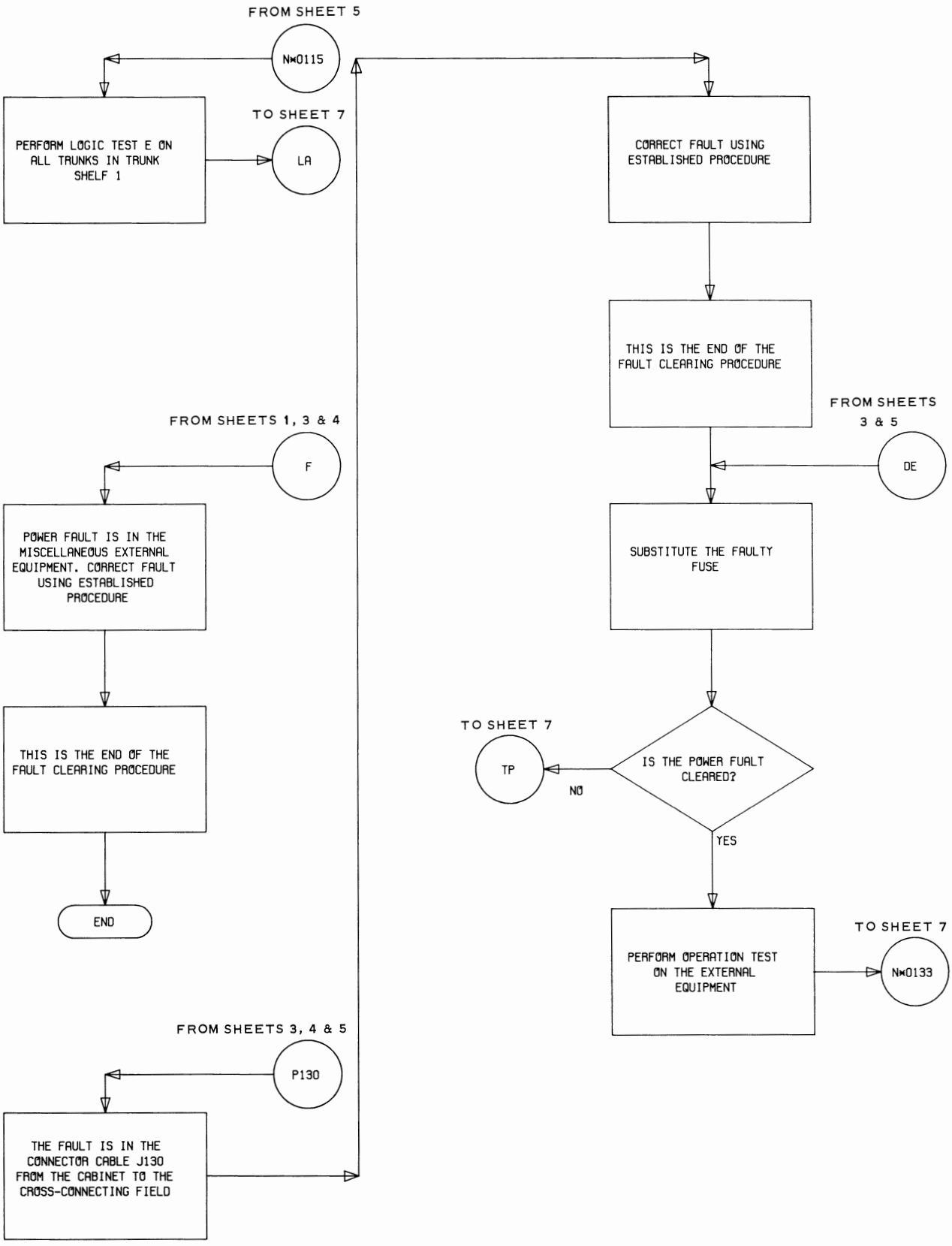
Flowchart 7 Continued — External Equipment and Miscellaneous Power Supply Fault-Clearing Procedure



