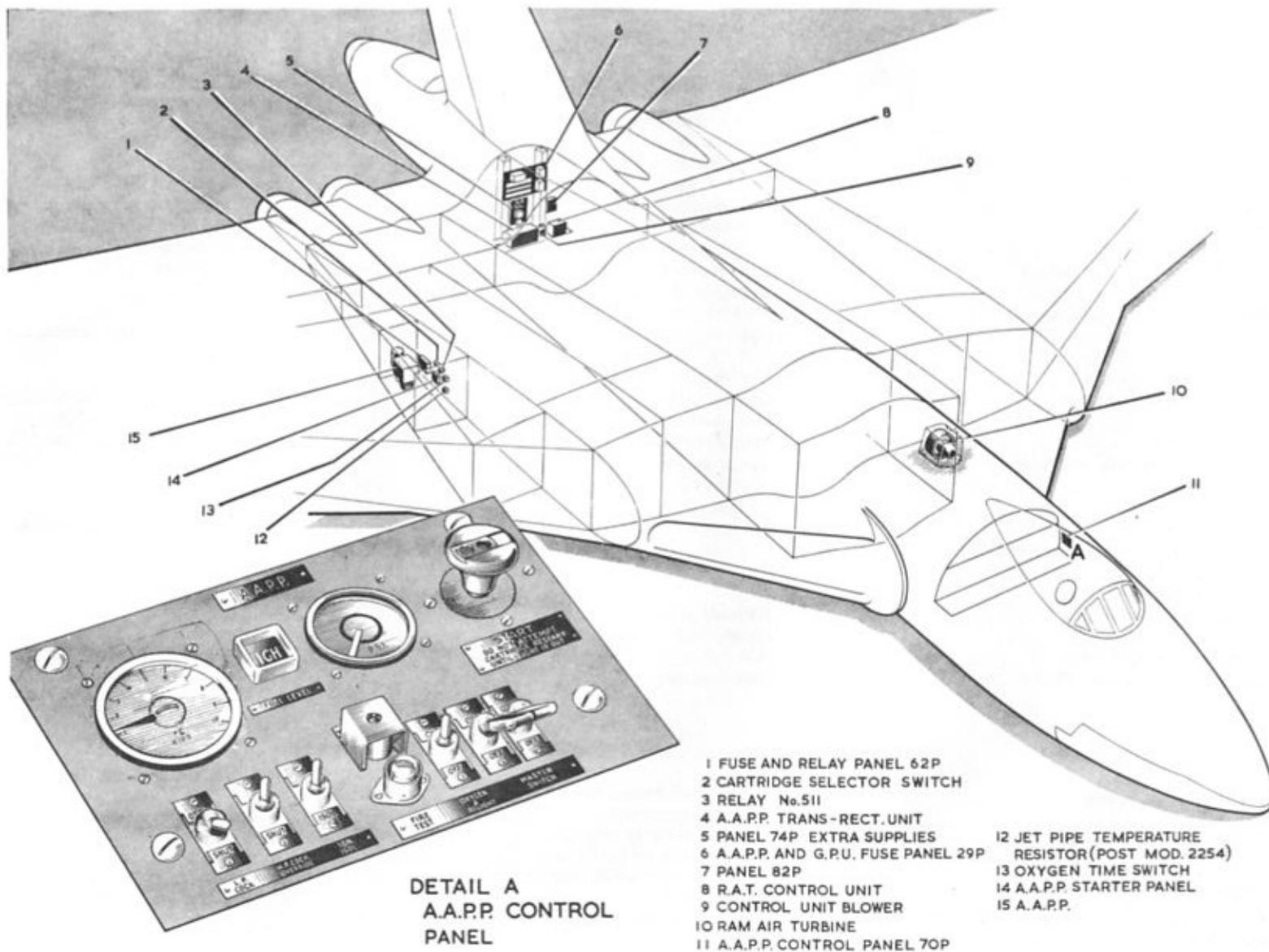


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DETAIL A
A.A.P. CONTROL
PANEL

- 1 FUSE AND RELAY PANEL 62P
- 2 CARTRIDGE SELECTOR SWITCH
- 3 RELAY No. 511
- 4 A.A.P. TRANS-RECT. UNIT
- 5 PANEL 74P EXTRA SUPPLIES
- 6 A.A.P. AND G.P.U. FUSE PANEL 29P
- 7 PANEL 82P
- 8 R.A.T. CONTROL UNIT
- 9 CONTROL UNIT BLOWER
- 10 RAM AIR TURBINE
- 11 A.A.P. CONTROL PANEL 70P
- 12 JET PIPE TEMPERATURE RESISTOR (POST MOD. 2254)
- 13 OXYGEN TIME SWITCH
- 14 A.A.P. STARTER PANEL
- 15 A.A.P.

Fig. 1 Location of equipment

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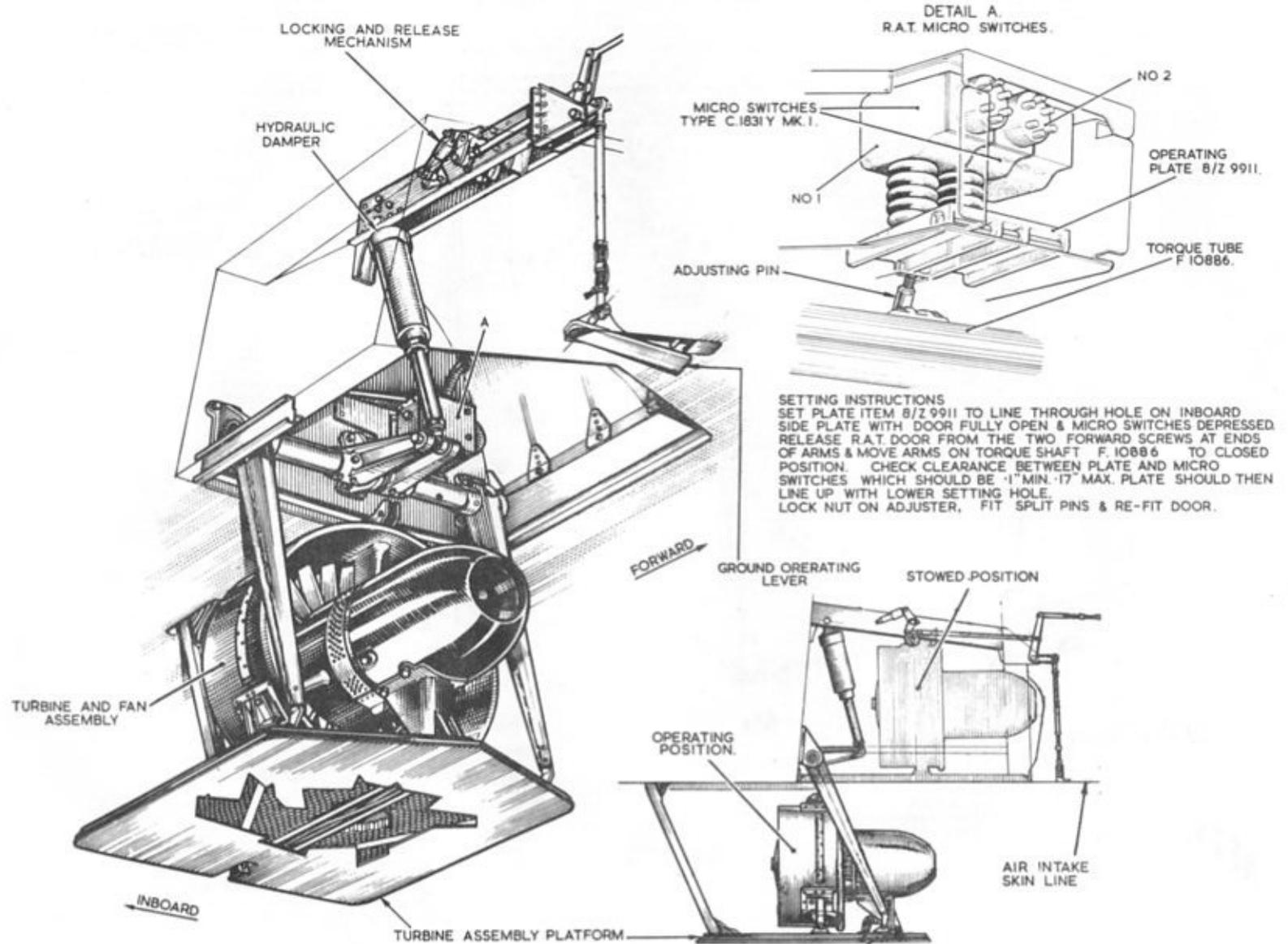


Fig.2 Ram air turbine

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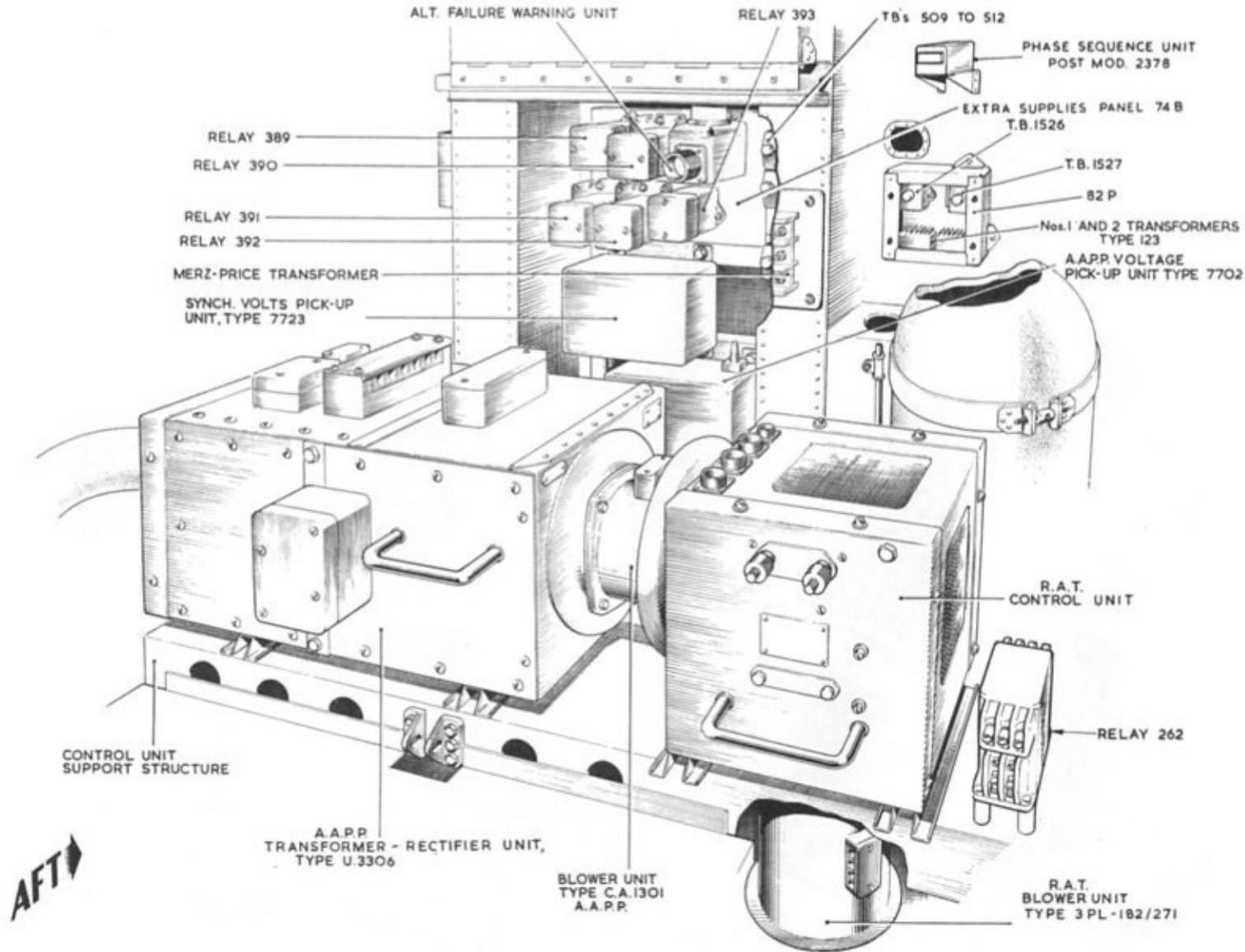


Fig. 3 Equipment in power compartment

▶ R.A.T. control unit type deleted ◀

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Introduction

1. This chapter provides descriptive and servicing information on the aircraft's a.c. emergency supplies. Modifications embodied are shown annotated on the appropriate illustrations.

2. Location illustrations of the equipment are included along with theoretical circuit diagrams. The associated routing charts are provided at the end of the text.

RAM AIR TURBINE**General**

6. The R.A.T., Plessey Type TRA170/26 is a ram air driven alternator with an output of 17 kW at 200 ± 4 volts, 3-phase, 400 ± 20 Hz within the height range 60 000 to 20 000 ft. throughout 365 to 250 knots I.A.S. or 0.95 to 0.85 I.M.N. Frequency is controlled by a mechanical governor, and voltage is controlled by a transducer circuit. On load, the frequency may drop by 2-3 Hz.

7. The R.A.T. is fitted in a compartment on the port side of the aircraft below the engine air intakes (fig.2) and is brought into operation when ejected into the slipstream. Ejection is effected by pulling a release handle above the pilots' coaming and would be selected instantly should failure of the four main alternators occur. A ground release lever, fitted flush with the aircraft skin, is located close to the R.A.T. stowage.

8. Since this power supply is for use only under extreme emergency conditions, no protection devices are incorporated in the circuit. Initial excitation of the alternator field is made from the vital busbar fuse 813 in 19P. The R.A.T. is fully described in A.P.105C-1005-16A. Details of the mechanical ejection system are contained in Book 1, Sect.3, Chap.11 of this publication.

3. Two alternative sources of a.c. power are available for use in an emergency. These are the Ram Air Turbine (R.A.T.) and the Auxiliary Airborne Power Plant (A.A.P.P.). Although each can be used independently, the system is electrically interlocked to prevent the power supplies being paralleled with each other, the ground power supplies or the main alternators.

4. Visual indication of the aircraft busbar

DESCRIPTION AND OPERATION**Main alternator failure**

9. Assuming failure of the four main alternators above 40 000 ft., the pilot will operate the release handle to lower the R.A.T. into the slipstream. With the R.A.T. extended, two micro switches are operated to perform the following functions:-

- (1) Initially excite the R.A.T. alternator field. The R.A.T. will thus immediately be ready to accept loads.
- (2) Shed all non-essential loads (Chap.6). This action also prepares the cartridge starting circuit for the A.A.P.P. (para 42).

Indication that the R.A.T. is connected to the synchronising busbar is given by the R.A.T. magnetic indicator on 10P.

Voltage and frequency check

10. The R.A.T. voltage and frequency can be checked by pressing the pushbutton on 10P, labelled R.A.T. TEST. This will connect the output via the R.A.T. control unit (plug 1, pin G) to the synchronising busbar voltmeter and frequency meter. Note that the voltmeter reading will be phase-to-earth, i.e., 115-volts.

system showing the connection of power sources is presented by a mimic busbar plan with magnetic indicators on the alternator control panel 10P. Starting controls and indicators for the A.A.P.P. are located on 70P.

5. Necessary cross references are made to the main generation system in Chapter 2, which should be studied in conjunction with this chapter.

Control unit

11. The output voltage is controlled by a control unit, Type U3702/3, or 3C (Pre-Mod 2503), Type U3702/4 or 4C (Post Mod 2503) which employs a transducer circuit, and is fitted in the power compartment (fig.3). The supply to initially excite the alternator field is fed through the control unit via plug 4, pin B, and plug 2, pin D. A full description of the control unit is contained in A.P.113D 07123-1.

12. Cooling air for the control unit is provided by a 200-volt, 3-phase blower unit, Plannair Type 3PL182/271, mounted underneath the control unit. The blower unit motor is fed from fuses 41R, Y, B via relay 262, which is energised to switch on the blower by the No.2 R.A.T. micro switch when the R.A.T. is lowered.

Synchronising voltage pick-up unit

13. A synchronising V.P.U., Type AE7723, fitted on 74P, ensures that the R.A.T., A.A.P.P. and G.P.U. cannot be paralleled with the main alternators or with each other (para 3). The relay coils of the V.P.U. are fed from synchronising busbar via fuses 167-168 (Chap.2, fig.12), so that any 200-volt supply connected to the busbar will energise the V.P.U. to open its contacts and, by subsequent circuit action, prevent other supplies reaching the busbar.

