Group D.2

ELEVATOR AND AILERON POWER CONTROLS (CODE PE AND PA)

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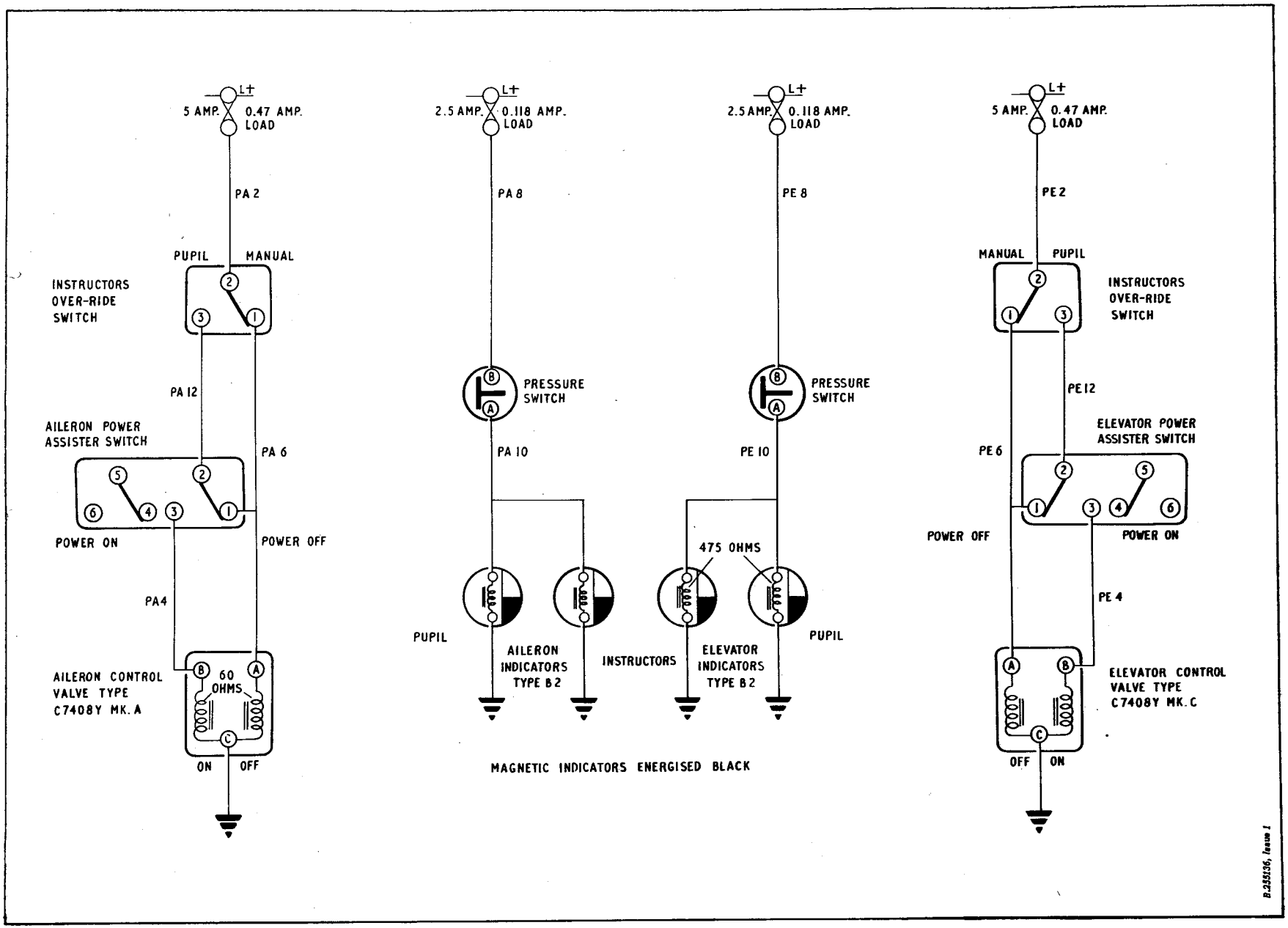

Fig. 1. Elevator and aileron power controls (theoretical)

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Introduction

1. This Group contains the description and operation of the elevator and aileron power control circuit, together with information on the servicing required to maintain the equipment in an efficient condition. Routeing and theoretical circuit diagrams are also included. For a general description of the aircraft's electrical system, reference should be made to Groups A.1, A.2 and A.3. Detailed information on the standard items of equipment used will be found in the Air Publications listed in Table 1.

DESCRIPTION

Elevator and aileron power controls

General

2. The elevator and aileron hydraulic booster units are permanently engaged with the flying surfaces, but hydraulic power may be selected on or off, on the ground or in the air, with the control columns in any position. Hydraulic power on or off is selected by use of two switches, which control electro-hydraulic selector valves in each system, and to enable the instructor to simulate manual reversion of the controls, two override switches are also provided. Electro-magnetic indicators, which are controlled by hydraulic pressure switches tapped into the pipelines feeding the booster units, are provided to indicate when hydraulic power is applied to the booster units.

