

J86742A
AUTOMATIC CONTROLLER
AUTOMATIC PARALLELING AND LOAD MANAGEMENT
FOR RESERVE ENGINE-ALTERNATOR PLANTS
INSPECTION, OPERATION, AND ROUTINE TESTS

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1. GENERAL

1.01 The J86742A controller (Fig. 1) is designed for automatic control, automatic paralleling, and load management of multi-engine ac reserve energy systems up to 4500kw capacity, and will accommodate engine alternators equipped with load sharing or droop hydraulic governors.

1.02 This section is reissued to incorporate the latest development information. Since changes are extensive, change arrows will not be used. This reissue does not affect the Equipment Test List (ETL).

1.03 The J86742A controller is a single door, dual access cabinet, 7 feet high, 2 feet deep, and 30 inches wide, with floor mounting facilities provided. Cable access is via a 12-inch square removable plate located at the top of the cabinet.

Danger: Hazardous voltages are present on some circuit boards in the controller.

1.04 Various subgroups of equipment are mounted on vertical angles. The front door provides access for mounting; servicing of relay panels; and for insertion, testing, and operational status of the various circuit packs. Access to the wiring side of the relay panels and synchronizer unit is provided by a rear door.

1.05 This issue of the section is based on the following drawings:

SD-82294-01 Iss. 1: Power System—AC Reserve Energy System Controller—For Automatic Paralleling And Load Management—J86742A

SD-82295-01 Iss. 2: Power Systems—Circuit Pack Schematic For J86742 Automatic Controller

SD-82325-01 Iss. 1: Power Systems—900 Type Plants—Automatic Reserve Power Plants—Application Schematic For J86742 Controller

If this section is to be used with equipment or apparatus reflecting later issue(s) of the drawing(s), reference should be made to the SDs and CDs to determine the extent of the changes and the manner in which this section may be affected.

1.06 While performing the procedures herein, consult the appropriate operating section for the engine alternators used. If trouble conditions develop, consult Section 155-022-701.

NOTICE

Not for use or disclosure outside the Bell System except under written agreement

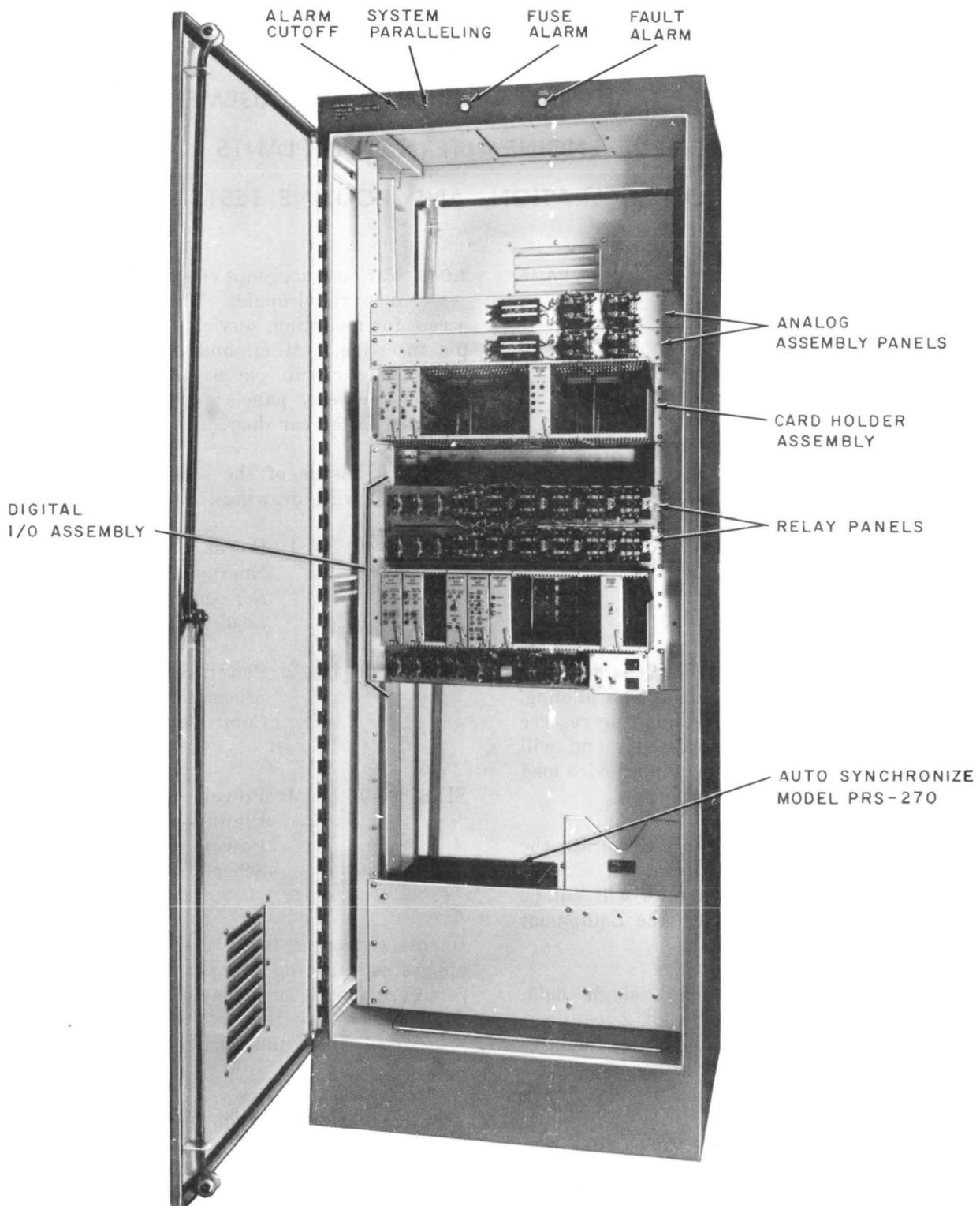


Fig. 1—J86742A Controller (Equipment Arrangement for Two Engines)

2. LIST OF TOOLS, TEST APPARATUS, AND MATERIALSCODE OR
SPEC. NO.

TOOLS	DESCRIPTION
—	Fuse pullers, 7 1/2 inches, Ideal Industries (or equivalent)
—	Small Screwdriver
TEST APPARATUS	
KS-14510	Volt-Ohm-Milliammeter (or equivalent)
—	Syncroscope, 360° calibrated dial, Westinghouse PI-161 (or equivalent)
MATERIALS	
—	24-volt Test Lamp, (WE Type 2U or 2J)
—	Connector, Twist Lock, Hubbell 4729C (or equivalent)

3. INSPECTION

3.01 Visual inspection should be made if there is a suspected trouble in the controller. Improperly mounted circuit packs, loose connections, or defective components are possible causes of trouble.

3.02 Circuit packs should be checked for proper identification codes to determine that circuit packs have been inserted in the proper connector. The circuit packs should be at a uniform height, fully seated, and locking devices on each circuit pack properly engaged in the circuit pack carrier framework. If a circuit pack is extending slightly higher than the other circuit packs, press the pack firmly into its connector. Intermittent continuity can result if the pack is not fully seated.

3.03 If a circuit pack is suspected of not making proper contact with the connector, the pack should be removed and the gold contacts examined for a damaged or scratched condition. If the contacts appear to be dirty, they should be cleaned with a suitable solvent. Examine the connector for bent or broken contacts.

3.04 It is recommended that defective circuit packs(s) be removed and new or reconditioned circuit pack(s) be installed. Defective circuit pack(s) may be returned to the Western Electric Company for repair and/or reconditioning.

4. OPERATION

4.01 Automatic operation of multi-engine systems will be achieved by both digital and analog signals provided by the controller. The primary function of the controller will be to automatically parallel up to six engine alternators of the 200kw to 750kw range on a common bus. The controller will also provide automatic load management control.

4.02 The controller utilizes techniques of digital and analog data processing to provide complete management. The functional groups which form the controller are:

(a) Analog Input/Output, Digital Input/Output—This group using relays and semiconductor devices provides a logic interface between the controller and the reserve energy system. The digital portion is provided on a modular basis to match the equipment furnished in the digital sequencer. The analog portion will be furnished only with the corresponding analog calculator.

