GROUP E.1

A.C. SUPPLIES (CODE CH)

CONTENTS

ILLUSTRATIONS

Equipment employed

1. The major components employed in the a.c. supplies circuit are quoted below, together with the appropriate Air Publications to which reference should be made for a detailed description and the necessary servicing required to maintain them in an efficient condition:

Inverters, Type 100A	A.P.113D-0104-16
Auto-transformers, Smiths 213 M.V.	A.P.113D–0400 series
Torque switches, Type B.1, E.A.P.2312	A.P.113D–1384-1
Circuit breakers, Type A.3	A.P.113D-0900 series
Suppressors, Type F.No.2	A.P.113D-1902-1
Magnetic indicator, Dowty Type C.5165Y, Mk.1	A.P.113F–0615-1
Relays, Type S.1, S.3 and 9.B No.1	A.P.113D-1309-1
Test and reset switch, C.W.C. Type XD.782, No.3 Inverter selector switch, C.W.C. Type XD.735, No.2	A.P.113D-1100 series

DESCRIPTION

A.C. supplies

2. This circuit controls the supply to the alternating current operated flight instruments and the engine temperature control circuit described in Section 5, Chapter 2 of this volume and to the A.R.I.5820 installation described in Section 6, Chapter 2.

◀ **Note . . .**

On aircraft post Mod.1420 radar ranging (A.R.I.5820) is rendered inoperative by isolating the system from aircraft power supplies. ▶

The supply is 115 volts, 3-phase, 400 cycles per second, which is obtained from two inverters mounted on the cabin floor on the starboard side behind the seat. The flight instruments and engine temperature control are normally operated by No.1 inverter, while No.2 inverter supplies the A.R.I.5820 installation, but should No.1 inverter fail, No.2 inverter will automatically off-load the A.R.I.5820 installation and act as a stand-by supply to maintain operation of the flight instruments and engine temperature control circuit. The No.2 inverter does, however, supply the flight instruments while the aircraft is on the ground until the engine is started and the generators come on the line. Located on the top of the a.c. junction box are two circuit breakers, one of which protects