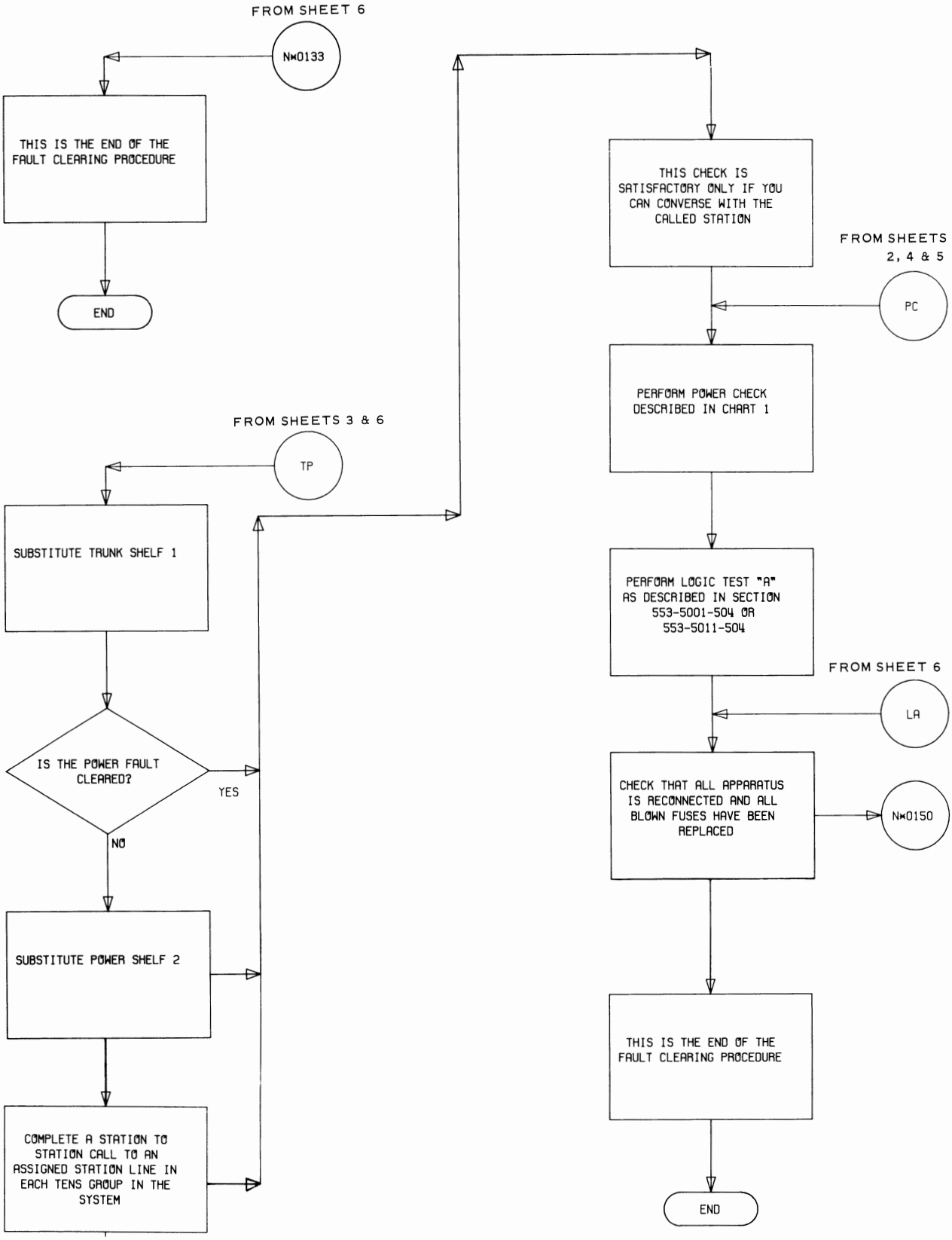
Flowchart 7 Continued — External Equipment and Miscellaneous Power Supply Fault-Clearing Procedure



Flowchart 7 Continued — External Equipment and Miscellaneous Power Supply Fault-Clearing Procedure



Flowchart 7 Continued — External Equipment and Miscellaneous Power Supply Fault-Clearing Procedure



Flowchart 7 Continued — External Equipment and Miscellaneous Power Supply Fault-Clearing Procedure