(b) Analog Calculator—Required with certain types of engine alternators in order to maintain proper load balance.

(c) Load management—Consists of breaker control, counter control, and decoder. This portion provides sequential operation of the circuit breakers in the telephone office switch gear that transfers normal telephone load, special telephone load, and essential building load to the standby AC reserve energy system.

(d) Analog Synchronizer and Analog Sync Check—This portion permits automatic paralleling of engine alternators through the use of digital input/output so only one engine alternator at a time is selected for automatic paralleling.

4.03 Operation and test procedures are flow-charted and presented as follows:

Fig. 2—Full Load Routine Test

Fig. 3—Auto Standby Operation

SECTION 155-022-501

Fig. 4—Semi-Automatic Paralleling For Droop or Droop Isochronous Operation	R	Engine control for sixth engine without load balance control
Fig. 5—Manual Return of Loads Operation	L	Load balance control for sixth engine add-on to Option R
Fig. 6—System Test	K	Load management by building switchgear using only 1 and 2 load priority groups
Fig. 7—Semi-automatic Restore to Commercial Service	J	Load management by building switchgear using 1 and 2 load priority groups and growth to six priority groups
4.04 The normal direction of the flowcharts is from left to right and top to bottom. The signal flows in the direction of the arrowheads on the flowlines.	J	Load management by building switchgear using 1 and 2 load priority groups and growth to six priority groups
4.05 The figure symbols used in this section are shown in Table A.	B,A,ZB,ZF	Load management by building switchgear for third, fourth, fifth, and sixth load priority groups, add-on to Option J
4.06 The controller can be used to satisfy the smaller reserve energy systems by using only the subgroup or specific sections as required, such as the engine alternator control section, alarm control section, power control section, or the synchronizer section; however, the following options shown on SD-82294-01 may be obtained to satisfy any configuration:	I	Complete load management by controller using 1 and 2 load priority groups, Dual Bus Type System (see SD-82325-01)
OPTION OR FEATURE	DESCRIPTION	
Z	Load balance control for two engines using droop-droop or droop-isochronous paralleling	G
V	Engine control for third unit without load balance control	H
Y	Load balance for third engine add-on to Option V	
S	Engine control for fourth engine without load balance control	
M	Load balance control for fourth engine add-on to Option S	
T	Engine control for fifth engine without load balance control	
X	Load balance control for fifth engine add-on to Option T	

Note: Some installations are intended to provide only automatic paralleling of engine alternators and the load management portion may not be furnished.

5. SYSTEM TEST

5.01 System test for the J86742 automatic controller and its associated circuit packs have been flow charted as follows:

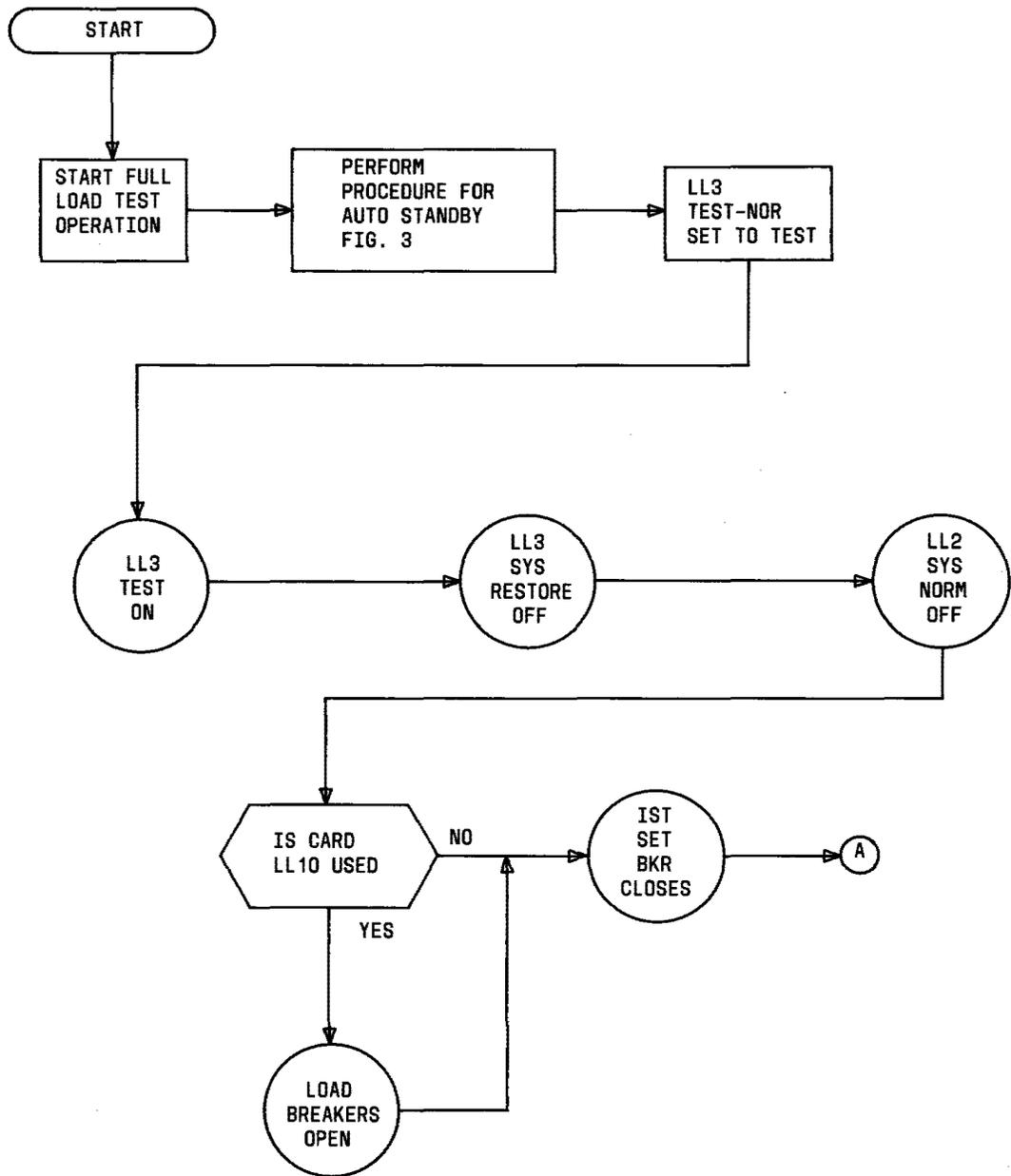


FIG. 2 - FULL LOAD ROUTINE TEST (1 OF 4)