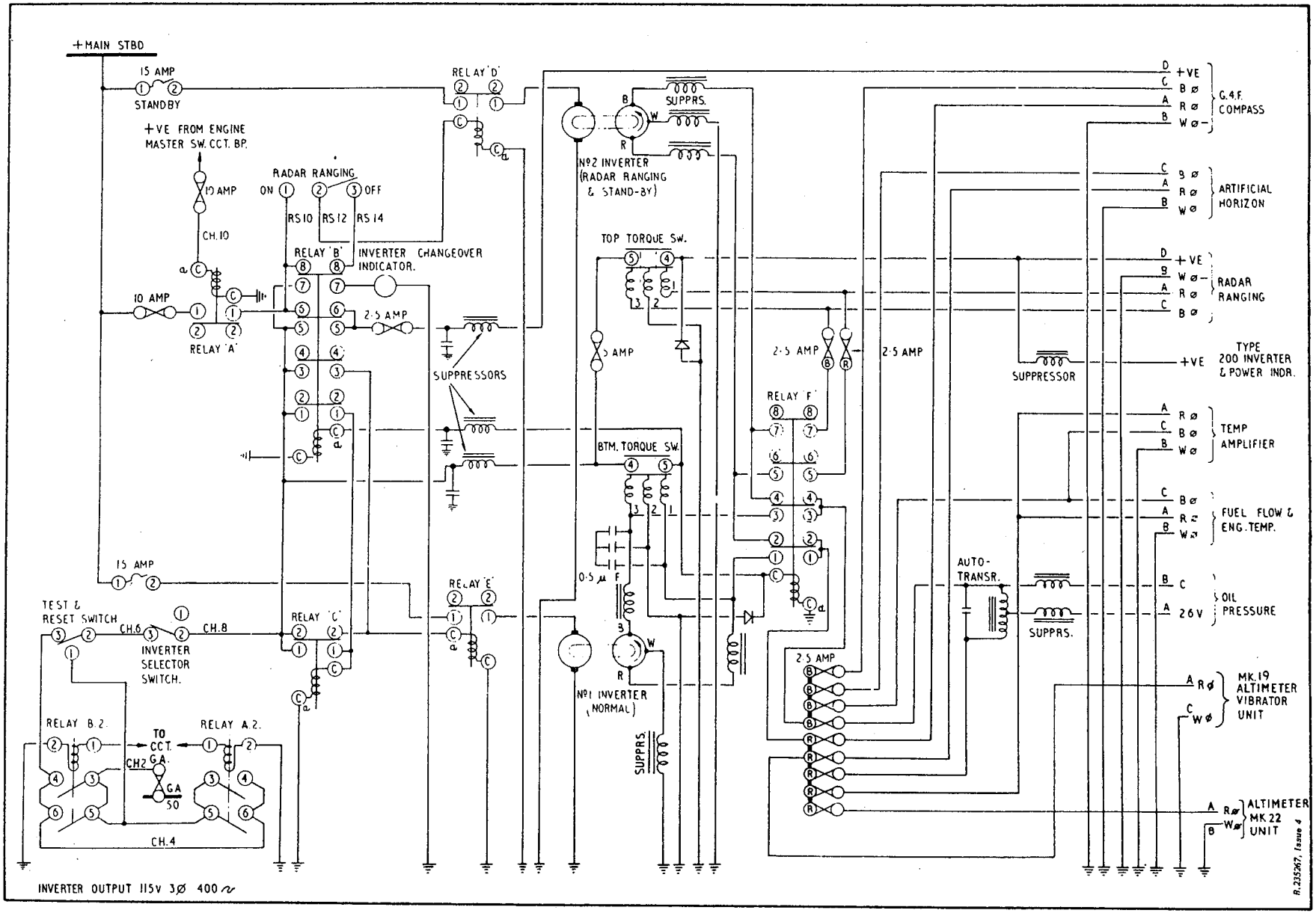

Fig. 1 A.C. supplies (theoretical)

(pre Mod.1375)

each inverter. A magnetic indicator to give indication of inverter changeover is provided on the centre instrument panel; and a switch, marked TEST and RESET is situated on the generator control panel. An inverter selector switch is located on the rear portion of the cabin port shelf and the d.c. input to each inverter is controlled by relays. Suppressors are provided between the d.c. and a.c. sections of the circuit to minimize interference with the radio equipment. The a.c. output of the inverters and the off-loading of the A.R.I. 5820 installation is controlled by two torque switches and a relay while the supply to the oil pressure gauge is taken through an auto-transformer and another suppressor. The torque switches, auto-transformer, control relays and suppressors are all located within the A.C. junction box, situated on the starboard side of the cabin. The circuit is coupled to the engine starter master switch and to the generators and batteries circuit. It can also be operated from a ground supply for test purposes.

Operation

3. When the engine master switch is placed in the ON position, a supply from the engine starter circuit breaker will energize relay A. With this relay energized, a supply is conducted from the 10-amp. circuit fuse, through a set of contacts of relay B, which are made while this relay is de-energized and through the radar ranging ON/OFF switch to energize relay D. The d.c. bias supply for compass correction is also taken from a set of contacts within relay B, via a 2.5-amp. circuit fuse and a suppressor. With relay D energized, the circuit from No.2 circuit breaker to No.2 inverter is completed and this inverter will commence operation and feed the phase bus-bars in the a.c. junction box, via contacts in relay F, which are made while this relay is de-energized. The compass, artificial horizon and the magnetic amplifiers in the cabin pressurization and engine temperature control circuits together with the oil pressure gauge, thus commence operation. The supply to the oil pressure gauge, is, however, taken through an auto-transformer, which reduces the voltage to the value required by this instrument.