Circuit operation

14. Assuming that the four main alternators

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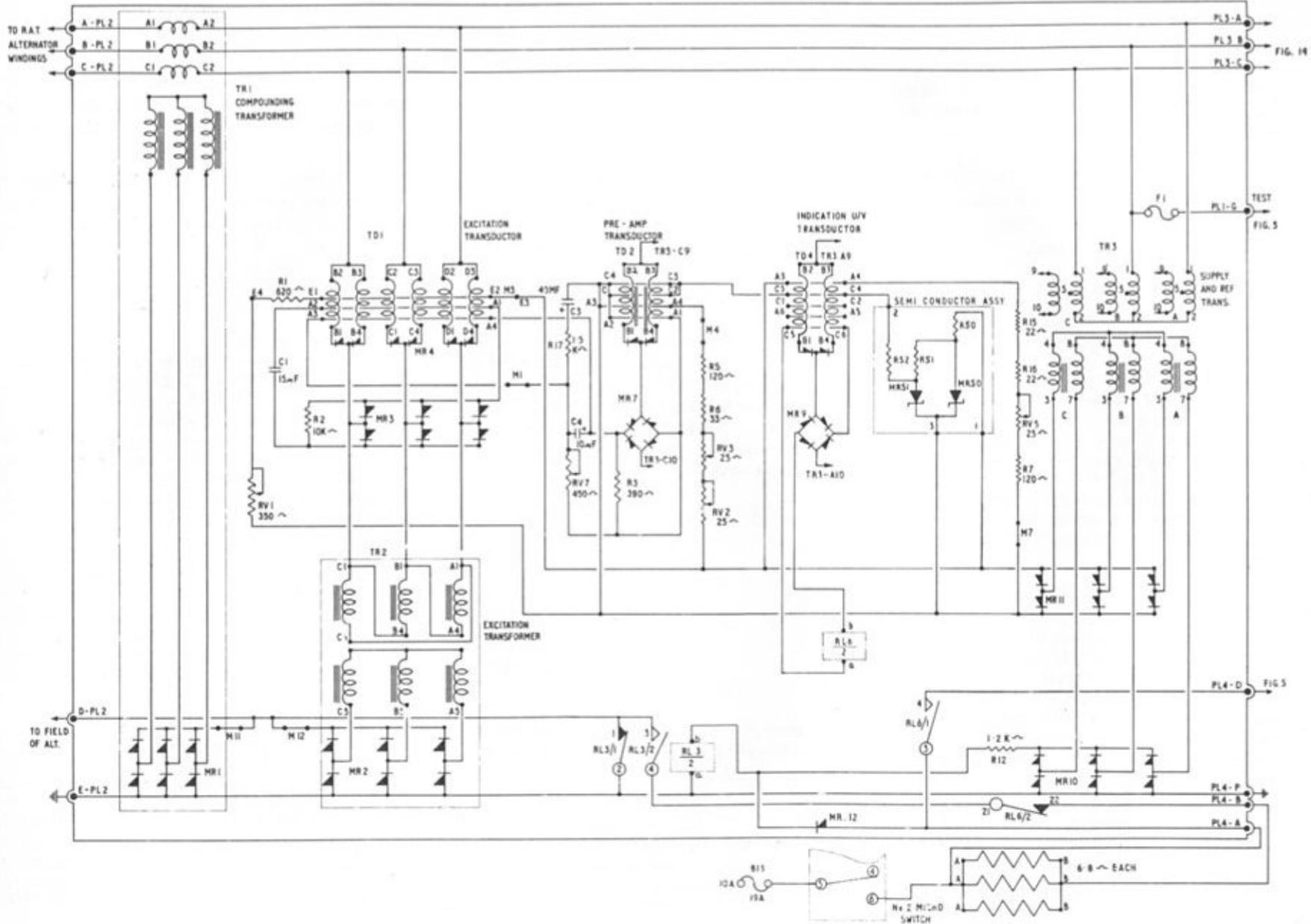


Fig 4 R.A.T. control unit Type U3702/3 or U3702/3C

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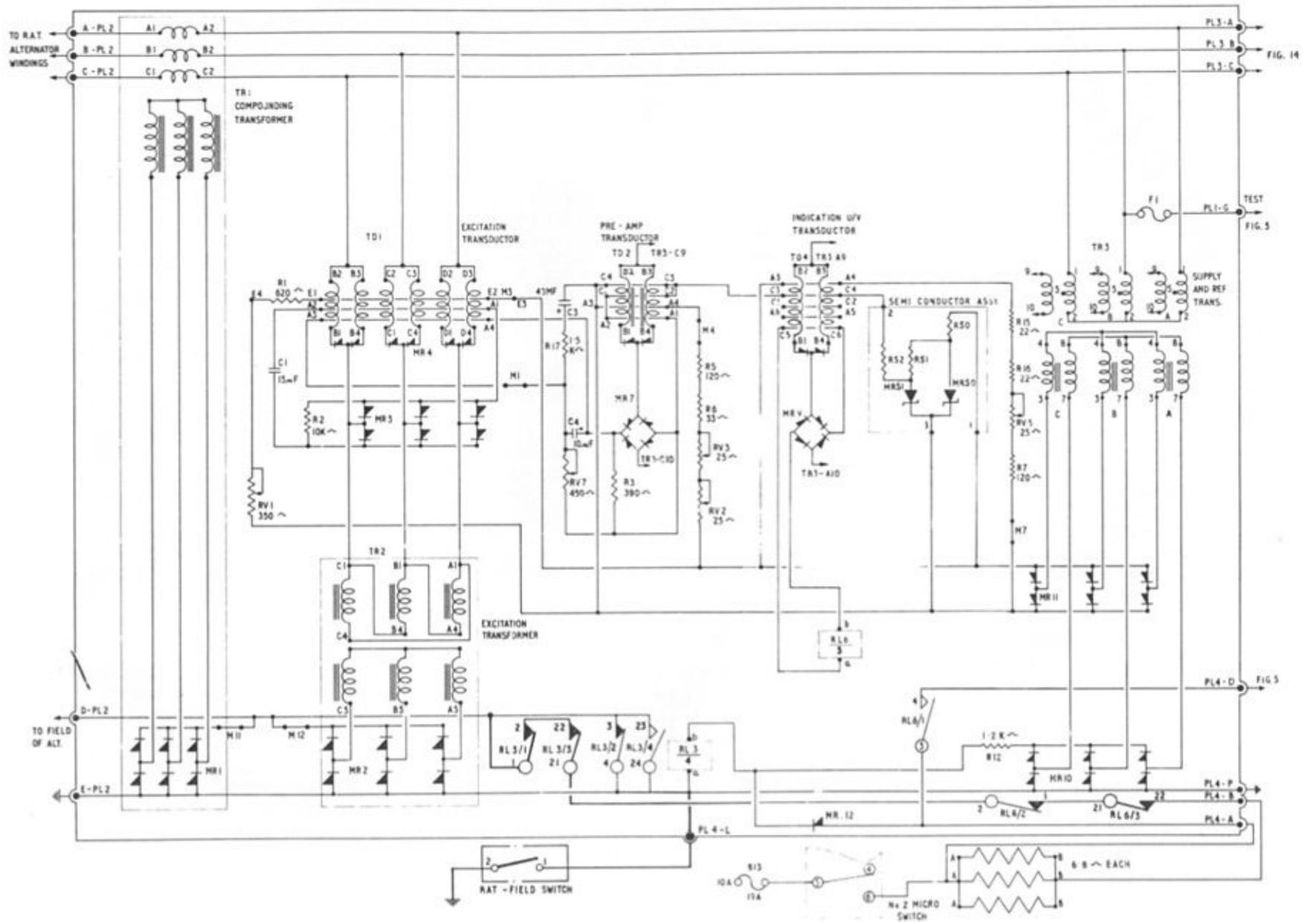


Fig 4A R.A.T. control unit. Type U3702/4 or U3702/4C
SEM/Vulcan/D41/STC (Mod 2503) 4

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have failed and that the R.A.T. has been ejected, the R.A.T. micro switches will be operated to make across contacts 2-3 and 5-6 (Chap.6). This action will connect a supply from fuse 813 (fig.4 or 4A) across the No.2 micro switch contacts 5-6 the resistor bank, plug 4, pin B, contacts 22-21 and 1-2 of RL6, contacts 21-22 and 2-1 of RL3 and plug 2, pin D to flash the alternator field. At the same time a supply will be made across contacts 2-3 of each micro-switch to trip the load shed contactors (relays 452 port and 451 starboard) which, in turn, will de-energize relays 559 and 560 (Chap.6). All non-essential loads will be shed and the cartridge starting circuit for the A.A.P.P. will be prepared (para 42).

15. With the R.A.T. alternator energized, a supply will be made from plug 4, pin D of the control unit (fig.5), contacts 390/3 and 391/2, contacts I-J of the synchronizing V.P.U. (de-energized) and contacts 13/4, to close and latch in the R.A.T. circuit breaker (relay 15) and bring the R.A.T. on the synchronizing busbar via the control unit. The synchronizing V.P.U. will now be energized from the R.A.T. output.

16. With the R.A.T. circuit breaker closed i.e., the main contacts connecting the supply to the synchronizing busbar, the auxiliary contacts will be operated as follows:-

- (1) Contacts 15/1 will close to energize the R.A.T. indicator on 10P, showing connection to the synchronizing busbar.
- (2) Contacts 15/2 will open to isolate the synchronizing monitor unit.
- (3) Contacts 15/5 will open to isolate the close coil of the A.A.P.P. circuit breaker.

16A. Should a serious overvoltage condition occur the R.A.T. output can be reduced to near zero by placing the R.A.T. field switch to the off position. This action completes the circuit from fuse 813 via plug 4, pin A, RL3 coil,

R.A.T. field switch to earth. Energizing RL3 makes contacts 3-4 and 23-24 in parallel connecting the R.A.T. field (plug 2 pin D) to earth via plug 2, pin E and plug 4 pin P in parallel. Contacts 1-2 and 21-22 of RL3 open to isolate the field flashing circuit.

Automatic trip

17. The system is arranged so that should the output from No.2 alternator be regained and switched on line, the R.A.T. will be automatically tripped from the synchronizing busbar and replaced by No.2 alternator. With No.2 alternator control switch placed to ON, the No.2 'A' breaker will close and the circuit action will be as follows:-

- (1) Relay 391 (fig.5) will be energized via contacts 3 of No.2 'A' breaker (Chap.2, para 68).
- (2) Contacts 391/2 will open and 391/1 will close completing the supply from plug 4, pin D of the R.A.T. control unit, via contacts 390/3, to trip the R.A.T. circuit breaker.
- (3) No.2 'S' breaker will then be energized to connect No.2 alternator to the synchronizing busbar (Chap. 2, para 56).

18. The R.A.T. will also be automatically tripped from the synchronizing busbar and replaced by the A.A.P.P. when the A.A.P.P. ON pushbutton is pressed (para 67).

Extra supplies trip

19. Should the output from a main alternator other than No.2 be regained (i.e., No.1, 3 or 4 alternator), the R.A.T. must be tripped by using the extra supplies trip pushbutton on 10P (para 70) in order to switch the main alternator on to the synchronizing busbar. A supply to trip the R.A.T. circuit breaker will then be fed from fuse 482 via contacts 390/2. Note that the

extra supplies trip pushbutton should be pressed at the same time as the alternator selector switch, as instructed on the label below the selector switch on 10P.

General

20. The A.A.P.P. is fitted in a compartment aft of the starboard main wheel bay, and is essentially a gas turbine engine coupled to a 40 kVA alternator delivering 200-volt, 3-phase, 400 Hz. Voltage is controlled by a carbon pile regulator, which forms part of a transformer-rectifier unit, and frequency is controlled by a governor on the turbine. A full description of the A.A.P.P. is contained in A.P.102F-0204-16A the alternator, Type 155, is dealt with in A.P. 113A-0311-1.

21. The A.A.P.P. is used primarily to provide electrical power for the aircraft services in emergency conditions, i.e., to replace the R.A.T. on the synchronizing busbar when the aircraft has dropped to below 30 000 ft. In addition, however, the power plant may be used to provide electrical power during ground servicing operations should ground power supplies not be available. Also, bleed air can be obtained from the engine for auxiliary A.V.S. when the aircraft is on the ground.

Sump heating

22. To make starting easier, a 600-watt immersion heater with thermostat, maintains the engine oil temperature at 50 deg.C while the power plant is not in use. The heater is fed from the 200-volt, 3-phase supply and is located, with the thermostat, in the oil sump. When the A.A.P.P. is started and running, the heater will be automatically switched off (para 50), the thermostat however, will then control the operation of an oil cooler actuator via relay 488 (para 26).

Sump temperature indicator

23. An oil temperature indicator, is fitted on the oxygen charge panel in the A.A.P.P. fuel tank compartment and connects to a temperature

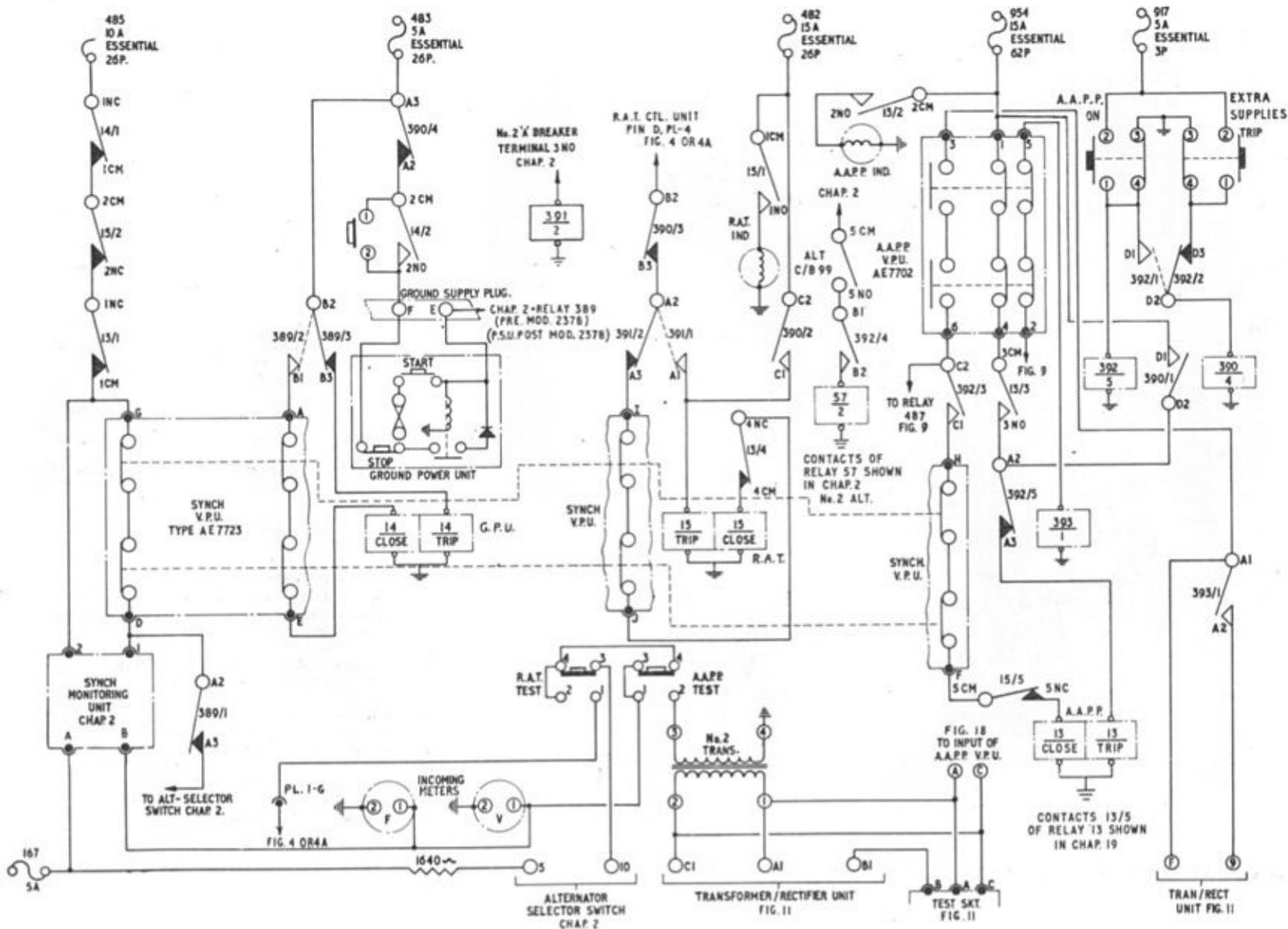
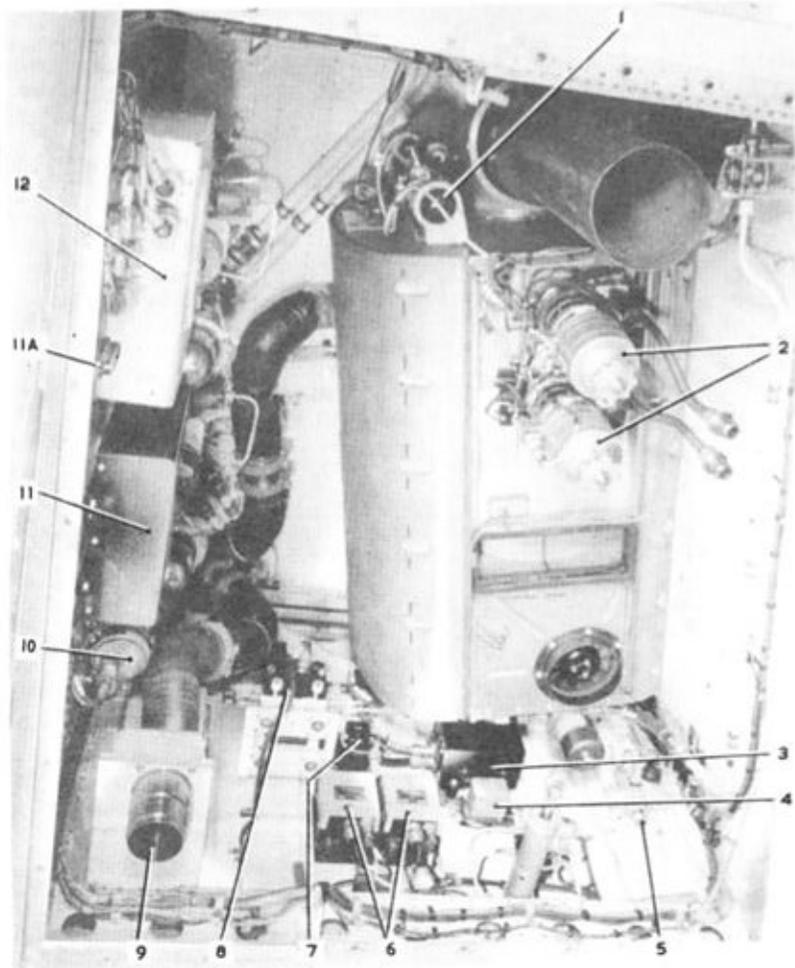