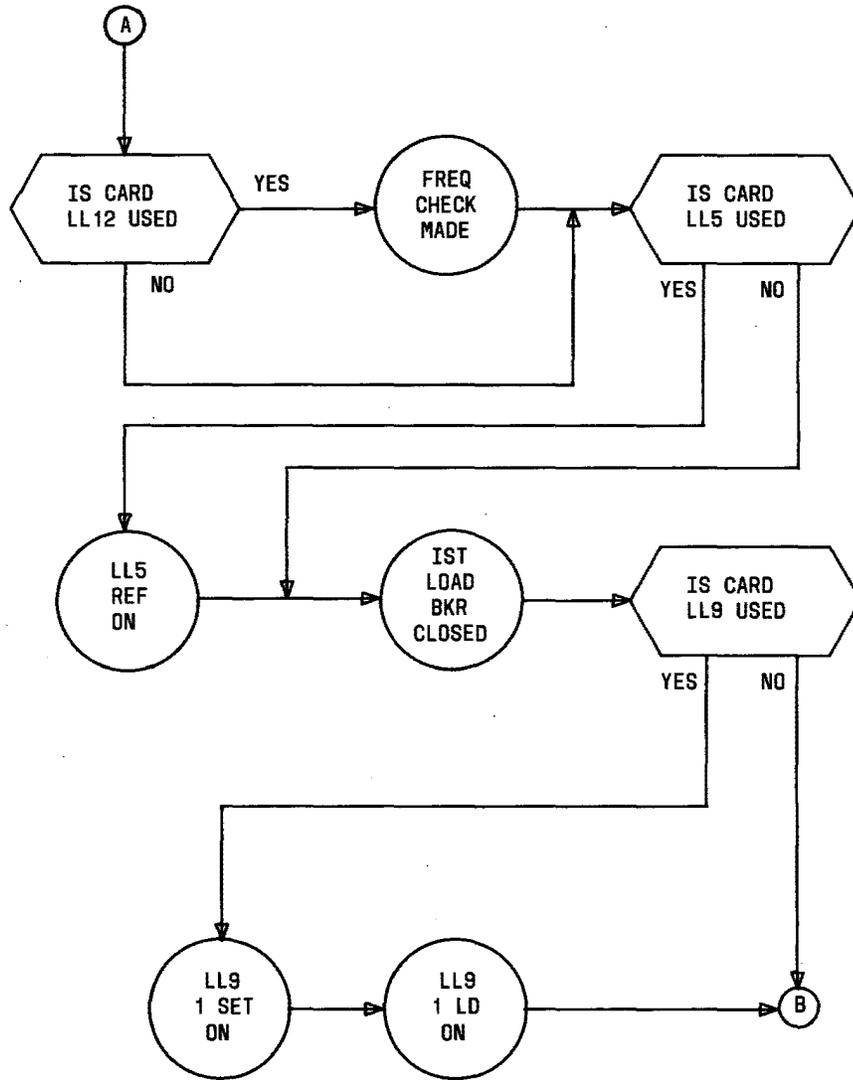


FIG. 2 - FULL LOAD ROUTINE TEST (2 OF 4)

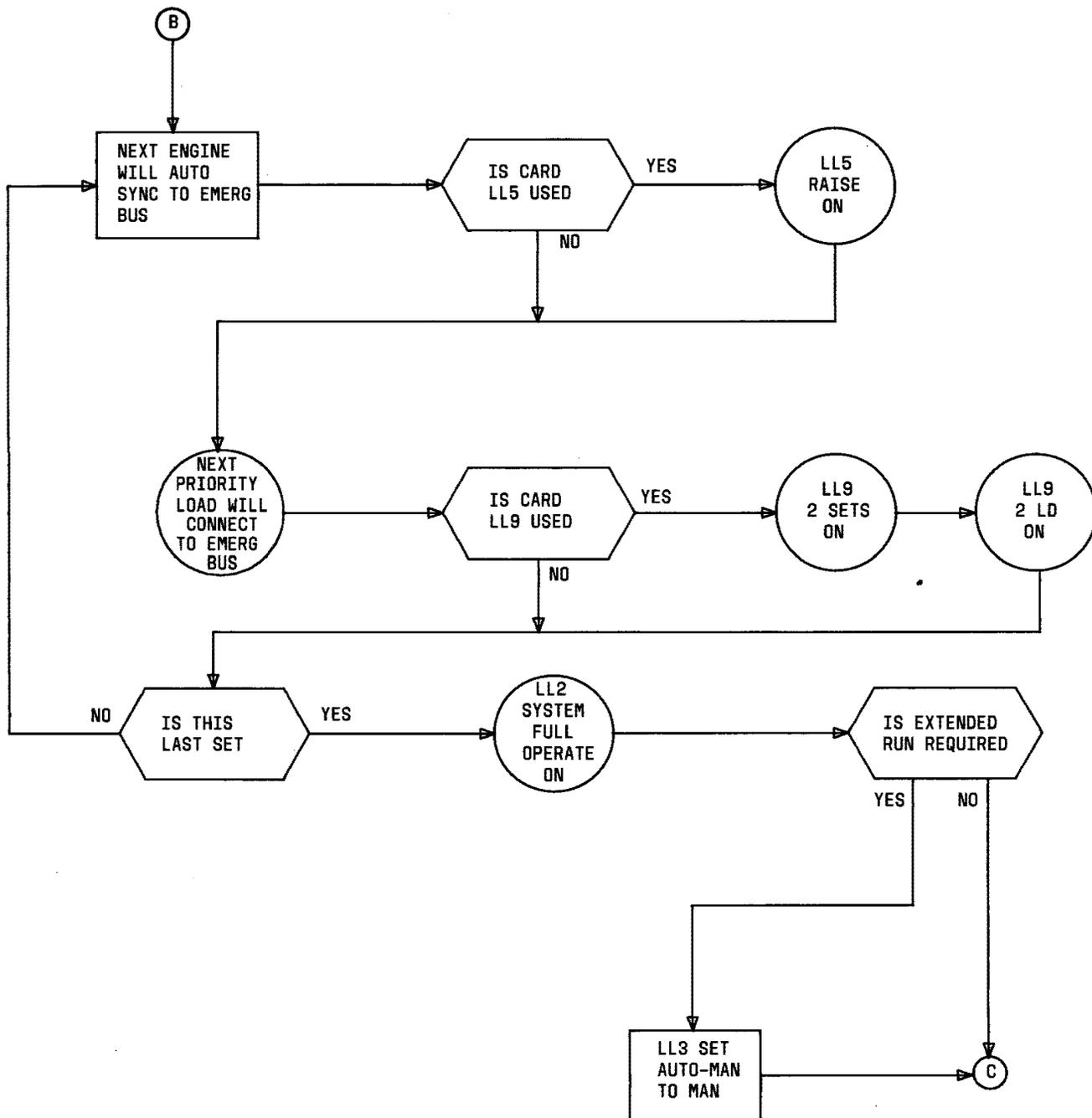


FIG. 2 - FULL LOAD ROUTINE TEST (3 OF 4)

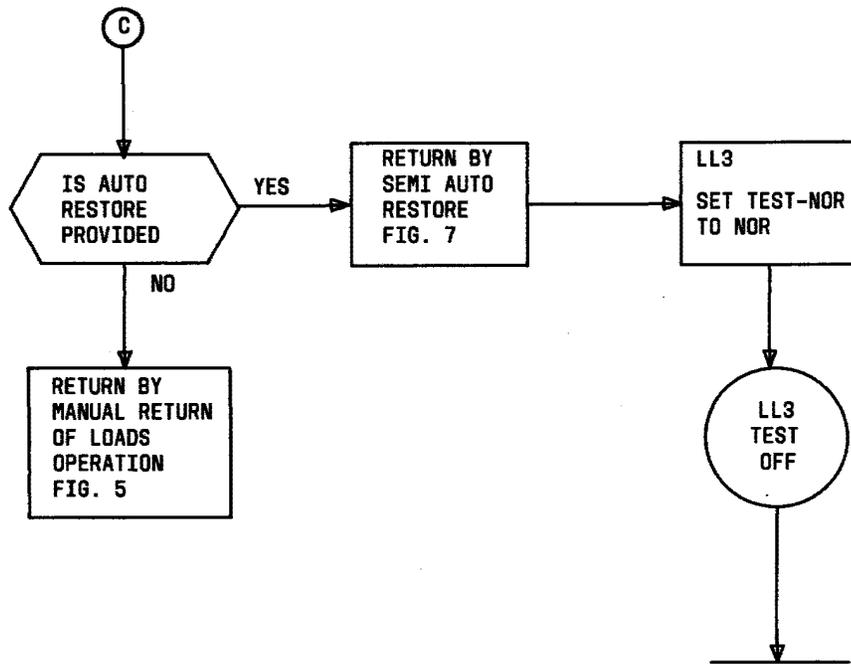


FIG. 2 - FULL LOAD ROUTINE TEST (4 OF 4)