4. When the aircraft's engine is started and the generators have come on the line, thus closing the main circuit breakers, relays A.2 and B.2 are energized. The circuit of relay E coil is now complete, via contacts of relay A2 or B2, the test and reset switch, the inverter selector switch and a pair of contacts in relay C, which are made while this relay is de-energized. With relay E energized, a supply is made to No.1 inverter, via its circuit breaker, and the inverter commences operation to energize the bottom torque switch. A supply is also made to the contacts of the top torque switch, via. a 5-amp. fuse, in preparation for supplying the A.R.I.5820 junction box and type 200 inverter when the top torque switch is energized *(para.5)*. When the output reaches 100 volts the torque switch makes contact and feeds the coils of relays B and F. When relay B is energized, it energizes relay C and the inverter change-over indicator. Relay E will not be de-energized by the operation of relay C as it is maintained in the energized state via the made contacts of energized relay B. Once energized, relay C is maintained in this state by a hold-on circuit through its own contacts. This prevents relay E from being re-energized by the supply from the main circuit breakers (Group B.1) when relay B is de-energized during failure of No.1 inverter *(para.6)*. The supply to the coil of relay D, via the radar ranging ON/OFF switch when in the OFF position, is also broken when relay B is energized, thus relay D is de-energized and No.2 inverter ceases operation. The equipment originally supplied by No.2 inverter will be fed from No.1 inverter via relay F, which controls the output of the inverters and when energized allows No.1 inverter to supply the phase bus-bars.

5. When the A.R.I.5820 installation is switched ON, a supply is conducted from the 10-amp. fuse to the contacts of relay A, which are closed while this relay is energized and through the radar ranging control switch to the coil of relay D. With relay D energized, the supply from No.2 circuit breaker to No.2 inverter is completed and the inverter commences operation to feed the top torque switch and the phase bus-bars in the A.R.I.5820 junction box, via the contacts of relay F, which are made while this relay is energized. When the output of No.2 inverter reaches 100 volts, the top torque switch will make contact to supply d.c. to the A.R.I.5820 junction box and Type 200 inverter *(para.4)* and the A.R.I.5820 commences operation.

