

## GROUP D.2

ELEVATOR AND AILERON POWER CONTROLS AND  
HYDRAULIC PRESSURE INDICATOR (CODE PE, PA AND HP)

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## Equipment employed

1. The major components in the elevator and aileron power controls and hydraulic pressure indicator circuits are quoted below, together with the appropriate

## Elevator and aileron power controls

|   |   |
|---|---|
| Aileron control valve Type C.5702Y, Mk.A  | A.P.1803D, Vol.1, Book 3, Sect.8, Chap.13 |
| Elevator control valve Type C.5702Y, Mk.C | A.P.1803D, Vol.1, Book 3, Sect.8, Chap.13 |
| Control switches Rotax Type D.10002       | A.P.4343C, Vol.1, Sect.1, Chap.-.         |
| Micro switches Type 1A                    | A.P.4343B, Vol.1, Sect.20, Chap.4.        |
| Indicators, Type B.2                      | A.P.4343E, Vol.1, Sect.18, Chap.-         |
| Switches, push button, Type A             | A.P.4343C, Vol.1, Sect.1, Chap.-          |
| Standby batteries, 12 Volt, 4 Amp.        | A.P.4343A, Vol.1, Sect.11, Chap.-         |

## Hydraulic pressure indicator

|   |                                     |
|---|-------------------------------------|
| Lamp, Type B                                    | A.P.4343E, Vol.1, Sect.18, Chap.8.  |
| Pressure switch Type TP.5207                    | A.P.1275A, Vol.1, Sect.11, Chap.24. |
| Relay, Type Q No.3                              | A.P.4343C, Vol.1, Sect.3, Chap.6.   |
| Audio warning cut-out switch, Rotax Type D.5405 | A.P.4343C, Vol.1, Sect.1, Chap.28.  |

## DESCRIPTION

### Elevator and aileron power controls

2. The electrical control circuits for the elevator and aileron power-operated controls, which incorporate a special fail safe feature as described in para. 4, consists of two spring return 3-position ON/OFF selector switches, one of which is mounted on the centre instrument panel to control the elevator electro-hydraulic selector valve and the other is located on the port instrument panel to control the aileron selector valve. The elevator selector valve is located between frames 54 and 55 in the rear fuselage lower fin structure while 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 booster jack and release unit, located between frames 52 and 55 in the rear fuselage lower fin structure and to the aileron booster jacks and release units located one in each outer wing. Two magnetic indicators located one on the port instrument panel and the other on the centre instrument panel, are provided to indicate when the elevator and aileron booster jacks are disengaged, due either to operation of the selector switches or to a hydraulic or electrical failure. These indicators, which are separately fused, are controlled by micro-switches operated by the release units on each booster jack. In addition to the above selector switches, two emergency power control disengaged push-switches are also provided on the centre instrument panel for use in conjunction with two series-connected standby batteries when it is required to disengage the power controls after electrical system failure. For a full description of the elevator and aileron power controls, reference should be made to Section 3, Chapter 4 of this volume.

### Operation

3. 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 aileron selector switch is held in the ON position, current will be conducted through the 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 so as to supply hydraulic pressure to the aileron booster jack servo valves and release units. As the control column is moved from side to side to engage the pawls of the release units with the booster jack rams, the micro switches will be operated by the release units and complete a supply from the selector switch, which must still be held in the ON position, through the normally closed contacts of the emergency aileron power control disengaged push-switch and the micro switches to energize the aileron magnetic indicator, which will change to black to indicate that both the pawls of the release units have engaged with the booster jack rams. The aileron selector switch may now be released to allow it to move, under its spring-return action, to the centre safe position. Hydraulic power is now engaged and movement of the control column will open one of two orifices in the servo valves. The orifice which is opened depends upon the direction in which the control column is moved. Hydraulic pressure will thus be directed to one side of the booster jack rams and this pressure will move the booster jack bodies, which being in connection with the ailerons will move the ailerons in the required direction.