Control switches

3. The supply of hydraulic power to the elevator and aileron booster units is controlled from the pupil's position by two double-pole, two-position ON-OFF change-over selector switches. These switches are mounted on the port instrument panel. The instructor's override switches, which are used to isolate the pupil's control circuit and energize the off solenoids of the electro-hydraulic selector valves to simulate manual reversion of the controls, are situated together on the forward portion of the cabin starboard shelf.

Electro-hydraulic valves

4. The elevator electro-hydraulic selector valve is located between frames 54 and 55 in the rear fuselage lower fin structure and the aileron selector valve is mounted on the front spar in the starboard wheel bay. These valves control the supply of hydraulic power to the elevator and

TABLE 1

Equipment type and Air Publication reference

Equipment Type	Air Publication
Aileron electro-hydraulic valve Type C.7408Y, Mk.A or 08808Y-A06 Elevator electro-hydraulic valve Type C.7408Y, Mk.C or 08808Y-A07	A.P.1803D, Vol.1, Book 3, Sect.18
Selector switches, double-pole, change-over without centre off C.W.C. Type XD.789, No.4 Instructor's override switches, single-pole change-over no centre off C.W.C. Type XD.778, No.4	A.P.4343C, Vol.1, Book 1, Sect. 1.
Pressure switches, Type T.P.5566	A.P.1275A, Vol.1, Sect.11
Magnetic indicators, Type B	A.P.4343E, Vol.1, Book 4, Sect.18