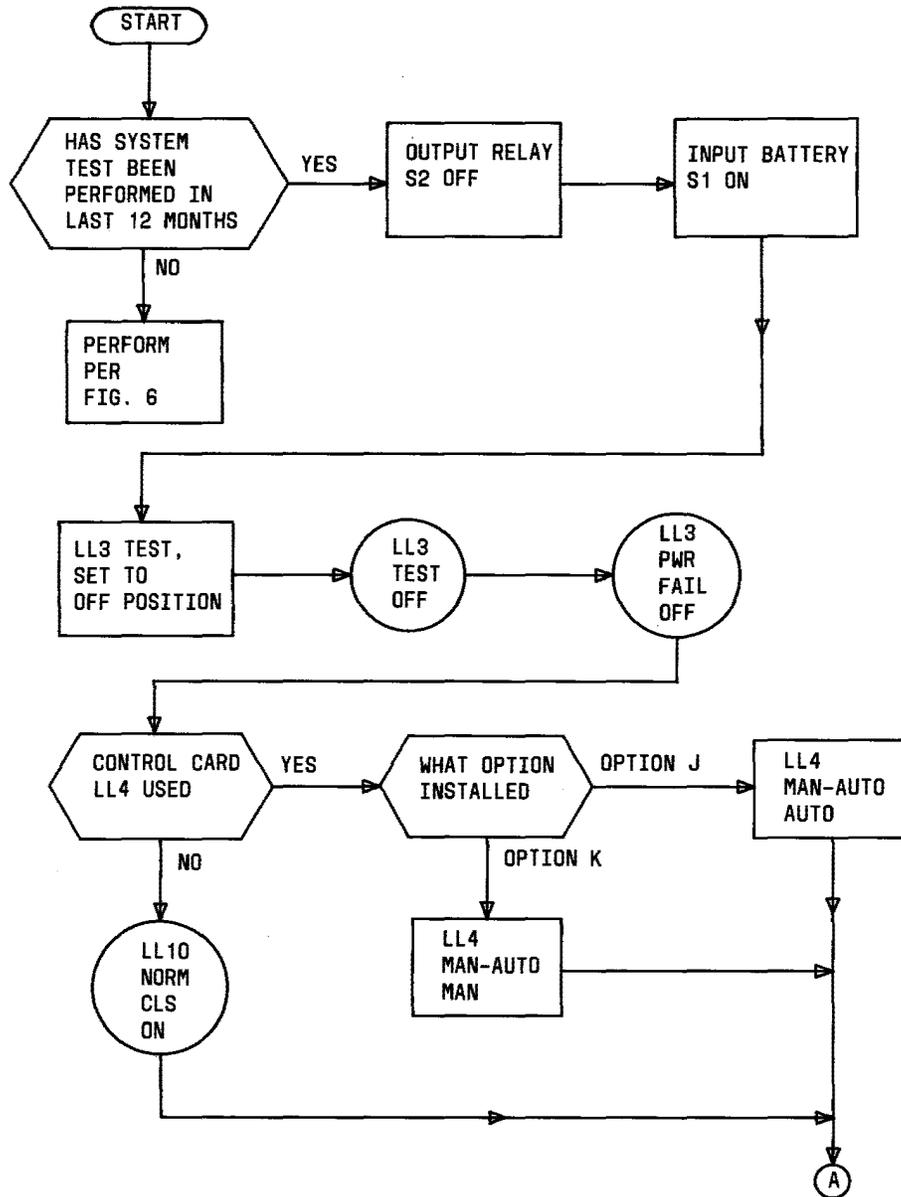


FIG. 3 - AUTO STANDBY OPERATION (SHEET 1)

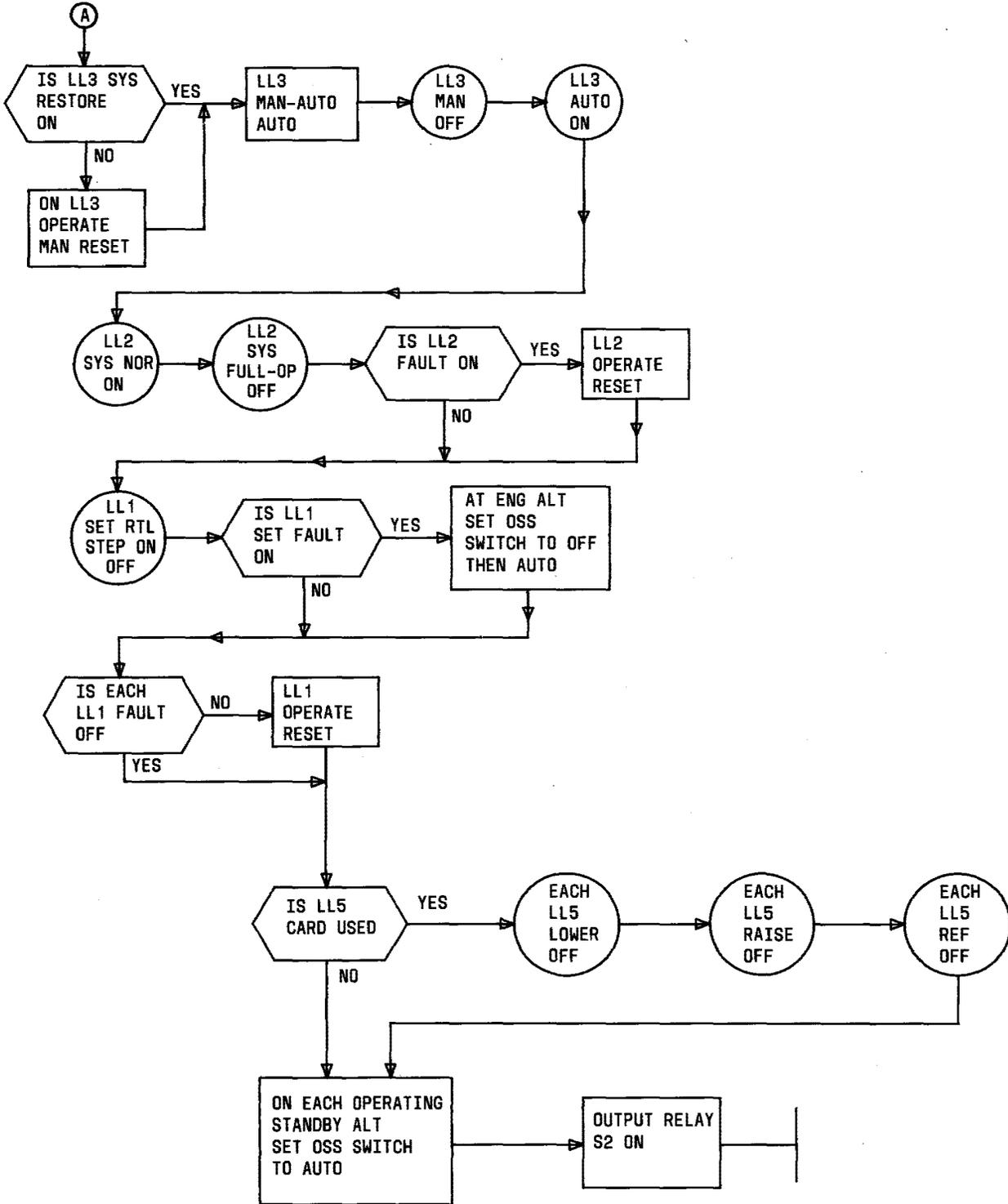


FIG. 3 - AUTO STANDBY OPERATION (SHEET 2)