4. When the selector switch is in the centre safe position the electro-hydraulic selector valve and magnetic indicator are maintained in the energized state by a feed from the centre contact of the selector switch, through the two micro switches and the emergency disengaged push-switch. This forms the fail safe feature of the circuit; for example, should the port release unit pawl disengage from the booster jack ram, for any reason, its micro switch

will operate to break the supply to the ON solenoid of the selector valve and make a supply to the OFF solenoid via a contact of the emergency disengaged push-switch. The starboard release unit's pawl will, therefore, immediately disengage from its booster jack ram and operate its micro switch to de-energize the magnetic indicator to show that the power is disengaged. A similar sequence of events take place should the starboard release unit's pawl disengage first, but in this case the magnetic indicator will be de-energized a moment before the port release unit's pawl disengages. It will be seen, therefore, that this safety feature renders it impossible for only one pawl to be engaged or a false anchorage to occur.

5. When the aileron selector switch is held in the OFF position, current will be conducted through the switch and 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 so as to cut off the hydraulic pressure to the booster jack servo valves and release units. The slide valve movement also allows the pressure in these units to flow back into the return line. As the pressure in the release units discharges into the return line, the release unit pawls disengage from the booster jack rams. In disengaging, the release units operate the micro-switches, which in turn de-energize the aileron magnetic indicator thus indicating that the power is disengaged and manual effort alone must be used to move the ailerons. When the power controls have disengaged, the selector switch may be released and allowed to return to the centre safe position and the OFF solenoid of the selector valve will be maintained in the energized state by a feed from the centre contact of the switch, through the contacts of the two micro switches, which are made while the release units are disengaged, and via a contact of the disengaged push-switch.

6. In the event of a hydraulic failure, the hydraulic pressure indicator lamp will illuminate and the audio warning sound to indicate that only a limited number

of power operations of the controls are available from an hydraulic accumulator in the system. When the accumulator is exhausted, the booster jacks will be automatically disengaged and the release units will operate the micro-switches to de-energize the ON solenoid of the electro-hydraulic selector valve and the magnetic indicator. At the same time, the OFF solenoid of the selector valve will be energized, to prevent hydraulic pressure from being trapped in the booster jacks, by a feed from the centre contact of the selector switch, through the contacts of the micro switches, which are made when the release units are disengaged from the booster jack rams, and via a contact of the disengaged push-switch. In the event of an electrical failure, the normal selector switch will be inoperative and both the solenoids of the electro-hydraulic selector valve and the magnetic indicator will be de-energized. In these circumstances, it will be impossible to disengage the power controls by use of the normal selector switch. Depression of the emergency power control disengaged push-switch, which is supplied from the standby batteries, will, however, energize the OFF solenoid of the selector valve to enable the power-controls to disengage in a similar manner to that described in para.4. When the power controls have disengaged, the disengaged push-switch may be released, as the selector valve will remain in the OFF position automatically, once this condition is selected.

#### Hydraulic pressure indicator

7. A lamp, situated on the port instrument panel and an aural warning interconnection with the V.H.F. installation, are provided to indicate failure of the hydraulic system. The lamp is controlled by a hydraulic pressure switch incorporated in the hydraulic system pipe-lines on the port side of the gun package bay. The aural warning is also controlled by the hydraulic pressure switch, via the contacts of an audio warning relay situated on the undersurface of the cabin port shelf, which may be energized to break circuit and cut-out the aural signal by operation of an audio warning cut-out switch situated on the cabin

starboard shelf. The contacts of the pressure switch close, to complete the circuit to the indicator lamp and aural warning when the hydraulic system pressure drops to below 600 lb. per sq.in.

#### Operation

8. The operation of the hydraulic pressure indicator circuit should be evident, once reference is made to the routing and theoretical diagram of the circuit given in fig. 1 of this group. For a full description of the hydraulic system as a whole, reference should be made to Section 3, Chapter 6 of this volume.