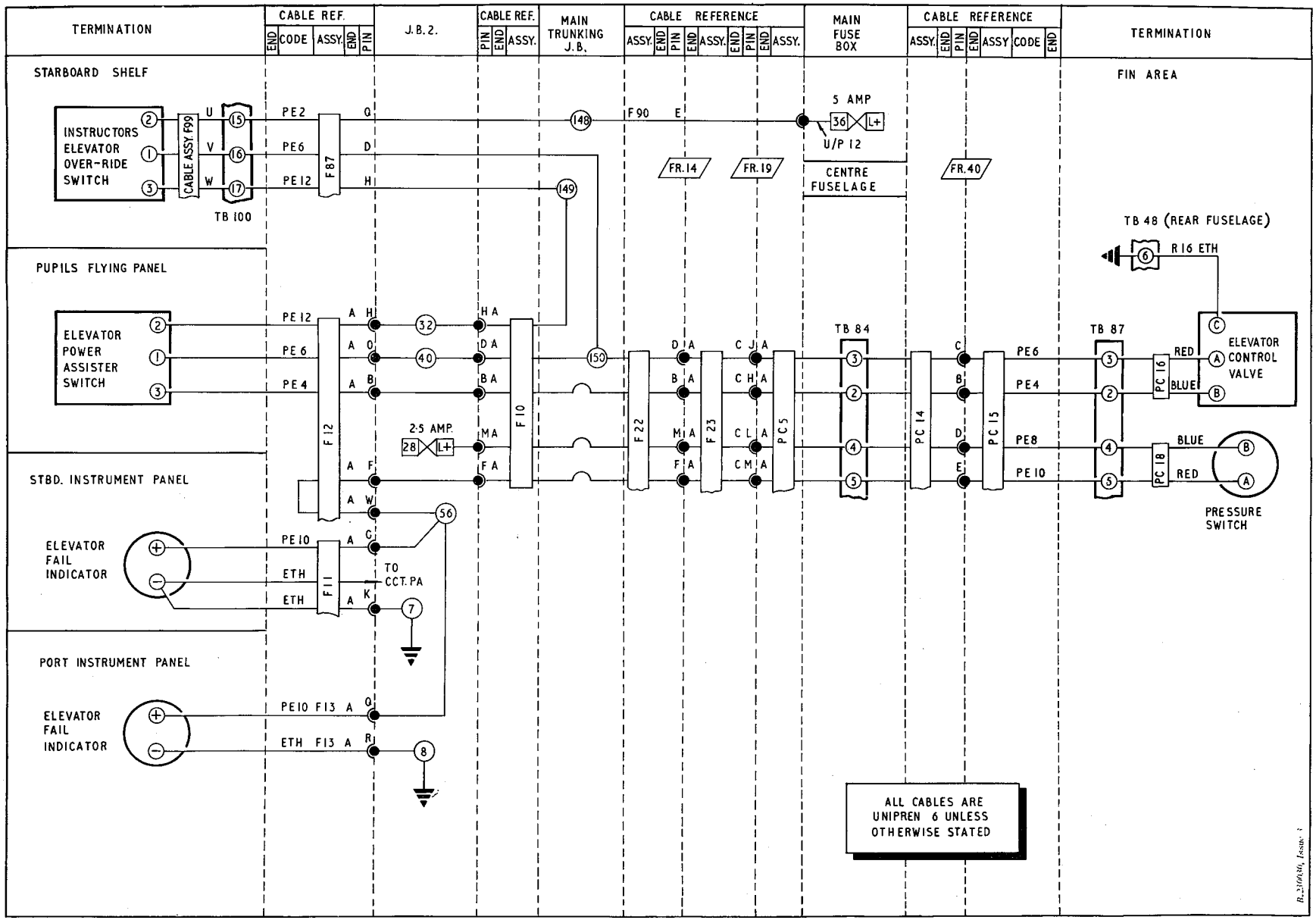

Fig.2. Elevator power controls (routeing)

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aileron booster units. The elevator booster unit is located between frames 52 and 55 in the rear fuselage lower fin structure and the aileron booster units are situated one in each outer wing.

Magnetic indicators

5. Electro-magnetic indicators, two for each circuit, are provided to indicate when hydraulic pressure is applied to the elevator and aileron booster units. Each circuit is separately fused and controlled by an hydraulic pressure switch. The indicators show BLACK when the hydraulic pressure supplied to the boosters is greater than 600 lb/sq in and WHITE when the pressure drops below this figure, due either to the operation of the ON/OFF switches or to an hydraulic or electrical failure. The pupil's indicators are located on the port instrument panel and those for the instructor are situated on the starboard instrument panel.

Hydraulic pressure switches

6. The hydraulic pressure switch controlling the indicators for the elevator booster unit is situated just forward of frame 54 in the fin structure below the tailplane and that controlling the indicators for the aileron booster units is located between interspar ribs E and F in the starboard wheel bay. These pressure switches are tapped into the hydraulic supply lines feeding the booster units and open their contacts to de-energize the indicators when the hydraulic pressure falls below that quoted in para.5.

Hydraulic failure

7. In the event of an hydraulic failure, the hydraulic pressure indicator lamp will glow and the audio warning system operate, as described in Sect.5, Chap.2, Group 5A, to indicate that only a limited number of power operations of the controls are available from hydraulic accumulators in the system. When the accumulators are exhausted, the elevator and aileron power control system will automatically revert to manual operation and the magnetic indicators will show WHITE to indicate this condition. During manual operation the boosters function as normal control tubes.

Operation

Power on

8. As the operation of the elevator and aileron power control electrical circuits are similar, only the function of the aileron circuit will be described. When the instructor's override switch is in the PUPIL position, and the aileron ON/OFF selector switch is placed in the ON position, current will be fed through the override switch to the selector switch and energize the ON solenoid of the aileron electro-hydraulic selector valve. When this solenoid is energized, it allows the hydraulic supply pressure to move the slide valve within the selector in such a direction as to supply hydraulic pressure to the servo valves of the aileron booster units.

9. When hydraulic pressure is applied to the booster units, the hydraulic pressure switch connected in the supply line will close its contacts and current will be fed from the circuit fuse to energize the aileron electro-magnetic indicators. When energized these indicators will show BLACK to indicate that power is available at the booster units.

10. Movement of the control column will operate the servo valve mechanism to open one of two orifices. The orifice which is opened depends upon the direction in which the control column is moved. Hydraulic pressure will then be directed to one side of the ram in each booster unit. This pressure moves the booster unit bodies, which are connected to the ailerons, and the ailerons will then move in the required direction.

Power off

11. When the aileron selector switch is placed in the OFF position, current will be fed from the instructor's override switch to energize the off solenoid of the aileron electro-hydraulic selector valve. When the off solenoid is energized, it allows the hydraulic supply pressure to move the slide valve within the selector in such a direction as to cut off the hydraulic pressure to the booster unit servo valves. The slide valve movement also allows the fluid in these units to flow back into the return line.

12. As the hydraulic pressure discharges into the return line, the hydraulic pressure switch opens its contacts to de-energize the aileron electro-magnetic indicators,