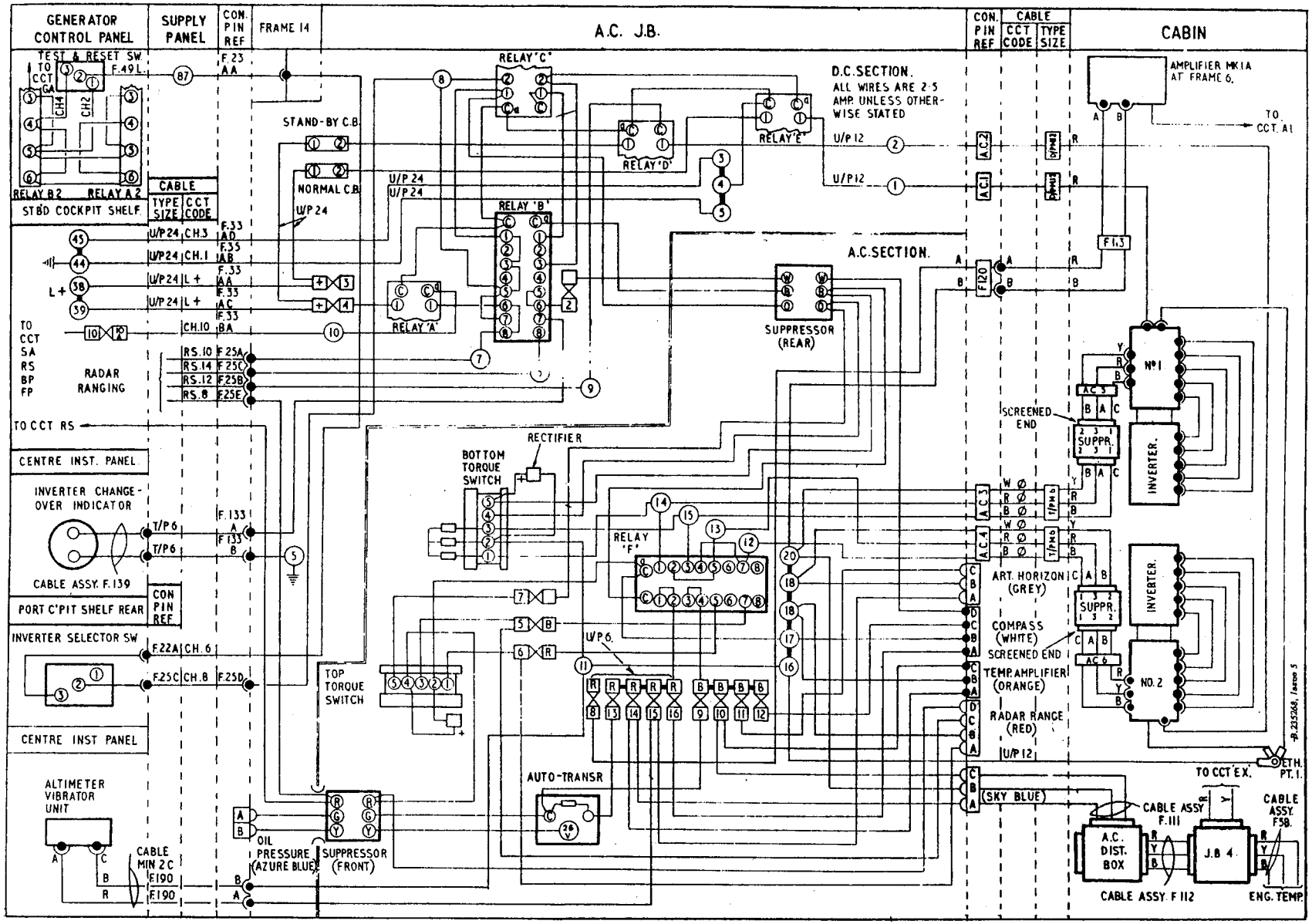

Fig. 2 A.C. supplies (routeing)

(pre Mod.1375)

6. If No.1 inverter fails, the bottom torque switch will be de-energized, thus breaking contact and de-energizing relays B and F. The de-energizing of relay B breaks the supply to the inverter changeover indicator and de-energizes relay E to isolate the supply to No.1 inverter. The de-energizing of relay F causes the top torque switch to de-energize and break the supply to the A.R.I.5820 installation, thus off-loading this equipment and rendering that installation inoperative. At the same time, No.1 inverter is isolated from the phase bus-bars and the output of No.2 inverter is connected to the bus-bars, thus maintaining the flight instruments in operation. This whole operation takes place automatically and the inverter changeover indicator provides warning that failure has occurred. A similar process takes place if the supply fails due to a fuse failure or an open-circuit.

7. Placing the inverter selector switch in the STANDBY position will break the hold-on circuit of relay C and de-energize this relay. Returning the selector switch to the NORMAL position will now energize relay E and complete the supply to No.1 inverter which will recommence operation as described in para.4. This facility is used to allow No.1 inverter to come back on the line if its failure is of a temporary nature.

SERVICING

General

8. For general servicing of the electrical system, reference should be made to Group A.1 of this chapter. Apart from keeping all the components clean and carrying out the standard routine tests of security and serviceability as described in the appropriate Air Publications quoted in para.1, the only other servicing is the testing of the stand-by circuit as described in para.9 of this group.

Ground testing standby circuit

9. During daily servicing and before each flight, the operation of No.2 inverter and its control circuit should be tested for correct functioning. The method to be adopted is as follows:-

(1) Ensure that the battery master switch is in the ON position or that an external supply is connected to the aircraft's external supply plug (Group A.1).

