GROUP D.6

CABIN PRESSURIZATION AND TEMPERATURE CONTROL (CODE CP)

LIST OF CONTENTS

Introduction

1. This group contains the description and operation, of the cabin pressurization and temperature control circuits, 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 description of the aircraft electrical system reference should be made to Groups A.1, A.2, and A.3 of this chapter. Detailed information on the standard components used will be found in the Air Publications listed in Table 1.

DESCRIPTION

Equipment details

General

2. The cabin air pressure and temperature is controlled by automatic and manual controls. The system is also linked with the cabin hood control circuit described in Group D.5 of this chapter.

3. The following automatic controls are provided:-

(1) Air supply control linked to the cabin hood control circuit.

(2) Control of cabin air pressure to differential limits related to external atmospheric pressure.

(3) Control of cabin air temperature to a manually selected value.

(4) Altitude switch control of a flood air supply.

4. The following controls are provided for operation and testing of the system.

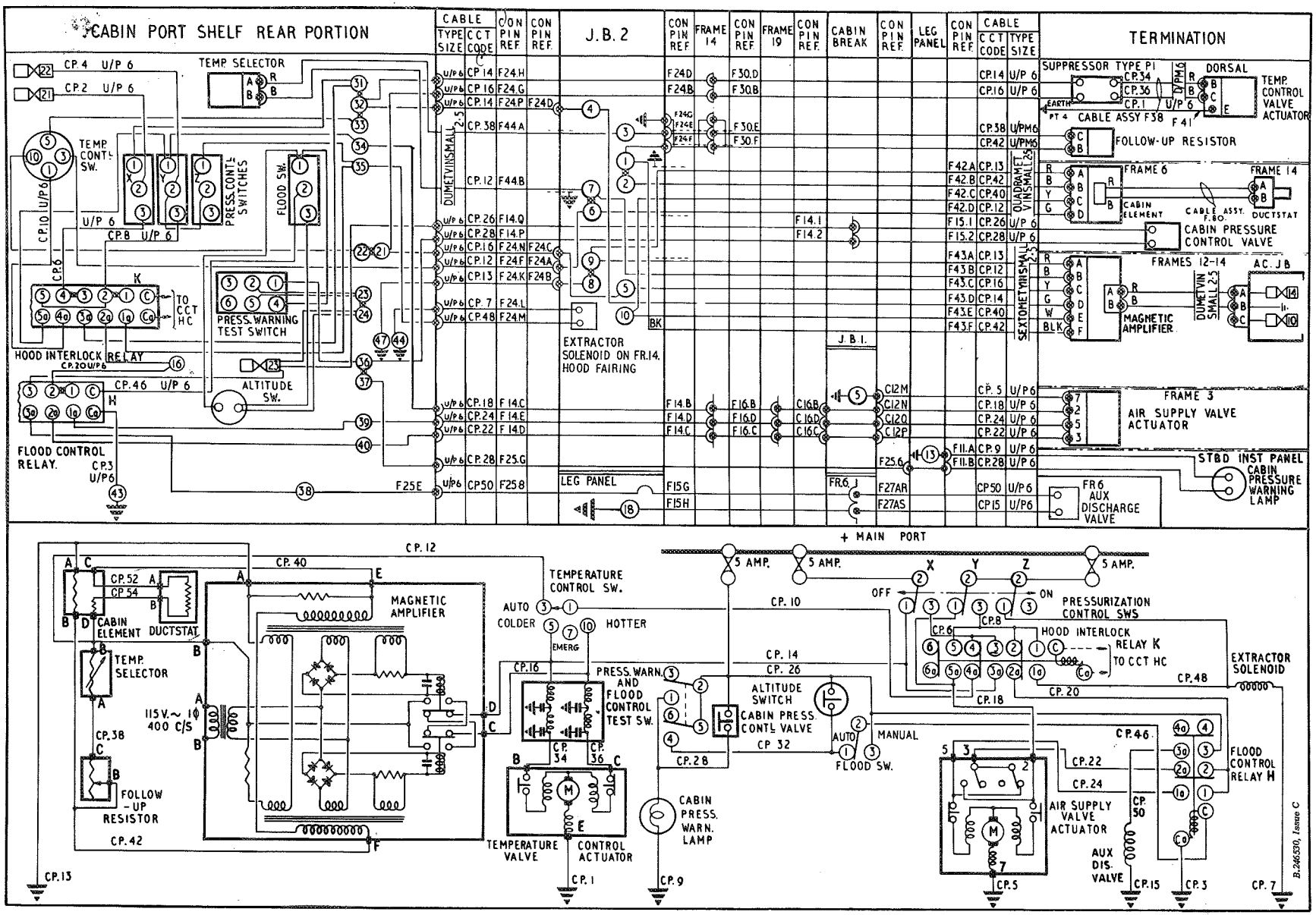

Fig. 1. Cabin pressurization and temperature control (routeing and theoretical)