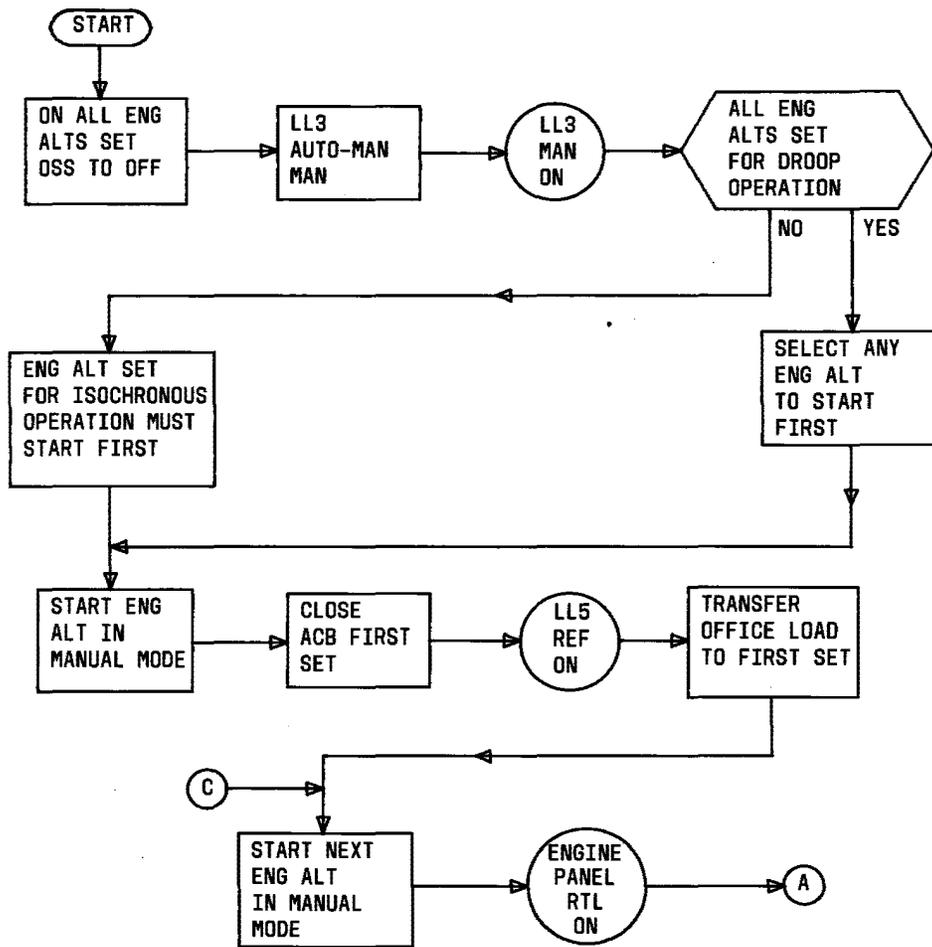


FIG. 4 - SEMI-AUTOMATIC PARALLELING FOR DROOP OR DROOP ISOCHRONOUS OPERATION (SHEET 1)

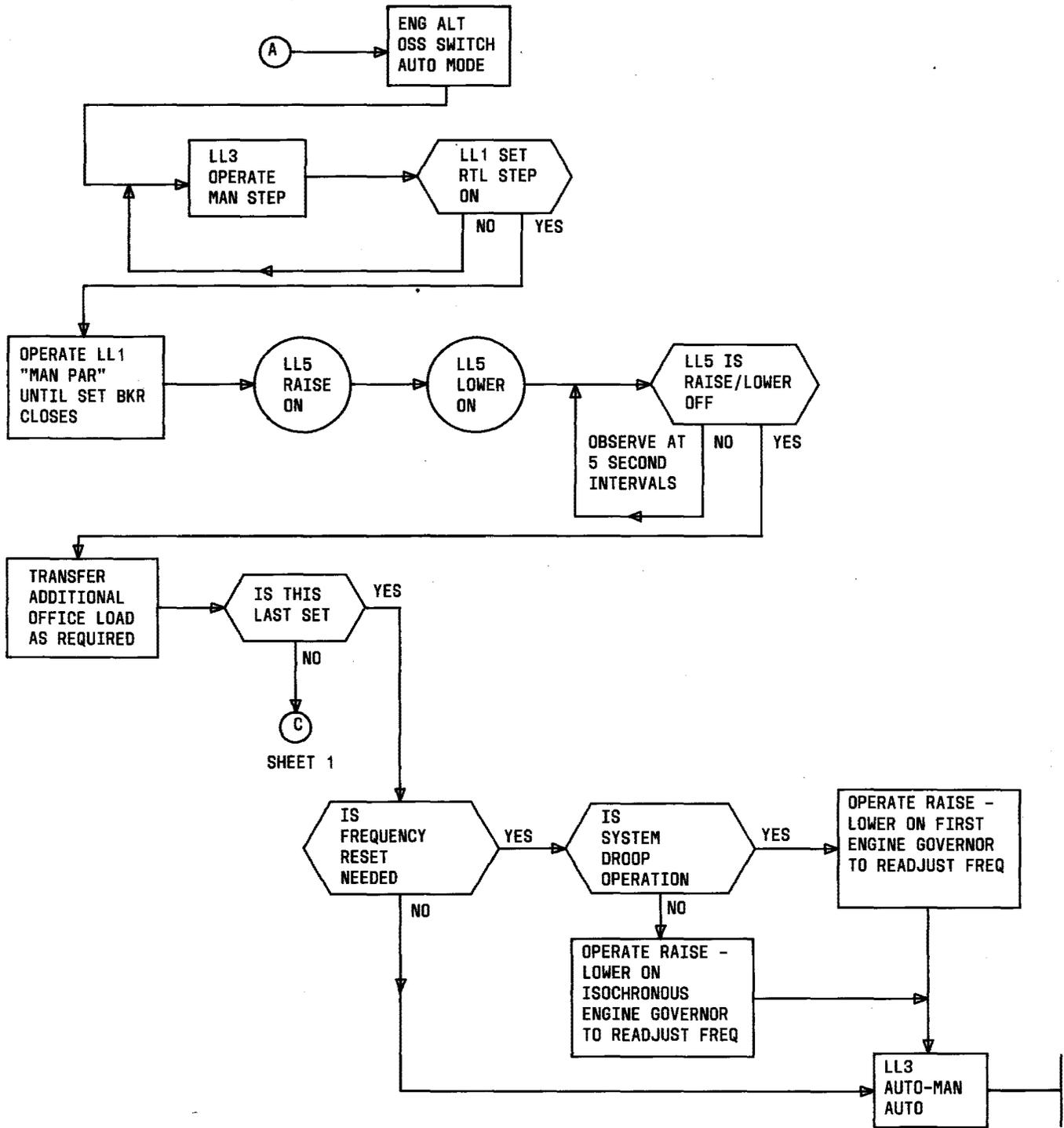


FIG. 4 - SEMI-AUTOMATIC PARALLELING FOR DROOP OR DROOP ISOCHRONOUS OPERATION (SHEET 2)