(2) Switch on the engine master switch and check that No.2 inverter runs up and supplies the G.4.F compass, the artificial horizon, and the oil pressure gauge. Check that this applies:-

(a) With the inverter selector switch in both NORMAL and STANDBY positions.

(b) With the radar ranging in both ON and OFF positions.

Then return the inverter selector switch to NORMAL and the radar ranging switch to the OFF positions.

(3) Operate and hold ON the test switch on the generator control panel *(thus simulating "engine-running" conditions)*. Check that No.2 inverter ceases operation and No.1 inverter runs up, the instruments originally supplied by No.2 inverter now being supplied by No.1. The change-over indicator should now show BLACK i.e. normal operation. Then check that:-

(a) Selecting STANDBY with the inverter selector switch causes No.2 inverter to take over from No.1 inverter.

(b) Returning the inverter selector switch to NORMAL brings No.1 inverter into operation again and shuts down No.2 inverter.

(4) With the inverter switch at NORMAL, switch the radar ranging switch ON. Check that No.2 inverter runs up and the radar indicator shows WHITE i.e. normal operation. Then leaving the radar on check that:-

(a) Selecting STANDBY with the inverter selector switch causes No.1 inverter to shut down so that the instruments are supplied by No.2 and the radar becomes inoperative. The change-over indicator will show WHITE and the radar indicator BLACK.

(b) Returning the inverter selector switch to NORMAL brings in No.1 inverter again and No.2 reverts back to supply the radar.

(5) Leaving the radar switch ON, trip the circuit breaker for No.1 inverter *(this simulates a failure)* and observe that this inverter ceases operation, also that the radar ceases to function. Check that the instruments continue to operate, however, as these are supplied by No.2 inverter, the radar having been off-loaded. The change-over indicator will now show WHITE and the radar indicator BLACK.

(6) Re-set No.1 inverter circuit breaker and note that there is no resulting change in the operation of the inverters i.e. No.2 inverter is still supplying the instruments and No.1 not functioning. Momentarily switch the inverter selector switch to STAND-BY and back to NORMAL again. Check that No.1 inverter recommences operation and supplies the instruments while No.2 reverts back to supplying the radar.

(7) Trip No.2 inverters circuit breaker and observe that No.2 inverter and the radar stop functioning. Reset the circuit breaker and check that the inverter and radar recommence operation.

(8) Release the test switch on the generator control panel and allow it to come to the NORMAL position *(this simulates engine or generator failure)*. Check that No.1 inverter and the radar cease operating and that the instruments are supplied from No.2 inverter. This completes the tests on the inverter change-over circuit.

(9) Return all switches to OFF or NORMAL positions and disconnect the external supply if used.

◀ **Setting up inverters**

10. The procedure for setting up the main and standby inverters on the bench, is given in the Air Publication quoted in para.1 and this procedure must be followed for all inverters, but for aircraft Post Mod. 538 i.e. radio compass introduced, the frequency of No.1 inverter *(main)* should be set to 398-400 c/s and the frequency of No.2 inverter *(standby)* set to 402-404 c/s. This is necessary, due to the change in inverter power factor, caused by the introduction of suppressors to prevent interference with the radio compass. ▶

REMOVAL AND ASSEMBLY

General

11. Once access has been obtained, the removal and assembly of the components forming the a.c. supplies circuit should present no unusual difficulties. The removal of the a.c. junction box, which contains the majority of the flight instruments control circuit components is described in Group A.2 and the location and access to all the components is indicated in Group A.3.