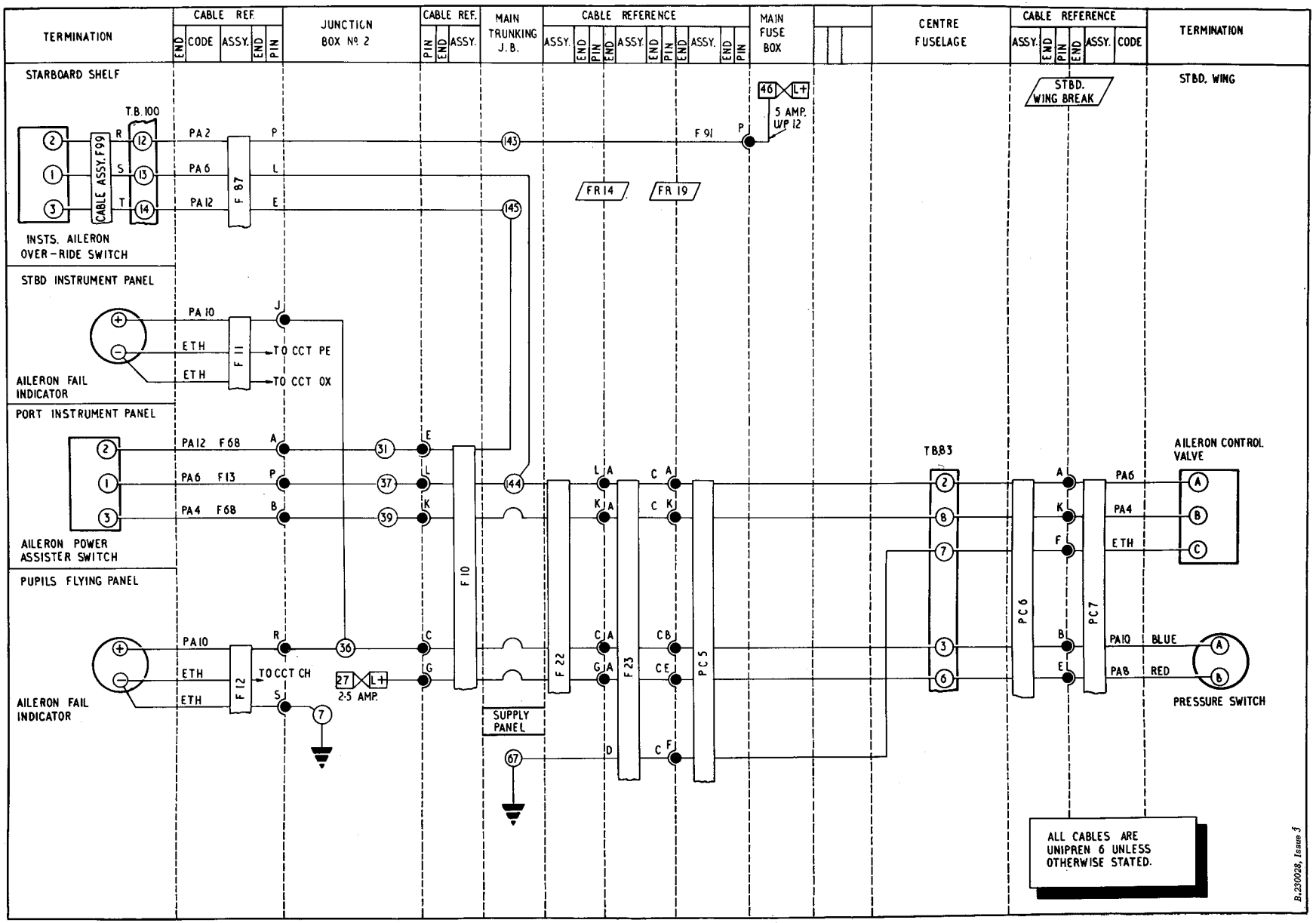

Fig.3. Aileron power controls (routeing)

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which then show WHITE to indicate that hydraulic power is no longer available at the booster units. The booster units now operate as normal control tubes and manual effort alone must be used to move the ailerons.

Instructor's override

13. Operation of the instructor's override switch to the MANUAL position, causes the pupil's control circuit to be isolated and the off solenoid of the aileron electro-hydraulic selector valve to be immediately energized. This cuts off the hydraulic supply to the servo valves of the booster units and the controls automatically revert to manual operations. The main purpose of the switch is to enable the instructor to select manual control, in order to simulate manual-reversion, and to give the pupil training in the correct drill under these conditions. The instructor may also use the switch to select manual control, in an emergency, should the pupil be unable to do so.

Manual reversion on ground (Post Mod. 895)

14. The controls are normally left in power operation after shutdown. If the oil pressure in the hydraulic accumulator is sufficient, reversion to manual control can be achieved by use of the handpump. If the oil pressure in the accumulator is insufficient, reversion to manual operating can be achieved by operating the pushbutton incorporated in each of the elevator and aileron electro-hydraulic valves while using the handpump.

SERVICING

General

15. For general servicing of the aircraft electrical system, reference should be made to Group A.1. Apart from keeping all the components clean and carrying out the normal routine tests of security and serviceability, the only other servicing necessary is the electrical tests of the electro-hydraulic selector valves as described in the appropriate Air Publication quoted in Table 1.

REMOVAL AND ASSEMBLY

General

16. Once access has been obtained, the removal of the electrical components comprising the elevator and aileron power control circuit should present no difficulties. The location and access to all the components is indicated in Group A.3.