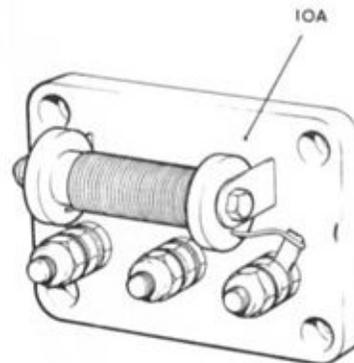
Fig. 5 Electrical interlocking

► Fig. No. cross references amended ◄

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FOR VIEW OF EQUIPMENT ON PORT SIDE OF COMPARTMENT SEE FIG. 8



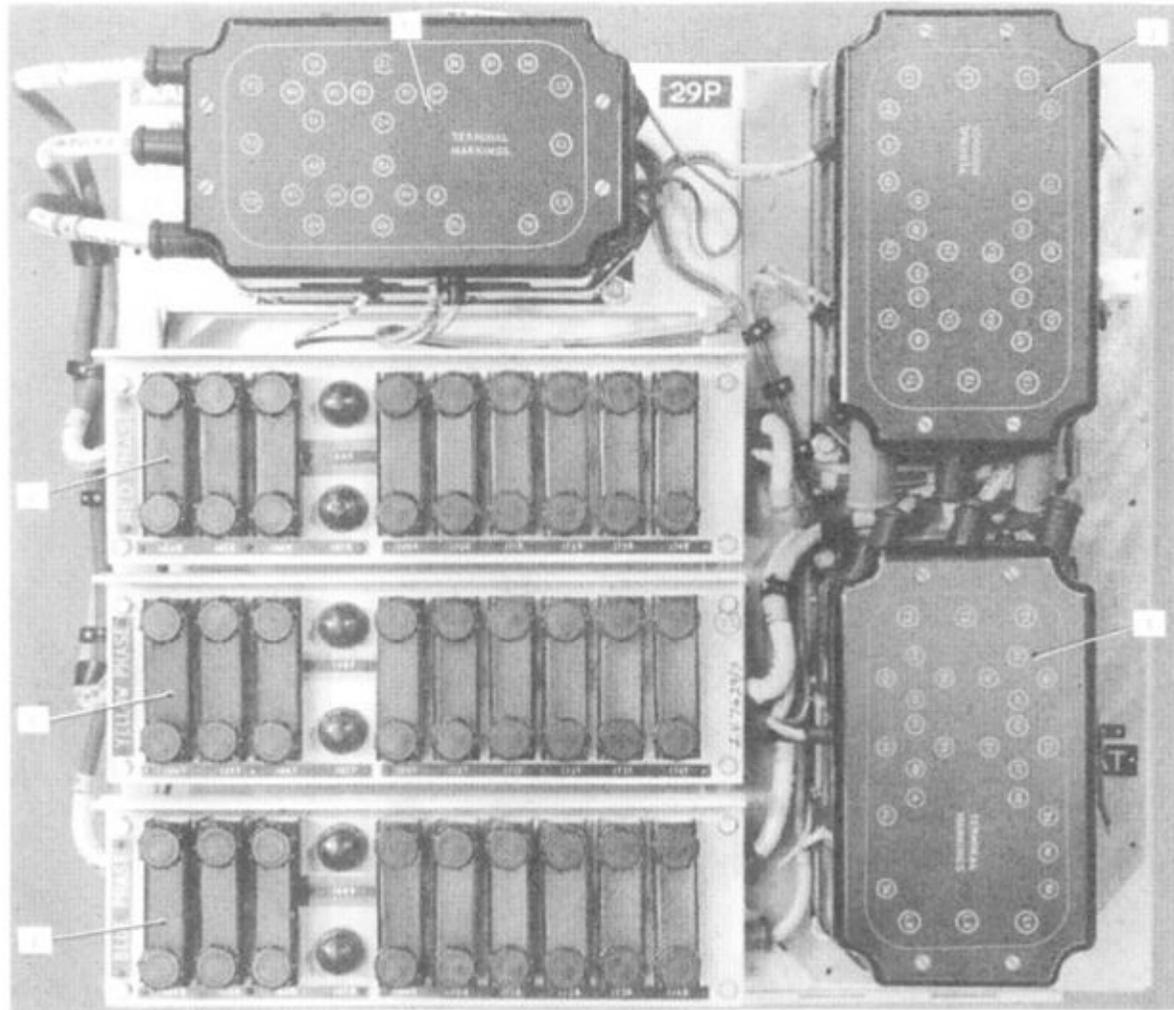
JET PIPE TEMPERATURE RESISTOR MOD 2254

KEY

- 1 OXYGEN BOTTLE
- 2 CARTRIDGE BARRELS
- 3 HIGH ENERGY IGNITION UNIT
- 4 RELAY D1740 (NUMBER 3, 4 AND 6 STARBOARD TANKS FIRE EXTINGUISHERS)
- 5 SCOOP SELECTOR VALVE
- 6 NUMBER 4, AND 6 STARBOARD TANKS FUEL CONTENTS AMPLIFIERS
- 7 RELAY 545
- 8 FIRETEC UNIT
- 9 GROUND AIR STARTER CONNECTION
- 10 SERVO POTENTIOMETER PRE. MOD 2254
- 10A J.P.T. RESISTOR POST MOD. 2254
- 11 STARTER PANEL, TYPE U4201
- 11A RELAY 821
- 12 FUSE AND RELAY PANEL 62P

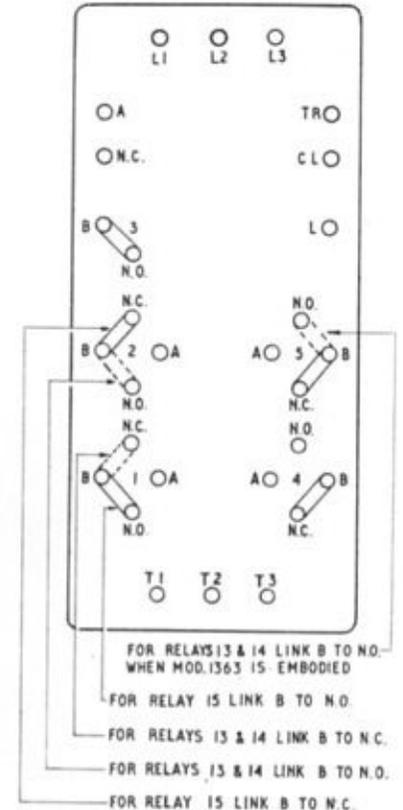
Fig. 6 A.A.P. installation

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KEY

- | | | |
|----------------------------------|----------------------------------|-----------------------------------|
| 1 A.A.P. CIRCUIT BREAKER (NO 13) | 3 R.A.T. CIRCUIT BREAKER (NO 15) | 5 FUSES 164 TO 174 (YELLOW PHASE) |
| 2 G.P.U. CIRCUIT BREAKER (NO 14) | 4 FUSES 164 TO 174 (BLUE PHASE) | 6 FUSES 164 TO 174 (RED PHASE) |



CIRCUIT BREAKER, TYPE AEC 681001

LINK SETTINGS FOR R.A.T., A.A.P.P.
AND G.P.U. CIRCUIT BREAKERS
NOTE - MOD. 975 PROVIDES FOR
CIRCUIT BREAKERS WHICH DO
NOT REQUIRE LINK SETTING

Fig 7. Main circuit breakers and fuses.

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bulb in the sump. The indicator enables the ground crew to check the sump temperature during servicing periods.

Controls

24. The controls and indicators for the a.c.

emergency supplies are located on panels 10P and 70P. The main circuit breakers and feeder fuses are fitted on 29P in the power compartment (fig.7). Prior to Mod.975, circuit breakers, Type 6Y No.2 are fitted, which have shorting links to set the auxiliary contacts to normally open or closed. The link settings are

shown in fig.7, and it is important, when changing a circuit breaker, to ensure that the links are correctly set otherwise the interlock system will be disturbed. Post Mod.975 circuit breakers Type 6Y No.4 are fitted, for which shorting links are not required. Both pre and

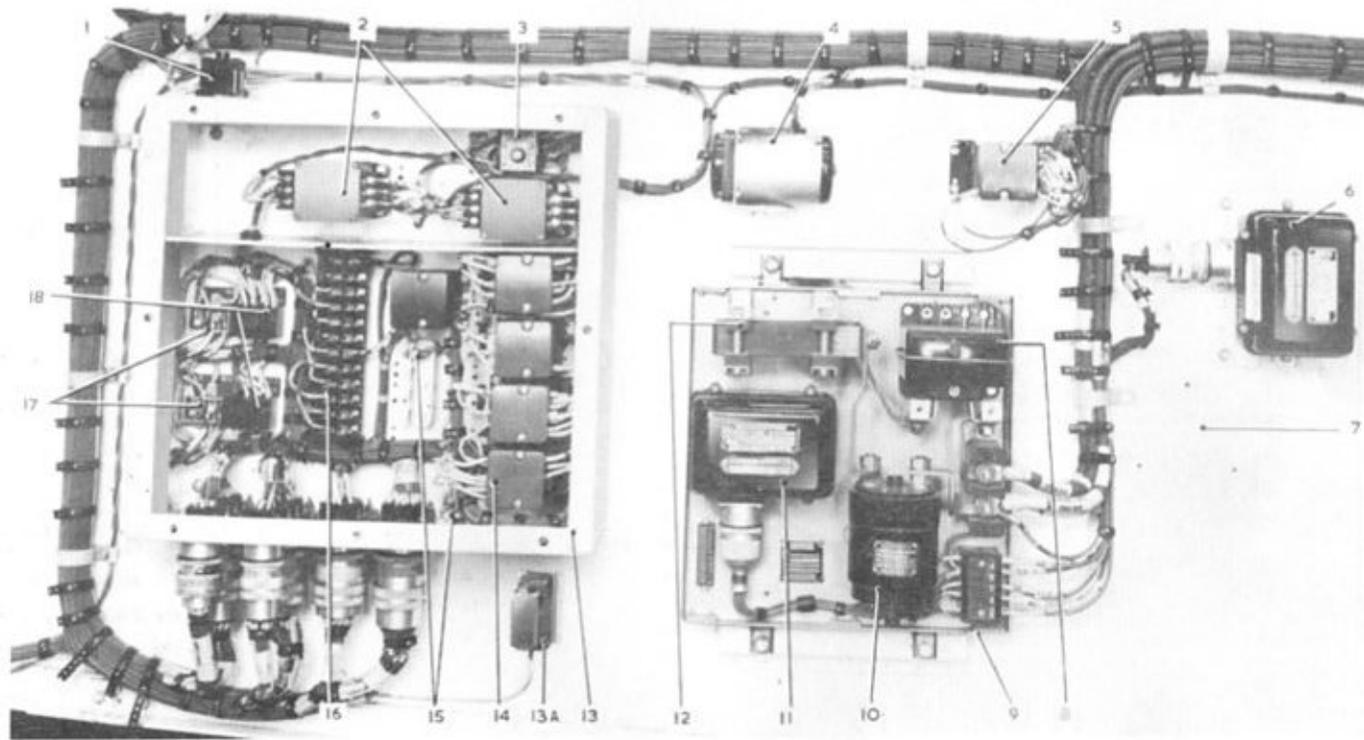
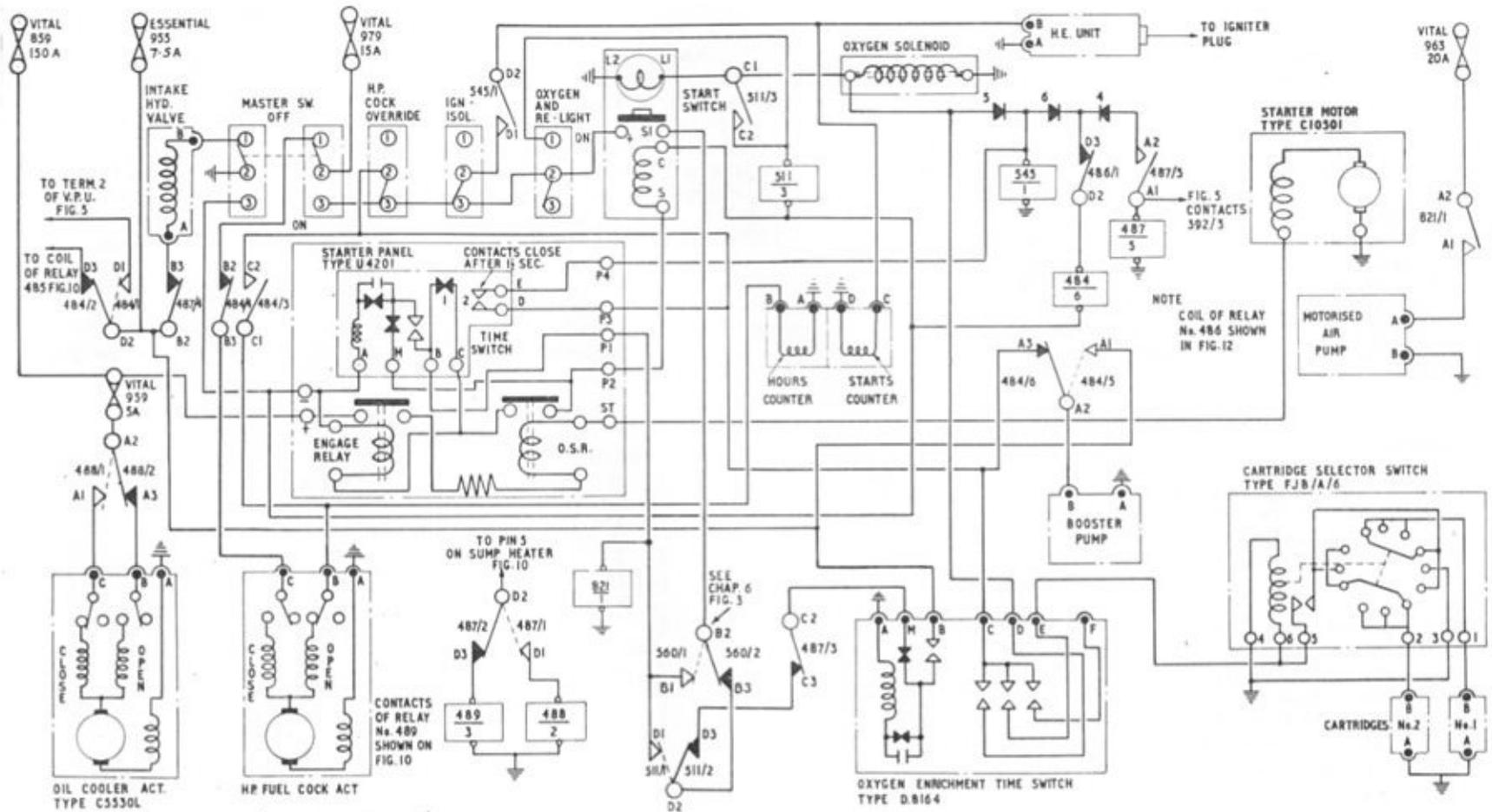


Fig.8 Starting equipment

- | | | |
|---------------------------------------------|-------------------------------|------------------------------------|
| 1. T.B.2150 | 8. OVERSPEED RELAY | 13A. RELAY 821 |
| 2. RELAYS 485 AND 489 | 9. STARTER PANEL, TYPE U4201 | 14. RELAYS 483, 484, 486, 487, 488 |
| 3. T.B.904 | 10. ENGAGE RELAY | 15. RECTIFIERS 4, 5 AND 6 |
| 4. CARTRIDGE SELECTOR SWITCH | 11. TIME DELAY SWITCH | 16. FUSES 952 TO 963 |
| 5. RELAY 511 | 12. STARTING LIMITER RESISTOR | 17. T.B.902 AND 905 |
| 6. OXYGEN TIME-DELAY SWITCH | 13. FUSE AND RELAY PANEL 62P | 18. T.B.903 AND 908 |
| 7. JET PIPE TEMP. RESISTOR LOCATION (FIG.6) | | |

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THIS CIRCUIT INCORPORATES
MODS. 1271, 1505, 1557, 2163

Fig 9 A.A.P.P. starting controls

► Fig No and title amended ◀

post Mod. conditions are shown on the appropriate routing charts, but on the theoretical circuit diagrams contacts are shown prior to the Mod.

Oil cooler actuator

25. Oil cooling is effected by an air cooler, which houses a 28-volt d.c. actuator coupled to a butterfly valve. The valve operates at the base of the air cooler to control the flow of air from a blower unit driven from the engine.

26. The actuator will open or close the valve depending on the operation of the sump heater thermostat (para 22). With the engine running, an increase in temperature above 50 deg.C will de-energize relay 488 to operate the actuator and open the valve. Conversely, a decrease in temperature below 50 deg.C will energise the relay to close the valve.

Starting systems

27. Two starting systems are provided, an electrical starter for normal conditions and a cartridge starter for emergency conditions; current for the surface discharge ignition plug is supplied by a high energy ignition unit.