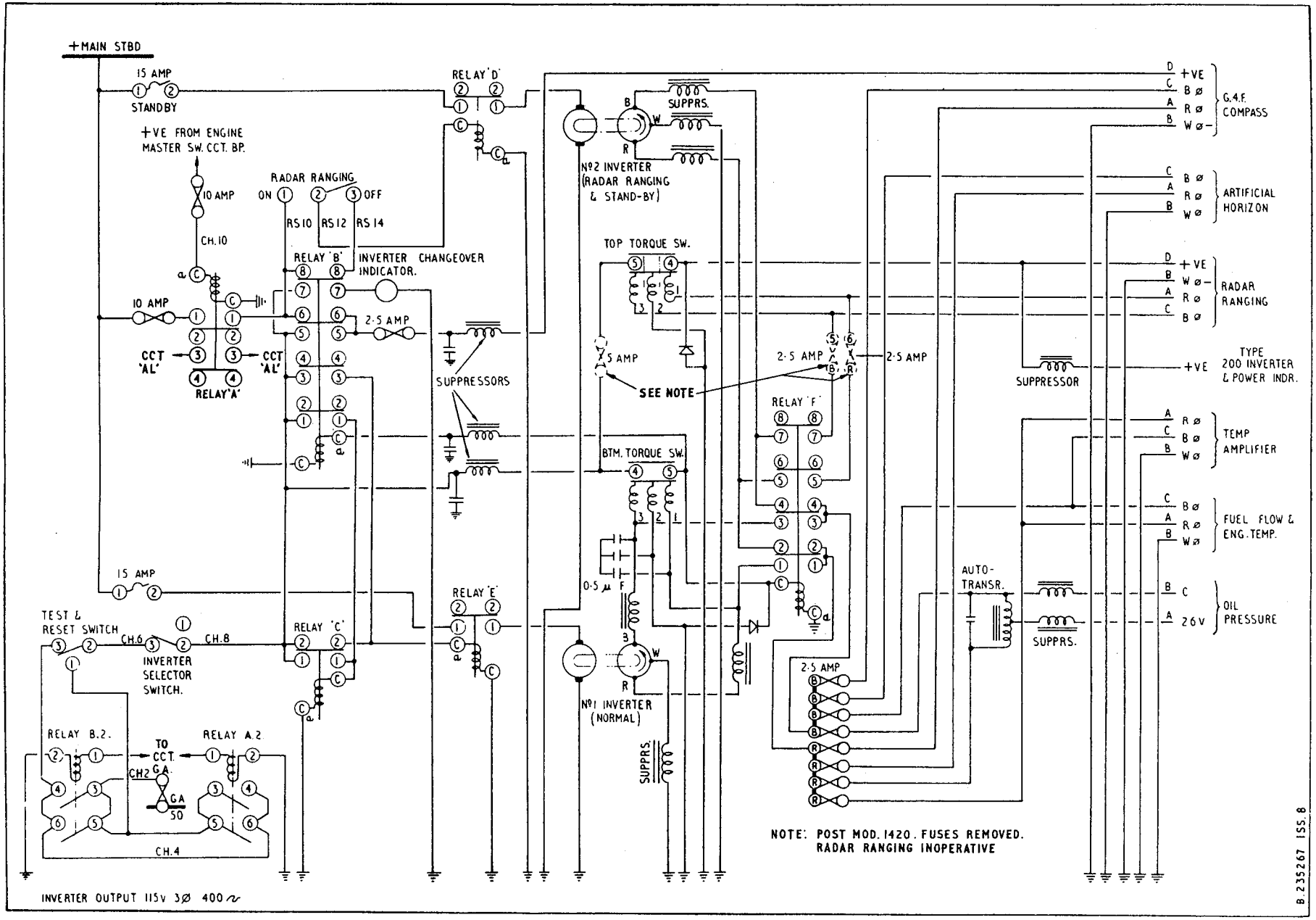

Fig. 3 A.C. supplies theoretical (post Mod.1375)
◀ (minor amendment. Mod.1420 added) ▶