RESTRICTED

TABLE 1

Equipment type and Air Publication reference

Equipment	Air Publication
Tumbler switches, S.P./C.O, Type XD.778 No.4 *(Control and flood)* Lever switch Type C.1223Y, Mk.12 Tumbler switch. D.P./ON-OFF Type XD.786 No.4 *(Pressure warning test)*	A.P.4343C, Vol.1. Book 1, Sect.1
Temperature selector, Type FHK/A/7 Cabin element, Type FHJ/A/7 Ductstat, Type FHG/A/49 Cabin pressure control valve Type A *(509930)*	A.P.1275A, Vol.1, Sect.20
Air supply valve actuator, Type CZ.64581 Temperature control valve actuator, Type CZ.54709/10/A	A.P.4343D, Vol.1, Book 3, Sect.16
Air extractor valve solenoid, Type ES/A/390	A.P.4343E, Vol.1, Book 1, Sect.2
Relay, Type S, No.3	A.P.4343C, Vol.1, Book 2, Sect.3
Altitude switch, Type KB.562/01	A.P.1275A, Vol.1, Sect.24
Suppressor, Type P, No.1	A.P.4343C, Vol.1, Book 3, Sect.5
Magnetic amplifier, Type FLM/A/1	A.P.1469E, Vol.1, Sect.1
Follow-up resistor, Type FLJ/A/2	A.P.4343E, Vol.1, Book 4, Sect.22
Warning lamp, Type B *(Air pressure)*	A.P.4343E, Vol.1, Book 4, Sect.18

(1) Cabin pressurization control; three ganged changeover switches marked ON and OFF.

(2) Flood air control; a single-pole changeover switch marked AUTO and MANUAL.

(3) Pressurization warning test and flood control test switch; a two-pole changeover switch marked OFF and TEST.

(4) Temperature selector switch; a three-position rotary potentiometric switch marked COOL, NORMAL and WARM.

(5) Temperature control switch, a four-position lever switch marked AUTO, COLDER, EMERGENCY and HOTTER.

All of these manual controls are mounted on the cabin rear port shelf. The system circuit diagram is shown in fig.1.

Cabin air supply control

5. The cabin pressurization air is taken from the last stage of the engine compressor, to a cooler and cooler-bypass system controlled by a temperature control valve; the operation of this valve is explained in para. 18 to 20.

6. From the cooler and cooler-bypass system, the air is passed to the cabin, when required, via a cabin air supply valve located at the top of the centre fuselage aft of the rear spar frame. This

valve is operated by an actuator controlled by the pressurization control switch and the hood interlock relay.

7. With the hood closed, the hood interlock relay is de-energized and the air supply valve actuator may be operated from the pressurization control switch. When this switch is OFF, the "close" field coil of the air supply valve actuator is energized and the valve moves to cut off the supply of pressurizing air. At the same time, the solenoid of an air extractor valve, located on the forward face of frame 14, is energized to open the valve and vent the cabin to atmosphere.

8. With the hood closed and the pressurization control switch set to ON, the air extractor valve solenoid is de-energized and the valve is closed. The "open" field coil of the air supply valve actuator is energized and the valve opens to admit pressurization air to the cabin.

9. With the hood open, or with the hood control switch set to OPEN while the hood is still closed, the hood interlock relay is energized as described in Group D.5 of this chapter. In either of these conditions, the "close" field coil of the air supply valve and the solenoid of the air extractor valves are energized regardless of the setting of the pressurization control manual switch. The cabin air pressure is thus reduced to the level of the surrounding atmosphere before the hood opens. While the hood is open the pressurizing air supply remains cut off.

Cabin air temperature control

10. The temperature control system comprises a temperature sensitive circuit operating in conjunction with the temperature selector switch to maintain a selected cabin temperature. The system includes a ductstat, a cabin temperature sensing element, a follow-up resistor, a temperature control valve with actuator, and a magnetic amplifier.

11. The ductstat, cabin temperature sensing element, the follow-up resistor and temperature selector switch, from a Wheatstone bridge. Unbalance in the bridge, produced by selection of a required temperature at the temperature selector switch, is used, via the magnetic amplifier, to give a polarized output for the operation of the temperature control valve actuator. The system acts generally as a position servo in which the actuator, in driving the temperature control valve to a pre-determined position, also drives the follow-up resistor to balance the bridge. This provides a rough control of cabin temperature based on an assumption of a given normal compressor air temperature and an arbitrarily selected, ambient air temperature value. Variations in compressor air temperature are compensated for by adjustments of the temperature control valve; these adjustments are made automatically in response to unbalance produced in the bridge by changes in the resistance of the ductstat when the compressor air temperature varies. Variations in the actual temperature inside the cabin are sensed by the cabin temperature sensing element and the resulting changes in its resistance also produce unbalance in the bridge, which therefore gives an output which will modify the temperature control valve setting to increase or decrease the cabin temperature.