Starter control panel, Type U4201

28. A single stage starter panel, comprising a time delay switch, engage relay and an over-speed relay is fitted in the A.A.P.P. compartment (fig.8). The time delay switch is energized by the start switch on the A.A.P.P. control panel 70P (fig.1), and operates to close the relays and connect the aircraft 28-volt d.c. supply via fuse 859 to the starter motor of the A.A.P.P. At the same time a supply is made to energise the high energy ignition unit. The starter panel is fully described in A.P.113D-0014-1.

29. The cartridge starting equipment is provided for emergency use whilst the aircraft is airborne and ensures that the A.A.P.P. is brought to fully operational speed in the

shortest possible time. Starting power is provided by two cordite cartridges independently fired to allow for two possible starts.

Cartridge selection

30. Cartridge selection and firing is controlled by the operation of a time switch fitted in the A.A.P.P. compartment (fig.8). This switch also controls the opening of an oxygen valve (para 33). A cartridge selector switch, Type FJB/A/6, is connected to the time switch and is operated to select and fire a cartridge. The time switch is started by operation of the master and starting switches on panel 70P.

Cartridge heating

31. To ensure that the cartridges will function at extremely low ambient temperatures, a

thermostatically controlled heater mat of 60 watt rating is bonded to the outside of each cartridge barrel, to maintain an external surface temperature of 20 deg.C. The heater mats are supplied from the aircraft 200-volt, 3-phase supply from panel 62P and are automatically switch off once the A.A.P.P. is running.

Oxygen enrichment

32. To ensure rapid starting at high altitudes, provision is made to feed oxygen into the combustion chamber from two storage bottles mounted on the rear end of the power plant casing.

33. In operation, a time delay switch (para 30) is actuated to energize a sol-

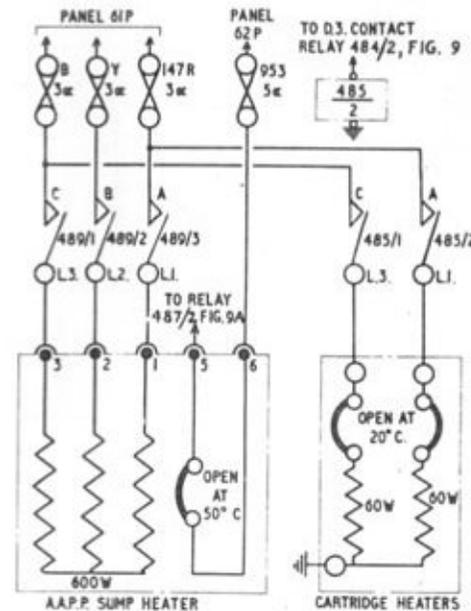


Fig.10 Sump and cartridge heaters

► Minor correction ◀

enoid valve and allow oxygen to enter the combustion chamber. The valve is automatically closed when the time switch runs down, (11 secs.). Oxygen flow can also be controlled via the oxygen and relight switch when making an electrical start.

Low pressure fuel cock

34. A low pressure cock fitted into the fuel line, (after the tank but before a high fuel pressure cock), is closed or opened by the operation of an actuator. Control is by means of a switch on panel 70P. The L.P. cock will be automatically closed when the fire system operates or on crash landing, (para.77).

High pressure fuel cock

35. A high pressure fuel cock, opened or closed by an actuator, controls the flow of fuel into the burner of the A.A.P.P. Operation of the master switch to ON and pressing the A.A.P.P. start switch (panel 70P) will automatically open the H.P. cock.

Booster pump, Type PDC-20-Mk.2

36. Fitted into the fuel tank is an electrically operated fuel booster pump. This pump is started whenever the master switch is placed to ON.

Jet pipe temperature

37. Four jet pipe thermo-couples, Type F1079/6, 7, 8 and 9, are mounted at equal distances around the exhaust cone. The thermo-couples are wired in parallel and connected via a resistor to a direct reading

indicator (post Mod.2254), Type S.218.5.70, mounted on panel 70P.

Air bleed components

38. As indicated in para.21, the secondary purpose of the A.A.P.P. is to provide a supply of compressed air to ducting in the aircraft for ground starting the main engines. This is achieved by operating the A.A.P.P. air bleed valves and the variable diffuser valves in a pre-determined sequence by two actuators. The actuators are operated via the aircraft 28-volt, d.c. system. Full details will be found in Chap.8 of this book.

Oil pressure

39. Oil pressure is transmitted to an indicator, fitted to panel 70P, by means of a pressure transmitter, Type S122-4-45, secured to the oil cooler. The transmitter consists of a bellows and spring assembly controlling a contact wiper arm which wipes over a potentiometer, this variation is recorded as an oil pressure reading on the indicator.

Tank fuel contents

40. The fuel contents of the tank are shown by a magnetic indicator on panel 70P. Two float switches, one for high level and one for low level are fitted into the tank. These switches are wired in such a way that when the tank is full, the magnetic indicator displays the word HIGH. When approximately two gallons remain in the tank, the word LOW will be displayed. Quantities in between the two levels, or when no supply is switched on, will de-energise the indicator to show black. Fuel system details are contained in Sect.4, Chap.2.

A.A.P.P. starting - circuit operation -

41. The following circuit operation describes the two methods of starting the A.A.P.P. (1) by cartridge start and (2) by normal electrical start, and reference should be made to fig. 9 which incorporates Mods.1271, 1332, 1505, 1557 and 2163. In each case the number of starts and engine hours run are recorded on two counters located on the forward end of the A.A.P.P. package. The control switches are fitted on panel 70P and are as follows:-

Master switch	Two single-pole 2-position switches, labelled MASTER SWITCH, ON - OFF.
H.P. cock	Single-pole, 2-position switch labelled H.P. COCK OVERRIDE, SHUT, spring loaded to central ON position.
Ignition isolation	Single-pole, 2-position switch labelled IGN. ISOL., - ISOL., spring-loaded to central ON position.
Oxygen and relight	Single-pole, 2-position switch labelled OXYGEN AND RE-LIGHT, ON OFF.
L.P. cock	Single-pole, 2-position switch labelled L.P. COCK, OPEN - SHUT.
Starting	Magnetically held-on push-switch labelled START, DO NOT ATTEMPT CARTRIDGE RE-START UNTIL LIGHT IS OUT.

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Cartridge starting

42. In order to effect a cartridge start, the associated load shed control relay 560 (Chap.6) must be de-energised to close contacts 560/2 (B2 - B3). This is done either by ejecting the R.A.T. or by pressing the non-essential supplies switch on 10P to TRIP.

43. The master switch should first be placed to ON. The earth connected to one side of the switch will then be changed over from terminal 1 to 3. This action will de-energise the air intake hydraulic valve, fed from fuse 955 via contacts 487/4, to lower the intake (Sect.3, Chap.11) and provide an earth for relay 484. (The earth is also completed to other parts of the circuit required for normal electrical starting). On the other side of the master switch, the supply from fuse 979 via contacts 484/4 to the close field of the H.P. cock actuator will be broken, and made direct from the fuse to the H.P. cock override, ignition isolation, oxygen and start switches. The booster pump will now run, being supplied via the H.P. cock override switch and contacts 484/6.

44. When the start switch is pressed, a supply from fuse 979 will be made across the switch contacts via contacts 560/2, 511/2 and 487/3 to energise the oxygen enrichment time switch at pin M. The time switch contacts at pin B will then close to provide an alternative energising supply from fuse 955, and the start switch can be released.

45. Operation of the time switch will close the internal contacts at pins C-D-E to connect the supply from fuse 979 across pins C-D to light the start switch indicator lamp, open the oxygen valve, energise relay 545 and, via contacts 486/1, energise relay 484. At the

same time, the supply across pins C-E will be fed to terminals 5 and 6 of the cartridge selector switch to select and fire one cartridge.

46. Contacts 545/1 will close to energise the H.E. ignition unit and the starts counter from fuse 979. Contacts 484/6 will open and contacts 484/5 will close to change over the supply to the booster pump from fuse 979 (vital) to fuse 955 (essential).

47. Contacts 484/4 will open to isolate the close field and contacts 484/3 will close to energise the open field of the H.P. cock actuator, thus opening the cock to admit fuel to the combustion chamber. The hours run counter will also be energised.

48. Contacts 484/2 will open to de-energise relay 485 (fig.10) and switch off the cartridge heaters, and contacts 484/1 will close to energise relay 393 via contacts 2 - 5 of the A.A.P.P. voltage pick-up unit (fig.5). Contacts 393/1 will then close to initiate field flashing of the A.A.P.P. alternator (para.63).

49. After a period of 11 seconds approx., the time switch will complete its cycle to cut off the supplies to the start switch indicator lamp, oxygen valve, cartridge selector switch, H.E. ignition unit and starts counter via relay 545, and relay 484. A supply to maintain relay 484 energised however, will be fed from the output of the A.A.P.P. (para.50). The circuit will then be prepared for a second cartridge start if required (i.e. should the first start prove abortive).

50. When the A.A.P.P. is started and running, relay 487 will be energised (para.66) to result in the following:-

- (1) Contacts 487/2 will open to de-energise relay 489 and switch off the sump heater.
- (2) Contacts 487/1 will close to energise relay 488. Contacts 488/2 will open and 488/1 will close to shut the oil cooler valve. The valve is now under control of the sump heater thermostat via the contacts of relay 488.
- (3) Contacts 487/3 will open to isolate the oxygen enrichment time switch.
- (4) Contacts 487/4 will open to isolate the air intake hydraulic valve.
- (5) Contacts 487/5 will close to maintain relay 484 energised via contacts 486/1.

Electrical starting

51. The A.A.P.P. is normally started by the electrical starter motor, for which the sequence of operations is given in the following paragraphs. In this case no prior load shedding action (as for cartridge start, para.42) is necessary, but for this operation it is assumed, that load-shedding has taken place and that relay 560 is de-energised.

▶ 52. Reference to fig.9 will show that with the master switch placed to ON the following circuit action (as outlined in para.43) will result:- ◀

- (1) Earth connection to air intake hydraulic valve broken, and air intake lowered.

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- (2) Earth connected to starter panel, relays 484 and 511, and the start switch hold-in coil.
- (3) Supply from fuse 979 via contacts 484/4 to the close field of the H.P. cock actuator broken.
- (4) Supply from fuse 979 made to the H.P. cock override, ignition isolation, oxygen and start switches.

- (5) Supply from fuse 979 made via H.P. cock override switch and contacts 484/6 to run booster pump.

53. With the oxygen and relight switch now placed to ON, relay 511 will be energised. Contacts 511/2 will open to isolate the oxygen enrichment time switch and contacts 511/1 will close to prepare an energising path to the starter panel via contacts 560/2. Also, contacts 511/3 will close to light the start switch

indicator lamp, open the oxygen valve, energise relay 545 and, via contacts 486/1, energise relay 484.

NOTE...

When contacts 511/1 close, a supply is also available to energise relay 821 (Mod.2163). Contacts 821/1 close and complete the circuit to a motorised air pump via fuse 963 (vital).

54. Contacts 545/1 will close to energise the H.E. ignition unit and the starts

(Continued overleaf)

counter from fuse 979. Contacts 484/6 will open and contacts 484/5 will close to change over the booster pump supply from fuse 979 (vital) to fuse 955 (essential).

55. Contacts 484/4 will open to isolate the close field and contacts 484/3 will close to energise the open field of the H.P. cock actuator, thus opening the cock to admit fuel to the combustion chamber. The hours run counter will also be energised.

56. Contacts 484/2 will open to de-energise relay 485 (fig.10) and, switch off the cartridge heaters, and contacts 484/1 will close to energise relay 393 via contacts 2 - 5 of the A.A.P.P. voltage pick-up unit (fig.5). Contacts 393/1 will then close to initiate field flashing of the A.A.P.P. alternator (para.63).

57. When the start switch is pressed, a supply from fuse 979 will be made across the switch contacts via contacts 560/2 and 511/1 to terminal P1 on the starter panel. This will energise the engage relay via the time delay switch contacts 1 connected across terminals B-C, and a supply to the starter motor will be made from fuse 859 through the contacts of the engage relay, the limiting resistor and the coil of the overspeed relay. The overspeed relay will be energised to close its contacts and connect the supply to energise the time delay switch and the start switch hold-in coil. The start switch will thus be held in and the start cycle will commence.

58. After a period of 30 seconds, contacts 1 of the time delay switch will open to de-energise the engage relay and the start switch. The supply to the starter motor will thus be cut off and the start switch will be released to terminate the start cycle. Should the turbine reach self sustaining speed in less than 30 seconds, the reduced armature current of the starter motor will fail to retain the overspeed relay, which will open to

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terminate the start cycle. In either case the starter panel will be reset for the next start sequence.

59. With the engine started and running, the oxygen and relight switch should be placed to OFF to cut off supplies to the start switch indicator lamp, oxygen valve, H.E. ignition unit and starts counter via relay 545, and relay 484.

60. Relay 487 will be energised from the A.A.P.P. output (para.66), which will in turn maintain relay 484 energised via contacts 487/4. The circuit operation for relay 487 is given in para. 50.

61. The operation of the time delay switch contacts 2, connected across terminals D-E is used during the ground starting sequence, i.e. when oxygen is not used. This is described in the next paragraph.

Ground starting

62. Ground starting the A.A.P.P. is similar to normal electrical starting in flight, except that oxygen is not used. The oxygen and relight switch, therefore, is left in the OFF position and the start switch indicator lamp will be out. The supply to energise relays 545 and 484 is controlled by the time delay switch contacts 2, which close 1.5 seconds after the start switch is pressed.

Field flashing

63. Alternator field flashing is initiated during a start sequence when relay 484 is energised. A supply from fuse 955 will be made via contacts 484/1 and contacts 2 - 5 of the V.P.U. to energise relay 393 (fig.9 and 5). Contacts 393/1 will close to complete a supply from fuse 484 to the alternator field winding via pins 10 - 9 - F of the transformer-rectifier unit (fig.11). When the A.A.P.P. is started and running, the field will be energised by a rectified output from the alternator.

Voltage and frequency check

64. With the A.A.P.P. running, a check should be made to ensure that the output voltage and frequency is correct before switching the alternator on to the synchronising busbar. This is done by pressing the push-button on 10P, labelled A.A.P.P. TEST, which will connect the output to the synchronising busbar voltmeter and frequency meter. The output is connected to the meters via No 2 transformer in 82P (fig.3), so that the voltmeter reading will be the equivalent of phase-to-earth. Readings obtained should be 115 ± 3 volts and 400 ± 20 c/s.

65. During ground running of the A.A.P.P. the line voltage at 200 ± 5 volts, and frequency can be checked from a socket in the power compartment.

Switching on the A.A.P.P.

66. When the correct voltage and frequency is attained, the A.A.P.P. V.P.U. will be automatically energised (fig.5). Contacts 2-5 and 1-4 will then open to de-energise relay 393 and isolate the trip coil of the A.A.P.P. circuit breaker (relay 13) respectively. At the same time, contacts 3 - 6 will close to energise relay 487 from pin F of the transformer-rectifier unit (rectified output).

67. When the A.A.P.P. ON push-button at panel 10P is pressed, a supply from fuse 917 is connected via push-button contacts 2-1 to energise relay 392. The following action occurs:-

- (1) Contacts 392/2 will open and 392/1 will close to energise relay 390.
- (2) Contacts 390/4 will open to isolate pin F of the ground supply plug.
- (3) Contacts 390/3 will open to remove the supply from the close coil of the R.A.T. circuit breaker (relay 15),

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assuming that the R.A.T. was previously on the synchronising busbar.

- (4) Contacts 390/2 will close to trip relay 15 by a supply from fuse 482.
- (5) Contacts 390/1 will close to prepare a supply to the trip coil of relay 13 (para.70).
- (6) Contacts 392/5 will open to isolate the trip coil of relay 13.
- (7) Contacts 392/4 close to connect a supply from fuse 491 to energise relay 57 (See No.2 alternator interlocking control, Chap.2, Para.69).
- (8) Contacts 392/3 will close to connect the supply at contacts 3 - 6 of the A.A.P.P. V.P.U. (para.66), through contacts H-F of the synchronising

V.P.U. and contacts 15/5 to energise relay 13.

The A.A.P.P. ON push-button may now be released, and since the A.A.P.P. circuit breaker will remain latched in, the A.A.P.P. will be connected to the synchronising busbar and the synchronising V.P.U. will be energised from the A.A.P.P. output.

68. It will be seen that should a fault prevent the A.A.P.P. circuit breaker from closing, the R.A.T. circuit breaker will reclose as soon as the A.A.P.P. push-button is released. Also, should the A.A.P.P. V.P.U. inadvertently become de-energised, a supply from fuse 954 would be made across its contacts 1 - 4, contacts 13/3 and 392/5 to trip the A.A.P.P. circuit breaker.

69. With the A.A.P.P. circuit breaker closed, i.e. the main contacts connecting the supply

to the synchronising busbar, the auxiliary contacts will be operated as follows:-

- (1) Contacts 13/1 will open to isolate the synchronising monitor unit.
- (2) Contacts 13/2 will close to energise the A.A.P.P. indicator on 10P, showing connection to the synchronising busbar.
- (3) Contacts 13/3 will close to prepare the circuit to the trip coil of the circuit breaker via contacts 392/5.
- (4) Contacts 13/4 will open to isolate the close coil of the R.A.T. circuit breaker.
- (5) Contacts 13/5 will close to prepare the emergency hydraulic power pack circuit (Chap.19).