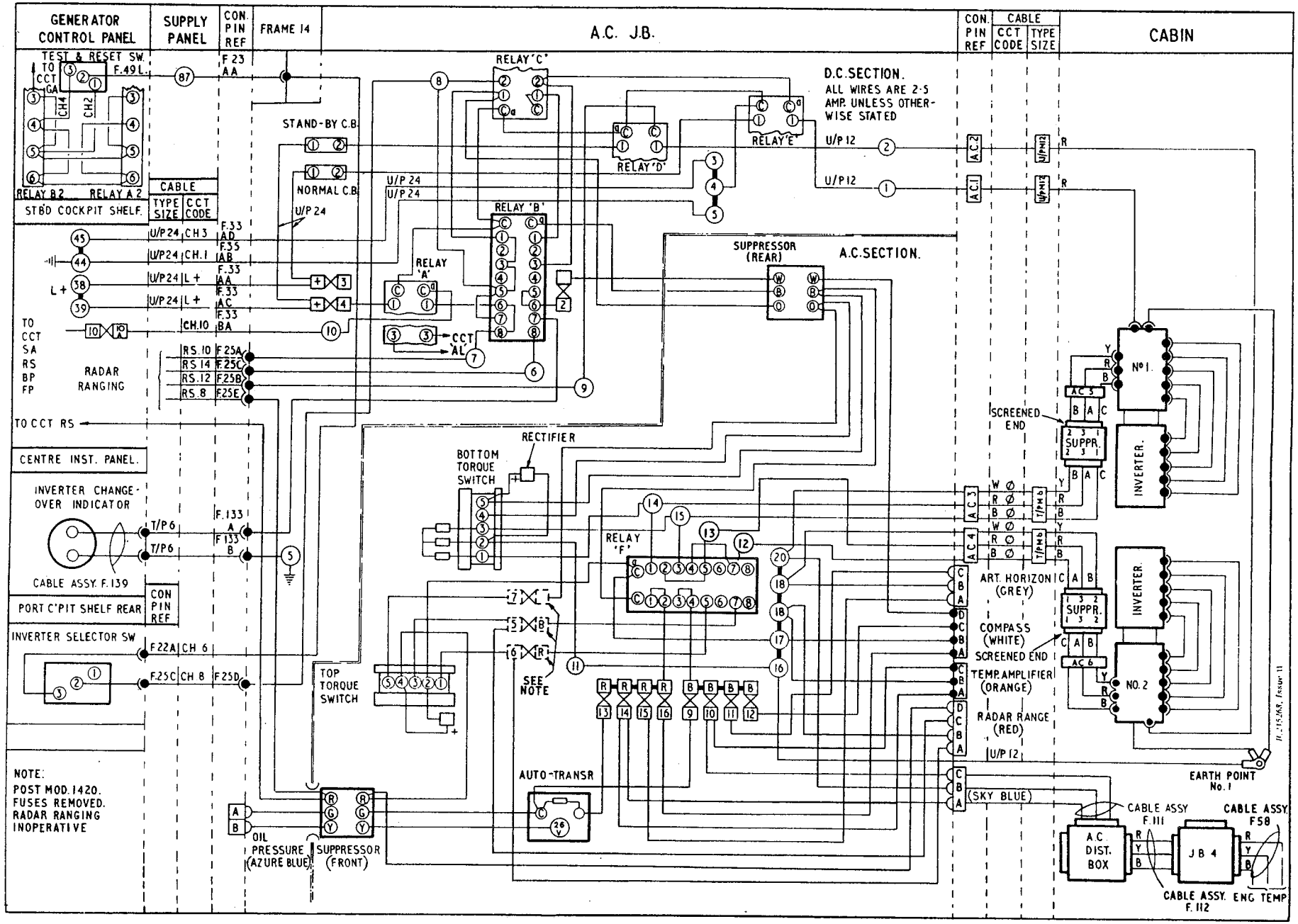

Fig. 4 A.C. supplies routeing (post Mod.1375)
◀ (minor amendment. Mod.1420 added) ▶