### SERVICING

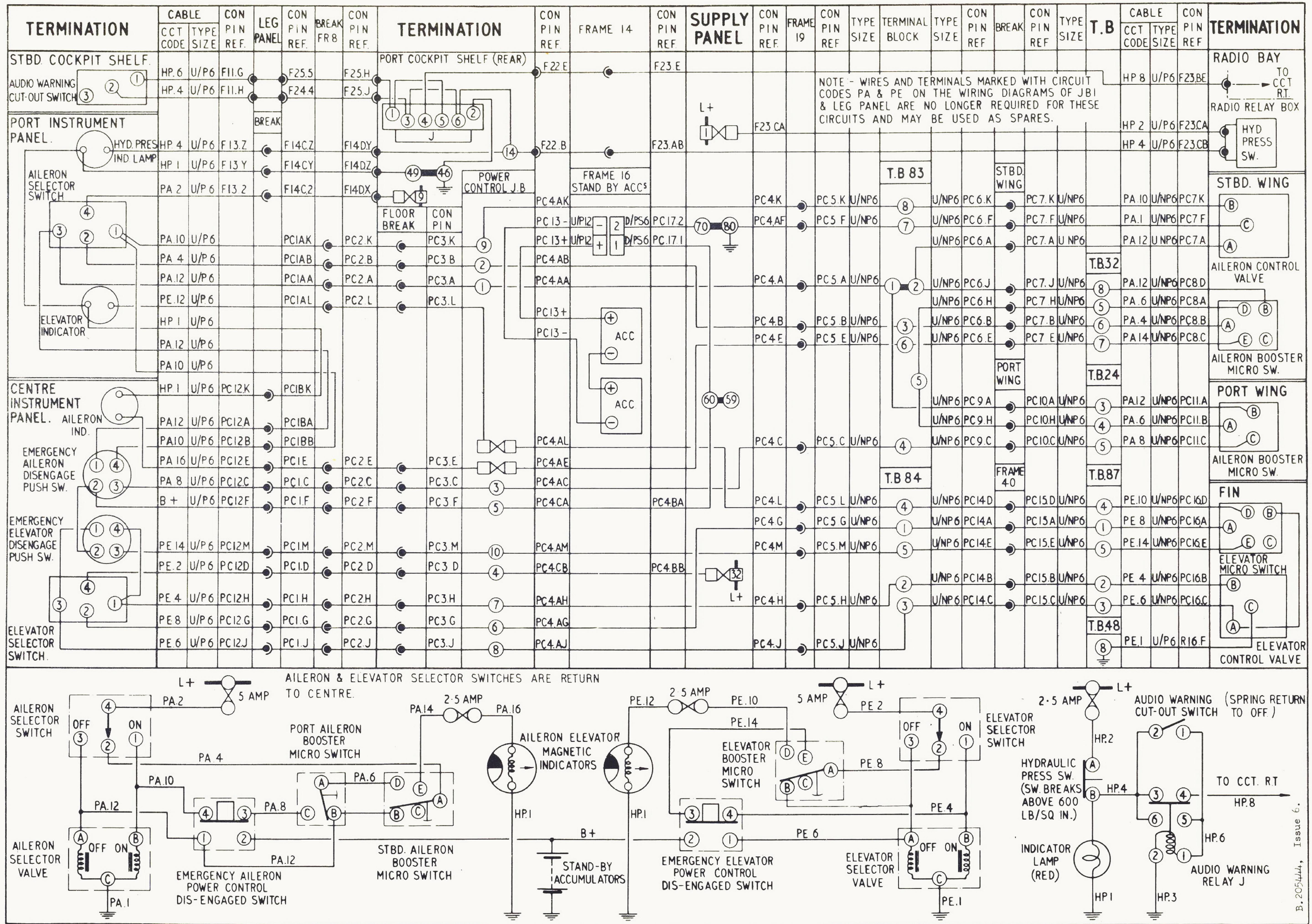
#### General

9. For general servicing of the electrical system as a whole reference should be made to Group A of this chapter. 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 Para. 1.

### REMOVAL AND ASSEMBLY

#### General

10. Once access has been obtained, the removal of the electrical components forming the elevator and aileron power controls and hydraulic pressure indicator circuits, should present no unusual difficulties. The location and access to all the components is indicated in Group A of this chapter.



## FIG. I ELEVATOR AND AILERON POWER CONTROLS AND HYDRAULIC PRESSURE INDICATOR

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