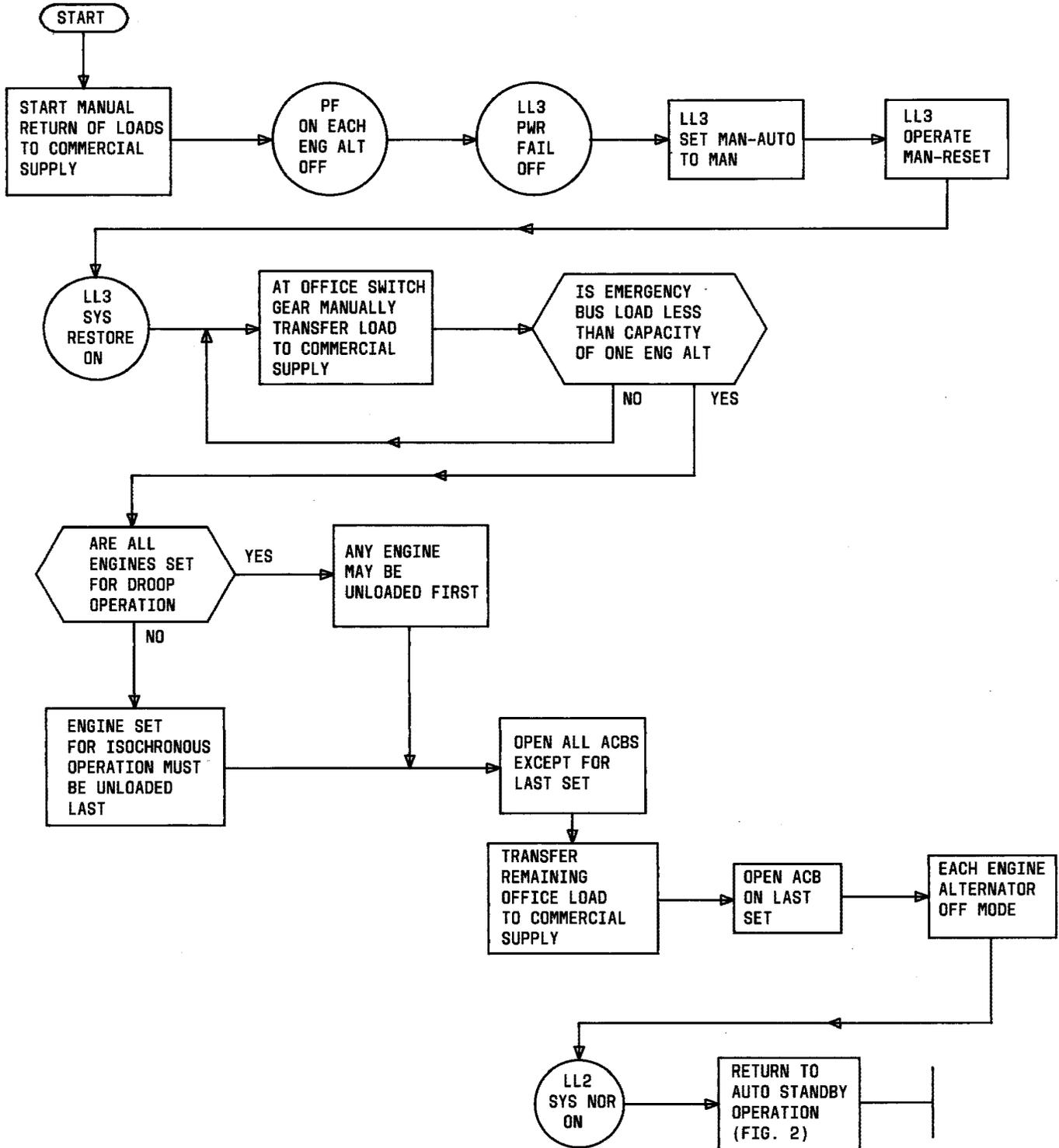
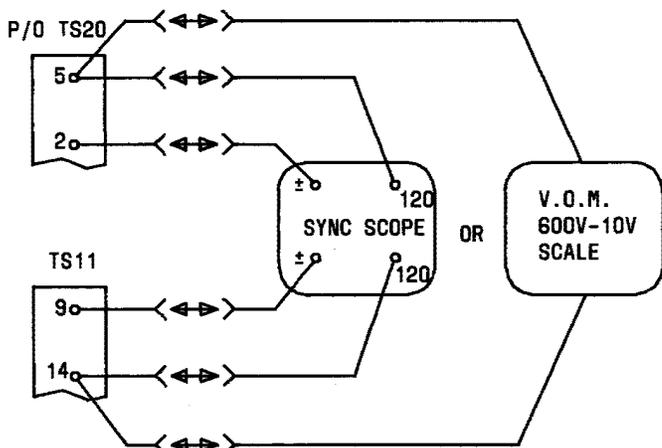
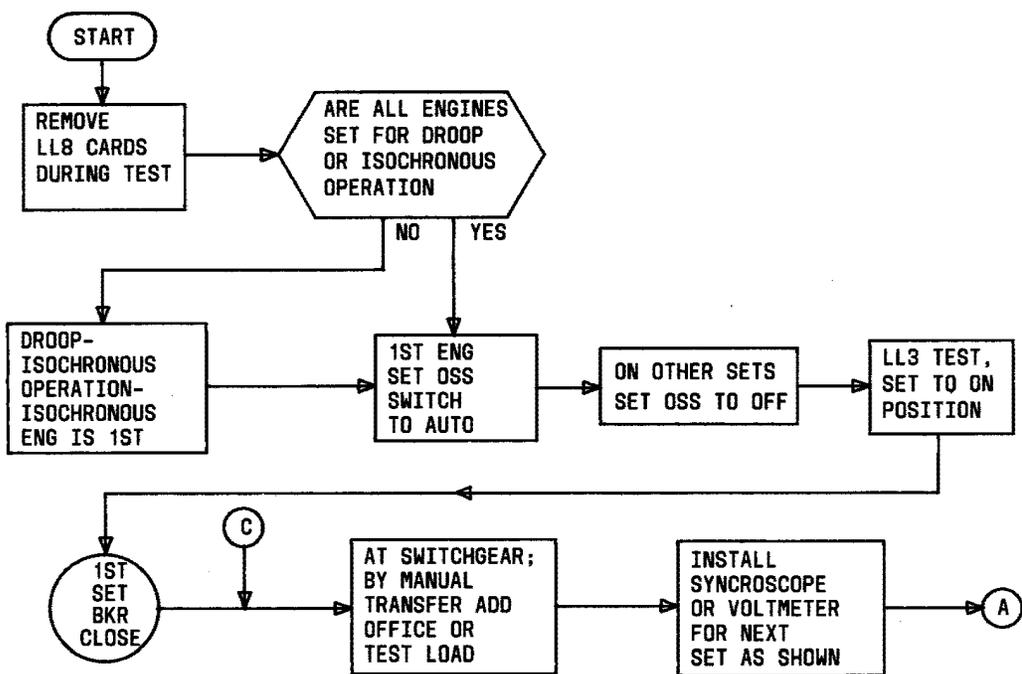


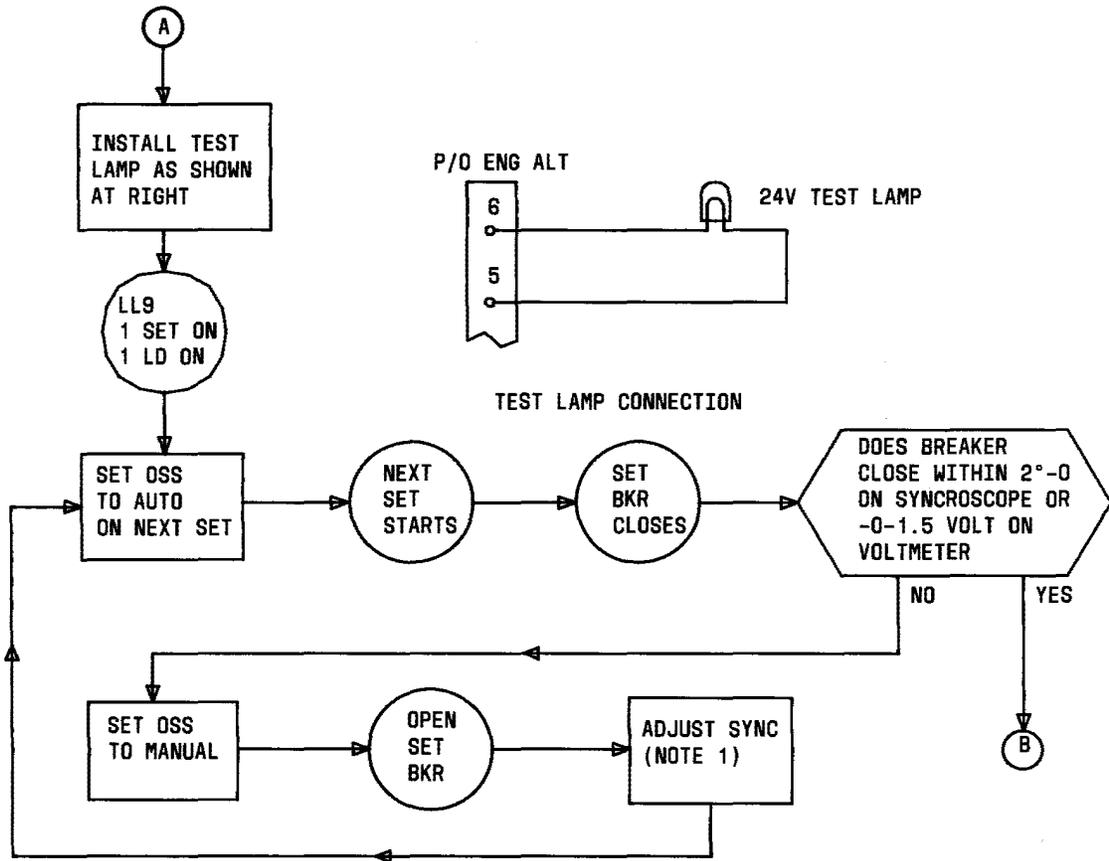
FIG. 5 - MANUAL RETURN OF LOADS OPERATION