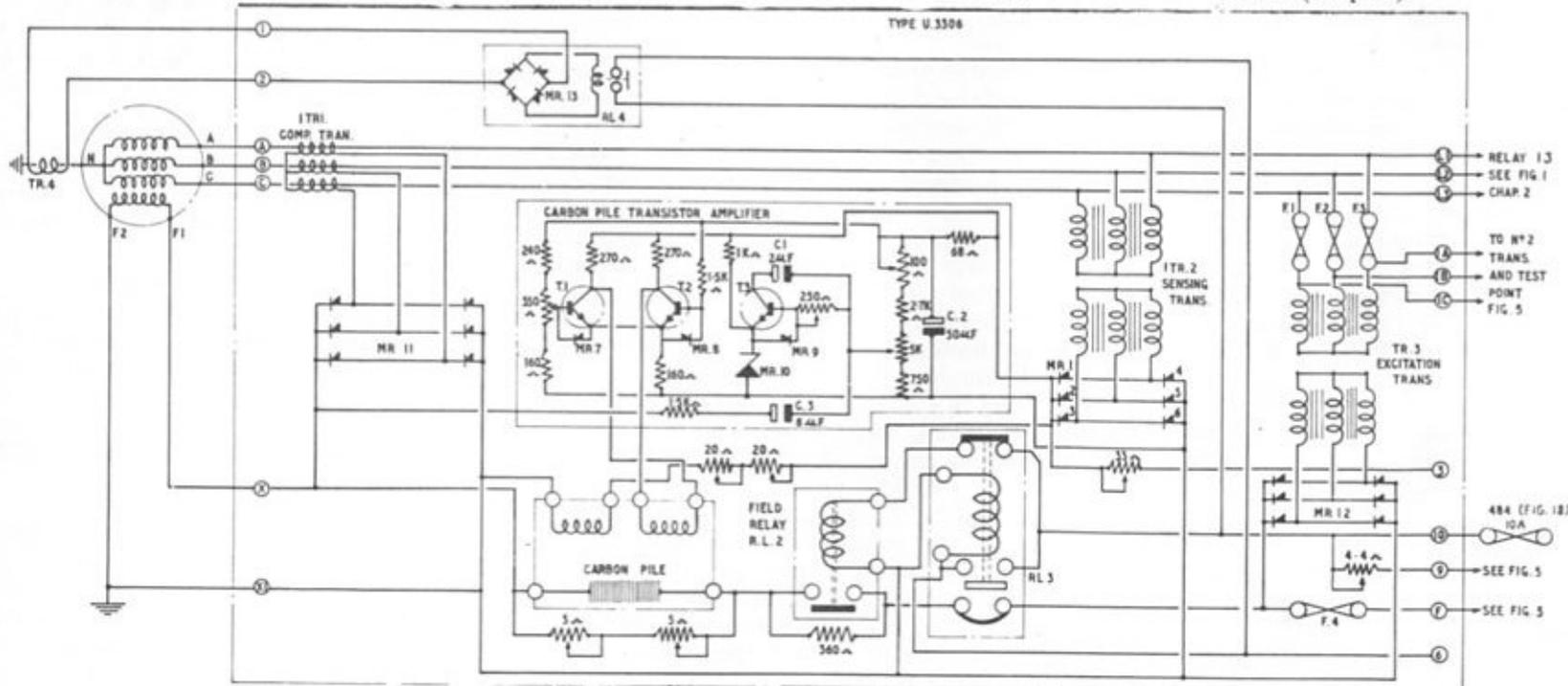


Fig.11 A.A.P.P. transformer-rectifier unit, Type U3306

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Extra supplies trip

70. The extra supplies trip push-button on 10P is used to trip any auxiliary supply connected to the synchronising busbar, i.e. the R.A.T. A.A.P.P. or G.P.U. When the push-button is pressed, a supply from fuse 917 will be made via its contacts 2-1 and contacts 392/2 to energise relay 390. The operation of the contacts of relay 390 is given in para.67, and it will be seen that whichever auxiliary supply is on the busbar, the associated circuit breaker will be tripped. In the case of the A.A.P.P., a supply from fuse 954 will be made via contacts 390/1 and 392/5 to trip the A.A.P.P. circuit breaker, the action of which will de-energise the A.A.P.P. indicator, and close the R.A.T. circuit breaker (provided the R.A.T. was previously selected).

**A.A.P.P. FIRE PROTECTION**

71. Fire protection for the A.A.P.P. is by means of the Firetec system. Fire detection and warning is fully automatic and operative immediately a fire or rapid rise in temperature occurs. The A.A.P.P. fire extinguisher bottle is brought into operation by depressing the push-switch labelled FIRE on panel 70P. The fire extinguisher bottle can also be discharged by the action of two inertia switches situated on the lower forward face of the cabin rear pressure bulkhead (Chap.15). All the fire extinguisher circuits including fire detection and warning come under the heading of vital services and are fed from the vital services bus-bar, via supply fuses in panel 3P.

72. The basic principles of the Firetec system are described in A.P.4343, Vol.1, Sect.22. The following paragraphs describe the installation fitted on the A.A.P.P. The system

employs the following main items of equipment:-

Control unit	Ref.No. 5CZ/5832
Fire extinguisher bottle	Type 124
Fire detection heads (4)	Ref.No. 5CZ/5129
Fire push-switch	Type C180-A-3
Test push-switch	Ref.No. 5CW/5057

Fire detector heads

73. A chain of four detector heads, each consisting of two thermo-couples connected in series, are disposed around the power plant. One thermo-couple of each pair is shrouded whilst the second is exposed to any temperature increase within the power plant casing.

74. Under normal operating conditions a slow temperature variation between the two thermo-couples of any detector head will generate only a very low voltage. With an abnormally high and rapid temperature increase, however, as in the case of a fire, the exposed thermo-couple responds to the increase before the shrouded one, and a voltage high enough to operate a sensitive moving coil relay fitted in the Firetec control unit is generated (fire warning lamp lights). The minimum voltage required for this purpose is 7.5 mV and this is generated when the temperature difference between the exposed and the shrouded thermo-couple reaches 185 deg.C. As a chain of four detectors is used the required voltage will be obtained when the difference between the combined temperatures of the exposed thermo-couples and the combined temperatures of the shrouded thermo-couples reaches 185 deg.C. When the

ambient temperature returns to normal (i.e. when the fire has been extinguished) the difference in temperatures between the thermo-couples decreases, the voltage becomes too low to operate the sensitive moving coil relay in the control unit and the fire warning is cancelled.

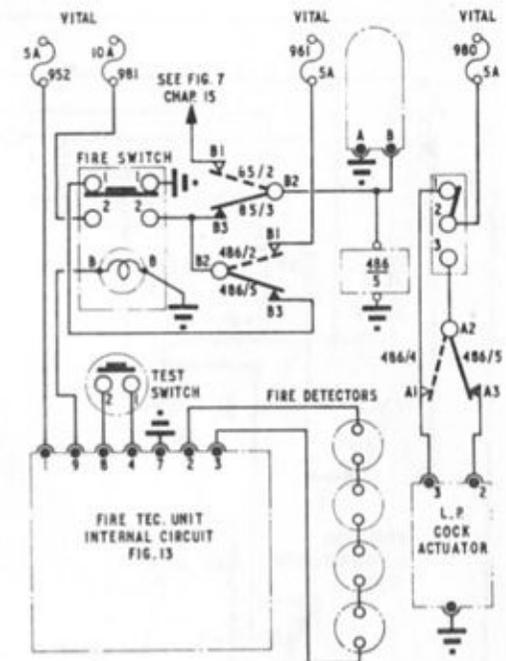


Fig.12 Fire extinguisher circuit

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Control unit

75. Fitted on the rear bulkhead of the A.A.P.P. compartment is the Firetec control unit. A remote test switch fitted on panel 70P and wired to the control unit is used for test purposes and will simulate fire conditions when pressed.

Fire push-switch

76. A fire push-switch which also combines a warning lamp is fitted to panel 70P. The warning lamp will show a continuous red light when the fire detector

heads sense a rapid rise in temperature. Operation of the push-switch will connect a supply to the fire extinguisher bottle causing methyl-bromide to be sprayed into the A.A.P.P. casing. This operation also closes the L.P. cock to shut off the fuel supply to the burner.

Inertia switches

77. Operation of the No.1 and No.6 inertia switches will also discharge the fire extinguisher bottle and close the L.P. cock.

WARNING...

Methyl-bromide is a highly poisonous non-irritant vapour. The effect may not be apparent at once and may be fatal if a large amount is inhaled.

Circuit operation

78. The following paragraphs describe the circuit operation of the Firetec unit and the circuit links to the fire extinguisher system.

79. Reference to fig.12 and 13 will show that when the fire detector heads sense a rapid change of temperature, a voltage will be generated in the detector chain. This voltage output is fed via pins 2 and 3 to a milli-volt relay (M1), via resistor R1 and the normally closed back contacts Y of test relay L7. When this voltage reaches 7.5 mV, the moving coil of the milli-volt relay will rotate clockwise and cause the centre contact, which is fixed to the coil, to touch the top or right-hand fixed contact of the milli-volt relay. This immediately causes the current to flow as follows:-

Positive supply from pin 1, resistor R10, Y contacts of relay L7, resistor R1, moving centre contact of M1, right hand contact of M1, coil of relay L5 to negative supply on pin 7.

80. Simultaneously with the foregoing, a part of the current will be fed, via pin 3, detector head chain, pin 2 and coil of M1 and will be in such a direction as to implement the chain current and cause the centre contact to press harder against the right hand contact. The L5 relay when operated, feeds via one pair of its contacts, the 24-volt positive via pin 9 to light the remote warning lamp, and also close its other pair of contacts to complete a holding circuit for relay L5 by by-passing the M1 contacts. This means that all electrical load is removed from the centre and right-hand contacts of M1 and the

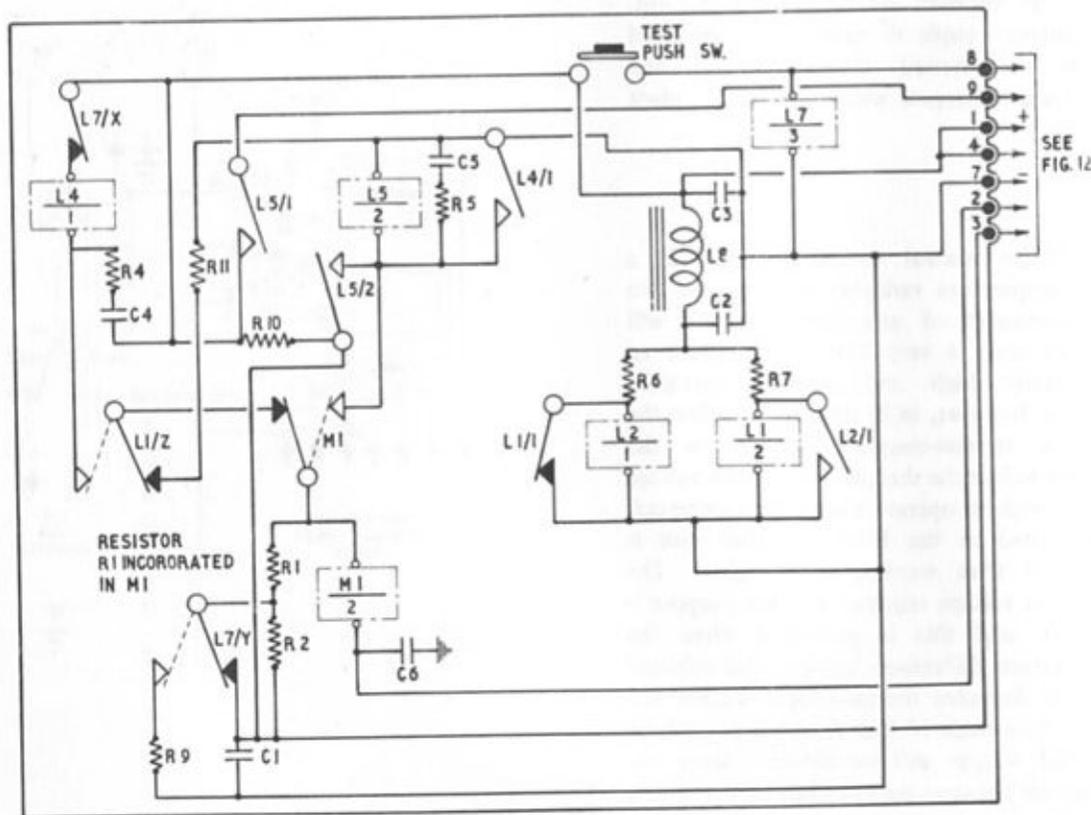


Fig.13 Firetec unit

current to maintain relay L5 energized is then as follows:-

Pole 1, resistor R10, hold contacts of relay L5, relay coil L5 to negative at pole 7.

81. Operation of the fire push-switch will connect the d.c. supply via fuse 981, terminal 2 and the normally closed relay contacts 85/3 to pole 13 of the fire extinguisher bottle and will also energize relay 486. The fire bottle will discharge its contents into the power plant casing.

82. The energizing of relay 486 opens the normally closed contacts 486/5 to isolate the 'open' field of the L.P. cock actuator. Contacts 486/4 close to connect the supply from fuse 980 to the 'close' field of the L.P. cock actuator. Contacts 486/2 close to form a hold-on circuit to relay 486 via fuse 961. Closing of the L.P. cock shuts off the supply of fuel to the power unit.

83. Until the fire conditions disappear relay L5 will remain operated (para.80). When the detector chain voltage output falls to a level of 5 mV or less, the moving coil of M1, and therefore the centre contact will rotate anti-clockwise until the centre contact of M1 touches the left-hand contact. When contact is made, a further current will flow through the M1 moving coil, except that its direction of flow will now be such as to oppose the chain voltage. The circuit is now as follows:-

Positive lead from pole 1, X contacts on relay L7, coil of relay L4, contacts Z relay L1, left-hand and centre contact of M1, resistor R1, Y contacts of relay L7 (shorting out resistor R2), hold contacts of relay L5 to negative line at pole 7.

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84. Release relay L4 is thus energized and its contacts close to short out the coil of relay L5. Relay L5 is de-energized, breaking the supply to the remote warning lamp, and also its own hold contacts which, being in series with the current for both relays L4 and L5, cause the electrical circuit to re-set to normal.

Pulse circuit

85. Relays L1, L2, resistors R6, R7, R.F. choke L8 and condensers C2, C3 form a 'pulsing' circuit. This is to provide a mechanical vibration to overcome any lag effect in the relay M1, thus allowing a continual cycling of the change-over contacts on relay L1. The pulsing of relays L1 and L2 is achieved as follows:-

Positive from pole 1, choke L8, resistor R7, relay L1 to negative via pole 7.

86. Relay L1 is energized, thus opening its contacts which are short circuiting the coil of relay L2, allowing this relay to be energized via choke L8 and resistor R6 to chassis negative. The operation of relay L2 closes its own contacts which short-circuit L1 causing the latter to be de-energized and its break contacts to close. These replace the short across the coil of relay L2, which in turn, is de-energized, and the cycle of operation re-starts to create a continual pulsing of these two relays.

87. The change-over contact Z on pulsing relay L1 is incorporated to alternate the electrical connection to the left-hand contact of relay M1. When the relay L1 is energized, the left-hand contact of M1 is connected to relay L4 for release or re-set of the detection circuit. On the other half cycle of pulse, when relay L1 is de-energized, the M1 left-hand contact is joined, via resistor R11, to the

negative supply line. This arrangement will produce a 'knock-off' voltage for a period of half the pulsing time across the M1 relay coil when the centre or moving contact is against the left-hand contact, by virtue of current flow through resistor R11 as follows:-

Positive supply line from pole 1, resistor R10, resistor R1 with the moving coil of M1 and the detector head chain across it, centre and left-hand contact of M1, pulsing change-over Z contact of relay L1, and resistor R11 to negative supply line.

88. This 'knock-off' voltage across the moving coil of M1 is in such a direction as to move the centre contact of M1 away from the left-hand contact, but directly this takes place the 'knock-off' voltage disappears and the M1 contacts touch again. It can be seen that an oscillation of the centre contacts of M1 will take place against the left-hand contact during every half cycle of the pulsing relay L1.

Test switch

89. The test switch on panel 70P and relay L7, resistors R9 and R2 form the test circuit which operates as follows when the switch is pressed.

90. Relay L7 is energized, operating its contacts. Resistor R9 is connected to the R1 side of resistor R2 and the short circuit across R2 is removed, causing current to flow through the coil of M1 from the positive supply line, through resistor R10, dividing through R2 and the series circuit of the detector head chain, M1 coil and resistor R1 which are in parallel with R2 and resistor R9 to negative supply line. This test current through the M1 coil results in normal operation of the relay L5 and

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the warning lamp, as would occur with excessive voltage output from the detector head chain under fire conditions. Cancelling or re-set of the circuit occurs when the test push-switch is released, since then the re-set relay L4 is connected to the positive supply

RAM AIR TURBINE

92. Apart from checking cables and fittings for security and freedom from damage, little servicing is required. Mechanical checks and setting of the micro switches are detailed in Sect.3, Chap.11. Note that when the R.A.T. is lowered for mechanical checks, fuse 813 should first be removed to isolate the field circuit. The fuse should be replaced when the R.A.T. is re-set in its stowage.