12. The temperature control manual switch may be used to override the automatic circuit. The switch is normally set to AUTO but may be set to COLDER or HOTTER to operate the actuator to either extreme position, or it may be used as an inching switch to achieve an optimum setting. Setting the switch to EMERGENCY disconnects the actuator from the circuit and this position may therefore be used, for example, after inching, to hold the valve at the setting established, the automatic controls will then be ineffective.

13. A suppressor, located adjacent to the temperature control valve between frames 15 and 16, is connected in the actuator circuit to minimize radio interference.

Cabin pressure control valve

14. A double-acting, pressure-balance valve, located on the aft side of frame 6, controls the discharge of cabin air. The valve allows pressurization to start at 10,000 feet and maintains a graded differential of internal-to-external pressure of up to 3½ lb./sq.in. Should the differential pressure fall by between ½ and 1 lb./sq.in. at any altitude, a switch is closed to complete the circuit of a lamp indicating pressure failure.

Altitude control of flood air

15. A barometric switch, located on the underside of the cabin port shelf is closed at 38,000 feet to operate the flood air relay, which introduces flood air to the cabin, and operates an auxiliary discharge valve located at the top of frame 6.

Manual control of flood air

16. Flood air may be introduced at any altitude by setting the flood control switch to MANUAL. This energizes the flood air relay and the circuit operates as if the altitude switch were closed.

Test switch

17. The pressure warning and flood control switch may be used, by setting to TEST, to check simultaneously the operation of the pressure warning lamp and the flood air supply.

Operation

Hood open

18. With the hood open, or with OPEN selected at the cabin hood control switch, the hood interlock relay is energized and the cabin pressurizing system is rendered inactive regardless of the position of the cabin pressurization control switch. With this switch in the OFF position, the "close" field of the air supply valve actuator receives a supply via connections 2 and 1 of switch Y. A supply from connections 2 and 1 of switch Z energizes the extractor valve solenoid which opens the extractor valve. With the cabin pressurization switch set to ON, the "close" field is energized via contacts 5 and 5a of the hood interlock relay and the extractor valve solenoids are energized via contacts 1 and 1a. The supply to the temperature control circuit is cut off at contacts 4 and 4a and the "close" field windings of the temperature control valve actuator are energized via contacts 3 and 3a to close the bypass and direct the hot engine air to the cooler.

Hood closed

19. With the hood closed, the interlock relay is de-energized. When the pressurization control switch is set to ON, a supply is connected to the "open" field of the air supply valve actuator via contacts 2 and 2a of the interlock relay and contacts 2 and 2a of the flood air control relay. The air supply valve will move to supply pressurizing air to the cabin. The extractor valve solenoid receives no supply and this valve is therefore closed. The temperature control switch receives a supply via contacts 4 and 4a of the interlock relay.

20. In the condition outlined above, and with the temperature control switch set to AUTO, the cabin pressurizing system operates to supply air to the cabin. Below 10,000 feet of altitude there is no change in the cabin air pressure because of venting provided by the cabin pressure control valve. The temperature control system is operative at all altitudes. Above 10,000 feet the pressure control valve and temperature control system operate together to provide automatic control of the cabin air condition unless the temperature control selector switch is set to any of the overriding positions, COLDER, EMERGENCY or HOTTER. Low cabin air pressure will be indicated by the warning lamp whenever the pressure drops ½ to 1 lb./sq.in. below normal and closes the cabin pressure control valve switch. To counter this loss of pressure, flood air may be introduced by setting the flood switch to manual. At 38,000 feet the altitude switch closes to energize the flood control relay to provide flood air automatically. When the flood control relay is energized by either of these switches, the "open" field of the air supply actuator is energized via contacts 1 and 1a and the auxiliary discharge valve is opened as the solenoid is energized via contacts 3 and 3a.

SERVICING

General

21. For general servicing of the electrical system, reference should be made to Group A.1. All the components should be kept clean and inspected periodically for signs of damage and to ensure that they are securely mounted. Apart from the routine functional testing of the circuit and components, no other servicing should be necessary, but should a fault be reported the cause must be investigated and rectified before the next flight. Should the fault be found to be in any component of the temperature control equipment or in the valve actuators, the faulty component

must be removed from the aircraft and replaced with a fully serviceable component, as no attempt must be made to service these units in-situ.

REMOVAL AND ASSEMBLY

General

22. Once access has been obtained, the removal and assembly of the electrical components forming the cabin pressurization and temperature control circuit should present no difficulty. The location and access to all the components is indicated in Group A.3.