CAUTION: REMOVE ALL AC PLUGS ON REAR PANEL WHEN CONNECTING TEST EQUIPMENT

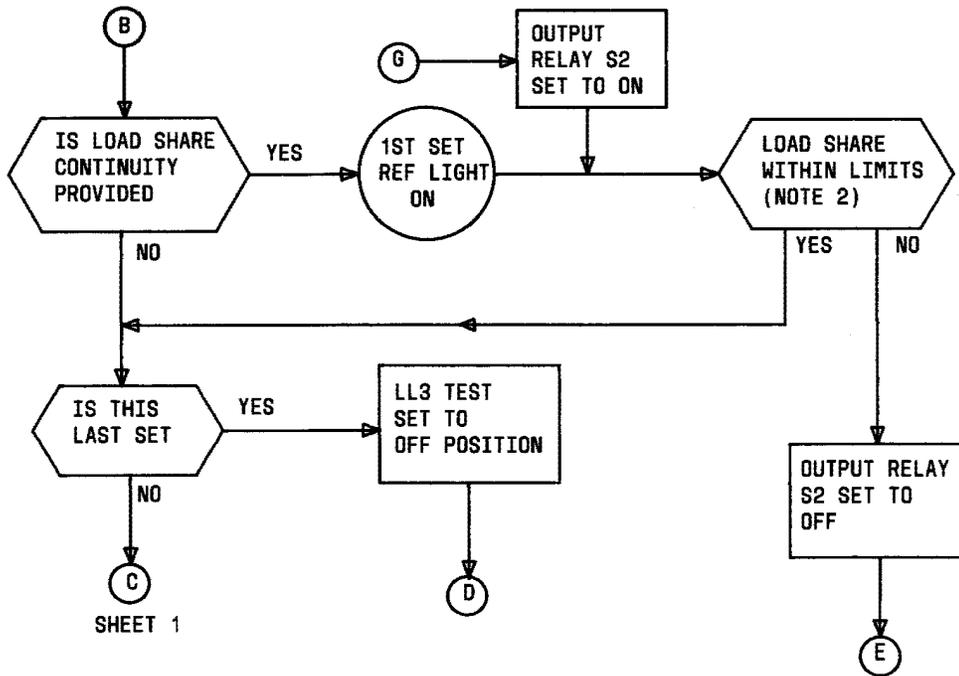
SYNCROSCOPE OR VOLTMETER CONNECTIONS

FIG. 6 - SYSTEM TEST (SHEET 1)



NOTE 1: TEST LAMP SHALL LIGHT AT A PHASE RELATIONSHIP OF 0° TO -2° AS INDICATED ON THE SYNCROSCOPE OR 0-1.5 VOLT ON VOLTMETER. THE SCOPE SHALL BE ROTATING AT A RATE NO FASTER THAN 1 ROTATION EVERY 10 SECONDS. IF LAMP LIGHTS BEFORE 2°, ADJUST BREAKER CLOSE TIME TO A HIGHER SETTING. IF LAMP LIGHTS AFTER 0° (PHASE COINCIDENCE), ADJUST BREAKER CLOSE TIME TO A LOWER SETTING. IF THE SCOPE ROTATES FASTER THAN SPECIFIED ABOVE, DECREASE THE "SLIP FREQUENCY ACCEPTANCE". AFTER SYNCHRONIZER HAS BEEN ADJUSTED, DO NOT MAKE READJUSTMENTS FOR OTHER ALTERNATORS

FIG. 6 - SYSTEM TEST (SHEET 2)



SHEET 1

NOTE 2: KW SHARE LIMITS

SETS <70% LOADED

SETS >70% LOADED

$$\frac{\text{TOTAL KW}}{\text{NO. OF SETS}} \times 0.90 = (\text{MIN KW})$$

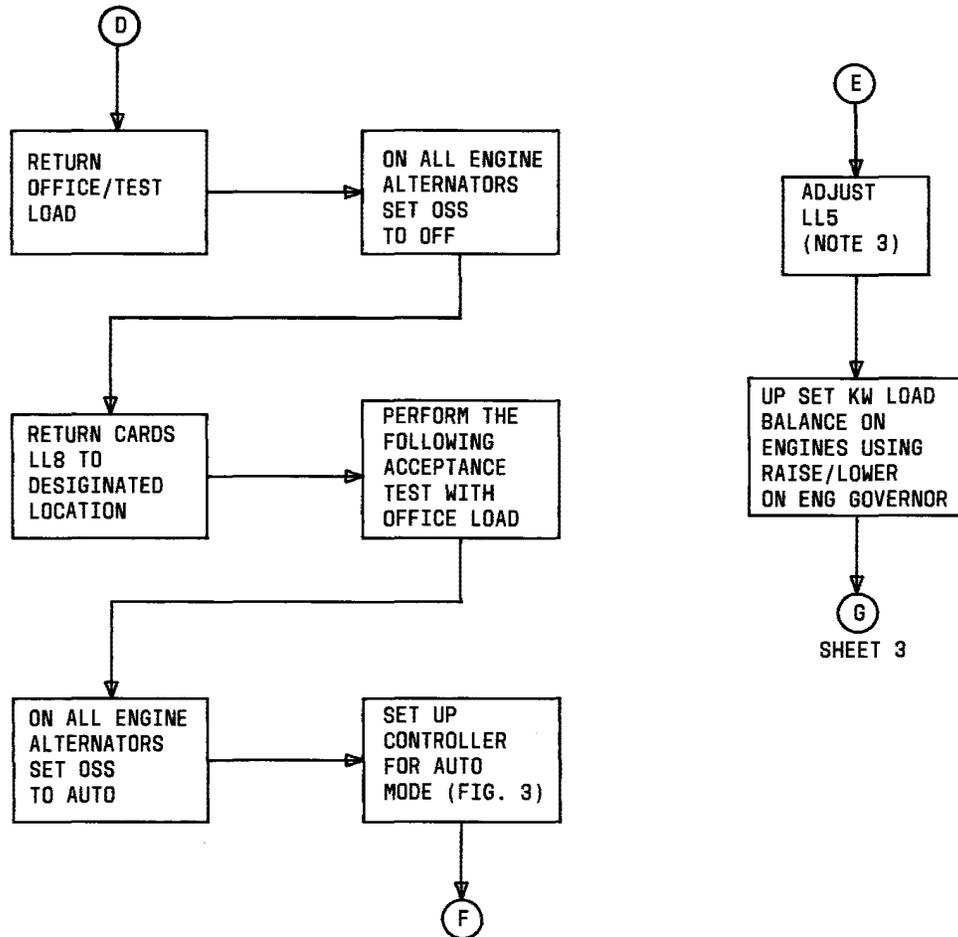
$$\frac{\text{TOTAL KW}}{\text{NO. OF SETS}} \times 0.95 = (\text{MIN KW})$$

$$\frac{\text{TOTAL KW}}{\text{NO. OF SETS}} \times 1.10 = (\text{MAX. KW})$$

$$\frac{\text{TOTAL KW}}{\text{NO. OF SETS}} \times 1.05 = (\text{MAX. KW})$$

USE KW METERS ON ENGINE CONTROL PANEL TO MAKE CALCULATIONS

FIG. 6 - SYSTEM TEST (SHEET 3)