Phase rotation check

92A. In the event of the connections to the R.A.T. being disturbed, or if a new R.A.T. has been fitted, it is essential then, and also at the appropriate servicing periods, to check the R.A.T. supply for correct phase rotation. This is done by lowering the R.A.T. and driving it from a Palouste air supply trolley. A ground test adapter, Ref.No. 26DC/45575, is fitted on the front of the R.A.T. and enables connection to be made by the Palouste air delivery hose. With this arrangement, correct phase rotation of the output can be conveniently checked at the R.A.T. circuit breaker (relay 15) in the power compartment. The check should be carried out as follows:-

- (1) Ensure that a 28-volt d.c. ground supply is connected.
- (2) Lower the R.A.T. by operating the ground release lever. Check that the two load shed indicators on 50P are showing vertical bars.

line via the break contacts on test push relay L7. This test circuit operation will indicate faults on components within the control unit, as well as open circuits and positive and negative supply line circuits to the detector head chain.

SERVICING

- (3) Connect the Palouste air delivery hose to the ground test adapter. Mount the assembly on the R.A.T. and secure by the three pip pins.

- (4) Start the Palouste and connect the air supply to the R.A.T.

NOTE...

Since the R.A.T. will not attain fully operational speed, it must not be driven from the Palouste for more than 30 seconds, otherwise damage to the R.A.T. control unit may result.

- (5) Connect a suitable phase rotation tester to terminals L1, L2, L3 of relay 15 in the power compartment and check that the phase rotation of the R.A.T. output is R, Y, B respectively. Remove the tester.
- (6) Stop the Palouste and remove the ground test adapter.
- (7) Re-set the R.A.T. in its stowage as outlined in Sect.3, Chap.11.
- (8) Press the non-essential supplies trip-reset switch on 10P to RESET. Release the switch and observe that the two load shed indicators are showing horizontal bars.
- (9) Remove the ground supply.

91. Radio suppression condensers C1, C2, C3, C6 and the R.F. choke L8 are incorporated in the unit. Condensers C4, C5 and resistors R4 and R3 prevent arcing taking place across the contacts of the relay M1.

A.A.P.P.

93. Full descriptive notes for servicing the A.A.P.P. are contained in A.P.4617A, Vol.1.

WARNING...

- (1) Before any servicing operation ensure that live cartridges have been removed from the cartridge breeches and replaced with clean empty cases complete with sealing O rings.
- (2) Prior to reconnecting the fire extinguisher after circuit tests, relay 486 must first be de-energized by removing and replacing fuse 961 (para.82).

Cartridge selector, Type FJB/A/6

94. The cartridge selector should be examined at the periods specified in the Servicing Schedule. Details will be found in ◀ A.P.113D-1329-16. ▶

Oxygen time switch, Type D.8164

95. The oxygen time switch should be examined for security and damage at the periods specified in the Servicing Schedule. Details for servicing the unit will be found in ◀ A.P.113D-1412-16. ▶

Starter panel, Type U4201

96. At the periods laid down in the Servicing Schedule examine the starter panel for security and operation. Details for servicing the unit will be found in A.P.4343C, Vol.1, Book 3.

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Starter motor, Type C.1051

97. Routine servicing of the starter motor consists of checking for security of electrical leads and the extent of brush wear. A description of the servicing and inspection procedure will be found in A.P.113E-0535-1

Rotary actuators

98. The four rotary actuators should be inspected at the periods laid down in the Servicing Schedule. In some cases it may be necessary to remove the actuator complete with valve for servicing. Details will be found in A.P.102F-0204-16A

Fuel booster pump

99. The fuel booster pump should be checked at the periods stated in the Servicing Schedule. Detailed instructions for servicing will be found in A.P.113E-0479-1. Fuel flow checking instructions will be found in Sect.4, Chap.2 of this publication.

Fuel float switches

100. Servicing the fuel float switches is limited to a functional check of the associated fuel and electrical systems. If a float switch is suspected of malfunctioning it should be removed from the tank for further inspection. Before a new or repaired assembly is fitted check the electrical connector for damage and corrosion. The insulation resistance should not be less than 20 megohms.

Oxygen equipment

101. Apart from recharging the bottles at the specified intervals and checking the rate of flow ($36 \pm 4 \text{ lb/in}^2$) by means of the test set

▶ Ref. No. 26DC/95393 little servicing should be necessary for the oxygen equipment. ◀

Jet pipe temperature

102. Providing the jet pipe temperature system is working satisfactory, servicing is limited to normal servicing of the components as laid down in the Servicing Schedule.

Line checks

103. If for any reason the system is suspect, it should be calibrated as follows:-

- (1) Place a precision thermometer up the jet pipe outlet one hour before taking readings for the calibration. Line test from the jet pipe temperature resistor in the A.A.P.P. compartment, the following circuits:-
 - (a) Cable F4114 at j.p.t. resistor +ve terminal to indicator (70P) terminal 2.
 - (b) Cable F4114 at j.p.t. resistor -ve terminal to indicator (70P) terminal 1.
 - (c) Cable 4/F2091 at j.p.t. resistor +ve terminal to pin 4 of plug 1.B.1. at the A.A.P.P. unit.
 - (d) Cable 4/F2091 at j.p.t. resistor -ve terminal to pin 5 of plug 1.B.1. at the A.A.P.P. unit.

(2) At panel 70P, disconnect the

electrical cables from j.p.t. indicator terminals 1 and 2. Connect a suitable multimeter, set to the ohms range, between the disconnected cable terminals. Check that the circuit resistance is $25 \text{ ohms} \pm 0.1 \text{ ohms}$.

- (3) Reconnect the j.p.t. indicator electrical cables.

Calibration

104. The Cambridge standard workshop potentiometer, Type 44226, is used for calibration of the system. Reference to the booklet provided with the instrument should be made paying particular attention to the necessity of 'Re-standardising'.

105. Connect the test set in series with the temperature circuit by means of an adapter plug (para.108), at 1.B.1. of the A.A.P.P. Take the ambient temperature reading of the thermometer in the jet pipe and note the corrected milli-volt equivalent of 600 deg.C. from the milli-volt chart.

106. By means of the Cambridge Potentiometer inject the corrected milli-volts into the circuit and check the temperature indicator on panel 70P. If necessary, adjust the indicator setting screw until the indicator reads 600 deg.C.

107. Inject the appropriate milli-volts and record readings at 700, 500, 400 and 300 deg.C., with a final re-check at 600 deg.C. Tolerance is 2% of reading checked.

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NOTE . . .

The setting screw must be used to set the temperature indicator at 600 deg. only. After setting, apply a pin point of white paint at one end of the screwdriver slot and the indicator glass, so that any alteration after calibration will be obvious.

Adapter plug

108. The adapter plug used in calibration can be made up locally and consists of a plug Ref. No. 5X/4500125 and a socket Ref. No. 5X/4500186. No.5 pin and socket are connected together. The No.4 pin of plug 5X/4500125 goes to -ve and the No.4 socket of 5X/4500186 goes to +ve of the Cambridge potentiometer.

EQUIPMENT IN POWER COMPARTMENT

T.R.U. Type U.3306

109. At the periods laid down in the Servicing Schedule, a visual inspection of the T.R.U. should be carried out. Ensure that the unit is secure and has not sustained any physical damage. Remove the terminal block covers and examine the mouldings for cracks etc., check that the electrical connections are clean, secure and free from corrosion. Remove the side and top panels from the unit (quick release

fasteners), and make a visual examination of the internal components to ensure that there is no visible damage. Check electrical connections for security and cleanliness. Replace panels after examination. A suspected unit should be removed from the aircraft for bay servicing and a replacement fitted. Further servicing details will be found in A.P.113D-0010-1.

Control unit

110. At the periods laid down in the Servicing Schedule, the control unit should be examined to ensure that it is secure and free from damage. Examine the electrical connections for security and freedom from corrosion. The interior components are mounted on two chassis, one fixed and the other hinged; by turning the hinged chassis about the hinge pin, access is gained to all components. Make an examination of all components and associated wiring for signs of damage. Check electrical connections for security and cleanliness. A suspected unit should be removed from the aircraft for bay servicing and a replacement unit fitted. Further servicing information is contained in A.P.113D-07123-1.

Blower unit, Type 3PL-182/271

111. The blower unit is used to supply cooling air to the control unit and should be serviced I.A.W. A.P.113E-0380-16. Ensure that the electrical connectors and the terminal block are secure and free from damage.

Blower unit, Type CA/1301

112. The blower unit Type CA/1301, used in conjunction with the transformer-rectifier unit Type U3306, should be serviced I.A.W. A.P.113E-03199-1.

Voltage pick-up unit, Type 7702

113. This unit should be checked for security and freedom from damage at the periods laid down in the Servicing Schedule. Servicing details are laid down in A.P.113D-0009-1.

Voltage pick-up unit, Type 7723

114. At the times and periods laid down in the Servicing Schedule the synchronizing V.P.U., Type 7723, should be examined for general security and freedom from damage. Servicing notes are contained in A.P.113D-0009-1.

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REMOVAL AND INSTALLATION

Precautions

115. Removal and assembly of the various units used on the systems described in this chapter should present no serious difficulties. Points to be borne in mind are:-

- (1) Before removing any item of electrical equipment ensure that the circuit is electrically 'safe'.
- (2) Always insulate and stow all disconnected cables.
- (3) Before connecting cables to units, check with the appropriate routing chart for correct terminal numbers and cable references.
- (4) Ensure that all bonding is replaced and is not damaged in any way.

Ram air turbine

116. Full removal and assembly instructions for the ram air turbine are contained in Sect.3,

Chap.11 of this publication. If for any reason the alternator connector terminal block is disturbed after removal of the alternator connectors, it is essential that the instructions laid down in A.P.2240C, Vol.1 and 6, Part 1, Sect.2, Chap.3 (re anti-tracking varnish) are carried out. A phase rotation check outlined in para.92A is also necessary.

A.A.P.P.

117. Full removal and assembly instructions for the A.A.P.P. will be found in Sect.4, Chap.1 of this publication.

Control unit,

118. When removing the control unit, the eight bolts holding the two top hat cross members to the main support assembly should be removed (fig.3). The unit can then be lifted clear by means of the transport handle.

119. Re-fitting is the reverse of the above instructions. The relevant routing chart should

be consulted for cable identification.

Blower unit, Type 3PL-182/271

120. Removal of the cooling fan from the base of the main support assembly should present no problems. When refitting and re-connecting the cooling fan correct phase rotation should be observed.

T.R.U., Type U3306

121. To remove this unit first release the clamp holding the air cooling pipe to the unit. Remove the eight bolts securing the two top hat cross members to the main support assembly and remove the unit complete with fan assembly.

122. If for any reason the fan assembly is dismantled, it is essential that when re-assembled and re-fitted to the control unit the terminal block is nearest to the control unit. Correct phase rotation must also be observed.

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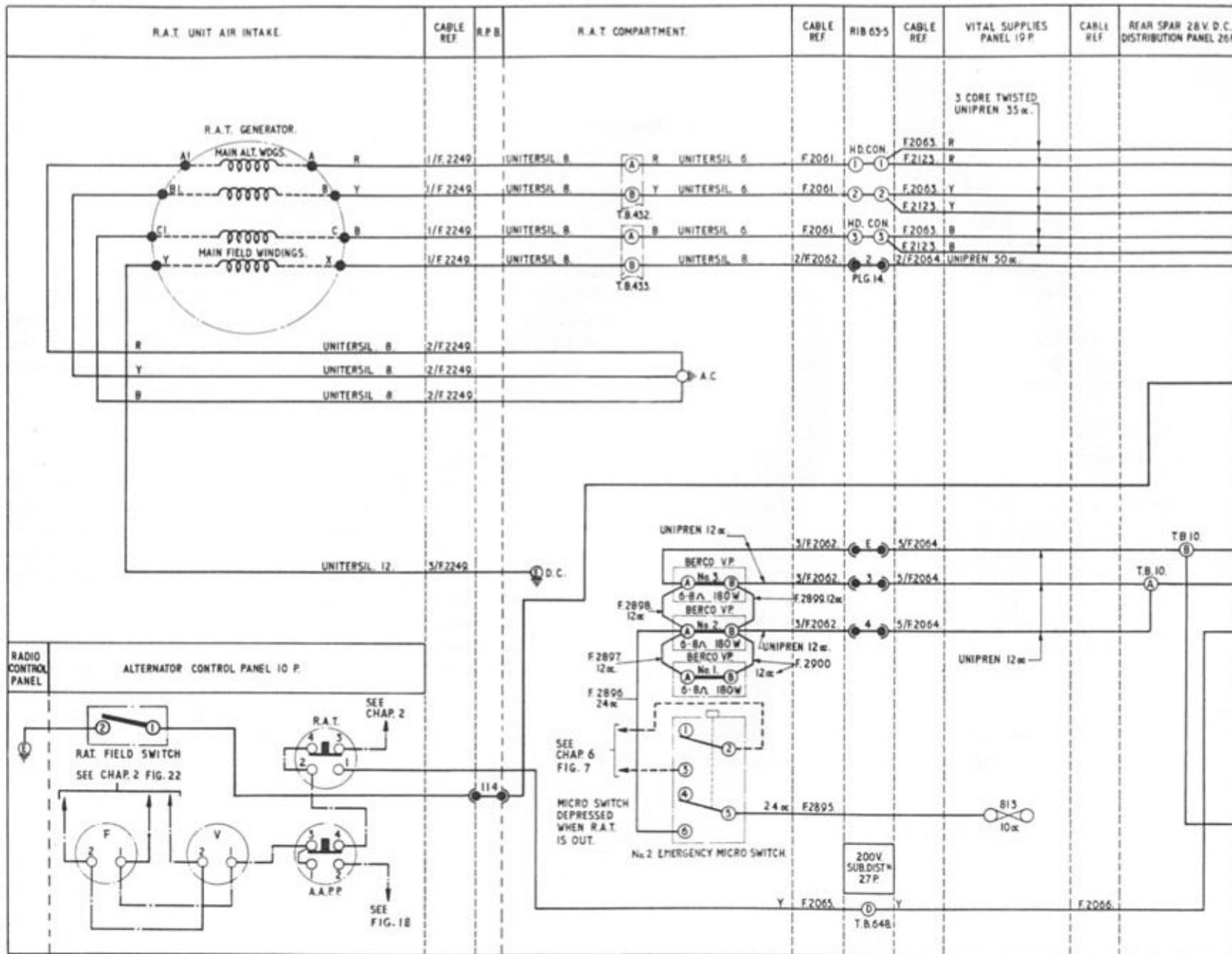


Fig 14 (1) R.A.T. alternator controls
 ▶ SEM/Vulcan/041/37C (Mod 2503) ◀

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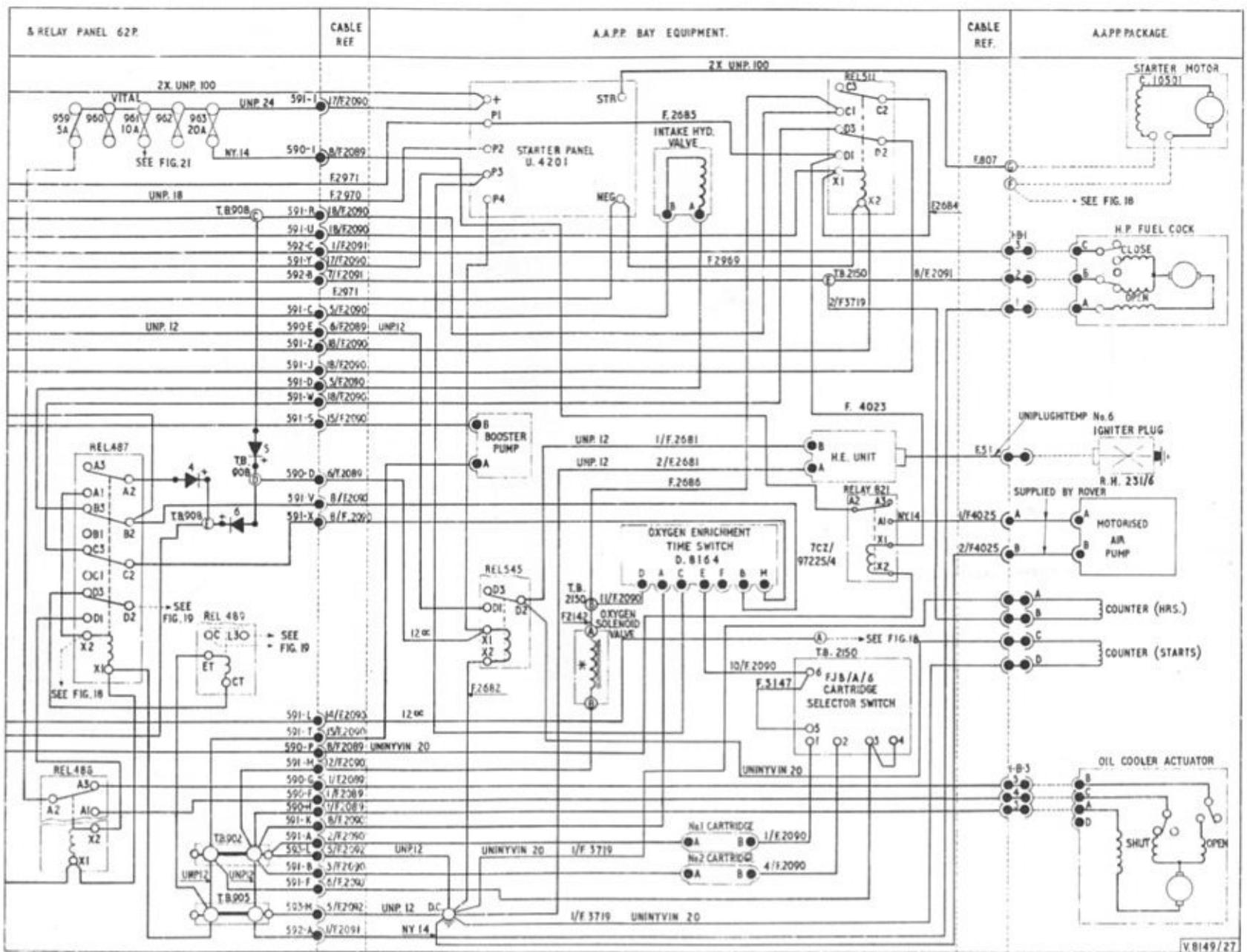


Fig 15 (2) A.A.P.P. start and control.