NOTE 3: TO OBTAIN STEADY STATE LOAD BALANCE IF OUTSIDE LIMITS TURN GAIN ADJUST CCW. ADJUST R19 (LOWER PULSE DURATION) OR R37 (RAISE PULSE DURATION) SO STEADY STATE LOAD BALANCE WILL BE REACHED WITHOUT OVERSHOOT OR UNDERSHOOT OF STEADY STATE NULL BAND. ADJUST R19 AND R37 CW TO INCREASE PULSE DURATION AND CCW TO DECREASE PULSE DURATION. ADJUST R15 (LOWER DWELL) AND R36 (RAISE DWELL) TO A PERIOD LONG ENOUGH FOR THE ENGINE ALTERNATOR TO SETTLE BACK TO A STEADY STATE AFTER PULSING THE GOVERNOR CONTROL. ADJUST R15 OR R36 CW TO INCREASE DWELL TIME AND CCW TO DECREASE. DWELL TIME WILL BE SHORTER UNDER A LARGE KW UNBALANCE CONDITION AND WILL INCREASE AS THE KW SHARING BETWEEN SETS APPROACHES STEADY STATE

FIG. 6 - SYSTEM TEST (SHEET 4)

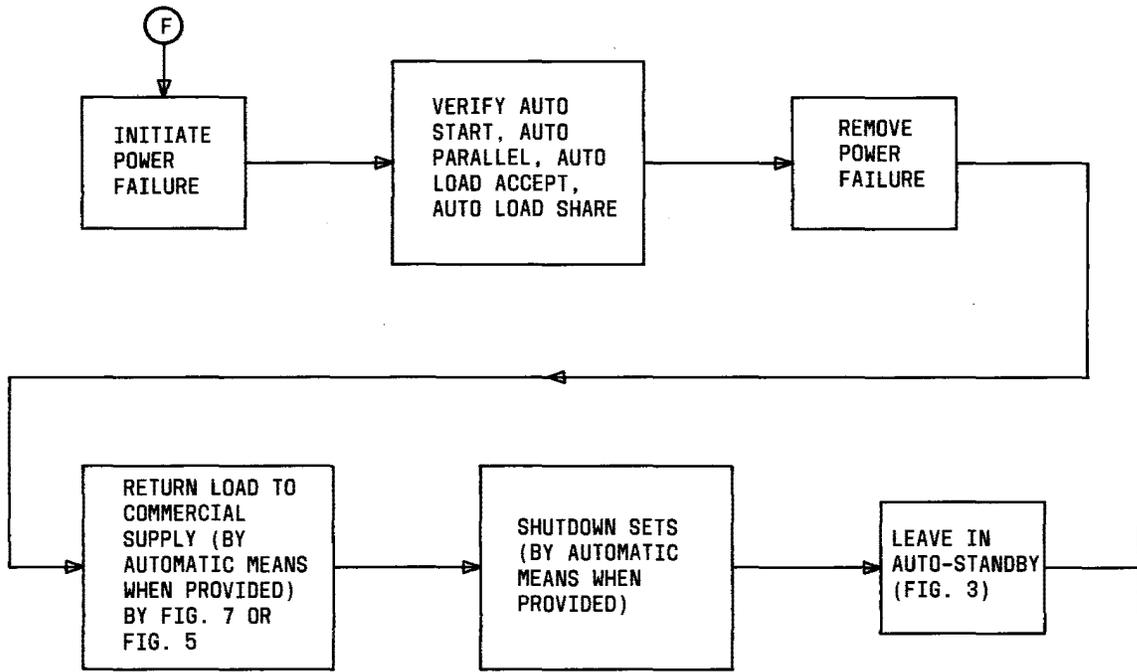


FIG. 6 - SYSTEM TEST (SHEET 5)

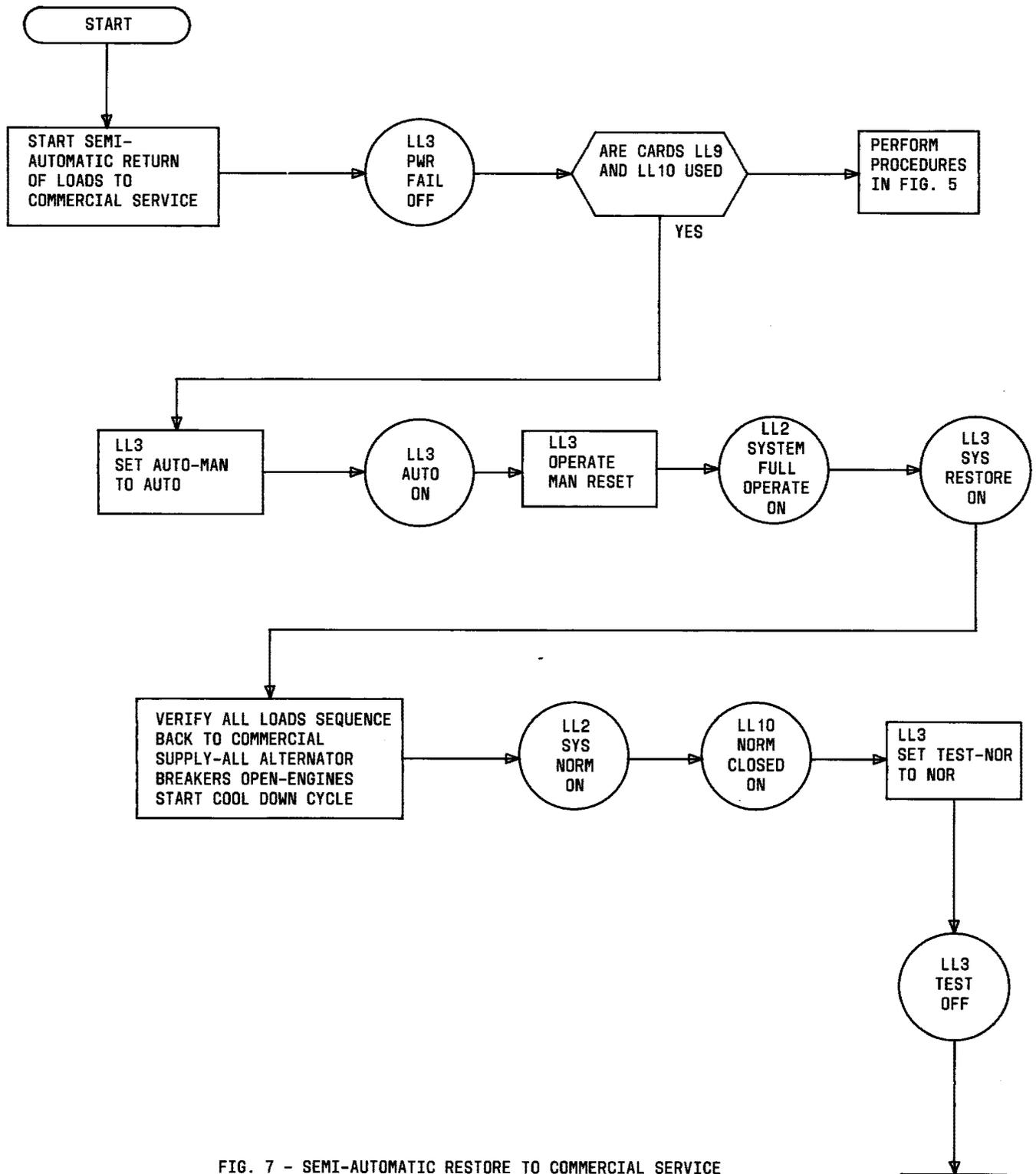
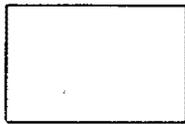
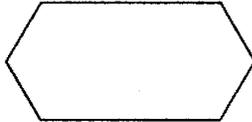


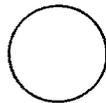
FIG. 7 - SEMI-AUTOMATIC RESTORE TO COMMERCIAL SERVICE



INSTRUCTION: PERFORM DESCRIBED
OPERATION OR PROCEDURE



DECISION: ENCLOSED ACTION DID OR DID NOT
OCCUR. PROCEED ON APPROPRIATE COURSE



INDICATION: EXPECTED DISPLAY, MEASUREMENT
OR AUDIBLE



DIRECTION FLOW LINES



COMPLETION BAR: PROCEDURE COMPLETE



BEGINNING OF PROCEDURE, START
AT THIS POINT

TABLE A
FIGURE SYMBOLISM