► Fig. No. and title amended ◀

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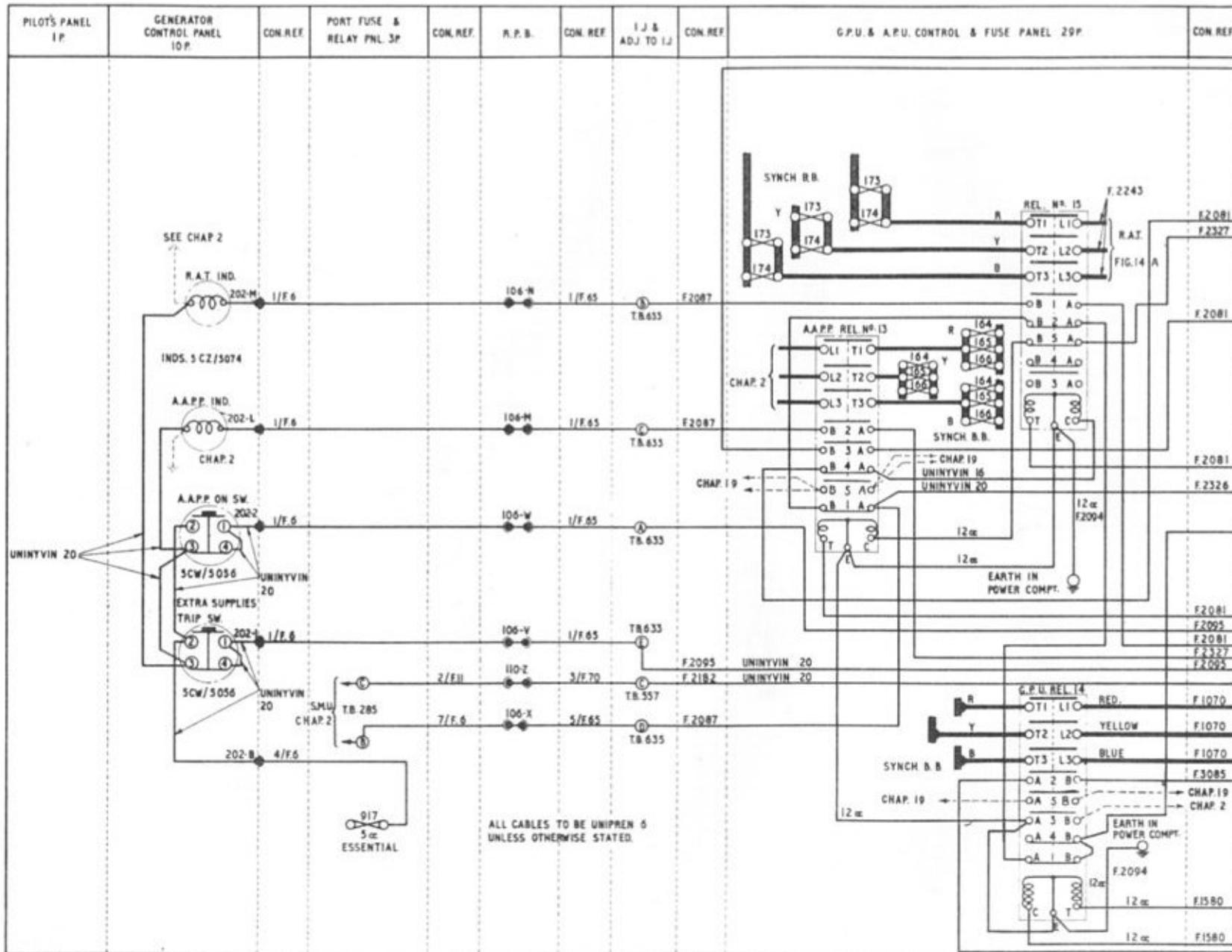


Fig 16 (i) Interlocking control, pre mod. 975

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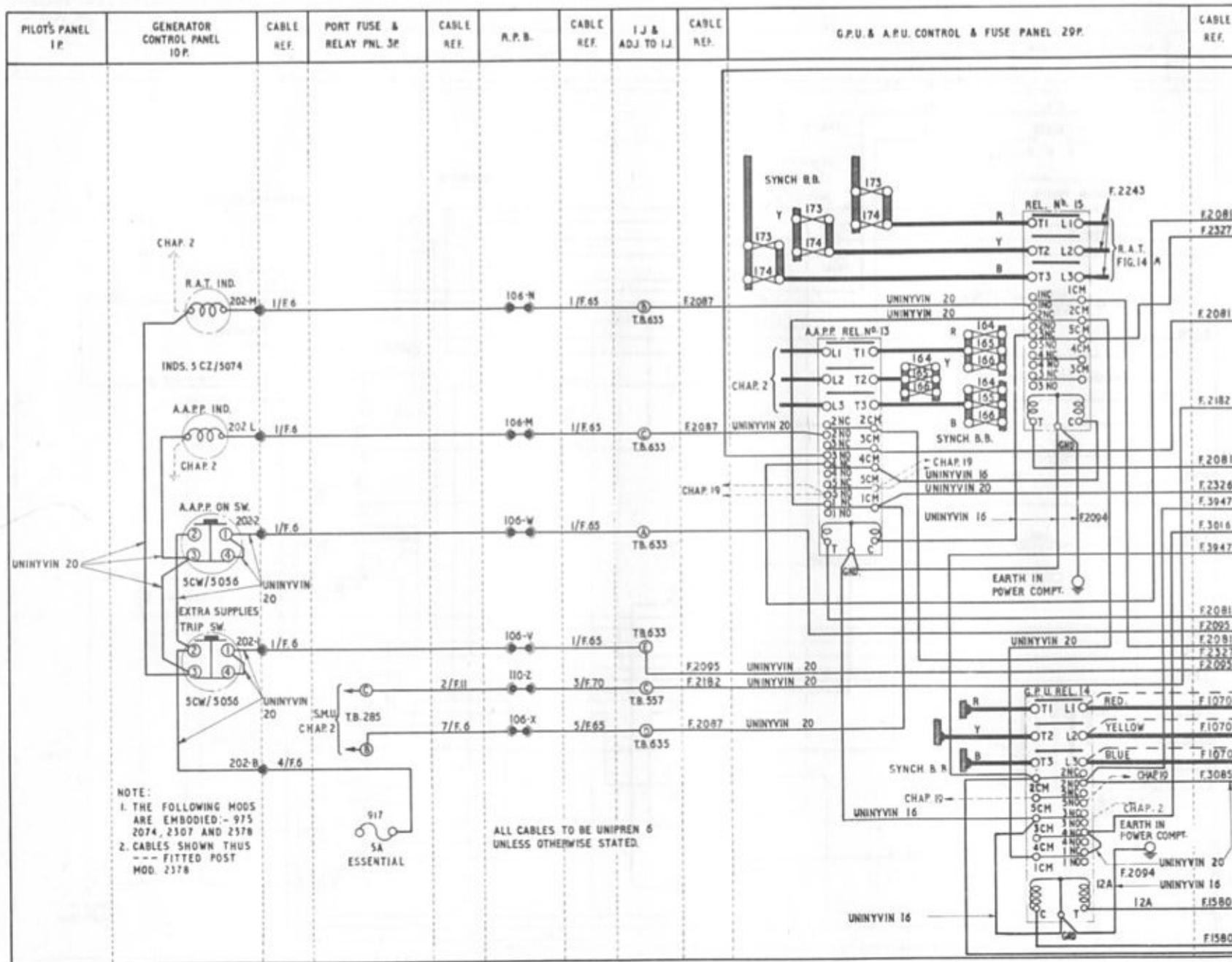


Fig.17 (i) Interlocking control (Post Mod 975)

«Mod. 2378 incorporated»

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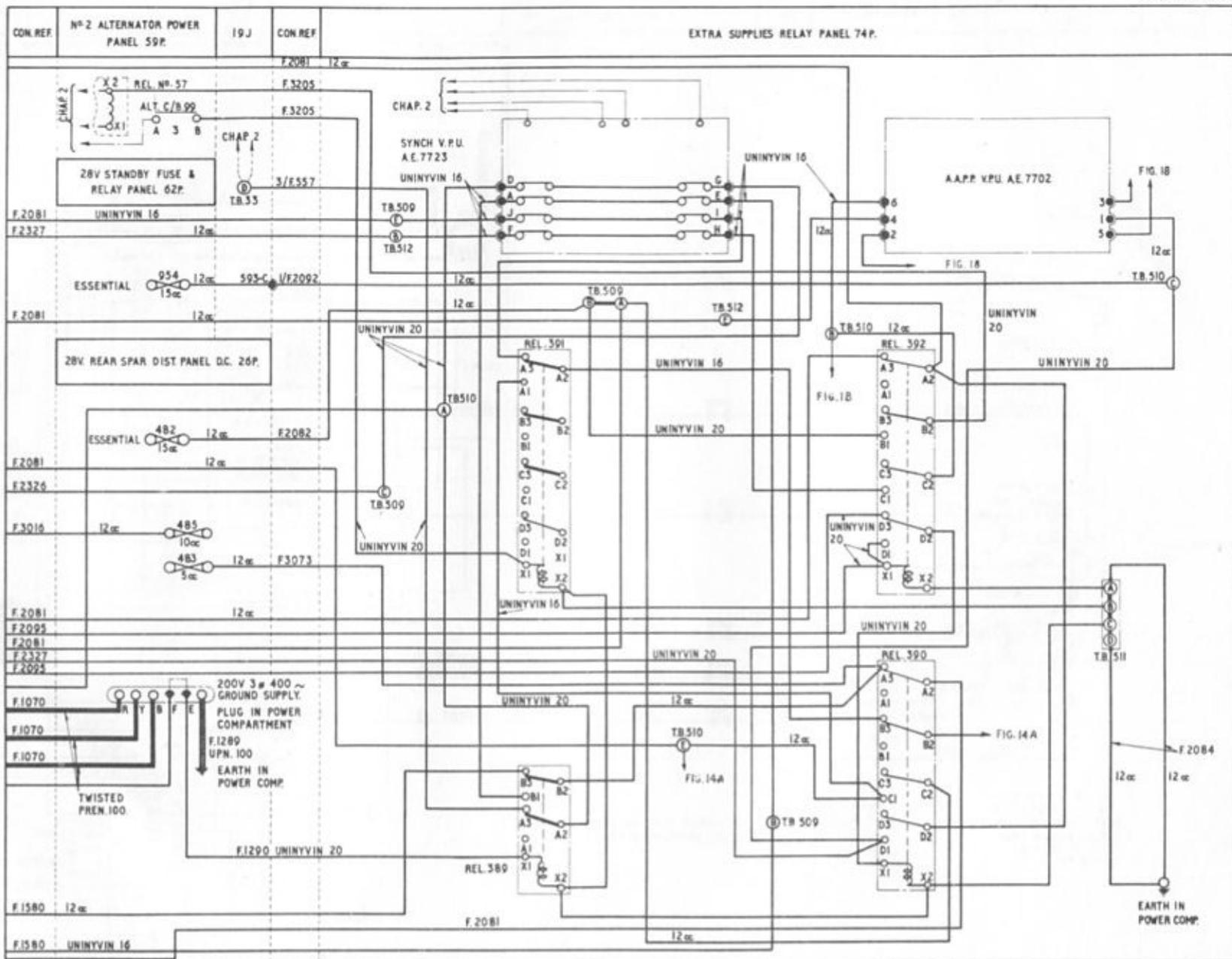


Fig.16 (2) Interlocking control, pre mod. 975

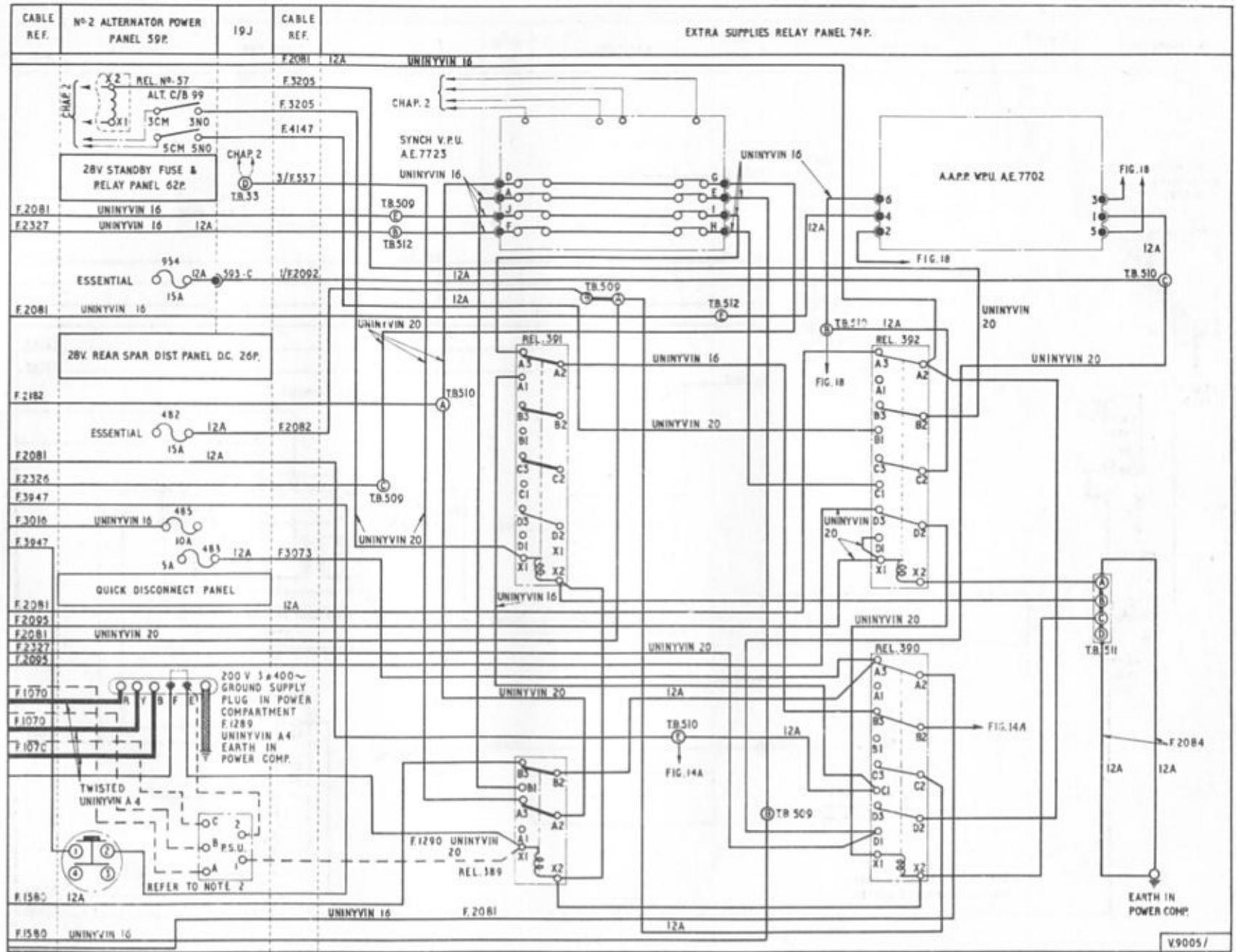


Fig.17 (2) Interlocking control (Post Mod. 975)

Mod. 237B incorporated

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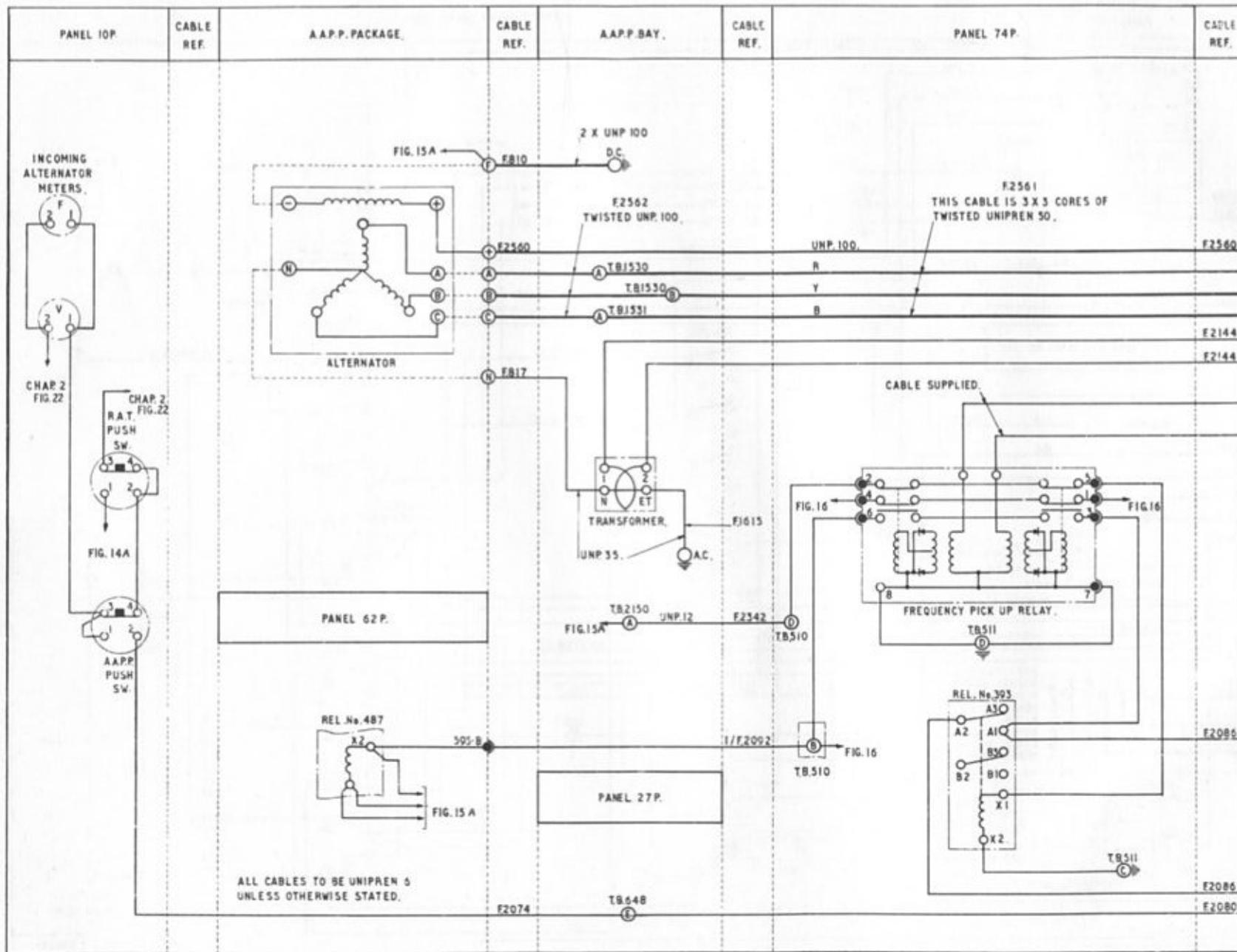


Fig. 1B (1) A.A.P.P. Alternator Control

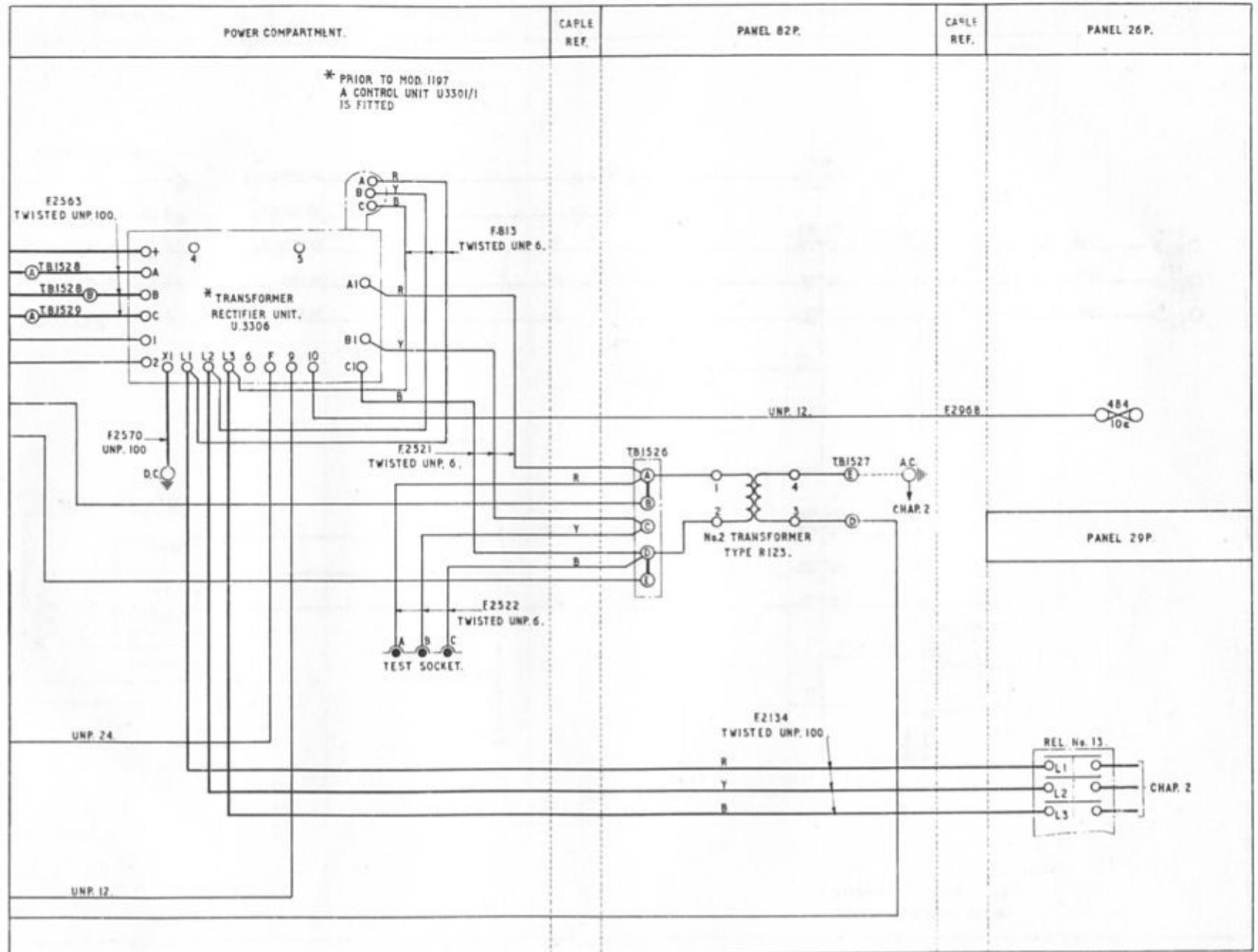


Fig. 1B(2) A.A.P.P. Alternator Control

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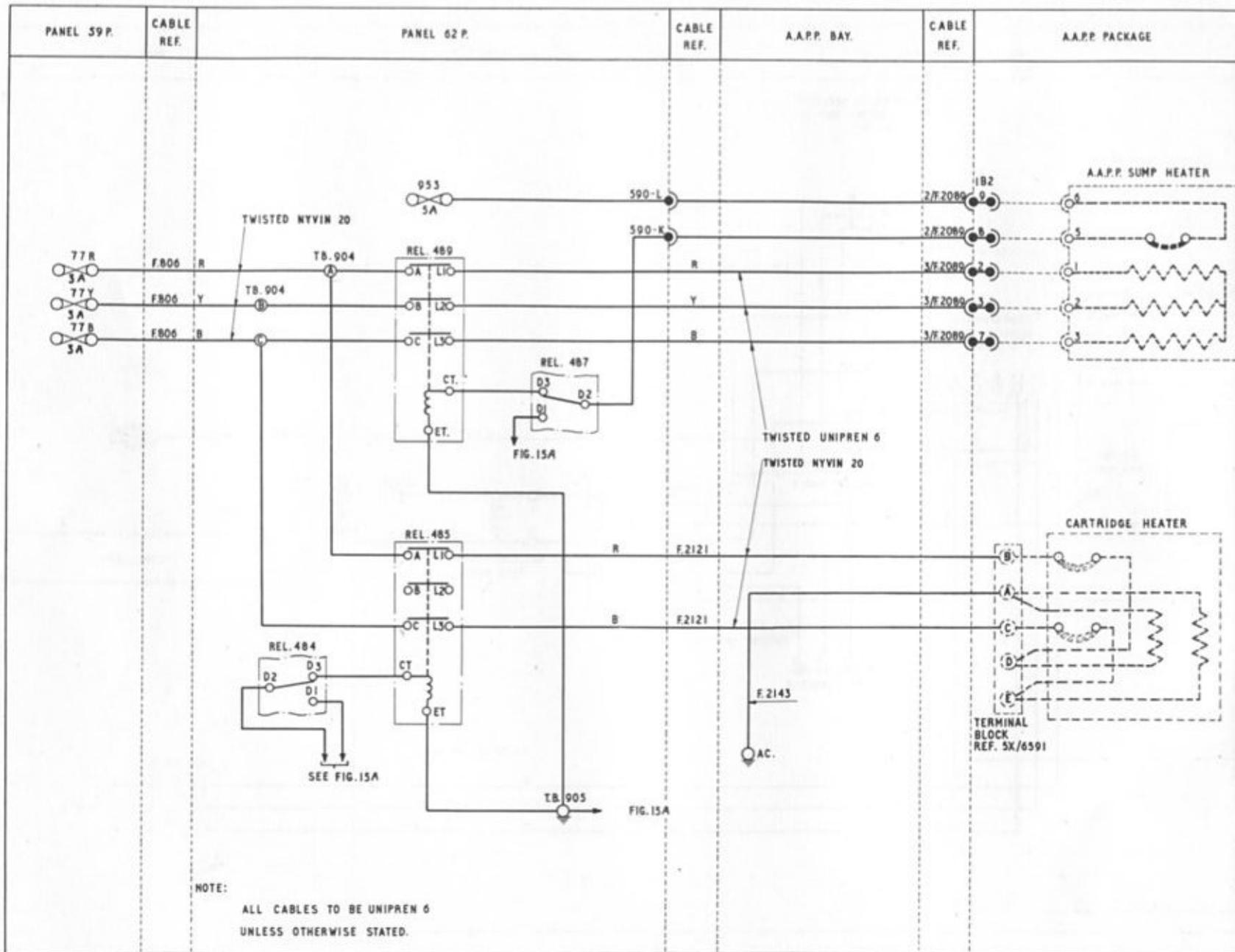


Fig 19 A.A.P.P. sump and cartridge heating

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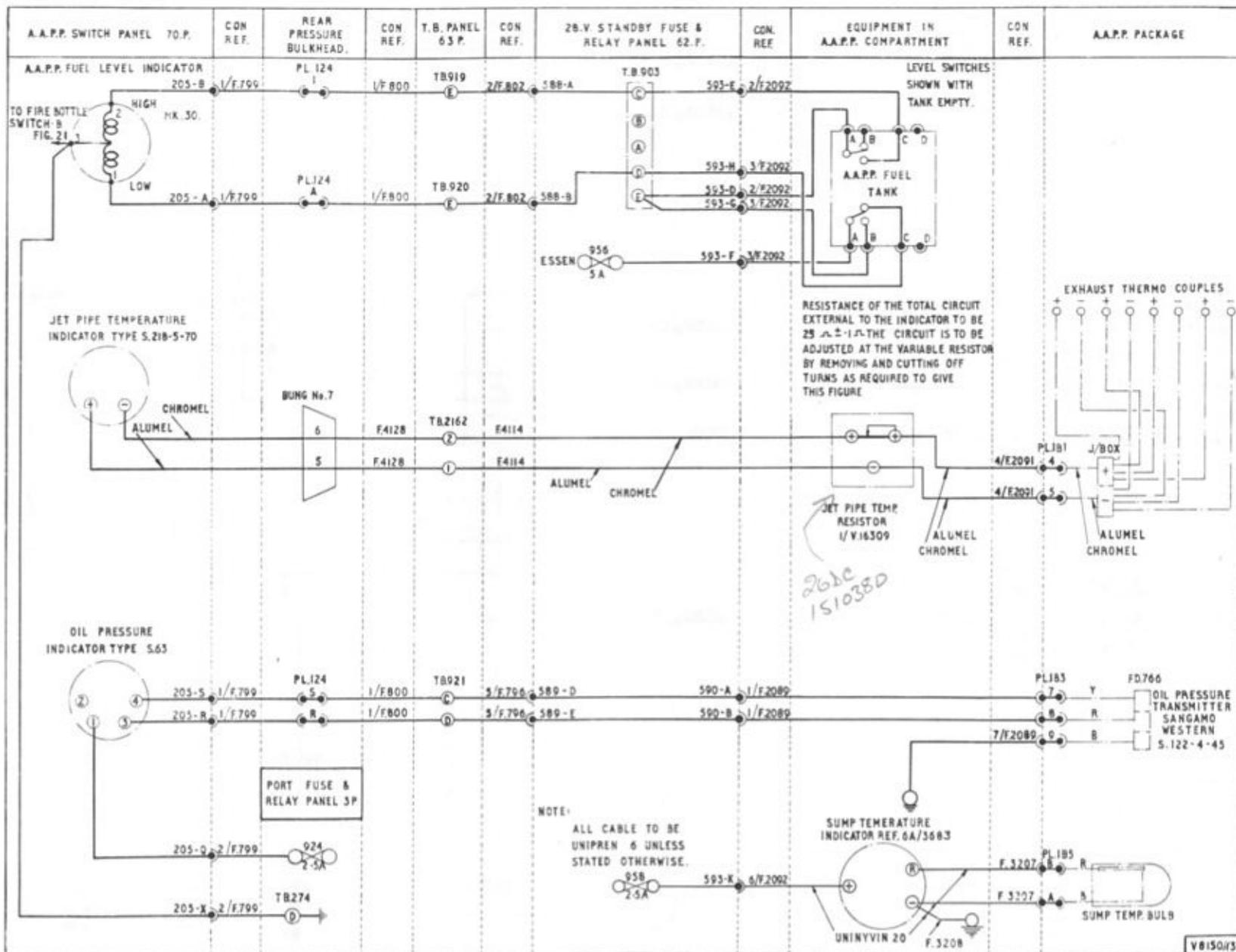


Fig.20 A.A.P. engine services

◀ Jet pipe resistor now 1/V16309 ▶

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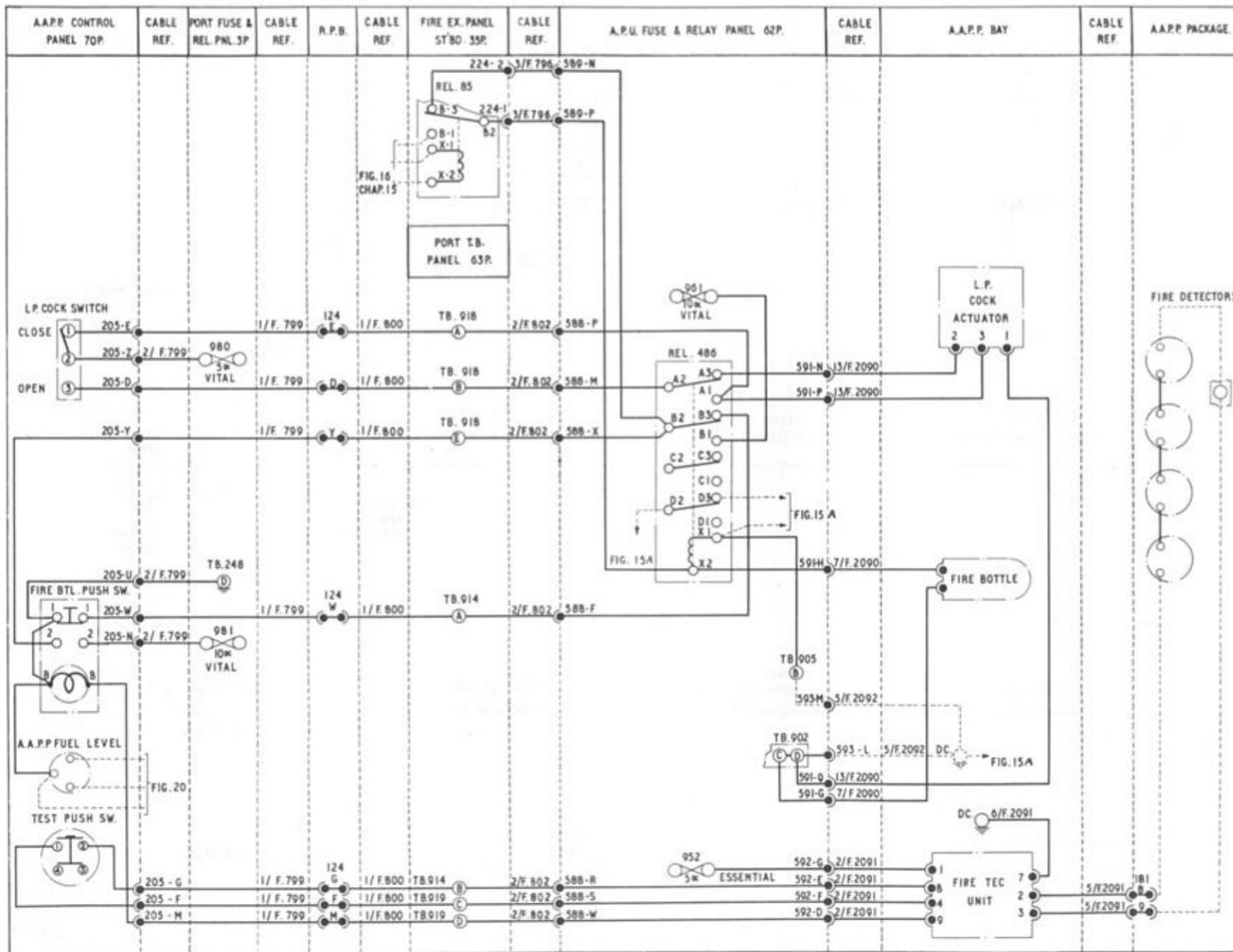


Fig. 21 A.A.P. fire extinguisher system

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